THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

CONDUCTED BY

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

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

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

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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ERRATA.

Arts. XX. and XXVIII., for *Rungun Valley,* passim, read *Rungnu Valley.*
Page 185, line 13, for *Catinus* read *Cyclaspis,* n. s.
Page 266, line 2 from bottom, for *Sunhul* read *Sinchul.*
Page 384, line 15 from top, for *hind* read *lower.*
Page 388, line 4 from bottom, for *Cauisa* read *Causia.*

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[THIRD SERIES.]

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

No. 13. JANUARY 1859.

I.—*On Fecundation in the two* Volvoces, *and their Specific Differences; on* Eudorina, Spongilla, Astasia, Euglena, *and* Cryptoglena. By H. J. Carter, Esq., H.C.S. Bombay.

[With a Plate.]

When I found *Eudorina elegans* undergoing fecundation, at the commencement of June last*, it was very evident to me that I had observed the same kind of process in *Volvox globator*; and on referring to my note-book, sketches of it were found, under date of the 18th of August, 1855, with mention of the pool of water from which the specimens had been obtained. I therefore then determined to watch for the return of this organism in the same pool when the month of August arrived, and, having done so, found it, as before, at first in company and afterwards in separate colonies, in the same pool with *V. stellatus*, and both undergoing fecundation, but this time as early as the 5th of August.

As soon as this was perceived, I followed the process as long as the colonies, which were rapidly being devoured by Rotatoria and Entomostracous Crustacea, lasted, and thus not only observed most of the facts connected with this process, but also sufficient to prove to me that the two *Volvoces*, which by Busk,

* Annals, ser. 3. vol. ii. p. 237.

Williamson*, and Cohn have been considered but one and the same species, are specifically different. As, however, the opinions of the two former in this respect are repeated by the latter, it will be enough to cite here, in proof of this, the concluding paragraph of the "extract" taken from Cohn's "Observations on the Organization and Reproduction of the *Volvocineæ*†," which runs as follows:—

"He [Dr. F. Cohn] adds that there is no doubt that the *Sphærosira Volvox* of Ehrenberg is a monœcious *Volvox globator*; that his *V. stellatus* is the same *V. globator* filled with spinose or stellose spores; and that *V. aureus* only differs from the common *Volvox* by having accidentally smooth spores."

How the authors above mentioned arrived at such conclusions, except from insufficient means of judging, I am ignorant; for my own observations lead me to the very opposite result, inasmuch as the differences between *Volvox globator* and *V. stellatus* in their adult forms, in the component parts of these forms, in their course of development, in their mode of fecundation, and in the form of their resting-spores, &c., appear to me to be so great, that there is not the least room left for even doubt about their being distinct species. But, as the reader will of course not be content with bare assertion against such high authority, I shall briefly describe these *Volvocineæ* under their respective heads, leaving him to contrast the differences, and by aid of the delineations of two which he will find arranged on opposite sides of Pl. I., thus form his own opinion of the truth of what I have stated.

Volvox globator, Ehr. Pl. I. fig. 1.

Adult form.—Spherical, or nearly so, consisting of three generations or families, within one another,—that is, the parent *Volvox*, containing generally eight daughters, in each of which there are generally eight grand-daughters, all *distinctly* visible‡. Daughters confined to the posterior three-fourths of the sphere, the anterior fourth being empty. Progressing with the empty part forwards. Daughters rotating (this marks the adult form) in their capsules respectively, which are fixed to the internal periphery of the parent. Grand-daughters large and perceptible, motionless, and fixed to the internal periphery of the daughters respectively. Peripheral cells globular, biciliated, 57-1880ths of an inch in diameter.

* Quart. Journ. Microscop. Sc. vol. i. pp. 39, 56.

† Annals, ser. 2. vol. xix. p. 187; translated from 'Comptes Rendus,' Dec. 1, 1856, p. 1054.

‡ Here I must use the terms "daughters" and "grand-daughters," and omit that of "cell" as much as possible, for perspicuity.

Development.—The daughter consists of an enlargement of one of the peripheral cells (Pl. I. fig. 11 *a*), which thus projects into the interior of the parent; and as it enlarges, the chlorophyll and protoplasm together are seen to form an areolar structure around the internal periphery of the cells (fig. 4), which goes on increasing in size, and the starch-cells and chlorophyll increasing in number and quantity respectively, until a sudden re-arrangement of the gonimic contents takes place, and the whole is transformed into a globe of peripheral cells. (Here is the great difference between this and the following species: contrast figs. 4 and 6 *c*.) Synchronously with this, the cilia are produced; the peripheral cells secrete a mucus around themselves which hardens into a thin pellicle, leaving two distinct channels for each pair of cilia; the pellicle thus hardening, the daughter separates itself from the cell-wall of the peripheral cell (the immediate parent or bud), and begins to rotate; after which, the peripheral cells of the parent waste and perish, and the capsules of the daughters, which now also contain the grand-daughters or third family, becoming deciduous at the same time (for these capsules are but a part of the parent), the whole structure breaks down, and the young family, including the grand-daughters, which now become "daughters," thus escapes. Hence the young *Volvoces* only contain *one* generation * (Pl. I. fig. 3).

Fecundation.—Sometimes, instead of the eight daughters producing eight grand-daughters, and thus passing into the common form above described, two, three, and not unfrequently all of the eight daughters may present an enlargement of thirty to fifty of their peripheral cells, indiscriminately scattered over the posterior three-fourths of their spheres respectively (fig. 7). These cells, which are twice or thrice the size of the rest, and of a light yellowish-green colour while the daughters remain within the parent, become still more enlarged and of a deep dark-green colour a short time after they have been liberated; they also then become surrounded by a thickened capsule, which appears to be slightly *wavy* in its outline, and are, in short, the spores. Thus we see that the daughter here is the alternating form,

* Professor Williamson considers the mucus which forms the pellicle, and ultimately becomes the cell-wall, to be secreted by the young peripheral cells after the development of the cilia has commenced (*l. c.* p. 54); and I can see no other more reasonable way of accounting for the formation of the holes in the cell-wall for the passage of the cilia than this. I incline to the theory which views the primordial protoplasm or utricle as the organ, and the cellulose or wall with which it becomes covered the product; and that the protoplasm may waste away by age or want of nourishment, as it may also increase by the latter, but does not become converted into cellulose.

and that she produces a cell which never becomes a grand-daughter *Volvox* itself, but produces another cell, which in the end may give rise to a new family or third generation through the process of fecundation. Whether each spore produces one or many *Volvoces*, is a question which can only be decided by watching its development.

Sometimes, on the other hand, instead of either of the forms just mentioned, one, two, three, or even all the eight daughters may present an enlargement of a far greater number of the peripheral cells, viz. upwards of one hundred, indiscriminately scattered over the whole of their internal peripheries respectively. Mr. Busk states over two-thirds only (*l. c.* p. 33), and analogy is in his favour; but I could not detect this (fig. 8). These cells undergo deduplicative subdivision *within* the parent, until their contents respectively pass into 128 (?) linear, ciliated segments, which are ultimately arranged vertically upon the same plane, in a circular, tabular group, with their cilia upwards; and when the latter are sufficiently developed, the group oscillates and rotates by their aid both upon its long and short axis (fig. 10 *a, b*). These segments are, in fact, the spermatozoids, each of which, when they separate, is observed to be linear, horn-shaped, and colourless anteriorly, where it is attenuated, and greenish posteriorly, provided with a pair of cilia which are attached to the anterior extremity, and some distance behind them with an eye-spot (fig. 8 *b*); their progression is vermicular from their extreme plasticity, and they keep up an incessant flagellating movement with their cilia. As yet, I have never seen any of these free in the daughter bearing the spermatic cells when the former has been *outside* the parent; nor have I ever seen them free under any circumstances, except once, in the old *Volvox*, when the daughter containing the spermatic cells from which they had been developed had been partly eaten up by Rotatoria.

This is the form of *Volvox globator* which has been called *Sphærosira Volvox* by Ehrenberg; and, like the daughters bearing the spore-cells, it becomes liberated from the parent before the spermatic cells attain their ultimate development, that is, before the groups of spermatozoids become separated, not before they are formed. It is worthy of remark, too, that the daughter bearing spermatic cells is never more than half the size of the spore-bearing daughter, at least as far as my observations extend.

Thus we have the spore-cells and the spermatic cells in *different* daughters; and as I have never seen them together in the same daughter, nor the daughters respectively bearing them in the same parent *Volvox*, out of some scores of instances, I can come to no other conclusion than that the two daughters meet after they have left their respective parents, when both the spores and the spermatozoids having become ripe for fecundation, individuals forming the groups of the latter separate, burst from their capsules into the cavity of the daughter, and from thence find their way out into the water, and then into the cavity of the daughter bearing the spore-cells, where they become incorporated with the latter.

Hence *Volvox globator* would appear to be diœcious, and not monœcious as stated by Cohn; and *Sphærosira Volvox* not, strictly speaking, another form of *Volvox globator*, but the spermatic form. Cohn, considering *Volvox globator* and *Volvox stellatus* the same species, has taken his fecundating character from the spermatic form of the latter, as will presently be seen.

It is strange that, while I have often met with free spermatozoids in the cavity of the spore-bearing daughter of *Volvox stellatus*, I have never been able to find any in that of *Volvox globator*. I have, however, frequently seen colourless, fusiform, biciliated cells in the latter, each containing a large oil-globule, which appeared to me to be the remains of the unemployed spermatozoids, as they have only been present when the spores had obtained their wavy, characteristic capsule and had become of a deep-green colour (fig. 7 *a*). Again, the frequent presence of *Spirilla* in the daughters of *Volvox globator* bearing impregnated spores, and their absence in those of *Volvox stellatus*, indicate the existence of some aperture or apertures either prepared for, or produced by, the entrance of the spermatozoids. That such may exist without destroying the *Volvox* directly, is shown by the fact that Rotatoria make their way into the latter without causing them to perish.

Volvox stellatus, Ehr. Pl. I. fig. 2.

Adult form.—Globular, slightly ovoid, consisting of three generations or families within one another; containing generally eight daughters, in each of which there are generally eight grand-daughters *indistinctly* visible. Daughters confined to the posterior three-fourths of the spheroid, the anterior fourth being empty. Progressing with the empty end forwards. Daughters rotating (this marks the adult form here also) in their capsules respectively, which are fixed to the internal periphery of the parent. Grand-daughters small and indistinct, motionless, and fixed to the internal periphery of the daughters respectively. Peripheral cells conical and biciliated, not uniciliated as figured by Ehrenberg. Size, 59-1880ths of an inch long and 54-1880ths broad.

Development.—The daughter consists of an enlargement of the peripheral cells, which thus projects into the interior of the parent, and begins to undergo duplicative subdivision almost immediately, that is, at the time when it does not exceed three times the diameter of the peripheral cells. (Here is the great point of difference between this and the daughters of *Volvox globator*, to which I have alluded.) As the daughter increases in size, the duplicative subdivision goes on until a little before it has reached its full development, when the cilia begin to be developed, the pellicle hardens into the cell-wall, leaving holes for the cilia, as before stated, and the young *Volvox*, thus becoming separated from its capsule, begins to rotate,—when the parent *Volvox*, as well as the capsule, breaking down, the daughter is liberated—though, as in *Volvox globator*, not before the next generation has become visible (Pl. I. fig. 5).

Fecundation.—Sometimes, instead of the eight daughters producing eight grand-daughters, and thus passing into the common form just described, two, three, and not unfrequently all the eight daughters may present an enlargement of eighty to a hundred of their peripheral cells, indiscriminately scattered over the posterior three-fourths of their spheres respectively (fig. 9). These cells, which are twice or thrice the size of the rest, and of a light yellowish-green colour while the daughters remain within the parent, become still more enlarged and of a deep-green colour a short time after they have left her; but before this takes place to its full extent, four or more of them become larger than the rest (fig. 9 *b, b, b, b*), and at the same time undergo duplicative subdivision until they have respectively passed into 128 (?) linear, ciliated segments, which are ultimately arranged vertically upon the same plane, in a circular, tabular group, with their cilia upwards; and when the latter are sufficiently developed, the group oscillates and rotates by their aid, both upon its long and short axis (fig. 10 *a, b*). These are the spermatozoids, which, when fully developed, separate, burst through their capsule into the cavity of the daughter-cell, and apply themselves vigorously to the other cells, which are the spores, and with which, according to Cohn, they become incorporated. Each spermatozoid may now be observed to be linear, horn-shaped, longer than that of *Volvox globator*, with the attenuated part, which is colourless, anteriorly, and the posterior part greenish from the presence of a little chlorophyll,—provided with two cilia, which are attached to the middle of the body, and, just opposite them, an eye-spot (fig. 9 *d*). During progression they have a vermicular motion, while their cilia float backwards; and when upon the spore, their elongated beak keeps up an incessant undulation, sometimes getting into that position which has induced Cohn to compare it to the "neck of a swan;" but a nearer similitude would be the elongated lip of the infusorium *Trachelius*. In active progression, when in the water, the cilia appear to be brought forwards.

That these spermatozoids do enter the spores as Cohn has stated, may be reasonably inferred without actual demonstration; for they may not only be seen to be continually dragging their plastic bodies over them, and behaving in the manner stated, but they never forsake them unless it be to go to another spore; added to which, the spinose development of the capsule of the impregnated spores (fig. 9 *c*) may be observed to be proportionally developed as the spermatozoids remaining in the cell are few or numerous. Hence *V. stellatus* is monœcious.

Observations.—The fact of the daughter of *V. globator* not passing into small cells until it has arrived at more than the 1-300th of an inch in diameter, while that of *V. stellatus* begins to undergo duplicative subdivision when it is only 1-2700th of an inch in diameter (figs. 4 & 6), is sufficient alone for a specific difference; and when added to the difference in the form of the spermatozoid and the mode of fecundation, &c., there can be no longer any doubt about these two *Volvoces* being distinct species.

Whether the daughter of *V. globator* is undergoing cryptodivision during its enlargement (fig. 4), and is thus finally prepared at once to pass into the form of the young *Volvox* when the time for so doing arrives, I cannot say; but if such should be the case, as I have already inferred, then we have apparently a similar instance to that of the cell of *Hydrodictyon*, which, commencing from a ciliated gonidium with one starch-cell, goes on increasing in size, in the quantity of its gonimic contents, and in the multiplication of the starch-cells and nuclei, until all at once the mass resolves itself into a multitude of gonidia, which, arranging themselves head to tail and *vice versâ*, for the most part in threes, thus pass into the form of the young Water-net*. But if it be difficult to catch this point in *Hydrodictyon* (which is the case), where there is nothing to impede the view, I do not know how it will be seen in the daughter of *Volvox globator*, where the chances of meeting with it must be still rarer, and the daughter always within the parent when this takes place.

Mr. Busk, in identifying the two *Volvoces*, observes that he has seen the "smooth and stellate globules" together "on several occasions" (*l. c.* p. 32), which, had he been speaking of the common form of *Volvox globator*, would have been confusing; but he happens to be alluding to the spore-bearing daughter of

* For a description of this, see A. Braun's 'Rejuvenescence in Nature,' translated by Prof. Henfrey, pp. 222, 260, &c., Ray Soc. Publications.

V. stellatus, where it might have taken place from some of the spores not having been impregnated, and thus not getting the spinose capsule. Out of some hundreds of specimens of *V. globator*, I have only met with two instances in which the daughter-cells were undergoing an irregular kind of duplicative subdivision something like that of *V. stellatus*; and these were in two specimens, each containing a single generation, where the latter had been disturbed in their development and partly destroyed by the presence of Rotatoria, which thus seemed to account for these abnormal forms. Nor have I ever seen the impregnated spores pass into the "matrass-form" mentioned by Dr. Cohn (*l. c.*).

Eudorina elegans, Ehr.

My first observations on *Eudorina elegans* this year were made at the commencement of June, after which the deluging rains of the monsoon commenced, and arrested everything in the way of active algal development until August, when the showers becoming less frequent and less powerful, and the sun reappearing for longer periods, I found *Eudorina* again in several places, and have thus been enabled to clear up, add to, and correct respectively what I have already stated of this organism in my paper on its fecundation. Had I, however, known that I should have had this opportunity again, after so short an interval, I should have deferred the publication of that paper until the present time, in order that these *addenda* might not have been required.

In my description of the development of *Eudorina** I have alluded to the question how, in the "second stage," the sixteen additional cells get their cilia through the external envelope, and have inferred that the sixteen new cells either make channels for themselves, or the group comes forth from its parent-cell with the thirty-two cells fully formed. Later observations have shown me that the latter is the case, and that this part of the development takes place in the manner already suggested in the development of *Volvox*; therefore there is one form of *Eudorina elegans* consisting of sixteen cells and another of thirty-two cells, and the two do not pass into each other. This point has been determined by my having found the two varieties in two separate tanks about 200 yards apart, and not mixed in either tank, although each tank swarmed with its respective variety. Thus, in one, all the *Eudorinæ* in the "first stage" contained thirty-two cells, and again passed directly into the form of thirty-two groups with thirty-two cells in each group; while in the other tank, all in the first stage contained sixteen cells, and they

* Annals, ser. 3. vol. ii. p. 237.

passed directly into the form of sixteen groups with sixteen cells in each group: so that the number 32 is persistent in the former, and 16 in the latter, whether of single cells or groups. Hence my "first stage," in the description to which I have alluded, should be the thirty-two-cell form, to agree with the description of the "third stage," which again should be termed the "second stage;" for we now see that there is no intermediate form: that which I have termed the "second stage," then, should have this term changed for "*fecundating form*," as this is a special development for the purpose, consisting more particularly of an enlargement of the thirty-two-cell *Eudorina*, with the transformation of the contents of the four anterior cells *only* into spermatozoids. I have never found the sixteen-cell form producing anything like spermatozoids.

Again, I have stated that *Eudorina* perishes in the second stage, as we shall now call it, "if the groups do not form new *Eudorinæ*." I have now found that the latter is the case, and that this is the way in which this organism is so rapidly multiplied.

But this second stage, as it now stands, may be the *Pandorina*-form, as I have before stated, in both the sixteen- and thirty-two-cell varieties, in which the groups, though still consisting of sixteen and thirty-two cells respectively, obtain a tabular arrangement; and here I am sure the *Eudorina* does end, though the next form into which they pass when liberated, viz. *Gonium pectorale*, Ehr., may, I think, be again repeated, in the transformation of the contents of each cell of the *Gonium* again into a young *Gonium*; at least, I once saw three cells in this condition united together, which seemed rather to belong to *Gonium* than to *Eudorina*: however, for the most part, *Gonium* seems to break up and perish, which would therefore make this one termination of the existence of the *Eudorina*.

By the aid of a higher magnifying power, I have also been able to see that each pair of cilia slightly diverge from each other as they leave the cell, and thus pass through the external envelope, not together, as I had formerly supposed, but by separate apertures, here as well as in the *Volvocineæ*, which separation increases with the size of the organism, so that in the larger forms there appears to be only one cilium to each cell, on account of the latter not coming into focus at the same time; and this is probably the explanation of Ehrenberg having given many of these forms only one cilium to their cells.

In neither of the tanks to which I have alluded, nor anywhere else, have I met with the "fecundating form" of *Eudorina* seen at the commencement of June, so that that only appears to be the season for this development: but, as I have before stated, the *Pandorina*-form which leads to that of *Gonium* is produced by a segmentation similar to that of the spermatozoid duplicative subdivision; and this, among the thirty-two-cell *Eudorinæ*, has frequently passed into conical groups of spermatozoids, so that the water of the tank in which this variety existed abounded in these groups, free and eliminated entire, and, it is worthy of notice, still retaining respectively the effete eye-spot of the parent adhering to one part of their circumference—showing that the whole contents of the mother-cell do not enter into the formation of her progeny. But the most remarkable thing presented by these groups was their pertinacious adherence, by means of their cilia, to the external envelopes of the entire *Eudorinæ*, while, when the groups were broken up, there was an equal amount of perseverance shown in the separate spermatozoid forms to incorporate themselves with the single cells which had become liberated, apparently from decomposition of the envelopes of the entire *Eudorinæ*,—thus evincing that same impulse to incorporation when there were no spore-cells present for them to fecundate, as that which I have described under the normal development of the spermatozoid for this purpose.

Notwithstanding the resemblance of these spermatozoids to those produced in the normal development, they were neither so plastic nor so linear in their form, having a great tendency to pass from the original horn-like or elongated flask-like shape into that of a conical biciliated cell. On the other hand, in the tank where the sixteen-cell *Eudorina* prevailed, though there was an equal amount of *Pandorina*-development, there was not a single spermatozoid. Not one came under my observation, which seems to afford another reason for inferring that, in this variety, spermatozoids are not developed. It is now also evident to me (as it seems to have been also to others), from the isolated state in which I have frequently seen the spermatic groups of *Sphærosira Volvox*, as well as those just mentioned, that, in their more enlarged or expanded forms, they constitute Ehrenberg's *Syncrypta, Synura*, and *Uroglena* (tab. 3. figs. 7, 9–11).

Lastly, in describing the cells of *Eudorina* (*l. c.*), I have called the starch-cells "nuclei," the nucleus itself being undistinguishable. Had I reflected a little, this mistake would not have occurred; but I was led into it by observing, in *Chlamydococcus*, that the single spherical cell which it contains became elongated and divided previous to each division of the *Chlamydococcus*, in order that each division and subdivision might be provided with a cell of this kind. It is, therefore, an important organ in the vegetable cell, but, as with many other things, escapes particular attention until we come to study the cell in its isolated and independent form, when it is living as a separate being; then, when every part is reduced to singleness within one little sphere, and the whole of this little sphere is watched during its œconomical operations, the value of the different organs which it contains becomes most obvious. Thus, this little cell, which is so numerous in the cells of the larger Algæ, seemed of so little import compared with the "nucleus" of the cell, that when I came to observe the most conspicuous cell or organ in the single Algal cell undergoing division provisionally for a subsequent duplication of this cell, I could not help at first viewing it as the "nucleus;" but subsequently observing that this organ was in the midst of chlorophyll, which, again, was most densely accumulated round its margin, its frequent and variable plurality, and, above all, its becoming purple by the addition of iodine, its identity with the starch-cell in the reticulate chlorophyll of *Œdogonium,* in the green bands of *Spirogyra,* and in the green layers of *Nitella,* &c., became complete.

To the term "cell," or "utricle" as it is called by Nägeli, however, Mohl objects, observing that it is only a part of the protoplasm (coloured with chlorophyll) defined by a circular line which "is firmer than the internal portion," and that it cannot be demonstrated to have a cell-wall any more than "a cheese,"—that "this is not enough to constitute a membrane, for it is indispensable to the notion of the latter that it forms a layer definitely bounded on both sides,"—and that "it is by no means to be denied that a globular mass of organic substance may acquire a membranous coat, through a hardening of its outer layers, and become converted into a utricle in the manner stated by Nägeli. But for the application of this expression to be fitting and admissible, it is quite requisite that the said process should actually have taken place, that a separation of envelope and contents should have occurred*." To dispute such high authority would, in one who has not given his attention particularly to the subject, be not only unwise but wrong, and to attempt to demonstrate a membrane round the "nucleus" or "starch-cell," while either is fresh and plastic, and in active vital operation, I think, with Mohl, almost impossible; but when, from age, disease, or accident, the contents of the Algal cell become more or less devitalized, then, I think, both the nucleus† and starch-cell will be found to be circumscribed by a membranous covering. With the "nucleus" I have nothing to do here, and shall only observe, respecting the starch-cell, that in the green layer of *Nitella,* as I have already figured and stated‡, the chlorophyll-disks may

* Mohl, On the Structure of Chlorophyll, translated by Prof. Henfrey, Annals, vol. xv. p. 322, 1855.

† Annals, vol. xix. p. 25, pl. 3. fig. 11, 1857.

‡ Annals, vol. xvii. p. 104, pl. 8. figs. 3–5, 1856.

frequently be seen to be in a pavement of cell-like cavities (if they be not real cells according to Mohl's definition) which lines the inner surface of the cell-wall of the internode. Whether these be mere inflations of a protoplasmic layer, I have not the means by me now to test; but they multiply by division, like the starch-cell of *Chlamydococcus*, &c., like the "nucleus" in many instances, and therefore like the plant-cell,—which, with the appearance of a cell-like line of demarcation around them, gives them so much the character of a "cell," that I question whether this term (or that of "utricle") is not still better adapted for them than the term "chlorophyll-granule" used by Mohl. It seems to me not at all improbable that these cells may be parts of the plant-cell-contents, which have a pellicle over them that isolates them from the protoplasm, just as much as the pellicle on the surface of an *Amœba* would isolate it, if similarly situated, and that this pellicle may become evident by hardening as the protoplasm within it gradually perishes. However, as before stated, I am not prepared to go into the matter further than for the purpose of correcting the error mentioned, and will therefore conclude by recommending a special study of this organ to those who would advance our knowledge of the vegetable cell.

Turning to another subject, it might also be incidentally observed here, that the *brown* discoloration of fresh water, arising from the presence of a multiplicity of *Peridinea*, to which I have had occasion to allude in noticing the red discoloration of the sea around the island of Bombay, which takes place from the same cause *, occurred in the tank where the sixteen-cell *Eudorina* was, to such a degree that in three weeks after their first appearance, viz. on the 15th of August, they had so increased by duplication, as not only to give the water a dark brown colour, but to obscure the bottom where it was not more than a foot deep.

As regards the *Eudorinæ*, they became scanty and disappeared, almost everywhere, by the end of August.

Spongilla.

By a reference to my description of the "Ultimate Structure of *Spongilla* †," it will be observed that I was not confident of the circular transparent area in the "ampullaceous sac" being an aperture, although it appeared to me, when situated on one side, to admit the particles of carmine into its interior. These, again, were evidently seen to be drawn in that direction by the presence of cilia, whose motion only became visible when the "ampullaceous sac" was in the centre of the microscopic field,

* Annals, vol. i. p. 258, 1858. † Annals, vol. xx. p. 28, 1857.

and the focus directed into it. Thus I imagined it to be a sac with a circular aperture in one part, and with cilia vibrating in its interior; and so I have given an "ideal section" of it*. But my scepticism as to the reality of this apparent aperture continuing, I again grew some *Spongillæ* from the seed-like bodies, in a watch-glass, as before, and having found a very favourable portion for observation, kept it under the microscope while a little indigo was placed in the water, when I noticed that all the particles were taken up by the exterior parts of the "ampullaceous sacs" in contact with which they came, through the crevices that exist between them, and none even appeared to go into their interior. I therefore inferred that there really was no aperture in these "sacs," and hence that the cilia must be outside instead of inside them; and so persuaded am I of this view now, that I would have, in the ideal section of the ampullaceous sac to which I have referred, the cilia placed outside, the "cortical layer" removed, and the internal lining membrane extended across the supposed aperture: thus there would remain a transparent, spherical sac, coated all over by a layer of monociliated and unciliated sponge-cells, except at one part, where the circular transparent area exists; and hence all analogies at which I have hinted, between this sac and the stomachal cavity of the lowest Polypes, &c., cannot now be permitted, nor the term "ampullaceous sac" retained. For the latter, that of "spherical sac" might now be adopted; but this is an inappropriate appellation: "sponge-cell" would be better; but then there are at least three kinds of Amœbous cells in *Spongilla* which might be so termed, viz. the monociliated and unciliated cells forming the cortical part of the "spherical sac," and the cells of the "investing membrane." Then there is the "seed-like body," which, again, is an inappropriate term, and the word "gemmule," much worse: "sporangium" would be better; and the transparent sacs which it contains, with their included granules (which pass into the monociliated and unciliated cells of each "spherical sac"), would respectively be more intelligibly named "spore-cells" and "germs." Yet none of this nomenclature sounds satisfactorily, for the simple reason that *Spongilla* is as much animal as vegetable, and therefore the nomenclature of neither kingdom suits it.

Latterly, since I have directed my attention to the *Volvocineæ*, these seem to me to bear the greatest resemblance to the spherical sacs of *Spongilla*; and while we are still unacquainted with the mode of fecundation in this organism, it may not be altogether useless to conjecture that the fecundation might be also similar; thus, the spherical sac might become the sporangium,

* Annals, vol. xx. pl. 1. fig. 5, 1857.

and the spore-cells arising from a number of the cortical cells becoming impregnated and projecting into the interior, as in *Volvox*, might thus altogether become surrounded by the siliceous cortical structure common to the sporangia or seed-like bodies of *Spongilla*, and so form the sporangia. But this should have no other influence than that of exciting a desire to pursue still further the history of this hybrid organism, which, though as it were at the angle from which the two great organic kingdoms diverge, and therefore assumed to be extremely simple in its organization and œconomy, is much more complicated in both than the common theorist would be inclined to conceive. It might, however, be observed, that the spherical sac is only 1-540th, while the adult *Volvox* is 1-33rd of an inch in diameter; but on a reference to M. N. Lieberkuhn's description of the "swarm-spore" of *Spongilla**, it will be observed that this (which appears to me to be a development from the spherical sac, and is also similarly coated with a layer of monociliated cells) can be seen with "the naked eye, being 1-35th [55th] of an inch in length."

Another point to which I have lately directed my attention again is the ciliated sponge-cells; for, seeing that M. N. Lieberkuhn had discovered some which he considered "spermatozoa-like bodies †," and that they were not like those which I thought might be such ‡, I determined to test the monociliated body, which appeared to me most like a spermatozoon, by placing some indigo in the water with a small portion of living *Spongilla* selected for the purpose, and then breaking it up for view under the microscope, when, if these bodies had taken in any portion of the colouring matter, I should conclude that they were not spermatozoids.

Now there are monociliated cells of different sizes in *Spongilla*, some of which are now known to belong to the cortical layer of the spherical sacs, and which I have already shown to take in colouring matter; but there is one in particular, which has two spines or ear-like points projecting backwards, one on each side of the root of the cilium (Pl. I. fig. 12), and this was the kind which I first discovered and described; but, confounding it with cells not possessing these spines, because I then thought the spines might be accidental prolongations of the sarcode, I did not give it this character; and the smooth cells being largest, the size I gave for them of course exceeded that presented by the cell with spines, that is, being smallest where these parts are smallest, which is in *S. cinerea*. In *S. plumosa* (fig. 12) it is about the

* Annals, vol. xvii. p. 407, 1856. † Annals, vol. xvii. p. 412, 1856.
‡ Annals, vol. xiv. p. 334, 1854.

1-6750th of an inch in diameter, and the cilium about four times this length, while in *S. alba* it is a little less; but its striking character in all is the presence of these spines. If any in particular, it was this spiniferous monociliated cell which I thought might be the spermatozoid; but on performing the experiment mentioned, I not only found it more or less charged with indigo in its isolated state, that is, when torn from its connexions, but also saw it afterwards *in situ*, covering in great plurality one of the spherical sacs of a piece of *Spongilla alba* which had been broken up and placed under the microscope for observation (fig. 13): so that this monociliated cell cannot be considered a spermatozoid*, while it evidently belongs to the cortical part of the spherical sacs, as the cells of this part only take in crude material; and it is curious also that in all the *Spongillæ* here (Bombay) it should have the same characters.

Whether the larger monociliated sponge-cells present these two spines anywhere about them, I cannot say, any further than that, if they do exist, I have never been able to discover them; certainly I have seen many monociliated sponge-cells without them.

The spiniferous, like the other monociliated sponge-cells, present an oscillatory motion in progression, being driven forwards by the undulations of the cilium, which, closely as *Spongilla* approaches the vegetable kingdom in many respects, form a decided difference, inasmuch as all cilia for progression in the zoospores of the Algæ, &c., with which I am acquainted are placed in front of these organisms, where, by a whip-like motion, they drag the body to which they are attached after them: on the animal side, however, the cilium of progression may be either in front or behind; thus, in *Astasia limpida*, Duj., it is placed in front, as in *Euglena*.

Astasia.

As I have had occasion to mention *Astasia limpida* here, I will take this opportunity of clearing up, as well as I am able, the confusion that exists respecting this genus.

In the first place, although no two Infusoria can be more alike than *Astasia limpida* and *Euglena* when casually observed, as my description and delineations will show†, yet the absence of chlorophyll and the presence of a stomachal cavity, &c., for the digestion of crude food in the former, and the presence of chlorophyll and absence of a stomachal cavity as well as of all

* That is, when it takes in food: I do not know what it might have been originally. Some Algal spermatozoids, if they do not become fecundating agents, evidently pass into a more advanced form, which would appear to require nourishment for its development.

† Annals, vol. xviii. pl. 6. figs. 45–48, 1856.

means of taking in crude food for digestion in the latter, are distinguishing characters which at once place *Astasia limpida* on the animal, and *Euglena* on the vegetable side, respectively, of the great organic kingdom; yet both Ehrenberg and Dujardin have classed *Astasia* and *Euglena* together.

In the next place, the genera and species of *Euglena* are so numerous, that their family name should be "Euglenia," as Dujardin has given them (but not for the reason he has assigned), and not "Astasieæ," as given by Ehrenberg, particularly when the *genus Astasia* is so imperfectly characterized by Ehrenberg with respect to *Euglena*, that I believe, with Dujardin, his *A. hæmatodes* and *A. viridis*, "in spite of the existence of the red eye-spot, ought to belong to the *Euglenæ*; and the two others, viz. *A. flavicans* and *A. pusilla*, if not identical, at least are very nearly allied to *Astasia limpida**."

But Ehrenberg has evidently described and figured *Astasia limpida* under the name of *Trachelius trichophorus*†, of which, although "capitate" in respect of the cilium, Dujardin states that Ehrenberg himself observes that he could not see this capitation in the same species when he afterwards examined it in Russia (*l. c.* p. 355), while Dujardin mentions, in another place, that he suspects Ehrenberg of having described a species of his (Dujardin's) *Peranema* "under the name of *Trachelius trichophorus*" (p. 354). Thus Dujardin identifies *Trachelius trichophorus*, Ehr., with his *Peranema*, which genus, together with his *Astasia*, he has made the first two genera of his family "Euglenia;" premising, however, in his prefatory observations to the subject, that they, with the "Monadiens," so pass into each other, that "one is liable to place in different genera the different degrees of development of the same animal" (p. 349); and in his classification, that *Peranema* and *Astasia* "are here grouped artificially and after insufficient characters" (p. 356). Hence it will not be wondered at that I should have identified *Trachelius trichophorus*, which Dujardin considers a species of *Peranema*, with his *Astasia limpida*. Our respective representations do not exactly correspond, probably for the same reason—that Dujardin had not been able to obtain sufficient characters, as he has stated, for describing this genus; but he has described sufficient and drawn sufficient for me to make the identification to which I have alluded.

Lastly, Dujardin, knowing the genus *Peranema* to take in crude food for nourishment, from his considering *Trachelius trichophorus* a species of it (for he has also observed that, according to Ehrenberg, this Infusorium is "voracious"), has placed it and *Astasia* among his "Euglenia," which, from the obvious

* Hist. Nat. des Zoophytes, p. 358.

† Ehrenberg, tab. 32. fig. 11.

distinguishing characters between *Astasia limpida* and *Euglena* which I have given at the commencement, is a mistake. For the purpose, therefore, of further emendation, I would also take away these two genera from the Euglenians, and, transferring Ehrenberg's name of "Astasieæ" to them, as well as his genus "*Astasia*," thus make a new family, which I know to have several forms so like the different species of *Euglena*, that they might be viewed as the *Euglenæ* of the animal kingdom, without confounding them with the true *Euglenæ*, which evidently belong to the vegetable kingdom.

Euglena.

Having during the past year met with two freshwater species of *Euglena* which appear to me to be undescribed, I have named and characterized them as follows:—

Euglena fusiformis, n. sp. Pl. I. figs. 15 & 17.

Short, thick, fusiform, obtuse, of a rich green colour, provided with a long, delicate, single cilium, which projects from a slightly bilabiate anterior extremity, a little behind which is the eye-spot, attached to the contracting vesicle. Nucleus central, situated between the ends of two elongated, refractive, nucleated cells, which extend round the body equatorially. Tailless. Motion during progression oscillatory, and rotating on the longitudinal axis. Length about 1-700th, breadth about 1-1100th of an inch.

Hab. Freshwater tanks in the island of Bombay.

Euglena zonalis, n. sp. Pl. I. fig. 16.

Short, thick, ovoid, cylindrical, slightly narrowed anteriorly, of a rich green colour; provided with a long delicate cilium, which projects from the notch of a slightly bilabiate anterior extremity; a little behind which is the eye-spot, attached to the contracting vesicle. Nucleus central, between the ends of two wide, refractive, nucleated cells, which extend round the body equatorially. Tail adhesive or suctorial (?), short, about one-sixth part of the length of the body. Motion during progression oscillatory, and rotating on the long axis of the body. Length 1-1100th, breadth 1-1800th of an inch.

Hab. Freshwater tanks in the island of Bombay.

Obs. These two *Euglenæ* are remarkable for having that refractive cell or organ which I have called the "glair-cell" equatorial instead of longitudinal, as in *Euglena spirogyra*, or single, and in the anterior lip, as in *Crumenula texta*, &c.*

* Annals, vol. xviii. p. 241. pl. 7. fig. 87, &c.

Cryptoglena, Ehr.

Cryptoglena angulosa, n. sp. Pl. I. fig. 18 *a, b, c*.

Lorica compressed, oblong, angular, shield-shaped, transparent, round posteriorly, square anteriorly, where it presents a short neck in the median line for the passage of the cilia; border thin, curled up posteriorly and anteriorly on opposite sides. Internal or green cell at some distance from the lorica, angular, lined with chlorophyll, provided with two cilia, which issue through the neck of the lorica; two contractile vesicles at their base; an eye-spot median and peripheral, and one to four starch-cells of a circular form. Swimming with its cilia forwards in an extremely irregular line. Length of lorica 1-1080th, and breadth 1-1800th of an inch.

Hab. Freshwater tanks in the island of Bombay.

Obs. When I observed this *Cryptoglena*, it was undergoing duplicate and quaternary division, when the lorica, which is extremely angular at first, loses its asperity, becomes smooth and widened laterally, till at last, the division becoming complete, it splits into shrunken halves, which remain attached to the internal cell as in *Cryptoglena lenticularis*, but without the persistence of the cilia.

With reference to the incorporation of the spermatozoid with the spore of *Cryptoglena lenticularis*, described in my last paper*, I would here mention that I have since seen it take place frequently and most satisfactorily.

EXPLANATION OF PLATE I.

N.B. Figs. 1, 2 & 7, 8, 9, are drawn on the scale of 1-40th to 1-1880th of an inch; and figs. 15 to 18 inclusive on the scale of 1-12th to 1-5400th of an inch.

Fig. 1. *Volvox globator*, adult form, containing daughters and grand-daughters; 57-1880ths of an inch in diameter: *a*, peripheral cell more magnified.

Fig. 2. *Volvox stellatus*, adult form, containing daughters and grand-daughters; 59-1880ths long, and 54-1880ths of an inch broad: *a*, peripheral cell (I am not sure, here, whether the external as well as the internal cell is not conical; it is so in the young daughter-*Volvox*, fig. 6 *c*).

Fig. 3. *Volvox globator*, daughter of, some little time after expulsion, and before the great-grand-daughters or fourth family have appeared. To contrast with fig. 5 at same period.

Fig. 4. Ditto, daughter of fig. 3, greatly magnified, to show the reticulated form of the gonimic contents; 18-5400ths of an inch in diameter;

* Annals, ser. 3. vol. ii. p. 249.

shows also the starch-cells, vibrating brownish granules in the reticular cavities, and marbled appearance of the chlorophyll and protoplasm. To contrast with fig. 6 *c*, of the same size.

Fig. 5. *Volvox stellatus*, daughter of, some little time after expulsion, and before the great-grand-daughters or fourth family have appeared. To contrast with fig. 3.

Fig. 6. Ditto, daughter of; more magnified view of the grand-daughter of fig. 2, 2-5400ths of an inch in diameter, to show that the gonimic contents already present the first line of segmentation, while those of the grand-daughter of *V. globator* (fig. 4) have reached 18-5400ths of an inch before transformation into distinct cells: *a* & *b*, magnified view of the grand-daughter on the same scale—thus showing the relative sizes of the three first stages of duplicative subdivision; *c*, last stage of duplicative subdivision, nearly, before the fourth family appears, 18-5400ths of an inch in diameter. To contrast with fig. 4.

Fig. 7. *Volvox globator*, spore-bearing daughter of, some time after expulsion; largest size seen 45-1880ths of an inch in diameter; spores 3-1880ths of an inch in diameter (the whole number of spores are not inserted here): *a*, more magnified view of spore after impregnation, showing the irregular form of the capsule.

Fig. 8. Ditto, spermatic-cell-bearing daughter of (*Sphærosira Volvox*, Ehr.); largest size seen, 20-1880ths of an inch in diameter: *a*, spermatic cells, 3-1880ths of an inch in diameter: the whole are not inserted here. Besides the spermatic and peripheral cells, there are always several others of intermediate size. *b*, form of spermatozoid, 2 to 2·5-5400ths of an inch long.

Fig. 9. *Volvox stellatus*, daughter of, bearing spores and spermatic cells *together*; largest size 50-1880ths of an inch long, and 44-1880ths broad; spores 2 to 2·5-1880ths of an inch in diameter: *b, b, b, b*, spermatic cells, each 3-1880ths of an inch in diameter (neither all the spores nor all the spermatic cells are inserted); *c*, more magnified view of spore, after impregnation, showing the stellose capsule,—thus still pointing out the tendency to the conical or elongated form which exists in this species, in contradistinction to that of the other, which is globular or spherical; *d*, form of spermatozoid, 2·3-5400ths of an inch long.

Fig. 10. Spermatic cell after the development of the spermatozoids, but before their separation, 3-1880ths of an inch in diameter; this is the same in both species: *a* shows a lateral view of the group, with the dark point representing the remains of the eye-spot of the parent; *b*, vertical view of same.

Fig. 11. Portion of peripheral cells from *V. stellatus*, showing that the daughter-cell, *a*, is an enlargement of one of them.

Fig. 12. *Spongilla plumosa*, monociliated spiniferous cell of, bearing portions of indigo; 1-6750th of an inch in diameter.

Fig. 13. *S. alba*, "spherical sac" of; 1-385th of an inch in diameter: *a*, presenting a cortical portion of monociliated, spiniferous, and *b*, unciliated sponge-cells and granules.

Fig. 14. Ditto, cortical portion of, consisting of four monociliated spiniferous cells.

Fig. 15. *Euglena fusiformis*, n. sp.; 8-5400ths long, 5-5400ths of an inch broad: *a, a*, "glair-cells;" *b*, contractile vesicle and eye-spot.

Fig. 16. *E. zonalis*, n. sp.; 6-5400ths long, including tail: *a, a*, glair-cells; *b*, contractile vesicle and eye-spot.

Fig. 17. *E. fusiformis*, transverse section of, to show the zonular position of the "glair-cells" and nucleus in both species: *a*, *a*, glair-cells; *b*, nucleus.

Fig. 18. *Cryptoglena angulosa*, vertical view; about 8-5460ths of an inch long; showing eye-spot, starch-cell, and double contracting vesicle: *a*, lateral view, showing the irregularities of the lorica; *b*, quaternary division before separation; *c*, ditto after separation of the daughter-cells; *d*, remains of old lorica; *e*, internal cell of ditto.

II.—*On the* Cerastium pumilum *of Curtis*. By Charles C. Babington, M.A., F.R.S. &c.

It is now many years since a little *Cerastium* was noticed near Croydon by Mr. Dickson, and a figure and description of it as *C. pumilum* published in the beautiful 'Flora Londinensis' of Curtis. No English botanist seems to have had any practical knowledge of it from that time to the present; and scarcely any have seen specimens. As Smith (Eng. Fl. ii. 331) considered it to be a variety of *C. semidecandrum*, it is clear that he can never have seen the plant; for it is not to be supposed that he could overlook the great difference of their bracts and sepals. Withering (Bot. Arr. ed. 3. 435) simply quotes the remarks of Curtis. Abbot, who includes it in his 'Fl. Bedford.' (p. 102), and names as localities "Ampthill and Aspley," says nothing by means of which we may form an opinion of the correctness of his nomenclature; and Smith, although quoting Abbot, does not name those localities. Having obtained authentic specimens of this little plant, I endeavoured, in the year 1837, to remove some portion of this obscurity (Mag. Zool. & Bot. ii. 318), but without much success; for in Hooker's 'British Flora' (ed. 4), published in the course of the following year, although my paper is quoted, the *C. pumilum* is placed as synonymous with *C. semidecandrum*, without the slightest remark.

In the sixth and seventh (Dr. Arnott's) editions of the same work, this plant is suspected to be "a pentandrous or early-flowering state" of *C. viscosum* (*C. triviale*). It is manifest that the writer of that remark, which may be traced back to Mr. W. Wilson (Brit. Fl. ed. 1. 214), had never taken much notice of the young state of *C. triviale*, for it has a very slight resemblance to *C. pumilum*, and a very different kind of pubescence; the latter is also one of the plants classed as *Fugaces* by Fries. It rises from seed in the early spring, and has shed its own seeds and died before (often long before) midsummer. *C. triviale* is perennial, or at the very least biennial, and continues to flower until the autumn is far advanced. My friend the Rev. W. W. Newbould has directed my attention to another very valuable distinction between *C. pumilum* and *C. triviale*, which is found in the petals. Those of the latter have a considerable number of parallel longitudinal furrows on their upper surface; and the substance of the petal is thickened under each furrow, so as to form a series of ribs beneath. *C. pumilum* totally wants these furrows and ribs, and has petals of equal thickness throughout. In Hooker's 'Botanical Miscellany' (iii. 117), Mr. W. Wilson remarks that the petals of *C. semidecandrum* are "striated or furrowed." Unfortunately, I have not the means of examining fresh specimens of that plant, which, singular to say, is not common near Cambridge. Should this remark be confirmed, which his great accuracy renders probable, we are furnished with another valuable character for the distinction of *C. pumilum* from *C. semidecandrum.*

It is only when a fragment of *C. triviale* is compared with a similarly imperfect specimen of *C. pumilum* that they have much resemblance. In that case, the *C. triviale* has not the declining peduncles, nor usually (if ever) the glandular pubescence of *C. pumilum.*

In the year 1851 (Bot. Gaz. iii. 1) I made a few remarks upon the *C. pumilum,* and requested botanists to look for it. As no communication on the subject has reached me, I venture to conclude that no one has found the plant. Before that date, I received from Mr. H. O. Stephens of Bristol (a most observant botanist) a specimen of what he believed to be the *C. pumilum,* but which I then mistook for *C. tetrandrum.* He has continued to think that it is *C. pumilum,* and having lately obtained, through his kindness, a supply of living specimens gathered on St. Vincent's Rocks near Bristol, I now concur with him; for, with the aid of them, my acquaintance with the plant has become tolerably complete.

On receiving these specimens, I took occasion to request my friend Mr. F. Townsend, a temporary resident at Torquay, to endeavour to discover the same species on the dry limestone hills of Devonshire. His success was almost immediate; for in the course of a few days I received an abundance of excellent specimens from him. It there grows in company with *Cerastium triviale, C. glomeratum, C. tetrandrum,* and *C. semidecandrum.* By the middle of May, most of the plants of *C. pumilum* have ceased flowering, many have shed their seeds, and all will very soon dry up and disappear. I have also received undoubted specimens of *C. pumilum,* which were gathered on Bembridge Down, in the Isle of Wight, by Mr. A. G. More.

As this plant is frequently met with on the opposite coast of Brittany, we may reasonably expect to find many stations for it in the south of England. It inhabits dry sandy and calcareous places.

C. pumilum (Curt.); foliis oblongis, *bracteis inferioribus herbaceis superioribus margine angustissime scariosis,* sepalis lanceolatis acutis marginibus anguste scariosis, pedicellis fructiferis calyce subduplo longioribus patentibus sed demum erectis apice recurvatis, capsula sursum curvata.

C. pumilum, *Curt.! Fl. Lond.* ii. t. 92 (fasc. vi. t. 30) (1778). *Bab. in Mag. Zool. and Bot.* ii. 318; *Man. Br. Bot.* ed. 4. 55 (non *Gren. et Godr.* nec *Bor.*).
C. glutinosum, *Fries! Fl. Hall.* 78 (1817); *Nov.* ed. 1. 51 (1817), ed. 2. 132; *Herb. Norm.* iv. 54. *Koch, Syn.* ed. 2. 133. *Gren. et Godr. Fl. Fr.* i. 268.
C. obscurum, *Chaub. in St. Amans Fl. Agen.* 180. t. 4 (1821). *Bor. Fl. du Centre de France,* ed. 3. 111.
C. litigiosum, *De Lens in Lois. Fl. Gall.* ii. 323 (1828). *Bor. l.c.* 111.

Root small, annual. Stem branching from the crown of the root; central stem erect, often short, sometimes in weakly plants solitary; lateral stems prostrate or ascending; lower part of all the stems purplish, usually unbranched. Leaves oblong, sessile, rather acute; radical leaves narrowed into a long haft, blunt. Panicles terminal, dichotomous with a flower in each fork. Lower bracts leaflike; upper ones smaller, and having a very narrow membranous margin (which is often invisible without a strongly magnifying glass). Peduncles short, lengthening as the fruit ripens so as to be about twice as long as it, curved at the top but becoming nearly, although not quite, straight when the fruit is ripe, declining from their base but ultimately erect. Flowers slightly open, 4–5-merous. Sepals lanceolate, the edges narrowly membranous in their upper half. Petals exceeding the calyx, although sometimes only in a slight degree, or even occasionally falling short of it, bifid, not ribbed. Stamens 5–10? Capsules a little exceeding the calyx, usually about half as long again as it, slightly curved upwards. Seeds small, reddish, nearly round, covered with darker tubercles throughout. Stem, leaves, and sepals with the exception of their membranous edge, covered with viscid gland-tipped hairs.

Hab. Near Croydon, Surrey, *Mr. Dickson* (1778). Lizard Point, Cornwall, *C. C. B.* (1839). St. Vincent's Rocks near Bristol, *Messrs. H. O. Stephens* and *G. H. K. Thwaites* (1842). Torquay, Devon, *Mr. F. Townsend* (1858). Bembridge Down, Isle of Wight, *Mr. A. G. More* (1858).

The branches of this plant are usually not more than three or four inches in length, often shorter, and are prostrate throughout most of their length; the central stem is frequently very short, always probably shorter than the branches. Sometimes there are no branches, and then the whole plant consists of a simple upright stem ending in a forked panicle.

The *C. litigiosum* is not distinguishable from the *C. obscurum*; for the chief difference is placed in the length of the petals, which is not constant. After an examination of specimens and comparison of descriptions, I have no doubt of their both being synonymous with the *C. glutinosum* of Fries. Also, I have no doubt that they are the plant intended by Dickson and Curtis when publishing the *C. pumilum*. Fries tells us that he has seen much taller individuals, and therefore objects to Curtis's name as being inapplicable, and indeed thinks that his plant is not the same as that of the 'Flora Londinensis.' After examining specimens received from him, and those of Dickson, and the valuable packet sent by my friend Mr. Townsend, and many from France and Germany, I believe that they are all of the same species.

Curtis's name, as being the oldest (1778), must stand, although that of Fries is much the best. Fries named his plant in 1817; the *C. glutinosum* of Humb. and Kunth was published in 1823; if therefore Curtis's name should ultimately be rejected, that given by Fries has the next best claim to adoption. It applies well to all the English specimens which I have seen, and to most of those from the Continent.

III.—*On the* Graptolites *from the Silurian Shales of Dumfriesshire, with a description of three new species.* By William Carruthers, F.R.P.S.E.*

At the meeting of the British Association held at Edinburgh in July 1850, Prof. M'Coy read a list of the then known Graptolites of the south of Scotland. They amounted to fourteen species. My examination of the Graptolitic shales has been chiefly confined to those which occur in Dumfriesshire. In this district the following Graptolites, amounting to twenty-four species, have been found:—

Rastrites peregrinus, *Barr.* Bran Burn, Dobb's Linn.
—— triangulatus, *Harkn.*

This is a remarkably abundant fossil at Garple Linn. Having examined a large number of specimens from this locality, and been unable to discover anything approaching the form of *G. Sedgwickii*, I am satisfied that this is a distinct species, and have consequently inserted it in this list.

Graptolites sagittarius, *Lam.* Lockerbie.
—— tenuis, *Portl.* Lockerbie, Dobb's Linn.
—— convolutus, *His.* Lockerbie.

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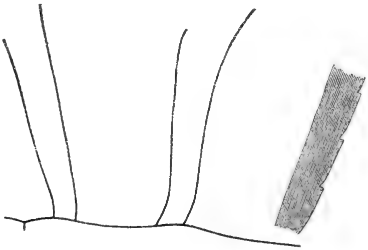
* Read before the Royal Physical Society of Edinburgh, April 28, 1858.

Graptolites Sedgwickii, *Portl.* Duff Kinnel, Dobb's Linn.
—— millipeda, *M'Coy.* Lockerbie.
—— lobiferus, *M'Coy.* Lockerbie.
—— Nilssoni, *Barr.* Bran Burn, Garple.
—— Nicoli, *Harkn.* Beld Craig, Glen Kiln.
—— Becki, *Barr.* Beld Craig.
Cladograpsus linearis, nov. sp. Hartfell.
Diplograpsus rectangularis, *M'Coy.* Dobb's Linn, Hartfell, Lockerbie.
—— foliaceus, *Murch.* Hartfell, Dobb's Linn.
—— folium, *His.* Dobb's Linn, Bran Burn, Hartfell.
—— mucronatus, *Hall.* Hartfell.
—— nodosus, *Harkn.* Bran Burn.
—— pennatus, *Harkn.* Duff Kinnel.
—— teretiusculus, *Harkn.* Glen Kiln.
—— bicornis, *Hall.* Hartfell.
—— tricornis, nov. sp. Hartfell.
Didymograpsus sextans, *Hall.* Hartfell.
—— ramosus, *Hall.* Hartfell.
—— Moffatensis, nov. sp. Hartfell.

Cladograpsus linearis.

Fragments of this fossil are frequently mingled with the *Diplograpsus foliaceus* at Hartfell. It may have been before noticed, and probably referred to some known species as a variety. Having obtained in this locality a number of specimens in a thin bed, where it occurred in great abundance and almost alone, I am able to describe it as a distinct species.

From a short and very slender base the zoophyte divides into two stems, each supporting the cells on their upper sides.

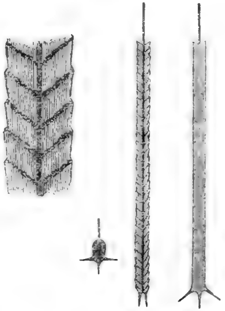


Branches are given off at irregular distances from these principal stems. The length of the polypidom has been very great: one specimen I have been able to trace for nearly three feet. The polypidom has been formed of a flexible substance; for they are seldom found in straight lines, but generally in curves, or bent, without breaking, on themselves. The appearance of this zoophyte in its living state—its long graceful stem yielding to the motion of the water, and its crown of tentacles occupying every cell, which were sufficiently removed to exhibit their individuality—must have been very beautiful.

The polypidom at its origin, near to the slender base, is very narrow, being little more than a fine line; as it increases in length it increases in breadth, until it is fully two-fifths of a line broad. The cells are very remote from each other, and are, at first sight, from the slight indentation they make in the stem, scarcely perceptible, giving the Graptolite the appearance as if it were a clear line. The mouth of the cell is straight and at right angles to the axis; it makes an indentation equal to about one-sixth of the breadth of the polypidom. The number of cells in an inch is about eighteen.

Diplograpsus tricornis.

This species can be readily distinguished by the three spines which adorn its base, and which are almost always preserved. The central spine is a continuation of the line of the axis; it is shorter than the lateral ones. They generally form a more or less acute angle with it, and are never farther removed than to form a right angle; occasionally they assume a graceful curve. The polypidom is more slender than in *D. foliaceus*, which in general outline it somewhat resembles. The axis is slender, and produced beyond the other parts of the fossil. The cell-walls are well marked, extending upwards from the axis to the boundary of the fossil. Each cell forms a rhomb



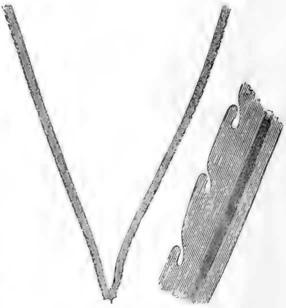
whose outer border is slightly indented, giving the boundary of the fossil a faintly serrated aspect. When the fossil is preserved so as to show the serratures, the spines are so compressed that the central one is almost or altogether lost. When the spines are well preserved and in the position described, no traces of the individual cells are discoverable; the boundary of the fossil is an unbroken line*.

This species is abundant in a thin bed at Hartfell.

* The length of the polypidom is more variable in this Graptolite than in any other I have gathered. A young form, as represented in the figure, is not uncommon.

Didymograpsus Moffatensis.

This is the most elegant of the British species of this genus. The base terminates in three distinct spinous processes. The zoophyte bifurcates from the base. The general appearance is like the figure; or occasionally the lines form an acute angle for about a quarter of an inch, then suddenly expand in slight curves, almost at right angles, for a short distance, when they again recur to their original direction. The branches are united for about a quarter of a line by a slight web, which in some specimens is terminated in a fine process of short length, taking the direction of a line bisecting the angle. The cells are arranged on the outer margins; they are very remote, and penetrate the polypidom to scarcely one-fourth of its breadth; they form slight openings on the margin of the polypidom, first entering at a right angle, and then suddenly turning downwards. These openings are lengthened ovate pouches, answering exactly in shape and size to the cell-serratures of the margin. The number of cells in an inch is about twenty. The breadth of the polypidom is about two-thirds of a line.



This species is found in the shales at Hartfell.

The specific name is derived from the locality where it is found, which is in the neighbourhood of Moffat.

IV.—*List of Coleoptera received from Old Calabar, on the West Coast of Africa.* By Andrew Murray, Edinburgh.

[Continued from vol. ii. p. 349.]

Harpalidæ.

Harpalus, Latr.

Subgen. *Hypolithus,* Dej.

1. *H. holosericeus,* Dej. iv. p. 171.

Fuscus, pubescens, subtilissime rugosus; thorace subquadrato, angulis posticis obtusis; elytris striatis; labro et antennis testaceis; pedibus pallide testaceis.

Long. $4\frac{1}{4}$–5 lin., lat. $1\frac{3}{4}$–$2\frac{1}{4}$ lin.

2. *H. Iris,* mihi.

Nigro-piceus, subnitidus; labro, antennis, palpis pedibusque flavo-testaceis; capite polito, impunctato; thorace subquadrato, testaceo-marginato, supra sublævi, antice leviter punctato, basi fortius et crebre sed leviter rugoso-punctulato, utrinque leviter impresso, angulis obtusis et rotundatis; elytris nigris, cyaneo-micantibus opacis, striatis, interstitiis planis, confertim punctatis, secundo seriatim remote punctato; subtus cæruleo-micans.

Long. $4\frac{1}{4}$ lin., lat. $1\frac{3}{4}$ lin.

One of the iridescent species. Piceous black, somewhat shining, most so in front. Head smooth, impunctate, with a punctiform fovea on each side between the antennæ; labrum, antennæ, and palpi testaceous yellow. Thorax flattish, somewhat shorter than broad, subquadrate, narrowest and pretty deeply emarginate in front, with the sides moderately rounded, most so in front and very slightly behind, truncate at the base, anterior angles slightly projecting, all the angles obtuse; piceous, somewhat shining, with the margins translucent and testaceo-ferruginous, the anterior portion faintly punctate, the base more distinctly and somewhat rugosely punctate, slightly impressed on each side; dorsal line faint, abbreviated both in front and behind; the anterior semilunar arch well marked. Scutellum small, impunctate and triangular. Elytra a little broader at their base than the thorax, with their sides parallel for three-fourths of their length, slightly sinuate at the apex, above flattish with a rather rapid descent at the sides; black, rather opake and bright blue iridescent, striated, the interstices flat (less so at the apex), closely punctate, with the punctures occasionally running into each other, and with a series of remote, deeper punctures on the inner side of the second stria, and also a series of variolar punctures along the exterior margin, the reflexed margins concolorous. Under side blackish piceous with a bluish iridescence, paler in the centre and at the margins of the segments and apex of the abdomen. Legs testaceous yellow.

When greasy, this species (as might be expected) loses its iridescence.

SIOPELUS, mihi.

(From σιωπηλὸς, *taciturn,* in allusion to the smallness (almost absence) of the ligula in the species on which I have founded the genus.)

Mentum profunde emarginatum, sine dente. Ligula minutissima angustata, apice truncato. Paraglossæ tenuissimæ, ligula vix longiores haud in totum ad ligulam adhærentes, rotundato-truncatæ. Palporum articuli ultimi (præsertim labialium) parum tumidi, ovales, ad apicem acuminati. Mandibulæ breves et arcuatæ. Labrum subquadratum, antice parum rotundatum. Caput antice parum depressum, postice vix retractatum. Oculi prominentes. Antennæ satis tenues, haud capite cum thorace longiores; articulus secundus cæteris brevior. Thorax subquadratus, antice emarginatus, postice parum angustatus. Elytra parum curta, subparallela, ad apicem sinuata, haud granulose punctata. Pedes mediocres; tibiæ anteriores externe inermes: maribus, tarsorum anteriorum quatuor primi articuli modice dilatati, squamulorum lineis duabus subtus parati; articuli triangulares; tarsi intermedii minus dilatati. Corpus parum depressum.

It is with reluctance that I have introduced this new genus for the insignificant species which follows; but every attempt to reconcile it with any genus yet established has failed. If I had been restricted to place it in a known genus, I think I would have given the preference to *Harpalus* proper, where it might have taken its place among a crowd of other imperfectly examined species; but it has no tooth to the mentum, which the restricted genus *Harpalus* has. The want of this tooth would carry us to *Selenophorus*, with which it has other affinities; for it possesses in a faint degree the deeper punctures on the alternate interstices of the elytra, which are one of the distinguishing characters of that genus: these punctures here, however, are very faint, and want the *impressive* character of those in the true *Selenophori* (although some of these, such as *S. parallelus*, Lec., have the punctures scarcely more observable than here). But what seems the most effectual bar to its admission among the *Selenophori* is the want of the Amaroid form which distinguishes them. It has more of the form of a true *Harpalus* or *Platymetopus*, or rather something between them. It wants the granulose punctured texture of the elytra which so readily distinguishes the genus *Hypolithus* from its congeners, besides that the latter has a tooth to the mentum. The only remaining genus with which its affinities would allow me to place it is *Platymetopus*; but in it the ligula is long and salient, and, besides, it has invariably the granulose punctuation of the elytra of the *Hypolithi*: this species has nevertheless a good deal of the facies of *Platymetopus*, although the anterior part of the head is not so much depressed as in that genus.

1. *S. Calabaricus*, mihi.

Modice curtus, nigro-piceus, satis nitidus, supra æneo-virescens; labro ferrugineo; palpis, antennis pedibusque rufo-testaceis;

capite lævi, impunctato; thorace subquadrato, postice leviter rugoso-punctato, disco lævi, anguste rufo-testaceo translucente marginato; elytris striatis, interstitiis lævissime sparsim punctulatis, 2°, 6^to^ et præsertim 4^to^ serie e punctis remotis evidentioribus.

Long. 3–$3\frac{3}{4}$ lin., lat. $1\frac{1}{4}$–$1\frac{1}{2}$ lin.

Somewhat short, piceous black, rather shining, with a greenish brassy virescence on the upper side, most distinct on the elytra, less so on the thorax, and not at all on the head. Head smooth, polished and impunctate, epistome more or less distinctly marked off by a transverse line. Labrum ferruginous, darkest in the middle; antennæ and palpi rufo-testaceous. Thorax depressed, subquadrate, slightly emarginate in front, sides gently rounded, posterior angles obtuse, with a minute lateral projecting tooth, occasioned by the meeting of a narrow marginal beading which runs along the sides and base; sides narrowly and posterior angles broadly translucent rufo-testaceous, disk impunctate, dorsal line distinct, reaching the anterior margin, but not the posterior, anterior semilunar depression very slightly and faintly rugose; basal portion of thorax finely rugoso-punctate, a very shallow basal depression on each side. Scutellum ferrugineo-piceous, impunctate. Elytra striated, striæ deepest at base and apex and impunctate, interstices faintly punctate, four or five larger punctures on the second interstice from the suture, several similar punctures on the fourth interstice, and three or four on the sixth interstice; stria next the margin with several larger punctures towards the base and apex, none in its middle portion: the alternate punctuation on the interstices above described is sometimes almost wholly wanting. Under side piceous; breast and other central portions and apex of abdomen paler; episterna sparingly punctate, abdomen almost without punctuation. Legs testaceous.

Platymetopus, Dej.

1. *P. granulosus*, mihi.

Nigro-piceus, pubescens, supra (præsertim capite et thorace) virescens: labro, palpis pedibusque testaceis; antennis fuscis, basin versus pallidioribus; capite et thorace crebre et fortiter punctatis; thoracis angulis anticis acutis, posticis obtusis; elytris striato-punctatis, interstitiis leviter granuloso-punctatis, ad apicem valde sinuatis.

Long. 4 lin., lat. $1\frac{3}{4}$ lin.

Pubescent, piceous black, head and thorax virescent. Elytra less so and more dull. Head depressed, densely and coarsely punctate, without any marked depressions; labrum ferrugineo-testaceous, wider behind than in front; antennæ fuscous, the basal joints testaceous; palpi testaceous; mandibles nearly straight, and projecting very slightly, giving a triangular outline to the front of the head. Thorax with anterior angles acute and posterior obtuse*; sides with a narrow raised edge and slightly sinuate behind, coarsely punctate over the whole surface, dorsal line faintly observable on the disk, and a considerable elongate fovea near each of the posterior angles. Scutellum small, transverse and impunctate. Elytra punctate-striate, most closely and deeply at the apex, the punctures in the striæ small and closely placed together, the interstices flat and thickly covered with a fine granulose punctuation; apex deeply excised, so much so as to remind one of the apex of the elytra in the male *Silpha sinuata*. Under side pretty coarsely punctate, except on the segments of the abdomen, which are only finely punctate. Legs testaceous.

V.—*Further Gleanings in British Conchology.* By J. Gwyn Jeffreys, Esq., F.R.S.

[Continued from vol. ii. p. 133.]

[With a Plate.]

I last autumn paid a short visit to my friend Dr. Lukis at Guernsey, and through his kindness became better acquainted with the Mollusca of the Channel Isles; and having received a consignment of Zetland shells from Mr. Barlee, and several valuable communications from the Rev. Mr. Norman, Mr. Hyndman, Mr. Lukis, Mr. Wm. Thompson, the Rev. Leonard Jenyns, Mrs. Collings, Mr. Wm. Clark, Mr. Alder, Mr. M'Andrew, Capt. Bedford, Mr. Bean, Mr. Pickering, Dr. Halley, Mr. Webster, and last, but not least, my zealous and able collaborateurs, Dr. Lukis and Mr. Barlee, I am enabled to make another contribution to British Conchology. Some of the facts which I have thus collected, and now present to my readers, will I think be found to possess not a little interest in a geological as well as a conchological point of view, and to show the intimate connexion which exists between the two sciences, while others have an important bearing on the difficult and unsettled question of geographical distribution.

I have also had opportunities of examining typical collections

* In his synopsis of the characters of this genus, Prof. Lacordaire (Genera, i. p. 301) has added a generic character to those given originally by the Count Dejean, which I do not think warranted, and which should be withdrawn, viz. that the posterior angles of the thorax are rounded. They are usually obtuse, and sometimes rounded, but not always so.

of Möller and Mörch from Greenland and of Lovén from Norway, in which nearly all the species (although sometimes disguised under different names from ours) are undistinguishable from those of this country, or are at most only local varieties. I have on another occasion pointed out the hindrance caused to science, and especially to Palæontological Geology, by the reduplication of names for the same species; and until the errors are rectified and a complete concordance established, it is evident that any catalogues, from which the relative proportions of fossil and recent species are deduced, cannot be of much value. In another respect, too, such catalogues are defective, viz. in assuming that all the recent species which exist in any given area are not also found in a fossil state. Such is the case with Philippi's catalogues (in his work on the Sicilian Testacea and his papers in Wiegmann's Archives), to which, although accurate to a certain extent, additions are continually being made, so as materially to alter the relative proportions. It is most probable that every species which he has described as now inhabiting the coasts of lower Italy will eventually be discovered to have also had its existence in the Tertiary epoch, and perhaps *vice versâ.* The old adage "De non apparentibus et non existentibus eadem est ratio" surely does not apply to the science of Natural History.

I will say a few words as to the way in which I believe many exotic species have been introduced into collections and catalogues of British shells. Whilst enjoying last autumn the hospitality of the Rev. Mr. and Mrs. Collings at the seigneurie in Serk, I witnessed, with a telescope from the tower, a scene which I shall not soon forget. It was that of at least 200 excursionists, who had landed from Guernsey steamers on the little Isle of Herm, and were busily engaged in picking up shells on the famous beach there,—some of them on their hands and knees, others in various recumbent attitudes, and all provided with bags and baskets. I was informed that most of the shells so collected were used in the manufacture of ornamental articles. These collectors were probably careless about the localities whence their specimens were procured; and thus, from the mixture of native shells with others from foreign countries of a more attractive form or colour, has arisen some of the confusion which exists in many collections purporting to be entirely of British species. For instance, in Mr. Macculloch's cabinet of shells from the Channel Isles, I observed some well-known West Indian species which had been procured in the above manner. Some spurious species have doubtless also been foisted on conchologists by design as well as inadvertence. Maravigna (in his 'Mémoires pour servir à l'Histoire Naturelle de la Sicile') states that he had reason to believe Philippi was in several instances deceived by fishermen; and in the 'History of the British Mollusca' it is stated (as I believe, with truth) that Montagu and Turton were often similarly misled. I do not think that many spurious species have been introduced by means of wrecked ships, though perhaps a small percentage may be thus accounted for. Mr. Hyndman, in his Report last year to the British Association, of the proceedings of the Belfast Dredging Committee, states that dead specimens of *Cypræa moneta* had been frequently found on the shore near Bangor, county Down, and he adds that there was a tradition that a ship engaged in the slave trade was wrecked there. Such cases are, however, I apprehend, very rare.

I am indebted to Dr. Lukis and Mrs. Collings for the accurate illustrations which accompany this paper; the former as to the shells, and the latter as to the lingual ribands or "tongues" of some of the Gasteropods. The representation of the hinge and teeth of *Limopsis pellucida*, which is altogether only $\frac{1}{40}$th of an inch in length, and of the tongue of *Euomphalus nitidissimus*, an animal scarcely half a line in diameter, may justly be reckoned among triumphs of microscopic art.

Acephala Lamellibranchiata.

Teredo Norvagica, *Forbes & Hanl. Brit. Moll.* vol. i. p. 66. Weymouth (*Mr. Thompson*); in a log of wood at Penzance (*Rev. Mr. Norman*).

T. megotara, i. 77. Mr. Norman informs me that Mr. Frederick Burton obtained this species last year, from wood thrown up near Newhaven.

T. malleolus, i. 84. In cork, Falmouth (*Rev. Mr. Norman*).

Pholas crispata, i. 114. Weymouth, by Mr. Metcalfe (*Mr. Thompson*); and Mr. Norman says that large valves, fully 3 inches in length, are frequently thrown up on the shore at Hunstanton in Norfolk.

P. candida, i. 117. In the decayed wood of a submarine forest at Hunstanton; very abundant (*Rev. Mr. Norman*).

Mya arenaria, i. 168. Weymouth, by Mr. Metcalfe (*Mr. Thompson*).

Sphænia Binghami, i. 190. A shell, sent by Professor Lovén to Mr. Alder as "*Mya Swainsonii*," and forwarded by the latter to me for examination, belongs to this species, and not to the young of *Mya arenaria*, which Turton described under the name of *Sphenia Swainsoni*.

Neæra cuspidata, i. 195. Tiberi, in his recent pamphlet entitled "Descrizione di alcuni nuovi Testacei viventi nel Mediterraneo," has separated the *Corbula cuspidata* of Philippi from our ordinary form, under the name of *Neæra renovata*. Both inhabit the Mediterranean. The first is thinner and more slender than the last, and it has the rostrum much more produced; the posterior lateral tooth being simple in the right valve of the one, and double in that of the other. Brocchi, in his 'Conchiologia Fossile Subapennina' (p. 515), mentions a specimen which had a primary as well as two lateral teeth.

Thracia villosiuscula, i. 224. Weymouth (*Mr. Thompson*).

T. pubescens, i. 226. Weymouth (*Mr. Thompson*).

T. distorta, i. 231. In rock-pools at Arran, N. B., and Bantry (*Rev. Mr. Norman*).

Diodonta fragilis, i. 284. Mr. Thompson says he found a live specimen of this local shell at Weymouth in 1855.

Tellina pygmæa, i. 295. Herm (*Rev. Mr. Norman*); Guernsey (*J. G. J.*).

Syndosmya prismatica, i. 321. Guernsey (*Rev. Mr. Norman* & *J. G. J.*).

S. tenuis, i. 323. Guernsey (*Mr. Edgar Macculloch*); Seaford (*Rev. Mr. Norman*).

Scrobicularia piperata, i. 326. Weymouth and Southport (*Mr. Thompson*); Hunstanton (*Rev. Mr. Norman*).

Ervilia castanea, i. 341. Herm (*Mr. Macculloch*).

Astarte crebricostata, i. 456. Forbes and Hanley distinguish this from *A. sulcata* by its having 30 or more ribs, instead of from 20 to 30, which the latter species possesses, and by "the posterior cessation" of these ribs. I have recent specimens from Zetland which show 36 ribs, and others from Norway, which Mr. M'Andrew obtained and obligingly gave me, showing as many as 42 ribs; but the number of ribs varies much in specimens from different localities, as well as the comparative want or cessation of them on the posterior side, and I must confess that I cannot see more than a varietal difference between the two so-called species.

A. triangularis, i. 467. Clyde district (*Rev. Mr. Norman*).

Cardium. The young of *C. echinatum*, as well as of *C. punctatum* and other species, have a remarkable slenderness and obliquity of outline, which in the adult becomes more portly, like

"the Justice,
In fair round belly with good capon lined."

C. aculeatum, ii. 4. Weymouth (*Mr. Thompson*).

C. punctatum. *C. nodosum*, ii. 22. Clyde district (*Rev. Mr. Norman*).

C. pygmæum, ii. 29. Herm and Serk.

C. papillosum. I found a single valve on the beach at Herm, within a few minutes of my visiting it; so that it would appear not to be uncommon on that part of our coast.

Clausina Croulinensis. The largest individual I have of this species, and which came from the Shetlands, measures in length nearly one-eighth, and in breadth one-tenth, of an inch. In fresh and young specimens a minute spiculum or horn-like process is seen to project from the right beak in a line with the shell. I should not be surprised if it proved to be the young of the *Axinus Sarsii* of Lovén, which is not angulated like *Cryptodon flexuosum,* and has no vestige of a tooth, although the shell is three times as large.

Montacuta ferruginosa, ii. 72. Bantry (*Rev. Mr. Norman*).

M. bidentata, ii. 75. Hunstanton and Falmouth (*Rev. Mr. Norman*). To this species belongs a shell which was sent by Professor Lovén to Mr. Alder, and forwarded by the latter to me for examination, under the name of "*Mesodesma exiguum*;" and it seems to agree with Lovén's description of the last-named species.

M. substriata, ii. 77. Weymouth (*Mr. Thompson*).

Kellia lactea. *Tellimya lactea,* Brown, Ill. Br. Conch. p. 106. pl. 42. f. 10, 11. *K. suborbicularis,* B. M. ii. 87. pl. 18. f. 9 (not 9^a or 9^b). *K. lactea,* Lovén, p. 44. *K. Cailliaudi,* Recluz in Journ. de Conch. t. vi. p. 340. pl. 12. f. 4, 5. I believe this is a distinct species from *K. suborbicularis,* being of a more ovate form, with the front margin somewhat compressed, and the form and position of the hinge, teeth, and ligament being different. It may be the variety noticed by Montagu. I have given a figure of the hinge and teeth in Pl. II. fig. 1, which may be compared with that of *K. suborbicularis* in the 'British Mollusca,' to show the distinction between them in this respect, the other figures in the same work admirably characterizing their respective forms. This species is not so common as *K. suborbicularis*; but both of them occur together on all parts of our coast from the Channel Isles to Zetland. M. Cailliaud of Nantes, who first discovered it in France, identified my shells as Recluz's species; and I also found specimens this autumn on the coast of Normandy. Mr. M'Andrew has taken it on the Atlantic coast of Spain; and I have seen a specimen which was received by Mr. Alder from Professor Lovén as his *K. lactea.*

K. rubra, ii. 94. Weymouth (*Mr. Thompson*).

Lepton squamosum, ii. 98. Falmouth (*Rev. Mr. Norman*). I have also taken it on the coast of Normandy with other shells hitherto considered to be confined to this country, and which will probably be noticed by M. Petit in the 'Journal de Conchyliologie.'

L. Clarkiæ, iv. 255. Zetland (*Mr. Barlee*).

L. sulcatulum, n. s. Pl. II. fig. 2 *a–g.*

Testa subrotunda, convexiuscula, nitida, pellucida, alba, sulcis confertis concentrice insculpta; margine antico aliquando (præsertim in adultis) sinuato; umbonibus prominulis, calyculatis, glabris; dentibus, in valvula dextra duo lateralibus validis approximatis, in valvula sinistra uno cardinali et duo lateralibus utrinque approximantibus; ligamento (uti in congeneribus) interno, fovea centrali triangulari, recepto; long. $\frac{1}{15}$ unc., lat. fere eadem.

This new and exquisitely beautiful species occurred to me rather plentifully in dredged sand and washings of corallines from the sublittoral zone at Guernsey. I also noticed it at Paris among some minute shells from Sardinia which were submitted to my inspection, as well as in Mr. M'Andrew's cabinet from Orotava and Lancerote in the Canaries; so that it appears to have a wide range. Mr. Clark justly remarks that it is allied to *L. Clarkiæ.* In form and sculpture it has some analogies with the genus *Codakia* of Scopoli. Even this tiny shell is sometimes found to have been drilled by one of the canaliferous mollusks.

Galeomma Turtoni, ii. 105. Weymouth, in *Eschara foliacea* (*Mr. Thompson*).

Sphærium calyculatum. *Cyclas calyculata,* ii. 115. Plymouth (*Rev. Mr. Norman*). Scopoli's generic name ought, I think, to be retained, as it was indicated by him, so long ago as 1777, with sufficient precision, and the type which he gave (*Tellina cornea* of Linnæus) is unmistakeable. I believe it is not generally known that the *Sphæria* and *Pisidia* possess the power of swimming and floating on the *under*-surface of the water. M. Moquin-Tandon, indeed, in his admirable work on the Land and Freshwater Mollusca of France, says, with regard to the *Cyclades,* "Ces mollusques rampent très bien sur les plantes aquatiques et même à la surface de l'eau, au moins pendant leur jeunesse." And he says, with regard to the *Pisidia,* "Les Pisidies rampent avec facilité; elles exécutent même des espèces de sauts. On assure que, dans certaines circonstances, elles se tiennent à la surface de l'eau et peuvent y nager." And M. Baudon, in his excellent Monograph on the French *Pisidia,* gives an interesting account of the mode of progression adopted by the *Pisidium.* But I think it will be also interesting to have Dr. Lukis's account of the natatory feats of the *Sphærium calyculatum,* as well as of a curious phænomenon resulting from the passage of a continuous stream of water through one or both of its siphonal tubes. He says, in a letter to me dated the 27th of October last, "I placed a number in a small fish-globe in clear water taken from the sluggish stream in which they were captured. In a short time they commenced crawling about and actually ascending the slippery concave glass. In a few days a considerable number of the fry had been cast, which proved far more active than their parents, readily climbing the sides of the globe, and rarely missing their footing, while the adults made many ineffectual attempts; but both fry and adults, when they reach the edge of the water, take to the surface easily, and creep along slowly and apparently cautiously, as if in search of some floating substance, near which they will rest for hours. The exserted foot moves, during this under-surface progression, by a gentle vermicular action, the siphons being at the same time protruded. The foot during repose is usually retracted, and does not seem necessary for mere floating purposes. I have not been able to detect any filament, as in *Kellia,*" &c. And he adds, "An interesting little scene occurred in the globe the other evening. Several individuals had reached a few leaves and hanging roots of minute water-plants which floated in the centre of the globe, down the stems of which three or four had crept to a depth of about an inch and a half. There they reposed: but they were not absolutely motionless, for to my surprise the whole group, plants and all, were dreamily enjoying the delights of a short, but long-continued, rotation. Round and round they all together went,—a little world revolving from some unseen cause, and leaving this for me to conjecture. At first I thought some minute water-insect had found its way unbidden into the globe, and was thus illustrating, like some learned lecturer to his sleeping audience, the laws of planetary motions. But no such lecturer was there; yet, as the revolution brought two of the audience closer under inspection, I observed their siphons to be curved exactly in the opposite direction to the line of motion. Here was a solution, at once, of the nymph-like στρόβιλος, which was evidently due to the recoil consequent upon the circulation and expulsion of the water through the siphons. The fortuitous position of the two individuals and the combined action of their expulsive tubes may not occur again; but the whole incident was so interesting and remarkable, that I could not help recording it. The fry are growing rapidly; and I opine the amount of exercise they indulge in is conducive to their health. I have observed the *Eulima distorta, Rissoa parva* and *cingillus*, as well as the *Odostomiæ* and *Jeffreysiæ*, ascend to the edge of a basin and creep along the under-surface of the water, in the same manner as the *Lymnæadæ*. But it is singular that bivalves should imitate their less unwieldy molluscan brethren in this seemingly unsuitable mode of progression." In another letter he says, "Sometimes a single individual will suspend itself to a little bit of the stem of the *Lemna*, and whirl quite alone for hours, even rapidly—say fifteen to twenty revolutions in a minute. The quantity of weed in the globe was very small." And in a subsequent letter he goes on to say, "The young are far more active than the parents. I do not perceive their siphons to be ever exserted, while this is almost constantly the habit of the older ones. They all continue to climb the glass globe, and rather more so in the evening, probably preferring to roam in the dark. I have had a fresh supply of about half-a-dozen, which, soon after being immersed, began an inspection of their new domain, and continued for a day or two more restless than the others. On climbing the glass, the front margin of the valves is applied to it, and at the same time both the foot and the siphons are exserted. The foot being extended to its full length, its extremity is cautiously pressed against the glass, and after a short pause the upward movement of the body commences, which is the work of a second of time; then another short pause, after which the front margin of the valves and the point of the foot are again applied cautiously to the glass, and the foot is again protruded to repeat the same process. When the edge of the water is reached, the pauses are longer, and it is necessary for the creature to be doubly cautious, for here is the point of greatest difficulty. However, the foot is conveyed horizontally along the under surface of the water, which appears to recede partially from it. On examining it with a lens, the foot is distinctly seen to have an undulating action on the surface, as well as an irregular and imperfect contraction and elongation along its whole extent; but it is never quite retracted, excepting when its base and the front margin of the valves are in contact with some floating weed which is capable of supporting the whole. Thus this elegant shell traverses the still surface. But it is most curious to see it descending the thread-like stems of the *Lemna*, or some assemblage of these delicate fibres—even a single stem is quite sufficient; and if the shell is free from any other contact, it immediately begins its rotatory movement. A single shell, thus suspended, revolves upon its axis in a direction which is most frequently from right to left of the observer, or in the opposite direction from that of a teetotum when made to spin by the fingers of the right hand. I have suspended single threads to circular pieces of cork in the water, but the stems of the *Lemna* are preferred. *C. cornea* is much less active or inclined to ascend the glass; in fact, I have not yet seen it accomplish the feat of its congener. Several of the *C. calyculata* will remain among the stems of the duckweed for hours perfectly inactive, with closed valves, as if sleeping or resting after their previous fatigue. When the valves are pressed against the glass while ascending, there seems to be a fulness about the base of the foot, as if the mantle served for adhesion to the glass." Dr. Lukis now informs me that he has detected the byssal filament in *Sph. calyculatum.* He says, "I have this morning (16th Dec.) watched one, which had reached the surface, *spin its filament,* and descend to half an inch below the surface, where it remained suspended for some time. It occupied three hours in spinning this short thread. I think it consists of more than a single filament, for some minute particles, which were floating in the water, became entangled in it. The surface of the water was, again, depressed or cupped." And he concludes by saying that he found the number of the fibres varies from one to at least four, which in one instance were far apart, the siphons and foot being at the same time exposed; and he adds that the animal has the power of raising itself by means of this byssus again to the surface after having been suspended below it for some time. The filaments appeared not to exceed half an inch in length, and rarely more than one thread was distinctly visible.

Pisidium. Having examined the original and typical specimens of Mr. Jenyns, which he most obligingly sent me for that purpose, and being aided by a critical investigation of the species which I have carried on for very many years in this country, as well as in France, Germany, and Italy, I am inclined to reduce all the British species to the following: viz. 1. *pusillum* (including *obtusale*); 2. *nitidum*; 3. *roseum*; 4. *Henslowianum* (including *pulchellum* and *cinereum,* the types of which last I have also examined, through the kindness of Mr. Alder); and 5. *amnicum.* The variation of form, striation, and comparative solidity is unquestionably greater among freshwater than marine shells; and it is probably owing to the different nature and qualities of the fluid which they inhabit and from which their materials are secreted.

P. pusillum, var. *P. obtusale* (teste Jenyns), ii. 120. Clevedon (*Rev. Mr. Norman*); Serk (*J. G. J.*). I have never met with this variety in company with the typical form. Its habits appear to be more active, owing perhaps to the difference of the water and localities in which it is found.

Ditto (typical form), ii. 123. A very fine variety, of a paler colour, occurred to me some time ago in the neighbourhood of Llanelly, Carmarthenshire; and Mr. Bean has lately sent me the same variety from Scarborough. Judging from the description and figure given by Poli in his 'Testacea utriusque Siciliæ,' t. i. p. 65. pl. 16. f. 1, I should say that his ***P. Casertanum*** ought to be referred to this species, and not to *P. Henslowianum* or *pulchellum*, as M. Baudon has supposed. Poli did not notice any other species. There being a difference of opinion on this point (probably arising from the description not being sufficiently explicit for identification of the species), it would not, in my opinion, be worth while to substitute the local name of *Casertanum* for either of these species, which are so well known by their present names.

Pisidium nitidum, ii. 126. Yatton, Somerset (*Rev. Mr. Norman*); Serk, with the last and two next species. It appears to be generally diffused throughout Great Britain and Ireland, but not to be so gregarious, or to occur in such numbers, as the last species.

P. roseum, Scholtz, Schlesien's Land- und Wasser-Mollusken, p. 140. *P. pulchellum*, var. δ, Jen. p. 18. pl. 21. f. 4, 5. *P. Gassiessianum*, Dupuy, Moll. terr. et d'eau douce en France, p. 685. t. 30. f. 7. This species differs from any of its congeners in the colour of the animal, from which the name given to it by Scholtz is derived, as well as in its gibbous shell, and the front or ventral margin being much compressed. It is found, but in comparative rarity, together with *P. nitidum* and *Henslowianum* (var. *pulchellum*), so that it cannot be a local variety of either of these species; and the position of its beaks, which is nearly terminal, will at once serve to distinguish it from *P. pusillum* or any of its varieties. I have taken it in many parts of England and Wales, as far north as Nottinghamshire; and I observed it, in 1843, in a pond by the road-side between Bonn and Poppelsdorff in the Rhine district. A comparison of Mr. Jenyns's typical specimen of *P. pulchellum* var. δ. with this species has satisfied me that they are the same. I have added a representation of it in Pl. II. f. 3 *a–c*. It was not without considerable hesitation that I adopted Scholtz's name of *roseum* for this species, because in a Supplement to the second edition of his work, which was published in 1853, he has considered it to be a variety of the *P. fontinale* of Pfeiffer (our *P. pusillum*); but the peculiar and constant colour of the animal appears to form a good distinctive mark, and Scholtz has not otherwise characterized any of the *Pisidia* with sufficient accuracy.

P. Henslowianum var. pulchellum, ii. 128. Guernsey (*Dr. Lukis*).

Ditto (typical form), ii. 131. Ferry Hill, co. Durham (*Rev. Mr. Norman*).

The *P. Recluzianum* of Baudon's monograph, p. 53. pl. 5. f. D, which is stated to have been found at Belfast, appears, from the description and figure given by him, to be the *Turtonia minuta*. He even states the colour of the shell to be "flavo-violacea," which is precisely that of *T. minuta*. Mr. Hyndman says, as to this species, "Abundant between tide-marks. Found in great quantity in the stomachs of mullet taken in the Harbour near Belfast. In one fish taken in Larne Lough, and the contents of the stomach given me by W. Darragh, Curator to the Belfast Museum, I estimated 35,000 of these little shells." It is equally abundant in the Channel Isles. The original species (*P. Recluzianum*) seems to have been founded by M. Bourguignat on young specimens of *P. Henslowianum* (var. *pulchellum*) from Boulogne, and is described and figured in the 'Journal de Conchyliologie,' t. iii. p. 174. pl. 8. f. 8 *a–e*.

Mytilus Galloprovincialis, Lamarck, vi. (1) 126. I believe this to be a distinct species from *M. edulis* or any of its varieties, and that it may be readily distinguished by the compression and sharp angle of the anterior side, the more rounded outline of the basal margin (which in *M. edulis* is subquadrate), the beaks being more incurved, and especially by the prominence of the posterior or byssal margin. It also attains a much larger size; a specimen which I noticed in the collection of M. Deshayes, from Toulon, measuring about five inches in length. Mr. Barlee's specimen of *M. edulis*, which is recorded in the 'British Mollusca' as measuring eight inches and a half in length, is a *Modiola modiolus*. Another characteristic mark, which I observed in Lamarck's typical specimen of *M. Galloprovincialis* at the Jardin des Plantes, and in all the other specimens which I have seen, is that the epidermis is more or less puckered, like what are called "crows'-feet," in some part or other of the shell. The *M. pellucidus* of Pennant and other English conchologists is most probably a variety of this species, and not of *M. edulis*; but I will not venture to restore Pennant's name, as he did not distinguish the species with sufficient precision. It is also probably the *M. dilatatus* of Gray, and the *M. subsaxatilis* of Williamson. It is not uncommon on our coasts; and I have some fine specimens from the Bristol Channel. A representation of this species will be found in Pl. II. fig. 4.

M. ungulatus, Pl. II. fig. 5. Linn. Syst. Nat. p. 1157. Poli, Test. utr. Sic. t. ii. p. 208.

While I was at Serk with Dr. Lukis, we found in the Gouliot Caves there several specimens of this unquestionably distinct species, mixed with *M. edulis* and *M. Galloprovincialis*. These caves are completely uncovered by the sea once only in about eight or ten years, and are never accessible except at low spring tides, and even then for a very short time only; and the mussels were obtained by scraping the side of one of the outer entrances which was under water. The tide sometimes rises on that coast to a height of 32 feet. The specimens in my possession exactly correspond with the description given by Linnæus in his 'Systema Naturæ,' and which is as follows:—"*M.* testa lævi, subcurvata: margine posteriori inflexo, cardine terminali bidentato." And in the 'Mus. Lud. Ulr.' p. 541, he says, "Testa rudis, fragilis, livida, striata transversim quasi ex lineis imbricatis. Sutura postica linea recta excurrit ultra apicem obtusum. Cardo rima longitudine suturæ eique parallela. Par testarum distinctarum, in plano juxta se positarum, refert ungulas pecoris binas medio a se invicem dehiscentes et basi divaricatas." And in his note 136* he adds, "Valvulæ valde convexæ. Nates distantes acutæ. Cardo apicis dentibus 2, 3, s. 4, notatus." The localities assigned by Linnæus to this species are Southern Europe and the Cape of Good Hope; but I suspect that the shells from the last-named locality may belong to a different species. The colour of the animal differs from that of *M. edulis* and *M. Galloprovincialis* in being bright yellow instead of brown; and the shells are at a glance equally distinguishable by the anterior side being extremely gibbous, the posterior or byssal margin being straight or inflected and umbilicated, the want of a dorsal angle, the pointed extremities, and also by the oblique slope on each side of the lower or basal margins to a point, causing the fanciful but striking resemblance to a bullock's hoof when the valves are placed side by side. The colour of the shell is purplish blue, the epidermis being olive-brown and highly iridescent. The size of our largest specimen is four inches and a half in length, and two and a quarter in breadth. In the Linnæan Collection two shells are still preserved; one of them being in a tin cradle-shaped box, marked on the lid "Mytilus ungulatus," in Linnæus's own handwriting; the other being loose in the same drawer. Both of these shells have on the inside of one of the valves the number "216" in the same handwriting; and this number corresponds with that under which the species is described in the tenth edition of the 'Systema Naturæ.' They agree with ours in every respect, except in being somewhat smaller. Dr. Lukis informs me that the "hoof" mussel is sometimes, but rarely, brought to the Guernsey market from a very large reef of rocks about twenty-five miles south of the island, and that such specimens are nearly as fine as those from the Gouliot Caves. The rediscovery of this long-lost Linnæan species is very interesting. None of the subsequent authors except Poli seem to have recognized it; and when they attempted to do so, they mistook other, and exotic, species for it. Since the above was written, Mr. Norman has sent me for examination some shells which he, and afterwards Mr. Webster, took at Hayle in Cornwall, and which clearly belong to this species, as well as a stunted specimen of the form or variety called *incurvatus*, found by Mr. Norman at the Land's-End.

Modiola tulipa, ii. 187. This forms a rude nest by agglutinating together small stones and bits of other shells, in the same manner as the *Limæ*; and when taken out, it floats on the surface, being either of less specific gravity than the water, or buoyed up by air-cells. I think this is a different species from the *M. tulipa* of Lamarck, which is exotic, and that the name "*radiata*," given to it by Mr. Hanley in Thorpe's 'British Marine Conchology,' ought to be adopted for our shell. A large and dark-coloured variety has been taken by Mr. Norman, as well as myself, plentifully in Falmouth Harbour. Specimens of this variety attain sometimes the size of two inches and a quarter in length.

M. cuprea, n. s.

Testa ovato-trapezoidea, gibbosa, solidula, nitida, epidermide fulva prismatica, antice flava pilosa, vestita, subtus albida, rugis concentricis raris irregulariter notata; angulo transversali ex apicibus ad latus anterius oblique decurrente; umbonibus obtusis; lateribus, dorsali rectiusculo elevatiore antice rotundato, posteriori abrupte truncato, ventrali convexo subsinuato postice declivi, anteriori quadrato; marginibus integris; bysso ex filis perpaucis curtis crassulis composito; long. $\frac{1}{6}$, lat. $\frac{1}{8}$ unc.

I have just received from Mr. Bean specimens of this pretty little *Modiola.* He says they were taken from the stomach of a Sanderling, which was shot on the north shore at Scarborough; they were mixed with the young of *Mytilus edulis* and *Littorina littoralis.* I regret that they reached me too late for illustration, my drawings being at the time in the engraver's hands. It somewhat resembles the fry of *Crenella nigra*, which is quite devoid of any longitudinal ribs or striæ; but the latter are of an oblong shape, and flatter, and they have no epidermis. *M. agglutinans*, or *vestita*, is also of a different shape, and not so tumid as this, although its epidermis is somewhat similar.

I much doubt the propriety of separating *Crenella* from *Modiola*, because the former is in its earliest stage of growth also quite smooth. It is true that some of the *Crenellæ* inhabit the tunic of Ascidians; but others (as *C. costulata, rhombea,* and *decussata*, as well as *C. discors* in its young state) are free. A few of the *Modiolæ* (as *M. tulipa* of British authors, and *M. agglutinans*) make and inhabit nests, while the rest are free. But these habits are not uniform, nor in my opinion sufficiently important in themselves to form a generic character. Mr. Stimpson, in his recent memoir on the New England shells, gives it as his opinion that *Modiola, Modiolaria,* and *Crenella* ought to be reunited to *Mytilus*, on the ground of the animals being the same in all, and of the differences which exist in species of these so-called genera being as great *inter se* as between the genera themselves. He also says that the British species of *Crenella*, which are found on the North American coast, do not possess the habit of burrowing in the tests of *Ascidiæ*.

Crenella costulata, ii. 205. Herm (*Mr. Macculloch*).

Nucula nitida, ii. 218. Dead valves are abundant in dredged sand from the Turbot Bank, Belfast Bay.

N. radiata, ii. 220. Weymouth (*Mr. Thompson*).

Arca tetragona, ii. 234. Abundant in crevices of the slate rocks at Bantry (*Dr. Armstrong, Mr. Barlee, Rev. Mr. Norman,* and *J. G. J.*).

Limopsis pellucida, n. s. Pl. II. fig. 6 *a–d*.

Testa ovata, ventricosa, nitida, pellucida, glabra, vix subauriculata, lineis incrementi conspicuis; umbonibus rectis, prominulis, obtusis; margine integro; cardine foveola media triangulari, subtusque denticulis 3 acutis, ad latus dextrum 11 et sinistrum 9 dentibus falcatis, instructo; ligamento foveolam cardinalem occupante; long. $\frac{1}{40}$, lat. $\frac{1}{30}$ unc.

I found two perfect specimens and a single valve of this almost microscopical shell in dredged sand from Guernsey; and the discovery is most interesting in adding a second species to the list of recent *Limopsides.* It appears to be adult, as the teeth are fully developed. It has no affinity with the fry of *Pectunculus Glyci-*

meris, which is quite of another shape, with the margin crenulate, and has only three or four tooth-like lamellæ on each side of the beak, besides wanting the central pit for the ligament. The *Pectunculus* (*Limopsis*) *minutus* of Philippi has an oblique form, much fewer teeth, more distinct auricles, and a crenulated margin; and the sculpture is very different. Our shell is more nearly allied to the *Arca aurita* of Brocchi; but in that species the form is also more oblique, and the surface is striated and sometimes decussated by the lines of growth. This sometimes resembles in appearance a minute *Ungulina.*

Lima subauriculata, ii. 263. Bantry (*Rev. Mr. Norman*). Lovén's specimens of *L. sulculus* agree with this in every respect; but I do not know his *L. subauriculata.* Judging from his description, it appears to be different from our species of the same name.

L. Loscombii, ii. 265. Mr. Hyndman, in his Report of the Belfast Dredging Committee for 1857, says, at page 224, that this species "makes a nest for itself, like *hians,* but often occurs without any. The animal swims vigorously through the water. The late James Rose Clealand, Esq., of Rathgael House, discovered this shell many years ago, off the Copeland Isles, and was aware of its making a nest."

L. hians, ii. 268. There appears to be a difference, but perhaps only a local or varietal one, between specimens taken in the west of Scotland and the south coast of England,—the former being larger and more swollen, and having the ribs and striæ much coarser, while adult shells from the latter locality are much smaller and flatter, and have a more delicate sculpture. Although the Scotch individuals form comfortable nests, those which inhabit the Channel Isles have none, but are found free under stones at low water.

Pecten furtivus, Lovén, p. 31. Specimens received by Mr. Alder and Mr. Hanley from Professor Lovén with this name, and which I have had an opportunity of examining, agree in every respect with our shells, and cannot be mistaken for any variety or modification of *P. striatus.*

P. aratus. *P. sulcatus,* Müll. Zool. Dan. Prodr. p. 248. no. 2995; Lov. p. 30. no. 228. *Ostrea arata,* Gmel. Linn. Syst. Nat. p. 3327. no. 60. A single valve, in a recent state, was taken by the dredge, under Mr. Barlee's directions, in from 60 to 80 fathoms, off the Skerries. Müller's original name of *sulcatus* having been pre-occupied by Born for a well-known Mediterranean species, Gmelin's name must be adopted for this.

Acephala Palliobranchiata, or Brachiopoda.

It is not improbable that this peculiar group of the *Mollusca* will have to be transferred to the *Molluscoidea,* and be assigned a place between the *Bryozoa* and *Tunicata.* No one can examine the *Argiopes* and *Lepraliæ* without being struck by the analogy between them in respect of the form, texture, and sculpture of their shells. Since the time of Montagu, the great tribe of the *Testacea* has lost several of its most important members in the Testaceous *Annelides,* the *Cirrhopoda,* and *Foraminifera*; and there is now a prospect of its being deprived of its right arm, the *Brachiopoda* :—

> "Singula de nobis anni prædantur euntes;
> Eripuere jocos, Venerem, convivia, ludum;
> Tendunt extorquere poëmata."

Terebratula capsula, n. s. Pl. II. fig. *7 a, b.*

Testa subæquivalvis, rotundato-ovata, convexiuscula, lateribus utrinque compressis, nitida, fulva, punctis tuberculiformibus, irregulariter sparsis, vix confertis, notata; alis perbrevibus, rotundatis; rostris prominulis; foramine angusto; intus-sceleto seu deltidio nullo, in valvula superiore fovea triangulari demissa et dentibus 2 lateralibus validis lamelliformibus, in valvula inferiore denticulis 2 lateralibus cuspidatis, munita; margine integro; long. $\frac{1}{30}$, lat. $\frac{1}{40}$ unc.

Several specimens of the very minute Brachiopod noticed in my last paper have since occurred to me; and I have been thus enabled to ascertain its generic position. By sacrificing some of my specimens, I have succeeded in examining the interior structure of the shell; and I am satisfied that it belongs to *Terebratulina* of D'Orbigny, or to an allied subgenus of *Terebratula*, and not to *Argiope.* Mr. Norman's shell is of rather a more oval shape than any of my specimens; but they vary a little in this respect. It cannot be mistaken for the fry of *Terebratula caput-serpentis,* which is of a very different shape, and is inequivalve, besides having the peculiar dichotomous ribs which distinguish that species, in addition to the tuberculiform dots. Under a magnifying power of 100 diameters, the inner surface of *T. capsula* appears to be marked with very fine wave-like lines which converge towards the beaks. This shell being equivalve or nearly so, it may be a question whether it ought not to be placed in a new subgenus of *Terebratula.* Mr. Hyndman sent me this species from Belfast Bay as *Argiope cistellula*; and I have found it in old shells from the same locality, mixed with *Argiope cistellula,* which, however, occurs much less frequently there. I also discovered both species at Etretat, on the coast of Normandy, on stones which had been taken up in the fishermen's nets at a distance of four leagues from land, and at a depth of about 25 fathoms.

Argiope cistellula, ii. 361 (Megathyris), and iv. 257. I noticed a specimen of this shell, mixed with some of *A. Neapolitana,* which came from Sardinia; and I have reason to believe that Philippi confounded both species in his description and figures of *Orthis seminulum.* I have given in Pl. II. fig. 8 *a, b,* a representation of a young specimen of *A. cistellula* from Guernsey, to show the variation of form to which this species is subject.

[To be continued.]

VI.—*On the Synonyms and Habitats of* Cavolina, Diacria, *and* Pleuropus. By ARTHUR ADAMS, F.L.S., Surgeon of H.M.S. Actæon.

To the Editors of the Annals of Natural History.

GENTLEMEN,

Having captured in the towing-net almost all the known species of the genera *Cavolina, Diacria,* and *Pleuropus,* while traversing the Atlantic and Indian Oceans and the China Sea, the results of my experience with regard to the species of these Pteropods may prove acceptable to your readers.

Gen. CAVOLINA, Gioëni.

1. *C. Telemus,* Linn.

Monoculus Telemus, *Linn.*
Anomia tridentata, *Forsk.*
Cavolina natans, *Abildg.*
Hyalæa cornea, *Lam.*
—— papilionacea, *Bory.*
—— teniobranchia, *Per. & Les.*
—— Chemnitziana, *Lesueur.*
—— Forskälii, *Blainv.*
—— Peronii, *Blainv.*
—— affinis, *D'Orb.*
Caulina natans, *Poli.*

Hab. Atlantic and Indian Oceans. Common. Varies from amber- and pale-yellow to transparent; varies also in size.

2. *C. gibbosa,* Rang.

Hyalæa flava, *D'Orb.*

Hab. Atlantic and Indian Oceans. Common. Varies in colour like the last.

3. *C. uncinata,* Rang.

Hyalæa Rangii, *Desh.*

Hab. Atlantic and Indian Oceans. Rather scarce.

4. *C. globulosa,* Rang.

Hab. China Sea. Rare; one specimen.

5. *C. quadridentata,* Lesueur.

Hyalæa quadrispinosa, *D'Orb.*

Hab. Atlantic and Indian Oceans. Common.

6. *C. longirostris*, Lesueur.

Hyalæa limbata, *D'Orb.*
—— ecaudata, *Lesueur.*

Hab. Atlantic and Indian Oceans; China Sea. The *H. ecaudata* of Lesueur is only a short-beaked variety, and D'Orbigny's *H. limbata* is merely a large variety.

7. *C. angulata*, Souleyet.

Hab. Indian Ocean. Common. This offers some peculiarities, but seems merely to be a small variety of *C. longirostris.*

8. *C. Orbignyi*, Rang (fossil).

Hyalæa aquensis, *Gratel.*

Subgen. *Orbignyia*, A. Ad.

9. *C. inflexa*, Lesueur.

Hyalæa elongata, *Lesueur.*
? —— depressa, *D'Orb.*
—— uncinata, *Höningh.*
—— vaginella, *Cantr.*

Hab. Atlantic and Indian Oceans. Rather abundant.

10. *C. labiata*, D'Orb.

Hab. Atlantic and Indian Oceans and China Sea. Less common than the former.

These two species are *Cavolinæ* much elongated, and present a peculiar appearance compared with the typical forms.

Gen. Diacria, Gray.

1. *D. trispinosa*, Lesueur.

Hyalæa mucronata, *Quoy & Gaim.*
—— triacantha, *Guidotti.*
—— depressa, *Bivona.*

Hab. Common in the Atlantic and Indian Oceans.

Gen. Pleuropus, Eschsch.

1. *P. pellucidus*, Eschsch.

Cleodora pleuropus, *Rang.*

Hab. ? Mediterranean.

2. *P. longifilis*, Trosch.

Hab. Mediterranean.

3. *P. lævigatus*, D'Orb.

Hyalæa lævigata, *D'Orb.*
Diacria lævigata, *Gray.*

Hab. Indian Ocean. Rare; one specimen.

I have captured all these species in a towing-net made in various forms and of different materials,—a bread-bag with a bunting tongue or cod being about the best. They are most numerous in fine weather, and seem to come near the surface during the night, and especially towards the evening. I have not succeeded, however, in making out the exact hours of their appearance near the surface, as M. D'Orbigny appears to have done, my captures having occurred at different and irregular intervals.

I am, Gentlemen,
Yours &c.,
ARTHUR ADAMS.

VII.—*Characters and Descriptions of some new British Sea-Anemones.* By PHILIP H. GOSSE, F.R.S.

Fam. **Sagartiadæ.**

Genus PHELLIA.

Sp. 1. *Phellia Brodricii* (mihi). SPECIFIC CHARACTER. Epidermis free at the margin, dense, transversely corrugated. Tentacles marked with a latticed pattern.

General Description.—FORM. Base adherent to rocks; considerably exceeding the column.

Column abjectly flat when completely contracted, and roughened with strong concentric wrinkles; rising to a tall, somewhat slender pillar, studded with low warts on its upper portion, but covered on its lower two-thirds with a tough, firmly adherent epidermis, the upper edge of which is free, with a ragged foliaceous margin, not forming a tube. The surface of this is transversely corrugated, but not warted. The animal frequently expands in its low condition, when the flower occupies the summit of a very low cone, and is not half the diameter of the base. Mr. Brodrick informs me, however, that the appearance and size of the flower have degenerated in captivity, and that its expanse was fully an inch in diameter at first. A slight margin, much wrinkled in semi-contraction, and forming a star of radiating furrows in closing.

Disk flat or slightly concave; outline circular.

Tentacles arranged in five rows, viz. 6, 6, 12, 24, 48 = 96;

short and slender, diminishing from the first row outwards; in ordinary extension not longer than one-fourth the diameter of the disk; generally carried arching over the margin, the tips occasionally turned up.

Mouth elevated on a strongly marked cone.

Acontia not emitted, even under strong irritation, while in my possession. Mr. Brodrick, however, has seen them projected from the mouth. They were very slender.

Colour. Column: exposed portion pellucid white, with the low warts opake white.

Epidermis ochreous drab, slightly darker in some parts, with longitudinal white lines proceeding from the base, and vanishing a little way up. Central star of button formed of alternate whitish and blackish rays.

Disk drab: each primary and secondary radius marked with two *parallel* lines of dark chocolate-brown; each tertiary radius similarly but more faintly marked, and the space enclosed is in these latter radii drab on their outer and white on their inner moiety, the divisions of the two colours being marked by a black spot. The space immediately bounding the foot of each primary tentacle dark brown.

Tentacles pellucid whitish; the lower half opake white on the front, crossed by four transverse bars of dusky, the whole (except the lowest one) being connected by three longitudinal lines of the same colour, which impart a latticed or window-like pattern to the tentacle.

Mouth: lip white; throat white, with black furrows.

Size. Diameter of base about seven-eighths of an inch, of extended column half an inch, of flower from one-third of an inch to an inch; height one inch.

Locality. Lundy Island, on rocks at low water.

Specific name. After William Brodrick, Esq., of Ilfracombe, who kindly favoured me with one of two specimens obtained in August 1857.

Fam. **Bunodidæ.**

Genus Hormathia (mihi).

Base adherent to shells, greatly expanded.

Column pillar-like, much corrugated, surrounded by a single horizontal series of warts. Name from *ὁρμαθὸς*, a necklace of pearls.

Sp. 2. *Hormathia Margaritæ* (mihi). Specific character. White, with purple tentacles.

General Description.—Form. Base very closely adherent to a living *Fusus antiquus*; far exceeding the column, and clasping the shell.

Column: skin delicate, much corrugated transversely; below the margin a horizontal row of large well-defined warts, about ten in number; summit very much corrugated, and falling into radiating folds in incipient retractation. A slight but distinct margin.

Disk slightly concave; outline almost circular.

Tentacles arranged in two or three rows, rather long, subequal, but the inner row somewhat longer than the outer; when fully expanded, curving over the margin.

Mouth not raised on a cone, slightly corrugated.

Colour. Column white.

Disk white, streaked with very light brown.

Tentacles dark reddish purple, without any markings.

Mouth: lip slightly yellow.

Size. Diameter two inches; height two inches.

Locality. Moray Firth, off Macduff, Banff; from deep water.

For this magnificent species I am indebted to the kindness of the Rev. Walter Gregor, who forwarded it to me. It was dead, however, when it reached me; but his own careful notes and sketches, made while it was alive, have enabled me, in combination with my own imperfect observations, to characterize it as above.

The genus is an aberrant one in the family Bunodidæ, approaching the Sagartiadæ through *Adamsia* and *S. parasitica*, with both of which it has obvious relations.

The specific name is given, at Mr. Gregor's request, in honour of an esteemed friend.

Genus Stomphia (mihi).

Base adherent, expanded.

Column pillar-like, without warts or suckers, imperforate (?); skin much corrugated; substance not at all cartilaginous, but soft and lax. Disk very protrusile. Tentacles perfectly retractile. Acontia not present.

Name from *στόμφος*, wide-mouthed.

Sp. 3. *Stomphia Churchiæ* (mihi). Specific character. Body dashed with scarlet on white or yellow; tentacles white, with scarlet bands.

General Description.—Form. Base adherent to rocks in deep water, expansile considerably beyond the column.

Column very protean in shape, generally a short thick pillar, sometimes constricted hour-glass fashion or like a dice-box; the base sometimes detaches itself, and becomes very concave with sharp edges, or, on the other hand, protrudes as a low cone. Skin much and irregularly corrugated transversely, and also longitudinally from the margin a little way downwards, thus giving a decussate appearance to the upper portion. Margin distinct, but without parapet or fosse. Substance pulpy, or softly fleshy, very lax.

Disk flat, but often protruded as a low cone; radii well marked.

Tentacles about 60, arranged in four rows, viz. 6, 6, 12, 36; subequal, the inner slightly longer than the outer, conical, much corrugated in contraction; when expanded, about equal in length to half the diameter of the disk; generally carried horizontally spreading, or descending with the tips slightly up-curving.

Mouth often widely opened; lip sharp, protrusile, forming a narrow, low, circular wall.

Colour. Column cream-white deepening to positive yellow, most irregularly sprinkled with dashes and streaks of rich scarlet, very much like a flaked carnation.

Disk white or yellowish white, pellucid.

Tentacles white or yellowish white, pellucid, marked with three remote rings of scarlet, and, on the lower half of their front face, with two parallel stripes of the same hue, running longitudinally to the foot, sometimes confluent throughout or in part. These lateral stripes vary much in distinctness and size even in the tentacles of the same individual; occasionally they run in upon the radii, and at times they are quite obsolete.

Mouth: edge of lip rich scarlet, sharply defined without, but within blending off quickly into the throat, which is white and strongly furrowed. Interior of gonidial tubercles scarlet.

Size. Column an inch and a half in height, and the same in diameter; flower about two inches in expanse.

Locality. All round the Scottish coasts, in deep water. Several specimens have been sent to me by Mr. Gregor from Banff; but I had received drawings and descriptions of it previously from Mr. C. W. Peach, of Wick, and still earlier (about two years ago) from Miss Church, of Glasgow. With the name of this lady, who was the first to bring it under my notice, I have honoured the species.

Varieties:—*a. Lychnucha.* The condition just described.

β. Incensa. The red of the column predominant and almost wholly confluent, interrupted merely by a few yellow flakes.

γ. Extincta. Column and disk pure white; lip faintly tinged with red; tentacles having the usual scarlet bars and the scarlet foot-lines: the latter faint, but distinct, and running in far upon the radii.

Fam. **Cerianthidæ.**

Genus Cerianthus.

Sp. 1. *Cerianthus Lloydii* (mihi). Specific character. Mesenteric prolongations of the septa regularly graduated in length. Basal pore central.

This species differs signally from *C. membranaceus* and *C. cylindricus* in the arrangement of the membranous plates which spring from the walls of the elongate abdominal cavity. In those (according to the researches of M. Haime) the ordinary lamellæ are short, while two are immensely prolonged, even to the bottom of the visceral cavity. In the present species the lamellæ are twenty-four in number, of which one pair is exceedingly minute, while the opposite pair extends close to the basal pore. From the one to the other of these conditions there is a regular gradation in length; but from the longest to the middle pair the diminution is slight, while from the middle pair to the shortest it is great and rapid.

General Description.—Form. Not differing in any recognized particular from *C. membranaceus.*

Colour. Column: a rich chestnut anteriorly, fading into a pellucid buff or drab posteriorly; the front edge of this colour is abrupt, and forms a serrated marginal line.

Disk pellucid whitish, separated from the tentacles by a broad ring of dark brown.

Tentacles: the peripheral rows barred alternately with white and brown—four to six bands of each colour, which is more opake or more pellucid in different specimens. The gular tentacles dark chestnut-brown.

Size. Six inches in length when extended, with a thickness varying from half an inch to one-fourth.

Locality. Menai Strait.

The specific name I have selected in honour of Mr. William Alford Lloyd, whose talent and enterprise have done so much for aquarian zoology. The species has been obtained in some plenty by that gentleman, who first introduced it to notice in the spring of 1856.

VIII.—*Characters of some apparently undescribed Ceylon Insects.* By F. Walker.

[Continued from vol. ii. p. 286.]

Fam. **Cicindelidæ.**

Tricondyla tumidula. Atra, thorace brevi fusiformi glabro nitente lateribus subconvexis, elytris convexis fusiformibus rude et conferte scabris lateribus subconvexis, femoribus rufis. Long. 9 lin.

TRICONDYLA SCITISCABRA. Atra, thorace angusto subconvexo vix nitente antice attenuato sulcis scitissimis transversis, elytris fusiformibus subconvexis scitissime et confertissime scabris. Long. $6\frac{1}{2}$–7 lin.

Fam. **Carabidæ.**

DROMIUS REPANDENS. Ferrugineus, capite nigro, thorace piceo cordato marginato sulcato, elytris conferte lineatis extus nigricantibus. Long. $1\frac{3}{4}$ lin.

COLPODES? MARGINICOLLIS. Niger, nitens, clypeo conico fulvescente, antennis pedibusque testaceis, thorace subrotundato late marginato, vitta lateribusque testaceis, angulis posticis obtusis, elytris lineatis, maculis quatuor angulosis margineque testaceis. Long. $2\frac{3}{4}$ lin.

PLATYSMA RETINENS. Nigrum, nitens, capite bifoveolato, thorace sulcato postice bifoveolato, elytrorum striis bene determinatis, antennis piceis basi nigris. Long. 7 lin.

HARPALUS DISPELLENS. *Fœm.* Niger, capite utrinque impresso, thorace sulco brevi discali, elytris apice oblique emarginatis, striis bene determinatis, punctis nonnullis discalibus plurimisque marginalibus, palpis apice ferrugineis, antennis ferrugineis basi piceis. Long. 5 lin.

DRIMOSTOMA? MARGINALE. Nigro-æneum, palpis antennis pedibusque fulvis, thorace abdomineque fulvo marginatis, thorace sulcato postice subretracto, angulis posticis bene determinatis, elytris scite striatis margine fulvo apud apices dilatato. Long. 3 lin.

Fam. **Dytiscidæ.**

HYDROPORUS INEFFICIENS. Testaceus, thorace maculis duabus posticis transversis nigris, elytris cinereis glabris testaceo strigatis basi nigris. Long. $\frac{3}{4}$ lin.

Fam. **Gyrinidæ.**

GYRINUS DISCIFER. Ater, margine tenui pedibusque testaceis, abdominis apice acutissimo, thorace et elytrorum margine lato (postice latissimo) tomentoso. Long. 3–$3\frac{3}{4}$ lin.

Fam. **Staphylinidæ.**

OCYPUS LINEATUS. Piceus, tomentosus, subsetosus, elytris badiis, pedibus fulvescentibus, femoribus supra nigro strigatis. Long. 5 lin.

PHILONTHUS PEDESTRIS. Ater, capite thoraceque nitentibus, thorace punctato-trilineato, coxis femoribusque anticis fulvescentibus. Long. $3\frac{1}{2}$ lin.

XANTHOLINUS INCLINANS. Ferrugineus, nitens, capite abdomineque nigris, antennis nigris basi testaceis, pedibus testaceis. Long. $1\frac{2}{3}$ lin.

Sunius? obliquus. Rufus, capite abdomineque nigris, antennis nigris apice rufescentibus, elytris nigro suboblique lateque vittatis, abdominis segmentis rufescente marginatis. Long. 3 lin.

Prognatha tenuis. Atra, nitens, glabra, capite thoraceque depressis, antennis rufescentibus subclavatis, thorace cordato, elytris testaceis, abdominis segmentis testaceo marginatis, tibiis tarsisque rufescentibus. Long. $1\frac{2}{3}$ lin.

Osorius? compactus. Ater, crassus, cylindricus, nitens, punctatus, antennis pedibusque rufescentibus, elytris abdomine vix brevioribus. Long. $1\frac{3}{4}$ lin.

Oxytelus bicolor. Rufescens, latiusculus, capitis vertice nigro, thorace tricarinato, elytris nigricante nebulosis, abdominis segmentis nigro marginatis, antennis nigricantibus basi rufescentibus, pedibus testaceis. Long $2\frac{1}{4}$–$2\frac{1}{2}$ lin.

Trogophlœus? Taprobanæ. Ater, nitens, gracilis, subtilissime punctatus, antennis pedibusque pallide rufescentibus. Long. 1 lin.

Aleochara translata. Nigra, palpis, elytris basi, abdominis dimidio basali pedibusque rufis. Long. $1\frac{1}{4}$ lin.

Aleochara subjecta. Nigra, latiuscula, nitens, antennis nigris robustis basi testaceis, pedibus testaceis, femoribus posticis supra nigricantibus. Long. $\frac{1}{2}$–$\frac{2}{3}$ lin.

Dinarda serricornis. Nigro-picea, antennis basi ferrugineis, articulo 1° longo subtumido, 2° parvo, 3° et sequentibus subtrigonis, 11° subfusiformi, thorace subquadrato sulcato, elytris conferte punctatis, pedibus ferrugineis. Long. $3\frac{1}{2}$ lin.

Fam. **Pselaphidæ.**

Genus Pselaphanax.

Corpus subsetosum. Caput latum, postice petiolatum. Antennæ filiformes, corporis dimidio longiores. Thorax subglobosus, subfusiformis, postice coarctatus. Elytra convexa. Abdomen elytra vix superans. Pedes longiusculi.

Pselaphanax setosus. Ater, subsetosus, nitens, antennis rufescentibus, articulis 4°–7° nigris, 8° et 9° albis, pedibus albidis, femoribus apices versus nigricantibus. Long. $1\frac{3}{4}$ lin.

Fam. **Scydmænidæ.**

Scydmænus megamelas. Ater, nitens, hirtus, capite thoraceque parvis, antennis submoniliformibus corpore vix brevioribus, elytris convexis latiusculis. Long. 1 lin.

Fam. **Nitidulidæ.**

Nitidula submaculata. Fulvescens, conferte punctata, antennis testaceis apice nigris, elytris maculis quatuor indistinctis nigricantibus. Long. 1 lin.

MELIGETHES RESPONDENS. Nigra, lata, lævis, subnitens, antennis pedibusque piceis. Long. $1\frac{1}{2}$ lin.

Fam. **Trogositidæ.**

TROGOSITA RHYZOPHAGOIDES. Ferruginea, angusta, antennis nigris subclavatis apice ferrugineis, capite thoraceque subpunctatis, elytris scite striatis. Long. $1\frac{3}{4}$ lin.

Fam. **Cucujidæ.**

CUCUJUS? INCOMMODUS. Testaceus, antennis apices versus obscurioribus corporis dimidio longioribus, elytris guttis duabus discalibus fuscis. Long. $1\frac{1}{4}$ lin.

SILVANUS SCUTICOLLIS. Ferrugineus, capite thoraceque conferte punctatis, antennis clavatis corporis dimidio brevioribus, thorace elongato, disco plano subcarinato, elytris striatis. Long. $1\frac{1}{4}$ lin.

SILVANUS PORRECTUS. Ferrugineus, angustus, capite thoraceque conferte punctatis, antennis clavatis corporis dimidio vix brevioribus, thorace longissimo, disco plano, elytris punctato-striatis. Long. $1\frac{1}{4}$ lin.

Fam. **Lathridiadæ.**

CORTICARIA RESECTA. Picea, nitens, antennis nigris, pedibus testaceis, elytris scite lineato-punctatis. Long. $\frac{1}{2}$ lin.

Fam. **Dermestidæ.**

ATTAGENUS? RUFIPES. Nigro-piceus, subovatus, nitens, subtilissime punctatus, palpis antennis pedibusque rufis. Long $1\frac{1}{2}$ lin.

Fam. **Byrrhidæ.**

Genus INCLICA.

Corpus ellipticum, crassum, convexum. Antennæ gracillimæ, subclavatæ, corporis dimidio breviores; articulus 1^{us} elongatus; 2^{us} mediocris; 3^{us} et sequentes minuti, rotundi. Abdomen alas posticas paullo superans. Pedes crassi, breves.

INCLICA SOLIDA. Nigra, nitens, glabra, elytrorum striis optime determinatis, antennis testaceis apice nigris, pedibus fulvis, femoribus posterioribus nigris, tibiis posterioribus nigricante late fasciatis. Long. $\frac{3}{4}$ lin.

Fam. **Histeridæ.**

HISTER MUNDISSIMUS. *H. Scævolæ* et *H. chinensi* simillimus at distinctus. Ater, nitens, glaber, mandibulis magnis inæqualibus, dextra dentibus duobus parvis acutis, sinistra longiore magis arcuata dentibus duobus majoribus subacutis, thoracis sulcis duobus lateralibus postice abbreviatis, elytris obscuris, striis optime determinatis, 1ª aut marginali abbreviata, 2ª 3ª et 4ª integris, 5ª subabbreviata, 6ª valde abbreviata. Long. 3½ lin.

Fam. **Dynastidæ.**

Xylotrupes reductus. *Mas.* Rufo-piceus, subtus rufescens fulvo-pilosus, capitis cornu brevi retracto apice conico, thorace sublævi excavato, elytris subobsolete punctato-lineatis, lineis suturalibus distinctis. *Fœm.* Capite inermi, thorace non excavato. Long. 7½ lin.

Xylotrupes solidipes. *Fœm.* Rufus, subpunctatus, subtus vix pilosus, capite transverse carinato, thorace convexo, tibiis crassissimis. Long. 7½ lin.

Phileurus detractus. *Fœm.* Niger, vix nitens, capite punctato, antennis palpisque rufis, thorace marginato subtilissime punctato, elytris punctato-lineatis. Long. 4–4½ lin.

Orphnus detegens. *Mas.* Niger, nitens, parce punctatus, subtus rufescens, capite cornu erecto, thorace valde excavato, carinis lateralibus cornutis. *Fœm.* Capite inermi, thorace plano. Long. 3–3½ lin.

Fam. **Melolonthidæ.**

Melolontha rubiginosa. Ochraceo-rubiginosa, subtus testaceo-albida, scutello pallido, abdominis lateribus albis, elytris apicem versus subgibbosis. Long. 15 lin.

Melolontha ferruginosa. Ferrugineo-picea, pallide tomentosa, subtus cano-pilosa, antennarum laminis rufescentibus, elytris apicem versus subgibbosis. Long. 13 lin.

Melolontha pinguis. Picea, subnitens, non tomentosa, pilis subtus nonnullis pallidis, capite dense punctato, thorace parce punctato, elytris rufescentibus parce punctatis apicem versus abrupte deflexis. Long. 9 lin.

Melolontha setosa. Picea, obscura, subpruinosa, rude punctata, pilis raris longis pallidis induta, subtus ferruginea, elytris apicem versus abrupte deflexis. Long. 10 lin.

Rhizotrogus hirtipectus. Rufescens, nitens, subpunctatus, pilis paucis longis indutus, pectore pilis testaceis dense vestito, capite nigricante conferte punctato. Long. 7 lin.

Rhizotrogus æqualis. Rufescente-testaceus, nitens, conferte punctatus, vix pilosus, capite marginato transverse bicarinato, elytrorum lateribus subundulatis, sulcis duobus humeralibus indistinctis. Long. 5½ lin.

Rhizotrogus costatus. Ferrugineus, nitens, vix tomentosus, confertissime punctatus, capite marginato antice inciso, elytris subquadricostatis, carinis duabus transversis subapicalibus, pedibus rufis. Long. 5 lin.

Rhizotrogus inductus. Piceus, vix nitens, conferte punctatus, subtus rufescens, elytris apicem versus abrupte deflexis. Long. 5 lin.

Rhizotrogus exactus. Ferrugineus, subnitens, confertissime punctatus, cano-tomentosus, clypeo vix inciso, elytris subquadricostatis, thoracis lateribus subangulatis. Long. 5 lin.

Trigonostoma nana. Testacea, nitens, capite thoraceque subtilissime punctatis, elytris rude lineato-punctatis. Long. $2\frac{1}{2}$ lin.

Popillia discalis. Viridis, nitens, subtus cano-pilosa, thoracis lateribus testaceo-pubescentibus, abdominis lateribus tomento albido maculatis, elytrorum vittis duabus discalibus abbreviatis rufescentibus, pedibus ex parte rufescentibus. Long. $3\frac{1}{2}$ lin.

Sericesthis rotundata. Rufescenti-picea, lata, iridescenti-tomentosa, clypeo punctato nitente, thorace velutino, elytris subtiliter lineato-punctatis. Long. 4 lin.

Sericesthis subsignata. Nigra, nitens, parce hirta, subtus iridescenti-tomentosa, clypeo rude punctato, thorace viridi subtilissime punctato, elytris subtiliter lineato-punctatis, lineolis quatuor basalibus rufescentibus. Long. $3\frac{3}{4}$ lin.

Sericesthis mollis. Rufescens, subvelutina, subiridescenti-tomentosa, capite nitente punctato, thorace subtilissime punctato, elytris subtiliter lineato-punctatis. Long. 3 lin.

Sericesthis confirmata. Rufescens, subvelutina, sat angusta, iridescenti-tomentosa, capite punctato nitente, thorace subpunctato, elytrorum lineis bene determinatis subtiliter punctatis. Long. $2\frac{3}{4}$ lin.

Plectris solida. Ferruginea aut nigra, nitens, crassa, testaceo-pilosa, scite et conferte punctata, clypeo brevi. Long. 3–$3\frac{1}{4}$ lin.

Isonychus ventralis. Cupreo-viridis, parce pilosus, capite thoraceque subtilissime punctatis, abdomine testaceo, macula apicali viridi, elytris punctato-lineatis, maculis duabus posticis furcatis maculisque duabus basalibus fulvis. Long. $3\frac{1}{4}$ lin.

Isonychus pectoralis. Niger, nitens, vix pilosus, capite thoraceque subtiliter punctatis, pectore abdomine pedibusque subtus rufescentibus, elytrorum lineis vix punctatis. Long. $3\frac{1}{4}$ lin.

Omaloplia fracta. Testacea, nitens, capite viridi depresso confertissime punctato, thorace scite et conferte punctato, disco viridi, elytris punctato-lineatis, plaga basali, strigis duabus humeralibus, duabus suturalibus posticis duabusque externis subapicalibus viridibus, tibiis posticis viridibus. Long. 3–$3\frac{1}{2}$ lin.

Omaloplia interrupta. Viridi-cuprea, nitens, pilosa, capite rude punctato, thorace scite punctato, maculis duabus posticis marginalibus testaceis, elytris testaceis punctato-lineatis, strigis nonnullis nigro-viridibus. Long. $2\frac{1}{2}$ lin.

Omaloplia semicincta. Testacea, nitens, capite thoraceque viridibus subtilissime punctatis, capite antico thoracisque margine testaceis, elytrorum lineis rude punctatis, macula basali margine suturaque viridibus, pectore viridi. Long. $2–2\frac{1}{4}$ lin.

OMALOPLIA HAMIFERA. Testacea, nitens, capite viridi confertissime punctato linea transversa testacea, thorace viridi scite punctato vitta margineque testaceis, abdominis lineis punctatis, vitta suturali hamata antice abbreviata lineisque duabus marginalibus interruptis viridibus, pedibus ex parte pectoreque viridibus. Long. 2 lin.

ANOMALA HUMERALIS. Testacea, nitens, capite piceo confertissime punctato, thorace scitissime punctato, elytris punctato-lineatis, sutura maculisque duabus humeralibus nigris, tarsis piceis. Long. $7\frac{1}{2}$ lin.

ANOMALA DISCALIS. Testacea, nitens, capite thoraceque scitissime punctatis viridi marginatis, elytris punctato-lineatis, sutura margineque nigricantibus, abdominis lateribus nigro fasciatis, fascia postica viridi, pedibus ex parte viridibus. Long. $5\frac{1}{2}$ lin.

ANOMALA CONFORMIS. Testacea, nitens, capite piceo confertissime punctato, clypeo ferrugineo, thorace scitissime punctato, elytrorum lineis vix punctatis, sutura picea. Long. 4 lin.

ANOMALA PUNCTATISSIMA. Æneo-viridis, nitens, confertissime punctata, palpis antennisque ferrugineis, elytris lineato-punctatis, tarsis piceis. Long. 4 lin.

MIMELA VARIEGATA. Viridis, nitens, subtus testaceo varia, capite thoraceque glabris, capite antico thoracisque lateribus luteis, elytris punctato-lineatis, maculis duabus discalibus strigisque duabus transversis anterioribus et exterioribus luteis. Long. $5\frac{1}{2}–6\frac{1}{2}$ lin.

Fam. Trichiadæ.

VALGUS ADDENDUS. Piceus, depressus, subtus cinereo-tomentosus, elytris punctato-lineatis cinereo subtrifasciatis. Long. $1\frac{3}{4}$ lin.

[To be continued.]

IX.—*Note on* Squilla Mantis, *Rondel.* By JAMES YATE JOHNSON, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN, Madeira, Nov. 15, 1858.

Having obtained a fine specimen of the Crustacean *Squilla Mantis*, Rondel., from deep water off this island, and having gone carefully over Mr. Bell's description of this species in his excellent 'History of the British Stalk-eyed Crustacea,' I beg leave to send you a note of several points, partly in addition to, partly in correction of, Mr. Bell's description, which appears to have been drawn up from a dried, and not fully-grown, individual, $4\frac{1}{2}$ inches in length,—whereas my specimen, which is a male, measures 7 inches, the narrowest part of the thorax measuring 1 inch across, and the widest part of the abdomen $1\frac{1}{2}$ inch.

1. The eyes are green. 2. The three filaments of the internal or superior antennæ are of very unequal length, the longest of them measuring $2\frac{1}{2}$ inches, the shortest only 1 inch. 3. The superior (Mr. Bell says the inferior) margin of the groove in the penultimate joint of the claws which receives the six spines of the terminal joint is denticulated. This groove is bridged over at five places by tubercles, as if for the purpose of giving support to the thin sides of the joint at their free and therefore weakened edges. 4. The lateral pieces of the carapace have each two longitudinal ridges or crests, *all* of which (Mr. Bell speaks of the outermost only) extend back to near the posterior margin. This posterior margin forms an uninterrupted curve from the sides inwardly. Mr. Bell's diagnosis of the specific character states that the posterior margin of the middle portion of the carapace is straight. 5. *All* the longitudinal ridges or crests of the fourth, fifth, and sixth abdominal segments terminate in spines; and the *lateral* ridges of the first, second, and third segments are similarly terminated. Mr. Bell refers to the ridges of the sixth segment only as being spined. The objects that look like fringed appendages upon five of the abdominal segments in Mr. Bell's figure are not to be found on the animal, saving as *depressions* in the integument. In Mr. Bell's specimen the median ridge of the last abdominal segment (the middle lobe of the tail) terminated posteriorly in an intramarginal *tubercle*: in mine it ends in a sharp spine. At the anterior extremity of this ridge there is a small tubercle on each side. The colours of this segment are worthy of notice. The median ridge is yellow; the raised and thickened margin is brown; the larger portion of the superior surface of the segment is of a lively purple; and on each side of the median ridge near the front margin of the segment is a large round spot of deep purple, like an eye, a quarter of an inch in diameter, the anterior portion being nearly black. These spots present a remarkable appearance when the animal is fresh from the water; but they disappear entirely, and the whole segment becomes in time of a dull brown colour. The colour of the abdomen is a pale varied purple washed with an impure white.

I am, Gentlemen,

Your obedient Servant,

James Yate Johnson.

X.—*Biographical Notice of the late* Richard Taylor, F.L.S. &c.

It is this month our painful duty to record the death of Mr. Richard Taylor, the founder of these 'Annals.' On a future occasion we shall endeavour to do more ample justice to his memory, but we cannot refrain from taking the earliest opportunity of giving a slight outline of his long, active, and useful career. In so doing we pay, however imperfectly, the tribute which is due to one of our most respected fellow-citizens, who nobly sustained the credit of the profession to which his abilities were devoted, and deservedly acquired the friendship, esteem, and confidence of the large circle of eminent men with whom it brought him into constant and familiar intercourse.

Richard Taylor was born on the 18th of May, 1781, at Norwich. He was the second son (of a family of seven) of John Taylor, wool-comber, and Susan Cooke, and great-grandson of Dr. John Taylor, the author of the celebrated 'Hebrew Concordance.' His education was received at a day-school in Norwich, kept by the Rev. John Houghton, whom he describes as an excellent grammarian and a severe disciplinarian. Under this able tutor and his son, he made early and considerable progress in classical learning, and also acquired some knowledge of chemistry and other branches of natural philosophy. It seems to have been the wish of the master that his pupil should proceed to the High School of Glasgow (where he had himself received his education), and there qualify himself for the ministry; but other counsels prevailed, and, principally at the suggestion of Sir James Edward Smith, the founder of the Linnæan Society, and a very intimate friend of his parents, he was induced to adopt the profession of a printer—a profession to which he became ardently attached. On Sir James Smith's recommendation, he was apprenticed to Mr. Davis of Chancery Lane, London, a printer of eminence, from whose press issued many scientific works of importance. During this period of his life, his leisure hours seem to have been employed in the study not only of the classics, but also of the mediæval Latin and Italian authors, especially the poets, of whose writings he formed a curious collection. From these, his "old dumps" as he was wont to call them, he derived great pleasure to the last moments of his life. He also became a proficient scholar in French, Flemish, Anglo-Saxon and several of the kindred Teutonic dialects,—a proficiency which afterwards proved of eminent utility in his professional career, by far the greater number of the Anglo-Saxon works, and works connected with that branch of literature, published in London during the last forty years, having issued from his press.

On the expiration of his apprenticeship, he carried on business for a short time in Chancery Lane, in partnership with a Mr.

Wilks; but on his birthday in the year 1803, at the age of twenty-two, he established himself, in partnership with his father, in Blackhorse Court, Fleet Street, from whence he soon after removed to Shoe Lane, and subsequently to Red Lion Court. His press speedily became the medium through which nearly all the more important works in scientific natural history were ushered into the world; and the careful accuracy by which all its productions were distinguished led to a rapid extension of its use. It was immediately adopted by the Linnæan Society; the Royal Society and many other learned bodies succeeded; individual members naturally followed the example of the Societies to which they belonged; and the same valuable qualities which had rendered it so acceptable to men of science were equally appreciated by those engaged in other pursuits. The beautiful editions of the Classics which proceeded from it, soon rendered his favourite device (the lamp receiving oil, with its motto of "Alere flammam") as familiar to all who had received a classical education in England as it had been from the beginning to the world of science. It would be tedious to enumerate even the more important of these works; but there is one in all respects so remarkable as to deserve especial mention. This is the facsimile of the Psalms from the Codex Alexandrinus, edited by the Rev. H. H. Baber, "at whose chambers in the British Museum," says Mr. Taylor in his Diary, under date of the 11th Nov. 1811, "I have collated the proofs of the first and second sheets with the Codex letter by letter, and I intend, if possible, to do the same for all the rest." A more striking proof could not be adduced of his strict attention to the accuracy of his press, and of his persevering devotion even to the minutest duties of his profession.

In the year 1807 he became a Fellow of the Linnæan Society, and at the anniversary of 1810 he was elected Under-Secretary, an office which he retained for nearly half a century, and in which he earned for himself the cordial esteem and good-will of every member of the Society. In his Diary, under date of the anniversary of 1849, he notes that he had "served with M^c^Leay, Bicheno, Dr. Boott, and Mr. Bennett, under the successive presidencies of the founder Sir J. E. Smith (the intimate and dear friend of my parents and my warm friend), of the Earl of Derby, the Duke of Somerset, and my excellent friend Dr. Stanley, Bishop of Norwich." To the names of the Presidents he might subsequently have added those of Mr. Brown and Mr. Bell; and he must have felt, though he was too modest himself to note it down, how highly he was esteemed by them all for his strict sense of honour, the amiability of his disposition, and his entire devotion to the interests of the Society.

Among the numerous other learned bodies of which he was a member, the Society of Antiquaries, the Astronomical Society, and the Philological were those in which he took the deepest interest. He also attached himself from its commencement to the British Association for the Advancement of Science, nearly all the meetings of which, while his health permitted, he regularly attended. At these pleasant gatherings of the scientific world, in the society of his numerous friends and of those whose names were most distinguished in science, many of the happiest days of his life were passed.

In 1822 he became joint editor with Dr. Tilloch of the 'Philosophical Magazine,' with which Dr. Thomson's 'Annals of Philosophy' were subsequently incorporated. In 1838 he established the present work, under the title of the 'Annals of Natural History,' and united with it, in 1841, Loudon and Charlesworth's 'Magazine of Natural History.' He subsequently (at the suggestion and with the assistance of some of the most eminent members of the British Association) issued several volumes of a work intended especially to contain papers of a high order of merit, chiefly translated, under the title of 'Taylor's Scientific Memoirs.' But his own principal literary labours were in the field of biblical and philological research. In 1829 he prepared a new edition of Horne Tooke's 'Diversions of Purley,' which he enriched with many valuable notes, and which he re-edited in 1840. In the same year (1840), Warton's 'History of English Poetry' having been placed in his hands by Mr. Tegg, the publisher, he contributed largely, in conjunction with his friends Sir F. Madden, Benjamin Thorpe, J. M. Kemble, and others, to improve the valuable edition published in 1824 by the late Mr. Richard Price.

For many years he represented the ward of Farringdon Without (in which his business premises were situated), in the Common Council of the City of London, and constantly paid strict attention to his representative duties. Of all the objects which came under his cognizance in this capacity there were none which interested him more deeply than questions connected with education. He took an active part in the foundation of the City of London School, and warmly promoted the establishment of University College and of the University of London. His politics were decidedly liberal; but his extended intercourse with the world, and the natural benevolence of his character, inclined him to listen with the most complete tolerance to the opinions of those who differed from him; and he reckoned among his attached friends many whose political opinions were strongly opposed to his own.

Early in the summer of 1852 his health gave way, and he found it necessary to withdraw from the excitement of active life. He settled down at Richmond, and once more gave himself up to Ovid, Virgil, and his old friends Paulus Manutius, Justus Lipsius, Ochinus, Fracastorius, &c. Increasing years brought increasing feebleness; and the severe weather of November last brought on an attack of bronchitis, of which he died suddenly on the 1st of December, in the seventy-eighth year of his age.—J. J. B.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

June 22, 1858.—Dr. Gray, F.R.S., V.P., in the Chair.

On the Systematic Arrangement of the Tailless Batrachians and the Structure of Rhinophrynus dorsalis. By Dr. Albert Günther.

The organ which in the tailless Batrachians offers the most remarkable character, and which is most closely connected with their mode of life, is the *tongue*. Wagler has already separated from the other *Ranidæ* a group without tongue, *Aglossæ*, comprising all other *Ranidæ* under the name *Phaneroglossæ*, which have a tongue entirely adherent in front. This division was also afterwards accepted by Bibron, who changed the name of *Aglossæ* into that of *Phrynoglossæ*. The separation of the first group appears the more justifiable, as Müller came to the same result by another principle. I now add a third form, hitherto very imperfectly known, and the tongue of which is not yet described. *Rhinophrynus dorsalis* is the only Batrachian which has a tongue free in front, with the anterior tip capable of being stretched out of the mouth. The details are as follows:—The base of the cavity of the mouth is occupied by the tongue. The front part of this organ is rather narrow and cylindrical, with an obtuse rounded tip, of a similar shape to that of one of the small Rodentia; the front part is quite free; somewhat anterior to the middle of its length it is fixed to the base of the mouth by a frenulum; behind this it becomes gradually broader, and is fixed on each side by a muscular pad. The hinder edge is rounded, not notched, entirely adherent, and exhibiting only a transverse slightly prominent swelling. The tongue is entirely soft, with a velvet-like surface, covered with *papillæ filiformes*, which gradually become longer behind; and whereas the front tip of the tongue is again capable of being stretched out of the mouth, both halves of the *musculus genioglossus* are well developed, forming the very base of the cavity of the mouth.

I propose to divide the *Batrachia anura* into three groups:—

A. *Aglossa* : *B. a.* without tongue.

B. *Opisthoglossa* : *B. a.* with a tongue adherent in front, and more or less free behind.

C. *Proteroglossa* : *B. a.* with a tongue free in front and adherent behind.

We find by far the greatest development and the greatest variety of forms in the second group; and therefore I prefer to consider the principles of further division first in this group, hoping to obtain in this way points of view according to which we may characterize and divide the few known forms of the other groups. Those characters which are generally considered as the most important, and which always command a separation of two Batrachians, are :—

1. The presence or absence of the maxillary teeth.

2. The dilated or cylindrical form of the transverse process or diapophysis of the sacral vertebra.

3. The dilated or not dilated tips of the fingers and toes.

When we consider that the lower jaw of the tailed Batrachians is provided with a series of teeth, and that these are wanting in the same bone of all the tailless Batrachians, we are obliged to acknowledge the importance of this character,—the more so as this difference is followed by a difference in the mode of life, as far as I have been enabled to observe it in European forms. In the former the *teeth* are the organs for seizing the food; in the latter, as well in those with maxillary teeth as in the toothless, the *tongue* serves this purpose. The former seize the prey in the same way as the Saurians do, and hold and press it with the teeth; the latter seize it with the clammy tongue, either filliping it out of the mouth as the frogs, or only turning it out, as the toads do, with broad and fixed tongue: the mechanism of seizing is the same as in *Myrmecophaga*, *Picus*, or *Chamæleon*. On examining the recently swallowed animals from the stomach of a lizard or newt, we find them always in a more or less lacerated condition; whilst those taken from the stomach of a toothed or toothless frog or toad are constantly uninjured. This is even the case with *Ceratophrys* and *Cystignathus*, which are provided with the strongest dentition among all the Batrachians. The prey when seized is held and pressed by the tongue against the upper part of the cavity of the mouth; and though in some of the species there are maxillary teeth, they appear to be entirely without function, and palatine teeth alone give assistance to this second part of the action. Therefore, not being able to consider the character of the dentition among the tailless Batrachians as one intimately connected with their mode of life, I think it right to subordinate it to another character which does correspond with this pretension. In a similar way the value of dentition is disregarded in the Edentata, which contain the toothless *Myrmecophaga* and *Manis*, and on the other hand the *Dasypus gigas*, which exhibits more teeth than any other mammal except some Cetacea. So also the Salmonidæ contain the nearly toothless *Coregoni* and the strongly-armed *Salmones*, &c.

What influence the dilated or more cylindrical form of the process of the sacral vertebra has upon the mode of life is difficult to explain, as it does not absolutely correspond with other physiological or anatomical characters. By the dilatation of these processes the pelvis obtains much more firmness; and a lateral motion is more or less entirely impeded. We should therefore expect to meet with this character in those Batrachians which are provided with the longest and most powerful hind legs, according to the physical problem, that the longest lever requires the strongest centre. But on the contrary, the Batrachians with the shortest legs exhibit a much-dilated sacral vertebra, whilst on the other hand the long-legged *Hylidæ* show the same peculiarity. In fact, *this osteological form seems to be connected with none of the modifications of locomotion*; for we find among these Batrachians good swimmers as well as bad, tree- as well as earth-frogs, those which always hop as well as those which often crawl; finally, we are unable to refer to it a peculiarity of any part of the propagation. Generally, I can only state—

1. *That all the* Batrachia anura *without maxillary teeth exhibit dilated processes of the sacral vertebræ, except the* Hylaplesidæ; but that, on the other hand, the *Batrachia anura* with maxillary teeth may have this bone sometimes dilated, and sometimes cylindrical in form.

2. *That all the* Batrachia anura *with paratoids exhibit dilated processes* (without any exception at present); but that, on the other hand, the *Batrachia anura* without paratoids have either this bone dilated or cylindrical in form.

From the above inquiries it is evident that I do not think this anatomical character fit for separating the whole group of the *Opisthoglossa*, so as to form two natural divisions; and there remains only the third of the above-mentioned characters,—*the dilated or not dilated tip of the fingers and toes.*

This natural character is connected with a strongly marked distinction in the mode of life, with *climbing* trees, which peculiarity is justly considered as one of the most important characters among the Vertebrata. No frog or toad without dilated toes is known to climb trees; and although our knowledge of the mode of life of the tropical forms is very limited, I have no doubt that the toothless Batrachians with dilated toes, of the tropics (*Hylaplesia, Hylædactylus, Brachymerus*, &c.), are enabled to climb trees, walls, &c., some being active during the day, others during the night. I am well aware that there are forms having the toes so slightly dilated that it is difficult to say to which section they belong; but in such instances the question will be decided either by observation of the living animals or by the more distinguishable form of closely allied species, as for example in the genus *Hylodes*. The objection to separating the toothless Batrachians in this way, they having been till now considered as a natural group, I get over by the fact that my two proposed series are parallel, and their members nearly corresponding; and I trust that at a not far distant time some of the wanting forms will be found. Therefore I divide the *Anura opisthoglossa* into two series:—

1. *Opisthoglossa oxydactyla* : *Opisthoglossa* with cylindrical or pointed tip of the fingers and toes.

2. *Opisthoglossa platydactyla* : *Opisthoglossa* with dilated tip of the fingers and toes.

Among the animals of both series we find that the same characters recur ; and so we are enabled to apply in both series the same further division. I have already mentioned what value I am disposed to attribute to the dentition ; and by co-ordinating with it the structure of the ear, I think we may obtain natural and scientifically-established groups. Especially I think we can thus satisfy the long-felt necessity of separating the *Bombinatores* in a strictly circumscribed group. Now-a-days a group, defined as Tschudi does the *Bombinatores*, "*Body and extremities short, head rounder than in the* Ranæ, *skin generally warty*," is not fit to form a part of the natural system. Huschke was the first who directed the attention of naturalists to a peculiarity in the ear of *Bombinator igneus*, stating, in the 'Beiträge zur Naturgeschichte und Physiologie,' p. 39, "Not much of a *cavum tympani* is to be seen in *Bufo igneus*, whereas muscles of the *ossicula auditus* appear to fill up the whole space." This information was not much enlarged by the inquiries of Geoffroy, Scarpa, and Windischmann ; but Johannes Müller, having found a similar structure in the ear of the *Pelobates* of France (*P. cultripes*), with his anatomical ingenuity applied this character for a distribution of the Tailless Batrachians into three groups :—

1. *Anura* with an entirely bony cavum tympani, with a cartilaginous cover of this cavity instead of a membranaceous tympanum, with the eustachian tubes united into a single aperture : *Dactylethra* and *Pipa*.

2. *Anura* with a partially membranaceous cavum tympani, with a membranaceous tympanum and the apertures of the Eustachian tubes separated : the greater part of the *Anura*.

3. *Anura* without tympanum, eustachian tubes, or cavum tympani, and with the cover of the fenestra ovalis cartilaginous : *Bombinator igneus* and *Pelobates cultripes*.

In rejecting this systematical arrangement of the *whole* suborder, I agree so far with Tschudi ; not, however, "because the anatomist ought not to prescribe divisions to the zoologist," but rather because the Batrachians with imperfectly-developed ear would form together an unnatural group, and would be separated too far from other allied forms, if we tried to apply this character as that of a section. On the other hand, it is much more important than Tschudi supposes, because it proves to be of absolute value, as always indicating the *total absence of the tympanum*. Batrachians with well-developed ear exhibit sometimes a conspicuous, sometimes an indistinct, sometimes a hidden tympanum, which differences may offer in some cases a generic, in others only a specific character ; even in many instances the appearance of the tympanum is variable in the individuals of the same species, being more or less conspicuous. The tympanum is *hidden* in those Batrachians where it is formed by a transparent membrane ; but the skin of the body, not modified and not adherent, equally covers the tympanic region, and the tympanum becomes visible only after the skin is removed. The tympanum is *indistinct* in those Batrachians where the skin of the body is firmly adherent to the tympanum, covering more or less of its surface. But in all these Batrachians the tympanum is *present*; and it is a great mistake to confound the characters of a hidden and of an absent tympanum; and much trouble and much misunderstanding would be saved to naturalists, if a more precise mode of expression were introduced into the descriptions. Secondly, we are obliged to acknowledge the value of the development of the ear in systematical arrangements, when we consider that this organ gradually returns to simplicity in the series of the Vertebrata, and that especially in the next class, of *Pisces*, it obtains systematic importance again. Therefore, though not accepting the structure of the ear as the first principle for the division of those animals, I shall combine it with the dentition. Tschudi discredited Müller's observation, vindicating for all Anura eustachian tubes and a cavum tympani, and only referring variations of the aperture of the eustachian tube in the cavum tympani to the age of the individual (*Bombinator igneus*). Besides he mentions frequent examinations of the structure of the ear, according to which this organ, especially among the "*Bombinatoridæ*," is liable to great variations, nearly in every genus, as regards the form and situation of the ossicula auditus, the chorda tympani, the tympanum, the tuba Eustachii, &c. It is a great pity that Tschudi never published these examinations; but in those which he has published I cannot quite agree with him.

The imperfect development of the ear I have found or recognized in *Bombinator igneus, Pelobates fuscus* and *cultripes, Alsodes monticola* (Wiegmann in *Telmatobius peruvianus*), *Micrhyla achatina**, *Phryniscus nigricans, lævis* and *cruciger, Brachycephalus ephippium, Hemisus guttatus* (*Engystoma guttatum*, Rapp), and finally in *Rhinophrynus dorsalis*, which, although not belonging to the *Opisthoglossa*, may be mentioned on account of the structure of the ear. In all these Batrachians, tympanum and cavum tympani are entirely absent; the eustachian tube is either entirely deficient, as I found it in *Phryniscus cruciger* and *Rhinophrynus* (and according to Müller's observations, perhaps in some specimens of *Bombinator igneus* and *Pelobates cultripes*), or it is only a blind tube without osteum tympanicum. Although I always found in some specimens of the same species the same development of the eustachian tubes, I do not venture to contradict other observations, according to which these tubes were found more or less accessible; and Tschudi may be right in stating a variation to occur with the age. But such a variation as regards abolition certainly would not reach the cavum tympani or the tympanum; and therefore I hold to the truth of the fact that in the aforesaid Batrachians this part of the ear is wanting. In *Bombinator* and *Pelobates* I have always found the osteum pharyngeum of the eustachian tube open. It is situated quite on the side of the pharynx,

* Cf. Tschudi's 'Batrachia,' p. 14.

is very small and narrow, and accessible only to a thin bristle; the tube passes near the united os sphenoideum and petrosum inwards and towards the back, crossing the carotis and the nervus vagus. The membrane by which it is formed becomes gradually excessively thin, and is closed without an aperture near the fenestra ovalis vestibuli. This aperture is really oval, closed by a cartilaginous cover and in direct contact with muscles; the nature of the vestibulum is proved by the soft white calcareous concrement. Such I found to be the structure of ear in *Hemisus guttatus* and *Micrhyla*. In *Phryniscus lævis* and *nigricans* and in *Brachycephalus* the osteum pharyngeum of the tube is more open. *Rhinophrynus dorsalis* exhibits the following details:—After removing the skin, an aperture of the ear is no more observable than a tympanum externally, the whole region being covered with muscles. The most accurate and repeated examination of old and young individuals did not enable me to find any osteum pharyngeum of the tube; at the point where it might be supposed to be situated, on the sides of the palatum molle, I found only a very short and flat groove, perhaps the same seen by Bibron, who describes the eustachian tubes as excessively small. After removing the muscles, the external entrance in the ear becomes conspicuous; it is the fenestra ovalis vestibuli—a large opening with a rounded outline, formed by swollen edges of the os petrosum. This opening is closed by a cartilaginous operculum, internally concave, externally convex, and so inserted by a membrane in the bony ring as to be rendered moveable. Round the bony ring arise some muscular fibres, which continue to the front edge of the shoulder-blade. Other muscular fibres, having arisen from the centre of the operculum, join them; and their function is, by moving the operculum outwards, to enlarge the cavity of the vestibulum. The vestibulum itself is spacious, quite bony, and forming an externally conspicuous, thin, flat *bulla*. In the interior is enclosed in the saccum vestibuli—a large, rounded, white and soft calcareous concrement. Besides the fenestra ovalis are to be observed 3 or 4 minute openings, through which a bristle can reach immediately the cavity of the skull, and a larger one, oval, near the canales semicirculares.

Thus we find in these *Anura* slight modifications in the type of the structure of the ear, as it is found in the *Cæciliæ* and *Urodelæ* (*Amphiuma, Menopoma, Siredon, Proteus, Triton, Salamandra*),—a circumstance which directs us not to neglect it as a character for systematical arrangement; and therefore I divide the *Opisthoglossa oxydactyla* and *platydactyla* into the following sections:—

I. *Opisthoglossa oxydactyla.*

1. With maxillary teeth and perfectly-developed ear: *Ranina.*
2. With maxillary teeth and imperfectly-developed ear: *Bombinatorina.*
3. Without maxillary teeth, and with imperfectly-developed ear: *Brachycephalina.*
4. Without maxillary teeth, and with perfectly-developed ear: *Bufonina.*

II. *Opisthoglossa platydactyla.*

1. With maxillary teeth and perfectly-developed ear: *Hylina.*
2. With maxillary teeth and imperfectly-developed ear: *Micrhylina.*
(3. Without maxillary teeth, and with imperfectly-developed ear: *not known.*)
4. Without maxillary teeth, and with perfectly-developed ear: *Hylaplesina.*

For the division of these sections into families I use:—

1. *The absence or presence of paratoids.*
2. *The form of the diapophysis of sacral vertebra.*
3. *The absence or presence of a web between the toes.*

I consider the latter character as the most subordinate of the three, and I have used for the systematical arrangement only those aggregates of *cryptæ*, which are found on the shoulder and generally are called paratoids. Similar glandular aggregates are found on other parts of the body; and having had the opportunity of examining some new examples of such large glands, I think it useful to give an account of them in all the species.

In the genus *Pleurodema* a large gland is situated on the loins, in the males of *Pelobates* on the upper arm, in *Limnodynastes dorsalis** and *Bufo calamita* on the calves.

In other Batrachians the glands are situated on the shoulder, being either prominent and conspicuous, or hidden.

1. *Anura* with prominent paratoids are—*Alytes, Scaphiopus, Uperoleia, Bufo, Otilophus* and *Phyllomedusa.*

2. In other *Anura* the cryptæ are accumulated on the shoulder, but do not form a prominent gland, and the aggregate becomes visible only by an incision in the skin, the structure of the paratoid being the same: as in *Heleioporus, Pelodryas,* and *Rhinophrynus.* It is far more peculiar in *Kalophrynus,* which offers quite a smooth surface of the skin; and not only on the shoulders, but on the whole surface of the back, the skin is densely crowded with large cryptæ, together forming a large dorsal paratoid.

Having now gone through the most important characters upon which I base the division of the *Opisthoglossa,* I add the following tabular arrangement, which will show at once the families thus created, their natural relationship, and the parallelism of more remote families and characters of forms which may be discovered. The vertical divisions show their agreement in the anatomical, the horizontal ones in the zoological characters.

* In this species I have only had the opportunity of examining the males.

			Maxillary teeth.				No maxillary teeth.			
			Ear perfect.		Ear imperfect.		Ear imperfect.		Ear perfect.	
			Sacral vertebra				Sacral vertebra			
			Not dilated.	Dilated.	Dilated.	Not dilated.	Not dilated.	Dilated.	Dilated.	Not dilated.
Toes not dilated.	No paratoids.	Toes webbed.	Ranidæ	Discoglossidæ	Bombinatoridæ			Phryniscidæ	Rhinodermatidæ	
		Toes free.	Cystignathidæ	Asterophrydidæ				Brachycephalidæ	Engystomatidæ	....
	Paratoids.	Toes free.		Uperoliidæ						
		Toes webbed.		Alytidæ					Bufonidæ	
Toes dilated.	Paratoids.	Toes webbed.		Pelodryadidæ					....	
		Toes free.		Phyllomedusidæ						
	No paratoids.	Toes free.	Hylodidæ	....				....	Brachymeridæ	Hylaplesidæ
		Toes webbed.	Polypedatidæ	Hylidæ	Micrhylidæ			....	Hylædactylidæ	

Both the series of *Opisthoglossa* are not to be considered as forming one continued series between the *Aglossa* and *Proteroglossa*; they do not form one series of animals, descending from the most highly organized form to the lowest one: such a gradation is equally found in both series; and one is at once struck with the identity of the chararacters in the single families, if brought side by side in two parallel series.

OPISTHOGLOSSA.

	Oxydactyla.	Platydactyla.	
Ranina.	Ranidæ.	Polypedatidæ.	Hylina.
	Cystignathidæ.	Hylodidæ.	
	Discoglossidæ.	Hylidæ.	
	Asterophrydidæ.	....	
	Uperoliidæ.	Phyllomedusidæ.	
	Alytidæ.	Pelodryadidæ.	
Bombinatorina.	Bombinatoridæ.	Micrhylidæ.	Micrhylina.
Brachycephalina.	Phryniscidæ.	....	
	Brachycephalidæ.	....	
Bufonina.	Rhinodermatidæ.	Hylædactylidæ.	Hylaplesina.
	Engystomatidæ.	Brachymeridæ.	
	Bufonidæ.	....	
	....	Hylaplesidæ.	

I am always afraid of admitting teleological principles into natural science; the most important results of truth are gained by adhering to objective facts, and by inquiring into them. Each system should be adapted only to the present state of our knowledge of animals; but at last we must come to that point where analogies will enable us to look further; and the future will show (if it is allowed to presume so far) that, among the forms which hereafter may be discovered, there will be found correspondents to the *Asterophrydidæ, Phryniscidæ, Brachycephalidæ, Bufonidæ,* and *Hylaplesidæ,* viz.:—

1. *Hylina,* without paratoids, with dilated sacral vertebra and free toes.
2. *O. platydactyla,* without maxillary teeth and with imperfectly developed ear.
3. *Hylaplesina,* with paratoids, with dilated sacral vertebra, and webbed toes.
4. *Bufonina,* without paratoids, with not dilated sacral vertebra and free toes.

Only three genera are known belonging to the first group of *Anura*, to the *Aglossa,—Dactylethra, Pipa* and *Myobatrachus,* the latter of which is imperfectly known to myself from a short notice of Dr. Gray in the 'Proc. Zool. Soc.' All these three genera offer such characters as to become the types of as many families. But as I do not know whether the star-like configuration of the toes in *Pipa,* or the horny claws of the toes of *Dactylethra,* have the same functional importance as in the *Oxydactyla* and *Platydactyla,* or whether the two horizontal fangs in the intermaxillary bone of *Myobratrachus* are true teeth, or only apophyses (as in the lower jaw of *Tomopterna*), I am at a loss which of these characters must be subordinated to the other; and therefore I refer first to the more-known structure of ear, and propose for the present the following division of this group :—

I. *Aglossa* with united eustachian tubes and entirely bony cavum tympani.
  a. With maxillary teeth : *Dactylethridæ.*
  b. Without maxillary teeth : *Pipidæ.*

II. *Aglossa* with separated eustachian tubes; cavum tympani?
  a. With two horizontal fangs in the intermaxillary bone: *Myobatrachidæ.*

Finally, of the last group of PROTEROGLOSSA only one genus is known, forming the type of a family—*Rhinophrynidæ,* the complete characters of which would be—

Proteroglossa without maxillary teeth, with imperfectly developed ear, paratoids, dilated diapophysis of sacral vertebra, and webbed toes.

Bibron has given the only published description of *Rhinophrynus dorsalis*; but having had only a single specimen in an imperfect condition, he was not enabled to point out all its peculiarities. I therefore finish this paper with a full description of it.

The body being of an oval depressed shape, appears to be broader than it in reality is, because the skin is too wide for the circumference of the body, forming on each side a broad longitudinal fold. It is rounded on all sides, the belly being rather more flat; the whole surface smooth, only in some places finely granulated. The head is confounded with the body, situated on the same level, and appears to be only the tapering front part of it; being somewhat depressed, it tapers conically, and ends suddenly with the obtuse, truncated top of the muzzle. The front part of the muzzle forms, if closed, a flat round disk, somewhat similar to the snout of a pig, but differing by being separated by the cleft of the mouth into an *upper smaller* and a *lower larger* half. The mouth itself is so peculiarly formed as to be unlike that of every other Batrachian. The cleft is situated in one plane, not on the lower side of the muzzle, but above the middle; and if the snout be imagined to be a truncated cone, the cleft splits it by a vertical cut going from the truncated plane to the base; the cleft therefore does not form a convex line, but three sides of the vertical cut of a truncated cone. Being of itself not small, and reaching nearly to the anterior angle of the eye, it does not allow a considerable widening of the mouth, as is necessary where a sling-tongue is present; and when we consider this configuration connected with the plump figure of the animal, we may conclude that its food consists only of small and slow animals. The nares are situated on the upper side of the head, at some distance from the end of the snout; they are formed by a small oval opening, surrounded by a low cutaneous fold, and can probably be closed. The eyes are situated but little further behind the nares, but rather more outwards; they are small, and placed behind a narrow cleft formed by the swollen external eyelids.

The posterior parts of the animal are very large and muscular. Just in the centre is the anus, situated in the upper end of a deep longitudinal furrow, which, formed by two thick cutaneous folds, extends along the lower part of the belly; probably it serves for conducting the products of generation. Each of the folds is in connexion with a broad muscle, destined for removing them one from the other; along the middle of the bottom of this furrow is a raphe, as in the perinæum of man. The extremities are short; and the single members are not conspicuous, on account of the wide and enveloping skin; the anterior ones are enveloped to the middle of the forearm. The fingers are four, quite free, ending in a blunt tip without being dilated; the thumb is the shortest, the second and fourth are nearly of equal length, the third much longer. There are callosities on the inner and outer side of the carpus. The hinder legs become more conspicuous from the articulation of the knee; the lower leg and tarsus are short; but notwithstanding the bluntness of the extremities, a free motion is allowed by the wide-folded skin. The planta is very broad; and the toes are joined by a web, which, deeply notched between the toes, reaches the extreme phalange as a narrow fold. The os cuneiforme forms a high, elongated, elliptical prominence, not so hard and sharp as in *Pelobates*, the integument of which may be separated from the bone together with the skin, and exhibits a surface with transverse grooves, a circumstance which affords a firmer hold when in locomotion. Immediately before this prominence is situated the rudiment of the first toe, modified into a perfectly similar and also striated but smaller prominence. This must support locomotion, especially as its surface is sometimes injured and lacerated. The four other toes end with a small round knot, the second being the shortest, the fourth the longest, the third intermediate between the second and fourth, the fifth rather longer than the second.

On the back, on the head, and round the snout, the skin is firmly adherent, all other parts being enveloped by it as by a too wide sac. It appears to be smooth on the back, but is pierced on all parts with innumerable minute pores. On the head appear scattered very small warts becoming gradually more crowded towards the end of the snout; they are not glandular in structure, perhaps bearing organs of feeling. The disk-like end of the snout is entirely smooth, polished and soft, but of a firm structure. There are whitish prominences on the neck, the belly, and on the under sides of the legs; they obtain, especially on the latter place, the circumference of fig-seed, and are glands without ductus excretorii. There is externally nothing of a parotis to be seen; but by an incision is found a thick aggregate of glands, as above mentioned, situated above and behind the shoulder-blade, and of the same circumference as the skull: the ductus excretorii of the single glands are not different from those scattered on the other parts. In the subcutaneous tissue a black pigment is thickly deposited: the colour of the upper part is dark bluish-olive, either uniform or with yellowish spots along the vertebral line, sometimes confluent into a streak; spots of the same colour are sometimes seen on the shoulder, and especially on the sides and on the upper parts of the extremities. The snout and the under parts are paler, and the disk of the snout is colourless.

The eye is protected by two external swollen eyelids, but the lower eyelid forms a double fold, the external of which is merely a fold of the cutis, the internal being transparent and representing an internal eyelid. There is no *membrana nictitans*; the pupil is round; the *lens* round, somewhat compressed; no *pecten*. The small size of the eye evidently shows that the animal is nocturnal.

There are no teeth; the edge of the jaws is obtuse and truncated, especially that of the lower jaw. Upon examination of the cavity of the mouth, it is found as spacious as the natural entrance is narrow. Behind the articulation of the mandibula, and on the side of the hinder insertion of the tongue, opens a large cavity, covered inside with a strongly-folded *mucosa*, and outside with a stratum of muscular fibres; the end of the bottom of this extends behind the head, and is situated near the insertion of the *musculus supraspinatus* at the shoulder-blade. Supposing this cavity to be a vocal sac, I do not think that it will be found in females; and it is a peculiarity of this animal that the vocal sac is covered by a muscular stratum, thus being quite separated from the skin; nor am I acquainted with any other instance in which the vocal sac reaches so far backward. The entire upper part of the cavity of the mouth is very concave, and covered by such a thin mucosa as to render the whole configuration of the bone transparent. Near the middle of the palate, and somewhat laterally, the inner nostrils are situated, being roundish-oval and of moderate size. The anterior part of the pharynx is separated from the hinder part by a cartilaginous transverse pad; and the latter part deserves the name of a palatum molle, inasmuch as it is provided with a soft body covered with a mucosa, as a similar one is found at the same place in the *Cyprinidæ*. Between the tongue and *cartilago thyreoidea* is situated a spacious cavity, such as is generally found in *Anura* beneath the tongue; it is quite closed. I think it is a *bursa mucosa*.

Concerning the *situation* of the intestines, the following is to be noticed. The heart is situated somewhat towards the right side of the medial line; and it is a highly interesting fact that it is surrounded by the liver in a similar way as in higher animals, as in other Batrachians it is surrounded by the lungs. The stomach is quite on the right side, and partly covered by the left hepatic flap, separated from the heart only by a part of the peritoneum: it is on its left side. The right lung is behind the liver; the left lung is larger and is placed behind the liver and stomach. The situation of the other intestines is the same as is generally found in the *Anura*.

The *glottis* is a simple cleft; the *larynx* and *trachea* are conspicuously separated by a pair of excessively large, thick, and soft *ligamenta vocalia*. The larynx itself is very spacious, and forms nearly the cavity of a globe; the trachea is of a similar form, separated from the lungs only by a slightly produced fold of the mucosa. The *lungs* and the *vascular system* do not differ from those organs in the other *Anura*, except in the situation, as mentioned above. There is a single ventriculus and two separated atria; from the former rises a very short bulbus arteriosus, the interior of which and of the other vessels could not be examined on account of their condition. The bulbus is soon divided into two strong stems, each of which emits three branches, ascending together for a short distance,—namely, an arteria pulmonalis, a carotis descendens, and a united stem of the a. cerebralis and a. lingualis. The right atrium receives the blood of the veins of the body; the left one that of two venæ pulmonales.

We find more peculiarities in the *tractus intestinalis*. The œsophagus is very strong, its circumference equal to that of the stomach; the mucosa is provided with very long villi, projecting nearly 1 mill. into the cavity; the next outer stratum is thick and of tendinous texture, thickest in the anterior and posterior medial line, and forming two very strong tendinous bands. These serve for the insertion of transverse muscular fibres, going from the anterior medial line to the posterior one, and forming two very strong constrictores, each surrounding one half of the œsophagus. If they co-operate, they then constrict the œsophagus as circular fibres would do; but by the separation into two parts the effect is rendered more powerful. The entrance from the œsophagus into the stomach is marked externally by the absence of the muscles, internally by the beginning of the mucosa ventriculi, which is deeply and longitudinally folded and wants the long villi. The stomach is short, ovoid, and gradually lost in the smaller intestines without a pylorus; the latter are $3\frac{3}{4}$ times the length of the body, and suddenly open into the excessively wide rectum. The *pancreas* is large, and joined with the intestine by a wide ductus Wirsungianus; about half an inch below the stomach three or four smaller branches open into the intestine, separated from the chief ductus; probably this is the place for the mouth of the ductus choledochus, which I could not find. The *liver* is large, and at the first glance it appears to be separated into a right half and a larger left one; but both parts are joined by a very narrow bridge, passing behind the heart: the left flap has a deep incision. Both flaps surround the heart, and the left one also the stomach. The gall-bladder is situated just in the medial line, beneath the uniting bridge, not in direct contact with the hepatic parenchyma, but fixed to it by the peritoneum; from each flap of the liver, one ductus hepaticus opens separately into the bladder. The *organa uropoietica* do not offer any remarkable differences, at least not in the male. The testicles oval; kidneys elongate, cylindrical; corpora adiposa formed by long appendages; the bladder enters the cloaca on the anterior part, the urethræ on the posterior one.

The *osteological* peculiarities only consist in differences of form; and as far as they can be made out in a single coherent skeleton, they are the following. All the external bones of the skull are entirely ossified; the cranium is flat, depressed, very broad, without crest, and with a sharp not prominent lateral edge. The foramen jugulare is very large, but closed by a fibrous membrane pierced by the nervus vagus and glossopharyngeus. The os petrosum is distinguished by a spheroid flat bulla ossea, which is quite different from that in some Mammals, being there the ossified cavum tympani, here a part of the vestibulum; it is very thin and transparent, so that the calcareous concrement may be seen. The upper part of the cranium is as broad as the os basilare is expanded; from the broad united ossa parietalia and frontalia suddenly projects a narrow long bone, situated between the nostrils, parallel with the ascending processes of the intermaxillary bone, and nearly reaching the symphysis of the intermaxillary bones. This is formed by the frontalia anteriora; and there is in front a vestige of a suture, perhaps of formerly-separated nasal bones. The edge of the maxillary and intermaxillary bones is sharp; and the latter are provided with very long and narrow ascending processes. There are nine vertebræ, the second with hammer-like, the third and fourth with long cylindrical diapophyses; that of the sacral vertebra is moderately dilated, triangular, and flat, and joined with the ossa ilea by a much-developed cartilaginous symphysis. The scapula is not notched on the inner edge; the bones of the extremities are distinguished by their shortness and by the large size of their condyles. There is no processus xiphoideus.

The *contents of the stomach* consisted of a great many excessively small beetles, some lumps of earth, and small pieces of stick. I suppose that the animal catches those insects by stretching out the tongue, as some other animals do. In this action small particles of earth, &c. adhere to the tongue. The lumps of earth found were balled together only in the stomach, being too large to have passed the narrow cleft of the mouth*.

A few remarks on the Habits and Economy of the Brown-capped Pomatorhinus (P. ruficeps, Hartlaub). By G. Krefft.

The range of this bird does not appear to be a very extensive one; it was first discovered in the Polygonium Flats bordering the Murray River and its backwaters; but on the Darling they were not found so plentiful. Their favourite haunts are clusters of dead box timbers, and scrubby flats studded with salt bush, &c.

This bird is remarkably shy, and so cunning, that in almost all cases it will evade pursuit by running into some scrubby bush, and hide there till the danger is over. Its power of flight is exceedingly moderate, and closely resembles that of the brown Tree-creeper.

These birds are always found in flocks of from four or five to twenty and more. They keep a good look-out; and as soon as they suspect danger, they will rise with a sharp whirring noise, and seek shelter

* M. Sallé, to whom science is indebted for the discovery of this strange animal, writes in a letter, " Je sais bien peu de choses sur le Rhinophrynus dorsalis; il vient des terres chaudes et tempérées de l'Etat de Vera Cruz; on le trouve dans la terre et assez profondément enfoncé, quelquefois à un pied ou deux; il paraît y vivre, il a des mouvements très lents et il est très mou, ce qui fait, que les indigènes le désignent dans des endroits sous le nom de *Sapo sin hueros* (Crapaud sans os); je ne sais pas comment il peut s'enterrer ni de quoi il se nourrit."

among the foliage of another tree, or run at a quick pace along the ground. They are very restless, and keep constantly moving up and down the branches and in the shade of the foliage; so that it is very difficult to obtain a shot at them.

Different kinds of insects appear to be their principal food, as I have found the remains of grasshoppers, &c. in their stomach.

Their nests are very remarkable structures, and about 30 to 36 in. long by 2 feet in circumference; the entrance is at the top, and protected by overhanging sticks. The whole fabric is very strongly constructed of dry branches, and at first appearance would never be taken to be the work of such a small bird. The inside of the nest is very small, consisting of a tunnel of about 14 or 15 in. in depth by 3 or 4 in. in diameter. The roof-like sticks covering the entrance are a good protection against the depredations of the spotted *Dasyurus* and other enemies to the eggs and young brood, showing the deep sagacity of this singular bird.

Travelling along the banks of the Murray, and now and then cutting off a bend of the river by crossing through the scrubble, the traveller cannot help noticing a great many of these nests buried between the forked branches of *Eucalyptus dumosa*, or into the very crown of the Huon pine. Whenever I asked my native companions to which birds these nests might belong, they would tell me their native name for it, which is Tannekun, but which left me as wise as before, as no Brown-capped Pomatorhinus was to be met with. It was not until Mr. Blandowski had returned to Melbourne, leaving me in charge of the expedition, that I was informed by that gentleman that this bird was not described by Mr. Gould, urging me to procure every information about its habits and economy; but very soon after this a splendid life-like representation appeared in the Supplement to the 'Birds of Australia.'

Measurements:—Weight hardly 2 oz.; between wings 11″; length $9\frac{1}{2}$″.

It was not so easy as I thought, to procure the eggs; and for two days I was unsuccessful—not one nest of more than a score which were searched contained any eggs; but on the 20th of September an inhabited nest was found in the top of a pine tree, which contained five fresh eggs of a light greenish-blue colour, with a few very indistinctly marked darker spots, and divided in the middle by a band paler than any other part of the egg.

When the nest was first seen there were about ten or fifteen birds hopping about it, by which and by the size of the nest I should suppose that more than one female deposits her eggs in it. The eggs which the natives brought in after this were almost all set upon: at the same time they brought some young birds; and about a fortnight later I shot several young birds on the wing.

July 13, 1858.—Dr. Gray, F.R.S., V.P., in the Chair.

On a New Species of Ptarmigan. By John Gould, F.R.S. &c.

Everything which tends to increase our knowledge of so important a group of birds as the *Tetraonidæ* must be regarded with especial interest; and hence I have great pleasure in exhibiting to the meeting a skin, imperfect though it be, of what I believe to be a new species of this family. I may remark that, while many specific names have been given to some species of this group, others appear to have been passed over unnoticed, of which latter the bird now before us is an instance in point, for I believe that it has not as yet received a specific appellation. It is to be regretted that the specimen is not in a better state of preservation; it furnishes, however, sufficient materials for a good description. Its native habitat is Spitzbergen, where I believe it is plentiful. It was brought to this country by Edward Evans, Esq., of Neath, who shot it during a visit to that part of the world in the summer of 1856; the specimen, which is a female, is of course in its summer plumage, as at no other season are these high northern lands visited by travellers. In size it considerably exceeds our Common Ptarmigan, from which it differs very remarkably in the colouring of the tail,—the basal half of nearly all the feathers being white, and the apical half black, narrowly fringed with white at the extreme tips. As is the case with all other Ptarmigans in their summer plumage, the primaries are white; in this species most of the secondaries and the wing-coverts are also white; the remainder of the plumage is rayed with black and ochreous yellow, the black predominating on the upper surface, while the feathers of the flanks are beautifully and equally barred with these two colours; the feet are white, the nails jet-black, and the bill brown. The total length of the bird is about 16 inches, of its wing $8\frac{1}{2}$ inches, tail $5\frac{1}{2}$, tarsi $1\frac{3}{4}$. I propose to call this species *Lagopus hemileucurus*.

With much kindness Mr. Evans sent me the only skin he procured, accompanied by permission to describe and make any other use of it I pleased, and the following note respecting it:—

"The skin sent is the only one I have from Spitzbergen, though I shot many. The bird was so plentiful, that, thinking I could always procure specimens, I neglected to preserve any at the time, and was obliged to come away at last with only this one. The hen birds had all assumed their summer plumage; but the males had not changed a feather, though the old ones, which had become very ragged and dirty, would almost fall off on being touched. I started one hen from her nest, or rather from the little dry hollow where she had collected a few stems of grass, and found two eggs; these were all we met with; the nest was placed in the high fields where in the dry parts scarcely any vegetation is to be seen, while the swampy portions where the snow had melted were covered with coarse grass and the dwarf willow, which is the only thing approaching to a shrub on these barren treeless islands. The specimen sent was shot on the 27th of June, on the south shore of Ia Sound, in about $77\frac{3}{4}°$ N. lat.

"The neighbouring country consisted of a belt of swampy ground covered with rank grass, with high, rugged and barren mountains rising behind, covered with snow, except on their sharp ridges and steep sides; these mountains, which are interspersed with vast snow-clad plains, stretch away for miles inland, and rise into beautiful cones in the distance; here and there in a few sheltered spots a scanty supply of small flowers were to be found, mostly belonging to the following genera: *Draba, Ranunculus, Saxifraga,* &c. The dark-grey rocks were covered with lichens in great variety, but of a gloomy and sombre hue, in strict keeping with the wildness of the scene; here too the reindeer moss grew in great abundance. I may remark that the Ptarmigans were so tame, that we could easily have knocked them down with a long stick, doubtless from being so unaccustomed to the intrusion of human visitors."

I cannot conclude without expressing a hope that some person visiting the country, such as the noble Lord Dufferin, will think of our museums as well as of gratifying their palates, and send us specimens of this new species, which would be highly prized.

Descriptions of Two New Species of the Family Hirundinidæ. By J. Gould, F.R.S., V.P.Z.S., etc.

One an *Atticora* from Guatemala, the other a *Chelidon* from Cashmere.

Atticora pileata, Gould.

Size of the Sand Martin (*Cotyle riparia*); crown of the head, ear-coverts, and back of the neck black, with bluish reflexions; back deep brown, becoming darker on the upper tail-coverts; wings blackish-brown, darkest on the shoulders; tail moderately forked, and of the same colour as the wing; throat mottled with dark brown and greyish-white; breast white, blending into brown on the flanks; under tail-coverts largely developed, and of a dark purplish-brown; bill and feet dark purplish-brown; thighs brown, gartered with white.

Total length, $5\frac{1}{8}$ inches; wing, $3\frac{3}{4}$; tail, $2\frac{1}{2}$; tarsi, $\frac{3}{8}$.

Hab. Guatemala.

Remark.—This bird is much smaller, but is of precisely the same form as the *Atticora fasciata.* Science is indebted to George Ure Skinner, Esq., for the introduction of this new and interesting Swallow.

Chelidon Cashmeriensis, Gould.

Considerably smaller than the common species *Chelidon urbica,* but of precisely the same form and colour, except that the axillaries and under part of the shoulder are dark brown instead of greyish-white; the feathered tarsi occur in both species; crown of the head, back, and shoulders black, with steel-blue reflexions; tail brownish-black; throat, under surface, and rump white, stained with brown on the flanks.

Total length, $4\frac{5}{8}$ inches; wing, $3\frac{7}{8}$; tail, 2; tarsi, $\frac{7}{16}$.

Hab. Cashmere.

Remark.—For our knowledge of this species we are indebted to Dr. A. Leith Adams of the 22nd Regiment; several of whose discoveries in ornithology have already been recorded.

Description of a new Species of the Genus Buteo from Mexico. By Philip Lutley Sclater, M.A., F.L.S., etc.

Mr. J. H. Gurney has called my attention to a specimen of a species of the genus *Buteo* belonging to the Norwich Museum, which I now exhibit. It was formerly in the collection of this Society, and was originally received along with other birds from the State of Tamaulipas, in Northern Mexico, by Mr. Gould. I have never seen any other bird quite resembling it—the nearest ally known to me being the *Buteo albonotatus* of G. R. Gray; from which, however, on comparison, it appears to be perfectly distinct. I agree with Mr. Gurney in considering it as probably undescribed; and in allusion to its nearly uniform sooty black plumage, propose to characterize it as

Buteo fuliginosus, sp. nov.

Saturate fuliginoso-brunneus unicolor; capite, dorso medio et alarum primariis extus paulo nigricantioribus: primariorum et secundariorum vexillis internis subtus albis, sex aut septem vittis nigris transversim notatis; tectricibus alarum inferioribus nigro-brunneis: cauda supra fuliginoso-brunnea, vittis quinque aut sex nigris obsolete transfasciata et nigro late terminata; cauda subtus alba et vittis dilutioribus: rostro nigro, pedibus flavis.

Long. tota 15·5, alæ 12·0, caudæ 6·5, tarsi 2·6.

Hab. In Mexico Boreali.

MISCELLANEOUS.

On the Burrowing Habits of Peachia hastata, *Gosse*. By E. W. H. Holdsworth, F.L.S. &c.

The recent acquisition of a living specimen of *Peachia hastata* has enabled me to observe some of its habits, and to ascertain its mode of penetrating the sand, in which it is generally found. Soon after it reached me, it was placed in a tall vase of sea-water, having a depth of about two inches of fine sand at the bottom; the first few hours of its confinement were employed in an examination of its prison, the animal crawling over the surface of the sand with an almost imperceptible motion. After it had selected a suitable place for burrowing, in the darkest part of the vase, the posterior extremity of the body became tapered to a fine point by a partial expulsion of the contained water, and at the same time turned downwards and pressed slightly into the ground; the fluid contents of the animal were then forced back until the base was completely distended, and by this means a shallow depression in the sand produced; the tail then reassumed its conical shape, was again thrust into the ground, and swelled out; and these proceedings were continued until a hole was made sufficiently large to admit the animal. Its first efforts in burrowing had but little effect; and it was only after an hour's labour, when the cavity had become large enough to allow the polype to work in an upright position, and with the assistance of its whole weight, that rapid progress was made.

It is probably by this hydrostatic pressure that all burrowing soft-bodied animals having a water-circulation are enabled to work their way into the ground.

Application of Polarized Light to the Microscope. By Dr. M. C. White.

For conducting microscopic investigations with polarized light, it is customary to employ two Nicol's prisms, one of which is placed below the stage of the microscope, and the other just above the object-glass. If the prism placed below the stage is large, a fine illumination is obtained by light reflected from a concave mirror placed below the prism, or by condensing the light, after it passes the prism, by means of an achromatic condenser. But as the Nicol's prism transmits only the extraordinary ray produced by double refraction of the Iceland spar of which it is composed, one-half the light is lost, and a powerful light is required to give adequate illumination.

The Nicol's prism above the object-glass, used for an analyser, requires to be large; otherwise the lateral portions of each pencil of light are cut off, the object seen in the microscope appears insufficiently illuminated, and the definition becomes very imperfect.

On the other hand, if the Nicol's prism is very large, its length is increased in the same proportion as the breadth, and considerable aberration is produced by transmitting the pencil of light through so great a thickness of Iceland spar. A lateral displacement takes place, equal to about one-twelfth of the length of the Nicol's prism through which the light is transmitted.

These errors may be corrected, and the definition of delicate objects greatly improved, by placing another prism, exactly like the first, above it in the body of the microscope below the eye-piece, with its plane of principal section rotated 180°. This corrects entirely the lateral displacement. The second prism in the body of the microscope may be simply a prism of Iceland spar of the same dimensions as the Nicol's prism used as an analyser. This prism of Iceland spar may be placed next above the object-glass, and the Nicol's prism, if sufficiently large, just below the eye-piece, without altering the effect. To show the *important* value of this *compensating prism* in the body of the microscope, I will describe the results obtained with this apparatus.

With J. & W. Grunow's microscope, No. 4, and a polarizing prism $2\frac{3}{10}$ inches in thickness beneath the stage, mounted to be used either with or without an achromatic condenser, I placed in the body of the microscope, above the object-glass, a Nicol's prism for an analyser, measuring $2\frac{1}{5}$ inches in thickness, and a prism of Iceland spar of the same dimensions (obtained from Rossie, New York), in a reversed position just below the eye-piece. With this arrangement, using an eighth-inch objective made by J. & W. Grunow, I was able to see three sets of lines on the *Navicula angulata* clearly defined; and with a good light I could also distinctly see the six sides of the little hexagons on the same specimens. These phænomena can be seen with either of the three eye-pieces belonging to the microscope; but the six sides of the hexagons are best seen with No. 2 or No. 3 eye-piece. Taking away the compensating prism of plain Iceland spar, and with the same arrangement in every other respect, at the utmost only two sets of lines were seen, and the hexagons appeared only as black dots, the form of which could not be distinguished. These facts prove conclusively, as I think, the great value of the compensating prism here described, which has never before been applied to the microscope, so far as my knowledge extends.—*Silliman's Journal*, November 1858.

On the Introduction of Bombyx Cynthia *into France.* By M. Guérin-Méneville.

One of the most active and distinguished of the members of the Society of Acclimation, M. Guérin-Méneville, who has been especially interested in the introduction of new silk-worms, has just succeeded in acclimatizing in France a new silk-worm from China, where it lives on the Varnish-tree (*Ailanthus glandulosus*). The species is the true *Bombyx Cynthia* of Drury (1773), figured for the first time by Daubenton, jun., in his coloured plates, which were published between 1760 and 1765, and raised for some centuries in China, where its silk clothes the people. Roxburgh, in 1804, supposed the *Eria* which is raised in British India to be the same; and this confusion has continued till recently,—so that the *Eria* (or 'Arrindy-arria,' as it is called in Hindostan) has gone by the name of *Bombyx Cynthia*. The *Eria* is a different species, living on the *Ricinus*.

The study of the species by Guérin-Méneville has brought to light differences between the two in the cocoons and the habits of the worms. The cocoons carded give an excellent flock of silk, which is used in China and Bengal for very firm tissues. The colour of the silk is a fine flax-grey; and clothes made of it are not injured by the rain, or oil, and wear long.

Now that the introduction of the silk-worm is accomplished, attention is turned to the extension of it industrially. Guérin-Méneville proposes for this end the making of plantations of *Ailanthus*, a tree that grows easily on poor soil, then to place upon them in spring the worms that were hatched in the month of May, and let them eat the leaves. Care should be taken to preserve them from the birds, which is easily done by an invalid workman incapable of other work, as has been the custom for centuries in China. At the end of June the first crop may be gathered, and a second in August. The cocoons for reproduction should be preserved until the next May, which requires, as with the silk-worm of the *Ricinus* and the *Dipsacus Fullonum*, special care in the winter.—*Silliman's Journal*, November 1858.

THE ANNALS

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[THIRD SERIES.]

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XI.—*On the Land Shells of Lanzarote and Fuerta Ventura; with Observations on the Molluscan Fauna of the Canary Islands in general.* By Professor A. Mousson. Translated (with Notes and Observations) by R. T. Lowe, M.A.*

A few years ago it was supposed that our researches had almost exhausted the Land Mollusks of the Canaries. The investigations formerly of Maugé†, the visit of M. D'Orbigny to Teneriffe‡ at the commencement of his voyage to South America, the prolonged residence of MM. Webb and Berthelot§, and M. Despreaux's more recent sojourn on several of the larger islands, had contributed to form a list of sixty-six species and good varieties, including seven of very doubtful origin. M. D'Orbigny‖ considered this an extraordinarily rich and faithful picture of the Molluscan fauna of these islands. This number, however, falls extremely short of the abundant harvest which the much smaller group of the Madeiras had afforded to the researches of Mr. Lowe, and compared with the variety of forms which is usually developed in archipelagos of larger islands. It has accordingly proved more recently to have been very incomplete. A residence of five months (1851) by the late not less zealous than acute Herr Blauner of Berne on the islands of Teneriffe and Palma alone sufficed to bring to light about forty-two new¶ species and varieties, some belonging to types of form quite new to these islands. They were described by Mr. Shuttle-

* From "Die Geologischen Verhältnisse der Inseln Lanzarote und Fuerta Ventura," von Georg Hartung, 4to, 1857, Appendix, pp. 130–139.

† Embodied in the works of Férussac and Lamarck. ‡ 1826.

§ Synops. Moll. Terr. et Fluv. &c., Ann. des Sc. Nat. 1833.

‖ Histoire Nat. des Iles Canar. ii. p. 45.

¶ Qu. new altogether?, new to the Canaries?, or new to Teneriffe and Palma only?—Tr.

worth*, and have raised the whole number of Canarian species, including some from the collections of M. Terver (in the Marseilles Museum) and of M. Moquin-Tandon, to 101† good species and varieties, besides seven doubtful. But that even this number must be of very little value with reference to most of the islands, is proved by the following comparison of the species authentically attributed to each of the larger,—seven species, of universal diffusion, being moreover here omitted.

	Teneriffe.	Palma.	Gomera.	Canaria.	Lanzarote.	Fuerta Ventura.	Without indication.
Limax	2						
Parmacella	..	..	..	..	1	1	
Testacella	1	..	..	1			
Vitrina	2	..	..	1			
Zonites	2	2					
Helix	22	11	3	11	5	4	7
Bulimus	7	1	2	3	1	..	3
Zua	2	1	..	2	..	..	1
Pupa	5	2					
Cyclostoma	2	1					
Pomatias	..	..	..	..	..	..	1
Physa	1						
Ancylus	1						
Hydrocena	1	1					
Truncatella	1						
Pisidium	1						
Total..	50	19	5	18	7	5	12

Thus the much-frequented island of Teneriffe would seem to possess seven or eight times more species than the not much

* Berner Mittheilungen, Nos. 241, 242 and 260, 261.

† There is some difficulty about this. The forty-two species and varieties found by Herr Blauner in Teneriffe and Palma alone can scarcely but include some proportion of the sixty-six (comprising seven of doubtful origin) previously enumerated by D'Orbigny; and in that case they ought not, of course, to be simply added on *en masse* to the latter, as they appear to have been by our author, in order to form his total amount of "101 good species and varieties, besides seven doubtful." A few more than fifty species and varieties, old and new, have recently been found in Teneriffe and Palma alone, during a three or four months' residence, by Mr. Wollaston and myself; but our joint researches in all the other five Canarian islands, during two or three months of the present year (1858), have not added above twenty-five or thirty distinct species to these fifty or sixty, which include, moreover, several altogether new or undescribed. The whole number of genuine Canarian species hitherto recorded can therefore scarcely exceed seventy or eighty, making due abstraction of the many spurious species which have been at different times erroneously introduced into the list.—Tr.

smaller but seldom traversed eastward islands of Lanzarote and Fuerta Ventura,—a disproportion scarcely owing to their natural poverty, but probably only to our deficient knowledge. These two latter islands, in every respect less cultivated, and, by their easterly position, placed in close connexion, are those visited by Herr Hartung. With other objects in view, he merely collected what fell in his way; yet even this scanty material possesses some interest, as conducing to the establishment of good specific characters and authentic habitats.

The following species had been recorded by M. D'Orbigny as peculiar to Lanzarote and Fuerta Ventura:—

Parmacella ambigua, Fér.
Helix simulata, Fér.; an oriental species, the name of which is probably improperly applied.
Helix monilifera, Webb.
—— *Lancerottensis*, Webb.
—— *sarcostoma*, Fér.

The following were added as common to all the Canaries:—

Helix pisana, Müll., with its varieties.
—— *plicaria*, Lam. From the former confusion of several different forms, its universal diffusion must be considered to want proof.
—— *lactea*, Müll. According to Webb, rare on most of the islands.
Bulimus decollatus, Brug.
Physa acuta, Drap.
—— *fontinalis*, Drap. Mr. Webb reckons both these species as of universal diffusion.

Herr Hartung has brought back only the following species:—

1. *Helix pisana*, Müll. The typical, more strongly perforated form, which almost exclusively prevails from the shores of Egypt to those of Spain, is very abundant in the Atlantic islands. Amongst Hartung's specimens from the two islands are found three forms which I introduce as varieties, although the last of them, on account of its peculiar habit, would be considered by many authors, perhaps rightly, as distinct.

a. Var. *clauso-inflata*, MSS. Globose, inflated, thin, faintly striated; the perforation faintly marked by a slight elevation of the unreflected pillar-lip; white with indistinct lines; sometimes a very faint indication of a rounded keel above and beneath on the last volution. The specimens are from Fuerta Ventura, but it is also found in Teneriffe.

b. Var. *Alboranensis*, Webb. Characterized by its small size, globose shape, early-evanescent keel, thickening of the shell with age, constriction of the perforation almost to its complete disappearance, absence of yellow colouring, prevalence, on the contrary, of grey cloudy colours with fine dark lines. It appears to live on the arid shores of both islands, and departs little or nothing from the typical examples from the Alboran Islands, except in the still more closed perforation.

c. Var. *geminata,* MSS. This is distinguished as a very well-marked variety, if not as a separate species, from the typical *pisana,* by the somewhat depressed form, especially of the last volution; by the still sharper fine transverse striation crossed by spiral grooves; by the disappearance of all polish; by the want of perforation—often, indeed, of any indication of the same, and that from its earliest stage; lastly, by the abnormal character of the colouring, which reminds one more of *Alboranensis.* On the greyish and brownish-white ground are traced zones of fine, entire or slightly interrupted, dark, spiral lines, radiating on the spire, longitudinal at the circumference, which often form an extremely elegant pattern, and remind one of the allied *H. ustulata,* Lowe, of the Salvages Islands. More poorly coloured individuals have brownish-yellow clearly defined zones, with distant rows of spots. In about forty examples from both islands, eight were quite uncoloured.

It is interesting to see these remarkable aberrations appear on the most easterly of the Canaries, nearest to the continent, whilst Teneriffe, except the closed perforation, already exhibits nearly the European habit, and even this aberration disappears again in the still more remote Madeiran and Azorian groups.

2. *Helix impugnata,* MSS.

Testa obtecte perforata, convexo-depressa, solidula, lineis rugosis transversis et subtilioribus longitudinalibus reticulata, opaca, griseo-albida, lineolis numerosis brunneis interruptis ornata; spira obtusa, subprominula; anfractus $4\frac{1}{2}-5$, superne planiusculi, filo-carinati; ultimus serrulato-carinatus, vix descendens, subtus convexus; apertura lunato-securiformis; perist. rectum, intus tenuiter labiatum, margine columellari carneo, perforationem semiclaudente.
Diam. maj. 12, minor $10\frac{1}{2}$, alt. 8 millim.

Mr. Webb has regarded this species as *H. planata,* Chemn., M. D'Orbigny as a mere variety of *pisana,* Müll. (*l. c.* p. 58),—both, as I think, improperly. From *planata,* which, according to Pfeiffer (Mon. iii. 137), is a native of Africa, as well as from its ally, *erythrostoma,* Phil. (*l. c.* iii. 137), which comes from Morocco, it is distinguished by the more elevated spire; by having one volution less; by the keel being prominent like a fine thread on all the volutions; by the absence of all polish in consequence of the fine sharp longitudinal, and wrinkly crossgrooving; by the less expanded mouth, with nearly sharp, scarcely thickened peristome, whilst the lower part of the lip in both the other species is very broadly developed and coloured. On the other hand, the aspect of this form, with its very constant characters, obvious even in the youngest individuals, of the widely flatter shape, the sharp thread-like keel, and the strongly marked perforation, seem sufficiently to justify its separation from the Canarian *pisana,* which occurs abundantly on the selfsame islands, without, as it appears, transitional states.

On the contrary, the connexion with *H. arietina,* Rossm. (Zeitschr. 1846, 17. 2), collected by Dr. Willkomm in the Spanish Sierra de S. Cristoval, which is rare in collections, is less clear to me, and may perhaps rest on similar differences to those between our var. *geminata* and typical *pisana,* namely the sharper sculpture and the aberrant colouring. Were *arietina* identical, however, as Herr Pfeiffer suspects (Monogr. i. 176), with *planata* of Ch., the affinity with our form would be but slight.

3. *Helix granostriata,* MSS.

Testa umbilicata, lenticularis, solidula, transverse seriatim granulata et sulculata, opaca, griseo-albida, unicolor vel interrupte fusco-bifasciata; spira depresso-conica, summo corneo; anfractus $5-5\frac{1}{2}$ superne plani, filo-carinati; carina subserrulata; ultimus non descendens, infra vix convexiusculus; umbilicus parvus, $\frac{1}{8}$ diametri non superans; apertura securiformis; peristom. rectum, intus labiatum, marginibus non approximatis, columellari non reflexo.
Diam. maj. 8, minor $6\frac{1}{2}$, alt. $3-3\frac{1}{2}$ millim.

At the first glance, this pretty species reminds one of *H. Setubalensis,* Pfr., or of the truly scalariform *argonautula,* Webb (D'Orb. ii. 64); but both have the under side more convex, a much wider umbilicus, a much coarser transverse striation, and more prominent keel; moreover, both are entirely without the elegant rows of granules in the direction of the striæ of growth, which indicate a slight approach to the Madeiran *polymorpha*-group. The two dark interrupted bands on the upper and under sides, disappearing on the spire in horn-coloured spots, recall to mind the colouring of the group of *Helix tumulorum,* with the members of which, however, no confusion is possible.

This species is also found on both islands. The example from Fuerta Ventura is somewhat stronger in structure and in sculpture than the other from Lanzarote, but partakes of all its other characters.

4. *Helix persimilis,* Shuttl. (Diagn. n. Moll. 1852, 1. 7). A few examples of this species, found in Lanzarote, are not to be distinguished from those which Herr Blauner collected in Palma;

they are, however, somewhat more globose in diameter, stronger, and more chalky. All the other characters agree closely.

5. *Helix monilifera,* Webb. I consider an example found in Lanzarote to be the true species brought by Mr. Webb from the same place, to which the preceding, at all events, is nearly allied. The shell is, however, still somewhat more globose than in the last, somewhat larger, white and chalky, with less distinct striation, but distinct scar-like impressions, especially beneath, and moreover somewhat shining. The dark bands are less connected together, broken up into dots; the perforation appears nearly closed by the reflexion of the lip, which extends from the columella to beyond the base. A somewhat strong white lip is continued round and within the peristome.

6. *Helix Despreauxii,* D'Orb. The original form comes from Canaria; the one brought by Herr Hartung, which, notwithstanding some aberrations, seems to me to be only a variety, from Lanzarote. Its differences may be stated as follows:—

Var. *moderata,* MSS.

Testa depresso-conica, fortiter perforata, bicarinata, carinis magis compressis et productis, secunda subtiliore; basis tuberculis granosis ornata.

The essential characters are those of the species, only less marked. The shape is altogether more depressed, with a flat, prominent primary keel, which seems to be rather erose than granulate-toothed; the second keel, in some examples, is but little prominent, in others as strong as the first; the close-set wrinkled warts of the under side assume more the appearance of coarse granulations on a finely striated ground. One of the examples has the upper side dark, contrasted by a white keel.

7. *Helix paupercula,* Lowe. This little species, remarkable for its much depressed form, and round constricted aperture, presents itself in two varieties. In the Azores (island of Fayal), and in its subfossil, rarely living, state in Porto Santo, it is smaller and flatter, with a less granulated surface, but especially with an aperture contracted by a wart-like tooth proceeding from the thickened lip of the right border. The prevalent living form in Porto Santo has scarcely an indication of the wart; that of Madeira is entirely destitute of it, with the shape less flatly depressed, the umbilicus narrower, the last volution less angular and more convex beneath, the aperture less horizontal, the upper surface more distinctly shagreened. This second variety was found in a few examples amongst the present specimens from Lanzarote.

8. *Helix sarcostoma,* Webb. This well-known handsome spe-

cies was discovered by MM. Webb and Berthelot on both the islands from which it has been brought by Herr Hartung. In some examples the aperture is quite horizontal at the base of the shell, and has a flat reflected rim more than a line broad.

9. *Bulimus decollatus*, Brug. Not to be distinguished from the European form. The whole of the individuals, as well as most of those of *H. sarcostoma*, and several of *H. pisana Alboranensis*, are in a white, chalky condition, which might be called semifossil; but this appears not to be so much an effect of age as of the habitat in hot sea-sand.

Of the nine species collected by Herr Hartung, one, *Helix granostriata*, is therefore quite new; *H. pisana geminata*, *H. impugnata*, *H. monilifera*, *H. Despreauxii moderata*, *H. sarcostoma*, although long known, appear peculiar to the two islands; only *H. persimilis* and *pisana Alboranensis* are also enumerated in other islands, whilst *B. decollatus* is common to the whole of the countries on the Mediterranean. From these results, one may hope for further discoveries when Herr Hartung carries out his purpose of another visit to both these islands, and of the exploration of others of the less-known Canary Islands. Not till the completion of our knowledge will it be possible to lay down, comprehensively and conformably to nature, the peculiarities of the Molluscan fauna of the Canaries, and its interesting relations to those, on one side, of the coasts of Europe and Africa, on the other, of the rest of the Atlantic archipelagos. I confine myself for the present to a few remarks.

In position, climate, volcanic soil, and vegetation, the Canaries approach very near to the Madeiran group. It is the more extraordinary to find the Molluscan fauna remarkably different and more nearly related to that of the continental shores of the Mediterranean. With the exception of a set of species (*Helix cellaria*, *lenticula*, *pisana*, *aspersa*, *lactea*, *Bul. decollatus*) which follow the shores of the Mediterranean from the east as far as Portugal, the Canaries and Madeira actually possess besides *H. paupercula*, not a single species in common,—at least none which does not also belong to the continent. All preceding statements (e. g. *H. tiarella*) rest on uncertain determinations or incorrect habitats. Moreover, even the predominant types on both these groups of islands are different; so that those very types which are developed in the richest variety on the one are scarcely or almost not at all represented on the other by single detached species.

Thus in Madeira and Porto Santo the following types form the basis of the *Helix*-tribe :—

(1.) The section *Ochthephila* of Beck, which Dr. Albers has divided into the groups *Tectula, Ochthephila,* and *Actinella,* and to which belong, e. g., *H. turricula, Maderensis, arcta, polymorpha, Bulweriana,* &c., comprehends in the Madeiran group not less than thirty-three species. In the Canaries, *H. tæniata,* Webb, alone bears the distinctive features of the type; this species is, however, doubtful, not having been collected on the spot, but found in bales of orchil not known to have come from any nearer place (D'Orb. *l. c.* p. 63)*.

(2.) The groups *Leptaxis* and *Plebecula* of Lowe, which are related to the species *erubescens, punctulata,* and *undata,* Lowe, and comprehend about fourteen species. The only Canarian shell approaching to this type is *H. advena* of Webb (D'Orb. p. 58), which, indeed, is directly called by Dr. Albers (Malac. Maderens. p. 49) a Porto-Santan species. If, however, the authentic form of Mr. Webb's species (D'Orb. t. 1. f. 18–20) be compared with the figure which Dr. Albers (t. 2. f. 26, 27) gives of the Porto-Santan shell, they can hardly be considered as identical†.

(3.) The division *Campylæa,* existing in three forms, partly living, partly subfossil, in the Madeiras, possesses in the Canaries not one single genuine representative; for the somewhat allied *H. Villiersi,* D'Orb., must rather be considered as an osculant form of the type *plicaria.*

(4.) In Madeira we find a set of *Clausiliæ,* all peculiar, but still the precursors of this very abundant European genus. In the Canaries, neither the researches of MM. Webb and Berthelot, nor the exhaustive discoveries in Teneriffe of Herr Blauner, have brought to light so much as a single species.

* *H. tæniata,* Webb, by examination of D'Orbigny's original types, proves to be merely a large state of *H. Maderensis,* Wood, which is one of the very commonest Madeiran species, but which has not hitherto been found in any of the other islands of even the Madeiran group, and certainly not in any one of the Canaries.—Tr.

† *H. advena,* Webb, by the original types in D'Orbigny's Canarian collection, is identical with the Madeiran (North and Great Dezertan) form (var. γ.) of *H. erubescens,* Lowe. The Porto-Santan shell, described and figured by Dr. Albers, *loc. cit.*, is another different or distinct form of the same species, found also by Mr. Wollaston and myself, in 1855, on the summit of Pico do Facho in Porto Santo. No form of this species has been ever really found in the Canaries; and there can be no reasonable doubt that the orchil which produced *H. advena,* Webb, like that in which *H. tæniata,* Webb, is said to have occurred, was of Madeiran or Dezertan origin—if both these shells, indeed, may not be supposed to have been collected in Madeira by Webb himself in 1828–9, and to have become afterwards mixed up by accident with Terver's orchil-species.

At all events, the two conclusions founded, in the text, on the supposed Canarian origin of *H. tæniata* and *advena,* require better substantiation; and *Ochthephila,* Beck, with *Leptaxis* and *Plebecula,* Lowe, still remain, equally with *Campylæa,* Beck, without any genuine or certain Canarian representatives.—Tr.

(5.) The genus *Pupa* in the Madeiras developes itself richly in about twenty very peculiar forms, of which one only, *P. anconostoma,* can be identified with a European species. From the Canaries M. D'Orbigny obtained only two species, viz. *P. dealbata,* Webb, belonging to a foreign southern type, and *P. maculosa,* Lam., of very doubtful habitat. Herr Blauner has added three small forms, one of which, *P. atomus,* Shutt., comes near the European *P. minutissima,* whilst both the others (*tæniata* and *castanea,* Shutt.) approach nearest the Madeiran *cheilogona* and *irrigua,* Lowe.

It is interesting to find represented also now in the Canaries, through Herr Blauner's admirable discoveries, and still by single species, three types which were regarded hitherto as quite peculiar to the Madeiras, viz.:—

(1.) The group of *H. bifrons,* Lowe, to which *H. Pompylia,* Shutt., is to be referred.

(2.) The remarkable type of the thin-shelled, carinated *H. Webbiana,* Lowe, to which *H. cuticula,* Shutt., belongs.

(3.) Lastly, the extraordinary group of *Cyclostoma—Craspedopoma,* which in Madeira furnishes both the species *C. lucidum* and *Lyonnetianum,* Lowe, and now in Teneriffe is represented by *C. costatum,* Shutt.

In the Canaries, wholly different types from these predominate, of which the following are the principal:—

(1.) The type *H. sarcostoma,* Webb, including *malleata** and *consobrina,* Fér. It stands perhaps in nearest alliance with the S. European *H. vermiculata,* M., which, strangely in contradistinction to *H. lactea,* M., not being found itself either in Madeira or in the Canaries, is not even represented in the latter† (?) by any allied form.

(2.) In like manner, the Madeiran group is entirely wanting in the type *plicaria,* Lam.‡, which yields in the Canaries six species.

(3.) Quite peculiar to the Canaries, and varying in a series of species through many shades from globose to carinate, is the group of *monilifera* and *tumulorum,* Webb. In Madeira, as also really in the Mediterranean, it is wholly wanting§, at least in any clearly expressed form.

* *H. malleata,* Fér. (= *H. bidentalis,* Lam.) cannot rightly be included with *H. sarcostoma,* Webb, and *consobrina,* Fér.—Tr.

† Rather, surely, "the former," *i. e.* Madeira, in which *H. lactea,* Müll., does not occur, whilst it abounds in several of "the latter," or Canaries, representing in them the S. European *H. vermiculata,* Müll.—Tr.

‡ *H. plicaria,* Lam., is merely an abnormal state, scarcely a variety, of *H. Adansoni,* Webb (*H. Pouchet,* Fér.), which can scarcely, without violence, be placed in a different group from that of *H. consobrina* and *sarcostoma.*—Tr.

§ The exclusively Porto-Santan (erroneously supposed Teneriffan or

(4.) The species *cyclodon,* Webb, *Despreauxii,* D'Orb., *moderata,* MSS., *argonautula,* Webb, *granostriata,* MSS., have no kindred forms in the Madeiras*. On the other hand, they unite —as, however, well-distinguished forms—with certain S. European types.

(5.) The same may be said of the horny-shelled *H. diaphana,* Lam., *afficta,* Fér., *fortunata* and *discobolus,* Shutt., *hispidula,* Lam. With the exception of the universally diffused *H. lenticula,* Fér., nothing similar occurs in Madeira†. On the other hand, the S. European *H. lens* and *ciliata* are more nearly related.

(6.) In *Bulimus,* the extensive groups of *obesatus* and *variatus,* Webb, uniting with the European *B. montanus* and *obscurus,* are quite wanting in Madeira and Porto Santo. Strange to say, however, they again find, though indeed in a remarkably aberrant form (*B. eganeus,* Alb.), a representative in the Azores.

(7.) *Cyclostoma lævigatum,* Webb, belongs to the type of the European *C. elegans,* also occurring in the Canaries ‡, but not mentioned as a Madeiran species.

These few observations may suffice to indicate the nature of the Canarian fauna in comparison with both the S. European and Madeiran, as also its far greater affinity with the first than with the last. To complete more perfectly its characterization and comparison, additions are still wanting to our information in three directions: 1st, with respect to the species of the less-visited islands; for, excepting Teneriffe and Palma, not one can really be considered as exhaustively explored; 2ndly, with reference to the Molluscan fauna of the Cape de Verdes, which, considering their position over against the continent, should have the nearest resemblance to the Canaries, though their more

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Canarian) *H. Michaudi,* Desh., is a genuine, nay, typical species of the same group, viz. *Lemniscia,* Lowe.—Tr.

* *H. argonautula,* Webb, certainly, and *H. granostriata* probably, belong to the peculiarly Madeiran group *Discula. H. cyclodon,* Webb, is of extremely doubtful origin as to habitat, and it is probably as little entitled to a place in the Canarian as in the Madeiran fauna. The assertion in the text, therefore, relatively to the Madeiras can be fully admitted only in the case of *H. Despreauxii,* D'Orb., of which *moderata* is merely a variety, and which, like *H. cyclodon,* D'Orb., belongs to the restricted group *Crenea,* Alb., typified by *H. elegans,* Drap.,—a group of which Madeira certainly possesses no true representative.—Tr.

† It may be doubted whether all the species above enumerated belong really to the same group; and some will perhaps prove to have their genuine counterparts in Madeira.—Tr.

‡ Whether *C. lævigatum,* Webb, be really distinct from *C. elegans* (Müll.), seems very questionable. Certainly one species only of this type has offered itself to the combined researches of myself and Mr. Wollaston in any of the seven Canarian islands. In the Madeiran nothing of the sort occurs.—Tr.

southern latitude and greater proximity to the continent must exercise some influence; 3rdly and lastly, with respect to the species of the adjacent African continent, of which only a few of the larger species, or of others introduced by commerce, but none of the far more numerous smaller kinds, are known. It is much to be desired that future investigations may be carried on in these directions.

Teneriffe, July 28, 1858.

XII.—*Descriptions of six recently discovered species, and Characters of a new genus of* Araneidea. By JOHN BLACKWALL, F.L.S.

Tribe **Octonoculina**.

Family LYCOSIDÆ.

Genus DOLOMEDES, Latr.

Dolomedes ornatus.

Length of the female $\frac{1}{10}$th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{20}$; length of a posterior leg $\frac{1}{7}$; length of a leg of the third pair $\frac{1}{8}$.

The cephalothorax is convex, glossy, compressed before, rounded on the sides, and has a slight indentation in the medial line; a broad brownish-red band, which tapers to its posterior extremity, extends along the middle, and on each side of it there is a longitudinal brown band, which decreases in breadth to the lateral eye of the posterior row; the sides have a pale, dull, yellow hue, that of the lateral margins is black, and a blackish spot occurs on the frontal margin, below each lateral eye of the anterior row. The falces are conical, vertical, and armed with a few teeth on the inner surface: the maxillæ are short, somewhat enlarged and rounded at the extremity, and slightly inclined towards the lip. These organs have a pale, dull, yellowish hue; a blackish streak extends along the former, and appears like a continuation of the spot on the frontal margin of the cephalo-thorax. The lip is nearly quadrate, and of a yellowish-brown colour, the sides being much the darkest. The sternum is heart-shaped, and of a pale, dull, yellow hue, with broad, brownish-black lateral margins. The eyes are seated on black spots on the sides and in front of the anterior part of the cephalothorax; the four anterior ones are minute, and form a straight transverse row, the exterior ones, each of which is placed on a minute tubercle, being rather the smallest; the other four are large, and describe a trapezoid whose posterior side is much the longest; the posterior eyes of the trapezoid are seated on tubercles, and the anterior ones are the largest of the eight. The legs are moderately long, provided with hairs and fine spines, and are of a pale yellowish hue, with minute black spots; the fourth pair is rather the longest, the first and second pairs are equal in length, 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 palpi resemble the legs in colour, and have a small, curved, pectinated claw at their extremity. The abdomen is oviform, thinly clothed with hairs, convex above, and projects over the base of the cephalothorax; the upper part is of a yellowish-brown colour; at its anterior part there are four short longitudinal streaks, the exterior ones of which increase in breadth to their posterior extremity; to these succeed three large spots placed transversely, the intermediate one being in advance of the other two; and between the latter and the spinners there is a series of short transverse bars, somewhat enlarged at their extremities, which decrease in length to the coccyx; these streaks, spots, and bars have a brown hue; the sides and under part are of a pale yellowish colour; the former are slightly tinged with brown, and a longitudinal brownish-black band occurs on each side of the medial line of the latter; these bands converge to the spinners, where they meet.

The Rev. O. P. Cambridge took two young females of this species at Lyndhurst, in the New Forest, Hampshire, in September 1858, which were transmitted to me by Mr. R. H. Meade in the same year.

Family Thomisidæ.

Genus Philodromus, Walck.

Philodromus elegans.

Length of the female $\frac{5}{24}$ths of an inch; length of the cephalothorax $\frac{1}{10}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{9}$; length of a leg of the second pair $\frac{1}{2}$; length of a leg of the third pair $\frac{3}{10}$.

The legs are long, slender, provided with hairs and spines, and are of a yellow-brown hue, with red-brown annuli; the second pair the longest, then the first, and the third pair the shortest; the metatarsi and tarsi have hair-like papillæ on their inferior surface, and the latter are terminated by two curved, pectinated claws. The palpi are short, and resemble the legs in colour. The cephalothorax is short, broad, convex, compressed before, rounded on the sides, clothed with whitish hairs, particularly on the lateral margins, and of a pale yellowish colour; a broad dark brown band extends along each side, a narrow longitudinal one of the same hue, which is enlarged near its middle, occupies the medial line, and a short, fine, dark brown streak occurs on each side of its anterior extremity. The eyes, which are nearly equal in size, are disposed on the anterior part of the cephalothorax in two transverse, curved rows, forming a crescent whose convexity is directed forwards; and the lateral ones are seated on minute tubercles. The falces are subconical and vertical: the maxillæ are convex near the base, obliquely truncated at the extremity on the outer side; and inclined towards the lip, which is triangular and pointed at the apex; and the sternum is heart-shaped. These parts are of a yellowish-brown colour, with the exception of the base of the lip, which has a dark brown hue. The abdomen is oviform, clothed with short hairs, convex above, notched in the middle of the anterior extremity, and projects over the base of the cephalothorax; a broad yellowish-brown band extends along the middle of the upper part, the anterior region of which comprises a dark brown fusiform band, having an angular point on each side, and occupying rather more than a third of its length; this band is bordered laterally with yellowish white, and between it and the spinners there is a series of alternate, short, yellowish-white and dark brown curved bars, whose convexity is directed forwards, a triangular spot of the latter hue, having its vertex in contact with the coccyx, terminating the series; the sides are of a dark brown hue, and have conspicuous yellowish-white streaks and spots disposed obliquely upon them; the under part is of a yellowish-white colour, with minute dark brown spots, and three longitudinal bands of the same hue, which meet at the spinners, the intermediate one being the narrowest of the three.

Specimens of this handsome *Philodromus*, which, by its colours and the design resulting from their distribution, bears a striking resemblance to certain species of the genus *Sphasus*, were taken in September 1858 at Lyndhurst, in the New Forest, by the Rev. O. P. Cambridge, who also captured immature individuals of *Sphasus lineatus* in the same locality; by which discovery he has added another genus to our indigenous spiders. Specimens of both species were transmitted to me by Mr. R. H. Meade.

Family Ciniflonidæ.

Genus Ciniflo, Blackw.

Ciniflo mordax.

Length of the female $\frac{3}{5}$ths of an inch; length of the cephalothorax $\frac{1}{4}$; breadth $\frac{1}{6}$; breadth of the abdomen $\frac{1}{4}$; length of an anterior leg $\frac{17}{24}$; length of a leg of the third pair $\frac{13}{24}$.

The eyes are disposed on the anterior part of the cephalothorax in two transverse rows; the anterior row, which is straight, is situated near the frontal margin, and the posterior row is slightly curved, with its convexity directed backwards; the intermediate eyes of both rows describe a trapezoid whose anterior side is the shortest; and the eyes of each lateral pair, which are rather the largest of the eight, are seated obliquely on a tubercle. The cephalothorax is large, convex, glossy, compressed before, and rounded on the sides, which are marked with furrows converging towards an elongated indentation in the medial line; it is depressed and broadly truncated in front, and of a red-brown colour, the cephalic region, which is much the darkest, having a brownish-black hue. The falces are very powerful, conical, vertical, convex in front near the base; armed with teeth on the inner surface, and of a brownish-black hue. The maxillæ are strong, enlarged and rounded at the extremity, and somewhat curved towards the lip: the lip is longer than broad, dilated about the middle, and truncated at the apex; and the sternum is oval and glossy. These parts have a red-brown hue, the sternum being much the palest, particularly in the middle. The legs are robust, provided with hairs and sessile spines, and of a red-brown colour; the metatarsi of the posterior pair are provided with calamistra on their superior surface, and 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 first pair the longest, then the fourth, and the third pair the shortest. The palpi resemble the legs in colour, the radial and digital joints being the darkest, and have a curved, pectinated claw at their extremity. The abdomen is oviform, convex above, and projects over the base of the cephalothorax; it is thinly clothed with hairs, and of a brown colour obscurely freckled with yellowish white, the under part being the palest; a yellowish-white band extends along the middle of the upper part, about two-thirds of its length, and an obscure longitudinal line of the same hue occurs on each side of the middle of the under part; the sexual organs are highly developed, and of a dark reddish-brown colour; the spinners are eight in number, and, with the exception of those of the inferior pair, which are united throughout their entire length and have a yellowish-white hue, are of a red-brown colour.

This spider was captured in the Isle of Wight, on the 1st of August 1858, by Frederick Bond, Esq., who gave it to the Rev. O. P. Cambridge; it was forwarded to me for inspection by Mr. R. H. Meade.

Genus Ergatis, Blackw.

Ergatis pallens.

Length of the female $\frac{1}{8}$th of an inch; length of the cephalothorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{6}$; length of a leg of the third pair $\frac{1}{8}$.

The cephalothorax is compressed before, depressed and rounded on the sides, which are marked with furrows converging towards the middle, and the cephalic region is convex and rounded in front; it is of a dark brown colour, with a broad yellowish-brown band, which tapers to its posterior extremity, and is densely covered with yellowish-grey hairs, extending from the eyes along the middle, nearly two-thirds of its length, and a dentated yellowish-white band on each lateral margin. The eyes are nearly equal in size, and disposed in two transverse rows on the anterior part of the cephalothorax; the intermediate ones of the two rows form a square, and those of each lateral pair are placed obliquely on a tubercle, near to each other. The falces are powerful, conical, and vertical: the maxillæ are convex at the base, somewhat dilated near the middle, rounded at the extremity, which is more abruptly curved on the inner than on the outer side, and inclined towards the lip, which is large, triangular, and rounded at the apex; and the sternum is heart-shaped. These parts are of a reddish-brown colour, the sternum and lip being the darkest, and the falces much the palest. The legs and palpi are moderately long, provided with hairs, and of a pale, dull, yellow hue. The legs of the first pair are the longest, then the second, and the posterior legs, which have a calamistrum on the superior surface of their metatarsi, are longer than the third pair; 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 abdomen is oviform, convex above, and projects over the base of the cephalothorax; it is clothed with short hairs, and is of a greyish-yellow colour; in the medial line of the upper part there is a dark red-brown spot, nearly of a circular form, situated full one-third of its length from its anterior extremity; and at the posterior extremity a few short, curved, transverse bars of the same hue occur, which diminish in length as they approach the spinners; a few obscure dark brown streaks and spots are disposed along the sides, and a broad longitudinal band of the same colour occupies the middle of the under part; the spinners are eight in number, and the two inferior ones are united throughout their entire length.

This *Ergatis*, which was taken among heath at Lyndhurst, in the New Forest, by the Rev. O. P. Cambridge, in September 1858, and was forwarded to me by Mr. R. H. Meade, though immature, is certainly a distinct species.

Genus Veleda, Blackw.

Eyes small, nearly equal in size, disposed on the anterior part of the cephalothorax in two transverse, curved rows, whose convexity is directed forwards; the anterior row, which is the less curved, is situated near the frontal margin, and the intermediate eyes, which are seated on a tubercle, are the largest, and the lateral ones rather the smallest of the eight; the lateral eyes of both rows are widely apart, and are placed on minute tubercles, and the intermediate ones form a trapezoid whose anterior side is the shortest, thus:— 

Maxillæ moderately long, straight, powerful, greatly enlarged and rounded at the extremity, which is prominent on the inner surface.

Lip short, triangular, and rounded at the apex.

Legs very unequal in length; the first pair much the longest, then the fourth, and the third pair the shortest; each metatarsus of the posterior pair is provided with a calamistrum situated on its superior surface.

Spinners eight; those constituting the inferior pair are united throughout their entire length.

Veleda lineata.

Length of the female $\frac{1}{8}$th of an inch; length of the cephalothorax $\frac{1}{16}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{12}$.

The abdomen is of an oblong oviform figure, convex above, and projects over the base of the cephalothorax; the anterior extremity and the posterior part of each side are densely covered with white hairs; the upper part is of a dull or brownish-yellow colour, with three longitudinal dark brown lines, whose posterior half is somewhat ramified, extending its entire length; one of these lines, which is broadest towards its anterior extremity, occurs in the middle, and another is situated on each side of it; the anterior and part of the superior region of the sides, extending towards the spinners, and the under part are of a brownish-black colour. The cephalothorax is long, moderately convex, compressed before, depressed and rounded on the sides, and clothed with white hairs; it is of a brown-black colour, with three longitudinal brownish-yellow lines, one in the middle, and another on each side, and narrow lateral margins of the same hue. The falces are short, conical, vertical, and of a yellowish-brown colour. The maxillæ and lip have a dark brown hue, the apex of the latter being much the palest. The sternum is of an oblong oval form; it is thinly clothed with white hairs, and has a brownish-black hue. The legs are hairy, and the inferior surface of the tarsus and of the extremity of the metatarsus of the posterior pair is provided with short spines; they are of a yellowish-brown colour, with dark brown streaks and annuli. The palpi are short, and resemble the legs in colour, that of the digital joint being dark brown.

Four specimens of this interesting spider, taken by the Rev. O. P. Cambridge among heath at Lyndhurst, in the New Forest, in September 1858, and forwarded to me by Mr. R. H. Meade, were all immature; independently, however, of this circumstance, the species presents such remarkable differences in external structure from the spiders belonging to the several genera included in the family *Ciniflonidæ*, that I have been induced to found a new genus upon it.

Family Agelenidæ.

Genus Agelena, Walck.

Agelena gracilipes.

Length of the male $\frac{1}{10}$th of an inch; length of the cephalothorax $\frac{1}{16}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{24}$; length of a posterior leg $\frac{5}{24}$; length of a leg of the third pair $\frac{3}{20}$.

The legs are long, slender, provided with hairs and sessile spines, two parallel rows of the latter occurring on the inferior surface of the tibiæ and metatarsi of the first and second pairs, and are of a dull yellow colour, with the exception of the genual joint, tibia, and metatarsus of the first and second pairs, which have a very dark brown hue, the genual joint being the palest; each tarsus is terminated by two curved, pectinated claws. The palpi have a dull yellow hue; the cubital and radial joints are short, and the latter projects a brown, pointed apophysis from its extremity, on the outer side; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, rather prominent, not very complicated in structure, with a small, curved, black spine at their extremity, and are of a dull yellow colour tinged with brown. The cephalothorax is convex, glossy, slightly compressed before, rounded and depressed on the sides, which are marked with furrows converging towards a slight, narrow indentation in the medial line; it is of a dark brown colour tinged with dull yellow, especially in the medial line, the lateral margins being the darkest. The eyes are disposed on the anterior part of the cephalothorax in two transverse curved rows whose convexity is directed backwards; the intermediate eyes of both rows form a trapezoid whose shortest side is before, those of the anterior row, which is rather the less curved, being the smallest of the eight. The falces are conical and vertical: the maxillæ are short, convex near the base, rounded at the extremity, and slightly inclined towards the lip; and the sternum is heart-shaped. These parts are of a brownish-yellow colour, the base of the falces being the brownest. The lip is nearly quadrate, being rather broader at the base than at the apex, and has a dark brown hue. The abdomen is oviform, thinly clothed with hairs, convex above, and projects over the base of the cephalothorax; it has a brownish-black hue on the upper part, with an obscure mark of a quadrilateral figure and yellow-brown colour at the anterior extremity; and between this mark and the spinners there is a series of obscure, curved, yellow-brown lines, having their convexity directed forwards; the under part is of a yellowish-brown colour, strongly tinged with dark brown at its posterior extremity, and the spinners, which are short, have a pale yellow hue.

The Rev. O. P. Cambridge took this spider at Lyndhurst, in the New Forest, in September 1858; and it was sent to me in the same year by Mr. R. H. Meade.

XIII.—*Descriptions of several new Land Shells from the Mauritius.* By W. H. Benson, Esq.

That the land-shells of the circumscribed island of Mauritius are as yet unexhausted, may be surmised from its having lately yielded the following species, some of them of typical forms not previously known among its testaceous productions. I am indebted to my friend Sir David W. Barclay for the opportunity of describing them.

Helix Caldwelli, Barclay, MSS.

Testa aperte umbilicata, orbiculato-depressa, confertim oblique sinuato-costata, costis crassiusculis elevatis, sub epidermide fulvo-albida; spira planulata, sutura leviter impressa; anfractibus 6 vix convexiusculis, ultimo antice majore, depresso, ad peripheriam valde rotundato, subtus convexo; apertura obliqua, ovato-lunata, peristomate sinuato, superne antice arcuato, depresso, ad dextram et infra reflexo, marginibus subapproximatis, basali intus stricte labiato, prope columellam dente lato laminari introrsum flectente munito; umbilico infundibuliformi.

Diam. major 9, minor $7\frac{1}{2}$, axis $3\frac{1}{3}$ mill.

Habitat in sylvis insulæ Mauritii.

Found under the roots of trees in a previously unexplored forest on the heights of Plaines Wilhelm, towards the head of Tamarind River and of the gorges of the Black River, by Professor Caldwell, of the Royal College, Port Louis, and named after its zealous discoverer at the request of Sir D. Barclay. The shell reminds the observer of more than one North American type in its tooth, costulation, &c., although not closely allied to any of them.

Helix setiliris, nobis.

Testa perforata, convexo-depressa, non nitente, sub lente oblique confertim striatula, costulis undulatis remotiusculis setiferis munita, translucente, rufescenti-cornea; spira breviter conoidea, apice planiusculo, nitido, sutura impressa; anfractibus 6–6½ convexis, arcte convolutis, ultimo medio subangulato, subtus convexo; apertura obliqua, subquadrato-lunata, peristomate reflexiusculo, intus labiato, infra incrassato, subduplici, marginibus callo parietali plica longa marginali sinuata elevata munito, junctis, columellari sinuato, introrsum obsolete tuberculato.

Diam. major 7, minor 6½, axis 4 mill.

Habitat in sylvis insulæ Mauritii cum præcedente.

A very beautiful and peculiar little species, in form and aperture approaching the European type to which *H. Cobresiana* belongs, and with a parietal callus somewhat similar to that of *H. plectostoma* of Trans-gangetic India. The marginal plait of the callus is suddenly bent inwards below the insertion of the outer lip; it is there largely bowed outwards, and then gradually bends inwards to the insertion of the columellar lip. There is a slight inclination towards the formation of a tooth on the descending columellar margin, at the part where it is exhibited in *H. Caldwelli*. The regular undulate riblets are closely set with short hairs, and more distant longer white ones. Discovered by Mr. Caldwell in the same quarter as the preceding species.

Bulimus vesiculatus, nobis.

Testa anguste rimato-perforata, ovato-acuta, oblique rugulosa, rugis subtus dense pustulato-rugosis, fulvo-castanea; spira convexo-conica, dimidium testæ superante, apice obtusiusculo, sutura impressa; anfractibus 5½ convexiusculis, ultimo circa umbilicum compresso; apertura ovata, $\frac{3}{7}$ longitudinis testæ æquante, peristomate reflexiusculo albido, margine parietali dente angulari obtuso munito.

Long. 13, diam. 7, apert. 6 mill. longa.

Habitat in insula Mauritii, rarissime.

The single specimen received has part of the subreflected lip broken away. It is apparently allied to *B. reticulatus*, Reeve, of West Africa, but has a more conical spire; and the parietal tubercle shows an affinity with *Bulimus Pupa* of the Mediterranean, and the Indian *B. tutulus* and *cœnopictus*. It is a curious fact in the geographical distribution of species, that a shell, not to be distinguished specifically from *B. cœnopictus*, was collected by Mr. Edgar Layard at Moçambic, and that a variety of *Bulimus punctatus*, Anton, occurred to him at the same place as well as at

Oibo and Mombas, through a range of 11 degrees of latitude, on the east coast of Africa. *B. punctatus* ranges northwards from Ceylon, and attains the bank of the Ganges at a single spot, Bithoura, near Futtehpore, nearly opposite to the scene of the recent defeat of Beni Madho, at Dhoondiakhera, by the forces under Lord Clyde.

B. vesiculatus is from the same locality as the preceding species.

Omphalotropis Harpula, nobis.

Testa subumbilicata, ovato-conica, solidula, oblique confertim flexuose costata, costis elevatis compressis, rufescente, albido obscure marmorata; spira gradatim conica, apice acutiusculo, saturate rubro, sutura profunda; anfractibus 5 convexiusculis, superne prope suturam angulatis, postremis sulco remotiusculo leviter impresso sculptis, ultimo convexo, carina basali elevatiuscula munito; apertura verticali, pyriformi, peristomate simplici acuto, marginibus callo appresso arcuato junctis, columellari expansiusculo, undulato. Operc. ——?

Long. 6, diam. 4 mill.

Habitat in insula Mauritii.

The deep suture, in conjunction with the peculiar formation of the upper portion of the whorls, sufficiently distinguishes this little shell from the ribbed *O. multilirata*, Pfr.

Dr. Pfeiffer now includes his genus *Omphalotropis*, under the designation of a section, in the genus *Hydrocena*, Parreyss. It forms a very natural group.

That distinguished author has, in his Supplement, described a shell, with a mark of doubt, as *Cyclophorus æquivocus*, the habit of the shell, as he remarks, associating it with *Cyclostomus*, while the formation of the peristome appeared not to be conformable with that genus.

A specimen, obtained by Sir David Barclay, in better order than the type in Mr. Cuming's collection, and provided with its closely fitting calcareous operculum, proves the shell to be a true *Cyclostomus*. It was received from a whaler, who cited the east coast of Africa as its habitat. The operculum is milk-white, with a blackish centre, slightly concave, and with $5\frac{1}{2}$ slightly corrugated whorls.

Cheltenham, January 12, 1859.

XIV.—*On Parthenogenesis.* By E. Regel*.

Thousands of accurately observed cases bear evidence that an embryo can be developed in a seed only under the influence of fecundation. A few naturalists did, indeed, up to the beginning

* Botanische Zeitung, Oct. 8, 1858. Translated by Arthur Henfrey, F.R.S. &c.

of the present century, deny the necessity of fecundation, but these were solitary voices (Schelver and Henschel*). The theory of fecundation, the practical proof of it (the production of hybrids), was assumed to be a settled fact, and up to our own time underwent a continually fuller development.

A few voices were here and there raised, not against the theory of fecundation generally, but for the proposition that in certain plants a true embryo might be formed without fecundation, where this was hindered; in other words, it was assumed that, "*Normally, the embryo is developed in a seed only under the influence of fecundation. But if the fecundation is prevented, in certain cases an embryo may be nevertheless developed.*" Strictly speaking, therefore, it was assumed that the male sexual organs of plants are wholly superfluous structures.

But this assertion was made always in reference only to particular plants, and indeed to the same with which Spallanzani had experimented in the year 1786, namely Hemp and Spinach†. How inexact Spallanzani's observations must have been, appears from the fact that he obtained ripe seeds even from Basil from which he had removed the anthers, also from Water-melons, &c.

On these latter and similar plants, on which it is easy to operate, there exist a number of direct experiments to show that the prevention of fecundation hinders the production of seeds capable of germination; these and similar observations have been repeated subsequently by persons who were wholly destitute of the knowledge requisite for an exact experiment. On the other hand, Bernhardi, an otherwise very exact observer, repeated Spallanzani's experiments on Hemp‡, and obtained exactly similar results.

This question then sank to rest again; Bernhardi's observations were explained by assuming inaccurate observation, or the formation of a bud in the seed.

In 1841, J. Smith § made known his observations on the production of seed by *Cœlebogyne ilicifolia,* which was stated to perfect all its seed without any fecundation. At the same period Lecoq asserted the occurrence of Parthenogenesis in a host of plants. From his superficial observations he drew the conclusion that all annual plants with separate sexes could form perfect seeds without fecundation. By such a wise contrivance, nature prevented the dying-out of such plants.

* Henschel, von der Sexualität der Pflanzen, nebst einem historischen Anhange von Dr. F. J. Schelver. Breslau, 1820.

† Spallanzani, Expériences pour servir à l'Histoire de la Génération des Animaux et des Plantes. Geneva, 1785.

‡ Otto und Dietrich. Allg. Gartenzeitung, 1839, pp. 327, 329.

§ Trans. Linnæan Society of London, 1841, p. 509.

Cœlebogyne is still in very few hands in flowering condition. So far as we know, it has not been observed, from the period of flowering to the ripening of the fruit, by any German botanist. Observations on the so-called unfecundated seeds, such as were made by Radlkofer, Klotzsch, and A. Braun, can have but a conditional importance. That all has not been seen that may be seen, in this plant, is evident from the fact that while Klotzsch demonstrated, from the formation of the seed of this plant, that it contained not an embryo at all, but a bud, Radlkofer and A. Braun are of the opposite opinion. The latter, however, made a most important observation, still unexplained by him,—namely, that he found a pollen-grain with a pollen-tube on the stigma of *Cœlebogyne.*

In leaving *Cœlebogyne* on one side, since on this only those are competent to speak who have been able to observe it, it may be noticed that this plant has been the cause of the resuscitation of the question as to the possibility of parthenogenesis in the vegetable kingdom, and this the more that a similar phænomenon in the animal kingdom was simultaneously asserted by von Siebold. Naudin and Decaisne in particular took up again the earlier experiments on *Spinacia* and *Cannabis,* adding to them a number of other plants. The result of their experiments was, that female plants of *Spinacia, Cannabis, Mercurialis annua,* and *Bryonia dioica* bore perfectly ripe seeds when they had been sufficiently guarded against the accidental influence of the pollen of male flowers. According to M. Naudin's report, neither he nor M. Decaisne could discover male flowers among the female flowers, which were borne in great numbers. On the other hand, *Ricinus communis* and *Ecbalium Elaterium* bore no seed when all the male flowers were removed before they opened.

Naudin concluded from his observations "*that only diœcious plants are capable of perfecting seeds without fecundation, while monœcious plants perfect their seed only under the influence of fecundation.*"

Radlkofer, from the cases made known by Naudin and Smith, deduced the further law, "*that ovaries which perfect their embryos without fecundation retain their stigmas much longer in a fertilizable condition than is the case when the embryo originates in consequence of regular fecundation.*"

As usual, the majority of naturalists have accepted these statements, promulgated as certain facts. The very circumstance that, in the supposed discovery, all those laws which we have invariably recognized in reference to the origin of embryos are opposed face to face—the attraction of the wonderful, which in these days possesses a powerful charm,—has brought many over to the party who believe in a parthenogenesis.

The author of this notice has expressed, in the last year or two ('Bonplandia,' 'Gartenflora'), his modest doubt as to the accuracy of the experiments of Naudin and Decaisne, which served as the basis of hypotheses of such great weight.

An objection arose in the outset, from the fact that the result was only obtained in small-flowered plants which developed a mass of flowers in every leaf-axil, while large-flowered plants, like *Ricinus* and *Ecbalium*, bore no seed when fecundation was prevented. Still more striking was it, that, of plants known to be polygamous, only female plants were mentioned, and an assurance was given that no male flowers were observed upon them.

I have in the present summer repeated the experiments made by Decaisne and Naudin. Although they are not yet quite concluded, they have afforded me proof that Decaisne and Naudin have observed but superficially, and that neither *Spinacia* nor *Mercurialis* are to be included among plants which can furnish proof of parthenogenesis *.

Plants of *Spinacia*, *Mercurialis annua*, and *Cannabis* were planted singly in pots; and the male plants were removed as they appeared, before the dehiscence of the earliest anthers. The female plants were kept in a place where no pollen from similar plants could have access to them. As soon as the first flowers were perfectly developed, they were cut away so as to leave only a few axillary inflorescences which could be easily examined. All newly-produced lateral branches, which were abundantly developed, were carefully removed, and the inflorescences of the plants experimented on observed daily with a lens. These observations refer, up to this period, only to *Mercurialis* and *Spinacia*, as *Cannabis* has not yet unfolded any flowers.

Mercurialis.—One of the female plants was placed in a different locality, where it grew freely without being cut. This plant has now set abundance of fruit, which will doubtless bear perfect seeds with embryos. But on examination it was found that solitary perfectly developed male flowers were produced in the axillary tufts of flowers, as can be testified by MM. Körnicke, Rach and Maximowicz, to whom I showed them. How this escaped the observation of MM. Naudin and Decaisne, is beyond my comprehension.

Two plants of *Mercurialis* were cut in and observed in the above described manner. Each of the few tufts of blossom produced a great number of female flowers. Here, again, solitary male flowers continually made their appearance, so that I have already removed more than twenty of them from each of the

* I have not yet full observations upon *Cannabis*; but this will doubtless furnish similar results.

experimental plants. Even with the most careful observation, an absolutely conclusive result could scarcely be obtained with this plant; for the male flowers are only detected after they have opened, and therefore may have scattered pollen. I used my utmost endeavours to suppress the male flowers at the right time; and in fact hitherto neither of the experimental plants have set fruit, all the earliest developed female flowers having withered up. But if these plants should still set fruit, this must be attributed to pollen received from some of the male flowers.

Spinacia.—Difficult as it is in *Mercurialis* to neutralize the influence of pollen from adventitiously developed male flowers, it is still more difficult with *Spinacia.* All the experimental plants were cut in. I observed at first, in the axillary tufts of female flowers, solitary normally developed anthers, which projected over the female flowers. I removed them, and placed the plants on which I had noticed them in a different locality. All my experimental plants appeared inclined to set seeds. I therefore placed all except one, on which the first flowers were beginning to unfold, in another situation, and continued the examination of this plant with redoubled attention, allowing in all only ten axillary tufts of blossom to come to perfection. All newly-produced lateral branches were necessarily broken off, as these at once developed new blossoms. First of all, I observed on this plant two stamens with anthers containing abundance of pollen. Placed under the microscope, this exactly resembled normal pollen. These stamens, however, did not arise (as I observed in *Chamærops* last year) from female flowers; but among the female flowers were scattered solitary stunted male flowers, which brought only one stamen, seldom more, to perfection. This fixed my attention. With the help of the lens, I soon saw, in the tufts of female flowers, isolated gland-like bodies, which I had taken at first for mis-shapen bracts. When I had dissected them out, I found that they were *sessile anthers,* developed in scattered abortive male flowers. These contained perfect pollen, as the above-mentioned gentlemen as well as myself can testify. These anthers are seldom perfectly seen, but are almost always partly covered up by the involucral scales of the flowers in which they arise, so that they may be easily overlooked or be taken for transformed bracts. In the isolated male flowers I usually found one sessile perfect anther, with several abortive; more rarely several perfectly developed anthers filled with pollen (all, however, sessile) exist in one flower. From one single axillary inflorescence I dissected out ten such male flowers with sessile perfect anthers. But as this had to be done on living plants under a lens, it could seldom be effected without injuring the anthers, by which pollen was always scattered. In such cases, I indeed removed the immediately adjacent female flowers; and the withering away of the earliest female blossoms was the result. At present, however, several appear to be swelling into fruit.

The very abundant development of axillary flowers here is of course a result of the cutting back of the plant and the removal of the lateral shoots which continually break out afresh from the axils, since the formative energy is wholly diverted to the development of flower-buds. A large proportion of the experimental plants did not bear this injury, and soon died away.

Whether the experimental plants of *Spinacia* and *Mercurialis* perfect seeds capable of germination, or not, these experiments have already fully convinced me that these two genera only develope perfect seeds under the influence of the pollen of adventitious male flowers, and that the only possibility of preventing fecundation is by daily repeated observation of every single flower that unfolds, limitation of the growth of the plant to a few tufts of inflorescence, and rightly-timed removal of each male flower which makes its appearance. An observer who merely looks over a number of female plants with thousands of little flowers, cannot possibly obtain any result of the slightest scientific value. Surveying therefore the conclusions drawn from these experiments, it becomes evident that they have no authority.

That *Ricinus* and *Ecbalium* perfected no seed, evidently arises from the fact that in these plants the male flowers may be easily enough detected in time and removed, which can scarcely be accomplished with certainty in *Mercurialis* and *Spinacia*, since, from the small size and close packing of the flowers, these can only be detected when too late, even if these flowers are not altogether overlooked. There is no ground for making a distinction between monœcious and diœcious plants in this respect.

The same is the case with the stigmas. All the flowers of my experimental plants that were really protected from fecundation soon withered, stigma included. When, on the other hand, fruit was formed in consequence of fecundation, the stigmas persisted a long time, which is by no means wonderful, considering the fleshy nature of the stigmas of these plants.

As soon as *Cannabis* flowers, this plant shall also be subjected to careful examination. I may be permitted to notice beforehand, that the results of previous observations on *Cannabis* have been very varied. Some obtained no seeds on separate female plants (Linnæus obtained this result); others obtained abundance of seed. It seems to be indicated by this, that in *Cannabis* there occur individuals bearing only female flowers, and others which may resemble those of *Spinacia* or *Mercurialis*.

We possess plants of *Cœlebogyne*; but, unfortunately, none of them have yet flowered. Yet I am convinced that in this plant careful observation will clear up the matter. I may refer to the peculiar glands which surround the female flowers, with which solitary imperfect anthers might be easily confounded*.

Parthenogenesis certainly does not occur in plants with evident sexual organs.

Petersburg, Aug. 13, 1858.

XV.—*Further Gleanings in British Conchology.* By J. Gwyn Jeffreys, Esq., F.R.S.

[Concluded from page 43.]

[With a Plate.]

Gasteropoda Prosobranchiata.

Chiton gracilis, n. s. Pl. III. fig. 9 *a, b*.

Testa elongato-oblonga, convexa, colore vario; valvulis clypeiformibus; rostris prominentibus, mucronibus subacutis; areis rostralibus lineatis, fere æque latis; granulis numerosis, inter *Ch. fascicularem* et *Ch. discrepantem* media; fasciculis brevibus, 18 ut in congeneribus et 1 ad termini postremi medium dispositis; vitta marginali lata, coriacea, setulis perbrevibus caducis sparsis obtecta; margine crinito; long. 1, lat. $\frac{1}{2}$ unc.

I detected several specimens of this new and interesting species, mixed with *Chiton fascicularis*, among some shells of Mr. Damon which had been dredged in deep water at Weymouth; and Mr. Metcalfe also procured it, many years ago, in the same locality. Mr. M'Andrew took the same species, in 1848, by dredging off Milford Haven, and considered it to be *C. discrepans*. It, however, differs from that species in its more elongated and arched form, the granules being less numerous, the tufts less developed, and the margin much less hairy; from *C. fascicularis* it may be known by the same distinctive marks, except that the granules are less numerous in that species; and from both of those species in the marginal band being coriaceous, as in *C. marmoreus*, and in having an additional tuft at the posterior extremity. In order to further elucidate the distinction of these three species (viz. *C. fascicularis, discrepans,* and *gracilis*), I have given, in Pl. III. figs. 9 *b*, 10 & 11, representations of their lingual ribands or tongues, by which it will be seen that they all essentially differ from each other. These species, as well as *C. Hanleyi*, belong to the genus *Acanthochætes* of Leach. *C. gracilis* is more probably the *C. discrepans* of Brown than the species which the late Mr. G. B. Sowerby named "*crinitus*;" but as the former

* The author does not appear to be aware that the characters of the male flowers of *Cœlebogyne* are well known. M. Baillon has proposed the same unsatisfactory explanation of this case.—A. H.

name has now been generally adopted for Sowerby's species, it seems a pity, by restoring the latter, to create more confusion, especially as the *crinitus* of Pennant is different from either of them.

C. Hanleyi, ii. 398. A specimen in my possession, from the Shetlands, measures no less than $\frac{5}{6}$ths of an inch in length, and rather more than $\frac{1}{3}$rd of an inch in breadth.

Patella vulgata, ii. 421. I was amused at seeing a party enjoying a limpet meal on the little Isle of Herm. It consisted of a farmer, two of his labourers, and a sheep-dog. This meal formed their dinner, and took place on a grassy plot near the sea-shore. The limpets were cooked by being laid on the ground in their natural position and covered with a heap of straw which was set fire to. When cooked, they were eaten with bread and butter; and I can answer for their being well-flavoured.

Calyptræa Sinensis, ii. 463. Weymouth (*Mr. Thompson*). I found at Serk specimens attached to small loose stones which had scarcely a broader surface than the circumference or base of the shell, and into the sinuosities of which they were closely moulded. It would therefore seem that they do not quit their position, like the limpets, but that their food is brought to them. The nucleus or inner circle of this circumference, showing the point of their attachment, is quite smooth, and apparently worn by the action of the foot; while the outer circle or rim is sometimes encrusted with *Melobesia polymorpha*, which thus grows inside the shell.

Fissurella reticulata, ii. 469. I found two or three shells, by dredging in Guernsey, which agree with the *F. costaria* of Deshayes. One of them has seventy-two longitudinal ribs and costellæ; but specimens of *F. reticulata* vary much in this respect, as well as in the comparative convexity and proportions of the shell. They may, however, be distinct species.

Haliotis tuberculata, ii. 485. The principal use to which the shells now appear to be put in the Channel Isles is to frighten away small birds from the standing corn,—two or three of them being strung together and suspended from a stick, so as to make a clatter when moved by the wind. The importation from southern climes of *Meleagrinæ* and other nacreous shells, has superseded the use of our native shells for inlaying and ornamental work.

Trochus umbilicatus, ii. 521. Var. spira elatiore, umbilico fere clauso. This remarkable variety, which Mr. Hanley noticed as having occurred to him at Herm, is abundant on every part of the coast of Guernsey at low water. Dr. Lukis observes that it inhabits quite a distinct zone from the typical form, and that they are never found together; and he is inclined to believe that the variety remains under water, while the ordinary kind seems ever endeavouring to crawl out of the vessel in which both are kept. In adult specimens the umbilicus is entirely closed, but in the young it is partially open. The animals do not appear to present any difference either in their external form and organs, or in their tongues. Mr. Rupert Jones has found the same variety in Jersey.

T. lineatus, ii. 525. Weymouth (*Mr. Thompson*).

Margarita pusilla (*Trochus*), ii. 534. Arran, N. B. (*Rev. Mr. Norman*).

M.? costulata (Skenea?), iii. 167. Mr. Bean informs me that he has obtained a specimen of this very rare shell from Lamlash Bay, in the west of Scotland.

Lacuna crassior, iii. 67. Weymouth (*Mr. Thompson*); Hunstanton (*Rev. Mr. Norman*).

Assiminia littorea, iv. 265. This occurs rather plentifully in Serk, and near the Chesil Bank, off the Isle of Portland; and I had opportunities of verifying the description of the animal as given by the late Professor Forbes, at the same time with that of *A. Grayana*, specimens of which Dr. Halley kindly sent me alive for that purpose. Both are decidedly Pectinibranch. A representation of the tongue of each will be found in Pl. III. figs. 12 & 13. Philippi seems most strangely to have given a very different account of the animal of *A. littorea* (both in Wiegmann's 'Archiv' and in his own work on the Sicilian Testacea) as regards the position of the eyes. His *Truncatella littorina* is evidently the same species; and I have it from Sardinia and the coast of Piedmont. It appears to be allied, both conchologically and by its habits, to some shells in the British Museum collected by Mr. Macgillivray, and presented by the Admiralty, which are stated to have been found in Norfolk Island on stones at high-water mark.

Rissoa striatula, iii. 75. Whitesand Bay; Clyde district (*Rev. Mr. Norman*).

R. abyssicola, iii. 86. A shell which Mr. Alder received from Professor Lovén under the name of "*Rissoa sculpta*," and kindly forwarded to me for examination, unquestionably belongs to this species, which, as well as *R. cimicoides*, appears to have been mistaken for the *R. sculpta* of Philippi. Lovén has not given in his work any description or diagnosis to identify his species, to which he referred that of Philippi.

R. cimicoides. *R. sculpta*, B. M. iii. 88 (non Phil.). Exmouth (*Mr. Clark*).

R. rufilabrum, iii. 106. Weymouth (*Mr. Thompson*).

R. labiosa, iii. 109. The solid variety from Helford, Cornwall; the thin, from Herm (*Rev. Mr. Norman*). A dwarf and thin variety is also found in Arnolds' pond, Guernsey.

R. inconspicua, iii. 113. Specimens of this variable shell, which were received by Mr. Alder from Professor Lovén, under the name of "*Rissoa albella*," and by the former forwarded to me for examination, appear to agree with our variety *albula*.

R. ventrosa, iii. 138. Clevedon (*Rev. Mr. Norman*).

R. subumbilicata. *Turbo subumbilicatus*, Mont. Test. Brit. ii. 316. *R. ulvæ*, var., B. M. iii. 142. Southampton and Guernsey. This appears to be a different species from *R. ulvæ*, with which it is found. The shell is more oval and slender, and the last whorl is much larger in proportion to the rest. But further observation is desirable.

R. denticulata. *Turbo denticulatus*, Mont. T. B. ii. 315. Mr.

Lukis found a specimen of this curious shell at Herm many years ago, and obligingly presented me with it. It bears a suspicious resemblance to the *Rissoa crassicosta* of the late Professor C. B. Adams, which is described in his 'Synopsis Conchyliorum Jamaicensium,' &c., p. 6; but my specimen, as well as Montagu's description, shows no trace of the numerous and very fine transverse striæ which cross the ribs in the West Indian shell. My shell has not the columellar tubercles noticed by Montagu; and his description may have been taken from a broken specimen, in which the sutural extremities of the ribs were left on the pillar lip, so as to give the appearance of tubercles.

R. unica. *Aclis unica,* iii. 222. I had overlooked Mr. Clark's excellent paper on the animal, which was published in the 'Annals of Natural History' for 1854, p. 122, and in which he clearly made it out to be a *Rissoa*. I am also satisfied, on conchological grounds, that it ought to be placed in that genus, and not in *Aclis* or *Chemnitzia*.

Barleeia rubra (Clark). *Rissoa rubra,* iii. 120. Bantry (*Rev. Mr. Norman*); var. alba, pellucida. Serk, on *Codium tomentosum*. This may be the variety noticed by Montagu (Test. Brit. ii. 321). The bright-red colour of the operculum (with its peculiar spike, like that of a *Neritina*) contrasts singularly with that of the shell.

Jeffreysia diaphana, iii. 152. Falmouth; Penzance; Cumbrae; Bantry (*Rev. Mr. Norman*). In its stomach Mrs. Collings detected a species of *Lithocystis,* allied to *L. Allmanni*.

J. opalina, iii. 154. Cumbrae (*Rev. Mr. Norman*).

J.? Gulsonæ. *Odostomia Gulsonæ,* iv. 281; var. minor. I found a specimen of this variety at Guernsey, which was not larger than the *Odostomia minima*.

Cæcum glabrum, iii. 181. Clyde district (*Rev. Mr. Norman*). The curious form and structure of the operculum suggest the affinity of this genus to *Bifrontia*.

Euomphalus nitidissimus. *Skenea? nitidissima,* iii. 158. I will now, without preface, introduce this anomalous and strange-looking creature by the representation given in Pl. III. fig. 15 *a, b,* and 16 *a–c*. While I was at Serk last autumn, I had the good fortune to observe, with the aid of an excellent microscope, for several hours, the form and motions of the animal,—comparing with it, at the same time, *Skenea planorbis,* an animal supposed to be its congener, but which is, in fact, totally dissimilar in respect of the soft parts as well as of the shell. Both are abundant almost everywhere on our rocky coasts, especially on the *Codium tomentosum,* which appears to constitute the food of these and other phytophagous mollusks; and it is strange that the animal of the *Euomphalus nitidissimus* has so long escaped observation. The following is a description of it, as taken on the spot:—

Animal flaky-white, nearly hyaline; it has no vestige of any tentacles, but instead of them it is provided with a large broad veil, which is bilobed in front, and has its outer margin fringed with short and close-set but irregularly disposed cilia. Some of these cilia are longer than the rest. There are a few of them also on the upper edge of the operculigerous lobe. The veil is flexible (probably serving the purpose of tentacles), and so transparent, that when it is extended beyond the foot, the latter can be seen through it. Foot rounded in front and pointed behind; it is stout and large for the size of the animal. Eyes two, very large in proportion, seated on the veil about half-way between the anterior edge of the shell and the terminal lobes of the veil; they do not appear to be raised at all above the level of the veil, and are not placed on peduncles or protuberances of any kind. When the creature is withdrawn within its shell, the eyes seem to reconnoitre you like a porter from a hall-window. Operculum very thin and paucispiral, with oblique striæ, which radiate from the suture and extend half-way across. I did not observe any other appendages. The animal is at first shy; but when undisturbed for some time, it crawls freely and rapidly, like a snail, with its shell edgewise in a perpendicular position and quite straight; and it also occasionally swims like the *Rissoæ* and other Gasteropods. It seems to be more comfortable near the sides of the watch-glass, for which it makes at once after being replaced in the water. I observed several specimens of different ages; and all of them presented the same appearance and habits.

I believe it will thus be seen that it resembles no known mollusk. It is true that the *Bullidæ* have no tentacles, and that some of them are furnished with eyes; but I am not aware that any possess the peculiar cilia which fringe the veil or anterior part of the head in this animal. It is also certain that none have an operculum,—while the shell, which is not an unimportant part of the animal, is totally different. I am also not aware of any recent *marine* generic analogue, as far as the shell is concerned, though this has in every particular the form of a freshwater *Planorbis*. As it is evidently not a *Skenea*, the question is whether a new genus should be formed for its reception. Captain Brown placed it in his genus *Spira*; but as one of the principal characters assigned by him to that genus is shell "nearly globular or semi-oval," which is by no means applicable to this species, and as *Spira* embraces a heterogeneous assemblage of minute and immature shells from Walker (viz. *Helix globosa*, *tubulata*, and others), I do not think it can be properly retained there. Without, however, attempting to found a new genus, I believe the same object will be attained (at least provisionally) by adopting the genus *Euomphalus* of Sowerby, which, constituted for fossil shells of the mountain limestone, seems to be exactly suited for the shell in question. The generic characters given by Sowerby in his 'Mineral Conchology,' vol. i. p. 97, are as follows: "An involute compressed univalve; spire depressed on the upper part, beneath concave or largely umbilicate. Aperture mostly angular." Having closely observed the animal and turned my attention to the shell, I was struck by the remarkable resemblance which it presented, although on a very small scale, to the *Euomphalus pentangulatus*; and a subsequent examination of other fossils, supposed to belong to the same genus (although some of them do not fulfil the generic characters given by the author), has confirmed my impression. I believe, therefore, that this shell is a living, but minute, representative of that ancient genus, hitherto considered to be long ago extinct; and it is the more interesting inasmuch as no such representative has, I believe, been traced in any part of the tertiary system. The *Euomphalus nitidissimus* has a wide range in the European seas, extending from the Shetlands to Sicily, and probably far beyond these limits. I lately detected specimens among some minute shells from Sardinia, and I have recorded it as existing at Spezia and elsewhere on the Piedmontese coast. I have no doubt that it is the *Truncatella atomus* of Philippi; but I cannot account for his making such a mistake as he did in his memoir on the genus *Truncatella* of Risso in Wiegmann's 'Archiv für Naturgeschichte,' as well as in his elaborate work on the Sicilian Testacea, by not only describing the animal to be exactly like that of *Truncatella* (viz. furnished with two long tentacles, and eyes placed near their external bases), but giving in the former work a figure of it in accordance with that description. In the 'Archiv' for 1841, p. 54, he states, with respect to his *Truncatella atomus*, "Das Thier, dessen Bildung ich bei einer sechszigmaligen Vergrösserung sehr genau erkannte, stimmte auf das allervolkommenste mit dem der *Truncatella truncatula* überein." A similar mistake seems to have been committed by him in saying that the animal of his *Truncatella littorina* (our *Assiminia littorea*) was also similar to that of *Truncatella truncatula* or *Montagui*, which I have elsewhere adverted to. I observed among other drawings of Mollusca made by M. Deshayes during his scientific visit to Algeria about fifteen years ago, but not yet published, an admirable figure of this animal; but as he did not use a microscope, he failed to notice the cilia, and represented the heart as seen through the transparent shell, but which I suspect were the branchiæ. He informed me that he found two or three specimens, from which his drawing was made, at Lacalle, and that the animals were preserved and deposited in the museum of the Jardin des Plantes, where, however, they are not now to be found. The only congener of this species is, as far as is hitherto known, the *Skenea? rota* of Forbes and Hanley, which I believe is almost as extensively diffused as the other. Figures 15 *a, b,* in Pl. III., show the lingual riband of *Euomphalus nitidissimus,* which appears to be quite as anomalous as the animal and shell, but bears some resemblance to the tongue of *Akera bullata,* as represented in Dr. Gray's most useful 'Guide to the Mollusca in the British Museum,' part 1. p. 196. f. 111. I could not detect any divisional plates or septa in the interior of the upper whorls of the shell by making a section of it, although the exterior surface presented the appearance of them. They are found in *E. pentangulatus.* I believe the *E. rota* was known to Montagu, because in one of his letters to my late friend Mr. Dillwyn, dated in 1814 or 1815, he mentions the discovery of a very minute recent Ammonite-like shell which exactly corresponds with the description of *E. rota.* In Pl. III. f. 14. is represented a portion of the tongue of *Skenea planorbis,* to show how very different it is from that of the *Euomphalus.*

Stylifer Turtoni, iii. 226. Mr. Norman questions this being found on *Echinus Sphæra*; and he says that Mr. Alder has informed him that all the specimens he had met with were from *E. neglectus.*

Eulima nitida (Lamarck), Phil. i. 157 and ii. 134. I believe the British shells which have been usually referred to this species are specifically distinct from *E. polita.* Besides the subulate and more regularly tapering form of the spire and the oblong (instead of oval) aperture, which distinguish this species from *E. polita,* the latter has (especially in young individuals) a faint keel on the lower half of the last whorl. I have specimens from Zetland and various other parts of the Scotch coast, as well as from Guernsey. A shell sent by Professor Lovén to Mr. Alder, under the name of "*Eulima nitida,*" and by the latter forwarded to me for examination, appears to agree specifically with our shells, although Lovén has not noticed the *E. polita* as a Norwegian species.

E. stenostoma. A young specimen was procured by Mr. Barlee in the Zetland dredgings.

Chemnitzia scalaris, iii. 251. In dredged sand from Belfast Bay. I am still of opinion that the *C. rufescens* of Forbes is merely the northern form or variety, and that it ought to be reunited to this species.

Odostomia conspicua, iii. 263. Zetland (*Mr. Barlee*).

O. Eulimoides, iii. 273; var. *O. pallida, b.* gracilior, anfractibus productioribus, Jeffr. in Ann. Nat. Hist. (2nd series) vol. ii. p. 336. Guernsey and Zetland. I have given a representation of this pretty variety in Pl. III. fig. 18 *a, b.*

O. Lukisii, n. s. Pl. III. fig. 19 *a, b.*

Testa subconica, solidiuscula, nitida, alba, striis longitudinalibus perpaucis vix conspicuis irregulariter notata, aliorsus glabra; anfractibus 5, convexiusculis, ultimo spiræ dimidium paullo superante, penultimo prominulo; apice obtuso; sutura distincta, insculpta; apertura ovali, superne in regionem columellarem contracta, subtus effusa; peristomate subcontinuo, labio reflexo; columella denticulo mediano prominente munita; umbilico parvo, angusto; long. $\frac{1}{10}$, lat. $\frac{1}{20}$ unc.

Although I am very unwilling to swell the list of British *Odostomiæ* with any more species, I cannot refrain from giving this, which I believe to be quite distinct from any of its numerous congeners; and Mr. Alder agrees with me in this belief. It has somewhat the aspect of *O. albella* (which is certainly, in our opinion, not a variety of *O. Rissoides*) in its shorter spire, much more convex whorls (especially the penultimate one), and the peculiar introversion and contraction of the peristome at its upper angle. From *O. Rissoides* it differs in wanting the turriculate form of that shell, which is occasioned by the great depth of the suture, and in its being more cylindrical, as well as in the greater prominence of the penultimate whorl and the contraction of the peristome. I have dedicated this species (without permission) to Dr. Lukis, as a trifling mark of the esteem in which I hold him as a scientific man. It is not very uncommon in the sublittoral and coralline zones at Guernsey ; and I noticed a specimen among the shells which Mr. Barlee collected this year in the Shetlands.

O. albella, Lov. *O. Rissoides, var.*, iii. 286. Salcombe, fide Alder (*Rev. Mr. Norman*) ; Oban (*Capt. Bedford*) ; Guernsey, with *O. Rissoides.* I still consider it to be distinct from that species. The spire in this is more cylindrical, and the whorls are never turriculate or so convex as in *O. Rissoides.* The circumstance also of their being found together, without any intermediate variation, is a strong argument in favour of their being distinct species.

O. acuta, iii. 269. Plymouth (*Rev. Mr. Norman*) ; Guernsey and Zetland (*J. G. J.*).

O. turrita, Jeffr. in Ann. Nat. Hist. (2nd series) vol. ii. p. 339. Coralline zone, Exmouth (*Mr. Clark*) ; Guernsey.

O. alba, iii. 278 ; var. A figure of this elegant variety will be found in Pl. III. f. 20 *a*, *b*.

O. nitida, iii. 280. Mr. Clark has found a specimen of this rare and local species at Exmouth.

O. cylindrica, iii. 287. Clyde district (*Rev. Mr. Norman*) ; in dredged sand from Belfast Bay (*J. G. J.*).

O. truncatula, iii. 294. Belfast Bay. Plymouth was the only previously known station for this species.

O. dolioliformis, iii. 301. Guernsey.

Eulimella clavula, iii. 314. Guernsey ; very rare.

Truncatella Montagui, iii. 317. Newhaven, Sussex. I have shown, in Pl. III. fig. 21, the lingual riband of this mollusk, which may be interesting as a further illustration of the relations which exist between *Truncatella* and *Assiminia.*

Natica monilifera, iii. 326. A very young *reversed* variety occurred to me in the Guernsey dredged sand.

N. sordida, iii. 334. Mr. Barlee obtained in the Zetland dredgings a young specimen which is of a yellowish-white colour, and marked with three brown interrupted or streaked bands.

N. Montagui, iii. 336 ; var. alba. A specimen of this pretty variety occurred to Mr. Barlee in the last Zetland dredgings.

N. Helicoides, iii. 339. A specimen procured by Mr. Barlee in Zetland, and now in his possession, is of the enormous dimensions of one inch and five-eighths in length and one inch in breadth.

N. clausa (Sowerby), Lov. 17. I found a few young specimens, apparently quite recent and fresh, in dredged sand from Belfast Bay, which Mr. Waller kindly sent me. It is true that this species occurs as a Pleistocene fossil in the Clyde bed ; but the aspect and texture of specimens from that locality are very different from those of my shells. It inhabits the Norwegian coast in company with *Terebratula caput-serpentis, Crenella decussata,* and many others which also are found living in Belfast Bay ; and I believe that *Buccinum* (or *Astyris*) *Höl-bollii,* which has been taken in the same part of the Irish Sea, has not yet been discovered as Pleistocene, though it is also a Norwegian species. Among the shells from the Turbot Bank in Belfast Bay, I detected some which were unquestionably fossil, having their texture completely changed and mineralized. The geological nature of the rocks of the adjacent coast, according to Mr. Hyndman in his Report of the Belfast Dredging Committee (Brit. Assoc. Rep. for 1857, p 229) is *Secondary*; and it does not appear that there are any Tertiary strata in the same locality. For the present, I am still inclined to consider all the shells of Arctic or Northern species, which have been lately taken in Belfast Bay, as *recent*. This term is of course comparative in respect of time; and as the shells of Mollusca are nearly indestructible by the ordinary agencies of air and water (especially when kept continually submerged in the sea, and never exposed to atmospheric influence), the specimens in question may have occupied the Irish sea-bed ever since the commencement of the present geological epoch—viz. for many thousands of years. It is therefore not improbable, for the reasons above given, that *Natica clausa, Buccinum Hölbollii*, with other boreal species, will sooner or later be discovered living in or near to the place where the shells now occur.

Recluzia aperta. Pl. III. fig. 22 *a–c*.

Testa globosa, tenuis, cretaceo-alba, epidermide fusco crasso rimato induta, rugis angustis confertis spiraliter cincta; spira brevi, obtusa; anfractibus 5, convexis, ultimo spiram superante; sutura cælata; apertura rotundata, infundibuliformi, utrinque subeffusa; peristomate continuo; labio columellæ annexo, reflexo; columella sinuata, ad basin tuberculo obtuso instructa; umbilico parvo, angusto, labio fere obtecto; long. $\frac{7}{12}$ unc., lat. eadem.

This is perhaps the *Natica aperta* of Lovén's Index, p. 17, though his comparison of that species with *Sigaretus* and the *Natica flava* of Gould, as well as certain discrepancies in his description, make me somewhat hesitate before considering my shell to be specifically identical with his. If they are not the same, I hardly think Lovén's shell belongs to the same genus; and in any case therefore the name I have adopted may serve for my shell. This evidently is congeneric with the *Recluzia* of M. Petit, which is described in the 4th volume of the 'Journal de Conchyliologie,' p. 117. Of the two species assigned by the author to this genus, I have seen one (*R. Rollandiana*); but it appears that, of the other species (*R. Jehennei*), only the typical specimen is supposed to exist. The first of these species came from Mazatlan, and the other from the Red Sea. They are both said to be destitute of an operculum,—a character (although negative) which is common to Lovén's shell, as well as mine; but M. Petit states, on the authority of Captain (now Admiral) Jehenne and Captain Passama, that the animal had a vesicular appendage or float, like that of *Ianthina*. This is remarkable, as the genus is allied, in many respects, to *Velutina*. *Natica Kingii* seems also to have some affinities to this genus, although it differs in the want of an umbilicus and the nature of the epidermis. My specimen, which appears to be semifossilized, or else in bad condition, was obtained by Mr. Barlee in the last Zetland dredgings. When the shell was brought to him by our dredger, it had a good deal of the epidermis adhering to it, of most of which, however, the shell has been unfortunately deprived in an attempt to clean it. An eminent naturalist, to whom the specimen was submitted for his opinion, pronounced it to be recent, because of its retaining the epidermis; but the persistence of such substances seems to be coeval with shells which are undoubtedly fossil. In answer to an inquiry I have made of Mr. Searles Wood on the subject, he says, "There cannot be much difference of opinion respecting the preservation and existence of the epidermis and ligament in the fossils of the *uppermost Tertiaries* in this country. I do not see the epidermis upon the few specimens of *Cyrena* in my cabinet; but in a specimen of *Unio littoralis* from Clacton I am now looking at, the valves are united and the ligament quite perfect, and it has on it some of the epidermis; besides which, the ligament is preserved on some of the Crag bivalves which are of older date."

Lachesis minima, iii. 577; var. alba. Guernsey; but rare.

Litiopa Bombyx. In Mr. Pickering's fine collection of British land and freshwater shells, I noticed a specimen appearing to belong to this pelagic species, and which he had taken at Gravesend, mixed with *Rissoa ventrosa* and other unquestionably indigenous shells. It is, however, much smaller than *L. Bombyx*, and has the upper whorls minutely tuberculated, the rest of the shell being smooth; so that it may be a species of *Melanopsis*. If the former, it has probably been dropped from Gulf-weed (*Sargassum vulgare*), which is known occasionally to visit our shores. Mr. Lukis told me that he saw, about fifty years ago, in a small bay at Guernsey, a bank of this weed, several feet high, which had been thrown up by the sea.

Triforis adversa. *Cerithium adversum*, iii. 195. A pale yellowish-white variety occurs in Guernsey; but it is very rare. The siphonal fold of the mantle, and the peculiar canal of the shell, are surely sufficient grounds for separating this genus from *Cerithium*, independently of its being always heterostrophe. Some of these characters indicate a nearer relation to *Cerithiopsis* than to *Cerithium*. The operculum is, however, Littorinan.

Cerithiopsis tubercularis, iii. 365. Mr. Norman says that a specimen in his cabinet, from Arran, N. B., measures 5 lines long and $1\frac{1}{2}$ broad, and that it has fourteen whorls remaining, at least three more having been broken off.

C. pulchella, var. alba. Guernsey.

C. metula. *Cerithium metula*, iii. 198. My largest specimen, which is from the Shetlands, measures more than $\frac{7}{10}$ths of an inch in length and $\frac{2}{10}$ths in breadth. Although the animal is not known, the deep canal of the shell, as well as the operculum, which is strictly Muricidal, would, I think, entitle it to a position in *Cerithiopsis*, and not in *Cerithium*.

C. Naiadis. One of the results of our Zetland dredgings was the acquisition of two small and imperfect specimens of a new and interesting species, which Mr. M'Andrew took on the coast of Norway.

Mr. Woodward has undertaken to describe it, with other Norwegian shells, in the 'Annals.'

C. nivea, n. s. Pl. III. fig. 17 *a*, *b*.

Testa conoidea, turrita, crassa, nitida, alba, costis longitudinalibus rectis compressis (18 in anfractu ultimo) et spiralibus intermediis 6 instructa; anfractibus 6–8, modice convexis; sutura distincta; basi carina marginali cincta; apertura ovata, tertiam spiræ partem subæquante, superne acutangulata, subtus effusa; canali brevissimo, recto; columella arcuata, incrassata; long. $\frac{3}{10}$, lat. $\frac{1}{8}$ unc.

Mr. Hyndman discovered two specimens in shell-sand which had been dredged from the Turbot Bank in Belfast Bay, and obligingly presented me with the one above described. Both are worn shells, and neither of them is quite perfect; but they cannot be mistaken for any other species. They have somewhat the appearance of the *Strombus Turboformis* of Montagu (Suppl. p. 110); but the latter wants the spiral intercostal striæ and the basal keel, which are evident in this.

Buccinum undatum, iii. 401. I found a dwarf and thin variety on the shores of the Solent Water at Southampton,—a full-grown specimen measuring not quite an inch and a quarter in length. Other species in the same locality are depauperated, perhaps owing to the chemical nature or quality of the water.

B. ciliatum. *Tritonium ciliatum*, Fabr. F. G. p. 401. no. 402. Mixed with the deep-water variety of *B. undatum* from the Shetlands, I found an adult and several half-grown specimens of the above distinct and remarkable species. It is rather more ventricose than the variety of *B. undatum*, and the transverse striæ are much more numerous; but the especial character which distinguishes the two species (as Fabricius remarked) is that the epidermis in this is raised into short close-set hair-like tufts. It appears to be the same species as that which Professor E. Forbes noticed and figured in his "Records of Dredging" (Mag. of Nat. Hist. vol. viii. p. 593. fig. 62), and for which he suggested the name of "*Zetlandicum*," but which, in a subsequent part of the same paper, he considered, as well as *Buccinum fusiforme*, to be only varieties of *B. undatum*. This species cannot be identical with *B. Humphreysianum*, as conjectured by the authors of the 'British Mollusca' (iii. 411, foot-note), because the latter never has any epidermis, even in the living state.

B. acuminatum (Broderip), Zool. Journ. v. p. 44. *B. undatum*, monstr. B. M. iii. 405. This form appears to be constant, but rare; and I believe it constitutes a distinct species. I have specimens from Cork and the mouth of the Thames. The typical specimen in the British Museum is said to have cost £12, being the highest price I have known to be paid for a British shell.

Fusus Islandicus, iii. 416. Weymouth (*Mr. Thompson*).

F. propinquus, iii. 419. With the ordinary form, from deep water in the Shetlands, I observed a monstrosity which appears to agree with the description of Mr. Alder's variety, noticed at p. 420.

The spire is shorter, the volutions are more swollen, and the transverse striæ on the last whorl are coarser than in the typical or ordinary form.

Mangelia Trevilliana, iii. 452. In dredged sand from Belfast Bay.

M. purpurea, iii. 465; var. alba. Zetland.

M. cancellata. In a living specimen, which was procured by Mr. Barlee in Zetland, the tip of each nodule or point of junction of the ribs is delicately tinged with pink.

M. reticulata. *Pleurotoma reticulatum* (Bronn), Phil. i. 196 and ii. 165. A specimen of this lovely shell was taken in the Shetlands; and it agrees exactly with the specimen from Guernsey, which I noticed in the 'Annals' for August last (vol. ii. no. 8. p. 131) under the name of *M. cancellata*. That species, however, differs from this in its more slender shape, and in not being turriculate, as well as in the longitudinal ribs not extending to the suture of each whorl, but leaving an interstice, which is only marked by the transverse striæ. The largest of my specimens does not measure half an inch in length; but some from the Mediterranean attain nearly double that size.

M. elegans, iii. 473. Mr. Barlee procured, in his Zetland dredgings, a specimen of this shell. It has been hitherto considered to be a Southern species.

M. Ginnanniana. *Pl. Ginnannianum*, Phil. i. 198 (*Bertrandi*) and ii. 168. *M. nebula*, var. *pyramidata*, B. M. iii. 478. This appears to be a distinct species, as well as *M. lævigata* (*Pl. lævigatum*, Phil.). It differs from *M. nebula* in being less slender, in the peculiar mode of its coloration, and in the transverse striæ being much finer and more close-set. It is also of a larger size, one of my specimens measuring nearly five-sixths of an inch in length. Mr. Barlee has taken it off the Arran Isles, county Galway, and in Zetland; and Mr. Clark has found it at Exmouth, together with *M. nebula* and *M. lævigata*. It is most probably the *M. nebula* of Lovén, which he says differs from the English form in the above particulars.

M. brachystoma, iii. 480. Weymouth (*Mr. Thompson*).

M. striolata, iii. 483. Falmouth and Oban (*Rev. Mr. Norman*).

Gasteropoda Opisthobranchiata.

Bulla cornea, Lam. vi. (2.) p. 36. Specimens of the true *B. hydatis*, or what is usually called the Mediterranean species (though both equally inhabit that sea), were found at Guernsey, many years ago, by Mr. Lukis; and I also found the *B. cornea* at Serk by dredging. There can therefore be no doubt as to the propriety of thus distinguishing the two species, as suggested by the authors of the 'British Mollusca.' The shell of *B. hydatis* is narrower and more solid, and it has the crown or apex rather deeply umbilicated. It appears to be the *Haminæa elegans* of Leach's 'Synopsis of the British Mollusca,' p. 42.

Cylichna mammillata, iii. 514. Guernsey.

C. nitidula, iii. 515. Belfast Bay; very rare.

C. umbilicata, iii. 519. With the last.

C. Lajonkaireana. *Bulla Lajonkaireana* (Basterot), S. Wood, Cr. Moll. p. 178, tab. 21. f. 5 *a–c*. I found this species at Guernsey, mixed with a dwarf variety of *C. obtusa*; but it is rare. Mr. Barlee has also taken it by dredging off Arran Isle, on the Galway coast. The spire is produced and pointed, resembling in this respect *Tornatella fasciata*; and the upper lip of the aperture joins the columella considerably lower than in *C. obtusa*. It had only been previously known in a fossil state; and Mr. Wood erroneously referred to it the *Bulla mammillata* of Philippi, the apex of which is truncated. Dujardin appears to have suggested the affinity of this species to *Tornatella*.

Scaphander lignarius, iii. 536; var. alba. Zetland; but rare. Dr. Lukis informs me that the shells of *S. lignarius* are almost invariably found broken when they are taken alive, and that the fishermen think the animal bites off the lip of the shell when it finds itself a prisoner.

S. zonatus. *Bulla zonata*, Turton in Mag. Nat. Hist. vol. vii. p. 352. *S. librarius*, Lov. p. 10. A young specimen has occurred to me among the Zetland shells, and it exactly corresponds with specimens collected by Mr. M'Andrew in Norway. The form is more oval and less oblong than that of a specimen of *S. lignarius* of the same size, the upper lip is rather truncated, and not so acute, and the crown is broader and umbilicated, which last is a character not belonging to the common species. I believe, on reconsideration, that this is Turton's species, as he distinguished it from the young of *S. lignarius* by its being of a more conic-oval shape, with the volutions more loosely connected, and having the crown *umbilicated*. The sculpture, however, appears to be the same in both species, as Lovén has remarked. In the young of *S. lignarius* are found the alternate zones and minute granular dots noticed by Turton, but not by Forbes and Hanley; although these dots are not "raised," as stated by the former: they are, on the contrary, impressed punctures. Unfortunately, Turton's specimen is in my cabinet at Swansea; and I cannot at present compare it with the Zetland and Norwegian shells.

Philine punctata, iii. 547. Bantry (*Rev. Mr. Norman*).

Pleurobranchus plumula, iii. 559. Bantry (*Rev. Mr. Norman*).

Gasteropoda Pulmonifera.

Limax gagates, iv. 24. Tenby; Torquay; Guernsey; Cumbrae (*Rev. Mr. Norman*).

Testacellus Maugei, iv. 28. I found this species, in company with the late Mr. Miller, who was then the curator of the Bristol Institution, about thirty years ago, in Messrs. Miller and Sweet's Nursery Grounds at Clifton; and it appears to have since become extensively spread and almost naturalized in this country. M. Moquin-Tandon says that it has been found at Dieppe, and he adds that it was probably brought there with some exotic plant. Mr. Norman says, "I am at a loss to understand why this species was excluded from 'The British Mollusca.' More than fifty years ago, *Testacellus Maugei* was discovered in what was then Messrs. Miller and Sweet's Nursery Grounds at Clifton, and from that time to the present it has continued to be found in that locality in considerable numbers. I have had as many as five dozen sent to me alive at the same time. The following are other localities in which *T. Maugei* has occurred, and to which it has doubtless been introduced among plants from the Clifton nurseries: viz. Bath, Corsham, Brislington, the gardens of Sir A. Elton, and nursery-gardens at Clevedon and Taunton. I have likewise seen a specimen which was taken at Plymouth, and another which was taken at Cork by Mr. Wright." I may add to this list of localities my own garden at Norton near Swansea, which was occasionally supplied with plants from the Clifton Nursery Grounds.

Zonites excavatus, iv. 40. Isle of Cumbrae (*Rev. Mr. Norman*).

Helix aspersa, iv. 44. A pretty dwarf variety, with a thin shell, is not uncommon on the downs of the south coast in Guernsey.

H. arbustorum, iv. 48. Mr. Pickering has found a dwarf variety, which is not larger than that of the Alps, in meadows by the side of the River Lea in Hertfordshire.

H. revelata, iv. 70. Plymouth and Land's-End (*Rev. Mr. Norman*).

H. fusca, iv. 77. Plymouth and Melrose (*Rev. Mr. Norman*).

Bulimus Lackhamensis, iv. 89. Sherborne Wood, Oxon; very abundant (*Rev. Mr. Norman*).

Azeca tridens, iv. 128. Brockley Combe, Somerset (*J. G. J.*, *Mr. Barlee*, and *Rev. Mr. Norman*). It is a local species.

Vertigo sexdentata (Montagu). *Pupa antivertigo*, iv. 109. Port des Moulins, Serk; Guernsey.

V. (Pupa) pusilla, iv. 111. Largs (*Rev. Mr. Norman*).

Limneus pereger; var. lineata, iv. 165. Capt. Bedford has sent me a charming little variety, marked with narrow alternate zones of white and brown, which he found in Ulva Isle, on the west of Mull.

L. acutus. Capt. Bedford informs me that he found this species, not in the neighbourhood of Oban, but near Corstophane, N. B. Mr. Barlee has also sent me specimens which he took in a pond at Yoxford, Suffolk.

Physa fontinalis, iv. 141; var. alba. Mr. Bean and Mr. Webster have sent me specimens of this pretty variety, which were found near Birkenhead.

Conovulus bidentatus; var. alba, iv. 192. Newhaven, Sussex.

Otina otis, iii. 321. Weymouth (*Mr. Thompson*); Arran, N. B. (*Rev. Mr. Norman*). The animal dies after it has been immersed some hours in sea-water.

Corrigenda.

Lepton sulcatulum, Ann. Nat. Hist. (3rd series) vol. iii. p. 34, Pl. II. f. 2. There is a minute, but indistinct, cardinal tooth in the right as well as the left valve, as shown in the plate; and the description must be amended in this respect.

Sphærium. I omitted to mention that Mr. Jenyns seems to have been fully aware of the quasi-natatory habits of *S. calyculatum* as well as of his *Pisidium obtusale*; and that a satisfactory explanation of this peculiar mode of progression in the former animal would be found at p. 12 of his valuable and interesting Monograph.

S. calyculatum. In page 35 of the last Number (three lines from the bottom) *read* "slow" instead of "short."

Pisidium Recluzianum. For M. Bourguignat's species *read* P. Reclu*s*ianum.

1 Montagu Square, London, Jan. 1859.

EXPLANATION OF THE PLATES.

Plate II.

Fig. 1. *Kellia lactea*, hinge of, magnified.

Fig. 2. *Lepton sulcatulum*: *a*, natural size; *b*, highly magnified; *c*, hinge and teeth of right valve, viewed horizontally; *d*, hinge and teeth of left valve, viewed horizontally; *e*, hinge and teeth of right valve, showing the ligament; *f*, hinge and teeth of left valve, showing the ligament; *g*, front view, showing the curvature of the margin.

Fig. 3. *Pisidium roseum*: *a*, natural size; *b*, front view; *c*, side view.

Fig. 4. *Mytilus Galloprovincialis*, natural size.

Fig. 5. *M. ungulatus*, natural size.

Fig. 6. *Limopsis pellucida*: *a*, natural size; *b*, front view, highly magnified; *c*, side view, highly magnified; *d*, hinge, very highly magnified; *e*, interior margin, very highly magnified.

Fig. 7. *Terebratula capsula*: *a*, natural size; *b*, highly magnified.

Fig. 8. *Argiope cistellula*, young: *a*, natural size; *b*, highly magnified.

Plate III.

Fig. 9. *Chiton gracilis*, natural size: *a*, segment magnified, to show the granulation of the valves and the marginal band; *b*, a portion of the lingual riband, highly magnified, and showing at A the division of the falcate teeth.

Fig. 10. *C. fascicularis*, a portion of the lingual riband of, highly magnified.

Fig. 11. *C. discrepans*, ditto, ditto.

Fig. 12. *Assiminia Grayana*, ditto, ditto.

Fig. 13. *A. littorea*, ditto, ditto.

Fig. 14. *Skenea planorbis*, ditto, ditto.

Fig. 15. *Euomphalus nitidissimus*, ditto, ditto: *a*, front view; *b*, side view.

Fig. 16. Ditto, animal of: *a*, natural size; *b*, highly magnified; *c*, operculum, highly magnified.

Fig. 18. *Odostomia Eulimoides*, var. *b*. Jeffr.: *a*, natural size; *b*, magnified.

Fig. 19. *O. Lukisii*: *a*, natural size; *b*, magnified.

Fig. 20. *O. alba*, var.: *a*, natural size; *b*, magnified.

Fig. 21. *Truncatella Montagui*, a portion of the lingual riband of, highly magnified.

Fig. 22. *Recluzia aperta*: *a*, front view, natural size; *b*, back view, natural size; *c*, magnified to show the sculpture and epidermis.

Fig. 17. *Cerithiopsis nivea*: *a*, natural size; *b*, magnified.

XVI.—*On the British Wild Geese.* By Arthur Strickland, Esq.*

[With a Plate.]

Geese are a natural group of birds, possessing several strongly-marked characters: they are aquatic birds, but live and feed much upon dry land; they feed in the day-time and rest at night, whereas ducks rest in the day-time and feed at night. They of all birds seem to undergo the least changes of colour in their plumage,—the males, females, and young birds in winter and summer being nearly alike, thus differing greatly from the duck tribe. They have a character apparently peculiar to themselves, —that of having in many cases the most perfect and delicate colours of their bills and legs when young, and losing that delicacy as they advance in age, thus entirely reversing the usual order. Some of the British wild geese, which we have now to consider, are so alike in plumage, that that important character can hardly be taken as an element to assist in discriminating the species,—the form and colour of their bills and legs, and the habits of the birds in a state of nature, being all, apparently, that we can safely rely upon. Besides this, they are the most difficult of all birds to study, the determined and persevering sportsman only being able to approach them; the naturalist has but few, and only casual, opportunities of examining them. From these circumstances the authors of works on British birds seem to have been satisfied to take matters as they found them, giving themselves no trouble to examine carefully the characters of the species they describe, and only giving the accounts of their appearance and disappearance, and habits, as mentioned by others, and collecting the records of their having been met with in various parts of the country. Mr. Gould has given us but three British Geese—the White-fronted, the Grey-lag, and the Bean Goose, thus including all that are not the first two above-named species, under the mysterious and misused name of *Segetum*, or Bean Goose. I will first make a few remarks on these two.

The *Anas albifrons*, or White-fronted Goose.—The white band in front (which is seldom wanting), the plain flesh-coloured bill, the conspicuous black patches on the breast, and the orange-coloured legs will always mark this bird. It is not, and probably never was, a regular migratory or abundant species in this country, but is occasionally found in hard weather, singly or in small groups, frequenting river-sides or running streams, and I believe

* Communicated by the author, having been read before the Natural History Section of the British Association, at Leeds, September 24, 1858.

is never found in the open country; but it is stated to be found in large migratory flocks on the continents of Europe and America, and is the only British goose found in the latter country.

The *Anas ferus* or *Anser*, the Grey-lag Goose, never was a migratory species in this country, but permanently resided and bred in the carrs of Yorkshire, and probably the fens of Lincolnshire; it has long since been banished from these places, yet still breeds sparingly in the western islands of Scotland. These birds are the origin of our domestic goose; and I had lately an opportunity of removing all doubt upon that subject by observing three beautiful birds brought from Scotland by a friend of mine, which were taken when he was shooting in that country. They at once assumed all the characters and habits of the domestic bird, and, had they not come to an untimely end, would probably soon not have been capable of being distinguished from them; they also exemplified my statement of the perfection of the colours of the bills of young birds. Nothing could exceed the beauty of their pink bills and white nails: so striking is this that we might as justly consider them a distinct species, under the name of the Pink-billed Goose, as has been done in the case of the Pink-footed Goose by making that a distinct species, though it is only an immature bird. With these remarks I dismiss these two species, and proceed to consider what remains of this group, not the Grey-lag or White-fronted Goose.

From time immemorial, one of the features of the north and east of England has been the regular periodical appearance of countless flocks of wild geese, which arrive every autumn about the end of harvest, and, when the objects of nature received more attention than they do in these days, got the name of the Bean Goose, as coming in the time of bean-harvest and when the bean-stubbles were ready for them. Can it be doubted that these large flocks are the produce of one distinct species marked by nature with peculiar characters and habits? *This species is the only one that has any claim* to the name of *Bean Goose* (or *Segetum*), the *only* migratory species in this country, and the *only abundant and common* species we have. Unaccountable as the case may appear, this bird is not figured or characterized in any work on natural history I am acquainted with, and is not mentioned in the works of Mr. Yarrell, Mr. Gould, or Mr. Morris, further than ascribing the habits of this bird to one given by these authors (with the figures and description of an entirely different species) under the erroneous name of *Segetum*, or Bean Goose. Some years ago Mr. Bartlett, struck by the obvious difference between the geese he met with in the markets and the descriptions and drawings given of the Bean

Goose, and not being properly acquainted with the real Bean Goose, was induced to institute a new species, under the name of the Pink-footed Goose. Though I was satisfied from the first that this was an erroneous view of the matter, and that this was really a fictitious species (being the young of the true Bean Goose, and further observations have entirely confirmed my convictions), still Mr. Bartlett had the merit in some degree of drawing the distinction between the Long- and Short-billed Goose. But the real Bean Goose still remained undescribed. This bird, *the true Segetum* or Bean Goose, is distinguished by its short and strong bill—its depth at the base being nearly two-thirds of its length,—and by its migratory habits—differing in that respect from all our other geese, arriving periodically every autumn, spreading during the day-time over the stubbles and clover-fields on the wolds and other open districts, rising like clock-work in the evening, and winging their way in long strings to the sand-banks in the Humber and other safe retreats for the night, returning as punctually in the morning to their feeding-grounds. This bird differs from the Pink-footed Goose in being larger, having a stronger bill and lighter plumage; but these differences are the result of age, not of species, and a careful examination of the numerous flocks on the wolds, as well as the individuals killed out of them, will confirm this.

The next bird to be considered is the Long-billed Goose, figured and described by Mr. Yarrell, Mr. Gould, and Mr. Morris under the name of *Segetum*, or Bean Goose. This is distinguished by having the bill exactly twice the length of the depth at the base—a proportion quite different from that of the Short-billed Goose.

Before the beginning of this century, when the carrs of Yorkshire were the resort of countless multitudes and numerous species of wild-fowl, giving employment to numbers of decoy-men, fowlers, and carr-men, I understand it was stated there were two species of Geese frequenting and breeding in the carrs, known by these people by the name of the Grey-lag and the Carr-lag. What the Grey-lag was is well known, as fortunately that bird retains the name originally given to it by the fowlers. What the Carr-lag was, it is probably impossible now to demonstrate; but I have every reason to think it was this Long-billed Goose—a bird that resided and bred in the carrs along with the Grey-lag, and like that is no longer to be found in these districts, and, as far as I know, is not at present to be found in any part of this country, and is now one of our scarcest British birds, or almost a lost species. This bird is distinguished from the Short-billed or Bean Goose by its entirely different habits, and, as before stated, by its long bill. It may be thought by some that this difference of length may be the result of age; but this cannot be maintained, as its bill is small and weak, suited to its aquatic habits—very unlike the short bill of the Bean Goose, suited to its granivorous and herbivorous feeding. It may be possible the goose found breeding in the north of Scotland by Mr. Selby may be this species; but the distinction between the Long- and Short-billed Goose has been so entirely overlooked that we cannot determine that without further research. I will now give a list of the species.

Anas albifrons (White-fronted Goose).—Bill flesh-coloured. (Gould, no. 349.)

Anas ferus or *Anser* (Grey-lag Wild Goose).—Bill pink, nail white. (Gould, no. 347.)

Anas Segetum (Bean Goose, Short-billed or Migratory Goose). —Bill short, strong, and deep, the depth at the base being nearly two-thirds of its length; pale red in the middle, black at the extremities, but varies much in the proportions of these colours. Old birds nearly as large and pale-coloured as the Grey-lag Goose.

Pink-footed Goose.—Bill nearly the same proportions and colours as the last, but smaller and weaker; bird less, and darker-coloured. It is the young of the last; but Mr. Yarrell has given us a drawing of nearly an old bird for this supposed species.

Anas paludosus (Carr-lag or Long-billed Goose).—Bill long and weak, being exactly twice the length of its depth at the base. This is the Bean Goose of Mr. Yarrell's and Mr. Gould's drawings, but not of their descriptions. (Gould, plate 348.) The colour of the bill is like that of *Segetum,* and equally various.

EXPLANATION OF PLATE IV.

[The figures are five-sixths the size of life.]

Fig. 1. *Anas paludosus.* Bill strongly toothed, a strong groove running the whole length of the lower mandible; bill $2\frac{3}{4}$ inches long, and $1\frac{3}{8}$ inch deep at the base.

Fig. 2. *A. Segetum,* from an old bird as large and pale-coloured as a Grey-lag Goose. Bill $1\frac{7}{8}$ inch long, and $1\frac{1}{8}$ inch deep at the base. In colour like the last; it is a pale red in the middle, and black at the extremities; but they vary greatly in the quantity and form of the black; indeed I have seldom found two alike. The bill of this bird seems more allied to that of the Bernicles than to that of the Long-billed Goose, with which it has been so much confounded.

Fig. 3. *Pink-footed Goose,* from a bird received some years ago from Mr. Bartlett; it so entirely resembles the last as not to require description, differing only in being a trifle smaller and weaker—evidently the result of age.

XVII.—*On the Natural Order* Styraceæ, *as distinguished from the* Symplocaceæ. By John Miers, F.R.S., F.L.S. &c.

In my observations on the affinities of the *Olacaceæ*, seven years ago, some remarks were offered* to show the relation which that order bears towards the *Styraceæ*, on which occasion I took the opportunity of pointing out the great difference in structure that I had remarked between the *Styraceæ* and *Symplocaceæ*, which appeared to have been associated into one family upon very slight and insufficient grounds. These views were subsequently more clearly detailed in Prof. Lindley's 'Vegetable Kingdom,' p. 593, where the characters of the *Symplocaceæ* and *Styraceæ* were defined, and where analytical figures were given, showing the incompatibility of their respective structures. I was some time ago led to resume the consideration of this subject after reading the very excellent memoir of Dr. Asa Gray, entitled 'Notes on *Vavæa*,' in which this learned botanist brought forward several arguments in opposition to this conclusion. This has induced me to collect additional evidence in support of my views, and to point out in still clearer terms the normal difference of structure existing between these two families. I will prelude these observations by a review of the discrepant opinions of botanists in regard to the affinities of the *Styraceæ*, which seem to have been loosely formed, little attention having been paid to the peculiar structure and growth of the ovary, and the general carpological features that distinguish this family from all others.

The earliest notice of the affinities of *Styrax* is by Linnæus (1751), in his 'Philosophia Botanica,' where, in his systematic arrangement of plants, he classes *Styrax* between *Citrus* and *Clusia*, in his group *Hesperides*; but no reason is given for this association.

Jussieu (1789), in his celebrated work, 'Genera Plantarum,' p. 156, places *Styrax* in his heterogeneous order of the *Guaiacanæ*, near *Halesia*, in a different section from *Symplocos* and its allies; and at that early period he very felicitously pointed out its relation to the *Meliaceæ*.

Jussieu afterwards (1799) changed the name of his *Guaiacanæ*, at the suggestion of Ventenat, into *Ebenaceæ*, still retaining in his first section the same genera as before; but in doing this, he was dubious as to the admissibility of *Styrax* and *Halesia*, and a second time hinted at their more probable affinity towards the *Meliaceæ*.

Again, in 1804 (Ann. Mus. v. p. 419), he repeated his doubts of the relationship of *Styrax* and *Halesia* with the *Ebenaceæ*,

* Ann. Nat. Hist. ser. 2. viii. p. 162; Contributions to Botany, i. p. 22.

on account of their possessing an embryo with cotyledons shorter than the radicle, and once more suggested their affinity with *Meliaceæ*, showing likewise their close analogy with *Strigilia* of Cavanilles (*Foveolaria*, R. & P.), which genus he considered to belong unquestionably to that family. He also united the several genera of his second section of the *Ebenaceæ* into one genus *Symplocos*, which he held to be the type of a distinct family, allied in some respects to *Ebenaceæ*, but having a relation towards the *Myrtaceæ* or the *Aurantiaceæ* (the last section of his *Hesperidæ*), and distinguished from all others of his former class by its ovary, at first superior and free, but afterwards inferior and invested by the persistent calyx, and signalized by its embryo with an extremely long filiform radicle enclosed in the axis of the fleshy albumen. From this it is evident that this great botanist, in that early stage of carpological science, displayed great acumen in indicating the true affinities of *Styrax*; and although the facts then known were too few to warrant any positive determination on the subject, he clearly perceived the ordinal distinction between the *Styraceæ* and *Symplocaceæ*, which succeeding botanists have been led to confound together.

The elder Richard (1808) confirmed the views of Jussieu in regard to *Styrax*, and first established the family of the *Styraceæ* (Analyse du Fruit, p. 48), which the latter had only indicated; but in doing so, he committed a great mistake, and laid the foundation of the fallacy which has since prevailed, by associating *Symplocos* with it, into which genus *Hopea* and its congeners were now absorbed.

Jussieu (in 1817), in his memoir on the *Meliaceæ* (Mém. Mus. iii. 439) repeated his former views of the affinity of *Styrax* and *Foveolaria* with that family.

Kunth (in 1818) entirely adopted the conclusions of Richard in his description of the order *Styraceæ* (Nov. Gen. et Sp. iii. 256).

The elder DeCandolle (in 1824), in his celebrated 'Prodromus' (i. 621), adopted the views of Jussieu only as regards *Strigilia*, which he arranged in *Meliaceæ*.

D. Don (in 1825), following the indication of Jussieu, separated the *Symplocaceæ* as a distinct family, and afterwards (in 1828) withdrew from the *Styraceæ* the genus *Halesia*, making it the type of a new order *Halesiaceæ* (Jameson's Journ. Dec. 1828), —a view sanctioned by the adhesion of Link in the following year (Handb. i. 667).

Adr. Jussieu (in 1830), after much attention to the study of the *Meliaceæ*, of which order he contributed his excellent Monograph, came to a conclusion somewhat different from that of his father, before mentioned; he showed (Mém. Mus. xix. 184) that

Styrax and *Foveolaria* (*Strigilia*) could not be separated from one another, and that both ought to be excluded from the *Meliaceæ,* although still allied to it: he thus acceded to the opinion generally entertained of the close affinity of these two genera, without bestowing further attention on them.

Lindley (in 1836), in his 'Introduction to Botany,' p. 228, following the example of Richard, united *Styrax, Foveolaria,* and *Halesia,* together with *Symplocos* and *Hopea* in the *Styraceæ,* as a suborder of the *Ebenaceæ.*

G. Don (in 1837), adopting his brother's example, made three distinct families of the *Styraceæ* of former authors; viz. *Symplocineæ* (Dict. iv. p. 1) for the single genus *Symplocos, Styraceæ* (*ib.* p. 3) for *Styrax* alone, and *Halesiaceæ* (*ib.* p. 6) for *Halesia* only.

Endlicher (in 1838), on the other hand, considered *Symploceæ, Styraceæ,* and *Halesiaceæ* merely as distinct suborders of the *Ebenaceæ.*

Bentham (in 1838), in a memoir published in the 18th vol. of the 'Linn. Soc. Trans.,' discussed the characters and affinities of *Symplocos, Alstonia,* and *Hopea,* and considered that these genera, together with *Styrax, Foveolaria,* and *Halesia,* constitute the distinct order *Styraceæ,* which perhaps might be held to be only a tribe of the *Ebenaceæ*: his valuable remarks were, however, confined merely to observations upon the differences existing in the calyx, corolla, and stamens, seemingly without having directed his attention to the great dissimilarity in the relative structures of the ovary and seed in these genera. He considered the affinity of the *Styraceæ* to be immediately with *Ebenaceæ* among *Monopetaleæ,* also tending directly towards *Humiriaceæ,* in the next instance to *Meliaceæ,* and perhaps with *Aurantiaceæ* and *Olacaceæ,* among *Polypetaleæ.*

Professor A. DeCandolle (1844), in his 'Prodromus' (viii. 244), described the *Styraceæ* as a family distinct from *Ebenaceæ,* dividing it into three groups:—1. *Symploceæ,* for *Symplocos* only; 2. *Styraceæ,* for *Styrax, Pterostyrax,* and *Halesia*; 3. *Pamphilieæ,* for *Pamphilia* and *Foveolaria.*

Professor Lindley (in 1845) entirely followed the views of DeCandolle (Veg. Kingdom, p. 593); but in his last edition of that work (1853), without expressing any opinion of his own, he there annexed the arguments, and by figures illustrated the facts, which I had communicated to him, and upon which my suggestion was based, for the separation of the *Symplocaceæ* from the *Styraceæ.* It was against these arguments, and to maintain the opinions of Prof. A. DeCandolle, that Prof. Asa Gray directed his remarks in his 'Notes on *Vavæa,*' to which I have before alluded.

Prof. Decaisne considered the *Styraceæ* nearly allied to *Alangiaceæ*; but in this conclusion there can be little doubt that he held *Symplocaceæ* in view, that being nearly the position I have assigned to the latter family.

Prof. Miquel (in 1856), in Martius's 'Flora Brasiliensis,' adopted the order *Symplocaceæ*, which he there described as distinct from *Styraceæ*, according to my suggestion, but without offering any comment on the matter.

Finally, Prof. Agardh, in a work just published (1858), gives quite a novel view of the affinity of the *Styraceæ*, which he is disposed to consider as a gamopetalous form of the *Tiliaceæ*, and more especially of the *Elæocarpeæ*. He seems to accord in the separation I have proposed of the *Styraceæ* from the *Symplocaceæ*, and suggests the probability that the latter family may prove to be a gamopetalous form of his group *Carpodeteæ*, which he arranges near *Cornaceæ*.

From this history it will be seen how constantly and how widely the conclusions of botanists have varied in regard to the affinities of these two small groups of plants; and this uncertainty shows a necessity for fixing their characters upon some more definite basis than has heretofore been attempted.

The affinities of the *Styraceæ*, and the mutual relationship of the several genera there associated, have hitherto been founded on the more trivial characters of the relative number of the stamens, and their cohesion at their base upon the petals, which at this point often become pseudo-gamopetalous by mere agglutination; while, on the other hand, no stress has been laid on its other far more essential carpological characters. Although it be true that in forming our judgment regarding affinities, we should trust to the assimilation of several features rather than to few, still the precept of Jussieu should be attended to, that the most constant elements are to be observed in the principal organs of reproduction, especially those of the ovary and seed, and that these characters therefore should hold a prior claim over other concomitant, more variable, and less important features, in our investigations into the mutual relations of plants. This rule appears to have been wholly disregarded, in respect to the *Styraceæ*, by nearly all the botanists who have written on this family. Notwithstanding that the diagnostic features of the genera are severally drawn up in a very elaborate and careful manner by Prof. A. DeCandolle, in his excellent monograph of the order, the differential characters of the tribe *Symploceæ* (Prodr. viii. 246) and those of the *Styraceæ* (p. 259) are confined wholly to the dissimilarity in the æstivation of the corolla, the number of stamens, and the size of the cotyledons in relation to the radicle: no comparison is made of the structure of the ovarium, which is so essentially different in these two groups; and although these last-mentioned features are respectively given in the generic details of *Symplocos* and *Styrax*, no inference in an ordinal point of view has been drawn from structures so totally distinct, and which it is difficult to reconcile under the same category.

Before I proceed to consider the affinities of these two groups, I will offer some details of the structure of their ovary, as well as of their fruit and seed. In the *Symplocaceæ* we have an ovarium composed of five (rarely fewer) carpels completely united around a central axis, which is placentiferous in its upper portion and continuous with the style, so that the cells are perfect and separated by as many complete partitions, which retain their integrity in the ripe fruit. In those cases where some of the cells are occasionally abortive, even where only one cell is perfected, the remains of the other cells, together with their previous axis, may always be distinguished in that portion of the paries which is thickened about that line. Hence it constitutes an essential feature in this family to have a plurilocular ovary, the margins of its carpellary leaves being always placentiferous and united together in the axis, so that the cells thus formed are complete from the base to the apex.

On the other hand, in *Styraceæ* we find a central placentation, more or less abbreviated, sometimes almost obsolete, which has never any connexion with the style, and hence the summit of the ovary, in a greater or less degree, is always unilocular; the placenta thus generally rises very little above the base of the central space, although it is sometimes elevated above the middle of the cavity: in all these cases the bottom of this central space is divided by three (in *Halesia* by four, and in *Pterostyrax* by five) short partitions, which unite with the central placenta, and, under the form of prominent parietal nervures, are continued up the wall of the ovary to near its summit, which always remains unilocular; but neither these nervures nor the margins of the short partitions of the basilar incomplete cells exhibit any ovules. The abbreviated central placenta is thick, fleshy, and ovuligerous, bearing frequently more than thirty ovules, that is to say, ten or twelve in each division, arranged in three or four rows, its surface being corrugated by as many fleshy projections imbricated on one another, and between which the ovules are imbedded to some depth: this process is not, however, observable in *Halesia*. Nothing approaching this structure exists in *Symplocaceæ*. From these facts we may conclude that the normal condition of the component carpels in *Styraceæ* is that their margins are never placentiferous, and do not unite in a solid axis, and consequently are never continuous or connected with the style; and the inference, in a theoretical point of view, is that the origin of the central placenta is due to the union of the petiolar bases of the hypothetical carpellary leaves in one common centre, where they are ovuligerous, their margins, as above shown, being barren.

If we follow those botanists who have more or less adopted the system of arrangement planned by Jussieu, of distributing the different families of plants according to the normal structure of the ovary, the *Styraceæ* ought to find their position near the *Meliaceæ* and *Humiriaceæ*, as originally suggested by that learned botanist, that is to say, among those families where the dissepiments of a polycarpellary ovary are incomplete in their summit, the placentary axis being unconnected with the style. Upon the same ground that I endeavoured to separate the *Icacinaceæ* from the *Olacaceæ*, so should the *Symplocaceæ* be removed from the *Styraceæ*. Pursuing the same rule, the *Symplocaceæ*, from the structure of their ovary and other leading features, will be found to range near the *Alangiaceæ*, *Cornaceæ*, and *Hamamelidaceæ*, to which they bear the same relation that the *Icacinaceæ* have to the *Aquifoliaceæ*. This position will be seen to be very near that assigned to this family by the great Jussieu.

These conclusions are further strengthened by pursuing the comparison of the relative structures of the fruit and seed in the two groups under consideration. In *Symplocos* the fruit is a fleshy inferior drupe, crowned by the persistent toothed rim of the adnate calyx; it encloses a hard bony nut, which is generally five-celled, rarely (by abortion) three-, two-, or one-celled; only a single seed is perfected in each cell, and this is long, cylindrical, and suspended from its summit; its integuments are thin and membranaceous, and its copious albumen encloses a narrow, axile, straight embryo, of its own length, its radicle being very long, slender, superior, and pointing to the hilum, with two very minute inferior cotyledons. This structure will be seen to be very different from that of *Styraceæ*.

In *Styrax*, *Cyrta*, and *Strigilia*, the fruit, though also drupaceous, is, on the other hand, quite superior, and half enclosed within the loose, persistent, tubular or campanular calyx. In *Strigilia*, which comprises all the South American species of *Styrax*, beneath a fleshy mesocarp is a single putaminous endocarp, polished on both sides; this is thin, horny, or pergamineous in texture, almost translucent, unilocular, and monospermous, rarely two seeds being perfected within it; this endocarp has three external grooves running from the base to the apex, which correspond with as many internal nervures formed of the three projecting parietal lines seen in the ovary, and each is beautifully marked by radiating interrupted purple lines proceeding from the nervures: on removing from this putamen its fleshy epicarpial coating, it may be separated into three valves by as many longitudinal sutures alternating with the grooves. The seed contained within this putamen is erect; the external tunic is hard, and marked by three longitudinal grooves caused by the pressure of the three parietal nervures of the endocarp : it is supported upon a short irregularly triangular base (the remains of the central placenta), around which may be seen twenty or thirty abortive ovules, proving, whatever be its nature or origin, that it is the external coating of the seed. This seminal tunic or shell is very osseous in texture; in *Strigilia* it is thinner and somewhat brittle, but in *Styrax* and *Cyrta* it is very thick and hard, and is everywhere polished except over its large basal hilum; upon this hilum, inclined towards one side, is seen an aperture leading to an internal channel, and in the direction of this channel the exterior face has a short, broad, prominent ridge: this channel, passing obliquely through the substance of the shell, soon reappears on the inner face in the form of a flattened bony tube, from the orifice of which a distinct cord issues, which thence extends upwards, soon divides into three branches, and then into numerous ramifications, which, crossing each other over the summit in broad bands, thus become distributed into a reticulated network that extends over the whole surface: this network, which consists of an infinity of very loose fine spiral threads, is placed between the external shell and a distinct dark-coloured membrane adhering equally to the nucleus, which thus becomes easily separated by means of its intervention; each spiral thread is, however, quite free, and is easily drawn away. Within this last-mentioned membrane is another intermediate tunic, which is very thin, colourless and transparent, and is intimately agglutinated to it. Within this, again, is found another thin, hyaline, reticulated integument, which is quite free from the former, but adherent to the albumen. The albumen is fleshy, of an oblong form in *Strigilia*, with a small nipple-shaped protuberance at its base, somewhat excentrically placed, in which is imbedded the extremity of the slender, terete, inferior radicle, while the oval, compressed, foliaceous cotyledons are situated in the middle of the albuminous mass, and are about $\frac{3}{4}$ths of its length, and somewhat narrower. This structure, with very little variation, I have found constant in *Strigilia*, *Styrax*, and *Cyrta*. The pericarp in *Styrax* and *Cyrta* is very analogous to that above described in *Strigilia*; in the two former the endocarp is more intimately combined with the mesocarp, so that in *Cyrta* the entire pericarp opens by three equal valves, although only unilocular and monospermous; in *Styrax*, these valves open only at the apex, the pericarp thus becoming cupuliform in shape, and closely investing the seed. On the side opposite to that of the origin of the raphe, a little beyond the large hilum, is seen a small scar, which closes a foramen beneath it open to the interior; and in this cavity the prominent nipple, containing the extremity of the radicle, enters. In *Styrax officinale*, where the albumen is in the form of a depressed globe, the embryo lies nearly in a horizontal position, with the cotyledons slightly inclined to the hilum; in *Cyrta*, where the albumen is oval, the embryo lies in a more diagonal position; but in *Strigilia*, where the albumen is oblong, the embryo is vertical: in all three cases, the radicle points to the cicatrix seen a little on one side of the hilum. The structure of the fruit and seed in *Halesia* differs from the foregoing in many essential respects, as I will presently show; but in every case throughout the *Styraceæ* it is totally unlike that existing in the *Symplocaceæ*.

It is important to notice here, that the external shell of the seed above-mentioned is in no way analogous to the outer osseous tunics which I have described in the families of the *Canellaceæ*, *Winteraceæ*, and *Lardizabalaceæ*, and which I have shown to be arillous in their nature. Nor can it be compared to the bony shell of the *Clusiaceæ* and *Magnoliaceæ*, where it constitutes a tunic lying within the fleshy coat that bears the raphe. Here the position and course of the raphe prove that in the *Styracineæ* the osseous shell of the seed is the proper testa, originating from the growth of the primine of the ovule: we see that the whole of its fleshy mesodermic tissue has become solidified* by the depo-

* This offers a strong confirmation of the view I have taken of the nature of the bony shell in the seed of *Magnolia*, which by a few eminent botanists has been thought to result from a deposition of sclerogen upon the inner face of the primine, leaving the outer face transformed into a thick fleshy aril-like coating containing the vessels of the raphe; and as these two integuments are considered to be one, it has been termed "a baccate testa." On the other hand, I have suggested reasons why these coats should be regarded as essentially distinct, both in their nature and origin. I refer the reader to those arguments (*huj. op.* 3 ser. i. 280), which show the improbability that one half of the tissues of the primine should become converted into a thick bony shell, while the other half remains soft and fleshy. On the contrary side, this last-mentioned view is defended by citing the case of the fruit of the Almond (*huj. op.* 3 ser. i. 357), where the nut is supposed to be formed by the deposition of sclerogen upon the endoderm of the young carpel, leaving its outer surface unchanged in its nature to become the fleshy part of the fruit. But this conclusion appears to be founded on an unsound basis, because we have convincing evidence, from the position and course of the fila nutritoria (from their origin in the torus to the funicle of the seed), and also from the presence of the woody fibres in the substance of the nut, resulting from the lignification of the nerves of the carpellary leaf, that the nut of the Almond is a solidification of the entire carpel, and that its fleshy covering is the growth of an expansion of the torus, as DeCandolle has shown (Organ. Vég. ii. 40. tab. 43. f. 1, 2), citing *Nuphar* as an example, where a thick fleshy covering, analogous to the coating over the Almond nut, surrounds the united carpels, without any portion of its substance being interposed between them, which

sition of sclerogen within or around its cells, and that, by the spreading of the raphe under its endodermal surface, the latter has become almost isolated from it, in the form of a separable opake pellicle. The existence of the micropylar opening, closed externally by the cicatrix before described, is a still further confirmation of the origin of the bony tunic of the seed in the *Styracineæ*.

The essential differences observable in the floral structure of the two families under consideration now remain to be considered. I have already alluded to the facts long since given in Prof. Lindley's 'Vegetable Kingdom' (p. 593 *a*): these details, as before mentioned, were subsequently combated by Dr. Asa Gray; and as the reasoning he employed on that occasion is highly applauded, to the exclusion of my inferences, in a criticism in the 'Kew Journ. Bot.' vii. 139, it is necessary to test the value of the evidence on both sides. In doing this, I gladly express my full appreciation of the high merits of the distinguished Professor, which are so deservedly eulogized in the review just mentioned: my object in this is not to arraign the remarks of one so pre-eminent for the clearness of his views and the general accuracy of his observations, but to defend the evidence I had previously endeavoured to establish, the truth of which he has denied. I will therefore confine myself solely to the facts thus impugned in his 'Notes on *Varæa*,' respecting the co-ordinal relation of *Styrax* and *Symplocos*. The grounds upon which this relationship is there defended are reducible to six heads*:— 1. It is urged, that, as an inferior ovary is common to both groups, this character affords no distinguishing mark of the *Symplocaceæ*. 2. The æstivation of the corolla establishes no

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would necessarily occur if that coating had formed any part of the original carpellary leaves. Gaertner demonstrates the existence of a similar peripherical thick envelope around the elastic cocci of the *Euphorbiaceæ* (De Fruct. *Croton*, pl. 107; *Jatropha*, pl. 108, 109, &c.): these cocci containing manifest nervures, show us that each is an ossified, distinct, and entire carpel; their adjacent sides, which split from one another, have no indication of the intervention of any portion of the peripherical envelope, which would infallibly have taken place had that external portion ever belonged to the normal carpels. DeCandolle also alludes to the instance of *Pæonia Moutan* (*loc. cit.* p. 40, et Syst. i. 388), where the ovary, from the expansion of the torus or disk, becomes covered by a fleshy membranaceous urceole which completely surrounds it, and through the perforated apex of which the stigma is exserted; this is at first quite free, but it afterwards appears to form part of the fruit. To this source we may attribute the origin of the fleshy covering of many fruits, analogous to the instance of *Nuphar*; and we must consider the nut of the Almond as the growth of the entire carpel, and its fleshy covering as an emanation from the torus, confluent with it.

* Mem. Amer. Acad. 2nd ser. v. 333, in a note.

ground of distinction, because it is imbricated in both cases. 3. It is not true, as I had stated, that the stamens are uniserial in *Styraceæ* and pluriserial in *Symplocaceæ*. 4. The feature I had implied, of the anthers being linear and dorsally attached to broad filaments for nearly their whole length in *Styraceæ*, and as being small, rounded, without connective, and slenderly affixed on the thread-like apex of the filament in *Symplocaceæ*, is not tenable. 5. The character given by me, that the *Styraceæ* may be distinguished from the other group by a superior ovary with three incomplete dissepiments, and a central placentation free from the style, cannot be maintained. 6. It is not correct to affirm that the fruit in *Styraceæ* contains a solitary one-celled putamen with a single erect seed. I will consider these objections in succession, solely in reference to facts, premising, however, that the differential ordinal characters, as sketched by me in the 'Vegetable Kingdom,' in that early stage of the inquiry, were derived mostly from my observations upon *Strigilia* and *Pamphilia*. I had not then seen *Halesia*, which, from the very discrepant characters of authors, appeared to me a doubtful genus of the order, so much so as to have been made the type of a distinct family by Don and Endlicher. Now that I am acquainted with the singular structure of that genus, my previous ordinal character will require modification; but this structure, instead of militating against my views, only tends to widen much further the differences existing between the two families under consideration.

Upon the first objection I will observe that, although it be true that the tubular and entirely free calyx which belongs to *Styrax*, *Strigilia*, *Cyrta*, *Pamphilia*, and *Foveolaria* does not exist in *Halesia* and *Pterostyrax*, this fact is of little importance in an ordinal point of view, in the presence of other more essential characters; for in some unquestionable natural orders, the *Melastomaceæ* for instance, the calyx, though usually adnate, is very often free. But this admission does not destroy the distinctive character of the *Symplocaceæ*, in having a nearly inferior plurilocular ovary, that is to say, its being enclosed within an adnate calyx from the earliest stage of its development up to the period of the ripening of the fruit. In *Pterostyrax*, on the authority of Zuccarini, the ovary is acknowledged to be half superior, as I have found it in *Halesia*, in which genus its superior moiety is free, rising above the staminiferous disk in a conical form; the calyx is at first so loosely adherent to the lower part of the ovary, that it is easily separable from it by the ntroduction of a blunt point. In *Styrax* and *Strigilia*, however, the ovary is wholly superior, although I have observed in *Styrax officinale* and in *Strigilia ovata* that the base of the ovary is very slightly imbedded in the torus at an early stage, while in other cases it is generally free; but even in these two instances, in a short time, by the upward growth of the ovary, this minute portion emerges, and the fruit is quite free from the calyx. In *Styrax* and *Strigilia*, the greatest increment of the ovary occurs in its upper portion, and the persistent calyx increases very little in size; but in *Halesia* there is no growth whatever of the upper portion, which remains unchanged, persistent, and crowning the fruit, the whole amount of increment being confined to the lower moiety, and with it a corresponding growth of the tube of the adnate calyx, as I will presently show.

2. Since I have been able to examine *Halesia* and *Pterostyrax*, I am satisfied that in these cases the æstivation of the corolla is decidedly imbricated, as shown by Dr. Gray; but it is certainly valvate, as I stated, in every other instance I had met with, especially in *Strigilia, Pamphilia,* and *Cyrta*. However important this feature of æstivation may be in some cases, as an accessory character, it is not considered of any ordinal importance in many families; in proof of which I need only refer to *Rubiaceæ* as furnishing numerous examples of both kinds.

3. Although it be quite true, in a general sense, as I affirmed, that the stamens are uniserial in *Styraceæ,* and pluriserial in *Symplocaceæ,* I admit that they are uniserial in *Barberina,* and that in *Halesia* the stamens are often four times the number of the petals; but in the latter case the filaments, though more numerous than usual, still only constitute a single whorl, being slenderly agglutinated by their adhesion to the base of the corolla in a single series. In *Symplocos,* however, where the filaments are broad at the base, and the stamens frequently as numerous as thirty or forty, they are arranged in three or four imbricated series of different heights, and are all agglutinated by their base to the corolla for more than half their length: in *Barberina* the stamens do not exceed fifteen or twenty, and they are quite free from each other and from the corolla; but as the filaments are there very narrow at the base, they may still be normally three- or four-seried, although forced by pressure to assume a uniserial position: in *Sympleura,* however, where the number of stamens is sometimes reduced to five, they are of course uniserial, as in *Styrax*; but this does not affect the general rule. This consideration, after all, is of very trivial importance where other and far more essential points of differential structure are manifest. The point in question therefore remains valid as a common rule of distinction, especially when connected with the following consideration.

4. My definition, that the *Styraceæ* are distinguished by linear

anthers dorsally attached to broad filaments for nearly their whole length, is denied by Dr. Gray, who refers to *Halesia* as showing the contrary. This character is, however, extremely prominent and constant in *Strigilia* and *Pamphilia*, where the free portion of the filament is short, and also in *Styrax* and *Cyrta*, where the filaments are relatively longer. I find also in *Halesia* and *Pterostyrax*, notwithstanding the greater comparative length of the filaments, that the anthers, still of considerable length, are linear, the two cells are parallel, separated from each other by a distinct interval, dorsally attached by their whole length, and each bursting by a longitudinal line in front, as in *Styrax* and *Strigilia*. On the other hand, in *Symplocaceæ*, in all cases I have seen, the filaments terminate in a slender thread, upon the summit of which almost oscillates a small globose anther formed of two adnate cells, without the intervention of any apparent connective, which cells burst laterally on their edges. This extreme difference may be seen by comparing the excellent analysis of *Styrax officinale* by M. Decaisne (Spach, Phan. pl. 136), and Mr. Bentham's details of *Symplocos laxiflora* (Linn. Trans. vol. xviii. tab. 18). The figures in Delessert's 'Icones,' v. tab. 42 and 43, showing the stamens of *Pamphilia* and *Foveolaria*, are not less instructive on this head. The features I have assigned to each family in this respect are therefore well-marked, and quite opposed to one another.

5. I have fully demonstrated, in a preceding page, the very different structure of the ovary of the *Styraceæ*, as contradistinguished from that of the *Symplocaceæ*: Dr. A. Gray denies the structure I have assigned to the former in the cases of *Pamphilia* and *Halesia*; but he is certainly under misapprehension regarding the former genus, as may be seen by reference to Delessert's 'Icones Selectæ' (vol. v. pl. 42), where we find in *Pamphilia styracifolia*, as well as in *Foveolaria ferruginea* (pl. 43), a superior ovary with precisely such a structure as I have described. I shall presently show that the ovary of *Halesia* at an early stage quite conforms to that of *Styrax*, notwithstanding the subsequent difference in the development of the fruit and seed, and that it bears no analogy whatever with that of *Symplocos*.

6. The last objection refers to my definition that in the *Styraceæ* the fruit consists of a unilocular putamen with a single erect seed, in contradistinction to that of *Symplocos*, where a single seed of very different structure is suspended in each of its five cells, and where, by abortion, it is often unilocular: in opposition to which, Dr. Gray shows that in *Halesia* often one, but sometimes three seeds are perfected in as many distinct cells, and that two are matured in *Pterostyrax*. To this I fully assent;

but at the same time I shall be able to show that in *Halesia* the remarkable development of its seed results from an ovary exhibiting exactly the same normal structure as that of *Styrax,* and that it offers no analogy whatever with the fruit and seed of the *Symplocaceæ.*

The structure and growth of the ovary and fruit of *Halesia* have been misunderstood equally by Gaertner, Don, Endlicher, and DeCandolle. In *H. tetraptera* the upper moiety of the ovary is quite free, rising in a conical form above the mouth of the calyx, and is completely unilocular within; inside its lower or adnate moiety, at its base, we find a depressed placentary axis connected with the walls of this portion by four very short, thin partitions, so that it is here spuriously four-locellate; and upon the short placentary axis, in each of these divisions, are seen four oblong ovules, two of them superior and standing erect, the others being pendulous within the cavity, all being attached by the short and sharp point of one of their extremities: laterally these ovules are separated by an interval; but vertically the points of attachment of each upper and lower ovule are approximated upon a minute prominence of the placenta. The space above the placenta is completely unilocular, comprising five-sixths of the entire length of the ovary; and the four short basal partitions are seen continuous with as many parietal nervures, that extend thence to the summit, where they are prolonged for some distance into the hollow style. This structure, irrespective of the number of ovules and partitions, agrees precisely with that of *Styrax,* with this difference, that in the latter genus the ovules are inserted upon separate tuberculiform processes emanating from the placenta, while in *Halesia* they are wholly free and attached by a point.

The growth of the ovary in *Styrax* and *Strigilia,* as before mentioned, is confined entirely to the upper portion, while the lower moiety remains of its original length. In *Halesia,* the reverse is observed; for at the same time that the upper moiety continues quite stationary, appearing afterwards like the swollen base of the style, the lower half acquires a gradual increment, until, by the period the fruit is perfected, it attains at least twenty times its former length and breadth. The changes that occur during this growth may be noticed distinctly about a month after the fall of the corolla, by which time the ovary has acquired double its former proportions. On making a section of the ovary at this period, it will be found that, owing to the much greater increment of its basal portion, the placenta, instead of appearing to originate, as formerly, from the very bottom, is now elevated considerably above the base of the central space, and one, two, or three of the incomplete cells are seen raised up with it, and affixed against the inner surface of the main cavity, like parietally suspended sacs, each containing one of its ovules greatly increased in size, with the abortive ones unchanged, while the fourth incomplete cell disappears entirely, so that the ovary now seems completely unilocular from top to bottom, and with one, two, or three ovuligerous open sacs parietally attached to its inner wall.

At the period of four months after the fall of the corolla, I found the ovary increased to ten times its original size; the ovules were in the same parietal position as last described, but their sacs, formerly open, were now enclosed and covered over, one with a bony coating, apparently an extension of the shell of the pericarp, now hardened by osseous deposits; the other cells or sacs, not destined to perfect their ovules, were also entire and enclosed, but the covering here was membranaceous and not ossified. I observed that sometimes two, or all three, of the cells became osseous, and produced perfect seeds. The entire cavity of the main central space, at this period, was filled with a soft white mass of light cellular tissue, which, after two or three days' exposure to the air, when cut open, gradually dried and shrank into a very thin membrane, lining the now hollow cavity of the half-matured fruit. At that period, if only one cellule became osseous, it contained an enlarged ovule, which, though not yet arrived at maturity, clearly exhibited its two distinct integuments, as well as its chalaza, raphe, and embryo; the other two membranaceous cellules contained each a considerably enlarged, though withered ovule, seeming as if it had lost its vitality at some intervening period. Upon the ventral side of these cellules as many distinct longitudinal woody threads are observed, which are the *fila nutritoria* of Mirbel and St. Hilaire, containing the nourishing vessels that originally supplied the placenta, and these are now traceable from the point of attachment of the ovules down to the base of the central vacant space, and into the peduncle.

I have examined the matured seed, in a fresh as well as dried state, and find exactly the same development, only that all the parts are now grown to double the last-mentioned proportions. It commonly occurs here that two osseous cells become perfected, and remain contiguous to one another upon one side of the bony endocarp, each containing a ripe seed; the third cellule is usually obsolete and membranaceous, while, as in the former case, all trace of the fourth cellule disappears: the nourishing threads of the extended placenta are here distinguishable in the position above described. The seeds, in the several instances examined, were either suspended or erect in the respective cells, according to the original position of the ovules from which they were perfected. In *Styrax* the testa is thick and osseous; in *Halesia* it is thin and membranaceous, and often somewhat adherent to the osseous cellule, but it is extracted without difficulty, and, when dry, is of a dark colour, smooth, thin, and of a somewhat chartaceous texture, with a very prominent, adhering, external, simple, cord-like raphe, proceeding from the hilar point of its attachment, and extending along its ventral face to its opposite chalazal extremity, in a line corresponding with the nourishing threads before described, and facing the original axis of the placenta: the inner integument is a delicate transparent membrane that closely invests the albumen; and at its extremity, opposite to that of the hilum, it has a small well-marked chalaza, under the form of a coloured transverse line; at the opposite extremity or radicular end, I have always found a distinct, dark-coloured, free, adpressed thread, which is easily raised by a point; it is a suspensor: the albumen and embryo quite accord with the descriptions of Gaertner and DeCandolle. It may be remarked that the radicular end, with its suspensor, is sometimes superior, at other times inferior, owing to the reason before assigned.

I will add a few words respecting the development of the entire fruit. The calyx, in its young state, has eight prominent external nervures, of which four are opposite to the incomplete cells of the ovary, and terminate in the points of the teeth of the border, the other four alternating with the calycine segments; these last, with the growth of the ovary, acquire a considerable increment, producing, in *Halesia tetraptera,* four long, broad, corticated wings, and in *H. diptera,* only two opposite broad wings, the two alternate ones being much narrower; these wings, in the ripe fruit, are thickened considerably towards the pericarp, and are filled with a soft pith, which extends in a thin layer over the whole of the nut; the latter is indehiscent, fusiform, sharply pointed at both ends, thick, and osseous, with about eight deep grooves. It is justly remarked by DeCandolle, that in the ovary, as well as in the fruit, the cells are placed opposite to the wings, not alternate with them, as figured by Gaertner.

From the above facts it is evident that, in order to comprehend the nature of the structure of the fruit in *Halesia,* it is necessary to trace the progress of the growth of its ovary from its earliest stages to the period of its ultimate development: we thus see how by degrees each ovule is removed from its normal basilar position, and apparently carried up towards the centre, and is afterwards found in a parietal sac attached to the middle of the wall that surrounds a large central vacant space in the growing ovary; but how this open sac extends itself into a completely closed cell, at first membranaceous, and then hardened by thick osseous deposits, I am unable to explain. I can only vouch for the truth of the facts as they are here recorded*.

In regard to the affinities of the *Styraceæ*, I have, in a preceding page, stated my conviction, following the mode of inference adopted by Jussieu, that, from the structure of its ovary, it should hold a position near the *Olacaceæ, Humiriaceæ*, and *Meliaceæ* †. Later botanists have lost sight of the true affinities of this order, from having been led away by its supposed connexion with the *Symplocaceæ*,—a misconception which I have endeavoured to rectify. It has from this cause been placed near *Ebenaceæ*, on account of the partial agglutination of its petals and stamens into a tube; but this character ought never to have been thus considered as one of such primary importance, because that union is never perfect; for in *Styraceæ*, even more than in *Symplocaceæ*, those parts may always be separated readily and without laceration. Prof. A. DeCandolle (Prodr. viii. 245), though he admits in some degree its relationship towards *Meliaceæ* and *Humiriaceæ*, yet considers such an affinity to be distant, on account of its ovary being sometimes inferior, also because of the want of a nectary, the different mode of insertion of the corolla, and a dissimilarity in the manner of junction of its monadelphous stamens. But I have shown that in the true *Styraceæ* (excluding the *Symplocaceæ*) the ovary is always wholly superior, or partially superior in those exceptional cases where, by a peculiar mode of growth, it becomes subsequently inferior: this partial immersion of the base of the ovary at an early stage, in *Halesia*, is probably owing to the existence of a disk (the rudiment of a nectary, as in *Humiriaceæ*, or analogous to the disk in *Olacaceæ*), which is here adnate both to it and to the tube of the calyx. In *Olacaceæ* we find in some cases a growth very analogous to that of *Halesia*,—in *Strombosia* for instance, where the calyx, in like manner, is small and inferior, the ovary being surmounted and surrounded by a thick fleshy five-lobed disk which rises from the torus; by the downward growth of the ovary, in a manner similar to that described in

* A very analogous circumstance is recorded by Mr. R. Brown in the case of *Persoonia* (Linn. Trans. x. 35), where the ovarium is unilocular and contains two ovules; after fecundation, a cellular substance is interposed between them, and this gradually indurating, acquires in the ripe fruit the same consistence as the putamen itself, from whose substance it cannot be distinguished; and thus a cell, originally unilocular, becomes bilocular. The same occurs in *Tribulus*, where each cell of the ovary becomes thus divided into four osseous superposed cellules; and a similar growth takes place in *Bontia*.

† See also my remarks on the affinity of *Styraceæ* with *Olacaceæ*, Ann. Nat. Hist. 2 ser. viii. 163; Contrib. to Botany, i. 23.

Halesia, the fruit becomes at length wholly inferior, and crowned by the unchanged toothed margin of the previously inferior, now become superior, and adnate calyx*. In other cases in that family (in *Olax* for example), the calyx enlarges into a tubular form quite free from the fruit which it encloses, as in *Strigilia.* There are many other points of structure which show the evident relationship of the *Styraceæ* to the *Olacaceæ.*

Dr. Asa Gray, in his 'Notes on *Vavæa,*' very justly lays great stress upon the affinities of the *Styraceæ* and *Meliaceæ,* and expresses his surprise that this fact had not occurred to me. I had, however, clearly implied it by proposing to place the former order close to the *Olacaceæ* and *Humiriaceæ,* among the *Cionospermeæ,* in which class, if adopted, the *Meliaceæ* would occupy a prominent position; but, notwithstanding all that has been urged by the learned American Professor on this point, to which I readily accede, I still remain of opinion that the proximate alliance of the *Styraceæ* is with the *Olacaceæ* and *Humiriaceæ* rather than with the *Meliaceæ.* In the latter family, the leaves are mostly of considerable length and pinnate; the filaments of the stamens are united into a compact tube, in the mouth of which the anthers are usually quite free and sessile, and where the staminal tube is toothed or lobed, the anthers commonly alternate with the lobes; the seeds, too, are generally arillate, and frequently without albumen, with large fleshy cotyledons, within which the small radicle is retracted: the plants of this family are bitter and astringent,—characters all much at variance with the *Styraceæ.* On the other hand, in *Olacaceæ* and *Humiriaceæ,* the leaves are simple, the stamens quite free, or only laxly agglutinated at base: in the latter family, the filaments are broader and longer than the anther-cells, which are distinct and separated by an interval, and dorsally attached by their whole length to the filament; the seeds are albuminous, with a terete radicle,—characters more in conformity with *Styraceæ.* The juice of *Humirium balsamiferum* has the same smell and balsamic properties as that of *Styrax,* from which it is scarcely distinguishable. The affinity of the *Styraceæ* to the *Humiriaceæ* was distinctly recognized by Prof. Von Martius when he established the latter family†, and was afterwards confirmed by the opinion of Mr. Bentham‡. The character which serves more than any other to establish the relationship of the *Styraceæ* with the three families just mentioned, is the imperfect union of the carpels, owing to which the ovary has its dissepiments always more or less incomplete, and therefore it is unilocular in the summit, so

* Blume, Mus. Bot. Lugd. Bat. i. 251. pl. 46.
† Nov. Gen. et Sp. Bras. ii. 142.
‡ Kew Journ. Bot. v. 97.

that there is never any direct connexion of the placenta with the style. Prof. A. DeCandolle fully admitted this affinity with the *Olacaceæ,* so much so that at one time he proposed to introduce the genus *Liriosma* into the *Styraceæ**. In my memoir upon the latter genus† I pointed out many circumstances in proof of this affinity. I showed that, in a manner analogous to that of *Strombosia,* mentioned in the preceding page, the ovary of *Liriosma* is at first superior, but that, by the expansion of the nectarial disk that supports it, the growth is wholly downwards, so that the fruit becomes completely inferior, as in *Halesia,* crowned by its small unchanged calyx. I noticed also the occurrence of an epigynous gland-like thickening of the ovary, similar to that existing in *Hyoscyamus*‡, which forms a prominent feature in *Liriosma* and *Strombosia* and some other genera of the *Olacaceæ,* and occurs sometimes in *Styrax* and generally in *Strigilia.* Dr. Asa Gray does not admit the existence of this epigynous thickening in *Styraceæ,* saying, "It is only the ordinary epidermis of the ovary, with its downy covering, unaffected by the pressure of the base of the corolla and the staminal tube, which closely encircles the lower part, and it readily separates from the rest of the parietes, as it does also in *S. Benzoin.*" I will not affirm that it is a distinct formation; but if it be the ordinary epidermis, it certainly assumes a very thickened appearance in *Strigilia,* projecting over the ovary like the eaves of a circular roof, while the lower moiety of the wall of the ovary is attenuated in substance §. The admission that "it readily separates from the rest of the parietes," seems to favour the idea that it is something more than epidermis, especially when analogy points to the remarkably thick epigynous gland that ordinarily surmounts the ovary in *Olacaceæ,* even when it is entirely superior. The concurrence of so many points of structure in these several families ought to have their due weight in the question of their relative affinities. Prof. DeCandolle ‖, although he admitted the distant relationship of the *Styraceæ* with the *Meliaceæ,* yet considered that his tribe *Pamphiliæ* was more intimately allied to the latter family than to the former¶. Yet the same features that established this identity in his opinion, exist equally

* Prodr. viii. 243.

† *Huj. op.* 2nd ser. viii. 103, 163; Contrib. Bot. i. 16, 23.

‡ Ill. S. Amer. Pl. i. 174; ii. App. 9. pl. 79. figs. 8, 9–13.

§ In *Styrax officinale* I do not find the same disk-like summit of the ovary that I have depicted in *Strigilia lævis*; but I notice (as generally throughout the *Styracineæ*) that the lower portion of its wall, which encircles the three-cellular portion of its base, is greatly thinner in substance than its unilocular upper portion, where it is comparatively fleshy.

‖ Prodr. viii. 215.

¶ *Ib.* p. 270.

in *Strigilia,* though they do not appear to have attracted his attention.

It is difficult to conceive the grounds upon which Prof. Agardh regards the *Styraceæ* (separated from *Symplocaceæ*) as being more immediately allied to the *Elæocarpeæ,* among *Tiliaceæ**. By his novel system, the affinities of different families of plants are best demonstrated by the form and mode of development of the ovules. As this character is liable to be modified by many circumstances, it can never retain the importance there attached to it, because if it be employed as a primary mark of distinction, it will often lead to error; but it is nevertheless of considerable value as an accessory feature, which has not hitherto been sufficiently attended to: if, however, we combine with this its essential concomitant, the position and distribution of the placentary portions of the component carpels of the ovary, the affinity in question ceases to be apparent. In his group of the *Elæocarpeæ,* in which he includes the *Tricuspidarieæ* of Endlicher, the union of the component carpels constituting the ovary is complete, and their placentary margins all unite in a solid axis in the centre, the ovules being attached in collateral pairs, in each cell, upon the middle of this axile column. No similar structure exists in *Styraceæ.* In the *Styracineæ,* as I have explained, the numerous ovules, generally in three series, are seated on a central abbreviated column, which has no direct connexion with the style, with the raphe ventral in the erect ovules, superior in the horizontal ones, and dorsal in the lower row, as Prof. Agardh admits: but this seemingly deviating position of the raphe is merely the effect of their resupination on their funicles, produced by mutual pressure during growth; for if each ovule be separately brought into one similar angle of radiation from the axis, the raphe in all of them will be seen in the same facial direction. As an example of the different mode of development in *Elæocarpeæ,* I will cite what I have observed in *Aristotelia*: the ovules, two in each cell, are there attached collaterally a little below the summit of the axis; they are naturally at first cupuliform, as Prof. Agardh shows in tab. 21, fig. 7; and in the progress of their growth they probably become, as he says, mutually heterotropal,—that is, one growing upwards, the other downwards, with the raphe towards the axis in both cases. In confirmation of this, I have observed that, at the period of expansion of the flower, the ovules, by the effect of pressure against the cavity of the cell, become twisted round upon their funicles, so as to appear superposed,—the left ovule becoming superior, with its singularly curved chalazal point directed to the dexter side, the right ovule becoming inferior, with its chalazal point turned to the sinister side; and this relative

* Theor. Syst. Plant. p. 269.

position is retained until they ripen into perfect seeds. I have here spoken only of *Aristotelia*, where the ovules are uniserial, on which account, and on a mistaken notion of a different disposition of the stamens, Prof. Agardh makes this genus the type of a group distinct from *Elæocarpeæ*; but in *Tricuspidaria*, one of his *Elæocarpeæ*, where the ovules are pluriserial as well as collateral, I find that they are all respectively heterotropal,—that is to say, with the raphes, in the one longitudinal row facing those of the other row, all diverging horizontally from the axis. There is no analogy here, in either case, with *Styraceæ*. Moreover, the unguiculate petals in *Elæocarpeæ*, always more or less incised at their summit, the long basifixed anthers opening by bilabiate pores at their apex, the more numerous stamens inserted within a hollow hypogynous disk, upon the outside of which the petals are attached, the dissimilar development of the raphe in the seeds, and very different nature of the seminal tunics, offer other characters completely at variance with *Styracineæ*. I will at some future period publish my analysis of the structures of *Aristotelia*, *Tricuspidaria*, *Dasynema*, and some other genera of the *Elæocarpeæ*, and will here only observe, respecting their seeds, that their seminal tunics are analogous in their nature to those I have described in the *Clusiaceæ* and *Magnoliaceæ** ; their outer fleshy coating, bearing a simple raphe, is such as I have termed an arilline, resulting from the growth of the primine†, and quite free and

* Linn. Trans. xxii. 81.

† I was at first led into error in regard to the origin of this outer coating, in opposition to the opinion of Dr. Asa Gray, who, I frankly admit, is perfectly correct in assigning it to the growth of the primine. I then considered it as originating from an expansion of the placentary sheath, which, indeed, it really is; but I confounded this development, from not having myself watched the actual mode of growth of the ovule, as explained in a subsequent article (*huj. op.* 3 ser. vol. i. p. 358): my reasoning then would have been correct if the prevailing theory of the inversion of the nucleus upon its centre, owing to the one-sided growth of the coats of an anatropous ovule, as taught in all our elementary books, had not been quite fallacious, as I am since convinced it is. I cannot, however, agree with the distinguished American Professor in considering that the outer fleshy tunic and the hard nut which it covers, in the seed of *Magnolia*, are both derived from one common origin (see *ante*, note, p. 132). Admitting the correctness of the facts, as detailed by that learned botanist, relative to the progress of growth of the ovule of *Magnolia* (Linn. Proc. i. 106), especially in regard to the period of the deposition of sclerogen in the tunic of the ovule, in the manner he relates, it appears to me far more reasonable to conclude that the tunic there described is composed of two integuments (primine and secundine) agglutinated together—the latter becoming solidified subsequently, as he shows—than that we should infer, as he does, that sclerogen is thus copiously deposited upon one half of the cellular tissues of the fleshy mesoderm, to constitute the nut, while the other half of the same tissue retains its lax cellularity—thus forming two seminal coatings of very different nature out of a simple ovular integument (see the former

distinct from the hard shell which has been called the testa, and which is probably here developed from the secundine, while the inner tegmen proceeds from the tercine. Prof. Agardh, following Martius and Endlicher, considers *Aristotelia* as the type of a distinct family; but I shall be able to show that it differs little from *Tricuspidaria, Vallæa,* and *Elæocarpus,* and that *Sloanea* and *Dasynema* resemble these in all essential features, if we except their want of petals through abortion. I cannot therefore accord with his opinion concerning *Elæocarpeæ* and *Styraceæ,* that "gemmularum positio et forma, fructus, gemmulæ paucæ evolutæ, et forma embryonis, in utroque ordine fere eadem sunt." Nor can I agree with him concerning the latter family in saying, "certe enim nec cum *Meliaceis,* nec cum *Olacineis* quædam affinitas."

The same authority (*l. c.* 270) says of the ovary of *Styrax officinale,* "plusquam dimidia parte calyci adnatum vidi." I find on the contrary, in its complete flower, that the ovary is generally wholly superior; sometimes, however, only a small portion of its cavity is below the line of junction of the calyx with the corolla; a solid disk or torus nevertheless supports the ovary, and interposes between it and the summit of the peduncle, the margin of which, adnate to the base of the calyx, sometimes rises a little above the line mentioned, but only in a trifling degree, which is a variable character in the same plant.

Prof. Agardh, again, speaking of my definition of *Styrax,* remarks, "nec ovarium vidi superne uniloculare, nec podospermio cupulato, nec in flore saltem placentam centralem." Now my own observations upon dried specimens of *S. officinale* are completely at variance with the above citation: its ovary appears to me unmistakeably unilocular in the summit, as I have constantly found in *Strigilia, Cyrta,* and *Pamphilia.* The fact is confirmed by the definition of the genus in DeCandolle's 'Prodromus' (viii. 259)*; and it is so figured in Delessert's 'Icones' (tab. 42 & 43).

note, p. 132). We have evidence that such an assumed action cannot have occurred, because, in such case, the vessels of the raphe, instead of existing (as they are seen) in the outer fleshy tunic of the seed, ought to have been found imbedded in the inner bony shell, deposited, according to that hypothesis, upon the internal face of the primine, where the vessels of the raphe are always seen attached. I am the more confirmed in this opinion by the instance of *Tricuspidaria,* which offers a strong case of analogy. I have found there, after the ovary has somewhat advanced in growth, subsequent to the fall of the corolla, that the primine becomes thick and fleshy, and remains quite loose over the firm integument that subsequently becomes the nut, being perfectly free from it at all parts of its surface, except at its broad chalazal extremity.

* Prof. A. DeCandolle states, in his generic character of *Styrax* (*l. c.*), solely on the authority of Richard, cited as far back as 1781, that the ovary

In regard to the next point, although I may not have been sufficiently precise in stating that the ovules in the *Styracineæ* are borne upon cup-shaped podosperms, I find there, what is nearly equivalent, that they are almost sessile upon rugose prominences of the placenta, which conceal their micropylar extremity,—the raphe, as above shown, being next the axis in the upper series: these prominences, whether considered as portions of the placenta, or as belonging to the funicles, are precisely analogous to the protuberances he has shown to exist in numerous other cases, where he calls them "telæ conductrices"—as in *Calla*, tab. 2. fig. 10; *Arctostaphylos*, tab. 9. figs. 15 & 16; *Cluytia*, tab. 15. fig. 16; *Hebenstreitia*, tab. 17. fig. 11; *Hedera*, tab. 20. fig. 2; *Erinus*, tab. 28. figs. 1 & 2; and, finally, he shows these very prominences in *Styrax officinale*, tab. 21. fig. 13, which he defines thus: "gemmulas in placenta lobosa magna inter lobos inserta." The central placentation attached to the short incomplete dissepiments cannot be doubted, following as a necessary consequence of the structure above demonstrated.

Prof. Agardh (*l. c.* tab. 22. figs. 16 & 17) confirms my observations upon the direction of the ovules in *Halesia tetraptera*: he also repeats what I have said, that in the ripe seed the chalazal extremity is either superior or inferior, according to whether an erect or pendent ovule has been fertilized; but his view of the structure of the ovary, that the expansion of the placenta divides its space into superior and inferior cells, is not borne out by the facts as they appear to me. He says also, regarding the ovules, "raphe et in adscendente et in pendula extrorsa:" to me, on the contrary, this seemed in both instances directed towards the axis of the ovary, or, perhaps, somewhat lateral to it, and in either case therefore introrse: in this respect they appear to differ from those of the *Styracineæ*, being thus heterotropous, while in the latter tribe, if we regard the fact of their resupination, they are all isotropous. The position I have assigned to the raphe in *Halesia* is moreover proved by its direction in the ripe seed, where it is always turned away from the wall of the nut, and facing the centre of its open space; and this is constantly the same, whether the chalaza be superior or inferior in regard to the apex of the fruit.

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at its base is adnate to the calyx. Richard probably had confounded the flower of *Halesia*, which is hardly distinguishable from that of *Styrax*, excepting the difference in question.

XVIII.—*Correction of an Important Error affecting the Classification of the* Psittacidæ. By Alfred R. Wallace.

A very beautiful section of the Parrot tribe inhabits the Moluccas, New Guinea, Australia, and the Pacific Islands, distinguished by the peculiar structure of the tongue, which has the appearance of being covered with a brush. This is not, however, formed by hairs, but by papillæ or fibres, which rise in longitudinal rows on each side of the upper surface of the tongue, and can be opened or expanded on each side of the median line, or depressed in such a manner as to be hardly perceptible. The birds possessing this structure form the subfamily of the *Trichoglossinæ* or "brush-tongued Parroquets," and are of small or moderate size, of elegant forms, and ornamented with the most brilliant colours—crimson, with blue, purple, and black, or with green and yellow.

I first became acquainted with these birds, so as to examine their peculiarities, in the Aru Islands, where species of *Trichoglossus* and *Chalcopsitta* are found, and afterwards in Amboyna, where the *Eos rubra* is abundant. It was there that I was struck by the remarkable similarity in form, structure of the bill and feet, and texture of the plumage, existing between these and the Lories, several species of which, of the genus *Domicella* of Wagler (namely, *Psittacus domicella, P. lory,* and *P. garrulus* of Linnæus), are commonly domesticated in the Moluccas. But the character of the genus *Domicella* is to have a smooth, simple tongue; and on that account these birds, and some others of the genera *Eclectus* and *Psittacodis,* have been formed into the subfamily *Loriinæ* or "true Lories."

It was not, however, till I reached Gilolo and New Guinea that I had an opportunity of examining any of the above-named species, when what was my surprise to find that both in the *D. garrula,* Wagl., of Gilolo, and in the *D. lory,* Wagl., of New Guinea, *the tongue has precisely the same structure as in* Trichoglossus *and* Eos! At first I could hardly credit my senses; for both species are common alive in Europe. Wagler says of both, "multas vivas vidi;" and also that he has dissected *D. garrula*; yet he says of the genus, "lingua simplex, glabra," and of the species, "lingua integra." It was only after examining some dozens of specimens, including two or three that had died in captivity, that I became convinced that the tongue was universally papillate or brush-tipped.

This discovery cleared up a great difficulty—that of the absolute identity in the external form and structure of the Lories and some of the *Trichoglossinæ,* while they were supposed to belong in reality to distinct groups; for an essential structural difference never exists in animals without making itself visible in external characters, however occasionally masked under a superficial resemblance of form or colour. No character, however, can be given by which, from skins alone, an *Eos* can be distinguished from a *Domicella*, whence much confusion has arisen in locating the species of these groups; and as the internal or structural difference hitherto relied on to separate them does not exist, they must be united in one genus, which had better be that of *Eos*,—first, because that has been correctly characterized and is generally accepted; and secondly, because not only are *Lorius* and *Domicella* synonyms, but are both further objectionable as being founded on old specific names, so that we must either say *Lorius lory* or *Domicella domicella*, or alter the specific name first given to these birds.

The *Trichoglossinæ* will now form a well-marked and highly natural group, characterized by a peculiar compressed form of bill, compact glossy plumage, a brush-tipped tongue, graceful forms, and active habits. They may be called in English, Lories, —a name by which many of the species are known both in Europe and in the Indian Archipelago. The genera *Eclectus* and *Psittacodis*, called here red and green Cockatoos (for even the natives see they have no resemblance to the "Lories"), having smooth tongues, need be no longer separated from the true Parrots, with which they agree in all essential points of structure and habits, while they differ altogether from the species with which they were before so unnaturally associated. *Eclectus*, indeed, is very like some Lories in colour; but this is a superficial resemblance only, the structure of the bill and of the plumage, as well as the general form and habits, being altogether different.

Having discovered in New Guinea another species of *Charmosyna*, much smaller than *C. papuensis*, I am enabled to determine with certainty the claims of that genus to a place among the *Trichoglossinæ*. This subfamily will now include nearly all the brilliantly coloured *Psittacidæ* of the Indian Archipelago, forming a group of birds alike interesting from their singular structure and their extreme beauty.

BIBLIOGRAPHICAL NOTICE.

The Natural History of the Tineina. By H. T. Stainton, assisted by Prof. Zeller, J. W. Douglas, and Prof. Frey. Vol. iii. 8vo. London, Van Voorst, 1858.

We have already called attention to the appearance of the first two volumes of this important work on the Natural History of the smaller Lepidoptera; and the third volume, which has lately been published, fully maintains the reputation acquired by its predecessors.

In our notice of the first volume we described the general plan of the work, and indicated what we regarded as defects in the mode in which this was carried out, so that, as no change has been made in these respects, we may pass at once to the consideration of the contents of the volume now before us.

The twenty-four species of minute Moths now selected by Mr. Stainton for illustration belong to two very nearly allied genera—*Elachista* and *Tischeria*. Of the former, there are, according to our author, seventy-two species already described, of which thirty-seven have been detected in Britain. They are for the most part less brilliant in their colouring than the charming little moths of the genus *Lithocolletis*, whose natural history was given in Mr. Stainton's last volume; but many of them nevertheless exhibit a delicacy in their markings which renders them beautiful objects, and a few are adorned with metallic tints. Like all the species hitherto described and figured in the present work, they are leaf-miners in their larva state; and they appear, singularly enough, to confine their attacks principally to the Grasses and the nearly-allied *Cyperaceæ*, only two species being at present known to feed on a plant belonging to another natural order, the *Luzula pilosa*. The same law would appear to prevail in warmer climates, a species having been reared from the bamboo in Calcutta. The larvæ sometimes only attack the parenchyma of the leaves, but in other cases they carry their mines down into the stem, and there is a considerable variety in the form and appearance of the mines. Many of the species produce two broods in the course of the year; and all of them appear to pass through the winter in the larva state, —some being nearly full-fed at that season, whilst others have but recently emerged from the egg. With the exception of one of the species which feeds on the *Luzula*, all the larvæ quit their mines when about to undergo their change to the pupa state; and the pupa is usually attached to the stems of the grasses and sedges, with only a silken belt round its middle.

The second genus treated of in this volume, *Tischeria*, only includes five species, of which three have been ascertained to be British, so that the single plate with its accompanying letter-press, which is here devoted to these insects, exhausts the natural history of the known indigenous species of this genus. In their characters they closely resemble the *Elachistæ*; but their habits present some differences. They are also leaf-miners, but are not confined within such narrow limits in their choice of food as their near allies just noticed; for, of the five known species, three inhabit trees and shrubs of the order *Rosaceæ*, whilst the other two form their mines in the leaves of that perfect world of insects, the oak. The mines of the larvæ are described as being always close to the upper surface of the leaf and beautifully lined with white silk; the larvæ—taking pride, like good housekeepers, in the cleanliness of their dwellings—are particularly careful to allow no grain of dirt to defile the purity of their delicate carpets; with this view they make a little slit in the upper or lower surface of the leaf, and through this eject their excrement. Unlike the *Elachistæ*, the insect undergoes its further metamorphosis within the mine, the silken carpet of which saves it the trouble of making any cocoon.

Like its predecessors, the volume now under consideration contains eight coloured plates, the figures on which have been beautifully drawn and engraved on copper by Mr. E. W. Robinson. They include representations of the larvæ and their mines, of the perfect insects, and in some cases of the pupæ; and the execution of these plates leaves little or nothing to be desired. In conclusion we cannot but cordially recommend Mr. Stainton's book to the attention of our entomological readers, as, notwithstanding the great bulk to which it must attain if it is ever to furnish anything like a complete Natural History of the Tineina upon its present scale, its cheapness is such as to place it within the reach of every one, and its intrinsic merits undoubtedly entitle it to an extended patronage.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

June 8, 1858.—John Gould, Esq., F.R.S., V.P., in the Chair.

NOTE ON THE EGGS OF THE FRIGATE BIRD AND CROCODILE OF JAMAICA. BY E. CAVENDISH TAYLOR, M.A.

The eggs of the Frigate Bird (*Fregata aquila*), which I now exhibit, were taken by my brother, Mr. J. C. Taylor, on the 1st of January 1858, at Fonseca Bay, on the Pacific coast of the Republic of Honduras. They are of a pure white colour, and measure $2\frac{3}{4}$ inches in length by $1\frac{3}{4}$ in breadth.

Although the species of *Fregata* are not as yet very accurately determined, it is believed that the same species (*Fregata aquila*) is found on both the Pacific and Atlantic shores of Central America.

The eggs of the Crocodile of Jamaica (*Crocodilus acutus*) were also obtained by my brother early in the present year, on that island. They present the elongated oval form peculiar to the Crocodilians. They are of a shining white colour, and measure $3\frac{1}{2}$ inches in length by 2 inches in breadth.

ON CHARADELLA AND LICHENELLA, NEW FORMS OF POLYZOA FROM AUSTRALIA. BY DR. J. E. GRAY.

The first of these corals is nearly allied to the genus *Amathia*—indeed some naturalists may be inclined to regard it only as a section of that genus; but as it presents a different mode of growth and habit, I think it is desirable that it should be distinguished by a distinctive name.

I may premise that the name of the larger group to which it belongs is the subject of a very unpleasant discussion. Lamouroux and

Lamarck both published the genus in the year 1812 under two different names, the first calling it *Amathia* and the second *Serialia*. The same thing occurs with many other genera established in the same works.

There can be no doubt that these authors studied their subject, and found out what they considered natural groups, and named them, independently. Lamouroux presented his memoir on the subject to the Institute in 1810, and Lamarck was named one of the Commissioners to report on his paper; so that he had the opportunity of knowing what Lamouroux had done two years before the publication of his own work; and this has given rise to Lamarck being charged with pirating the labours of Lamouroux.

But I think any one who has known anything of the character of Lamarck must consider such a charge as groundless; and I merely cite this as an instance of the very unpleasant position in which a naturalist is placed by being called upon to examine and adjudicate on an unpublished paper of another author engaged on the same branch of study;—and an opinion by one not so engaged is generally worse than useless. I consider this one of the great objections to the system of reference which is so commonly adopted in this country, France, and America.

In France and America they do their best to obviate the evil by making the names of the referees public, and requiring them to send in a written report, while here the referee is often only known to the officers of the society. Neither system obviates the evil which laid Lamarck open to the unpleasant, and, I believe, ungrounded charge which has been brought against him, and which may be made against any scientific man who is called upon to read the MS. communication of another labourer in the same field of study.

Lamouroux named one of the species of *Amathia*, *cornuta*, because the end of the stem beyond the cluster of cells is produced into two setaceous filaments or tags. If these tags are examined, it will be found that the cells are gradually developed upon them, and they are only the commencements of the next articulations which are to bear the cells. They are to be observed, more or less developed, on all the species I have examined; and when the stem is simple, as in *A. lendigera*, there is a single tag; and when the coral is repeatedly forked, then there are two tags at the end of the last cell-bearing articulation, as is also the case in *A. lendigera*, where a branch is going to be formed. In the genus now noticed, as the branches arise in three, it has three such tags.

Charadella.

Polypidom tree-like, branched; stem formed of numerous tubes, constituting at the base an expanded mass of tubes; branches many, pinnate or bipinnate, formed of numerous articulations, each articulation throwing off, at its point of junction, two opposite branches formed of a single joint, each joint furnished on its upper edge with a series of small subequal tubular polype-cells.

1. Charadella trifida.

Pale brown; the branches furnished at the end with trifid tags, being the commencements of the branches in process of formation.

Hab. Australia, Portland (*Mrs. Maccloud*).

The coral forms a bush 8 or 10 inches high.

The genus *Amathia* of Lamouroux and *Serialia* of Lamarck constitutes a very natural group, which may be divided into the following genera or subgenera:—

I. *Cells simple, in a straight cluster on the joints.*

1. Amathia.

Coral creeping; stems rarely forked; joints filiform, the upper half covered with one or two series of cells, terminal joint or tag simple or rarely bifid.

1. Amathia lendigera.

2. Amathella.

Coral arborescent, erect, repeatedly forked; joints short, rather incurved, covered with one or two series of cells; terminal joints or tags bifid.

* *Cells in two series.*

1. Amathella biserialis, Krauss.

Hab. S. Africa.

** *Cells in one compressed series.*

2. Amathella uniserialis.

3. Charadella.

Coral arborescent, erect, repeatedly trifid; joints moderate, rather incurved, upper side covered with one or two series of cells; terminal joint or tag trifid.

C. trifida.

Hab. Australia.

II. *Cells simple, disposed spirally on the articulations. Coral arborescent, forked.*

4. Serialia.

Coral arborescent, forked; articulation elongate, naked at the tail, cell-bearing above, subspiral; terminal joint bifid.

1. Serialia convoluta.

Hab. Van Diemen's Land.

5. Spiralia.

Coral arborescent, forked; articulations short, covered with crowded cells, forming together a nearly continuous spiral series of cells on the stem; tags indistinct.

1. Spiralia spiralis.

2. Spiralia unispiralis.

S. unispiralis, Holdsworth, MSS.

III. *Cells with an elongated horny process on each side, and disposed spirally on the articulations.*

6. Cornalia.

Coral arborescent, forked; articulations elongate, upper end with a crowded spiral series of cells, each armed with an elongated horny process on the side.

1. Cornalia Australasiæ.

Hab. Van Diemen's Land.

In 1850 Mr. Francis Brent sent me a Coralloid from Western Australia, which is exceedingly peculiar in its character; for though it is evidently allied to *Flustra*, it is so unlike, both in substance and appearance, any that I have before seen, that I feel assured it must form a distinct genus.

The specimen is not in as good a state as I could wish, I therefore placed it on one side for a time in hope that I might procure other examples that might more completely illustrate its structure; but as they have not occurred, I am now induced to bring it before the Society.

It may be thus described:—

Lichenella.

Coral frondose, erect, branched, hard, calcareous, and brittle; the stems and branches are convex on one side, and flat or rather concave on the other; the stem is broad and flat; the branches are narrow, with a more or less expanded thinner margin, which is dilated at the tip into broad foliaceous expansions, which are sometimes proliferous, giving out at the top a thin branch bearing an expanded tip.

The concave surface of the stem and branches are marked with the remains of squarish cells. The expanded ends of the branches are sometimes smooth on both sides; but generally they are marked externally with longitudinal grooves, and on the upper side furnished with longitudinal series of thin, rather calcareous, cells, which are each provided with a regularly circumscribed roundish mouth closed by a thin membrane marked with a central longitudinal depression. The smooth surface of the coral under the microscope exhibits closed transverse punctated undulated cross lines.

This coral has much more the appearance of a *Lichen* than of a *Flustra*.

1. Lichenella Brentii.

Hab. W. Australia (*F. Brent, Esq.*, 1850).

The coralloid is so very like the calcareous Alga named *Mastophora Lamourouxii* by Decaisne, from the same locality, that I am in doubt if it should be regarded as distinct from it. It differs from the usual specimens of that Alga in the leaf-like expansions being covered with cells on the upper surface, and longitudinally grooved on the under surface, the grooves forming the ridge between the cells on the upper side, while in the Alga both sides of the leafy expansions are smooth like *Pavonia*. I must, however, at the same time own that one or two of the expansions at the top of one or two of the branches are smooth like the Alga.

Can it be a specimen of *Mastophora Lamourouxii* in which the form of the leaves is changed by a parasitical coral, which causes the leaves to be radiately grooved longitudinally ?

July 13, 1858.—Dr. Gray, F.R.S., V.P., in the Chair.

On the Vespertilio suillus of Temminck, the type of the genera Murina (Gray) and Ocypetes (Lesson). By Robert F. Tomes.

Contemporaneously with the adoption of *Kerivoula* as a new genus, Dr. Gray gave the name of *Murina** to the species which Temminck had long before described under the name of *Vespertilio suillus*. During the same year, M. Lesson bestowed on it the generic appellation of *Ocypetes* †.

The departure in some of its external characters from the more ordinary species of *Vespertilio* was noticed by the original describer ; but as his genus *Vespertilio* was a very comprehensive one, no generic separation was attempted. At a later date, but before the appearance of the names proposed by Dr. Gray and M. Lesson, Count Keyserling and Prof. Blasius, in the arrangement of the *Vespertilionidæ* appended to their paper on European Bats published in the fifth volume of Wiegmann's Archiv, had placed this species by itself, immediately following their second group of the genus *Vespertilio*, as an aberrant form, but without any name.

Dr. Gray and M. Lesson, as above noticed, have made it the type of a new genus, for which each has advanced a name ; but the appearance of these names in one year, renders it difficult to ascertain which claims the priority—supposing that a name is required, which is by no means certain. As the name imposed by Dr. Gray has the advantage over that given by M. Lesson, of having an accompanying generic description, I should choose, if a name be required, to give it the preference, believing that the practice of making new genera by the mere alteration of a name, done in some instances in anticipation of the investigations of others, or on the mere chance of its

* Ann. and Mag. Nat. Hist. vol. x. (1842), p. 258.

† Nouv. Tab. Règ. Anim. p. 30 (1842).

turning out to be a genus, and without perhaps ever having seen the species, is a habit that cannot be too carefully avoided by the truth-seeking investigator.

At one time I was much disposed to adopt one of these names for the species under view; but a more intimate examination made me pause. I found that the external peculiarities on which the genus was founded were not supported by such characters in the cranium as I deemed essential to generic independence. But at the same time, as I have been able to examine a limited number only of specimens, and all of them in the state of skin, I scarcely hold myself qualified to determine this point with certainty, and therefore shall content myself with giving what I believe will be found a more complete description than has yet appeared, and with pointing out some affinities with other species, which have been overlooked,—believing that this species, like many others, is one of those that are ever and anon appearing, to warn the scientific zoologist that while he constructs generic and other divisions, and expands or contracts them here or there, moulding them to what he thinks they should be, nature, working to her inscrutable ends, presents such an infinite variety of forms, as, in their numberless and complicated affinities, to baffle and perplex the most determined systematist.

In proceeding to give the characters of this species, I shall first give those which may be supposed to be of generic or subgeneric value, followed by a list of synonyms, and these again by the notice of such peculiarities as appear purely specific. This paper will, by this arrangement, take the form of the other monographs which I have communicated to the Society.

The top of the head is but very little elevated above the facial line, just as in the group containing the *Vespertilio formosus, V. emarginatus, V. rufo-pictus,* and *V. Pearsonii*; and the muzzle is produced in about the same degree as in *V. formosus*. It has also about the same vertical thickness in relation to its breadth as in that species. The mouth and the end of the nose are also pretty much as in the examples of that group; but the nostrils have their margins so much produced as to have the appearance of two tubular excrescences, which, however, differ from the same parts in the Chinese examples of *V. formosus* (with which only I have compared it) in degree rather than in actual difference of form. The ears are rather large for the size of the animal, and are of a roundish oval form, with a regular outline, and without a trace of external basal lobe. In this respect they differ from those of the group above alluded to; but in the form of the tragus there is but a slight difference. It is straight, narrow, and pointed, but not so long; nor is the tip so acute.

The organs of flight are rather broad in relation to their length, and are furnished with a long and strong thumb having a very short basal phalange enclosed in a narrow piece of membrane extending from its joint along the upper surface of the index finger. Its second phalange is long, as in *V. formosus, V. emarginatus,* &c. The wing-membranes are said to extend the whole length of the foot, quite to the claws, which they certainly do in the specimen in the British Museum ; but in a specimen in my own collection they do not reach to the claws ; scarcely further than to the middle of the toes *. This I have been able to ascertain by softening the specimen ; but one in spirit is required to determine this point with accuracy. The feet themselves are rather long, and the toes are two-thirds of their entire length.

The tail is a little longer in relation to the size of the animal than it is in the species of the group with which I have found it most nearly allied, *i. e.* the group containing the before-instanced species, *V. formosus*, &c.

All the membranes are somewhat translucent ; those of the wings are rather distinctly veined ; and near to the sides of the body and legs they are marked with dotted lines, as is also conspicuously the case with the interfemoral membrane. The ears are faintly marked with small dots, but not nearly so much so as in *Kerivoula.*

The fur of the head extends uninterruptedly to near the end of the nose, in precisely the same manner as it does in *V. emarginatus* ; and there is a similar naked space around the eye. All the upper surface of the interfemoral membrane is hairy, as is also the upper surface of the wing-membranes near to the body ; but everywhere else the membranes are naked. On the back the fur is tricoloured ; on the under parts it is bicoloured.

In general form the cranium very much resembles that of *V. emarginatus* ; and in form and relative proportion the teeth are also similar, but differ in numbering one more premolar in the upper jaw, and one less in the lower. Their number may be thus stated :

$$\text{Inc. } \frac{2-2}{6}\text{; Can. } \frac{1-1}{1-1}\text{; Prem. } \frac{2-2}{2-2}\text{; Mol. } \frac{3-3}{3-3}=\frac{16}{18}.$$

Those of the upper jaw are arranged in two straight lines, which are nearly parallel ; and across the front opening of these the incisors are placed in pairs, of nearly uniform size, close together, with a very moderate interval on each side between them and the canines, and a moderate central opening. They are simple in form, with their cutting edges somewhat flattened. The canines are short and stout, somewhat conical, without accessory cusp or point, and with a feebly developed *cingulum* inside the tooth. Following these are two premolars, short and stout, and somewhat pyramidal in form, without internal lobe or projection. The following two molars are of the form so common in all the *Vespertilionidæ* ; but they, like all the other teeth, have their cusps less acute than is usual, and the inner ones rather less extended towards the central part of the palate. The last molar is of small size, and transverse in form.

In the lower jaw the teeth are, as may be inferred from those in the upper, arranged in two straight lines, a little narrower in front than behind. The incisors are of the ordinary form, and trilobed ;

* This specimen is one I purchased with other Indian mammals, which formed part of the collection made by Capt. Boys.

but the canines are very short and rather stout, and are furnished with an obtuse lobe on their inner surfaces sufficiently prominent to occupy a space equal in breadth to the two outer incisors on each side, behind and above which it may be seen when looking at the jaw in front. The same peculiarity occurs, but in a less degree, in the canines of the common *Noctule Bat*. The two next teeth are triangularly pyramidal in form, short and blunt, with faint indications of inner accessory cusps. Following these are the three true molars, requiring only to be noticed as having their cusps less acute than is usual.

VESPERTILIO SUILLUS, Temm.

V. suillus, Temm. Mon. ii. p. 224. pl. 56. f. 4, 5, 6, 1835–41; Wagn. Supp. Schreib. Säugth. i. p. 512, 1840; Keys. et Blas. Wiegm. Archiv, vi. p. 2, 1840.

Murina suillus, Gray, Ann. & Mag. Nat. Hist. vol. 10. no. 65. p. 258, 1842; Zool. Voy. Samar. no. 5. p. 9, 1849; Gervais, Voy. Castelnau, Mamm. p. 78, 1855; Horsf. Proc. Zool. Soc. pt. 24. p. 394, 1856.

Ocypetes suilla, Less. Nouv. Tab. Règne Anim. p. 30, 1842.

Noctulinia lasyura, Hodgs. Journ. A. S. Bengal, no. 182. p. 896, 1847.

On all the upper parts, with the exception of the interfemoral membrane, the fur is tricoloured, brown at the base, succeeded by pale rufous, and with the ends of the hairs of a brighter and deeper tint of the same colour; and in the specimen in the British Museum the extreme tips are a little paler, giving an indication of a fourth colour. The hair on the interfemoral membrane is of a uniform light brownish-rufous colour. Beneath it is bicoloured, dark brown at the base, with its terminal third brownish cream-colour, but rufous on the humeral region. The specimen in the British Museum (included in Dr. Gray's Catalogue) has the fur much more distinctly marked with the different tints than the one in my own collection, in which they are very faint. The specimen in the Museum of the Hon. East India Company, collected by Mr. Hodgson in Nepal, and forwarded with the name of *Noctulinia lasyura* attached, has the colours well-marked. This, with the one in the National Collection, is decidedly smaller than the one in my own collection. M. Temminck's specimen would seem to be smaller than either; but I cannot find any other disparity, excepting that of size, sufficiently marked to establish the existence of a second species. Probably the smaller island example, from which M. Temminck took his description, may hold the same relation to those from the continent of India, which the smaller specimen of *V. Pearsonii* from Amboyna does to those collected by Dr. Pearson at Darjeeling, of which I have spoken in a previous communication.

In the following Table the dimensions of column No. 1 are those of the specimen in the British Museum; those of No. 2 are from the one in my own collection (collected by Capt. Boys); No. 3 from M.

Temminck's description, but reduced to English measure; and No. 4 from Mr. Hodgson's description of *Noctulinia lasyura*. A specimen bearing the latter name having been forwarded by that gentleman to Dr. Horsfield, has enabled me to identify it with the *V. suillus* of M. Temminck.

	1.		2.		3.		4.	
	in.	lin.	in.	lin.	in.	lin.	in.	lin.
Length of the head and body...	2	2	2	0	1	9	2	6
——— of the tail	1	6	......		0	$8\frac{3}{4}$	1	9
——— of the head..............	0	8	0	9	......		0	$11\frac{1}{3}$
——— of the ears	0	$4\frac{3}{4}$	0	7	......		0	$8\frac{1}{4}$
Breadth of the ears..............	......		0	$5\frac{1}{2}$				
Length of the tragus	0	$3\frac{1}{4}$	0	4				
——— of the fore-arm	1	2	1	$5\frac{1}{4}$	1	1	1	9
——— of the arm	......		......		......		1	$1\frac{1}{2}$
——— of the longest finger ...	2	4	2	9	......		3	3
——— of the fourth finger ...	......		2	2				
——— of the thumb	0	5	0	5				
——— of the tibia	0	7	0	8				
——— of the foot and claws...	0	$3\frac{1}{2}$	0	$4\frac{1}{2}$				
Expanse of wings.................	9	2	10	9	7	9	13	0

Hab. Java, Sumatra, and the continent of India.

Although Mr. Hodgson has forwarded an unquestionable example of this species under the name of *Noctulinia lasyura*, yet the dimensions which are appended to his description are more nearly those of *V. Pearsonii*. It is quite possible that the two may have been confounded.

During the examination of this singular species, its affinities with the group consisting of *V. formosus*, *V. emarginatus*, *V. rufo-pictus*, and *V. Pearsonii* became sufficiently manifest. The general form of the head and face, of the tragus, of the organs of flight and the members of support, the quality and distribution of the fur, but, more than all, the general conformation of the cranium and the shortness of the teeth, are points of essential resemblance,—whilst the differences are, with the exception of that in the number of the premolars, purely external. So external are they, that a neat hand, with the assistance of a pair of scissors and a sharp knife, might speedily, with very slight alteration, remove all the external peculiarities of *Murina*. If a very small piece were scooped out of the outer margin of the ear, it would resemble that of *V. Pearsonii*; if the prominent rim of the nostril were reduced a little, the nose and face would precisely resemble the same parts in *V. formosus*; and if a mere scrap of membrane were taken from the margin of the wing near to the toes, reducing it to the base of the latter, the change would be complete.

The more important difference therefore consists in the presence of an additional premolar in the lower jaw, and the absence of one in the upper jaw.

Mr. W. H. Flower exhibited a flying fish (*Exocetus volitans*), to which was attached a specimen of *Penellus Blainvillii* (Milne-

Edwards, Nat. Hist. des Crustacés)—*Leoneopenna Blainvillii* of Lesueur. The latter was $2\frac{1}{2}$ inches long; the head and three horn-like processes were buried in the muscular mass on the right side of the spinal column of the fish, and the whole of the exposed part gave lodgment to a colony of little Cirripeds—*Conchoderma virgata*, Spengler, sp. (Darwin's Monograph of *Cirripedia*); these were of various sizes, the largest measuring 9 lines in length.

When first caught they were all living, and being placed in a basin of sea-water, exhibited beautifully the characteristic motions of the cirri; while a circulation was also observed in the Lernead.

The specimen was taken in the Atlantic Ocean, about 5° 17′ south latitude, and brought home by Mr. Walter Crisp, Surgeon to the 'Monarch,' East Indiaman.

MISCELLANEOUS.

On Electra verticillata, *with a Notice of its different Forms of Growth.* By E. W. H. Holdsworth, F.L.S., F.Z.S. &c.

The fact that but little attention has been given to a remarkable variety of growth in *Electra verticillata* must be my apology for bringing before this Society an animal that was first noticed more than seventy years ago. Ellis described this species in 1786, under the name of "*Flustra verticillata*," or the "Basket-work Sea Mat," from a specimen that he received from the Mediterranean; and he was followed by other naturalists, who retained the same title for it. In 1824 Lamouroux's translated work 'Corallina' was published in England, from which it appears that, observing the branched polypidoms and verticillate arrangement of the cells in this species, he proposed a genus for its reception under the name of *Electra*; and in this he was supported by many subsequent writers, including Risso, Cuvier, and Blainville,—the last-mentioned author, however, stating that *Electra* could hardly be separated from *Flustra*.

Its true position appears to be close to *Membranipora*, but distinct from it on account of the regular transversely linear arrangement of the cells under all its varieties of growth; this will especially distinguish it from *Flustra*, and in a less degree from *Membranipora*, where the quincuncial disposition of the cells is not so uniformly observed, and their arrangement is more frequently irregular. I am inclined to consider Lamouroux's view of the case correct, and shall therefore retain the name that he proposed for the genus.

Several naturalists have mentioned the occasional growth of *Electra* in subcompressed linear fronds; but the only published figures of the species that I know—those of Ellis, Lamouroux, and Blainville—are all taken from the cylindrical variety, which appears to have been considered as typical. My own experience of *Electra* rather points to this encrusting of slender branching sea-weeds as exceptional, and the suberect ribbon-shaped fronds as being the most common form. I have only observed the species in one locality however—on the northern shore of Portugal, near Oporto, where the free compressed variety is abundantly met with in a dried state on the beach; fourteen specimens were obtained of this shape, and only one was found of the cylindrical form usually described. The early growth of the polypidom, however, is undoubtedly encrusting, and generally on *Fucus*; but after the formation of a few cells on the surface, the erect form is assumed, and dense clusters of narrow ribbons spring up, with occasional branches budding from their edges, each ribbon being composed of a double layer of connected opposite cells, placed in transverse parallel rows of 10 or 12 in each. The cells are compressed and cup-shaped, with the walls minutely punctured, and have the margin surmounted by several irregularly-placed erect denticles, and a long curved vibraculum inserted a little below the anterior edge. In the ribbon-shaped variety, these vibracula are generally aborted on alternate rows; but in such cases the external cells are protected by the development of the denticles into conspicuous spines.

The variety of *Electra* usually described and figured consists simply of the disposition of the cells over the cylindrical branches of some sea-weed, and not, as has been stated by one author, "around an ideal centre."

According to Lamouroux, the polypidom in a living state is of "a red-violet colour; but when exposed to air and light, it becomes an earthy white." The polypes are probably the same as in *Membranipora*.

Electra appears to be widely distributed; for it is said to be common in the European Seas, and I believe Prof. Busk has received it from the Cape of Good Hope.—*Proc. Zool. Soc.* June 8, 1858.

On the Reproduction of Nemertes Borlassii. By William Beattie, Esq.

On the last week in February, Commander Lysaght, of the Coast Guard, brought me from one of the fishermen on the coast a very long specimen of *Lineus longissimus* (*Nemertes Borlassii*); after keeping the animal alive four days, it produced a young one 18 inches long and about $\frac{2}{3}$rds of a line or $\frac{1}{18}$th of an inch in diameter, of a cream-colour. Both lived for nearly a week; but in consequence of my illness the water was not changed, and the little creature died and was considerably decomposed before I knew. I have the remains in spirits. At first I fancied it must be an intestinal worm; but its habits were the same as the supposed parent.

Dr. Baird has examined the specimen produced by the *Nemertes*. It is not in a good state; but he is satisfied that it is not an *Ascaris* or *Filaria*, and thinks that it is very probably the true young of the *Nemertes*.—*Proc. Zool. Soc.* June 8, 1858.

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[THIRD SERIES.]

No. 15. MARCH 1859.

XIX.—*On the Mammoth-tree of Upper California.* By Berthold Seemann, Ph.D., F.L.S.

When, at the conclusion of the Mexican war, Upper California was ceded to the United States of America, a report that the newly transferred territory was teeming with gold suddenly changed lonely forests into busy mining districts. Exploring parties of adventurous immigrants spread over the face of the whole country, and many a valley and creek never before trodden by the foot of the white man was visited, in hopes of reaping there an abundant harvest of the precious metal. Stories of most wonderful discoveries soon filled every newspaper, some of which proved utterly fictitious, while, again, others seemed to bear out the old adage that "truth is stranger than fiction." But, as often happens, fiction was in many instances implicitly believed in, whilst the sober truth was absolutely rejected. Among the statements which shared the latter fate was that of an adventurous Californian, who, penetrating into the recesses of the Sierra Nevada, had met, near the head-waters of the Stanislaus and San Antonio rivers, with a grove of trees rivalling, if not surpassing in height the highest buildings in the universe. So little, indeed, was it believed, that even the name of the discoverer is not known, unless we accept a Californian tradition which points to J. M. Wooster, and is so far borne out by actual evidence, that there exists on one of the trees, now termed "Hercules" by the people, the inscription of "J. M. Wooster, Ju. 1850." Soon afterwards this extraordinary grove, which henceforward obtained the name of "the Mammoth-tree Grove," from the vegetable giants being called the "Mammoth-trees," was visited repeatedly, and the accuracy of the rejected statement was ascertained beyond a doubt. Strangers from all parts of the country now thronged to the place, making it quite a fashionable resort of Californian society, and inducing Mr. Wm. W. Lapham to establish there, as early as July 1853, a hotel, with all the comforts the nature of the country would admit of. About the same time Mr. William Lobb, the botanical collector of Mr. Veitch's Nursery at Exeter and Chelsea, visited the grove, and did not fail to procure leaves, cones, specimens of the wood, and an excellent sketch of one of the trees (drawn from nature by Mr. Wm. W. Lapham). These materials, having been transmitted to England, were placed at the disposal of Dr. Lindley, who thought he recognized in them a new genus of *Coniferæ*, on which he conferred, in commemoration of the Duke of Wellington, and in consideration of the huge size of the tree, the name of *Wellingtonia gigantea*.

It was supposed, at the time when the first scientific accounts were published in England, that this tree might possibly be identical with a *Taxodium* described by the unfortunate Douglas, in one of his letters to Sir William J. Hooker (Bot. Mag. Comp. ii. p. 150), as imparting to the mountains of California a most gloomy appearance, and attaining the height of 300 feet. Douglas had transmitted no specimens with his account; but a barren branchlet of *Pinus* (*Abies*) *bracteata*, Don, was thought by Sir W. J. Hooker to be part of the plant alluded to, and figured by him in the 'Icones Plantarum,' t. 379, as *Taxodium sempervirens*. This mistake was afterwards corrected by the author of it himself, but unfortunately not until Endlicher (Synopsis Coniferarum, p. 198) had founded a new species of *Sequoia* (*S. gigantea*, Endl.) upon this figure, with which he also coupled Douglas's account. The referring of Hooker's figure to its proper species (viz. *Pinus* (*Abies*) *bracteata*, Don) left it again doubtful to which plant Douglas's account referred, and justified in a measure the supposition of Dr. Lindley and others that it might possibly apply to the newly discovered Mammoth-tree; but this supposition has not been verified. Douglas, in saying, "The great beauty of Californian vegetation is a species of *Taxodium*, which gives the mountains a most peculiar, I was almost going to say awful, appearance—something which plainly tells us we are not in Europe," evidently alludes to rather a common plant, such as the Redwood (*Taxodium*, or now *Sequoia sempervirens*) really is in the mountains of Upper California; he cannot possibly speak of the Mammoth-tree, as that, if not confined to the grove called after it, is at all events very local. We are, besides, furnished with a historical proof that Douglas's account does not relate to any other plant than the Redwood (*Sequoia sempervirens*, Endl.). Mr. W. Lobb, who avows himself perfectly familiar with the route followed by Douglas, has shown (Gardeners'

Chronicle for 1854, p. 22) that that enterprising traveller was not within 120 miles of the Mammoth Grove; and in the other localities in which the tree has as yet been discovered, it has not been found attaining the height which Douglas records. We may therefore fairly conclude that Douglas did not see the Mammoth-trees, and that until the year 1850 these monsters of the vegetable creation were totally unknown to Europeans.

The generic name of *Wellingtonia* did not meet with approbation in the United States. The Americans would have felt more pleased if George Washington, the father of their great Republic, had been commemorated in the nomenclature; and they even commenced in their newspapers an agitation against the adoption of the name "*Wellingtonia*," quite ignoring that the savans of their country bow to the same code of scientific laws which govern the conduct of their European brethren, and that no amount of popular clamour could cause the right of priority here at stake to be set aside. When, therefore, Dr. Winslow exhorted his countrymen, in grandiloquent language, to call the Mammoth-tree, if it be a *Taxodium*, *T. Washingtonianum*,—if a new genus, *Washingtonia Californica*,—he simply proclaimed to all the world that he knew nothing whatever of the laws governing systematic botany. The genus *Wellingtonia* would have suffered nothing from this and similar attacks if otherwise it had enjoyed a firm foundation. Such, however, was not the case. When more perfect specimens of the tree than were (in 1853) at Dr. Lindley's disposal came to hand, it was found that the Mammoth-tree (*Wellingtonia gigantea*, Lindl.) presented the same generic characters as the Redwood (*Sequoia sempervirens*, Endl.), and that consequently *Wellingtonia* must henceforward be considered merely as a second species of *Sequoia*. As far as I am aware, there are only three botanists who have maintained, in print, the untenability of the genus *Wellingtonia*,—Torrey, Decaisne, and myself. Torrey seems to have been one of the first who received specimens of the tree, and who arrived at the conviction that he had before him a new species of *Sequoia*. But he refrained from publishing it; nor did he, after the institution of *Wellingtonia*, make it generally known; he communicated it, however, to several of his friends, among them Asa Gray; and it was the latter who first stated, in the 'American Journal of Science and Arts' (Second Series), vol. xviii. p. 286, that Torrey had given to the Mammoth-tree the name of *Sequoia gigantea*; and in August 1855, Dr. Torrey made to the American Association for the Advancement of Science a communication to the same effect. This remark is the more necessary, as Dr. Torrey, in the 'Report on the Botany of Whipple's Expedition' (Washington, 1857), p. 84 [140], refers to a paper of his, in 'Silliman's Journal,' on the subject, which would naturally lead us to expect that the name had there been published by him. But such is not the case, as a careful search of the said journal, and a conversation with Dr. Torrey during my last visit to New York (1857) enable me to state. The first time that the name of *Sequoia gigantea* occurs in Dr. Torrey's *own* writings is in the Report just quoted, where, after alluding to Dr. Bigelow's Report (not yet received in Europe?) for a full account of the tree, he says:—"We have shown that in this tree, as in many species of *Juniperus*, the leaves are dimorphous; we have also proved that there is no generic distinction between the two trees (viz. *S. gigantea*, Torrey, and *S. sempervirens*, Endl.). The male aments of *S. gigantea*, which were not known to Lindley and Hooker, prove to be in all respects like those of *S. sempervirens*." Torrey's views were borne out by Decaisne in a communication to the Botanical Society of France (Bull. de la Soc. Bot. de France, i. p. 72, 1854). Finally, after examining the specimens in the Museum at Kew, and some that had come into my possession, I stated that *Wellingtonia* was a congener of *Sequoia sempervirens* ('Bonplandia,' iii. p. 27, in adnot. Jan. 15, 1855), at the same time changing the name into *Sequoia Wellingtonia*, Seem. The time has now arrived when it must be decided which of the three names (*Wellingtonia gigantea*, *Sequoia Wellingtonia*, or *Sequoia gigantea*) is to be adopted. After every doubt respecting the generic identity of the Redwood and the Mammoth-tree has been dispelled, there cannot be two opinions about the retention of the name *Wellingtonia gigantea*; it must be given up, and one of the others take its place. My reasons for rejecting the specific name "*gigantea*" were to avoid a possible confusion with that strange compound, the *Sequoia gigantea* of Endlicher, which belongs, as a synonym, partly to *S. sempervirens*, Endl., partly to *Pinus* (*Abies*) *bracteata*, Don. Torrey, not taking this danger into consideration, retained Lindley's specific name, which, under any other circumstances, would have been the only true course to follow. I am fully aware that, by putting *S. gigantea*, Torrey (nec Endl.!), and *S. gigantea*, Endl. (nec Torrey!), that danger may be guarded against, as is done in numerous instances, and that my name would have no chance of being adopted on that account alone. But it has, besides, the recommendation of enjoying the right of priority; for, as I have stated, although Dr. Torrey was undoubtedly the first who determined the true systematic position of the tree under consideration, he did not publish his name until 1857, whilst mine was published in January 1855. The synonymy of the Mammoth-tree and its ally, the Redwood, will therefore stand as follows:—

Sequoia, Endl. Synop. Conifer. p. 197 (1847); Gen. Plant. Suppl. iv. pars ii. p. 7. n. 1808 (1847). *Condylocarpus,* Salisb. MSS. *Taxodii* sp., Lamb.

1. *Sequoia Wellingtonia,* Seem.* Bonpl. iii. p. 27, in adnot. (1855).

Wellingtonia gigantea, Lindl. in Gard. Chronicle for 1853, p. 823 (1853); Hook. Bot. Mag. t. 4777, 4778 (1854); Van Houtte, Flor. des Ser. ix. p. 93, t. 892, 893, & p. 121, t. 903 (1853–54).

Washingtonia Californica, Winslow in Californian Farmer for 1854; Hooker's Journal of Bot. and Kew Misc. vii. p. 29 (1855).

Taxodium Washingtonianum, Winslow, *ibid.*; Hooker's Journ. *l. c.* (1855).

Sequoia gigantea, Torrey (nec Endl.!) in Rep. on Bot. of Whipple's Expedition, p. 84 [140] (1857).

Nomina vernacula: *"Mammoth-tree," "Big tree," "Wellingtonia."*

2. *Sequoia sempervirens,* Endl. Synop. Conifer. p. 198 (1847).

Taxodium sempervirens, Lamb. Pin. ii. t. 64.

Taxodium Nutkaense, Lamb. Herb.

Taxodium, sp., Dougl. in Bot. Mag. Comp. ii. p. 150 (1836).

Sequoia gigantea, Endl. (nec Torrey!) Synop. Conifer. p. 198 (1847).

Nomen vernaculum: *"Redwood."*

* The entire literature of the Mammoth-tree is already very voluminous, and, as far as it is known to me, may be here subjoined:—

American Journal of Science and Arts (Second Series), xvii. p. 440; xviii. pp. 150, 286; xx. p. 281; xxiv. p. 440.

Bonplandia, ii. p. 238; iii. p. 27; vi. p. 343.

Botanical Magazine, t. 4777, 4778.

Bulletin de la Soc. Bot. de France, i. p. 72 (1854).

Flore des Serres et des Jardins, ix. p. 93, t. 892, 893, p. 121, t. 903.

Gardeners' Chronicle and Agricultural Gazette for 1853, pp. 819, 823; for 1854, pp. 22, 40, 118, 134, 373; for 1855, pp. 7, 69, 83, 838; for 1856, pp. 260, 502, 518, 534, 567, 580, 631, 643, 694, 726, 742, 774, 790, 805; for 1857, pp. 517, 534, 550, 678, 629, 643; for 1858, pp. 671, 686, 702, 717, 733, 814.

Hamburger Garten- und Blumenzeitung, x. pp. 61, 139, 239, 423, 439; xi. p. 120; xii. pp. 235, 489; xiii. pp. 93, 158; xv. p. 12.

Hooker's Journal of Botany and Kew Garden Miscellany, vii. p. 26; viii. pp. 106, 150.

Mammoth-tree from California, by George L. Trask: 4to, 4 pp. (Two pamphlets issued to the visitors when the bark of the tree was exhibited in the Philharmonic Rooms, Newman Street, Oxford Street, and Adelaide Gallery, Strand, London, and containing numerous extracts from the New York and London newspapers in reference to the tree.)

Report on the Botany of Whipple's Expedition, by John Torrey, p. 84 [140]. Washington, 1857.

The Mammoth-tree is rather local in its geographical range. True, Carrière states that an officer of the French navy brought cones identical with those obtained in California from a latitude about 10 degrees north of the locality in which it was first discovered; but as no difference between the cones of *Sequoia sempervirens* (a common tree in that latitude) and *S. Wellingtonia* has as yet been pointed out, the evidence adduced cannot be looked upon as conclusive. More probable seems the statement that *Sequoia Wellingtonia* has been met with in Carson Creek, a few miles northward of the Mammoth-tree Grove, and that of its having been observed in various other parts of the Sierra Nevada, where, however, according to the unanimous testimony of the various accounts, it does not attain those gigantic dimensions we are wont to associate with it. It is beheld in the greatest perfection in the Mammoth-tree Grove, situated near the head-waters of the Stanislaus and San Antonio rivers, in the county of Calaveras, latitude 38° N., longitude 120° 10′ W., at at elevation of between 4000 and 5000 feet above the sea, and about fifteen miles from Murphy's Camp, the nearest gold-diggings, ninety-five from Sacramento city, and eighty-five from Stockton (by stage route). In visiting the place, the traveller can obtain vehicles and animals at Murphy's Camp, and proceed to his destination by carriage-road, gradually ascending, through a splendid forest of pines, cedars, and firs, here and there dotted with fine oaks. The valley in which the grove is situated contains about 160 acres of land, and, according to Winslow, is a basin of coarse siliceous material surrounded by a ridge of syenitic rock, which in some places projects above the surface. The soil is a rich and very deep-black loam. The climate is delightful. During the summer it is entirely free from the scorching heat of the lower country, the vegetation remaining fresh and green, while the water is as pure as crystal and almost as cold as ice. The vicinity, we are assured, offers every inducement to sportsmen, many kinds of game abounding, while the brooks teem with excellent trout. Delightful horse-back rides conduct the visitor to the Falls of San Antonio, the basaltic cliffs on the North Fork of the Stanislaus, and other interesting points of scenery and objects of curiosity.

Things are easiest judged of by comparison; and what proclaims loudly the enormous size of our vegetable giant is its growing in a country as distinguished for huge trees as Kentucky and Virginia are for tall men. Bateman has attempted more special comparisons, strikingly illustrated in a series of diagrams which he exhibited in a lecture on the subject at Congleton, and afterwards in the rooms of the Horticultural Society of London. One of these diagrams (on the scale of

1 foot to 10 yards) represented a Mammoth-tree 300 feet high, and a ladder of a common length, with a man half-way upon it, leaning against the trunk: by comparison the ladder assumed the appearance of a walking-stick, the man that of a beetle. More fully to illustrate these extraordinary dimensions, sketches had been drawn of some of the tallest buildings in the world,—the Pyramids of Egypt, St. Peter's at Rome, Salisbury Cathedral, and St. Paul's in London,—showing that the Mammoth-tree contested the palm with St. Peter's, and was but a small distance below the Pyramids. In a comparison with other trees, the Californian giant came off equally victorious: the highest Palm dwindled down to the appearance of a sugar-cane, the Spruce to that of a juniper, and even the far-famed Cedar of Lebanon to that of a mere bush. A quotation of the absolute height of the *Sequoia Wellingtonia* is equally calculated to impress us with amazement. Most of the specimens now standing at the Mammoth Grove attain the average height of 300 feet; but one of them—known as the "Mother of the Forest," and stripped of its bark to the height of 116 feet for the purpose of being publicly exhibited—actually measures 327 feet in height and 90 feet in circumference; or, if we are disposed to credit the statement put forward by the exhibitor of the bark in New York and London, its full height is 363 feet, diameter at base 31 feet, and diameter 100 feet from the base, 15 feet. Enormous as these dimensions may be, they are as it were put in the shade by remembering what those of another tree must have been when in full vigour. This "Father of the Forest," as the specimen has been appropriately termed, measuring 112 feet in circumference at the base, can be traced 300 feet, where the trunk was broken by falling against another tree: it here measures 18 feet in diameter; and, according to the average taper of the other trees, this giant must have been about 450 feet, and was no doubt one of the highest vegetable forms of the present creation.

Other Coniferæ often attain an enormous size, as for instance the Redwood (300 feet), or the *Pinus Lambertiana*, Dougl. (150–200 feet and more); and some of the Gum-trees of Van Diemen's Land are 215 feet high; but they are all topped by a fully developed Mammoth-tree. The mind involuntarily asks how many years were requisite to pile up such mountains of vegetable cells, and begins to speculate on the possible age of such monsters. When the Mammoth-tree first came into notice, it was assumed to be 3000 years old; or, in the editorial language of the 'Gardeners' Chronicle, "it must have been a little plant when Samson was slaying the Philistines, or Paris running away with Helen, or Æneas carrying off good Pater Anchises upon his filial shoulders." Subsequent investigations, however, have proved his assumption to be erroneous. The *Sequoia* under consideration is evidently a fast-growing species, performing, according to the careful observations made by J. Reed of Peterborough, its growth between 6 P.M. and 6 A.M., and retarding and increasing in proportion to the warmth of the night. Plants raised from the seeds brought to England towards the end of 1853, had already in 1857 attained 6 feet in height, thus having grown in every year about $1\frac{1}{2}$ foot; so that if they continue growing at the same rate, it would require two hundred years to produce a tree 300 feet high. But it is a well-known fact that the growth does not proceed at such a uniform rate; and no process except that of counting the annual layers of the trunk can be applied for the purpose of computing the age of these trees. Asa Gray, in a paper on the age attained by the largest known trees, has attempted to do this; unfortunately, the section of the trunk exhibited at Philadelphia, and supplying him with the principal data, was not that of the *Sequoia Wellingtonia,* as he at the time believed, but that of the *Sequoia sempervirens**; and it is probably owing to this mistake that the

* By carefully bearing in mind that the trunk exhibited at Philadelphia was that of *Sequoia sempervirens,* and not that of *S. Wellingtonia,* Gray's article, weeded of all matter arising from the confusion of the two species, may still be made to bear indirectly upon the questionable age of the Mammoth-tree. This I have attempted to do in the following. Gray says:—"The size of this tree is such as to give it a presumptive claim to rank amongst the oldest of the present inhabitants of the earth, its length being (on the authority of the proprietor of the section) 322 feet. ...... This section was taken at the height of 25 feet from the ground, and, according to the measurement of my friend Thomas P. James, Esq., of Philadelphia, it is about $12\frac{1}{2}$ feet in diameter, including the bark. Mr. James, at my request, has taken a careful measurement of the wood itself, excluding the bark. The three diameters taken by him respectively measure 9 feet 6 inches, 10 feet 4 inches, and 10 feet $10\frac{1}{2}$ inches; the average diameter of the trunk, at the height of 25 feet from the ground, is a little over 10 feet 3 inches..... The section of the trunk at Philadelphia has been hollowed out by fire and other means to a shell of 3 or $4\frac{1}{2}$ inches in thickness. Of this I have, through the kindness of the proprietor and of Mr. James, a piece of the wood, including nearly 3 inches of this section. What is now wanted, and what, unfortunately, I do not possess, is a foot or two of the wood from the central parts of the tree,—a desideratum which may doubtless be supplied hereafter. The data at hand, however, will suffice for determining an age which the tree cannot exceed, unless it be supposed to have grown more slowly during the earlier $\frac{9}{10}$ths of its existence than during its later years, which is directly contrary to the ascertained fact in respect to trees in general. Now, the piece of wood in my hands exhibits an average of forty-eight layers in an inch. The semidiameter of the trunk at the place where it was taken is about 5 feet 2 inches. If the tree increased in diameter at the same rate throughout, there would have been 2976 annual layers, which, allowing twenty-four years for the tree to have attained the height of 25 feet, would give it an age of 3000 years from the seed. This

scientific public still fancy the age of 3000 years, originally allotted to the tree in question by vague computation, may still be considered as correct,—quite overlooking that Dr. Torrey, counting the layers on a complete radius of another trunk, about the genuineness of which there was no doubt, has furnished the following data:—

"The 1st hundred	layers	occupy a	breadth of	$17\frac{1}{2}$	inches.
2nd	"	"	"	14	"
3rd	"	"	"	$12\frac{1}{2}$	"
4th	"	"	"	13	"
5th	"	"	"	$16\frac{1}{4}$	"
6th	"	"	"	$8\frac{3}{4}$	"
7th	"	"	"	$7\frac{3}{4}$	"
8th	"	"	"	11	"
9th	"	"	"	10	"
10th	"	"	"	11	"
11th	"	"	"	$11\frac{1}{4}$	"

The remainder of 20 layers occupies over 1 inch: 1120 layers

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corresponds so closely with Dr. Lindley's estimate [of *Sequoia Wellingtonia*!], that we may suppose him to have employed equivalent data in a similar manner. How great a deduction must we make from this estimate, in consideration of the greater thickness of the layers on a younger tree? The only direct data I possess bearing on this point are derived from a piece of a transverse section, $3\frac{1}{2}$ inches deep, of a 'rail,' which the exhibitor says was taken from the trunk at the height of 275 feet from the ground. As its layers, on a breadth of nearly $\frac{7}{8}$ths of an inch, show only a slight curvature, it must have come from a part of the trunk still several feet in diameter. On this section, the exterior inch, nearly all alburnum, contains 90 layers, the next 60, the next 45, the remaining half-inch 16, making 32 to the inch. That the exterior layers should be thinner at this height than more near the base of the tree, is just what would be expected. If we apply this ratio of decrease of the number of layers to the inch as we proceed inwards to the section of 25 feet from the ground, we should, at 4 inches within that part of the circumference which I have examined, have only seventeen layers to the inch, which, taken as the average thickness, would make the tree only $1034 + 24 = 1058$ years old. But it is not probable that the thickness of the layers increases so rapidly. The data we possess on other trees go to show that a tree, after it is 400 or 500 years old, increases in diameter at a pretty uniform rate for each twenty additional years, on the whole, although the difference of the thickness of any two or more contiguous layers, or the same layer in different parts of the circumference, is often very great. Still, when we consider how very much thicker are the annual layers of a vigorous young tree than of an old one, perhaps we should not be warranted in assuming more than the average of seventeen layers to the inch for the whole section. Some useful data may be obtained from a tree more nearly related than any other to those of California, though of a different genus, namely the so-called Cypress of our Southern States (*Taxodium distichum*, Rich.). I possess three sections of different trees of *Taxodium*, reaching from the centre to the circumference.

on the semidiameter of 135 inches, or 11 feet 3 inches. We have ventured to reduce by more than one-third the accredited statement or estimate that this tree was 3000 years old. The facts show that the tree lacks almost three centuries of being half as old as it was said to be! Its enormous size is owing to its continued rapid growth rather than to any extraordinary age." The Mammoth-tree, therefore, so far from having been a contemporary of the unhistorical personages whom Homer's immortal songs have made famous, has sprung up in quite a historical epoch—a few centuries after the commencement of the Christian era; and, moreover, its still considerable age is equalled, if not surpassed, by its congener the Redwood (*Sequoia sempervirens*, Endl.).

The tenacity of life keeps equal pace with the vitality of the tree. One of the specimens in the Mammoth Grove has been stripped of its bark to a height of 116 feet, but, we are assured, without being in the least affected in its growth; and most of the other specimens there have, in consequence of the fires raging through the forest, or perhaps the fires kindled by the Indians, burnt cavities, a few of which are sufficiently large to admit a person on horseback to enter, and they are moreover 40 feet deep; but the trees do not seem to have suffered particularly from this. In some of the dead, fallen-down trunks, cavities 200 feet long [caused by age?] can be traced. The large tree, felled by speculators, put forth several young shoots after it had been felled for some time (conf. Bonpl. ii. p. 238). Such an almost willow-like tenacity of life is met with in but a few *Coniferæ*, and may with justice be counted among the most prominent peculiarities of the *Wellingtonia*.

The wonderful inventions and discoveries of our age have in more than one instance outstripped all limits of poetic fancy.

One of these, on an average radius of 27 inches, exhibits 670 layers; a second, on a radius of 30 inches, has 525; a third, on a radius of 22 inches, has 534 layers. The average is 576 layers to a semidiameter of 26 inches, or about 22 layers to an inch. Half of this growth (13 inches radius) was attained at the close of the first century, while the exterior layers of the oldest specimen were only the 15th or 16th of an inch in thickness....... We may safely infer, I think, in the absence of other data, that when the tree in question had attained the size of 26 inches in semidiameter, it was only 576 years old. If, therefore, we suppose it to have increased at the intermediate ratio of thirty-five layers per inch for the next 26 inches, and at the actual rate of the last century (as ascertained by inspection), namely at forty-eight layers per inch for the remaining 10 inches, we should assign to it the age of 2066 years as its highest probable age. I think it more likely to be shown, when the wanting data are supplied, that the tree does not antedate the Christian era."—Asa Gray, in American Journal of Arts and Science. Second series, vol. xvii. p. 440 (1854).

By means of the electric telegraph, we have outdone Puck's startling promise to

> "put a girdle round about the earth
> In forty minutes;"

and our Californian giant more than rivals the tree placed by Milton in the hands of Satan as a lance,

> "to equal which,
> The tallest pine hewn on Norwegian shores,
> To be the mast of some great ammiral,
> Were but a wand."

But this very fact, the realization of much that was thought ideal, has engendered and nursed a desire to behold with our own eyes whatever belongs to this category. There probably never was a time in history when "sight-seeing" was regarded with more favour, or found readier advocates, than the present. Speculators were therefore not backward in making capital out of this state of feeling as applied to the Mammoth-tree. To transport masses of people to the grove was impossible; but to transport at least portions of the famous giants to the centres of our great cities, practicable. The latter, accordingly, was done; and the earliest accounts of the Mammoth-tree which reached Europe were coupled with the sad intelligence that a piece of Vandalism had been perpetrated in Upper California, unexpected in our enlightened days. One of the finest trees of the grove, we were informed, had been felled for the purpose of being publicly exhibited. This individual was 96 feet in circumference at the base, and solid timber. The work of destruction commenced by boring with augers and sawing the spaces between,—a labour engaging twenty-five men for five days. But when this was done, the tree was found to stand so nearly perpendicular that it would not fall; and it was only by applying a wedge and battering-ram, during a strong breeze, that the trunk was finally upset. In falling, it convulsed the earth, and by its weight forced the soil from beneath it, so that it lies in a trench; and mud and stones were hurled near a hundred feet high, where they left their mark on neighbouring trees. The bole forms the bed for two bowling-alleys. A section of 2 feet long taken from the stump, also a portion of bark, were both exhibited. The latter was put up in a natural form, and constituted a spacious carpeted room, containing a pianoforte, with seats for forty persons. On one occasion 140 children were admitted without inconvenience. The surface of the stump, still remaining in the ground, is smooth, and affords ample space for thirty-two persons to dance, it being 75 feet in circumference; theatrical performances have also been given upon it on various occasions. It is covered by a rustic arbour, and connected by a floor with the Mammoth-tree Hotel, founded by Mr. Lapham, to whom we are indebted for much valuable information respecting the plant under consideration. The success with which the public exhibitions of these specimens in San Francisco, New York, and Paris had been attended, induced, in 1854, another speculator to strip a second magnificent tree, called the "Mother of the Forest," up to a height of 116 feet, of its bark, fortunately without affecting by this ruthless process the vitality of the tree. It required the labour of five men ninety days. During this time a person had a fall of 100 feet from the scaffolding, and, curiously enough, escaped with a broken limb. The bark was removed in sections 8 feet in length, and each piece marked and numbered, so that it could be put up in precisely the same position that it occupied on the tree. It was then, after being carted eighty miles overland, shipped down the river to San Francisco, and thence on a clipper vessel around Cape Horn to New York, where, after being exhibited for a season in the Crystal Palace, it was transmitted to London, and was for the first time on view, April 1856, in the Philharmonic Rooms, 14 Newman Street, Oxford Street, and afterwards at the Adelaide Gallery, Strand. But both of these localities were too low to admit of the whole section of the stripped bark being put up; nor, indeed, was there any other available building in the British metropolis which could serve this purpose. Fortunately the Crystal Palace at Sydenham possessed the necessary height; and ever since the autumn of 1856 the whole of the bark, to the height of 116 feet, has there been exhibited. The interior is fitted up with a table, chair, and other furniture, and forms a large and spacious drawing-room. Daguerreotypes and photographs of the tree and grove can also be seen, together with living specimens of the species; and if this exhibition on the one hand fills us with regret at the Vandalism of mercenary men, it on the other brings home to us the prodigious power of American vegetation.

It was at one time feared that not many years would elapse before the last vestige of the Mammoth-trees would be destroyed. It was the 'New York Herald' which, on the 17th of December, 1854, first pleaded for their protection. "We say," argued the 'Herald,' "that Congress should interpose, upon the presumption that these trees are public property, are on the public lands of California, and because Congress has already interposed to protect the public Live-Oak (*Quercus virens*) forests of Florida from the rapacity of unscrupulous speculators......We repeat that it is the duty of the State of California, of Congress, and of all good citizens, to protect and preserve these Californian monuments of the capabilities of our American soil." In Europe, the danger in which the trees were placed was viewed with equal apprehension, inducing a correspondent of the 'Gardeners' Chronicle' to suggest that a petition of the scientific men might be sent to the American Government, praying for the protection of this eighth wonder of the world. Fortunately the authorities were fully alive to their duty, by prohibiting the removal of any tree under any circumstances whatever, and thus, by throwing the sanctity of the law around the hallowed grove, preserved to North America an object quite equal in grandeur to the famed Falls of Niagara, the Mammoth Cave of Kentucky, or the Natural Bridge of Virginia.

The number of large specimens still standing in the Mammoth-tree Grove amounts to ninety-two, nearly all of which have received from the people some appropriate and romantic name. A few of the most prominent it may not be uninteresting to describe. After leaving the hotel, and proceeding into the forest by the upper trail, we are at once struck with the magnitude of the trees, and passing several immense specimens, we reach the "Miner's Cabin," measuring 80 feet in circumference, and attaining 300 feet in height. The "cabin," or burnt cavity, measures 17 feet across its entrance, and extends upwards of 40 feet. Continuing our ramble, admiring the luxuriant growth of underwood, consisting of firs, cedars, dog-wood, and hazel, we come to the "Three Graces." These splendid trees appear to grow, and perhaps do grow, from one root, and form the most beautiful group in the forest, towering side by side to the height of 290 feet, tapering symmetrically from their base upwards; their united circumference amounts to 92 feet; it is 200 feet to the first limb on the middle tree. The "Pioneer's Cabin" next arrests our attention, rising to the height of 150 feet (the top having been broken off), and 33 feet in diameter. Continuing our walk, we come to a forlorn-looking individual, having many rents in the bark, and withal the most shabby-looking in the forest: this is the "Old Bachelor;" it is about 300 feet high and 60 feet in circumference. The next tree is the "Mother of the Forest," already mentioned as having been stripped of its bark by speculators in 1854. We are now amidst the "Family Group," and standing near the uprooted base of the "Father of the Forest." This scene is grand and beautiful beyond description. The venerable "Father" has long since bowed his head in the dust; yet how stupendous even in his ruins! He measures 112 feet in circumference at the base, and can be traced 300 feet, where the trunk was broken by falling against another tree. A hollow chamber or burnt cavity extends through the trunk 200 feet, large enough for a person to ride through. Near its base is a spring of water. Walking upon the trunk, and looking from its uprooted base, the mind can scarcely conceive its prodigious dimensions, while on either hand tower his giant sons and daughters. Passing onward, we meet with the "Husband and Wife," leaning affectionately towards one another; they are each 60 feet in circumference, and 250 feet in height. "Hercules," one of the most gigantic specimens in the forest, stands leaning in our path. This tree, like many others, has been burnt at the base; it is 325 feet high, and 97 feet in circumference. The "Hermit," rising solitary and alone, is next observed. This tree, straight and well-proportioned, measures 320 feet high and 60 feet in circumference. Still returning towards the hotel by the lower trail, we pass the "Mother and Son," which together measure 93 feet in circumference; the "Mother" is 320, the "Son" a hopeful youth of 300 feet. The "Siamese Twins and their Guardian" form the next group: the "Twins" have one trunk at the base, separating at the height of 40 feet, each measuring 300 feet high; the "Guardian" is 80 feet in circumference, and 325 feet high. Beyond stands the "Old Maid," slightly bowing in her lonely grief; she measures 60 feet in circumference, and is 260 feet high. Two beautiful trees, called "Addie and Mary," are the next to arrest our attention, measuring each 65 feet in circumference and nearly 300 feet high. We next reach the "Horseback Ride," an old fallen trunk of 150 feet in length, hollowed out by the fires which have, in days gone by, raged through the forest. The cavity is 12 feet in the clear in the narrowest place; and a person can ride through on horseback a distance of 75 feet. "Uncle Tom's Cabin" next claims our admiration, being 300 feet high and 75 feet in circumference. The "Cabin" has a burnt entrance of $2\frac{1}{2}$ feet in diameter; inside, the cavity is large enough to seat fifteen persons. Two other trees we must note; one of which, named the "Pride of the Forest*," remarkable for the smoothness of its bark, measures 280 feet in height and 60 feet in circumference. The "Burnt Cave" is also remarkable; it measures 40 feet 9 inches across its roots, while the cavity extends to the distance of 40 feet,—large enough for a horseman to ride in, and, turning round, return. We now reach the "Beauty of the Forest," a tree 65 feet in circumference, fully 300 feet high, symmetrical in form, and adorned with a magnificent crest of foliage. Reaching the road, and returning to the house, we pass the "Two Guardsmen," which tower to the height of 300 feet, and are 65 and 70 feet in circumference, forming an appropriate gateway to this wonderful forest.

The trunk of the Mammoth-tree is very straight, and covered

* In some accounts, "Bride of the Forest." I hold "Pride" to be correct.—B. S.

with a bark much resembling that of the Redwood in appearance; it is of a rich cinnamon-brown, and from 18 to 22 inches thick! The wood, when first cut, is white; but it soon becomes reddish, and long exposure makes it as dark as mahogany; it is soft, yet nevertheless of slow decay, and abounds in the red colouring matter, soluble in water, from which the Redwood takes its name. The branchlets are round, somewhat pendent, and resemble those of a Cypress or a Juniper. As is the case in a more or less marked manner in most *Coniferæ,* not excepting even *Sequoia sempervirens,* there are two kinds of foliage, the same branch often presenting both imbricated and distichous leaves. The leaves are alternate, perennial, in the younger plants oblong-subulate, apiculate or mucronate, semiamplexicaul, keeled at the back, plane within, but with a slightly elevated central ridge; in the older plants they are smaller, shorter, more compact and crowded, ovate-lanceolate, acute. Both male and female flowers present the same structure as those of *S. sempervirens;* the same may be said of the cones; the only difference in the latter being that those of *S. Wellingtonia* are generally a little larger than those of its congener.

The Mammoth-tree was introduced into European gardens by Mr. William Lobb; and in 1853 single plants were sold by Veitch's Nursery for £2 2*s.*; but since then quantities of seeds have been imported, and there is now hardly a horticultural establishment without one or more representatives of this remarkable evergreen. In England it seems to stand the winter without injury; and even in Germany and other parts of Northern Europe it does not require the protection of a glass-house; so that even in those countries it may become a forest- and useful timber-tree. In July 1856, complaints were heard that, in spite of the most careful culture, a peculiar disease had befallen this new *Sequoia,* in consequence of which the twigs were observed to die off in the same manner as they do in *Cryptomeria Japonica.* Horticulturists began to take alarm, and feared that their new acquisition would inevitably be lost; but Dr. Lindley soon discovered that, though the twigs died, the main stem and branches continued to grow vigorously, and that the so-called disease was constitutional, and could not be looked upon as a sign of ill-health, or a proof of bad culture. In 1858 it bore ripe fruit in England, under the skilful treatment of Mr. J. Buckle, at Thetford. May the Mammoth-tree continue to flourish, and display in the gardens and pleasure-grounds of Europe the same gigantic proportions that render it an object of wonder and amazement in its native valleys of America!

22, Canonbury Square, Islington,
January 10, 1859.

XX.—*A Sectional Distribution of the genus* Alycæus, *Gray, with Characters of six new species and of other* Cyclostomidæ *collected at Darjiling by* W. T. Blanford, Esq., *Geol. Survey.* By W. H. Benson, Esq., Retired Bengal C.S.

The examination of a collection of Darjiling shells, made by Mr. W. T. Blanford, enables me to add several new forms to my previous list of the productions of that rich locality. The number of species now known to me is fifty-four, of which thirteen or fourteen, belonging to Helicidous groups, have been met with elsewhere in the mountain ranges of India. Nearly in accordance with a former remark regarding the limited tracts occupied by each particular species of the Cyclostomidæ of these regions, only one of the operculated species has occurred elsewhere; but this shell (*Cyclophorus tomotrema,* B.) was found, at Pankabari, with an aperture so imperfect, that its identification may be open to a slight doubt. Two Darjiling forms are deficient in the present collection; these are *Cyclostoma Tryblium,* B., and a small *Helix* previously communicated by Mr. Blanford to Mr. Theobald, and forwarded to me for examination.

The collection is singularly rich in the interesting little genus *Alycæus,* Gray, which offers six new species, including my unpublished *A. Otiphorus,* received from Mr. H. Blanford in 1857. The Darjiling representatives now amount to nine. Having before me eighteen species out of twenty at present known, I am enabled to propose a more natural grouping of the species than that given by Dr. Pfeiffer in the 1st Supplement to his Monograph, where he divides them into "subturbinate" and "depressed." The mode of constriction appears to me the best character for the division of the genus into natural sections, and preferable to the form of the shell, or to the greater or less development of the sutural tube or siphon. Inasmuch as the divisions (*Dioryx* especially) may be eventually held to possess good generic differences, I shall designate those which are removed from the original type by distinct names.

Sect. 1. *Alycæus.* Normal group.

The last whorl constricted somewhat remotely from the aperture, tumid on both sides of the constriction. It contains ten species, including that earliest known, *A. gibbus,* Fér.

a. Subpyramidal.

gibbus, *Fér.* Sutural tube variable (from injury?). Cochin China.
pyramidalis, *B.* Tube elongate. Tenasserim.

b. Globose- or ovate-conical.

constrictus, *B.*	Tube very short.	Darjiling.
Otiphorus, *B.*, n. s.	Ditto.	Ditto.
Bembex, *B.*, n. s.	Ditto.	Ditto.

c. Subtrochiform.

sculptilis, *B*. Tube mediocre. Pegu.

d. Depressed.

umbonalis, *B*. Tube elongate. Pegu.
Physis, *B*., n. s. Tube elongate. Darjiling.
prosectus, *B*. Tube mediocre. Khasia Hills.
armillatus, *B*. Tube short. Pegu.

Sect. 2. *Charax*, B.

Constriction broad, contiguous to the aperture, and divided more or less remotely from it, across the whorl, by a ridge which is hollow internally.

a. Depressed.

* *Ridge curved back remotely from the peristome.*

hebes, *B*. Tube mediocre. Khasia Hills.
Gemmula, *B*., n. s. Tube mediocre. Darjiling.

** *Ridge parallel to and approaching the peristome.*

stylifer, *B*. Tube mediocre. Darjiling.
spiracellum, *A. Ad*. Tube short. Borneo.
strangulatus, *Hutt*. Tube short. West Himalaya.

*** *Ridge parallel with and close to the base of the peristome.*

plectocheilus, *B*., n. s. Tube mediocre. Darjiling.

Sect. 3. *Dioryx*, B.

Constriction narrow, and immediately behind the aperture; the sutural tube arising proportionally nearer to the peristome than in Sections 1 and 2.

a. Globose- or ovate-conical.

Amphora, *B*. Tube very long. Tenasserim.
Urnula, *B*. Tube mediocre. Darjiling.
? distortus, *Haines*. Tube not described. Siam.

b. Depressed-turbinate.

crenulatus, *B*., n. s. Tube elongate. Darjiling.

The names will help the memory,—*Charax* being a rampart, *Dioryx* a fosse or ditch. There is a disposition in the ridge of *strangulatus* to subside into the ordinary tumidity of the first section, and thus to unite Sections 1 and 2; but the ridge is often sharply defined, and shows the internal sulcus distinctly.

Alycæus distortus is imperfectly described by Haines, but is inserted provisionally in *Dioryx* with reference to the character "prope aperturam constricto," although said to be allied to *A. gibbus*.

In estimating the length of the sutural tube, it is necessary to observe whether its brevity or mediocre size is permanent and natural, or due to decay or injury, especially in specimens which have become brittle from weathering. In the species of which I have been enabled to examine a series, I find that the perfect tube is invariably of uniform length in each form. The character is so important, that I have thought it worthy of notice in the sectional arrangement.

1. *Alycæus Otiphorus*, n. s.

Testa perforata, ovato-globosa, minutissime confertim striata, cinereo-cornea; spira conica, apice obtusiusculo, rutilo, sutura valde impressa; anfractibus 4 convexis, ultimo ventricoso, ab apertura subremote constricto, tum pone labrum tumidiusculo, lævigato, tubulum brevissimum suturalem gerente; apertura vix obliqua, peristomate duplici, interno continuo, expanso, interdum breviter porrecto, externo dilatato, reflexo, ad umbilicum processu auriculari brevi, subito reflexo, perforationem subtegente munito. Operculo normali, concaviusculo, planato.

Long. $4\frac{1}{2}$, diam. obliq. 4 mill.

Habitat ad Pankabari (1000 ped. alt.) et in valle Rungun (4000 ped.) prope Darjiling Himalayanum.

This shell, which seems to be not uncommon on the west side of the Rungun valley, as well as at a lower elevation in the Sikkim ranges, was forwarded to me by Mr. H. Blanford in 1857. In form it approaches *A. Amphora* and *constrictus*, and, like the latter, which belongs to the same type in the mode of constriction, it is remarkable for the shortness of the sutural tube, but is at once distinguished by the process of the peristome at the umbilicus.

2. *Alycæus Bembex*, n. s.

Testa umbilicata, ovato-conica, lævigata, hic illic striatula, striis ventriculi confertis, ad umbilicum striatula, hyalina?; spira elevato-conica, sutura profunda, apice acutiusculo; anfractibus 5, valde convexis, ultimo compresso-rotundato, pone stricturam modice tumido, tubulum suturalem brevissimum gerente, pone aperturam rursus tumidulo; apertura obliqua, subcirculari, peristomate simplici, tenui, undulato, expansiusculo, subreflexo, superne leviter emarginato. Operc. —— ?

Diam. major 4, minor 3, axis 4, long. 5 mill.

Habitat in valle Rungun.

This is one of the most elevated in the spire among the known Himalayan *Alycæi*. The specimens sent are all weathered, but present no evidence of any considerable sculpture or colouring. The very short sutural tube is a character shared by *Otiphorus* and *constrictus*; and altogether the shell is deficient in prominent features, although perfectly distinct from any of its allies, especially in its aperture (sinuous, and at its upper angle emarginate), its wider umbilicus, plainer sculpture, and more compressed whorls.

3. *Alycæus Physis*, n. s.

Testa mediocriter umbilicata, conoideo-depressa, tenui, regulariter planato-striata, striis opacis, minime elevatis, confertissimis, ad umbilicum perspectivum nonnullis elevatis acutis, hyalina, nitida; spira brevi, apice subpapillari, sutura impressa; anfractibus 4 subconvexis, ultimo ad latus, pone constrictionem, valde inflato, tubulum suturalem elongatum gerente, pone labrum tumidiusculo; apertura obliqua, subcirculari, peristomate duplici, interno breviter expanso, incrassato-reflexo externum celante, marginibus callo parietali expansiusculo semicirculari junctis. Operc. ——?

Diam. major. 10, minor 8, axis 6 mill.

Habitat in valle Rungit (alt. 2000 ped.), prope Darjiling, raro occurrens.

Larger than the Khasia *A. prosectus*, from which it is abundantly distinguished by the characters of the aperture, the less mucronate spire, its peculiar striation and lustre, shorter sutural tube, and the greater inflation of the last whorl. In *prosectus* the space between the constriction and the aperture is suddenly tumid near the constriction, the swelling decreasing towards the peristome; in *Physis* the swelling increases gradually towards the mouth, which is not inclined to be so very oblique. There are faint indications of spiral sculpture evident in the facet-like appearance of the surface. Within the umbilicus, near the inflated part, every fourth or fifth of the scarcely elevated striæ (which would elsewhere be hardly distinguishable except for their white opacity on the hyaline ground) is raised into a knife-like edge.

In size and form *A. Physis* nearly approaches *umbonalis*; but the colour, opakeness, great solidity, and the more moderate inflation of the last whorl, in addition to the more remote constriction, and the very different sculpture presented by the Burmese species, preclude any danger of confounding it with its Himalayan ally.

4. *Alycæus Gemmula*, n. s.

Testa umbilicata, conoideo-depressa, lævigata, nitida, ad ventriculum minutissime, ad umbilicum crasse striata, hyalina; spira conoidea, apice obtusiusculo, sutura profunda; anfractibus 4 convexiusculis, ultimo compresse rotundato, tum tumido, tubulum mediocrem gerente, tunc fossiculato-constricto, strictura crista recumbente, demumque area planata ab apertura separata; apertura obliqua, superne arcuatim prominente, peristomate duplici, valde incrassato-

reflexo, intus superne ad angulum et infra ad basin leviter emarginato; umbilico profundo. Operc. ——?
Diam. major $2\frac{1}{4}$, minor $1\frac{1}{2}$, axis $1\frac{1}{2}$ mill.
Habitat rarissime in valle Rungun.

Of this little shell the sole specimen obtained by Mr. Blanford was forwarded to me for examination. Its affinities are with the Khasia *A. hebes*; but it is perfectly distinct in colour, smaller size, sculpture, narrower constriction behind the ridge, narrower umbilicus, and in the emargination visible within the aperture at the lower part.

5. *Alycæus plectocheilus*, n. s.

Testa aperte umbilicata, depresso-turbinata, confertim striatula, striis nonnullis ad suturam elevatis, nitente, subpellucida, rufescenti-albida; spira brevi, depresso-conoidea, apice obtuso, sutura impressa; anfractibus $3\frac{1}{2}$ convexis, ultimo rotundato, profunde constricto, tubulum mediocrem gerente, strictura crista angusta elevata, intus cavo-sulcata, peristoma expansum simulante, ab apertura separata; apertura vix obliqua, subcirculari, peristomate duplici, margine columellari leviter incrassato-reflexo, dextrali valde incrassato-porrecto, fortiter acutangulatim crispo-plicato, plicis quinque aperturam arctantibus, marginibus callo prominente angulato junctis. Operc. ——?
Diam. major $2\frac{1}{2}$, minor 2, axis vix 2 mill.
Habitat in valle Rungun.

The dimensions given are those of the largest of four specimens. The strenuously vandyked plication of the incrassate edges of the porrect dextral side of the peristome is a remarkable feature in this minute species. It recalls the curious frill in *Pterocyclos bilabiatus*, Sow., but in a more exaggerated guise, notwithstanding the smallness of the shell. The edges of the folds are thickened and slightly reflected. Its smaller size, sculpture, and wider umbilicus, and, above all, the mode of constriction, prove that it is not an exaggerated form of *crenulatus*. The deceptive appearance of the ridge or crest at first induced me to class the shell with *Dioryx*; but a closer investigation of the mode in which the ridge was attached to the true peristome, and a view of the internal sulcus, revealed the true position of the species.

6. *Alycæus crenulatus*, n. s.

Testa umbilicata, depresso-turbinata, dense oblique costulata; spira conoidea, sutura profundiuscula, apice papillari; anfractibus 4 convexis, ultimo rotundato, ad latus inflato, eo costulis confertioribus ornato, tum juxta peristoma breviter constricto, lævi, tubulo suturali elongato non procul ab apertura oriente munito; apertura vix obliqua, circulari; peristomatis labro subduplici incrassato, exteriore reflexo, interiore crenulato quadriplicato aperturam vix coarctante, labio simplici, tenui, marginibus callo crasso prominente junctis. Umbilico profundo, margine rotundato. Operculo ——?

Diam. major 4, minor $3\frac{1}{3}$, axis 3 mill.
Habitat in valle Rungun.

The constriction of the last whorl is near the aperture, without any intermediate ridge or swelling, in this respect showing an affinity with *Amphora* and *Urnula*. In the crenulation of the peristome it exhibits an analogy with *sculptilis* of the normal group, in which the crenulations are twelve in number, with the origin of the sutural tube remote from the aperture.

The specimens examined are all weathered and bleached. It is a singular circumstance, that each of the three natural sections of *Alycæus* should have an analogical connexion through the plicate peristomes of *sculptilis, plectocheilus,* and *crenulatus*. The genus *Pterocyclos,* as above noted, has also its analogical representative of the form in *P. bilabiatus*; and it is worthy of remark that it claims affinity with *Alycæus,* as well as with *Opisthoporus,* through the aberrant *P. hispidus,* Pearson, which exhibits a retroverted sutural siphon, although the structure of the operculum, which is very similar to that of its siphonless near relative, *P. tenuilabiatus,* Metcalfe, confirms its location among the *Pterocycli*.

Alycæus constrictus, B., var. minor.

I find in the collection four specimens of a small variety of this shell, bleached, but otherwise agreeing with the specimen which I noticed in the 'Annals' for Oct. 1852, when recording the additional character for the genus afforded by the presence of the sutural tube. I can find no other feature to distinguish it from the type than the more flatly expanded and distinctly doubled peristome, in addition to the smaller size. As yet, only a single specimen of the larger type is known; it is in a fresh state, but slightly mutilated, and the colour is paler than in my specimen of the smaller type. The latter is deficient in the distant ribs, but they are plainly visible on more than one of Mr. Blanford's weathered examples. A fuller comparison of a series of fresh specimens of the two forms will be required to decide on their claim to separation.

Alycæus stylifer, B.

Several specimens in the collection correspond in all particulars with the description in the 'Annals' for March 1857, founded on a single example. Unfortunately the shells are all in the same bleached and weathered state, only one of them having a clear rosy tinge at the apex. It is noted, as well as *A. constrictus,* as occurring in the Rungun valley, and, being evidently abundant, ought, like *A. strangulatus,* to be found alive in damp masses of fallen leaves.

Alycæus Urnula, B.

Several specimens in a bleached state accompany the collection, one of them reaching 6 mill. in length, and allowing a more full comparison with the nearly allied Burmese *A. Amphora.* Dead specimens may be distinguished from the latter by the shorter sutural tube, the slightly expanded, not double peristome, and by the absence of a slight angular compression round the umbilicus,—a character which I neglected to note in my description of *Amphora. A. Urnula* is an inhabitant of the Rungun valley.

When we find that a single valley below Darjiling furnishes eight out of the nine species which it has been my good fortune to describe from that neighbourhood, what an accession to the genus may not be expected from further researches in that quarter, in the vales of Nipal, and especially in Bootan, stretching towards the more humid region of the Khasia range, which has supplied, from a single spot, two other distinct species of this most interesting little genus!

7. *Diplommatina Pullula,* n. s.

Testa imperforata, ovato-turrita, oblique confertim costulata, fulvescenti-albida, versus apicem rubella, spira subturrita, sutura impressa, apice obtusiusculo; anfractibus 6–7 convexis, antepenultimo tumidiore, ultimo antice valde ascendente, costulis remotioribus irregularibus; apertura subverticali, vix superne spectante, oblique obovali, peristomate duplici, interno porrecto expansiusculo, externo subreflexo, marginibus callo appresso expanso junctis, columellari verticali planato intus acute unidentato basi angulato-rotundato, dextrali valde arcuato. Operc. —— ?

Long. 3, diam. $1\frac{1}{4}$ mill.

Habitat in valle Rungun, ad latus occidentale.

In form and size between *Huttoni* and *folliculus,* Pfr.; dextrorse like the latter, though agreeing with the former in having the tooth apparent on the columellar lip. The tooth is as strong, in comparison with the size of the shell, as in the other more Eastern species of the North Indian ranges. The more considerable rise of the last whorl on the penultimate is a feature also observable in the large *Dipl. MacGillivrayi,* Adams. The columellar base is deficient in the sharp angle observable in the larger Khasia *diplocheilus* and Darjiling *pachycheilus;* and its elongate subturrited form at once distinguishes it from *polypleuris.*

Further specimens of *D. pachycheilus,* B., kindly sent to me by Mr. H. Blanford, and contained also in the collection, confirm the characters given from a single specimen in the 'Annals' for March 1857. In one specimen I find the striation exceedingly minute, closely set, and obliquely undulate. It occurs in the Rungun valley, about the mineral spring of Sungtoot, in company with *Streptaulus Blanfordi,* B., which is found in crevices and at the sides of large boulders of gneiss, in damp decaying leaves, as reported by the discoverer.

8. *Pomatias Himalayæ,* n. s.

Testa perforata, attenuato-turrita, solidiuscula, oblique confertim crassicostata, albida, epidermide tenui pallide cornea induta; spira elongato-turrita, sensim decrescente, apice obtuso, sutura impressa; anfractibus 7–8 convexiusculis, ultimo rotundato, costis remotioribus nonnullis intervenientibus, mox desinentibus, pone aperturam munito; apertura verticali, ovato-rotundata; peristomate duplici, incrassato, externo expanso reflexiusculo, interno continuo, superne ad angulum parietalem fissura minime profunda diviso. Operculo tenuissimo, membranaceo, translucente, paucispirato.

Long. $5\frac{1}{2}$–10, diam. $2\frac{1}{2}$–4 mill. Apertura majoris 3 mill. longa, $2\frac{1}{2}$ lata.

Habitat copiose in valle Rungun (4000 ped.) nec non ad Darjiling (7000 ped.).

This shell seems to be an aberrant *Pomatias,* with reference to the characters of the aperture. It enables me to assert that the anomalous ribbed shell which, in its imperfect condition, I assigned, in the 'Annals' for April 1857, to the genus *Bulimus,* under the name of *pleurophorus,* belongs to the same operculated genus as this species, with a stouter form and a thinner shell. These examples occur far beyond the known limits of the genus *Pomatias,* and encroach on the territories of *Hydrocena,* which, in Oriental China, assumes a turrited form, but never obtains the costulated sculpture of *Pomatias.* A single operculum contained in the collection cannot be examined in order to ascertain its internal structure; but, on account of the double peristome having the internal portion continuous, and of the costulation, I have no hesitation in referring the species now described, and its evident congener *pleurophorus,* to *Pomatias,* hitherto only known as a Southern European form. The imperfect slit in the parietal margin becomes occasionally obsolete. A young shell is of a clear pale horn-colour.

Descriptions of all the *Alycæi, Diplommatinæ,* &c., hitherto published will be found in Pfeiffer's 'Monographia Pneumonopomorum' and the Supplement lately added. A number of species of *Alycæus, Diplommatina, Pterocyclos, Cyclophorus, Megalomastoma, Streptaulus,* and *Pupina,* lately described by me in the 'Annals,' have been figured in plates 35 and 37 of Pfeiffer's 'Novitates Conchologicæ.' Others previously published in the same work appear in Küster's Monograph of *Cyclostoma,* up to plate 50.

Cheltenham, January 8, 1859.

XXI.—*Descriptions of new species of* Helix, Streptaxis, *and* Vitrina, *collected by* Mr. W. Theobald, jun., *in Burmah, the Khasia Hills, and Hindustan.* By W. H. Benson, Esq.

1. *Helix Ceryx,* n. s.

Testa perforata, turbinato-conica, tenui, nitidula, oblique striatula, liris pluribus remotis, striisque confertissimis interpositis spiralibus sculpta, translucente, albida, fasciis duabus latis fuscis, superiori prope suturam, altera infra peripheriam, ornata; spira attenuato-conica, apice obtusiusculo; anfractibus 4 convexiusculis, ultimo medio carinato; apertura obliqua, rotundata, peristomate tenui, acuto, margine columellari verticali anguste reflexo, perforationem subtegente.

Diam. major 6, minor 5, axis 5 mill.

Habitat ad Phie Than, vallis Tenasserim, raro occurrens. Teste W. Theobald.

The single specimen sent for inspection is injured in the right lip. There are five raised lines, at regular intervals, on the upper side of the whorls, between the suture and the periphery; these lines are more irregular in the last whorl. The translucent brown bands contrast strongly with the white ground of the shell.

2. *Helix Attegia,* n. s.

Testa anguste perforata, conica, tenui, striatula, liris tenuibus vix elevatis, remotiusculis, spiralibus, striisque minutissimis interpositis decussata, pellucida, cornea; spira subanguste conica, sutura leviter impressa, apice acuto, pallido; anfractibus 7 convexiusculis, ultimo filoso-carinato, subtus convexiusculo; apertura vix obliqua, rhombeo-lunari, peristomate acuto, recto, margine columellari verticali, superne valde dilatato-reflexo, perforationem subtegente.

Diam. major 8, minor 7, axis 8 mill.

Habitat ad Phie Than, vallis Tenasserim, frequens.

Distinguished from the Cingalese *H. hyphasma,* Pfr., by its narrower conical form, sculpture, structure of columellar lip, &c.

3. *Helix Arx,* n. s.

Testa anguste perforata, acute conica, tenui, striis minutissimis confertissimis obliquis, lirisque 3–4 spiralibus, validis, superne sculpta, subtus læviori, translucente, olivaceo-cornea; spira gracili, conica, lateribus concavis, sutura marginata, apice acutiusculo, hyalino; anfractibus $7\frac{1}{2}$, superioribus convexiusculis, tum planiusculis, ultimo acute carinato, subtus convexiusculo; apertura obliqua, trapeziformi, peristomate recto, acuto, margine columellari breviter reflexo, superne perforationem subtegente.

Diam. major 10, minor 9, axis $7\frac{1}{2}$ mill.

Habitat ad collem Therabuin, vallis Tenasserim, nec raro; detexit W. Theobald.

Distinguished by its sculpture and slender concave spire, which recalls that of my Nilgherry species, *H. cacuminifera*.

4. *Helix Catinus.*

Testa sinistrorsa, late umbilicata, lenticulari-depressa, lævigata, superne demum oblique rugata, fuscescente; spira depresse conoidea, apice obtuso, sutura marginata; anfractibus $7\frac{1}{2}$ lente crescentibus, superne planulatis, ultimo non descendente, acute carinato, carina compressiuscula, basi convexa, circa umbilicum profundum perspectivum subangulata; apertura perobliqua, rotundato-lunari, peristomate expanso, reflexo, superne prope carinam prominente, angulato, marginibus lamina valde elevata lamellam breviter intrantem emittente junctis.

Diam. major 18, minor 16, axis $6\frac{1}{2}$ mill.

Habitat prope Moulmein, provinciæ Tenasserim, rarissime.

Intermediate between *H. plectostoma*, B., and its own provincial neighbours, *H. Achatina*, Gray, and *refuga*, Gould. It is distinguished from the former by its inconspicuous sculpture and more depressed form, by the entering parietal plait, greater size, and solidity; and, representing the two latter by the feature of a parietal plate, it presents a strong contrast to them in its subconoidal spire, carination, and deeper umbilicus.

The single specimen transmitted for examination is in such a corroded state, that the true nature of the sculpture can merely be guessed at. The aperture is whitish.

5. *Helix Oldhami*, n. s.

Testa late umbilicata, orbiculato-depressa, tenui, oblique irregulariter flexuoso-striata, cornea?; spira vix elevata, vel depressissime conoidea, apice exsertiusculo, obtuso, sutura impressa; anfractibus $6\frac{1}{2}$ lente crescentibus, planulatis, ultimo antice breviter rapide descendente, superne obtuse carinato, subtus convexo, circa umbilicum profundum perspectivum angulato; apertura obliqua, subcirculari, peristomate expansiusculo, reflexiusculo, marginibus conniventibus, approximatis.

Diam. major 13, minor 11, axis 6 mill.

Habitat in regno Burmano.

Collected by Professor Oldham, Chief of the Indian Geological

Survey, during his visit to the capital of Ava. The specimens examined are in a weathered and bleached condition. Its nearest ally is the Chinese *H. Oculus*, Pfr.; but, independently of the smaller size of *H. Oldhami*, it may be at once distinguished by its more depressed form, carinated periphery, fewer whorls, peristome, &c. In a fresh state it is probably clothed with a conspicuous epidermis. The form is interesting from its geographical position, indicating an approach to the Chinese and Loo-Choo fauna.

6. *Helix Cassidula*, n. s.

Testa perforata, semigloboso-turbinata, striatula, striis minutissimis, confertissimis, spiralibus, sub lente apparentibus, decussata, nitidula, albido-lutescente, fascia 1 lata, rufo-fusca, supra peripheriam cincta; spira conoidea, sutura impressa, leviter marginata, apice obtusiusculo; anfractibus 5 convexis, lente accrescentibus, ultimo ad peripheriam rotundato, subtus convexiusculo; apertura parum obliqua, subquadrato-lunata, peristomate tenui, acuto, margine columellari brevi, verticali, expansiusculo, cum basali angulum rectum efformante.

Diam. major 6, minor $5\frac{1}{3}$, axis 4 mill.

Habitat ad Moulmein, nec raro.

7. *Helix Bombax*, n. s.

Testa subaperte et profundissime umbilicata, subdepressa, superne oblique flexuose costulato-striata, subtus lævigata, albida; spira convexiuscula, apice vix elevato, planulato, lævigato, sutura impressiuscula; anfractibus $5\frac{1}{2}$ convexiusculis, ultimo ad peripheriam rotundato, subtus convexo, circa umbilicum perspectivum vix subangulato; apertura parum obliqua, quadrato-lunata, peristomate tenui, recto, superne antrorsum arcuato, margine columellari vix oblique descendente, breviter expansiusculo, cum basali angulum obtusum efformante.

Diam. major 8, minor 6, axis 4 mill.

Habitat ad Moulmein, necnon ad Phie Than in provincia Tenasserim, satis frequens.

The single specimen sent is bleached, and without epidermis. The strong flexuously-ribbed striation on the upper side of the shell, and the prominent arcuation of the right lip above, are notable features, and will secure recognition even if the shell should prove to be translucent and horn-coloured when perfect.

8. *Helix Bascauda*, n. s.

Testa anguste et profunde umbilicata, conica, trochiformis, costis elevatis remotiusculis obliquis, subtus flexuosis, regularibus ornata, rufo-cornea; spira conica, apice obtusiusculo, sutura impressa; anfractibus 6 convexiusculis, ultimo non descendente, ad peripheriam filoso-carinato, subtus convexo, circa umbilicum subangulato; apertura quadrata, peristomate tenui, acuto, margine columellari, necnon basali, parum expansiusculo.

Diam. major $4\frac{1}{2}$, minor 4, axis 4 mill.

Habitat ad Teria Ghát, montium Khasiæ.

A pretty little species, distinct in character from any Indian shell yet published, and remarkable for the frequent strong and regular ribs, and for its thread-like carination.

9. *Helix diplodon*, n. s.

Testa perforata, subgloboso-conica, tenui, lævigata, parum striatula, sub epidermide cornea, albida; spira convexo-conica, apice obtusiusculo, sutura impressiuscula, marginulata; anfractibus $6\frac{1}{2}$ vix convexiusculis, ultimo acute carinato, non descendente, basi convexiusculo, antice prope peripheriam planulato-excavato, medio subito tumidiusculo; apertura obliqua, subhorizontaliter angulato-lunata, intus bidentata, dentibus basalibus 2, 1 subcolumellari obtuso, altero remotiusculo, pliciformi, sinuato, intrante, peristomate superne tenui, acuto, margine columellari ad umbilicum breviter reflexo, basali arcuato, expansiusculo.

Diam. major $6\frac{1}{2}$, minor $5\frac{1}{2}$, alt. 5 mill.

Habitat in montibus Khasiæ, prope Teria Ghát, versus orientem.

Easily distinguished from its smaller allies, *H. bidenticulata*, B., and *Pirrieana*, Pfr., of Southern India, by the pliciform entering tooth, and by the characters of the base near the aperture; from the former, also, by the absence of the spiral sculpture so conspicuous in that species.

10. *Streptaxis Theobaldi*, n. s.

Testa arcuate rimato-perforata, depressa, oblique pyriformi, valde transversa, tenuistriata, striis ad suturam et ad umbilicum validioribus, albida, nitente; spira convexa, apice prominulo, sutura impressa, submarginata; anfractibus $5\frac{1}{2}$, primis lente accrescentibus, antepenultimo ad sinistram subito majori, ultimo tumidulo, parum deviante, antice longe ascendente, basi prope umbilicum compressa, circa peristoma extus triscrobiculata; apertura subtriangulari, obliqua, septemdentata, peristomate expanso, reflexo, superne ad angulum valde sinuato, tum antrorsum arcuato, marginibus callo tenui junctis, dextro tridentato, dente tertio majori, basali bidentato, parietali biplicato, plica superiori angulari, prorsus descendente, tum intus transverse producta, inferiori validiori, elongata, flexuosa.

Diam. major 6, minor $4\frac{1}{3}$, axis 3 mill.

Habitat ad Nauclai (lat. 25° 15′, long. 92° 30′); detexit W. Theobald.

This Khasia species is remarkable for its transverse depressed form, and is only approached in the number of teeth by the Cochin Chinese *Str. aberrata*, Souleyet. It is one of the smallest species of *Streptaxis*, and deserves notice as the most north-westerly wanderer of this singular genus. In addition to the localities of oriental species given in vol. xii. ser. 2. p. 90, Malacca and Shanghai must be cited for Pfeiffer's *Str. conoidea* and *Fortunei.*

11. *Pupa* (*Ennea*) *vara*, n. s.

Testa arcuato-rimata, attenuato-cylindrica, costata, albida; spira sensim attenuata, apice obtuso, sutura valde impressa; anfractibus 8, primis convexis, tum convexiusculis, ultimo compresso, lævigato, antice breviter ascendente, latere scrobiculato, basi pone rimam strictiuscula; apertura subaxiali, non laterali, verticali, distorte auriculari, peristomate undique incrassato-dilatato, margine dextro superne profunde sinuato, medio intus arcuato, plicam obtusam palatalem decurrentem exhibente, parietali callo crasso longe ascendente, et plica angulari valida, profunde intrante, ad plicam palatalem prope approximante, munito.

Long. 5, diam. $1\frac{1}{2}$ mill.

Habitat cum præcedente, raro occurrens.

This shell must be classed in the group *Ennea*, Adams. The nearest approach to it among the species hitherto described is to be found in the Southern Indian *Ennea Pirriei*, Pfr.

12. *Vitrina Scutella*, n. s.

Testa valde depressa, peripheria oblongo-ovata, arcuatim striatula, nitente, translucente, pallide viridi-lutescente; spira valde planata, apice prominulo, sutura impressa, marginata; anfractibus $3\frac{1}{2}$ rapide accrescentibus, ultimo antice latissimo, superne antrorsum arcuato, horizontaliter compresso, non descendente, peripheria valde rotundata; apertura valde obliqua, ovato-lunari; peristomate simplici, marginibus conniventibus, columellari oblique descendente, basali leviter arcuato.

Diam. major 18, minor 13, axis 6 mill.
,, ,, 16 ,, 11 5 ,,
Apert. lat. 12, alt. 7 mill.
,, ,, 11 ,, 6 ,,

Habitat ad Teria Ghát, montium Khasiæ; necnon ad Nasmana, regionis Kashmir.

Of this species the larger example from Kashmir was first sent by Mr. Theobald, and subsequently another specimen, obtained by him at Teria Ghát, was received. The non-occurrence of the form in the intermediate mountains of Sirmore, Kemaon, and Sikkim, where other species take its place, is worthy of note. It is remarkable for its depressed form and lengthened aperture, which at once distinguish it from its ally, *V. monticola*, occupying the mountain region between the rivers Sutlej and Gagra. The Khasia specimen has a few remote spiral depressions on the last whorl near the suture; they are probably accidental.

13. *Vitrina Salius*, n. s.

Testa subgloboso-depressa, peripheria ovata, tenuissima, fragili, nitidissima, pellucida, fuscescenti-cornea vel pallide cornea, obsolete arcuatim striatula; spira brevissime conoidea, sutura leviter impressa, marginata; anfractibus $3\frac{1}{2}$ rapide accrescentibus, ultimo depressiusculo, subventricoso-rotundato, antice superne antrorsum arcuato; apertura obliqua, subrotundato-lunari, peristomatis margine columellari subverticaliter descendente, superne vix calloso, basali leviter arcuato.

Diam. major 8, minor 6, axis 4 mill.; apert. lat. $4\frac{1}{2}$, alt. $4\frac{1}{2}$ mill.
Habitat ad Teria Ghát, cum præcedente.

I have named this little species from its habit, observed by Mr. Theobald, of springing several inches from the ground, like the little Cape *Helix Tollini*, Albers, recorded in a former Number of this Journal on the authority of Mr. E. L. Layard. *V. Salius* also occurs near Darjiling, where Mr. W. T. Blanford has found it sparingly, in company with another new species.

Mr. Theobald met with my large species, *Vitrina gigas*, at Cherra, on the mountains above Teria Ghát; it was not common. On the limestone at the same place, a solid variety of the little Western Himalayan shell, *H. plicidens*, B., was common.

Cheltenham, 29th January 1859.

XXII.—*On the Germination of the* Lycopodieæ. By Dr. A. de Bary*.

The complete failure of all attempts hitherto made to obtain the germination of the Lycopodiaceæ proper, such as *Lycopodium*, *Psilotum*, and *Tmesipteris*, leaves an important and very unsatisfactory gap in the history of the development of the Vascular Cryptogams, otherwise so well made out, thanks especially to the happy investigations of Dr. W. Hofmeister.

By their mode of growth, their general organization, and especially by the position and development of their sporanges, the Lycopodieæ proper are closely connected with the *Selaginellæ*, which were long confounded with them under the same generic denomination. On the other hand, however, the Lycopodieæ proper resembled the Ferns and Equisetaceæ in possessing only one kind of reproductive body. Now, as the spore of the Ferns and that of the Equisetaceæ both give birth to a prothallium furnished with sexual organs, these two families of Cryptogamia constitute a particular natural class, the Pterideæ of Griesbach, while *Selaginella*, presenting at the same time two kinds of

* From the Reports of the Natural History Society of Freiburg, Breisgau, March 1858. Translated by A. Henfrey, F.R.S.

spores upon adult individuals, find their place rather in that other class of Vascular Cryptogams which Griesbach has termed Hydropterideæ*. To this latter group belong the Rhizocarpeæ of Mettenius† and the genus *Isoëtes*, which, joined to *Selaginella*, form the family Isoëteæ (a designation perhaps preferable to that of Selaginelleæ adopted by Mettenius). Thus, in our state of ignorance of their mode of germination, the Lycopodieæ occupy an uncertain place between two perfectly definite classes of Cryptogamous plants; and according as a predominant importance is attributed to the development of the organs of vegetation, or to that of the reproductive bodies, they will constitute a unique family, comprehending at once the *Selaginellæ* and the true Lycopodieæ, or will be divided into two distinct families, one of which, exclusive of *Selaginella*, will belong to the Pterideæ. The fitness of this division is supported by the opinion formally expressed by Hofmeister, Mettenius, and other observers; on the other side, it must be admitted, with Spring, that the power of producing macrospores is extremely reduced in the Lycopodieæ in the period of real vegetative life.

As the spores of the Ophioglosseæ, those of *Equisetum*, and of many other lower Cryptogams, after being so often sown in vain, had ultimately, under the influence of favourable circumstances, manifested their germinative power and unfolded their vegetation, I thought that a similar result might be hoped for with the Lycopodieæ. Strongly impressed with this conviction, in the course of last year I instituted, as often as occasion offered, different experiments on the germination of our indigenous Lycopodieæ, and, in my herborizations, sought to discover some of their spores commencing their vegetation. My experiments and my searches have attained scarcely any result; but I have succeeded in observing the earliest phænomena of the germination of *Lycopodium inundatum*.

In the month of September 1855, ripe and freshly-gathered spores of this Lycopod were sown on the same soil as that which had nourished the parent plant,—namely a gravelly soil clothed with a slimy layer, several lines thick, formed by various Algæ, especially by *Palmoglœa chlamydospora*, Rabenh. (Alg. exsicc. 514). Fragments of this soil were placed in a shallow vessel, and kept in a sufficiently moist state, either in my chamber or, during the winter, in the orangery of the Freiburg Botanic Garden; the spores were spread over the surface of the slimy coat of *Palmoglœa*, and some remained uncovered, while others were protected by little bell-glasses.

The majority of these spores underwent no change; but from

* Griesbach, Syst. Bot. p. 170.

† Filices horti Lipsiensis.

the ninth day after sowing, I discovered among them a *prothallium* formed of seven cells. Some decayed and perished during the winter. In March 1856, I procured new fragments of the native soil of the same *Lycopodium*; abundance of spores existed scattered in it naturally; and towards the end of May I was able to find among them at least five-and-twenty in more or less advanced states of germination.

Just as occurs in the Cryptogamia analogous to those of which we are speaking, the internal cell of the tetrahedral spore of *Lycopodium inundatum* swells and becomes elongated at the moment of germination, takes the form of a nearly round vesicle, and emerges from the *exosporium*, which bursts and opens widely into three lobes.

At a later period this vesicle divides, by means of a plane septum, into two hemispherical secondary cells; one of these, the inferior (*basilar cell*), remains undivided, scarcely enlarges, and remains surrounded by the remains of the *exosporium*; the superior cell (*apical cell*), on the contrary, determines, by its development and successive division into several cells, the ulterior growth of the plant.

This same superior cell developes, internally and at several successive epochs, alternating septa, inclined to either side, and intersecting reciprocally at very open angles; by this means it step by step gives birth to a terminal cell of the second degree, and an intermediate cell, disk-shaped, semicircular, and narrowed towards the middle of the cellular body taken as a whole.

Each of these median cells soon exhibits a septum parallel to its external surface, which divides it into two unequal cells,—one axile, small and cuneiform; the other peripherical, large and semi-annular.

The final result of these divisions and multiplications of the cells is a body composed of a central series of short irregular cells, surrounded laterally by two peripherical cells, and covered at the base by the latter, and at the summit by a terminal cell.

While the germ is still only composed of two cells (I have seen it in this state only once), it contains, like the spore, scarcely anything but large, colourless, oleaginous drops. These subsequently disappear. The peripherical cells become filled in great part with a clear liquid; but a few very minute grains of chlorophyll are seen applied upon the wall of the primordial utricle. The central or axile cells, on the contrary, are abundantly furnished with a granular, turbid plasma, often quite opake, sometimes containing chlorophyll, but often colourless. All the cells generally possess a large rounded nucleus.

The most developed germs that I have seen, presented, independently of the two extreme cells, four axile cells and four or five lateral or peripherical cells—in all, eleven cells or more. The germs formed of seven or eight cells only were most numerous.

All my efforts to discover plants more advanced in their development remained without effect. Those of which I have just spoken all perished without growing any larger. I have, unfortunately, been able to visit the locality of my *Lycopodium inundatum* only in autumn and early spring, and I have never found the least trace of spores in germination.

Imperfect as my observations are, the germinative power of the spores of *Lycopodium* is now demonstrated; only we are not yet able to say with certainty how the *prothallium* completes its growth.

According to what is known of the initial development of the prothallium of the Ferns and the Equisetaceæ, this organ has a very different mode of increase in the Lycopodieæ. On the other hand, it would seem to imitate very manifestly the primitive form of the archegonium of the Ferns,—so much so, indeed, that at first sight it might readily be taken for an imperfect archegonium supported on a single basilar cell.

If it is admitted that the bodies which I have observed are the product (as seems very probable, from their resemblance to each other) of a normal vegetation, the question arises, whether we are to regard each of them as a rudimentary *prothallium*, analogous perhaps in form and structure to that of the Ophioglosseæ (the earliest development of which is still unknown), and destined subsequently to bear sexual organs, or rather as a young archegonium with a single basilar cell, which must be fecundated doubtless ulteriorly by spermatozoids issuing, like those of the Hydropterideæ, from special spores resembling only externally those from which the archegonia are produced. Of the two analogies, the second seems to me, in truth, the least probable; but there are so many relations of organization between the true Lycopodieæ and *Selaginella*, that it deserves to be taken into consideration, and perhaps may ultimately prove to be correct. These first positive results, which I am now enabled to make known, show sufficiently that an attentive and long-continued study of the subject cannot be made in vain.

XXIII.—*On the British* Trochus Cutlerianus (*Clark*), *being the* ? Skenea Cutleriana *of the 'British Mollusca;' and on the* Trochus exilis *of Philippi* (*Moll. Sicil*). By Wm. Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, 7 Norfolk Crescent, Bath, February 1859.

Mr. Jeffreys, in his "Gleanings," which have lately appeared in the 'Annals,' has impugned my discovery of the *Trochus*

Cutlerianus, at least to the extent of being an original one; I therefore beg you to allow me a small space in your valuable Journal to defend my claim of being the author who first introduced this species to the notice of naturalists. As ten years have elapsed, I venture to bring to recollection that I originally described the shell and its animal as a typical *Trochus,* previously misnamed a ? *Skenea,* which is a mere discoid *Rissoa.* My description appeared in the 'Annals' for 1849, 2nd series, vol. iv. p. 424; and in the 'British Mollusca,' vol. iii. p. 163, and vol. iv. p. 270.

As far as I am concerned, I should not have interfered in the present matter; but Miss Cutler, an eminent naturalist, having honoured me by accepting the dedication of this new species, I am bound to maintain her undoubted title to the appellation of *Trochus Cutlerianus.*

Mr. Jeffreys, in his "Gleanings," in the 'Annals,' 3rd series, vol. ii. p. 125, observes,—"M. exilis. *Trochus exilis,* Philippi, vol. ii. p. 156, pl. 25. fig. 15. *Skenea Cutleriana,* Brit. Moll. vol. iii. p. 164, and (*Trochus*) vol. iv. p. 270. In dredged sand from Skye and Guernsey; and Mr. M'Andrew has it from the Mediterranean. A specimen, larger than usual, confirms the idea I entertained from the first, that this is Philippi's species." Mr. Jeffreys only proves by this, that my *T. Cutlerianus,* which I described as a new species ten years ago, has been found in Skye, Guernsey, and in the Mediterranean. The other part of Mr. Jeffreys's notice only presents one datum—that a larger specimen than usual (of what?) confirms him in the idea that *Skenea Cutleriana* is Philippi's species, which itself rests on the foundation of a single fossil: I quote Philippi's words, "Panormi in calcareo specimen inveni." I ask, can this meagre exposition be sufficient to upset my discovery, and prove that Philippi's *T. exilis* is my *T. Cutlerianus*? But I proceed to show that Mr. Jeffreys's opinion is erroneous, and that the two species are distinct.

I will now consider Philippi's text and figures of *T. exilis* in comparison with *T. Cutlerianus*; and it is fortunate he has given a greatly enlarged figure, in addition to that of the natural size, to exhibit the minutiæ and accurate contour and form of his shell. The pattern figure represents a globose and subconic shell, having its axial and transverse diameter of much the same length, showing *five* volutions—that being the number stated by Philippi in his text; my British shell, of which I have taken many hundreds, and have now in my collection sixty live, perfect, and operculated specimens, has barely *three* volutions, which is the normal number that stamps the adult shell. This difference is so important and overwhelming a character as to be conclusive that my *T. Cutlerianus* cannot be the *T. exilis* of Philippi, and establishes the mistake of Mr. Jeffreys. I might here close my case; but in corroboration I proceed.

The general form of the *T. exilis* tapers from the globose body-volution, with *four* others, to a subconic pointed termination; mine, from the subglobular basal whorl, cannot be said to taper at all, but suddenly subsides into a flattish, blunt, irregular coil of hardly *two* turns.

The aperture in the *T. exilis* in the text is called suborbicular, and the figure explains the character of that term by portraying a regularly curved and perfectly even apertural periphery; but, in the British and perfect examples of the *T. Cutlerianus,* the aperture presents two conspicuous sinuations (it is never without them)—one at the base, and another at right angles about the middle of the outer lip, which sinuations or indentations, under adequate optical assistance (which, in so minute an object, should be a powerful Coddington lens), exhibit an apertural periphery of a subquadrangular instead of a suborbicular form.

It is useless to continue the comparison of two species so diametrically opposed in every essential character. I challenge the production of a British *T. Cutlerianus* that departs from the distinctions I have enunciated. As to size, ten years ago I stated that my shell was "circa $\frac{1}{8}$ unciæ" in length and breadth; but the selection of the largest specimens from many hundreds captured by myself, and accurately measured, has proved that in no instance has it ever reached $\frac{1}{15}$th of an inch, either axially or transversely; and I feel confident that no adult *T. Cutlerianus* will ever be found to exceed these dimensions, or even to equal them. I may state that the presence of the sinuations of the aperture is a true test of a *T. Cutlerianus* being full-grown; and that shibboleth never fails to appear before it has reached $\frac{1}{20}$th of an inch diameter.

The natural size given in the figure of Philippi's single fossil is at least twice that of the largest *T. Cutlerianus.* After this comparison, can any intelligent observer believe that my shell, that may be said not fully to complete *three* volutions, is Philippi's of *five,* and that the form of his shell represents mine? or that his regularly-curved even aperture is that of my object with its curious sinuations, which, I repeat, are invariably present in adult perfect examples? Can we suppose that so excellent an observer would have failed to mark the indentations in his enlarged figure, if they had existed?

I conclude, and trust I have fairly demonstrated that the *T. exilis* and *T. Cutlerianus* are most distinct species; and that, agreeably to the conventional laws of naturalists, I am, by priority of discovery, at least as yet, entitled to be considered the original author of *T. Cutlerianus*, which, though proved by me to be a strict *Trochus*, has lately by some naturalists had attached to it the generic title of *Margarita Cutleriana*.

We beg that the figures of our species in the 'British Mollusca,' plates 88 and 132, be carefully compared with Philippi's *T. exilis*, when it will be evident that they differ greatly: in pl. 88, figs. 3 and 4, there is a fair representation, though largely magnified, of the general aspect of my shell; and fig. 4 shows portions, pretty well delineated, of the two apertural sinuations I have so particularly mentioned and insisted on: the figures of pl. 132 are not so characteristic, and only feebly mark the sinuous margin of the aperture.

I am, Gentlemen, your most obedient Servant,

WM. CLARK.

XXIV.—*Descriptions of new species of Phytophagous Beetles.* By J. S. BALY, Esq.

[With a Plate.]

THE present paper contains the characters of upwards of twenty new insects, principally belonging to the families *Cassididæ* and *Megalopidæ*. Amongst the most interesting are some very beautiful species sent by Mr. H. W. Bates from the Upper Amazon. The insects described, with a single exception, are in the cabinet of the author.

Crioceris scapularis.

C. nigra, nitida; elytris plaga magna humerali, nigro-notata, fulva. Long. $3\frac{1}{2}$ lin.

Subelongate, shining black. Antennæ moderately robust, rather more than half the length of the body, subfiliform; four basal joints shining, the rest opake. Thorax as long as broad, cylindrical, slightly flattened above, sides deeply constricted in the middle; disk distinctly, but not very closely punctured, indistinctly depressed transversely just behind the middle. Scutellum smooth, impunctate. Elytra oblong, much broader than the thorax, convex, obsoletely depressed transversely below the scutellum; each elytron with eleven rows of regular punctures, the first abbreviated, puncturing distinct and deeply impressed at the base, finer and much less distinct towards the apex; shining black, a large subquadrate patch at the base, extending from the outer margin nearly to the suture, fulvous, the inner edge sinuate, the lower margin deeply and irregularly notched; its surface marked with one or two small black spots. Beneath shining black, covered with adpressed hairs.

Hab. Northern China. Collected by Mr. Fortune.

Lema Batesii.

L. supra nitido-fulva; capite (collo postico excepto) elytrisque nigris, his linea marginali antice, fascia transversa maculisque duabus fulvis; antennis nigro-piceis, apice albis; subtus pallide fulva; pleuris, femorum linea, tibiis tarsisque nigro-piceis.—Long. 4 lin.

Subelongate. Head shining black, the posterior half of the neck fulvous. Antennæ nearly as long as the body, filiform, nigro-piceous; second joint obscure fulvous, three terminal joints, and sometimes the apex of the preceding, white. Thorax rather longer than broad, cylindrical, sides deeply constricted in the middle; above smooth, shining fulvous, impunctate, transversely impressed behind the middle. Scutellum smooth, shining black. Elytra much broader than the thorax, oblong-ovate, convex, slightly depressed transversely below the scutellum; each elytron with eleven regular rows of fine punctures, more deeply impressed at the base; shining black, a rotundate patch below the base, a second near the apex, a transverse slightly arched band across the middle, abbreviated at either margin, and a narrow marginal line in front, fulvous. Beneath covered with adpressed cinereous pubescence, pale fulvous; the pleuræ, metasternum, tibiæ, tarsi, and a line on the upper surface of the thighs, pitchy black.

Hab. Ega, Upper Amazons.

This beautiful species has been sent by Mr. H. W. Bates, after whom I have named it.

Spilophora tetraspilota.

S. subtriangularis, leniter convexa, fulva, nitida; thorace nigro, fulvo-marginato; elytris utrisque maculis duabus cyaneis.—Long. 3 lin.

Subtriangular, pale fulvous; thorax shining black, its anterior and lateral margins pale fulvous; each elytron with two large metallic blue spots. Head smooth above, longitudinally grooved between the eyes, the latter piceous. Thorax more than one-half broader than long, sides rounded, reflexed; above smooth and shining; disk moderately convex, impressed with three or four small deep foveæ, sides near their base distinctly punctured; black, the lateral and anterior margins fulvous. Scutellum smooth, shining fulvous. Elytra subcordate, truncate at their base, humeral angles rounded, sides rounded, narrowed from before their middle to the apex, the latter acutely rounded; above moderately convex, sinuate below the shoulders, distinctly punctate-striate, the puncturing towards the sides confused; outer margin moderately dilated, slightly deflexed, irregularly punctured; pale fulvous, each elytron with two large, suboval, deep metallic blue spots, one placed immediately below the base and attached to the outer margin, the other on the hinder disk.

Hab. Ecuador.

Spilophora speciosa.

S. minus triangularis, subconvexa, fulva, nitida; elytris plagis duabus communibus et utrisque macula marginali læte cyaneis.—Long. $3\frac{1}{2}$ lin.

Less triangular than any of the other species, subovate, narrowed behind, bright fulvous; elytra with two large common patches, and each with a marginal spot, bright metallic blue. Antennæ rather more than half the length of the body. Head smooth. Thorax transverse, sides rounded, nearly straight behind; above slightly convex, smooth and shining, sides concave and irregularly excavated. Elytra much broader than the thorax, ovate; shoulders rounded; sides dilated and rounded to the middle, thence narrowed towards the apex, the latter acutely rounded; above smooth and shining, finely punctate-striate, puncturing somewhat irregular on the sides; dilated margin deflexed, distantly punctured; bright fulvous, two large transverse common patches, one at the base, the other below the middle, transversely ovate, and a small ovate spot placed near the middle of the outer margin on each elytron, shining metallic blue.

Hab. Ega, Upper Amazons.

Spilophora Bohemani.

S. subtriangularis, flavo-fulva, nitida; antennis nigris; elytris cæruleo-purpureis, flavo-fulvo-marginatis.—Long. $3\frac{3}{4}$ lin.

Very similar in form to *S. sellata,* but differing from that species in the broader thorax, in being rather less triangular and more ovate, in having black antennæ, and in the different coloration of the elytra, which have also their outer border more closely punctured. Antennæ black, their basal joints flavo-fulvous; eyes piceous. Thorax twice as broad as long; sides rounded; disk smooth, slightly convex, sides indistinctly excavated, sparingly punctured. Scutellum smooth, impunctate. Elytra subovate, truncate at the base; shoulders rounded, sides gradually dilated and rounded to their middle, thence narrowed to their apex, the latter subacutely rounded; above moderately convex, disk regularly punctate-striate, puncturing confused towards the sides, lateral margin moderately dilated, closely and irregularly punctured; bright metallic blue, the entire limb (the inner half of the base excepted) bright flavo-fulvous.

Hab. S. Paulo, Upper Amazons. Collected by Mr. H. W. Bates.

Dolichotoma speciosa. Pl. V. fig. 6.

D. rotundata, leniter convexa, nigro-æneа; elytris plaga magna intramarginali sanguinea, nigro-ænea notata instructis.—Long. $7\frac{1}{2}$ lin.

Rotundate, moderately convex, dark nigro-æneous, subopake; each elytron with a large sanguineous submarginal vitta, which extends from below the base nearly to the apex, its surface dotted here and there with roundish nigro-æneous spots. Head impressed on the vertex with a large fovea; antennæ nearly the length of the body, black, six basal joints rufo-piceous beneath. Thorax short, transverse, concave-emarginate at the apex; sides rounded and dilated, reflexed; above convex in the middle, concave on the sides, central line transversely impressed just in front of the basal lobe, surface indistinctly punctured. Elytra much broader than the thorax; shoulders rounded, sides regularly rounded and dilated to their middle, narrowed and subsinuate below the latter, thence to their apex regularly rounded, apex obtuse; above moderately convex, obsoletely gibbous below the scutellum; surface covered with large deep punctures, which are smaller and less deeply impressed close to the apex; margin dilated, slightly deflexed, its outer edge somewhat reflexed; smooth, and almost entirely covered by a large submarginal sanguineous patch, over the surface of which are scattered some shallow subrotundate nigro-æneous spots. Beneath dark shining nigro-æneous; under surface of four anterior thighs rufous.

Hab. Ega, Upper Amazons. Collected by Mr. H. W. Bates.

Calaspidea Bohemani.

C. rotundato-ovata, valde convexa, obscure viridi-ænea, subopaca; elytris intra marginem laxe sanguineo-reticulatis.—Long. $9\frac{1}{2}$ lin.

Rotundate-ovate, subopake, obscure metallic green, the outer border of the elytra sparingly covered with some irregular sanguineous reticulations. Head smooth; antennæ more robust than in *C. discors*, third joint rather longer than the fourth. Thorax transverse, apex concave-emarginate; sides dilated, reflexed, regularly rounded; above convex in the middle, indistinctly depressed transversely in front of the basal lobe, sides deeply concave and covered with irregular shallow depressions; surface shining metallic green, indistinctly punctured. Elytra much broader than the thorax, very convex, shoulders slightly prominent, retuse, humeral angle obtuse; sides dilated and rounded to their middle, thence narrowed and rounded to the apex, the latter rounded; disk covered with shining, distinctly punctured, slightly elevated reticulations, which enclose small opake areoles; lateral margin dilated, deflexed, subopake, finely punctured, covered within the outer border with irregular loose sanguineous reticulations, the puncturing of which is more distinct than the rest of the surface. Beneath nigro-æneous; abdominal segments narrowly edged with rufous.

Hab. Peru.

Omaspides pulchella. Pl. V. fig. 3.

O. rotundata, modice convexa, rufo-testacea, subopaca; antennis nigris; elytris metallico-viridibus, plaga magna submarginali testacea; subtus picea; thorace utrinque macula, abdomineque rufo-testaceis.—Long. $6\frac{1}{2}$ lin.

Rotundate, moderately convex, rufo-fulvous, subopake; antennæ black; elytra dark metallic green, each with a broad submarginal vitta, rufo-fulvous. Thorax semicircular, subtruncate at the apex; sides slightly oblique and sinuate; above subconvex, transversely impressed in front of the basal lobe, longitudinally grooved down the middle; subopake, rufo-testaceous, lateral margin obscure picco-æneous. Elytra much broader than the thorax, subtruncate at the base, shoulders rounded, sides much dilated and rounded to their middle, thence slightly narrowed towards the apex, the latter rounded; above moderately convex, obsoletely gibbous below the scutellum; surface finely and closely punctured, subgranulose on the disk; sides much dilated, slightly deflexed, rather less closely punctured; obscure metallic green, a broad vitta within the outer margin, extending from immediately below the base nearly to the apex, rufo-fulvous. Beneath piceous; a longitudinal patch on either side the thorax and the abdomen rufous, the latter stained with piceous.

Hab. S. Paulo, Upper Amazons.

Agathomerus Batesii. Pl. V. fig. 2.

A. elongatus, niger; elytris purpureis; antennarum apice, thorace infra limboque supra, elytrorum fascia transversa maculisque duabus, femoribusque infra, flavo-albis.—Long. $4\frac{3}{4}$ lin.

Elongate, shining black, covered with adpressed black pubescence; elytra purple; three terminal joints of antennæ, together with the intermediate joints beneath, the under surface of the thorax, its entire limb above, a small humeral patch, a transverse subapical stripe and a transverse band across the middle of the elytra, together with the under surface of the thighs, yellowish white; the pubescence concolorous. Head shining black; vertex convex, smooth, impunctate; upper portion of face indistinctly excavated, finely punctured; clypeus separated from the face by a deep transverse groove; antennæ more than half the length of the body. Thorax transverse, sides notched near their apex; above transversely convex, deeply grooved at the base and apex, impressed on either side near the posterior angles with a distinct fovea; surface smooth and shining, glabrous, the entire limb yellowish white. Scutellum smooth and shining, transversely grooved, its apex yellowish white. Elytra oblong, parallel, convex above, transversely depressed below the scutellar space, the latter slightly elevated, surface closely punctured, bright purple, covered with black hairs; a small spot on the shoulder, a transverse patch just within the apical border, and a transverse band across the middle, abbreviated at the extreme outer margin, yellowish white. Beneath black; head, thorax (a small spot on either side the latter excepted), coxæ, and the under surface of all the thighs, yellowish white; hinder pair of thighs nearly as long as the elytra, thickened, ovate, more convex on the upper border.

Hab. Ega, Upper Amazons. Collected by Mr. H. W. Bates.

Mastostethus thoracicus.

M. oblongus, subdepressus, flavus; antennis, facie inter oculos verticeque, thoracis plaga, elytrorum dimidio postico lineaque submarginali antice, tibiis tarsisque posticis, nigris.—Long. 5 lin.

Var. A. Thorace maculis duabus parvis nigris notato.

Oblong, subdepressed, deep fulvous. Head shining, indistinctly punctured on the vertex, closely and deeply punctured along the inner margin of the eyes; face separated from the clypeus by a deep transverse groove; antennæ, apex of jaws, and a large patch covering the upper half of the face between the eyes and extending backwards across the middle of the vertex, shining black. Thorax twice as broad at the base as long; sides straight, narrowed from the base to the apex; above transversely convex, indistinctly punctured, impressed at the hinder angle with a deep fovea; a large transverse patch, covering the middle of the disk, black. Elytra oblong, subdepressed above, narrowed behind, apex rounded, dehiscent at the suture; surface distinctly punctured, puncturing much finer and less distinct towards the apex; posterior half of each elytron, and a narrow submarginal line, running upwards as far as the shoulder, shining black, rest of the surface deep shining fulvous. Beneath bright fulvous, sparingly covered with concolorous hairs; hinder pair of tibiæ and tarsi black, covered with similarly coloured pubescence. Apex of anal segment in the *male* with a shallow semicircular impression, in the *female* with a deep semicircular fovea, in the middle of which is a distinct circular puncture.

Var. A. Thorax marked with two small black spots.

Hab. Ega, Upper Amazons.

This insect is very closely allied to *M. dimidiatus,* and differs principally from that species in the presence of the black mark on the thorax, and also in having the narrow submarginal line: these characters, although slight, are nevertheless constant in all the specimens I have seen.

Mastostethus Batesii. Pl. V. fig. 8.

M. oblongus, nitido-fulvus; antennis extrorsum, oculis, capitis maculis, thoracis maculis septem elytrisque nigris, his macula humerali parva fasciaque transversa ante apicem albis; tarsis piceis.—Long. 5–5½ lin.

Var. A. Antennis, tibiis tarsisque nigris, thoracis maculis duabus anticis obsoletis.

Head excavated and punctured on either side between the eyes, vertex finely punctured; shining fulvous, a transverse spot on the clypeus, a longitudinal line between the eyes, and two spots on the hinder part of the vertex black. Antennæ compressed and much dilated towards the apex; five or six basal joints fulvous, more or less stained above with black, remaining joints entirely black. Thorax nearly three times as broad at the base as long; sides narrowed from their base to the apex, indistinctly rounded, obsoletely sinuate at the base, notched at the apex, anterior angles slightly produced obliquely into an obtuse tooth; above subconvex from side to side, obsoletely impressed near the posterior angles; shining fulvous, a small spot at each angle and three on the disk black. Scutellum broad, triangular, smooth, shining fulvous, its base transversely grooved. Elytra rather broader than the base of the thorax, slightly narrowed towards the apex, the latter dehiscent; above subconvex on the sides, flattened along the back, finely punctured, surface sparingly covered with fine black adpressed hairs; shining black, the extreme base sometimes fulvous; a small spot at the humeral angle and a narrow fascia towards their apex white; this latter is somewhat dilated towards the suture, its anterior margin curving slightly upwards. Beneath shining fulvous, sparingly covered with fulvous pubescence; the apex of the jaws, a patch on the pleuræ in front, a spot in the middle of the anterior surface of the intermediate thighs, and another at the base of the posterior pair black; four anterior tarsi pitchy, their medial line fulvous; apex of posterior claws pitchy.

Var. A. Antennæ (the basal joint beneath excepted), tibiæ and tarsi entirely black; face with the following additional markings: one on the labrum and four on either side, one being placed at the base of the antennæ, and another at the inner margin of the eyes, which are pale piceous. Thorax with the spots on the anterior angles obsolete; sides beneath with an oblong black patch; the transverse band on the elytra more dilated towards the suture.

Hab. Ega, Upper Amazons. Var. A. Peru.

Mastostethus Pascoei. Pl. V. fig. 7.

M. oblongus, supra pallide fulvus; antennis (articulis intermediis exceptis) nigro-piceis; capitis maculis duabus, thoracis macula discoidali, elytrisque plaga magna communi ovata a basi ultra medium extensa maculaque apicali nigris; subtus fulvus; pleuris, femorum maculis, tibiisque anticis quatuor supra, tibiis tarsisque posticis totis nigris.—Long. 4 lin.

Oblong, pale fulvous above. Head smooth, finely punctured, lower portion of face separated from the clypeus by a deeply grooved transverse line; a patch on the hinder vertex and an oblong spot between the eyes black; antennæ pitchy black, intermediate joints fulvous; eyes piceous. Thorax transverse, narrowed from the base to the apex; above slightly convex from side to side; surface shining, minutely but not closely punctured, impressed near the hinder angles with a distinct fovea; fulvous, a transverse patch on the disk, emarginate in front, pitchy black. Scutellum black. Elytra subovate, slightly convex, subdepressed above, narrowed and rounded towards their apex, the latter dehiscent; surface distinctly punctured; fulvous, a large ovate common patch, extending from the base to beyond the middle, and occupying nearly the whole surface, together with a subtriangular spot at the apex, black. Beneath fulvous, sparingly covered on the legs and abdomen with coarse concolorous pubescence; some irregular patches on the pleuræ, the hinder pair of tibiæ and tarsi, the upper surface of the four anterior tibiæ, and three oblong patches, one on both the upper and lower surfaces of the intermediate pair of thighs, and the third on the outer surface of the hinder pair, black.

Hab. Ega. Collected by Mr. H. W. Bates.

Mastostethus Jekelii.

M. anguste oblongus, subparallelus, dorso subdepressus, pallide fulvus; elytrorum apice anticeque fascia lata communi, extrorsum abbreviata, margine postico leniter angulata, femoribusque posticis extrorsum, nigris; pleuris macula, oculis tibiisque quatuor anticis extrorsum, nigro-piceis.—Long. 4 lin.

Narrowly oblong, subparallel, slightly subdepressed above; pale fulvous. Head finely but subremotely punctured, puncturing closer and more deeply impressed along the inner border of the eyes, the latter nigro-piceous. Thorax twice as broad as long at the base; sides nearly straight, narrowed from the base to the apex; above transversely convex, surface shining, indistinctly punctured, impressed near the hinder angle with a deep fovea. Elytra oblong, sides narrowed and rounded at the apex, the latter dehiscent; surface distinctly punctured, the apex and a broad transverse band in front black; the latter, which is abbreviated close to the outer border, extends from just below the basal margin to the middle of each elytron, its posterior border being oblique, and forming a more or less obtuse angle at the suture. Beneath pale fulvous, covered with coarse concolorous hairs; hinder thighs incrassate, their outer surface (the extreme base excepted) shining black; a patch on the pleuræ, a spot on the upper and under surfaces of the intermediate femora, and the outer surface of the four anterior tibiæ, nigro-piceous.

Hab. Ega, Upper Amazons.

Mastostethus Javeti. Pl. V. fig. 1.

M. subelongatus, supra fulvus; plaga inter oculos, thorace macula discoidali bilobata elytrisque nigris, his vitta obliqua ante, fascia transversa pone, medium, maculaque prope apicem, fulvis; subtus pallide fulvus, pleuris macula tibiisque extrorsum nigris.—Long. 4–4½ lin.

Subelongate, subdepressed; above fulvous. Head distinctly punctured along the inner border of the eyes, puncturing finer and less crowded on the vertex; face separated from the clypeus by a deep transverse groove; fulvous, apex of jaws and a round spot between the eyes black; eyes piceous. Thorax twice as broad as long at the base; sides narrowed from the base to the apex, rounded behind the middle, slightly sinuate in front; above transversely convex, finely but not closely punctured, impressed near the hinder angle with a deep fovea; fulvous, a large transverse patch on the disk, bilobate behind, black; surface of the thorax surrounding this patch more or less stained with piceous. Elytra oblong, subdepressed above; sides subparallel, narrowed and rounded near the apex, the latter dehiscent; surface distinctly punctured; black, a spot at the humeral angle, an oblique vitta extending from the scutellum nearly to the outer border at the termination of its anterior third, a transverse band immediately below the middle, and a small patch near the apex, fulvous. Beneath pale fulvous, sparingly covered with concolorous pubescence; an oblong patch on the pleuræ, and the outer surface of all the tibiæ, black.

Hab. Ega, Upper Amazons.

Megalopus Waterhousei.

M. elongatus, angustatus, parallelus, fulvus, subnitidus; capite, thoracis macula antica, tibiis tarsisque posticis nigris; elytris griseis, nigro-hirsutis, linea submarginali vittaque obscure fulvis.—Long. 4–5 lin.

Head distinctly punctured; front longitudinally impressed between the eyes, the latter prominent; black, covered with concolorous hairs; the base of the jaws and the palpi yellow. Thorax cylindrical, constricted at the base and apex, posterior angles produced into an obtuse tooth; surface shining, distinctly but subremotely punctured, flavo-fulvous, a spot in the middle of the anterior border black. Scutellum shining yellow. Elytra rather broader than the thorax; sides nearly parallel, scarcely narrowed behind; apex acutely rounded, dehiscent at the suture; above convex, flattened and slightly excavated along the suture; placed somewhat obliquely near the apex of this latter is a short longitudinal fossa; surface closely and distinctly punctured; grey, covered with adpressed black pubescence, a narrow submarginal line terminating near the middle, and a broad obscure vitta on the inner disk, abbreviated towards the apex, obscure fulvous. Beneath pale fulvous, sparingly covered with pubescence of the same colour; posterior pair of tibiæ and tarsi black, covered with concolorous hairs; anal segment of abdomen also black; posterior pair of femora moderately incrassate; tibiæ of the same pair incrassate, suddenly thickened beyond their middle; apical half of four anterior tibiæ, together with the tarsi, more or less stained with piceous. (*Male.*)

(*Female.*) Posterior femora slightly incrassate; tibiæ slightly curved, gradually increasing in thickness towards their apex.

Hab. Ega and San Paulo, Upper Amazons.

Temnaspis speciosus. Pl. V. fig. 4.

T. elongatus, parallelus, niger, nitidus; femoribus piceis; abdominis basi apiceque, metasterni tuberculis, thoracis lateribus elytrisque flavis, his macula humerali, fascia transversa centrali maculaque subapicali nigris; femoribus posticis modice incrassatis, subtus bispinosis. (*Mas.*)—Long. 5–6 lin.

(*Fœm.*) Femoribus posticis vix incrassatis, unispinosis; abdomine flavo, medio plaga transversa nigra.

Elongate, parallel, convex, subdepressed along the suture; shining black, sparingly covered with short hairs, the pubescence on the under surface of the body longer and more distinct; abdomen (a large central patch excepted), the metasternal tubercles, the sides of the thorax, together with the elytra, yellow, these latter with a humeral spot, a transverse band across the middle, and a subtriangular patch behind, black. Head shining, distantly punctured on the vertex, transversely grooved between the eyes; anterior margin of clypeus fulvous; edge of labrum clothed with fulvous hairs; antennæ rather longer than the head and thorax, entirely black. Thorax scarcely broader than long, subcylindrical; sides constricted in front and at their base, produced just below the middle into a stout subacute process; above shining, grooved in front and on either side at the base, the anterior groove widened and angled in the centre, descending backwards down the disk nearly to its middle; surface finely and distantly punctured, puncturing at the apex rather closer; black, the lateral margin yellow. Scutellum smooth, shining black, its apex obsoletely notched. Elytra broader than the thorax; sides parallel; apex rounded, slightly dehiscent at the suture; above convex, slightly depressed along the suture; shoulders prominent, produced obliquely upwards and outwards, their apex subacute; surface distinctly punctured, sparingly covered with short fulvous hairs; yellow, an ovate patch on the shoulder, a broad transverse band across the middle, produced slightly along the suture both in front and behind, and a large subtrigonate patch behind the middle, black. Beneath black, clothed with longer and coarser hairs; abdomen (a large central patch excepted), the metasternal tubercles, and the sides of the thorax yellow; these latter are marked at the base of the lateral protuberance with a small black spot; thighs piceous, posterior pair moderately incrassate, their apex with several yellow spots; lower surface armed with two acute spines, the first subapical, large, the other smaller, and placed near the middle. (*Male.*)

(*Female.*) Posterior thighs scarcely incrassate, spine in the middle of the under surface obsolete.

Hab. Northern India.

Temnaspis Downesii. Pl. V. fig. 5.

T. elongatus, parallelus, fulvus, subnitidus, villosus; antennis extrorsum, thoracis macula, elytrorum plaga obliqua prope medium, nigris; subtus nitidus; pleuris, abdomine plaga femoribusque posticis macula nigris.—Long. $5\frac{1}{2}$ lin.

Elongate, parallel, convex, shining fulvous; whole body covered with coarse fulvous hairs; seven terminal joints of antennæ, an oblong vitta on the disk of the thorax, and a large subquadrate patch across the middle of the elytra, black. Head closely punctured, impressed on the forehead between the eyes with a deep longitudinal fossa; eyes griseous. Thorax rather broader than long, transversely grooved at the base and apex; either side of the disk with a thick longitudinal elevated ridge, the inner margin of which is bounded by a shallow fossa; surface distinctly but less closely punctured than the head; middle of the disk with a broad vitta, rather broader behind, abbreviated at the base and apex. Scutellum triangular, its apex entire. Elytra subelongate; sides parallel; apex rounded, dehiscent at the suture; above subdepressed along the back, convex on the sides and apex; surface closely punctured, each elytron with two indistinct longitudinal ridges; fulvous, a broad subquadrate patch extending across the middle of each elytron, abbreviated at the extreme outer margin, black; this patch forms a common transverse fascia, emarginate on the suture at its base and apex; the hairs on its surface are concolorous. Beneath shining; a large irregular patch on the pleuræ, another transverse one across the middle of the abdomen, and a large spot on the outer surface of the posterior pair of thighs, black; hinder femora much incrassate, ovate, their lower edge armed in the middle with an obtuse tooth.

Hab. Northern India.

Temnaspis quinquemaculatus.

T. elongatus, supra fulvus, villosus; thorace macula elytrisque utrisque maculis duabus nigris; subtus fulvus; thorace utrinque maculis duabus, pleuris, abdominis plaga centrali femoribusque posticis macula nigris.—Long. 4 lin.

Elongate, parallel, convex, covered with coarse hairs. Head coarsely punctured, front excavated; eyes piceous. Thorax one-third broader than long; sides narrowed from behind forwards, constricted at the apex and extreme base, produced near the latter into an indistinct obtuse protuberance; above convex, grooved at the extreme base and on either side in front; surface irregular, shining fulvous, coarsely but subremotely punctured, central portion gibbous, and covered with a large black patch. Scutellum shining black, triangular, its apex emarginate. Elytra broader than the thorax; sides parallel; apex rounded, dehiscent at the suture; above convex, coarsely punctured and covered with coarse pubescence, puncturing finer and more distant towards the apex; shining fulvous, each elytron with two transverse bands, abbreviated at the suture and outer margin, one placed before, the other behind the middle. Beneath shining fulvous; two spots on either side the thorax, the pleuræ, a transverse patch on the centre of the abdomen, and an ovate spot on the outer surface of the posterior thighs, black; hinder thighs incrassate, ovate, armed at their apex beneath with two acute teeth.

Hab. Northern India.

Temnaspis pulcher.

T. elongatus, niger; thorace elytrisque flavis, illo maculis tribus, his utrisque maculis duabus, nigris; subtus flavus; thoracis maculis, pectore, abdominis plaga centrali, pedibusque (femoribus posticis apice exceptis) nigris.—Long. 4 lin.

Elongate, parallel, convex, shining black, sparingly covered with concolorous hairs; thorax and elytra pale yellow, the former with three, the latter each with two black spots. Head shining black, front impressed with a deep ovate fovea; clypeus surrounded by a bright yellow line. Thorax subcylindrical, slightly constricted at the base and apex; sides rounded, slightly produced behind into an indistinct process; surface shining, a large subovate spot on either side, and a smaller one behind, black. Scutellum shining black. Elytra broader than the thorax; sides parallel; apex rounded, dehiscent at the suture; above convex, distinctly but not very closely punctured; pale shining yellow, sparingly covered with black adpressed hairs; a spot on the shoulder and a large patch near the middle of the disk, bifurcate behind, black. Beneath pale shining yellow; two spots on either side the thorax, the entire breast, a large patch in the centre of the abdomen, together with the legs (the apex of the hinder thighs alone excepted), shining black; tibiæ covered with coarse adpressed black hairs; posterior pair of thighs incrassate, ovate, armed on their lower surface with two acute spines, the first shorter, placed near the middle, the other subapical.

Hab. Northern China. Collections of the British Museum and W. W. Saunders, Esq.

Temnaspis nigriceps.

T. subelongatus, parallelus, nitido-rufo-fulvus, villosus; pleuris capiteque nigris; facie inferiori, antennis, thorace, femoribus quatuor anticis, tibiis tarsisque flavis; unguiculis piceis; elytris nigro-purpureis, macula apicali rufo-fulva.—Long. 4 lin.

Subelongate, parallel, shining rufo-fulvous, villose. Head coarsely punctured, front impressed between the eyes with a deep fovea; shining black, lower portion of face and the antennæ yellow, the latter more than half the length of the body, four basal joints shining, sparingly covered with long hairs, the rest covered with a short adpressed concolorous pile. Thorax broader than long, subcylindrical; sides slightly rounded, constricted at the extreme base and in front, produced near the former into an indistinct protuberance; above shining yellow, grooved at the apex, and narrowly so at the extreme base, anterior groove dilated and slightly angled in the middle; surface deeply but not very closely punctured, covered with coarse erect hairs. Scutellum triangular, its apex emarginate, distantly punctured, shining black, limb fulvous. Elytra broader than the thorax; sides parallel; apex rounded, dehiscent at the suture; above convex, deeply punctured, covered with long subdepressed hairs; shining black, a narrow semilunate apical patch rufo-fulvous. Beneath shining rufo-fulvous; pleuræ nigro-piceous; legs (the posterior thighs excepted) pale yellow; claws more or less stained with piceous; hinder femora strongly incrassate, ovate, their under surface armed near the apex with two acute spines.

Hab. Nepal.

Temnaspis insignis.

T. elongatus parallelus, nitido-fulvus, villosus; elytris nigro-purpureis, macula apicali rufo-fulva; tarsis quatuor anticis piceis.—Long. 5 lin.

Elongate, parallel, shining fulvous, villose; four anterior tarsi piceous; elytra purple-black, a narrow semilunate patch at their apex rufo-fulvous. Head shining, deeply punctured, punctures distant on the face; front impressed with a deep fovea; antennæ more robust than in *T. nigriceps.* Thorax subcylindrical; sides constricted in front and at the extreme base, produced near the latter into an obtuse tubercle; above shining, grooved at the apex and narrowly so at the extreme base, anterior groove dilated and angled in the middle; surface deeply but not closely punctured, sparingly covered with erect hairs. Scutellum triangular, its apex emarginate. Elytra longer than in *T. nigriceps,* broader than the thorax; sides parallel; apex rounded, dehiscent at the suture; above convex, less deeply and closely punctured than in the last species; shining black, covered with long subdepressed hairs, apical margin rufo-fulvous. Beneath shining fulvous, covered with long erect hairs; posterior thighs as in the last species; four anterior tarsi piceous.

Hab. Northern India.

Longer and narrower than the preceding insect.

Pœcilomorpha Murrayi.

P. subelongata, fulva; pectore, abdominis fasciis, antennis pedibusque nigris.—Long. 6 lin.

Subelongate, fulvous, sparingly covered with adpressed hairs. Head coarsely punctured; clypeus separated from the face by a deep transverse fossa; antennæ, apex of jaws, and an indistinctly raised tubercle between the eyes, black. Thorax transverse, constricted at the base and apex; sides rounded in front, produced posteriorly into a stout obtuse protuberance, which is flattened towards the apex; above convex, deeply grooved at the base and apex, shining fulvous, sparingly punctured. Elytra broader than the thorax; sides subparallel; apex rounded, dehiscent at the suture; above convex, slightly flattened along the back, shoulders slightly prominent; surface closely and distinctly punctured, sparingly covered with fulvous hairs. Beneath black; head, thorax, anterior coxæ, a spot at the apex of the posterior thighs, together with the abdomen, fulvous, the latter with a transverse black band on all the segments (with the exception of the last), the pubescence on the black portions concolorous; under surface of the thighs and tibiæ fringed with bright fulvous hairs; posterior femora moderately incrassate, ovate.

Hab. Old Calabar.

This species is nearly allied by its general form to *P. atripes*; the difference in the shape of its thorax will, however, at once distinguish it from that species.

Pœcilomorpha fulvipennis.

P. elongata, subangustata, convexa, nigra, nitida, fulvo-hirsuta; faciei elytrisque maculis duabus flavo-fulvis.—Long. 4 lin.

Elongate, subangustate, convex, shining black; whole body covered with coarse pale fulvous hairs; two patches between the eyes rufo-fulvous; the elytra flavo-fulvous. Head shining, distantly punctured; the labrum, the anterior margin of the clypeus, and two patches between the eyes, rufo-fulvous. Thorax subcylindrical, constricted at the base and apex; sides produced behind into an indistinct subacute process; surface transversely grooved at the base and apex, shining, impunctate. Scutellum triangular, shining black, longitudinally grooved. Elytra broader than the thorax; sides parallel; apex rounded, dehiscent at the suture; above convex, distinctly and closely punctured; flavo-fulvous. Beneath shining black, covered with coarse pale hairs; posterior thighs slightly incrassate, elongate-ovate.

Hab. Port Natal.

Similar in form to *P. afra*, but easily separated from that insect by the produced sides of the thorax and by the narrower scutellum, as also by the different coloration.

XXV.—*Notes on Lepidoptera collected in Madeira by* T. V. Wollaston, Esq.; *with descriptions of some new species.* By H. T. Stainton, Esq., V.P. Ent. Soc.

1. *Eupithecia Insulariata*, n. sp.

E. alis anticis fuscis, albido-lineatis, dorso et margine postico ferrugineo suffusis; fascia tenui ferruginea ante lineam subterminalem alarum posticarum; abdomine ferrugineo punctato.—Exp. al. 9 lin.

Allied to *Eupithecia pumilata*; but the central portion of the wing darker, the second paler fascia more angulated and indented, and especially distinguished by the reddish fascia on the posterior wings and the reddish spots on the abdomen.

Inhabits Madeira proper, Porto Santo, Dezerta Grande, &c.

2. *Acidalia atlantica*, n. sp.

A. alis anticis dilute griseis, lineis tribus e punctis nigricantibus compositis, costam versus angulatis et latioribus, puncto discoidali nigro supra lineam centralem posito; margine postico nigro punctato.—Exp. al. $6\frac{1}{2}$–7 lin.

Allied to *Acidalia Virgularia*, but paler and neater; the three lines parallel, and distinctly angulated towards the costa; the discoidal spot placed on the central line, and the hind margin of the hind wings more dentated: the hind tibiæ of the male are incrassated, with no spurs, and the tarsi almost obsolete; the hind tibiæ of the female have one pair of spurs.

Inhabits Dezerta Grande.

3. *Scopula ferrugalis*, Hübner.

Udea ferrugalis, Stephens, Mus. Cat. p. 240.

Inhabits Madeira proper.

4. *Simaëthis Fabriciana*, Linnæus.

Simaëthis Fabriciana, Stephens, Mus. Cat. p. 248.

Two specimens, both a trifle darker than European specimens of this insect, but apparently not specifically distinct.

Inhabits Madeira proper.

5. *Eudorea decorella*, n. sp.

E. alis anticis albidis, striga anteriore recta latiuscula, striga posteriore tenui arcuata et indentata, externe late saturate fusco marginata, signo ☿ ochraceo expleto, spatio antemarginali angusto albo.—Exp. al. 8 lin.

In the sharp contrast of colour, this resembles *E. resinea*; but from that species it is abundantly distinguished by the form of the second striga, the distinct white submarginal space, and the ochreous filling-up of the mercurial marking.

Inhabits Madeira proper.

6. *Eudorea frequentella*, Stainton.

Eudorea frequentella, Stephens, Mus. Cat. p. 4.

Three specimens, in bad preservation, should probably be referred to this species; but in all, the central portion of the wing is dark, as in the variety (?) *concinnella*.

Inhabits Madeira proper.

7. *Eudorea acuminatella*, n. sp.

E. alis anticis angustis, acuminatis, dilute griseis, striga priore acute fracta, extus saturatius marginatis, striga posteriore biarcuata et obliqua, signo ♉ subobsoleto, spatio antemarginali grisescente.—Exp. al. 9–10 lin.

Closely allied to *E. angustea,* but the anterior wings even narrower and more pointed, the ground-colour of a more uniform grey, and the mercurial marking far more indistinct.

Inhabits Madeira proper and the Dezerta Grande.

8. *Myelois cinerella,* n. sp.

M. alis anticis angustulis dilute griseo-ochreis, fusco valde suffusis, striga priore obliqua, posteriore sinuata, ciliis dilute griseo-ochreis.—Exp. al. 10–11 lin.

An obscure-looking insect, not closely allied to any known species; the labial palpi are unusually short, and the median vein of the posterior wings is trifid, as in *M. compositella.*

Inhabits the Northern Dezerta.

9. *Ephestia elutella,* Hübner.

Ephestia elutella, Stephens, Mus. Cat. p. 20.

A specimen of this cosmopolitan insect is rather neater and greyer than the species generally occurs, but does not appear to be specifically distinct.

10. *Tortrix ? reticulata,* n. sp.

T. alis anticis brunneis, saturate brunneo irroratis, fascia antica et maculis duabus posticis obsolete dilutioribus; alis posticis albis cinereo-reticulatis.—Exp. al. 1 unc. 1–2 lin.

Not allied to any species with which I am acquainted. From its large size, it has almost the appearance of a *Chilo;* but the broad brown anterior wings and grey-chequered white posterior wings give it quite a peculiar character.

Inhabits Madeira proper.

11. *Tortrix subcostana,* n. sp.

T. alis anticis brunneo-ochreis, fascia obliqua saturatiore extus dentem emittente, costa postice fusco-punctata; alis posticis albis.—Exp. al. 9 lin.

Allied to *Tortrix costana,* but distinguished by the fascia not becoming paler in the middle, and emitting a tooth posteriorly, and by the absence of the costal blotch towards the apex.

Inhabits Madeira proper.

12. *Tortrix retiferana,* n. sp.

T. alis anticis brunneo-ochreis, area basali oblique desinente saturatiore, macula obliqua saturate brunnea a costæ medio in fasciam rectam latiusculam obsolete saturatiorem desinente, macula parva (interdum) anguli analis saturate fusca; alis posticis albidis cinereo-reticulatis.—Exp. al. 7 lin.

Not closely allied to any known species: the dark basal half of the anterior wings and the reticulated appearance of the pale posterior wings furnish it with rather striking characters.

Inhabits Madeira proper.

13. *Tinea pellionella,* Linnæus.

Tinea pellionella, Stainton, Mus. Cat. p. 14.

Two specimens of this insect, which is probably co-extensive with the human race, are among Mr. Wollaston's captures from Madeira proper and the Southern Dezerta; one of them is rather darker than usual, but does not appear to be specifically distinct.

14. *Plutella Cruciferarum,* Zeller.

Plutella Cruciferarum, Stainton, Mus. Cat. p. 43.

A specimen of this insect in no way differs from English specimens; it was taken in Madeira proper.

15. *Gelechia ocellatella,* n. sp.

G. alis anticis obscure ochreis, fascia postica parum angulata dilutiore, sub costa fusco-marmorosis, puncto plicæ ante medium saturate fusco, albido-cincto; ciliis apicis nigricantibus.—Exp. al. 6 lin.

This insect reminds one slightly of *Gelechia costella* and *maculiferella,* but is readily distinguished from both by the indistinctness of the costal blotch and by the ocellated spot on the fold.

Inhabits Porto Santo.

16. *Gelechia Portosanctana,* n. sp.

G. alis anticis brunnescenti-ochreis, striga obliqua ante costæ medium fusca, puncto nigro plicæ ante medium; ciliis costalibus posticisque fuscis.—Exp. al. 6 lin.

Two specimens, rather worn. It is not impossible that this may be only a form of the preceding species, from which it differs in the absence of the nebular costal blotch, and the indistinctness of the spot in the fold, which is devoid of the ocellated appearance.

Inhabits Porto Santo.

17. *Gelechia submissella,* n. sp.

G. alis anticis griseo-ochreis, dorso late, striga obliqua ante medium, fascia postica angulata dilutioribus, puncto plicæ ante medium, duobus disci nigris, dilutius circumcinctis.—Exp. al. $4\frac{1}{2}$ lin.

Allied to *G. Artemisiella*; but the inner margin of the anterior wings distinctly and broadly pale ochreous, and the spots more contrasted from their being surrounded with pale rings.

Inhabits Porto Santo.

18. *Gelechia fasciata*, n. sp.

G. alis anticis griseis, saturatius nebulosis, fascia media obliqua lata externe dentata, fasciaque postica angulata albidis.—Exp. al. $4\frac{1}{2}$ lin.

Not closely allied to any known species: it reminds one rather of *domestica*; but the ordinary spots are lost in the dark ground-colour. The broad central pale fascia with its outer edge toothed, affords the most striking character of the insect.

Inhabits Dezerta Grande.

19. *Gelechia Anthyllidella*, Hübner.

Gelechia Anthyllidella, Stainton, Mus. Cat. p. 82.

Exp. al. $4\frac{1}{4}$ lin.

A specimen, rather smaller than usual, appears to be referable to this species.

Inhabits Porto Santo.

20. *Gelechia Elachistella*, n. sp.

G. alis anticis fuscis, parum nitidis, maculis posticis oppositis albidis; capite griseo, fronte albido.—Exp. al. 3 lin.

Smaller even than *G. captivella*, and with the fascia divided into two opposite spots; back of the head grey—by no means snowy white as in *G. captivella*.

Inhabits the Northern Dezerta.

21. *Pterolonche? Maderensis*, n. sp.

P. alis anticis longis, acuminatis, albidis parum griseo irroratis.—Exp. al. 6–8 lin.

The ascending palpi, with a projecting tuft of scales from the second joint, and with a slender terminal joint, remind one of *Plutella*; but the form of the wings, and the exserted ovipositor of the female, the flattened abdomen, &c., abundantly distinguish these insects from the *Plutellidæ*.

Inhabits Porto Santo and the Northern Dezerta; abounding in barren rocky places.

22. *Endrosis fenestrella*, Scopoli.

Endrosis fenestrella, Stainton, Mus. Cat. p. 99.

Inhabits Madeira proper.

23. *Bedellia somnulentella,* Zeller.

Bedellia somnulentella, Stainton, Mus. Cat. p. 134.

Inhabits Madeira proper.

24. *Oinophila flava,* Haworth.

Oinophila V-flava, Stainton, Mus. Cat. p. 136.

The occurrence at Madeira proper of this insect, which, with us, resides in the corks of wine-bottles, is interesting.

25. *Pterophorus acanthodactylus,* Hübner.

Pterophorus acanthodactylus, Stainton, Mus. Cat. p. 174.

Inhabits Madeira proper.

26. *Pterophorus pterodactylus,* Linnæus.

Pterophorus pterodactylus, Stainton, Mus. Cat. p. 177.

Inhabits Madeira proper.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

July 13, 1858.—Dr. Gray, F.R.S., V.P., in the Chair.

On the Genus Synapta. By S. P. Woodward and Lucas Barrett.

The marine animals allied to the Sea Cucumbers, forming the genus *Synapta,* possess a peculiar interest for that large class of persons who study Natural History with the microscope, because they afford the miniature *Anchors,* of which a hundred may be shown in the field of the "inch object-glass," and thousands sometimes exist in the space of a square inch—each elegant in form and perfectly finished, and articulated to an anchor-plate whose pattern (as well as that of the anchor itself) is characteristic of the species to which it belongs.

Curiously enough, these anchors were unknown to all the earlier writers, and most of the moderns. Forskål, who had the merit of describing two species of *Synapta* so long ago as 1775, remarked that they "adhered to the finger by glutinous papillæ invisible to the eye." O. F. Müller called the Northern species *Holothuria inhærens* for the same reason. And Eschscholtz, who met with several species at Tahiti and on the coast of Russian America, concluded that they ought "to form a class apart, not having tubular feet, but adhering, by means of their sharp skin, to extraneous objects, on which account they might be called *Synapta* *."

* Appendix to Kotzebue's Second Voyage, 8vo, Lond. 1830, p. 338. Van der Hoeven makes Eschscholtz say the *Synapta* adheres "by means of small hook-

Only five years ago (in 1853) Mr. Cocks of Falmouth described two British species, and gave a magnified figure of the skin, without seeing the anchors; and still more recently Mr. Gosse was unable to find them, even with the aid of a microscope *. However, they are present in all the examples that have come under our notice, and they can always be seen with a common pocket lens. Indeed the larger anchors of *Synapta digitata* are nearly half a line in length, and visible to the unassisted eye.

Jæger says that all the anchors of his *Synapta Beselii* are $\frac{1}{3}$rd of a line in length, and can be seen without a glass. This great *Synapta* of the Celebes is a yard long, and called a "sea-serpent" by the natives! †

Two other large species, described by Lesson, were said to create a burning sensation when handled; but it is not clear whether this was caused by the anchors, or by urticating organs, like those of the *Actinia* and *Eolis*. No such phænomenon could be detected by Quatrefages or other observers who have handled the smaller *Synaptæ* when alive.

The anatomy of these creatures appears to have been first investigated by Leuckart ‡, who examined the *Synapta vittata* of Forskål, and ascertained that it had no internal respiratory organs like the *Holothuria*.

Anchors and plates attributed to this species, which comes from the shores of the Red Sea, near Suez, are to be found in the cabinet of every microscopic observer. The slides are prepared in Paris, and extensively re-manufactured in this country. The anchor-flukes are plain and simple, and the articular end of the shank is deeply subdivided. The plates are furnished with a raised arch at the smaller end, forming a sort of cavity for the reception of the anchor-stock. They are exactly like those figured in Müller's article, "Über den Bau der Echinodermen" (Berlin Trans. 1854, t. 6. f. 17), under the name of *S. serpentina*. There is a woodcut of them in Carpenter's work on the Microscope; and figures are also given in the Micrographic Dictionary. Mr. Wm. Griesbach has a *slide* with the miliary plates, which are oval and granular, very numerous, and all alike.

Prof. Forbes was unacquainted with the anchors of the British *Synaptæ*; and Dr. Carpenter in his last work (1857) says it is not known whether they have anchors, or wheels like *Chiridota*.

We have obtained evidence of both the European *Synaptæ* from several British localities; and as the published notices are scattered in many works, we propose to give some account of them, and also to describe a new species from China.

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lets;" but this expression (der sie überall wie Kletten anhängen) is employed in the introductory paragraph. In the special description of *Synapta* he only speaks of "small *roughnesses* (Rauhigkeiten) invisible to the naked eye." And he describes *Chiridota verrucosa* as, "corpore undique verrucis rubris adhærentibus obsito."—Zool. Atlas, fol. Berlin, 1829.

* Aquarium, p. 243.

† Dissertatio de Holothuriis, 4to. Turic. 1833.

‡ Isis, 1831.

1. Synapta digitata (Holothuria), Montagu.

The earliest account of this species appears to have been given by Montagu *, who discovered it on the coast of Devonshire, and correctly observed its affinity with the *Holothuria inhærens* of the 'Zoologia Danica,' but pointed out its characteristic difference by the epithet "*digitata*." It has four fingers to each of the twelve tentacles, and a minute thumb, which has been overlooked by all observers except J. Müller. It was again found, prior to 1818, by Cranch (the Naturalist to the Congo Expedition), whose specimens are preserved in the British Museum †. In 1844 Mr. Joshua Alder discovered it on the west coast of Scotland, the most northern locality yet known. He says in a letter :—"I dredged the true *digitata* of Montagu in Rothsay Bay in 1844. At that time I could have got any number of specimens, though it was confined pretty nearly to one spot in shallow water. They broke themselves up so that it was impossible to keep them entire ; I, however, made a drawing of one at the time, which I now send for your inspection." Mr. Alder further states that he had received specimens from Mr. Barlee, dredged in Birterbuy Bay and at the Arran Isles, on the west coast of Ireland.

In 1845 Mr. Alder again met with this species in Torbay ; and in January 1854 the Rev. Charles Kingsley "collected many living specimens on the beach, near Torquay, washed ashore after a heavy gale."

In the 'Contributions to the Fauna of Falmouth' for 1853, by Mr. W. P. Cocks, this *Synapta* is figured and described, but not very minutely. "The specimens procured measured from $2\frac{1}{2}$ to $4\frac{1}{2}$ inches in length, and about $\frac{1}{4}$ inch in diameter. Found in the blue mud and sand, Helford ; plentiful in particular localities ; Falmouth, very rare."

The *Synapta digitata* ranges southward to the Mediterranean, and seems to be very common on the shores of the Adriatic near Trieste, since J. Müller speaks of finding the "molluskigerous sacs" in upwards of 70 individuals ‡. By the kindness of Dr. Hartmann of Berlin, we have received examples from the same locality. It was not found by Prof. Edward Forbes in the Ægean ; the specimens distributed by him were taken by Mr. MacAndrew in Vigo Bay, on the north-east coast of Spain, in the year 1849. Last year (1857) we accompanied Mr. MacAndrew in a second dredging excursion to the same coast, and obtained numerous examples of the *Synapta* in 10-fathom water, a few miles below the town of Vigo ; they had been previously found in shallow water, on the quarantine ground, about twelve miles higher up the bay. The specimens were small, none exceeding 6 inches in length and $\frac{1}{4}$ inch in diameter. In colour they were dull purplish red, slightly darker in front and on the back, and marked with five pale bands, indicating the longitudinal muscles

* Linn. Trans. xi. p. 22. t. 4. f. 6.

† Gray, Catalogue of British Radiata, p. 12.

‡ Ueber *S. digitata* und über die Erzeugung von Schnecken in Holothurien. 4to. Berlin, 1852.

which answer to the lines of suckers (or *ambulacra*) of the other Echinodermata. The skin was also mottled with minute red spots, produced by epidermal papillæ. We preserved every specimen we could find, hoping to detect the "molluskigerous sacs" in some new phase of their development; but in this we were entirely disappointed. The intestines of the creature were filled with inorganic mud, in which we detected an occasional Diatom or Rhizopod, but nothing more. When placed in basins of sea-water, they showed their tentacles freely, and most of them remained expanded when preserved in spirit. They were very sluggish, and did not evince much disposition to vomit their interiors or to break up into fragments. We readily detected them in the dredge, even when obscured with mud, by their clinging to the fingers, as described by Eschscholtz.

In some examples the *anchors* are very few, and ranged in a double line along the muscular bands. They vary from about twenty-five in the field of the inch object-glass to three times that number. Their length averages about $\frac{1}{100}$th of an inch. The anchor-flukes are sometimes plain, and sometimes barbed with three to five serrations. The *anchor-plates* are oval and leaf-shaped, having a process (or stalk) at the end to which the anchor is articulated; the disk is perforated by four large simple holes surrounded by an irregular series of smaller openings; the articular process has a slit like the eye of a needle. In the northern specimens these plates are rounded and rather "obcordate," but in those from the southern locality they are longer, less regular, and somewhat contracted in the middle; the perforations also are larger in proportion, and more angular.

Some specimens possess a few great anchors, four times as long as the rest, and with large flukes, lying with great regularity in the interspace of the muscular bands; their plates are correspondingly large, and irregular in outline.

All the anchors are fixed transversely to the *length* of the animal, some being turned one way and some the other.

Besides these, the skin contains innumerable smaller particles, or *miliary plates*, which are especially crowded over the muscular bands. They are oblong, or hour-glass shaped, and about $\frac{1}{4}$th to $\frac{1}{8}$th the length of the anchor-plates, or from $\frac{1}{1000}$th to $\frac{1}{500}$th of an inch long.

By far the greater number of the anchors are imbedded in the skin; only a few rise above the surface or swing freely on their pivots. They are developed beneath the epidermis, become liberated by the wearing of the surface, and are themselves broken by use and worn away and replaced by others. The anchors are developed before the anchor-plates. First, we find a simple, slender spiculum; then another, longer and expanded at one end; those only which have attained their full length begin to develope flukes; and it is not until the anchors are completely grown that we detect any trace of the anchor-plate. This also makes its appearance as a straight needle lying beneath the middle of the shank; in the next stage it is forked at each end ; these branches grow and divide again, until the plate is all sketched out, the margin being added last, and the whole becoming more solid. We have not met with any figure of the spicula of *S. digitata,* except the bad one given by J. Müller, whose work we have only been able to see in the Library of the Museum of Practical Geology.

2. Synapta (Holothuria) inhærens, O. F. Müller.

The second European *Synapta* was discovered at Christiansand, on the coast of Norway, and figured and described in the 'Zoologia Danica' (1781). The anchors and plates are also figured in the admirable Memoir of Duben and Koren *. The anatomy of this species is described at some length by M. Quatrefages †, who regarded it as a new species, and called it *S. Duvernæa.* These specimens were obtained on the coast of Brittany, at the Isles Chaussey near St. Malo, where they were very abundant in the mud near low water, and attained a length of 10 to 18 inches, with a diameter of 5 to 12 lines.

The anchor-plates of this species more nearly resemble those of the Red Sea *S. vittata* than the last. They are oval, with no arch or process at the articular end ; and the disk is perforated by six oval cells surrounding a central opening each with a scolloped border, as in *S. vittata.*

The anchors have serrated flukes, the serrations varying from 3 to 7 ; and the anchors are sometimes shorter than the plates, sometimes considerably longer.

The miliary granules are few, and confined to the muscular bands ; they are only half as long as in *S. digitata,* and rudely crescent-shaped.

A specimen of this *Synapta* was obtained by Mr. Henslow at Aberystwith, and communicated in 1819 to Dr. Leach, who labelled it "*Jemania Henslowana.*" It is a small individual with imperfectly developed spicula, but showing the characteristic pinnate tentacles.

In June 1856 Mr. J. W. Wilton, of Gloucester, found another example at Criccieth, on the same coast of Cardigan Bay. It was discovered under a stone, at low water, and presented the appearance of "a clear pinkish waving worm, about 3 inches long, with a number of little papillæ all over it, and five faint longitudinal bands from head to tail. It had twelve tentacles, with five digits on each side. It was perpetually waving and swelling in one part, contracting in another ‡. It lived but a short time, and finally constricted itself and broke up into half a dozen fragments."

In February 1856 Mr. E. C. Buckland obtained a finer specimen under similar circumstances, in Lihou Bay, Guernsey. A microscopic preparation of the skin of this specimen shows 150 anchors

* Proceedings of the Royal Academy of Sciences, Stockholm, 1846.

† Annales des Sciences Nat. 2 sér. t. xvii. Zool. p. 19.

‡ Forskål named one species *Synapta reciprocans,* on account of these remarkable muscular movements.

in the field of the inch object-glass ($\frac{1}{7}$ inch diameter); and the anchors are more than half as long again as the plates *.

Mr. Cocks, who met with *Synapta inhærens* on the coast of Cornwall, regarded it as a variety of *S. digitata*. He describes it as having "13 digitated pinnæ on each tentaculum. Length of specimens procured from 1 to $2\frac{1}{2}$ inches by $\frac{1}{16}$th to $\frac{1}{8}$th of an inch. Found in hard and stony soil; Helford, scarce; Falmouth, very rare. I have kept them alive for months in sea-water procured from Helford or Gwyllyn-vase, but they invariably broke into fragments as soon as water from Green Bank was thrown into the glass."

Lastly, two small specimens were dredged by Mr. MacAndrew in Bantry Bay, in August 1857.

Synapta bidentata, W. & B.

The new species which we have now to describe was presented to the Zoological Museum of the Cambridge University by the Rev. G. Vachell, who brought it from China. There is also a specimen in the British Museum presented by Mr. Reeve. In its contracted state it measures only 2 inches in length and 5 lines in diameter. The skin is unusually thick, much corrugated transversely, and thrown into five deep longitudinal folds. It is almost devoid of colour, but the ventral band may be distinguished by its breadth, the lateral being rather less wide, and the dorsal muscles narrower still. The twelve tentacles are each furnished with four lobed digits surrounded with a sheath.

The anchors are short and stout (rather shorter than those of *S. digitata*), with straight projecting "beams"; the flukes are smooth and bifid. From 50 to 70 occur within a radius of $\frac{1}{14}$th of an inch.

The anchor-plates are obovate, truncated at the articular end, and pierced by very numerous circular holes, which diminish in size from the centre to the circumference. The margin is never completed (so far as we have seen), but the boundary of the external perforations is broken, like that of a wire-gauge.

The miliary granules are rather large, very numerous, and resemble cruciform fragments of the anchor-plates. Near the bases of the tentacles they become still more numerous, larger, and more complicated.

Monstrosities.—As might be expected of minute organs indefinitely multiplied, monstrosities are not unfrequent. Mr. Hislop has a slide of *Synapta vittata* in which two of the anchors have double shanks, and we have seen *S. bidentata* with three flukes.

Genus Chiridota, Esch.

This genus was proposed by Eschscholtz at the same time with *Synapta*. It was defined as having *digitate* tentacles, whilst *Synapta* had pinnate tentacles,—an unfortunate definition, as all the species figured in the 'Zool. Atlas' are represented with *pinnate* tentacles; and of the two other examples of *Chiridota* quoted, viz.

* "Slides" of this specimen are in many cabinets, with a red label, but with no specific name or locality.

Holothuria inhærens and *H. lævis*, the first is a *Synapta* according to the author's own definition. It was on this account that Prof. Forbes referred our *digitate* species to *Chiridota*.

However, subsequent authors have agreed to apply the name *Synapta* to the species with anchors, which consequently adhere to the finger * ; and to call those *Chiridota* which are ornamented with microscopic wheels. In *C. lævis* these wheels are very minute and clustered in little groups beneath the epidermis, and when the surface is raised with a needle point they are set free. In *Chiridota violacea*, figured by Müller in the Berlin Transactions, and again in Dr. Carpenter's 'Microscope,' the wheels are attached to a common connecting thread.

Prof. Steenstrup has formed a genus (or subgenus) for another Greenland species—*Myriotrochus Rinkii*, in which the wheels are larger and scattered over the skin, each having its own stalk. These wheels first appear as little stars, with rays or spokes of various number (18 to 25), which increase until they attain their normal length, and then expand at their ends until they join and form a rim (or *tire*) to the wheel. A ring of spines is afterwards formed on the thickened margin ; the spines are pointed towards the centre of the wheel, and are as numerous as, or rather more numerous than, the spokes. As the wheels only occur on the three dorsal intermuscular bands, they can scarcely assist in locomotion, and must be regarded as ornamental characteristics, such as nature loves to bestow for us to marvel at.

SYNAPTA, Eschscholtz, 1829.

1. *S. vittata* (*Fistularia*), Forskål, 1775. Suez, Red Sea.
2. *S. reciprocans*, Forsk. Suez, Red Sea.
3. *S. inhærens* (*Holothuria*), O. F. Müller, 1781 (=*Holothuria flava*, Rathke ; *Jemania Henslowana*, Leach ; *Synapta Duvernæa*, Quatr.). Christiansand og Krageröe ; Aberystwith and Criccieth, North Wales (*Henslow and Wilton*) ; Falmouth, Cornwall (*W. P. Cocks*) ; Bantry, W. Ireland (*MacAndrew and Barrett*) ; Guernsey (*E. C. Buckland*) ; Iles Chaussey, near St. Malo (*Quatrefages*).
4. *S. digitata* (*Holothuria*), Montagu. Devonshire (*Mont.*, *Cranch, Alder, Kingsley*) ; Falmouth (*Mr. Cocks*) ; W. Ireland (*Mr. Barlee*) ; Rothesay, Bute (*Mr. Alder*) ; Vigo Bay, N. Spain (*MacAndrew*) ; Trieste (*Joh. Müller, Dr. Hartmann*).
5. *S. mamillosa*, Esch. Tahiti.
6. *S. maculata*, Chamisso & Eysenh., Act. Nat. Cur. x. p. 1. t. 25.
7. *S.? verrucosa* (*Chiridota*), Esch. Sitcha, Russian America.
8. *S. Beselii*, Jäger, 1833. Celebes. Berlin Trans. t. 6. f. 15.
9. *S. radiosa*, Reynaud (teste Jäger). Coromandel.
10. *S. bidentata*, W. & B. 1858. China.
11. *S. lappa*, Müll., Berlin Trans. 1854, t. 6. f. 16. W. Indies.
12. *S. serpentina*, Müll., id. f. 17. Celebes.

* The name *Fistularia*, given by Forskål, has been abandoned, partly because the author included under it some true *Holothuriæ*, and chiefly because Lamarck employed it for these latter instead of the *Synaptæ*.

Chiridota, Esch.

1. *C. lævis* (*Holothuria*), O. Fabr. Greenland.
2. *C. violacea*, Peters. Mozambique.
3. *C.? purpurea*, Less. Falkland Islands.
4. *C. lumbricus*, Esch. I. Radak, Coral Sea.
5. *C. discolor*, Esch. Sitcha, Russian America.

Myriotrochus, Steenstrup.

1. *M. Rinkii*, Stp. Greenland.

July 27, 1858.—Dr. Gray, F.R.S., V.P., in the Chair.

On the Geographical Distribution of Reptiles. By Dr. Albert Günther.

It was with great pleasure I read Mr. Sclater's paper "On the Geographical Distribution of the Members of the Class Aves," published in the 'Proceedings of the Linnæan Society,' February 1858. And again, in personal interviews with my friend on similar subjects I had often the satisfaction to agree with him in results he had gained from another part of the animal kingdom. But such gratifying results as we find in the aforesaid paper can only be obtained, not merely by an extended knowledge of the whole animal kingdom, but by a complete knowledge of the details of a separate portion of it; and the reason why all the attempts at a general account of the geographical distribution of animals are not satisfactory enough for the naturalist, is to be found in the circumstance, that the authors were not acquainted in the same degree with every part of the subject treated, as also from our limited knowledge of zoology. Thus I may follow the example of Mr. Sclater and give for the present only an account of the geographical distribution of those animals, to the knowledge of which especially I have latterly devoted myself; and often referring to that paper, I shall show how far I can agree with the general views contained therein, and whether these groups of the natural kingdom give us a division of the earth's surface into the same natural provinces.

Part I.

On the Geographical Distribution of the Snakes.

Schlegel, as he first founded philosophical views in the knowledge of Snakes, first gave an essay on their geographical distribution, showing the exact locality of the species as far as was then possible. He however only pointed out the geographical areas over which the species extend,—certainly the first basis upon which a knowledge of the geographical distribution of the families and genera can be founded. But at that time the much more limited knowledge of specific forms obliged him to establish genera of too great extent; and in consequence he could not bring, in a more or less accordant correspondence with a certain province of the earth's surface, those genera which are really peculiar to such a separated district. And although that sketch, with which the first volume of Schlegel's 'Essai' is concluded, deserves the more admiration, as this branch of science, not previously cultivated, was raised by him at once to a degree of philosophical view adequate to his system, it must share the destiny of every such attempt, when our knowledge of faunas as well as of geography is more advanced: many stated truths will hold good —a part or all the principles applied before will form the basis of the next attempt; but many other points will appear to be modified or wrong, and will be replaced by other results. For a better understanding, one may compare my view of the geographical distribution of Reptiles in Africa with that of Schlegel. In this attempt I have maintained his idea of *species*, but I think I have gained more general and more true results by more limited genera (far different from those "subgenera," which are in fact species) and by a modified view of the geographical regions. But we now also want far more correct information concerning the genera and families, before we can arrive at very satisfactory conclusions.

There is, in the first place, a much greater disproportion in the distribution of Reptiles over the different regions, with respect to the number of genera and species, as well as of individuals. Amphibian life is entirely different from that of the higher animals, being exposed to the slightest modifications of external physical influences; and there are again great differences among the Reptiles themselves. Let us compare some of our Snakes with Batrachians, in a few instances only. Frogs and Toads are found on the Shetlands, whilst *Vipera berus*, the most northern Snake, is already scarce in the north of Scotland. *Rana temporaria* is met with in the Alps round lakes, near the region of eternal snow, which are nine months covered with ice; whilst *Vipera berus* reaches only to the height of 5000 feet in the Alps, and of 7000 in the Pyrenees. A Triton or a Frog being frozen in water will awake to its former life, if the water is gradually thawed; I found myself that even the eggs of *Rana temporaria*, frozen in ice for seven hours, suffered no harm by it, and were afterwards developed. A Snake can only endure a much less degree of cold: even in the cold nights of summer it falls into a state of lethargy; it awakes late in the spring, when some Frogs and Tritons have already finished their propagation; it retires early into its recess in harvest, while the evenings still resound with the vigorous croaking of the Tree-frogs and the bell-like clamour of *Alytes obstetricans*. Our European Snakes die generally, in captivity, during the winter, partly from want of food, partly by the cold nights. The eggs of our oviparous species are deposited during the hottest part of the year, requiring a high temperature for development. Further, though some accounts of Batrachians enclosed in cavities of the earth or trees may be exaggerated, the fact is stated by men whose knowledge and truth are beyond all doubt, that such animals live many years apparently without the supply of food necessary for preserving the energies of the vital functions *. Dr. A. Smith himself was an eye-witness how several specimens of *Brachymerus fasciatus* were found in a lethargic state in a hole of a tree, completely closed, conspicuously open before and grown together afterwards. Such a tenacity of life is never to be observed in a Snake: the higher the temperature the greater is the need of food; and a Snake having endured fasting during six or nine months always dies. Moreover, the tenacity of life in the Batrachians is proved by their power of reproduction, which has never been observed in a Snake. If we add the fact that Snakes do not produce many eggs or young ones, that they are able to propagate only when several years old, that they incur continual dangers by their numerous enemies, and that they are deprived of the means of performing distant journeys, we must consider it as the natural consequence, that no species will spread so far as Batrachians. These are enabled to endure temporary physical disadvantages, to traverse localities without the regular supply for their life, and to make up yearly for the lost number by a numerous offspring. More or less confined to a fluid element, they are favoured by another agency for an easier spreading. But these facts are really applicable to a comparatively small number of species only; and the question why we do not find all these peculiarities equally exhibited in all the Batrachians or in a great part of them, is as difficult to be answered as why one species is richer in individuals than another: but it is remarkable that just those species which are spread over the widest range are also those distinguished by an intensity of individuals.

On the other hand, we find Snakes almost entirely limited to the original locality of the individual: but if the individuals are restricted to the soil which gave them birth, the whole group, formed by such individuals, is likewise stationary; and if there be different creations, corresponding to the different natural divisions of the earth's surface, such a group as the Snakes must be best adapted for proving it, because here the agencies are wanting by which a species or a genus is spread over a larger part of the globe in the course of time, thus becoming mixed with foreign forms.

After these preliminary remarks, I proceed to the special objects of our inquiry; and we shall then see what conclusions can be formed in comparison with those of the ornithologist †. According to the above-stated peculiarities of the life of Snakes, there is *no cosmopolitan species*, and we can find only a few examples where one and the same species extends over the borders of the neighbouring region (cf. p. 226, *Naja haje, Echis carinata, Zamenis ventrimaculatus*, and pp. 233, 234, some species ranging from the Nearctic region into the Neotropical, and *vice versâ*). Among the genera we do not find one

* Cf. "Observations on the Common Toad, and on its long abstinence from food," by John Brown, Esq. (Ann. & Mag. Nat. Hist. 1842, vol. x. p. 180).

† As for the systematical denominations adopted, I refer to the 'Catalogue of Snakes' (*Crotalidæ, Viperidæ, Hydridæ, Boidæ*) by J. E. Gray, London, 1849, and to my 'Catalogue of Colubrine Snakes in the Collection of the British Museum,' London, 1858.

true *cosmopolitan genus*. *Tropidonotus* is one of those which have the widest range, a genus containing about thirty well-known species, each of which bears natural characters so conspicuous, that its position in the system is not to be mistaken: they are not to be found in the Æthiopian region only; they are truly called freshwater Snakes, following the course of the rivers and the borders of lakes. Some of the species (*T. natrix, hydrus, quincunciatus, ordinatus, fasciatus*) have a very wide range within the borders of its peculiar region. A few of the Asiatic species exhibit slight modifications of the general appearance of the genus (*T. cerasogaster* and *vibakari*). The second genus, which may be almost called a cosmopolitan, is *Coronella*, being spread over the whole globe except the Indian region, where it is replaced by such modifications of the characters as to justify the separation of them into new genera—*Simotes* and *Ablabes*, sp. The latter, closely allied to *Coronella*, accompanies this genus, extending over all the regions, except over the Australian one. Thus, if I speak hereafter of cosmopolitan genera of Snakes, they are to be understood with the restrictions mentioned. The *families* of Snakes in the different systems are at present founded upon such general characters, that in most of them genera of some or of all the geographical regions are comprised; perhaps at some later period they will be limited to more contracted boundaries of less general characters, thus approaching more to the borders of the geographical regions. But for the present we cannot derive from them our deductions as to the primary creation of the natural regions of the earth's surface, as the ornithologist does; and we are obliged to confine our views to the genera: we have not even such families of Snakes as are peculiar to one of the two great geographical divisions, either to the old world or to the new, except those in which the characters of the family are identical with those of the single genus. This discrepancy between Ornithology and Herpetology may be caused by a different systematic treatment of the characters, and may be more reconciled in course of time; but there will always remain forms common to the new and old world. Therefore it is not possible to give a list of *Familiæ Neogeanæ* and *Familiæ Palæogeanæ* (cf. Sclater, *l. c.* p. 133).

But I may here give an account of such genera as, I think, will still long remain examples of forms common to the new and old world (cosmopolitan genera excepted): they are *Rhabdosoma, Coluber, Spilotes, Coryphodon, Cyclophis, Philodryas, Dipsas*. I could add as many other genera; but I think such genera as *Rhinostoma, Dryophis*, &c. will be subdivided hereafter into two. Further, with regard to the aforesaid genera, the same observation as in Ornithology cannot be made, viz. that these are invariably genera belonging to temperate regions, disappearing entirely before we reach Tropical and Southern America. A part of the members of these genera are peculiar to the Neotropical (Tropical America) Ophidio-fauna; a part reach the Tropics in the old world, and a third part belong to the temperate portions of both hemispheres.

Taking the amount of similarity or dissimilarity of ornithic life as a guide, Mr. Sclater states the following primary divisions of the earth's surface :—

I. *Palæarctic Region* (Regio Palæarctica).

Extent.— Africa, north of the Atlas; Europe; Asia Minor; Persia and Asia generally, north of the Himalaya Range; upper part of the Himalaya Range (?); Northern China, Japan, and the Aleutian Islands. Approximate area of 14,000,000 square miles.

II. *Æthiopian or Western Palæotropical Region* (Regio Æthiopica).

Extent.—Africa, south of the Atlas Range; Madagascar; Bourbon; Mauritius; Socotra, and probably Arabia up to the Persian Gulf, south of 30° N. lat. Approximate area of 12,000,000 square miles.

III. *Indian or Middle Palæotropical Region* (Regio Indica).

Extent.—India and Asia generally, south of the Himalayas; Ceylon; Burmah, Malacca, and Southern China; Philippines; Borneo; Java; Sumatra and adjacent islands. An area of perhaps 4,000,000 square miles.

IV. *Australian or Eastern Palæotropical Region* (Regio Australiana).

Extent.—Papua and adjacent islands; Australia; Tasmania and Pacific Islands. An area of perhaps 3,000,000 square miles.

V. *Nearctic or North American Region* (Regio Nearctica).

Extent. — Greenland, and North America down to centre of Mexico. Area of perhaps 6,500,000 square miles.

VI. *Neotropical or South American Region* (Regio Neotropica).

Extent.—West India Islands; Southern Mexico; Central America, and whole of South America; Galapagos Islands; Falkland Islands. Estimated area of about 5,500,000 square miles.

The notices devoted to each region will show how great is the conformity which this most natural division and the definition of the limits of the regions exhibit in Herpetology.

I. *Palæarctic Region* (Regio Palæarctica).

Characteristic forms.—(*Calamaria?*) *coronella*, (*Tachymenis?*) *vivax*, (*Simotes?*) *diadema*, *Rhinechis*, *Zamenis*, *Chorisodon*, *Cœlopeltis*, *Eryx*, *Pelias*, *Vipera*, *Echis*, *Cerastes*.

Form common to India.—*Trigonocephalus*.

This region is at once distinguished by the small number of generic forms and of species: great variety of amphibian life is produced only by the sun of the Tropics, and dependent upon a similar variety of the vegetative world. Where the soil is covered with social plants, either trees or grasses, there we find an equal uniformity in the life of Reptiles, which uniformity is still more manifest in temperate zones.

North of 62° N. L. no Snake has hitherto been found; and thus the forty species which live within the boundaries of this region are very unequally distributed over an area of 14,000,000 square miles. We have on an average a single species to each 350,000 square miles. All the species are of small size, dusky colour, and of a timid disposition; by far the greater part belong to the *Colubrina*, —their ratio to the *Boina* being that of 20 : 1, and to the *Viperina* of 4 : 1.

The identity of the creation in the different provinces of this region may be represented by the following examples, which will forcibly show the reason why I unite the Æthiopian shores of the Mediterranean especially with this region, instead of considering Spain and Portugal as a part more approximate to Africa than to Europe, as Schlegel did. *Eryx jaculus* may be traced from the eastern half of the shores of the Mediterranean, through the temperate part of Asia, into the south of Siberia; *Tachymenis vivax* from Egypt northwards to Hungary. Further, the genus *Zamenis* is one of the most characteristic types of this region,—*Z. atrovirens* being spread along the northern shores of the Mediterranean, *Z. Cliffordii* along the southern ones, *Z. hippocrepis* and *Dahlii* going entirely round this inland sea, *Z. ventrimaculatus* reaching from Egypt through Kurdistan to the south of the Himalaya, and, finally, *Z. caudolineatus* being a native of Kurdistan. *Coronella austriaca*, more common in the parts north of the Alps, is replaced in the south by *C. girundica*, in the north of Africa by *C. cucullata*. *Tropidonotus natrix*, reaching into the heart of northern Asia, is represented in North Africa by *Trop. viperinus*. *Trop. hydrus* appears to range still further towards the west of Asia. *Coluber quadrilineatus*, common on the northern shores of the Mediterranean and on its eastern islands, is again found in the north of China. *Cœlopeltis*, a true native of Northern Africa, is found in the Pyrenean peninsula. *Pelias berus* inhabits Ireland, Scotland, England, Norway, Sweden, and all the central parts of Europe, and is again found on the shores of the Lake of Baikal.

The viperine snakes of this region exhibit generic differences on the north and south of the Mediterranean,—on the former we find *Pelias* and *Vipera*, on the latter *Echis* and *Cerastes*. But the above-stated facts sufficiently show that the lower part of Egypt should be united with this region as well as Algiers; and I am surprised that Mr. Sclater leaves it uncertain whether he includes that part of Egypt or not. A few true African forms intrude themselves into the African parts of the region; *Echidna atricauda* and *mauritanica* are found in Algiers, and *Naja haje*, following in many varieties the course of the African rivers, comes down with the Nile and reaches the Delta. That *Echis carinata*, more frequently met with in the East Indian continent, is also found in Egypt, is a curious fact stated by Duméril and Bibron (vii. p. 1448); and as Schlegel mentions it as being found also in the deserts south of the Caspian Sea, it quite corresponds to the aforesaid range of *Zamenis ventrimaculatus*.

The genus *Trigonocephalus*, which has its focus in the Indian region, is curiously enough represented by a single species (*T. halys*) in the southern parts of Siberia, reaching to the north of the Caspian Sea. Thus, of all the genera peculiar to the Indian region, *Trigonocephalus* advances furthest northward, emitting moreover another species (*T. Blomhoffii*) to Japan.

Japan, that outpost of the Palæarctic region, is not in the same way peopled with Palæarctic snakes as we find it with Palæarctic forms of other classes of the animal kingdom. As to its Herpetology in general, it is truly a debateable ground between the Palæotropical and Indian Amphibio-faunæ: but as regards the *Ophidia*, it belongs entirely to the Indian region; for the present, at least, we do not know one Japanese snake which is also found in the Palæarctic region, or even only belonging to one of its peculiar generic forms.

II. *Æthiopian or Western Palæotropical Region* (Regio Æthiopica).

Characteristic forms.—*Hortulia, Sanzinia, Pelophilus, Casarea, Calabaria. Homalosoma, Psammophylax, Heteronotus, Prosymna, Meizodon, Psammophis, Dasypeltis, Bucephalus, Hapsidophrys, Langaha, Simocephalus, Lamprophis, Alopecion, Lycophidion, Metoporhina, Boodon, Holurophølis, Naja haje, Cyrtophis, Elaps? hygiæ, Dendraspis, Causus, Sepedon, Atractaspis, Clotho.*

Forms common to other regions. — *Philodryas, Chrysopelea, Ahætulla, Dryophis, Leptodeira, Dipsas, Dipsadoboa.*

We now enter a tropical region, and immediately find forms of gigantic magnitude, vast variety and vivacity of coloration, and a great multiplication of the number of generic forms and species, although only the southern part of this truly continental region has been examined in a satisfactory manner: it is not many years since the borders of Western and of part of Eastern Africa were explored; and the great advance of zoological knowledge, produced by this first search, promises the most extensive results to those daring attempts to cross a continent which, instead of being a continuous burning desert, contains a new world of vegetable and animal life. An enumeration of the reptiles of Western Africa, by Dr. Gray (P.Z.S. 1858, p. 155 *et seq.*), shows how greatly our knowledge of the Herpetology of that country has been enlarged in the course of a few years. Therefore I hope that the ratio here given of the geographical area and distribution of the *Ophidians* will only be a proof of the distance between our present knowledge and that of the coming decennium. Taking the area of this region at 12,000,000 square miles, and the number of species of Snakes contained therein at 80, we have on an average a single species to every 150,000 square miles, or $2\frac{1}{3}$ species to the same area for which we found only one in the Palæarctic region.

The number of *Colubrina* is again predominant, but is to that of the *Boina* only as 8 : 1, and to that of the *Viperina* as 11 : 1; the proportional number of the *Boina* therefore is increased, that of the *Viperina* diminished. We must observe, first, as a peculiarity of this region, that at present there is not one species known of the genus *Tropidonotus*. Schlegel believed he found its representative in *Dasypeltis scaber*; but a snake living on trees, devouring birds' eggs, the shells of which it breaks by its gular teeth, with an irregular arrangement of the lateral scales, is a form quite peculiar in itself, and peculiar to this region. Highly interesting is the fact, that more than one-third of the genera live on trees, which ratio is never met with in any of the other regions: there we find a member of the family of *Lycodontidæ* (a family which contains either Ground-snakes, or forms only slightly approaching to that structure which indicates the capability of climbing trees) entirely transformed into a very Tree-snake (*Simocephalus*). There we find Tree-snakes with perforated fangs in front (*Dendraspis*). The African species of *Naja* (*N. haje*), so closely allied to the Indian *Cobra de Capello*, is to be considered as a Tree-snake as well as Ground-snake, whilst *N. tripudians* never appears to climb trees. But the Indian and the African species offer a similar series of varieties; and it would be, in many cases, very difficult to assign one of those varieties, if of unknown origin, to the right species, without the single character of the sixth upper labial shield. The question whether those varieties really are species is not yet decided. Every large collection should obtain as many specimens as possible of both forms, with the most accurate accounts of their localities. There are about 70 specimens in the collection of the British Museum; but even with this number I was unable to distinguish separate species within accurately limited boundaries.

Another peculiarity of this region is the abundance of Snakes provided with longer front teeth, or *Lycodontidæ*; and it agrees also in this respect with India: in fact, the western and middle Palæotropical regions equally partake of this family, each region producing a form with entire subcaudal plates. *Venomous Colubrina* here form a great portion among the *Ophidia*, a greater one than the true *Viperina*; and they also exhibit quite a peculiar group, namely such *Colubrina* as are provided with permanently erect and perforated fangs (*Dendraspis, Atractaspis*). Our knowledge of the whole region is very limited, as also is the case with the large island connected with it, Madagascar. The following Snakes are known belonging to its fauna:—

Sanzinia. *Pelophilus*.
Heterurus gaimardii and *arctifasciatus*.
Psammophis sibilans, var.
(*Herpetodryas bernierii*. Isle de France.)
Herpetodryas quadrilineatus.
Enicognathus rhodogaster.
Philodryas miniatus and *goudotii*.
Ahætulla lateralis. *Langaha*.

None of these Snakes, except *Psam. sibilans*, have been found on the continent of this region, or in any other part of the globe; and it may be a question, as already suggested by Schlegel, whether such a separate and peculiar fauna as that of Madagascar might not furnish a reason for establishing a separate region, small as regards the geographical area, rich as to its animal and vegetative life, if the still hidden parts should prove to be as peculiar as that which we know. *Sanzinia, Pelophilus*, and *Langaha* constitute genera not represented by other species in other provinces. If we look at the forms common to other regions, we find them all to be Tree-snakes, having the allied species spread over the tropical regions in the west or east.

III. *Indian or Middle Palæotropical Region* (Regio Indica).

Characteristic forms.—*Chersydrus, Acrochordus, Xenodermus, Python, Cliftia, Cusoria, Gongylophis, Clothonia, Cylindrophis. Calamaria, Rhabdion, Brachyorrhos, Aspidura, Haplocercus, Elapoidis, Trachischium, Oligodon, Simotes, Ferania, Homalopsis, Phytolopsis, Tropidophis, Hypsirhina, Fordonia, Raclitia, Miralia, Xenodon* (with keeled scales), *Gonyosoma, Euophrys, Psammodynastes, Passerita, Leptognathus? indicus, Amblycephalus, Pareas, Hologerrhum, Lycodon, Tetragonosoma, Leptorhyton, Ophites, Cercaspis, Cyclocorus, Hamadryas, Bungarus, Naja tripudians, Elaps* (with thirteen rows of scales). Hydridæ: *Trimesurus, Parias, Megæra, Atropos, Trigonocephalas, Daboia* (except *D. xanthina*, Gray).

Forms common to other regions.—*Rhabdosoma, Cerberus, Coluber, Elaphis, Spilotes, Coryphodon, Chrysopelea, Dendrophis, Dryophis, Eudipsas, Dipsas, Dipsadomorphus, Echis.*

Whether the Indian region really is richer in peculiar generic and specific forms than the African one, or whether this difference is caused only by our more extended knowledge of the former, the future will show; for the present it is not even rivalled by the South American region: for, taking the area of the Indian region at 4,000,000 square miles and the number of species of Snakes at 240, we have on an average a single species to every 17,000 square miles, or 21 species to the same area for which we found only one species in the Palæarctic region, and 9 for the same area in the Æthiopian. The ratio between the different sections of the Snakes shows that, in comparison with Africa, the relative number of *Boina* is diminished, their ratio to the *Colubrina* being 1 : 12: but that of the Viperine Snakes has as much increased as the absolute one; each seventh species belongs to this truly venomous section (1 : 6). Quite a new form of snakes enters into this fauna—the *Hydridæ*: organized for living in the sea, they are seldom found on the coasts, and we do not yet know whether they approach the beach occasionally, or when obliged by certain physiological functions. But being constant inhabitants of the sea, they are endowed with active as well as with passive locomotion to enable them to traverse greater distances than the snakes living on dry ground; and therefore it is not to be wondered at that we find not only the section in general, but the single species spread far beyond its actual native ground—namely the sea between the southern coast of China and the northern one of New Holland—and extending to the south of the Australian region, and far between the tropical islands of the Pacific. A certain proximity to land appears to be necessary for their life, as they are never found in those wide marine spaces which are void of islands, not being able by traversing them to spread into the Neotropical or Æthiopian regions *; and thus they may be brought as properly as marine birds into the statement of the ratio between the number of species and the area of dry land. A second form, quite peculiar to this region, are Snakes covered with granular tubercles, *Chersydrus, Acrochordus, Xenodermus*; without being venomous, they approach the *Hydridæ* by the genus *Chersydrus*, an inhabitant of rivers and their mouths, and with an organization like that of true Sea-snakes. As the family of the *Lycodontidæ* must be assigned to the Indian and African region, each exhibiting different genera, so that of the *Calamaridæ* should be divided in the same way between the Neotropical and this region, whereas *Homalosoma* and two species of *Rhinostoma* may perhaps be hereafter separated from this family. The above-mentioned genera of *Calamaridæ* are highly characteristic; and the very aberrant forms which abound in India are here represented by a genus of this family having no palatine teeth. Those intermediate forms between the well-proportioned structure of the family of *Colubridæ* and the excessively slender one of the true Tree-snakes, which I unite in one family of *Dryadidæ*, and which are so common in the Neotropical region, are feebly represented by some species of *Cyclophis* and *Gonyosoma*. The genus *Ahætulla* is here represented by *Dendrophis*—one species (*D. picta*) extending to New Guinea, another (*D. punctulata*) to Australia. *Dryophis* is found in the Neotropical region as well as in the Indian one, but the species of both regions differ in dentition; the African species (*D. Kirtlandii*) agrees with the South American ones; finally, *Passerita* is only limited between the boundaries of the East Indies. If we exclude the *Hydridæ*, the number of *venomous Colubrinæ* is far surpassed by that of the *Viperina*; and all the latter exhibit the peculiarity of having a pit on the side of the face, which is also found in the representatives of the New World, not in those of Africa. Ceylon offers a remarkable exception, producing a form without such a pit.

Among those large islands which are connected with the middle Palæotropical region, none offer forms so different from those of the continent and the other islands as Ceylon: it might be considered the Madagascar of the Indian region. We not only find there peculiar genera and species, not again to be recognized in other parts, but even many of the common species exhibit such remarkable varieties, as to afford ample means for creating new nominal species.

1. *Calamaria* and *Elaps* are not represented in this island.

* During the printing of this paper, I first heard of Sea-snakes seen near the western shores of America. They were observed in considerable numbers by M. Sallé and Mr. Salvin, at different times, from steamers crossing the Bay of Panama, and were about the size of an eel. I have not the slightest reason to doubt the credibility of the observers; but so long as we have not obtained them it will always be a question whether the animals seen were Snakes or not.

2. The following species are common to Ceylon and the other parts of the region, the Ceylonese specimens exhibiting no remarkable variation:—*Simotes Russellii, Coryphod. Blumenbachii, Ablabes collaris, Chrysopelea ornata, Dendrophis picta, Tropidonotus stolatus, Lycodon aulicus, Naja tripudians.*

3. Ceylonese specimens of the following species always exhibit one and the same variation:—*Simotes purpurascens, Tropidonotus quincunciatus* (two Ceylonese varieties), *Tropidonotus chrysargos, Passerita mycterizans, Bungarus fasciatus.*

4. The following species are peculiar to Ceylon; but representatives of the genera are found in other parts of this region:—*Cylindrophis maculata, Oligodon sublineatus, Cynophis helena* (appears to be the representative of *Elaphis subradiatus*), *Cyclophis calamaria, Dipsadomorphus ceylonensis* (is the representative of *D. trigonatus*), *Trimesurus ceylonensis* and *nigro-marginatus, Megæra trigonocephala, Trigonocephalus hypnalis, Daboia elegans.*

5. Finally, the following genera, exhibiting entire subcaudal plates, are peculiar to Ceylon:—*Aspidura, Haplocercus, Cercaspis.*

If we look at the forms of this region, common to other ones, we see that most of them belong to Schlegel's two genera, *Coluber* and *Dipsas*. The separation of the former into smaller natural genera has not yet been effected in such a way as to satisfy the systematist; and therefore it is the less suited for a consideration of its geographical distribution (*Zamenis* excepted). Nearly the same is the case with the genus *Dipsas*; and even if we separate single forms more aberrant from the general type, there remain a great many species which, comprised in one genus, do not give us the idea of a cosmopolitan genus, but of a "tropicopolitan." Species of *Rhabdosoma* are found in the Neotropical, a single species of *Cerberus* and *Dendrophis* in the eastern Palæotropical region; the geographical distribution of *Dryophis* and *Echis* has been stated above.

I may add a few words to prove what I have before mentioned, viz. that the Snakes of Japan belong to the fauna of the Indian region. The following species from these islands are known *:—

1. *Tropidonotus tigrinus,* and

2. *T. Vibakari* belong to a cosmopolitan genus; but the former, being also found near Ningpo in China, belongs to a group of this genus, which is formed solely by species native in India; and the second species is the single type of another peculiar group (see Catal. of Colubr. p. 60).

3. *Coluber conspicillatus,*

4. *Elaphis quadrivirgatus,* and

5. *Elaphis virgatus,* exhibit not only a remarkable similarity in general habits, and in the system of coloration, with other true East Indian Snakes (*Elaphis subradiatus,* &c.), but the two latter are also found on the Indian continent, in China, south of the Yellow River.

6. *Trigonocephalus Blomhoffii* belongs to a genus with four species in the East Indies and one in the northern parts of Asia.

* Cf. Schlegel, 'Fauna Japonica'—"Reptiles."

How greatly different the view gained by a consideration of the geographical distribution of the Batrachians is, we shall see in the Second Part of this paper. Our knowledge of the Herpetology of Celebes is yet too limited to allow a satisfactory attempt to compare its fauna with that of other parts.

IV. *Australian or Eastern Palæotropical Region* (Regio Australiana).

Characteristic forms.—*Morelia, Liasis, Nardoa, Enygrus, Bolyeria, Myron, Glyphodon, Diemansia, Hoplocephalus, Pseudechis, Pseudonaja, Brachysoma, Vermicella, Acanthophis.*

Forms common to other regions.—*Cerberus, Dendrophis, Dipsas, Hydridæ.*

What I have said in the beginning of my notices on the Æthiopian region I can as justly repeat respecting this part of the globe, the borders only of which are known to us; so that the proportionate numbers here given will be far from the truth, and can be considered only as proportionate to our present knowledge. If we allow 50 species as peculiar to this region, and take the area of dry land at 3,000,000 square miles, we have on an average a single species to every 60,000 square miles, or $2\frac{1}{2}$ species for the same area in the Æthiopian; but the Indian region is richer, giving $3\frac{1}{2}$ species for the same area in which we have only one in the Australian.

We find a peculiar character of this region in the ratio between the numbers of species in the different sections of the Snakes. Two-thirds are venomous snakes—a disproportion not to be found again in any of the other regions, where the number of innocuous snakes always greatly predominates; secondly, two-thirds of the non-venomous snakes are *Boidæ*; thirdly, there is only one genus (*Acanthophis antarctica*) belonging to the tribe of *Viperina*, the whole of the other venomous snakes being constituted by Colubrina with grooved fangs. We know only six non-venomous Colubrina from New Holland, two of which (*Coronella australis* and *Tropidonotus picturatus*) belong to cosmopolitan genera, the third (*Dipsas fusca*) to a tropicopolitan genus, the fourth and fifth (*Dendrophis punctulata* and *Cerberus australis*) to East Indian ones: for the sixth (*Myron Richardsonii*) a separate genus was established; but it is closely allied to the East Indian *Hypsirhina*. The genus *Elaps*, represented by a different form, *Vermicella*, is so far from being capable of being united with the East Indian forms, that it is nearer to those of the Neotropical region. Thus, if we except three species and the *Hydridæ*, which are subjected to totally distinct physical conditions, we have in the eastern Palæotropical region a fauna of Ophidians as widely different from the nearest one of the East Indies as from all the other ones. It must be mentioned, that there is no snake known for the present from New Zealand. I say, for the present; for, not many years since, a total absence of Serpents in all the numerous isles of the Pacific Ocean was believed in.

V. *Nearctic or North American Region* (Regio Nearctica).

Characteristic forms.—*Charina, Wenona, Conopsis, Conocephalus, Carphophis, Osceola, Ninia, Lodia, Sonora, Rhinochilus, Tantilla, Simotes? coccineus, Ischnognathus, Helicops, Farancia, Dimades, Abastor, Virginia, Contia, Pituophis, Cenchris, Crotalophorus, Uropsophus, Crotalus.*

Forms common to other regions.—*Heterodon, Coluber, Coryphodon, Herpetodryas, Cyclophis, Elaps.*

There is some difficulty in stating the southern boundary of this region; the Tropical fauna advances along the Isthmus of Panama, and, extending over the again expanding part of Southern Mexico, it is gradually mixed with the Arctic fauna. And in these parts the fauna of the same latitude is the more mixed on account of the great differences of the elevation above the level of the sea, and the resulting great variety of climate in a small space; but as the climate gradually assumes the tropical character, so also do vegetative and animal life. Nevertheless we have in the New World two entirely different creations, radiating from the system of the Mississippi in the north, and from that of the Amazon in the south; and in each of those smaller provinces situated on the boundary between both regions, it will be a question whether the larger number of its species belong to northern or southern forms. As far as we are able at present to judge, the tropic of Cancer may be considered as the boundary. No Snake is to be found north of 60° N. lat.,—a latitude where in the Palæarctic region *Pelias berus* exists. But taking 6,500,000 square miles as the amount of the whole dry land in this region, and allowing seventy-five* species as peculiar to it, we have one species to every 87,000 square miles, or four species to the same area for which we found only one in the Palæarctic region. Thus this region indicates a much greater degree of intensity of species than the Palæarctic region; but if it be stated that it also surpasses the Æthiopian region, this I consider as not an established fact, but only an appearance caused by the circumstance that North America has been much more fully explored than Africa. Even then, if we consider (according to Dr. Gray's system) *Charina* and *Wenona* to be *Boidæ*, the ratio of this section to the number of *Colubrina* is very small (1 : 18), the ratio between *Viperina* and *Colubrina* being large (1 : 5); in this respect this part of the fauna quite agrees with the same part of the Old World.

Among the non-venomous *Colubrina* the two families of *Calamaridæ* and *Natricidæ* offer the most generic and specific forms. The type of *Heterodon* is a North American form; but one species is also found in South America.

* Without summing up the number of all the North American species described since the publication of the 'Catalogue of North American Reptiles' by Baird and Girard, 1853, I only mention that they describe therein 119 species. What I think of such species is shown by the synonymy of the North American Snakes in my Catalogue.

Colubrina with grooved fangs in front can hardly be considered as pertaining to this region, only two species of *Elaps* reaching into the most southern parts. The Viperine Snakes are represented by most peculiar forms, all belonging to the family with a pit on each side of the face: they all exhibit entire subcaudal shields (at least on the anterior part of the tail).

VI. *Neotropical or South American Region* (Regio Neotropica).

Characteristic forms.—†*Epicrates, Xiphosoma,* †*Corallus,* †*Boa, Eunectes,* **Chilabothrius,* **Ungalia, Tortrix, Streptophorus, Homalocranion, Elapomorphus, Elapocephalus,* **Arrhyton, Liophis, Stenorhina, Erythrolamprus,* **Hypsirhynchus, Xenodon* (with smooth scales), *Uranops, Hydrops, Hygina,* **Gerarda,* **Hipistes, Ficimia,* †*Dromicus, Psammophis? lineatus, Thamnodynastes, Dipsas? cenchoa, Rhinobothryum, Leptognathus, Tropidodipsas, Scytale, Oxyrhopus,* **Elaps* (with fifteen rows of scales), †*Craspedocephalus, Lachesis.*

Forms common to other regions.—*Rhinostoma, Rhabdosoma, Tachymenis, Tomodon, Heterodon, Spilotes, Coryphodon,* †*Herpetodryas,* †*Philodryas,* †*Ahætulla,* †*Dryophis, Leptodeira, Eudipsas, Dipsadomorphus, Dipsadoboa.*

If the number of species duly attributable to this region be reckoned at about 150, and its geographical area at 5,500,000 square miles, we have a single species to every 36,000 square miles, or nearly $2\frac{1}{2}$ species to the same area for which we found a single one in the Northern region. As for intensity of species, this region is far surpassed by the East Indies, exhibiting only half as many species for the same area, and therefore showing itself proportionally far less productive of snakes than of birds. This fact will be very near the truth, as we know nearly equal portions of both regions. In the ratio of the different sections of snakes, South America does not agree with any other region, showing a ratio between *Boina* and *Colubrina* = 1 : 8, and between *Viperina* and *Colubrina* = 1 : 15. All the *Boina* have only a single row of subcaudal plates, whilst the other tropical regions exhibit such species with entire subcaudals as well as with two-rowed. Among the Colubrine Snakes, it is rich especially in those intermediate forms without prominent characters, the systematical arrangement of which is far from being complete.

Another character of the Region is, that true *Lycodontidæ* are wanting: they are replaced by *Scytale* and *Oxyrhopus*, in many respects similar to the East Indian *Lycodontidæ*, and forming a connecting link between these and the *Dipsadidæ*. All the *venomous Colubrina* belong to the genus *Elaps*, differing from the East Indian species by having fifteen rows of scales and another system of coloration; one or two species range into the southern parts of the former region. Finally, all the *Viperina* exhibit a pit on the side of the face, two-rowed subcaudal plates, and the head covered with scales, being thus more closely allied to the greater part of the East Indian genera than even to those forms which we meet with in North America, One Viperine Snake with a rattle, *Crotalus horridus*, ranges into this region; but being also found in the more northern parts, and having other relations in North America, it must be reckoned among those of the latter region.

Of the forms common to other regions there are found—

1. In the Æthiopian region, species of *Rhinostoma, Philodryas, Ahætulla, Dryophis, Leptodeira, Dipsadoboa.* In fact all the species belonging to these genera show severally, according to each different region, such different characters as may be hereafter considered to be generic, if they are again to be found in other species of the same region; and I wish therefore to point out a much greater difference between both regions than might appear by the number of forms mentioned as common. For instance, the South American species of *Rhinostoma* exhibit a posterior grooved tooth; in *Rhinostoma cupreum* of Africa I found the same tooth not grooved; if *Rh. occipitale* of Hallowell, from Western Africa, or other species hereafter to be discovered, should prove to have also smooth teeth, I should consider it to be a character sufficient to separate the Neotropical species from those of the western Palæotropical region. Not knowing the species of *Philodryas* from Madagascar, I refrain from giving my opinion in respect to them.

2. In the Indian region, species of *Rhabdosoma, Tomodon, Spilotes, Coryphodon, Dryophis, Eudipsas, Dipsadomorphus.* I have already pointed out that South America exhibits in more than one respect similarities with the middle Palæotropical region; and thus, excepting those forms which are represented in both regions by different genera, we have two genera truly common to them, *Rhabdosoma* and *Coryphodon*. The other genera I reckon of the same account as those mentioned as common to the Æthiopian region.

3. In the Palæotropical region, one species of *Tachymenis*.

4. In the Nearctic region, species of *Heterodon, Herpetodryas, Coryphodon*. The first two genera are limited to the New World,—one exhibiting more species in the northern part, the other more in the south.

The Ophidians decidedly show that the West Indies are referable to the Neotropical region only. Hardly one species § is common to them and to the Nearctic region, and only the genus *Herpetodryas* might be considered such. On the other hand, many Southern continental species are again found in the West Indies; and how many generic forms are common to both, the number of genera marked above with a cross (†) will represent. The genera peculiar to the West Indies, and marked with an asterisk (*), do not express a common peculiar character; and some of them are founded on relatively slight characters.

§ Hallowell mentions *Ischnognathus Dekayi* as found in Jamaica (Proc. Ac. Nat. Sc. Philad. 1856, p. 237).

SCHEMA OPHIDIORUM DISTRIBUTIONIS GEOGRAPHICÆ.

CREATIO NEOGEANA.	ORBIS TERRARUM.	CREATIO PALÆOGEANA.	
12,000,000 square miles, 225 species, $= \frac{1}{53,000}$.	45,000,000 square miles, 635 species, $= \frac{1}{70,000}$.	33,000,000 square miles, 410 species, $= \frac{1}{80,000}$.	
V. Regio Nearctica, 6,500,000 square miles, 75 species, $= \frac{1}{87,000}$.		I. Regio Palæarctica, 14,000,000 square miles, 40 species, $= \frac{1}{350,000}$.	
VI. Regio Neotropica, 5,500,000 square miles, 150 species, $= \frac{1}{36,000}$.	II. Regio Æthiopica, 12,000,000 square miles, 80 species, $= \frac{1}{150,000}$.	III. Regio Indica, 4,000,000 square miles, 240 species, $= \frac{1}{17,000}$.	IV. Regio Australiana, 3,000,000 square miles, 50 species, $= \frac{1}{60,000}$.

The above Schema is made to accord with Mr. Sclater's Schema of the geographical distribution of Birds; but in both schemes the calculations made as to the number of square miles to one species cannot be looked upon even as attempts at approximations, in those regions of which a part only has been explored by naturalists. Thus the large space of Central Asia, between 250° and 300° W. long. and between 35° and 50° N. lat., is quite unknown —a space of about 3,000,000 square miles, which cannot be justly taken into account; and then we should have a ratio of 1 : 275,000. In the Æthiopian and Australian region, at least two-thirds of the area mentioned being unknown, we should have on the average a single species to 50,000 square miles for the former, and to 20,000 square miles for the latter region. In this way we arrive at least at a more accurate idea of the series in which the regions follow one another as to their respective richness in forms :—

1. Indian region 1 : 17,000.
2. Australian region 1 : 20,000 (instead of 1 : 60,000).
3. South American region 1 : 36,000.
4. Æthiopian region 1 : 50,000 (instead of 1 : 150,000).
5. North American region 1 : 87,000.
6. Palæarctic region 1 : 275,000 (instead of 1 : 350,000).

Thus from the consideration of the geographical distribution of Snakes, we are obliged to acknowledge the views of the primary divisions of the earth's surface given by Mr. Sclater as those most natural. I have endeavoured always to state those facts which apparently contradict this view, as well as those which favour it; but, by stating the former, I intend rather to direct the attention of the systematist to such less satisfactory results of his exertions, than to destroy the idea of primary ontological divisions. As, however, we do not know one species of Snakes extending fully over two regions, and as we find each region occupied by a majority of peculiar genera, we come to the inevitable conclusion that these different forms of Snakes were created in the different parts of the world where they are now found ; but it would be a too precipitate inference to maintain the same for all other species of the animal kingdom. As I said in the beginning of this paper, Snakes form a most stationary tribe among animals; but other animals are subjected to internal or external agencies by which they are necessarily spread, in a longer or shorter lapse of time, beyond their primary boundaries; and it is a great mistake, in such instances, not to admit the identity of species, even though it be modified into a climatic variety. How the Batrachians are related in this respect, and what are the most natural divisions of the earth's surface as to this order of Reptiles, will be the subject of the Second Part of this paper.

MISCELLANEOUS.

On the Reproductive Organs of Sertularia tamarisca. By Prof. Allman.

In a communication read in the Natural History Section at the Leeds Meeting of the British Association, the author called attention to the fact that *Sertularia tamarisca*—which, like most of the Hydroid Radiata, is strictly diœcious—presents the further remarkable character of having its male and female gonophores (generative vesicles) totally different in form,—an important fact as regards the zoographical characterization of the species.

The male gonophores appear to be those figured by Ellis in his description of this species; they are compressed somewhat obcordate bodies, with a short terminal tubular aperture.

The female gonophores are far less simple in form; they are oval for about the proximal half of their length, and then become trihedral with the sides diverging upwards, while the whole is terminated by a three-sided pyramid. The sides of the pyramid are cut into two or three short teeth along their edges; and each of their basal angles is prolonged into a short spine.

The trihedral portion, with its pyramidal summit, is formed of three leaflets, which merely touch one another by their edges without adhering, so that they may be easily separated by the dissecting-needle. They consist of the same chitinous material as that which invests the rest of the gonophore, formed doubtless originally on the surface of an ectodermal lamina.

The male gonophore is traversed by a fleshy axis (blastostyle), which gives origin to one or more sporosacs containing the spermatogenous tissue surrounding a well-developed spadix *. The spermatozoa have an elongated body of a cylindrical form, with a long caudal filament.

On laying open the female gonophore, the oval portion of it is seen to be occupied by a blastostyle, which gives origin to one or more sporosacs entirely resembling the male sporosacs except in the nature of their contents, which are here ova instead of spermatozoa.

The oval portion of the gonophore terminates upwards by closing round the remote extremity of the blastostyle, where it forms a ring with tooth-like processes, by which the extremity of the blastostyle is encircled. This oval portion constitutes the proper capsule of the gonophore, and is the only part developed in the male. From the summit of the blastostyle several irregularly-branched cæcal tubes, apparently communicating with its cavity, are given off. They lie altogether external to the proper capsule, and embrace a delicate sac, within which are one or two ova in an advanced state of development, each in a delicate structureless sac of its own, which is con-

* The author proposed the term *spadix* to indicate the diverticulum from the common cavity of the cœnosarc, which in most of the Hydroid Zoophytes extends into the centre of the sporosac, and round which the generative elements (ova or spermatozoa) are developed.

tinued by a narrow neck towards the summit of the proper capsule, with whose cavity it would seem to communicate; but the author did not succeed in tracing its connexions beyond this point.

These ova, with their investing sacs, and the surrounding cæcal tubes, would thus lie entirely exposed, were it not that they are surrounded by the three leaflets already mentioned as constituting the trihedral portion of the gonophore. These leaflets are given off from the oval portion or proper capsule near its summit, and, being in contact by their edges, completely enclose a space which is occupied by the structures just described.

These structures are thus truly extra-capsular, and correspond with the extra-capsular ovigerous sacs which occur in *Sertularia pumila, S. cupressina,* and other species, and into which the ova are conveyed from the interior to undergo, as in a sort of *marsupium,* a further development previously to their final liberation as embryos.

With regard to the true import of the sporosacs and their relation to the Medusoid buds produced by other Hydroids, the author insisted on the necessity of bearing in mind that the spadix has no ectodermal covering, and consists of endoderm alone. He considered it to be homologous with the manubrium ("peduncle") of a Medusa separated from its ectoderm by the intervention of the generative elements, which in the sporosac are always found between the endoderm and ectoderm of an organ strictly homologous with the so-called "peduncle" of a Medusa. By the continued growth of the generative elements, the ectoderm is separated more and more from the endoderm, which now constitutes a diverticulum from the cavity of the blastostyle, enveloped by the ova or spermatozoa, while the ectoderm forms the walls of a sac which immediately confines these elements. The whole is enclosed in an external sac, which seems to be an extension of the ectoderm of the blastostyle.

We have thus, in the sporosac of *Sertularia tamarisca,* an organ which easily admits of comparison with the Medusoid buds of other Zoophytes; it consists, in fact, of a manubrium peculiarly modified, so as to constitute a sac for the retention of the generative elements, and chiefly differs from the proper Medusoid buds in the non-development of a swimming-organ or umbrella. In other instances (*Cordylophora,* &c.), as the author has elsewhere shown*, peculiar cæcal tubes, generally more or less branched, are developed from the base of the spadix, and thence extend, along with the ova or spermatozoa, between the ectoderm and endoderm towards the summit of the sporosac. The author had already compared these tubes to the radiating gastro-vascular canals of a Medusa; and if this comparison be just, they remain in the sporosac as the sole representatives of the parts found in the umbrella of a Medusa †. A change of position,

* Phil. Trans. 1853.

† In a paper by the author, on *Cordylophora lacustris* (Phil. Trans. 1853), he expressed his belief that the umbrella of a Medusa had its representative in the walls of the sporosac; subsequent examination, however, of the sporosacs in a great number of species had caused him to modify this view, and adopt that contained in the present communication.

however, has taken place; and the radiating canals, having withdrawn themselves from the covering of ectoderm which they possess when forming a constituent part of the developed umbrella, are now composed of endoderm alone, and lie between the endoderm and ectoderm of the manubrium, where they form cæcal processes from the spadix or endodermal portion of the manubrium.

Rare Animals from India.

By the 'Nile,' which proceeded down the river yesterday morning, we hear that the celebrated huge Tiger, "Jungla," the largest and most beautiful of the famous fighting tigers of Lucknow, is shipped for sale in England. This splendid animal is not only remarkable for his size, which far surpasses that of any tiger or lion yet seen in Europe, but for the extraordinary beauty of his colouring and markings—having all his body-stripes *double*. He is, moreover, extremely tame and gentle to those he knows; but many a big buffalo has been felled by his tremendous sledge-hammer of a paw. There was, in fact, no sport at all about his method of procedure: he went most systematically to work; and the business was done in no time. In a civilized country he will of course have to forego the pleasure of such feats; but we doubt not that he will become an object of great admiration for his size and beauty.

By the same vessel is likewise forwarded, for sale in England, a fine healthy yearling bull-calf of that very rare animal to obtain alive, the gigantic Gaour, or *Bos gaurus*, which sportsmen in India persist in miscalling the Bison; it is the largest of existing bovine animals—the finest bulls even exceeding 20½ hands high, measuring from the summit of the singularly elevated dorsal ridge*. This, indeed, is one of the most remarkable features of the species, the spines of some of the dorsal vertebræ measuring 16 inches in length. Another characteristic of the adult animal consists in its very broad *concave* forehead, surmounted by a high transverse arched bony ridge between the horns. The skull is extraordinarily massive. We have seen one which, with the horns attached, but *minus* the lower jaw, weighed exactly 30 lbs. The peculiar form of the head is scarcely even indicated in the yearling calf; and the animal is a very slow grower. We have heard of one which lived for three years in the possession of an officer in the Madras Presidency, and was still, to all appearance, a mere calf. This is doubtless the first Gaour ever shipped for Europe; and the species must not be confounded either with the Gayal (*B. frontalis*), or with the Banteng (*B. sondaicus*). Though only generally known as a wild animal, we have been assured that the Gaour, in addition to the Gayal, is domesticated in the interior of the Tippera Hills. The calf at present on board the 'Nile' retains not a vestige of wildness, but is as quiet and tractable as any ordinary domestic animal.—*Overland Hurkaru*, Calcutta, Dec. 8, 1858.

* *Vide* 'India Sporting Review,' new ser. no. 3. p. 329, and no. 5. p. 210.

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[THIRD SERIES.]

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XXVI.—*On* Plœsconia *and* Kerona. By H. J. Carter, Esq., Bombay.

[With a Plate.]

There are no animalcules more interesting than *Plœsconia* and *Kerona*, from their being the highest of the class of Infusoria in point of development, whilst there are none more difficult to study, on account of their complicated structure, incessant motion, transparency, and rapid diffluence or change of form after death; so that, on the one hand, while they attract notice from their position, they, on the other, almost elude acquaintance, without the most prolonged watching under the most favourable circumstances; hence, probably, the imperfect way in which they have hitherto been described and delineated.

All who have given their attention to the Infusoria generally must be aware of the unsatisfactory details which we possess of the *Plœsconiæ* and *Keronæ*, and therefore of the desirableness of obtaining more precise information respecting them, that it may be really known how near the highest animalcules approach those forms with which we are most conversant among the Invertebrata.

At first sight the *Plœsconiæ* have very much the appearance of insects, and hence they have been called "water-spiders;" but although they outwardly resemble the Articulata, and, indeed, approach them in form, as will be presently seen, yet their internal organization remains strictly Infusorial. Again, one has been described as also undergoing a metamorphosis in its development, something like insects, which gives the family additional interest; so that altogether there are many reasons for subjecting these animalcules to further and more rigid examination.

Having early become sensible of this, I have, during my microscopic investigations, taken advantage of the opportunities that have come before me of sketching and describing these animalcules when they have appeared under favourable circumstances; and although these have only happened now and then, yet, in the absence of a special report upon the subject, it is hoped that they may prove acceptable.

In reviewing them for publication, I find, however, that they will not admit of my describing with certainty more than two species of *Plœsconia* and one of *Kerona*, which are not only the most common in the salt and fresh water of the marshes in the island of Bombay, but, according to Dujardin's accounts, equally common in Europe, and, being respectively perhaps the best of their types, will do as well there as here for conveying the best idea of the structure and organization of the whole. In compiling the illustrations, too, I have endeavoured to facilitate the reader's acquaintance with these animalcules by shading them as opake or semi-opake objects, and not transparent, as they really are in nature, since it is impossible to give a clear idea of their forms unassisted by actual observation, if both the upper and lower surfaces are represented in the same figure; the appendages, too, have severally been slightly exaggerated and artificially placed, in order that they may be better seen; but, although these liberties have been taken, the deviation from nature is so trifling, that, for the object for which they are intended, they may be considered almost correct. To view them as perfectly accurate is not my wish, since there may be a leg too little or too many; but I can vouch for their being better in this respect than those of Ehrenberg and Dujardin, whose deficiencies, rendered more confusing by their having represented these animalcules with their natural transparency, in which all their parts are seen at once, chiefly induced me to adopt the opake shading above mentioned.

Among other observations, I have had the opportunity of witnessing the encapsulation of one of the *Plœsconiæ* and the *Kerona*, together with their subsequent changes and the elimination of the former, all of which, bearing strongly on the metamorphosis of the "*Oxytricha*" into *Trichoda Lynceus*, described by the late M. J. Haime*, to which I have above alluded, will also be detailed and illustrated.

In my descriptions, I would also have it remembered that everything therein mentioned has been seen by myself, unless otherwise stated, in order that it may not be supposed that I am merely repeating the observations of those who have gone before

* Ann. des Sc. Nat. 3 sér. t. xix. p. 109, Zool. 1853.

me, and that too without acknowledging the sources from which they have been derived.

With these preparatory remarks, then, let us proceed with the *Plœsconiæ* first, as they are the highest in the scale of development.

PLŒSCONIA, Duj.

Plœsconia truncata. *Euplotes truncata,* Ehr. Pl. VI. figs. 1–4.

Oblong, oval, shield-like, firm in consistence, more or less discoidal according to the distension of the abdominal cavity; about twice as long as broad. Presenting an upper or dorsal and an under or ventral surface. Dorsal surface convex, smooth. Ventral surface plane, irregular, furnished with large and small legs, and a kind of gill. Gill situated on the left side anteriorly, and consisting of a ladder-like row of bars or narrow sessile plates, which, commencing on the left margin in front, extends backwards and inwards obliquely, to terminate in a more or less attenuated form just behind the middle of the body; larger legs scattered over the right two-thirds of the ventral surface, which is defined by a wavy longitudinal line on the left side, forming, with the oblique border of the gill, a triangular area open in front, which terminates behind in a pointed depression leading to the oral orifice. Oral orifice situated a little behind and to the left side of the middle of the body, just in front of the termination of the gill. Large legs thirteen in number, supported on short articulations, and divided into an anterior and posterior set; posterior set largest, five in number, of which the three on the right side are fixed to the ventral surface about the junction of the middle with its posterior third, and the two others a little further back, all extending a short distance beyond the posterior margin of the body, and each cleft at its termination into a lash of hairs, successively longer than each other, and capable of being closed or expanded at the will of the animalcule; anterior set eight in number, styliform, not cleft, fixed chiefly to the anterior part of the ventral surface, where the two on the left side in front are the largest. Short legs four in number, situated posteriorly and laterally, two on the right and two on the left side, fixed to the ventral surface submarginally; those on the right side terminating in an expanded lash of hairs respectively, and the two others styliform. Posterior and lateral margins of the body sharp, smooth, even, defined; anterior margin divided into two lips, forming a groove which is closed on the right and open on the left side, in which a wreath of long curved cilia are fixed, that diminish in length towards the left side, and terminate at the commencement of the gill, where they appear to form lateral extensions of its anterior bars. Abdominal cavity containing sarcode charged with molecules, refractive hepatic (?) oil (?)-globules, and, when also present, digestive spaces enclosing fragments of food. No hepatic cells. Anal orifice and contracting vesicle marginal, situated together on the right side, at the junction of the posterior with the middle third of the body. Nucleus long, cylindrical, situated circumferentially, and extending three-fourths round the body, that is, commencing posteriorly, passing round by the left side, and ending just in front of the contracting vesicle. Length about 1-134th of an inch, but variable.

Hab. Both fresh and salt water, feeding on small animalcules, Diatomaceæ and Algæ.

Loc. Island of Bombay and Europe.

Obs. Although in the illustrations (Pl. VI. figs. 1 & 2) the dorsal is much raised above the ventral surface, yet it should be remembered that this is caused by the abdominal cavity being distended with embryonic cells, and that when these are absent the animalcule is frequently so flat that the two surfaces are nearly in contact.

I am not *quite* certain about the number of the anterior set of legs, whether it be eight or nine, but I think the former. Sometimes also five or six longitudinal lines are visible, apparently on the ventral surface, where they seem to divide the posterior legs from each other at their bases; but they do not appear to constitute a specific difference, or to be peculiar to *P. truncata*, for they are more or less present in the other *Plœsconiæ* which have come under my observation, although only now and then perceptible (fig. 4 *n*). The basal articulations are only seen under favourable circumstances, and even then but very imperfectly, as well as the hairs into which the posterior legs are cleft; so that the microscopist must not expect to see these features immediately, nor be surprised if he find one or more of the anterior legs cleft, in opposition to what I have stated; for it was only after long watching that I met with individuals of *P. truncata* in which this feature was disclosed in the posterior ones. Dr. Lachmann has noticed the articulations at the base of the short legs or "*styli*" in the *Euplota,* and that one of them in *E. patella* has been observed to bear "setiform branches;" also that the posterior legs or "*uncini*" are "cleft at the end in some species, as for example in *Euplotes patella**."

The ladder-like structure (fig. 3 *b*), to which I have applied the name of "gill," from its branchial appearance, seems to pre-

* Annals, vol. xix. p. 217, 1857.

sent a movement of its bars in succession to that of the wreath of cilia with which it is conjoined anteriorly; but as this wreath appears to be chiefly concerned in bringing the particles of food to the oral orifice, I am not certain that the gill may not have an independent, perhaps respiratory, function.

The abdominal cavity at first appears to be equal in extent to the dorsal surface; but the particles of food never extend to all the margins of the latter, and are seldom seen to occupy more than the anterior and right two-thirds of this space, while opposite the triangular depression leading to the mouth the dorsal and ventral surfaces appear to be nearly in contact, which accounts for the greater transparency of this portion; however, in fig. 2, where the embryonic cells well mark the extent of the abdominal cavity, a few of them may be seen over the lower part of the gill, and extending forwards on the left side of the triangular depression. This area has been coloured with a dark shade in fig. 3 *a*, in order to show in relief the gill and part of the ventral surface by which it is bordered. I question, too, whether the under lip (fig. 2 *a*) is not more prominent in the representations generally than it is in nature, and also think that this may be owing to the pressure of the covering slip of glass. The contracting vesicle is surrounded by several sinuses, which, filling first, then pour their contents into it, while these again appear to be expelled by the contracting vesicle through the anal orifice—assuming that the anal orifice in *P. truncata* is situated in the same position as in the following species. I have never been able to discover any hepatic cells (viz. those containing cellules or oil-globules), in the abdominal cavity of either *Plœsconia* or *Kerona*, such as those in *Nassula*, &c., and nothing but a number of refractive globules, which appear to be of an oleaginous composition, and secreted direct from the sarcode. We have the same differences in the common worm *Nais* and in the microscopic *Filaria*; viz. the hepatic element in the former consists of cells which produce the oil-globules, and the oil-globules in the latter are produced apparently independent of cells.

Of the position and shape of the nucleus, too, in *P. truncata*, I am not quite certain; for I have only been able to see it once, in apparently half-starved individuals, and then it was so indistinctly marked, that, without further confirmation, I cannot assert that it is truly represented in fig. 4. I doubt if it ever becomes visible unless the abdominal cavity be void of food, and nearly free from the presence of the hepatic oil-globules and granular matter, as it was in this instance.

It will now be obvious that the terms "hooks" and "horns," originally applied to the legs of the *Plœsconiæ*, are calculated to mislead, as the hook-like appearance merely arises from the bent form of the legs, while their office, being essentially locomotive, demands the more appropriate appellation of "legs." In describing these animalcules, too, it will be necessary, if we are ever to make any advance in our knowledge of their species, to determine the number of the legs, as well as their position and form, together with that of the body; for there are some species which approach others so nearly in the latter, that the form or number of the legs alone presents the chief distinguishing character.

Multiplication by transverse division is common in *P. truncata*; but I have not yet seen longitudinal division in this species.

Plœsconia Charon, Duj. *Euplotes Charon*, Ehr.
Pl. VI. figs. 12–15.

Oval, slightly truncated anteriorly. Dorsal surface convex, divided into 5–6 longitudinal ridges, which are granulated on the margins, and radiate meridionally from a caudal point. Ventral surface plane, irregular, furnished with a gill and fifteen large styliform legs, of which five are posterior and do not appear to terminate in lashes of hairs, and the rest anterior. Small legs four in number, situated posteriorly and laterally, fixed to the ventral surface submarginally, two on one side, and two on the other of the median line, all styliform. Anal orifice and contracting vesicle situated together on the right side, marginally, and a little posteriorly. In other respects this species is constructed so like *P. truncata*, that, with a reference to the illustrations, no further description is necessary. Nucleus not seen. Length varies from 1-700th, which is the smallest size I have seen, to 1-300th of an inch.

Hab. Salt and fresh water, especially the former in the main drain of the island of Bombay, feeding on small animalcules, Diatomaceæ and Algæ.

Loc. Island of Bombay and Europe.

Obs. I have not been able to see the granulations on the ridges, but their existence may be inferred from their impressions being left on the empty capsules of this species after its elimination, as will be more particularly noticed hereafter (fig. 19). In some instances that part of the border between the posterior margin and the gill is so much expanded, that at first sight it seems to indicate a different species; but I think this will be found to be owing chiefly to a more fully-developed or robust form of the animalcule, probably under the influence of good food. Some individuals are frequently not more than one-third of the size of the largest of the kind; and although diminution to a certain extent is often owing to want of nourishment, yet, when they are so small as this, they have the appearance of having come more or less direct from ovules or embryonic cells, which, again, is opposed to the view of their being a metamorphosis of an *Oxytricha* or *Kerona*, a point to which we shall have occasion to recur again by-and-by.

There is another species very like *P. Charon*, which is common in the main drain of Bombay, and also appears to be equally common in Europe, if I am right in identifying it with *P. longiremis*, Duj.; but the latter is so imperfectly figured by Dujardin, that all that I can state, beyond its resemblance to his delineation, is that it differs from *P. Charon* in the straightness of the margin on the right side, in having no ridges on the dorsal surface, in the posterior end of the "gill" being curved forwards, and in having five small legs, instead of four, posteriorly and laterally, viz. two on the left, and three on the right side of the median line. Here, then, the short submarginal legs form a valuable specific character; for the ridges on the back of *P. Charon* are not always distinct, while the presence of longitudinal lines on the posterior half of the ventral surface, similar to those of *P. truncata*, may be easily mistaken for them, and thus the two species, but for the short legs, confounded.

I am not quite certain, either, of the exact number of anterior legs on *P. Charon*; for in some of my sketches there are nine, and in others ten. Dr. Lachmann figures ten*.

Multiplication in *P. Charon* and *P. longiremis* by longitudinal and transverse division is equally common; and the former is very likely to be mistaken for copulation, from the inferiority in size of the left individual, which is frequently so small as to make it appear as if they were originally derived from different sources.

Kerona, Duj.

Kerona pustulata, Müll. *Stylonychia pustulata*, Ehr.
Pl. VI. figs. 5–7.

Oval elongate, soft in consistence, more or less flat; about twice as long as broad. Presenting a dorsal and ventral surface; the former more or less convex, smooth; the latter plane, irregular, and supporting a gill and legs as in *Plœsconia*. Posterior legs five in number, fixed to the ventral surface a little in front of the posterior margin, stiff, straight, styliform, not used in progression; anterior legs styliform, seven (?) in number, freely moveable upon short round articulations, used in progression. Oral orifice situated about the middle of the body, just in front of the posterior termination of the gill. Anal orifice marginal, on the left side, about the

* *Loc. cit.* pl. 9. fig. 10.

union of the posterior two-fifths of the body. Abdominal cavity containing sarcode charged with molecules, refractive globules as in *Plœsconia*, dark angular grains, and, when present, digestive spaces more or less filled with fragments of food, but no hepatic cells like those of *Nassula*, &c. Contracting vesicle on the left side, marginal, posterior, and opposite to the termination of the gill. Nucleus long, cylindrical, occupying the greater part of the left side, sometimes divided into two portions, and even more when the *Kerona* is about to become encapsuled. Posterior and lateral margins more or less round, fringed with cilia. The anterior margin, with the wreath of cilia, the gill, and the triangular or buccal depression leading to the mouth, so much the same as in *Plœsconia* that, with the illustrations of *K. pustulata*, they do not need a separate description. Length varies; when full-grown, about 1-200th of an inch.

Hab. Salt and fresh water, generally in company with *Plœsconia Charon*, but not always; feeding on small animalcules, Diatomaceæ and Algæ.

Loc. Island of Bombay and Europe.

Obs. This animalcule differs very much in size, appearance, and development, according to its age and the amount of nourishment where it may be living. When young, the anterior legs are by no means evident; and this makes it look very much like an *Oxytricha*, for which it appears to me to have been taken in the instances to which I shall presently allude. The legs, however, become plainly visible when it is a little older and larger, which conditions may be brought about by adding a little glue to the water, as this offers a palatable nourishment, which not only keeps the animalcule alive, but leads to its full development, especially if it be in salt water. The salt, too, somewhat delays the diffluence after death; and if a little of the water be dropped upon a glass slide, so as to assume a globular form as much as possible, and then left to evaporate until it is nearly flat, these animalcules will have congregated together in the centre, and under a light piece of thin glass will be sufficiently controlled in their movements and remain sufficiently long without diffluence to be observed most satisfactorily.

The nucleus, although represented as consisting of a single cylindrical organ in the illustrations, is often seen to be divided into two portions, and even into four just previous to encapsulation, when it disappears altogether, apparently by dissolution*. Thus, with the nucleus divided into two portions, and the contracting vesicle on the left side opposite the termination of the

* This division of the nucleus into two portions has also been noticed by M. Balbiani (Comptes Rendus, and Annals, vol. ii. p. 443, 1858).

gill, we have features which agree so precisely with Ehrenberg's *Oxytricha Pellionella*, *Kerona Polyporum*, and *Stylonychia Silurus*, as well as with the "*Oxytricha*" figured by M. J. Haime as the larva of *Trichoda Lynceus*, that, with the variable appearances assumed by *Kerona pustulata* in different stages of development, I am inclined to think that all these may be only different forms of this species,—an inference which meets with no opposition from Ehrenberg's delineations, since these and his figures of the *Plœsconiæ* are the most unsatisfactory of all his representations. Even his *Oxytricha caudata* has the moveable legs in front, which make it a *Kerona*; at least there is a form here exactly like it in general contour, which is undoubtedly a *Kerona* in this respect. Dujardin's delineations of these animalcules are not a bit better: the want of care, labour, and consequent preciseness with which they have all (his as well as Ehrenberg's) been drawn, renders their details so doubtful, that they are worse than useless for identification. Vexing as this is, however, it should not be forgotten that the subject is one which is attended with the difficulties mentioned at the commencement of this paper.

Multiplication by longitudinal and transverse division, as well as by budding, are all equally common in *Kerona pustulata*; and here also the longitudinal division is very likely to be mistaken for copulation, from the inferiority in size of the left individual, particularly if there are not sufficient examples present to show this in all its stages.

General Observations.

On comparing *Plœsconia* with *Kerona*, we cannot help seeing the unity of plan on which they are constructed, while the differences in the consistence of the body, definition of form, development of the posterior legs, situations of the contracting vesicle and anal orifice respectively, form and position of the nucleus, and the presence of cilia round the margins in *Kerona*, are quite sufficient to make them separate families.

Again, we cannot help remarking in the inferior family, viz. *Kerona*, the downward approach towards *Paramecium Aurelia*, in the resistant state of the body, the ciliated margins, and the position of the anal orifice, which is exactly the same as that in *Paramecium*, while it is the opposite to that of *Plœsconia*.

Then, in the other genera of the *Keronæ*, such as *Oxytricha*, we have not only the posterior but also the anterior legs motionless and styliform, which is a still nearer approach to *Paramecium*, in which such appendages are altogether absent.

As regards the approach of the *Plœsconiæ* to higher Invertebrata, we have certainly legs, which apparently move on short articulations like those of the Articulata, but so transparent that they can only just be seen now and then when the light is favourable; and in the cleft terminations of the posterior ones there is a resemblance to the divided termination of the leg generally, but more particularly to the setiferous legs of the Entomostracous Crustacea; besides, we have a gill-like apparatus at the side, which would appear to have a different function (perhaps respiratory) from that of the wreath of cilia in front, with which it is continuous, the office of which is distinctly to bring the particles of food to the oral orifice, and which, again, might be considered analogous to the *palpi*. But here all resemblance ceases, since there is no defined alimentary canal (although there may be a distinct alimentary cavity), and there is the organ called the "gland" or "nucleus," which is essentially a character of the Infusoria, and the contracting vesicle, which does not, so far as my observation extends, appear in any of the Entomostracous Crustacea,—that which I formerly stated to be a contracting vesicle in the "Water-flea," or young of *Cyclops*, being merely contractions of the last part of the alimentary canal*.

Another remarkable difference between the *Plœsconiæ* and higher Invertebrata is the phænomenon of "diffluence," which takes place at death, when a part or the whole of the body, according to the amount devitalized, disintegrates—as a bunch of iron-filings held together by magnetism falls to pieces when that fluid is abstracted.

Thus the study of the *Plœsconiæ* points out to us that a complicated structure is not necessarily a more cohering one, none the less simple because it cannot be seen,—facts which should be borne in mind when we would limit structure and organization by the powers of the microscope, and intricacy of form by want of molecular tenacity.

Among the *Plœsconiæ* I would include all Ehrenberg's *Euplota*, together with his *Aspidisca Lynceus* (*Trichoda Lynceus*), which is very common in Bombay, and essentially of the type of *Plœsconia*; but not his *Diophrys*, I think; and most certainly not his *Loxodes*, which, with *Chlamidodon*, is more nearly allied to *Kolpoda*, Ehr.; at all events, they are not *Plœsconiæ*.

Of the *Keronæ* I am not prepared to state more in this respect than is mentioned in the observations after the species which I have described.

Generation.—Multiplication by longitudinal and transverse division in *Plœsconia* and *Kerona* has been already mentioned, and budding in the latter; but I have not seen budding in *Plœsconia*. Disparity in size under longitudinal division, as

* Annals, vol. xviii. p. 129, 1856.

leading to the idea that this might be the congress of two individuals originally separate, has also been noticed; and to this I might add the possibility of *Plœsconia* and *Kerona*, during the early stages of division, as well as the young buds of the latter, being so different as to lead to a false multiplication of species. Another point might be noticed here, viz. the analogy which the disparity in size of the two individuals during longitudinal division bears to a similar disparity observed in the cell-division of many of the Algæ, especially in *Cosmarium* among the Desmidiaceæ—making fissiparation, if we would carry on the disparity or diminution still further, a mere variety of budding.

Generation by impregnation I have never seen; neither do I think I have ever seen the congress of individuals of *Plœsconia* or *Kerona* preparatory to this; but I have frequently seen *P. truncata* more or less charged with globular, refractive, semi-opake, yellowish bodies, of uniform size, as represented in the illustrations (figs. 1 & 2); and M. J. Haime has stated that he has seen such bodies issue one after another from the anal orifice in more than one distinct species of *Plœsconia*, remain stationary for a little, develope a filament from each of their extremities, and then move round rapidly on their axes*: after which they should pass into the form of *Oxytricha*, preparatory to assuming the higher one of *Plœsconia*, if the metamorphosis described by this naturalist be common to all the *Plœsconiæ*; but as this has not been proved, and the encapsulation of these animalcules is intimately connected with this process, we will now shortly direct our attention to both.

Encapsulation.

It is a common practice among the Infusoria to surround themselves with a capsule, which seems to be ordained chiefly for self-preservation during want of food or water, after which, on the recurrence of either one or both of these necessaries, they may return to active life either as simple individuals, or multiplied by duplicative subdivision. But this does not appear to be the case with the *Oxytrichina*, among which, according to M. J. Haime, there is at least one species which undergoes metamorphosis in this way into *Trichoda Lynceus*,—a process which does not seem improbable, from the insect-like form of *Plœsconia*, but one entirely at variance with the common result of encapsulation among the Infusoria generally. Wishing therefore to witness this myself, I embraced the first opportunity that was presented to me of collecting a number of *Kerona pustulata* which were becoming encapsuled under my eye, and transferring them to a watch-glass for observation, where, after a certain time, and under cer-

* Ann. des Sc. Nat. *l. c.* p. 131.

tain circumstances which will presently be related, they appeared to issue from the capsules in the form of *Plœsconia Charon*; but as the series of observations is not complete, inasmuch as I did not see the *Plœsconiæ* actually issue from the capsule of *Kerona*, I shall not insist upon the fact any further than the details of the experiment may seem to demand.

Before proceeding, however, to this, it is desirable to premise a short abstract of that part of M. J. Haime's paper which more particularly refers to the metamorphosis described by him, in order that the reader may be able to compare the principal facts contained in it with those about to be noticed by myself.

This talented naturalist, who found the *Oxytricha*, described and figured in his communication *, in the month of September 1852, in a ditch near Paris, has stated respecting its encapsulation, that the process commenced by the *Oxytricha* gradually assuming a spheroidal form by becoming shorter and shorter, until at last it passed into a round ball; that during this period the cilia also gradually disappeared, so that, finally, nothing but the round ball, consisting apparently of a little granular matter with a contracting vesicle, seemed to remain; that in this state it continued from eight to twelve days, when some small portions of its internal contents were discharged, and then the rest began to separate itself from the envelope or capsule. Cilia now became visible, and the portion began to rotate rapidly at intervals, sometimes one way, sometimes the other. This continued for several days, when the rotating mass discharged another portion of its contents, which this time remained within the capsule, and turned round equally rapidly with the living one. The latter now began to assume the form of *Trichoda Lynceus*, and to project a few of its cilia through the crevice in the envelope formed by the discharge of the first portions of superfluous material; after this a part of the body was projected through it, which remained there for a while, and was then withdrawn, when the rotatory motion was again renewed; that all this was repeated several times successively, until the crevice became large enough to allow the whole body to pass through it, and thus the *Trichoda* effected its exit.

Such is a brief summary of M. J. Haime's minute and circumstantial account of the metamorphosis, which I had hardly read when a host of *Keronæ pustulatæ* made their appearance in a basin of water containing some *Oscillatoriæ* which I had under observation; and being so like his *Oxytricha*, and undergoing similar encapsulation, I thought that they might also undergo a similar metamorphosis, and therefore collected some for the experiment, of which the following is a detailed account :—

* *Loc. cit.* p. 123.

The *Oscillatoria* had been obtained from the salt-water drain of Bombay, where it floats in dark-green silky clots, and the clots placed in a basin of fresh water on the 16th May, 1855. Six days afterwards, during which a host of *Vorticella microstoma* had made their appearance, and had for the most part become encapsuled, *Kerona pustulata* (figs. 5–7) appeared.

On the seventh and eighth days the *Keronæ* had increased to an inconceivable number, apparently from fissiparation, and on the ninth day they began to become encapsuled, when a quantity of them, in all stages of this process, complete and incomplete, were transferred to a watch-glass filled with fresh water.

During encapsulation, the first change that presented itself was the absence of all crude aliment in the abdominal cavity; then a division of the nucleus into four parts, preparatory to its disappearing altogether; at the same time, certain dark angular grains, which had been floating round with the sarcode of the abdominal cavity, became congregated into the posterior extremity (fig. 6 *e*). The *Kerona* now became shortened; its cilia gradually disappeared (fig. 8); and finally it passed into a rounded oval ball (Pl. VI. fig. 9). This, after a certain time, resolved itself into an obtuse elliptical capsule enclosing a spherical cell with a separate mass of dark angular grains (fig. 10); the capsule (*a*) was laminated and ragged on the outside, and defined by a clear line internally, while the spherical cell (*b*) contained all the vital remains of the *Kerona*, together with the contracting vesicle, but exclusive of the "dark angular grains" (*e*), which, adhering more or less together, were still enclosed within the capsule, and thus formed an excellent distinguishing mark for it throughout the experiment. At this time the spherical cell was rotating, probably from the presence of cilia on its surface, and the contracting vesicle active (*c*); but subsequently the granular mucus of which it was composed became transformed into a number of uniform, round, refractive, oil-looking bodies (*d*), and the contracting vesicle disappeared.

In this state, up to the 14th of June, that is, thirty-six days after they had been placed in the watch-glass, which was kept constantly filled with water, they remained unchanged, and no other organisms were present but a few *Amœbæ* and *Vorticella microstoma*; when, having waited much longer than the time mentioned by M. J. Haime for the metamorphosis, I thought that this still-existence might be owing to the absence of nutritive matter. Accordingly, having some portions of dried *Nostoc* at hand, a few of these were placed in water, and when they had become gelatinous, their soft parts were squeezed through a piece of fine cambric into another watch-glass, to which a portion of the *Kerona*-cysts contained in the original one had been previously transferred; and the former, having been filled with fresh water, was put aside for observation.

For twenty-four hours after this, nothing occurred; but at the expiration of this time a few individuals of *Plœsconia Charon* appeared, some of which were undergoing transverse fissiparation, and in a few hours they became innumerable,—during which the contents of the spherical cysts in the *Kerona*-cysts respectively had also become active, had separated themselves from their cysts, and had assumed definite forms, some having escaped from the cells, while others were still rotating in them rapidly, sometimes one way, sometimes the other, attended by intervals of rest: with many also a lifeless portion was present, which was forced round equally fast with the living one; and in several of the latter I could not only see cilia when they were at rest, but, while they were rotating, I thought I could perceive ridges like those on the back of *Plœsconia Charon.*

In this state I watched some of them, at intervals, for three hours continuously, which was as much at a time as my official avocations would then allow me to devote to the subject, but unfortunately not sufficient for me to see any escape; and therefore I could only infer that this had taken place from several of the cells being empty and presenting a rent in one part of them (fig. 11), while the group of "dark angular grains" outside the spherical cell, but still confined within the oval cyst (fig. 11 *c*), remained unaltered, and thus, as before stated, served as a distinguishing mark for this cyst throughout.

I now sought about for the *Keronæ*, but could find none, not even a single individual, and no animalcules of any consequence, in this experiment, except *Plœsconia Charon*, as before stated, in great numbers, a few *Amœbæ*, *Vorticella microstoma*, and *Paramecium.*

Encapsulation of Plœsconia Charon.—The *Plœsconiæ* had not appeared more than twenty-four hours when they also began to assume a globular form, in the same manner as *Kerona pustulata* had done—that is, by becoming shorter and shorter, and at the same time secreting an albuminous substance around them, within which the legs and cilia were gradually withdrawn, and a spherical capsule thus formed, which adhered to the watch-glass (figs. 16–18). All trace of the *Plœsconiæ* now became lost, with the exception of the refractive globules common to the abdominal cavity, and the contracting vesicle, which, although active at first, also soon disappeared. In this passive state of existence the *Plœsconiæ* continued for two days, when the contracting vesicle again began to resume its functions, and the *Plœsconia* detaching itself from its capsule, began to rotate gradually. Cilia now presented themselves; the rotatory motion was accelerated; and with it the distension of the contracting vesicle became greater and greater at each time, until at last it thus burst the capsule, and a portion of the cilia of the *Plœsconia* was at the same time protruded. A few minutes of rest now succeeded; and the cilia having been withdrawn, the rotatory motion was again resumed, while the distension of the contracting vesicle, also going on, at last became so great as now to force a portion of the body of the *Plœsconia* through the rent, when this vesicle again contracted, and an interval of rest followed as before; the portion of the body was then withdrawn, and the same process repeated several times, until at length the *Plœsconia* thus obtained its exit. It was now almost spherical (fig. 18), from the enormous distension of the contracting vesicle, behind which appeared the hepatic globules (*b*), and at the circumference the legs and cilia. In this state it continued stationary for some minutes, until the distensions of the contracting vesicle, evidently increased for the bursting of the capsule, were gradually reduced to the natural size, when the different parts of the *Plœsconia* regained their respective positions, and the animalcule, having undergone several twitches in different directions, at last assumed its original form and bounded off in quest of food.

The capsule.—On turning to the capsule (fig. 19), this was found to present an ovate elongation superiorly, upon which were five lines of puncta, converging towards the small end, and evidently corresponding to the ridges on the back of the *Plœsconia,* which I thus learnt to be granulated in the manner described by Ehrenberg. In some instances, however, there was no elongation; for I had watched the evolution of *P. Charon* from its cyst, unaccompanied by *Kerona pustulata,* before this, and have done so since, when the five punctated lines were bent meridionally over the empty cyst.

Observations.—Thus has been described the encapsulation of *Kerona pustulata,* followed, under the circumstances mentioned, by the appearance and encapsulation of *Plœsconia Charon,* which sequence at the time appeared to me confirmatory of M. J. Haime's conclusions respecting the metamorphosis of "*Oxytricha*" into *Trichoda Lynceus,* especially as the remaining *Kerona*-cysts were divided into three portions, and treated separately in the way above-mentioned, with precisely the same results.

However, since then it has occurred to me that the absence of *Kerona pustulata* and the sudden appearance of *Plœsconia Charon* might have arisen from the *Kerona* perishing at its exit, on the one hand, and from an elimination of the *Plœsconiæ* from their own cysts, on the other, which were mixed up with the *Kerona*-cysts when the latter were transferred to the watch-glass, and whose contents, as a matter of course, became equally active with those of the *Kerona*-cysts on the addition of the nutriment to the water in which they were contained. The absence of the *Kerona*, therefore, is no proof of the metamorphosis.

Secondly, the cyst of M. J. Haime's *Oxytricha* and that of *Kerona pustulata* are quite different (as may be seen from our drawings respectively), while the former clearly approaches that of *Plœsconia Charon*, which being intimately allied to *Trichoda Lynceus* in every respect, leads to the inference that the cysts of *Trichoda* were also in M. Haime's case mixed up with those of *Oxytricha*, and that he mistook the former for the latter, which thus led to the conclusion that *Oxytricha* had undergone metamorphosis into *Trichoda*. Again, the resemblance between his *Oxytricha* and *Kerona pustulata* is so great, that one would think that they should be equally alike when encapsuled, which not being the case, still further supports the supposition that the capsule from which *Trichoda Lynceus* issued was not that of *Oxytricha*, but its own capsule.

Lastly, in my own case, the direct ovular-like origin of *P. Charon*, from its extreme smallness on some occasions, is, as before stated, opposed to the view of metamorphosis, in which such a diminution in size could hardly ever occur. Latterly I have had a host of *Keronæ pustulatæ*, obtained from the source above-mentioned, among which there was not a single *Plœsconia* of any kind to be seen, from the 1st November 1853, when the water containing them was transferred from the main drain of the island of Bombay to the basin for observation, up to the 28th, when almost all animalcular life in it had ceased to exist. Although during this time the *Keronæ* had been nourished with glue so successfully that they not only attained their full development, but multiplied themselves to an incalculable degree by fissiparation and budding, and in many instances presented the early stages—viz. the shortening, &c.—of encapsulation, which may reasonably be inferred to have been completed, though I did not meet with any of the cysts—thus arriving at the state which must have led to metamorphosis, under the continued nourishment that was afforded them, long before this was withdrawn,—yet not a single *Plœsconia* of any kind was observed among this group throughout the whole experiment.

All things considered, then, the above statements rather throw a doubt over, than confirm, the conclusions of M. J. Haime respecting the metamorphosis of *Oxytricha* into *Trichoda Lynceus*.

EXPLANATION OF PLATE VI.

Fig. 1. *Plœsconia truncata*, Ehr., filled with embryonic cells, lateral view, right side: *a*, anterior wreath of cilia resting on prolonged under lip; *b*, anterior legs; *c*, gill; *d*, posterior legs, cleft.

Fig. 2. Ditto, dorsal view. Here the gill, together with parts of the legs and the contracting vesicle, are faintly seen through the other parts: *a*, under lip; *b*, contracting vesicle and anal orifice.

Fig. 3. Ditto, ventral view, without embryonic cells, but presenting algal cells and hepatic globules in the abdominal cavity,—the former indicated by their oval form, large size, and dark colour (having been taken in for food), and the latter by being colourless and circular; these, together with the sarcode, form the contents of the abdominal cavity: *a*, triangular depression leading to *b*, the oral orifice, through which an algal cell is represented in the act of being conveyed into the abdominal cavity; *c*, contracting vesicle and anal orifice.

Fig. 4. Ditto, dorsal view, unshaded; chiefly to show the form and position of the nucleus: *a*, posterior legs; *b*, anterior legs, of which *c* are the two largest; *d*, posterior short legs on the right side, cleft; *e*, ditto on the left side, styliform; *f*, anterior wreath of cilia resting on *g*, the lower lip; *h*, gill; *i*, triangular depression leading to *k*, oral orifice; *l*, nucleus; *m*, contracting vesicle; *n*, longitudinal lines, apparently on the ventral surface.

Fig. 5. *Kerona pustulata*, lateral view, right side; abdominal cavity charged with digestive spaces and hepatic globules,—the former containing food, which is indicated by the dark shade, and the latter being colourless and circular: *a*, anterior wreath of cilia resting on lower lip; *b*, anterior legs; *c*, gill; *d*, contracting vesicle; *e*, marginal cilia; *f*, posterior legs.

Fig. 6. Ditto, dorsal view: *a*, anterior wreath of cilia resting on *b*, lower lip; *c*, digestive spaces; *d*, hepatic globules; *e*, dark angular grains; *f*, nucleus; *g*, anal orifice.

Fig. 7. Ditto, ventral view: *a*, anterior legs; *b*, posterior legs; *c*, gill; *d*, triangular depression leading to *e*, oral orifice, in which is an algal cell; *f*, contracting vesicle; *g*, nucleus; *h*, anal orifice.

Fig. 8. Ditto, shortened preparatory to encapsulation: *a*, contracting vesicle; *b*, hepatic globules; *c*, dark angular grains.

Fig. 9. Ditto, ditto, further advanced: *a*, contracting vesicle; *d*, dark angular grains.

Fig. 10. Ditto, encapsuled: *a*, capsule; *b*, spherical cell filled with *d*, minute globular bodies, apparently of an oleaginous composition; *c*, contracting vesicle; *e*, dark angular grains.

Fig. 11. Ditto, empty capsule of: *a*, with ragged external part absent; *b*, spherical cell, empty, ruptured; *c*, dark angular grains.

Fig. 12. *Plœsconia Charon*, lateral view, right side; abdominal cavity without food, but presenting hepatic globules: *a*, anterior wreath of cilia resting on lower lip; *b*, anterior legs; *c*, gill; *d*, posterior legs.

Fig. 13. Ditto, posterior view, showing the form of the dorsal ridges.

Fig. 14. Ditto, dorsal view: *a*, granulated ridges; *b*, wreath of cilia resting on *c*, under lip; *d*, digestive spaces containing fragments of food; *e*, contracting vesicle and anal orifice; *f*, the part which is sometimes much expanded.

Fig. 15. Ditto, ventral view: *a*, anterior legs; *b*, posterior ditto; *c c*, short legs; *d*, triangular depression leading to *e*, oral orifice, in which there is an algal cell to show its position; *f*, gill; *g*, contracting vesicle and anal orifice.

Fig. 16. Ditto, becoming shorter, preparatory to encapsulation: *a*, contracting vesicle; *b*, hepatic globules.

Fig. 17. Ditto, encapsuled, the contracting vesicle passive, and therefore not seen: *a*, hepatic globules.

Fig. 18. Ditto, immediately after elimination: *a*, contracting vesicle; *b*, hepatic globules; *c*, posterior legs.

Fig. 19. Ditto, empty capsule after elimination of *Plœsconia Charon*: *a*, elongated portion bearing the impressions of the granulated ridges, in the midst of which is represented the aperture through which the *Plœsconia* escaped.

Bombay,
January 7th, 1859.

XXVII.—*Characters of some apparently undescribed Ceylon Insects.* By F. Walker.

[Continued from p. 56.]

Fam. **Sphæridiadæ.**

Cercyon vicinale. Luridum, ellipticum, capite nigro, palpis pedibusque testaceis, thoracis disco piceo, elytris subtilissime striatis. Long. ½ lin.

Fam. **Hydrophilidæ.**

Berosus decrescens. Sordide testaceus, capite æneo, thorace vitta lata guttisque duabus lateralibus æneis, elytris subtilissime striatis, punctis nonnullis elongatis nigris. Long. 1–1¼ lin.

Fam. **Buprestidæ.**

Agrilus cupreiceps. Niger, obscurus, subtus nigro-æneus, capite cupreo, thorace subtilissime punctato, elytris subtilissime punctato-striatis basi impressis. Long 2–2¼ lin.

Agrilus cupreicollis. Niger, fronte pedibusque anterioribus cyaneo-viridibus, vertice thorace pedibusque posticis cupreis, elytris confertissime punctato-striatis. Long. 1½ lin.

Fam. **Elateridæ.**

Corymbites bivittata. Testaceo-rufescens, capite piceo, antennis, scutello et elytrorum vittis duabus marginalibus nigris, thorace subtilissime punctato, elytrorum striis punctatis bene determinatis. Long. 3½ lin.

Ampedus acutifer. Niger, thorace subtilissime punctato, angulis posticis testaceis acutissimis, elytris testaceis conferte punctato-striatis, plaga apicali, sutura vittisque duabus abbreviatis nigris. Long. 2–2½ lin.

Ampedus discicollis. Luteus, antennis pedibusque testaceis, thoracis disco nigro, angulis posticis acutis, elytris conferte punctato-striatis, fasciis duabus dentatis nigris. Long. 1¾–2 lin.

Fam. **Lampyridæ.**

Lycus humerifer. Niger, angustus, elytris linearibus costatis inter costas punctatis basi luteis, antennis subdilatatis corporis dimidio paullo longioribus. Long. $2\frac{1}{2}$ lin.

Lycus pubipennis. Ater, thoracis angulis posticis productis, elytris luteis linearibus pubescentibus costatis inter costas punctatis apices versus atris, antennis latis serratis corporis dimidio valde longioribus. Long. 3 lin.

Lampyris vitrifera. Pallide testacea, subtilissime punctata, capite nigro, antennis piceis, thoracis disco subconvexo antice vitreo, elytris sublinearibus vix costatis. Long. 4 lin.

Colphotia promelæna. Straminea, sublinearis, confertissime punctata, capite, palpis, antennis, tibiis anticis intus tarsisque nigris, antennis corporis dimidio brevioribus. Long. $4\frac{3}{4}$ lin.

Fam. **Melyridæ.**

Malthinus forticornis. Ater, sublinearis, sat nitens, antennis validis basi testaceis corpore longioribus. Long. $1\frac{1}{4}$ lin.

Malthinus retractus. Niger, capite pedibusque testaceis, antennis corpore brevioribus basi testaceis, elytris abbreviatis basi testaceis. Long. $1\frac{1}{4}$ lin.

Fam. **Diaperidæ.**

Tritoma bifacies. Rufa, lævis, nitens, semiglobosa, thorace maculis tribus nigris, elytris atris rufo bimaculatis, pedibus latis. Long. 2 lin.

Tritoma præposita. Testacea, lævis, nitens, elliptica, elytris scitissime punctato-lineatis, pedibus latiusculis. Long. $2\frac{1}{2}$ lin.

Fam. **Lyttidæ.**

Mylabris recognita. Atra, elytris dimidio fere basali fasciaque posteriore subundulata testaceis, fascia maculari anteriore maculisque duabus basalibus atris, tarsis apice tibiisque fulvis. Long. 4 lin.

Fam. **Œdemeridæ.**

Cistela falsifica. Pallide fusca, longi-elliptica, cano-pubescens, subtus rufescens, antennis corporis dimidio brevioribus, elytris scite punctato-lineatis. Long. 2 lin.

Allecula flavifemur. Picea, longi-fusiformis, capite antico testaceo, antennis apices versus rufescentibus, thorace subsulcato confertissime punctato, elytrorum costis bene determinatis, sulcis intercostalibus punctatis, femoribus flavis, tibiis subarcuatis. Long. 6 lin.

Genus Sora.

Corpus gracile. Caput subtransversum, thorace antico paullo latius. Palpi breves, articulo 3° securiformi. Antennæ filiformes, corporis dimidio paullo longiores, articulo 11° longissimo. Thorax longi-subconicus. Elytra scitissime punctato-lineata.

Sora marginata. Lutescens, antennis pedibusque testaceis, elytris piceis testaceo late marginatis. Long. $3\frac{1}{2}$ lin.

Genus Thaccona.

Corpus gracile. Caput subproductum. Palpi subclavati; articulus 3^{us} subfusiformis. Antennæ filiformes, corporis dimidio non longiores; articulus 2^{us} minutus; 11^{us} lanceolatus, 10^{o} paullo longior. Oculi magni. Thorax subrotundatus, submarginatus, capite latior. Elytra longa, linearia. Pedes tenues.

Thaccona dimelæna. Lutescens, capite piceo antice testaceo, oculis atris, palpis antennisque testaceis, thorace nitido subpunctato, elytris pubescentibus subtilissime granulatis apice nigris. Long. $3\frac{1}{2}$ lin.

Fam. **Mordellidæ.**

Mordella defectiva. Nigra, longi-subfusiformis, femoribus tibiisque ferrugineis, abdomine fœm. attenuato elytra superante. Long. 2 lin.

Fam. **Anthicidæ.**

Anthicus stricticollis. Testaceus, capite piceo, thorace ferrugineo cordato, elytris fasciis duabus (2^{a} apicali) nigricantibus. Long. 1 lin.

Fam. **Cissidæ.**

Cis contendens. Piceus, latus, crassus, subtilissime punctatus, vix nitens, thorace antice marginato inciso. Long. 1 lin.

Fam. **Tomicidæ.**

Apate submedia. Nigra, scabra, capite antico fulvo-pubescente, thorace globoso, elytris apices versus tricostatis. Long. 6–8 lin.

Bostrichus mutilatus. Niger, crassus, subcylindricus, capite fulvo-pubescente, thorace antico tuberculato, elytris conferte punctatis apice sexdentatis et oblique truncatis, femoribus rufescentibus. Long. $2\frac{1}{2}$–3 lin.

Bostrichus vertens. Niger, crassus, subcylindricus, antennis, elytrorum lateribus anticis pedibusque rufescentibus, thorace antico tuberculato marginato, elytris confertissime punctatis. Long. $1\frac{1}{4}$–$1\frac{1}{2}$ lin.

Bostrichus moderatus. Nigro-piceus, cylindricus, thorace subtilissime scabro, elytris scite lineato-punctatis, pedibus rufescentibus. Long. 1 lin.

Bostrichus testaceus. Testaceus, cylindricus, nitens, thorace antico conferte punctato, elytris subtilissime lineato-punctatis. Long. $\frac{3}{4}$ lin.

Bostrichus exiguus. Piceus, cylindricus, nitens, capite nigro, thorace antico nigro conferte punctato, elytris scitissime lineato-punctatis, pedibus rufescentibus. Long. $\frac{2}{3}$ lin.

Platypus minax. Piceus, cylindricus, punctatus, nitens, elytris apice quadridentatis, discis anticis rufescentibus, pectore femoribusque rufis. Long. 3 lin.

PLATYPUS SOLIDUS. Piceus, cylindricus, angustus, nitens, capite antico truncato obscuro, thorace glabro, elytris scitissime lineatis, pedibus rufescentibus. Long. $1\frac{1}{2}$ lin.

PLATYPUS LATIFINIS. Rufescens, longus, cylindricus, nitens, thorace glabro, elytris scitissime lineatis apice nigris subdilatatis abrupte truncatis, angulis exterioribus acutis. Long. 2 lin.

HYLURGUS DETERMINANS. Niger, capite thoraceque conferte punctatis, antennis tarsisque pallidis, elytris inter costas punctatis, costis bene determinatis. Long. $1\frac{3}{4}$ lin.

HYLURGUS CONCINNULUS. Niger, nitens, capite pedibusque rufescentibus, thorace glabro, elytris costatis inter costas punctatis. Long. $\frac{3}{4}$ lin.

HYLESINUS CURVIFER. Niger, robustus, obscurus, capite thoraceque confertissime punctatis, antennis pedibusque piceis, elytrorum striis bene determinatis, stria marginali subundulata. Long. $1\frac{3}{4}$ lin.

HYLESINUS DESPECTUS. Ferrugineus, obscurus, capite thoraceque confertissime punctatis, elytrorum striis bene determinatis. Long. 1 lin.

HYLESINUS? IRRESOLUTUS. Piceus, cinereo-tomentosus, antennis pedibusque rufescentibus, elytris fasciis tribus subdiffusis cinereo-tomentosis. Long. $1\frac{1}{2}$ lin.

Fam. **Curculionidæ.**

BRUCHUS FIGURATUS. Niger, lituris nonnullis pallide rufescentibus, thorace litura postica lanceolata nivea, elytris fascia obliqua pallide rufescente, abdomine maculis duabus subapicalibus niveis, pedibus anterioribus tarsisque posticis rufescentibus. Long. 1 lin.

BRUCHUS INCRETUS. Fusco-cinereus, thorace elytrisque cano subvittatis, abdomine lurido, pedibus anterioribus rufis. Long. 1 lin.

BRUCHUS DECRETUS. Canescens, elytris subtilissime lineatis, pedibus rufis, femoribus anticis basi, femoribus intermediis pedibusque posticis nigris. Long. $\frac{1}{2}$ lin.

EUCORYNUS COLLIGENDUS. Nigricans, punctis nonnullis albidis, antennis fascia ante clavam albida, pedibus albido fasciatis. Long. 3–4 lin.

EUCORYNUS COLLIGENS. Niger, subtus cinerascens, capite thoraceque conferte punctatis, elytris rude lineato-punctatis cinereo trifasciatis, fascia 1^a versus humeros dilatata, 2^a 3^aque apicali utrinque connexis. Long. $3\frac{3}{4}$–5 lin.

XYLINADES INDIGNUS. Niger, robustus, subtus cinereus, capite antico rugoso, thorace tuberculato, elytris lineato-subtuberculatis cinereo substrigatis. Long. 7 lin.

Xenocerus angulifer. *Fœm.* Niger, subtus cinerascens, antennis subclavatis corporis dimidio brevioribus, capite vittis duabus obliquis cinereis antice connexis, thorace vittis tribus cinereis, elytris cinereo marginatis, lineis tribus transversis cinereis, linea 1ª obliqua bifurcata. Long. 6 lin.

Xenocerus revocans. *Mas.* Ater, capite vitta testacea, rostro longo apice dilatato, antennis corpore triplo longioribus, thorace vittis tribus testaceis, elytris testaceis sex-vittatis, vittis duabus mediis antice suturalibus postice arcuatis, vittis duabus exterioribus postice abbreviatis, vittis duabus marginalibus integris. Long. 5 lin.

Anthribus apicalis. Niger, cinereo-tomentosus, capite thoraceque nigro substrigatis, elytris nigro guttatis apice albidis. *Mas.* Antennis corpore longioribus. *Fœm.* Antennis corporis dimidio non longioribus fascia albida. Long. 6 lin.

Aræosarus intangens. Nigro-cinereus, elytris cinereo substrigatis. Long. $1\frac{1}{2}$–$1\frac{3}{4}$ lin.

Aræosarus bifoveatus. Ater, tibiis rufescentibus, elytris foveolis duabus anticis. Long. 1 lin.

Arrhenodes approximans. Piceus, antennis thorace paullo brevioribus, thorace subconico, elytris rude punctato-lineatis, lituris quatuor rufis, basali et apicali angustis, duabus intermediis transversis. *Mas.* Capite antico producto foveolato subdilatato. *Fœm.* Rostro tenui cylindrico antennis breviore. Long. $8\frac{1}{2}$ lin.

Arrhenodes facilis. Ferrugineus, rostro piceo, thorace fascia interrupta guttata et incisa nigricante, elytris lituris suturalibus et marginalibus nigris, pedibus nigro fasciatis. Long. $2\frac{1}{2}$ lin.

Cerobates aciculatus. Piceus, rostro tenui cylindrico, antennis thorace longioribus rostro vix duplo longioribus, elytris punctato-lineatis, maculis quatuor rufis, 1ª 3ª et apicali suturalibus, 2ª marginali, pedibus rufescentibus. Long. 3 lin.

Ceocephalus cavus. Piceus, angustus, attenuatus, subcylindricus, thorace late sulcato, elytris striatis apud latera punctatis. *Mas.* Rostro antennis vix duplo longiore, apice subdilatato. *Fœm.* Rostro antennis longiore, apice tenui. Long. $8\frac{1}{2}$–11 lin.

Nemocephalus planicollis. *Mas.* Piceus, angustus, subcylindricus, rostro antennis breviore basi sulcato, lateribus subtuberculatis, apice subdilatato, thorace postico plano sulcato, elytris striatis rufo quadrimaculatis, macula 1ª basali attenuata, 2ª 4ªque parvis, 3ª transversa. Long. 9–10 lin.

Nemocephalus spinirostris. *Mas.* Piceus, rostro sulcato tuberculato apice subdilatato et bispinoso, antennis rostro vix duplo longioribus, thorace convexo, elytris rude punctato-lineatis rufo quadrimaculatis, macula 1ª basali elongata, 2ª marginali, 3ª transversa. Long. 11–12 lin.

Apoderus scitulus. Pallide rufus, nitens, glaber, capite thoraceque unilineatis, capite longi-obconico elytris breviore, thorace conico elytris duplo breviore, sulco antico transverso, elytris scite punctato-lineatis antice impressis. Long. $2\frac{1}{4}$ lin.

Rhynchites suffundens. Æneo-viridis, rostro brevi, thorace punctatissimo, elytris punctato-lineatis nigro-cyaneis basi æneo-viridibus. Long. $1\frac{1}{2}$ lin.

Rhynchites restituens. Æneus, subtus niger, rostro brevi, thorace punctatissimo, elytris punctato-lineatis. Long. 2 lin.

Apion cingalense. Ferrugineo-piceum, rostro elytris breviore, antennis testaceis clava nigra, pedibus testaceis, elytris striatis. Long. $1\frac{1}{4}$ lin.

Strophosomus suturalis. Nigricans, capite thoraceque sulcatis, antennis capite longioribus, thoracis lateribus canis, elytris canis punctato-lineatis, vittis duabus cano punctatis suturaque nigricantibus. Long. $2\frac{3}{4}$ lin.

Piazomias æqualis. Viridis, subtus purpureo-cupreus disco viridi, capite thoraceque subsulcatis, capite purpurascente, thorace punctato vitta purpurascente, elytris punctato-lineatis, sutura margineque apices versus purpurascentibus. Long. $2\frac{1}{2}$–$3\frac{1}{2}$ lin.

Astycus ebeninus. Niger, subtus purpureo-cupreus disco viridi, capite tricarinato, thorace rude punctato non sulcato, elytris punctato-lineatis. Long. $3\frac{1}{2}$ lin.

Astycus immunis. Niger, viridi aureoque scintillans, subtus cyaneo-viridis, capite thoraceque subsulcatis, elytris punctato-lineatis. Long. 2–$2\frac{1}{2}$ lin.

Cleonus inducens. Niger, cinereo ex parte subpubescens, capite tricarinato subruguloso, thorace ruguloso postice subtuberculato, elytris rude punctato-lineatis fascia postica inæquali late interrupta cana. Long. 6 lin.

Myllocerus spurcatus. Fuscescente-tomentosus, capite antico sulcato, ore nigro, thorace subtilissime punctato, elytris punctato-lineatis. Long. $2\frac{1}{2}$ lin.

Myllocerus retrahens. Piceus, cano ex parte tomentosus, capite cano sulcato, thorace rude punctato, elytris punctato-lineatis. Long. $1\frac{3}{4}$ lin.

Myllocerus posticus. Fuscescens, cano subnebulosus, nigricante subnotatus, thorace punctato, elytris punctato-lineatis fascia postica inæquali albida. Long. $1\frac{3}{4}$–$2\frac{1}{4}$ lin.

Phyllobius mimicus. Longi-ovatus, squamis viridibus densissimis ornatus, thorace conferte punctato, elytris subtilissime punctato-lineatis, pedibus fulvis. Long. $1\frac{2}{3}$ lin.

Lixus nebulifasciatus. Niger, longi-fusiformis, capite thoracis longitudine, thorace punctato linea lateribusque cinereis, elytris punctato-lineatis, fasciis quatuor cinereo-tomentosis, fascia 1^a perobliqua, 2^a abbreviata, 3^a obliqua, 4^a apicali. Long. $5\frac{1}{2}$ lin.

ALCIDES OBLIQUUS. Ater, longi-subfusiformis, rostro subtiliter punctato thoracis longitudine subtus apicem versus testaceo, thorace scabro vittis duabus lateralibus sat latis unaque dorsali tenui testaceis, elytris rude lineato-punctatis, vittis duabus testaceis, interiore latissime interrupta, exteriore oblique interrupta postice furcata. Long. 5 lin.

ALCIDES TRANSVERSUS. Niger, fusiformis, rostro punctato thoracis vix longitudine, thorace scabro vittis quinque albidis, elytris rude lineato-punctatis, maculis sex anticis fascia interrupta posteriore liturisque duabus angulatis apicalibus albidis. Long. 4 lin.

ALCIDES CLAUSUS. Niger, sublinearis, rostro subpunctato thorace paullo longiore, thorace scabro vittis tribus testaceis, elytris piceis punctato-striatis, vittis duabus anterioribus postice connexis fasciisque duabus posterioribus interruptis testaceis. Long. $3\frac{1}{4}$ lin.

APOTOMORHINUS ALBO-ATER. Ater, rostro gracili nitente elytris vix breviore, thorace scitissime punctato maculis duabus posticis magnis lateralibus albis, abdomine albo, elytris scite punctato-lineatis fascia apiceque albis. Long. $2\frac{1}{2}$ lin.

APOTOMORHINUS SIGNATUS. Ater, rostro elytris breviore, thorace scite punctato strigis duabus posticis lateralibus albis, elytris scite lineatis, strigis sex scutelloque albis. Long. $1\frac{3}{4}$ lin.

CRYPTORHYNCHUS INEFFECTUS. Longi-subellipticus, testaceo-cinerascente-tomentosus, nigro-setosulus, rostro brevi nigro, thorace conferte punctato, vitta albida, elytris scabro-striatis. Long. $3\frac{1}{2}$ lin.

CRYPTORHYNCHUS? ASSIMILANS. Subfusiformis, fuscescente-tomentosus, rostro gracili nigro nitente, thorace subcarinato rude punctato disco nigricante, elytris nigro notatis albido variis rude punctato-lineatis. Long. 5 lin.

CRYPTORHYNCHUS NOTABILIS. Fuscescens, angustus, linearis, rostro nigro brevi tenui nitente, thorace confertissime punctato, elytris rude punctato-lineatis, sutura nigra. *Var.* Thorace vitta albida antice abbreviata, elytris fascia postica albida. Long. $3\frac{1}{2}$–4 lin.

CRYPTORHYNCHUS DECLARATUS. Ferrugineus, subfusiformis, rostro nigro nitente sat tenui coxas intermedias attingente, thorace rude punctato, elytris rude punctato-lineatis, fasciis quatuor inæqualibus, duabus albis duabusque nigris, pedibus albis, femoribus posticis tibiisque nigro-cinctis. Long. 5 lin.

CRYPTORHYNCHUS VEXATUS. Ferrugineo-nigricans, subfusiformis, rostro brevi crasso punctato apice nitente, thorace rude punctato, elytris tuberculatis rude punctato-lineatis fascia postica albida. Long. 5 lin.

DESMIDOPHORUS COMMUNICANS. Ferrugineus, crassus, rostro nigro crasso breviusculo quadrangulato punctato, thorace tuberculato maculis duabus posticis lateralibus albis, elytris valde convexis rude tuberculatis, plagis duabus basalibus lateralibus fasciaque postica albis, femoribus posterioribus apice albidis. Long. 3–$3\frac{3}{4}$ lin.

Desmidophorus strenuus. Niger, crassus, rostro crasso brevi rude punctato, thorace scabro, elytris fasciculatis scabro-striatis valde convexis, pedibus testaceo-pubescentibus. Long. 5 lin.

Desmidophorus inexpertus. Ferrugineus, brevis, subovatus, rostro nigro brevi crasso multicarinato, thorace subtuberculato, elytris tuberculato-striatis fascia tenui albida. Long. $2\frac{3}{4}$ lin.

[To be continued.]

XXVIII.—*Descriptions of new* Helicidæ *contained in the Darjiling Collections of* Messrs. W. T. and H. F. Blanford. By W. H. Benson, Esq.

1. *Helix macropleuris,* nobis, n. s.

Testa subaperte umbilicata, attenuato-pyramidata, oblique minute arcuato-striata, superne costis remotis elevatis arcuatis munita, decorticata albida, nitidula; spira pyramidali, superne attenuata, apice papillari, papilla læviori, sutura carinato-marginata; anfractibus 8 convexiusculis, ultimo non descendente, filoso-carinato, subtus planulato, versus aperturam convexiusculo, circa umbilicum profundissimum, anguste perspectivum, angulato; apertura obliqua?, transversa, quadrata, peristomate tenui, recto, margine columellari lato, expansiusculo.

Diam. major 5, minor $4\frac{1}{2}$, long. $5\frac{1}{2}$ mill.

Habitat in valle Rungun, prope Darjiling, rarissime.

This shell is an exaggeration of the *Bascauda* type of the Khasia Hills, with a more remote costulation and lengthened attenuate spire. The aperture of the single dead specimen collected by Mr. W. T. Blanford is not in the best condition.

2. *Helix Corys,* nobis, n. s.

Testa perforata, elongato-pyramidali, oblique confertim minutissime costulato-striata, albida, non nitente; spira anguste pyramidali, apice obtusiusculo, sutura impressa; anfractibus $5\frac{1}{2}$ convexiusculis, ultimo ad peripheriam filoso-carinato, basi planiuscula; apertura obliqua?, quadrata, longitudine latitudinem æquante, peristomate tenui, recto, margine columellari verticali, longe vix expansiusculo.

Diam. 2, long. 3 mill.

Habitat in valle Rungun, prope Darjiling, rarissime occurrens.

A single dead specimen occurred to Mr. W. T. Blanford. This minute shell is of a type allied to the last-described species in form, but is very differently sculptured. Its more pointed, not papillate apex, and the absence of costulation at somewhat remote intervals, and of a marginate suture, through so many whorls, prove that it is not the young of *macropleuris.*

From the clear horn-coloured *Helix fastigiata*, Hutton, of the Western Himalaya, it may be known by its narrower spire, decided sculpture, minute size, the absence of a marginate suture, and by its perforate base; and from the dark-coloured *H. Barrakporensis*, Pfr., of the Sikkim Terai, by the first three characters.

3. *Helix Rimicola*, nobis, n. s.

Testa vix perforata, orbiculato-pyramidata, tenui, fragili, oblique striatula, diaphana, pallide cornea; spira conica, apice obtuso, sutura leviter impressa; anfractibus $5\frac{1}{2}$ convexiusculis, ultimo convexo, compresse rotundato; apertura obliqua, subquadrato-lunari, peristomate tenui, recto, margine columellari verticaliter descendente, basali arcuato.

Diam. major $4\frac{1}{2}$, minor 4, axis 4 mill.

Var. peripheria primo subangulata, angulo versus aperturam evanescente, in juniori magis conspicuo.

Habitat forma typica prope Landour Himalayæ occidentalis, varietas in valle Rungun prope Darjiling, rarissime.

I got a single fresh specimen of this fragile species, in October 1842, in a precipitous rift at the back of the Seinty or Queinty ridge, eastward of my grounds at Rockville, near Landour, and at an elevation of nearly 7000 feet. The Messrs. Blanford have lately procured the variety, but rarely, and in a dead state, in the Rungun Valley in Sikkim, at an elevation of 4000 feet. From the data furnished by Mr. W. T. Blanford respecting the resort of species at Darjiling, I observe that the same forms evince a disposition to descend there to a lower altitude above the sea than in the western portion of the range—a circumstance attributable probably to the greater moisture of the climate,—whereas the drought and hot winds, which prevail for so many months in the year at the base of the western ranges, drive species to a greater height in order to obtain the humidity necessary to their existence. At Landour this form escaped the active researches of the late Dr. J. F. Bacon; and I am not aware of its having yet occurred to Capt. T. Hutton.

4. *Helix rorida*, nobis, n. s.

Testa subperforata, globoso-depressa, tenuissima, minutissime radiato-striatula, polita, pellucida, fusco-cornea; spira depresse conoidea, apice obtuso, sutura impressiuscula, tenui-marginata; anfractibus 4 convexiusculis, ultimo ad peripheriam convexo, subtus convexiusculo; apertura obliqua, subrotundato-lunari, peristomate tenui, recto, margine columellari verticali, arcuato, superne brevissime reflexo, perforationem fere celante.

Diam. major 5, minor $4\frac{1}{2}$, axis $2\frac{1}{2}$ mill.

Habitat ad Darjiling, necnon ad collem Sunhul.

Independently of its smaller size, translucent dark corneous tinge and polish, this shell is distinguished from *H. Hodgsoni*, Blanford, by the narrow but more distinct margination of the suture, its more depressed spire, fewer whorls, and by the absence of any degree of compression at the periphery. It inhabits a region varying from 7000 to 8000 feet, living, according to Mr. W. T. Blanford, on succulent shrubs.

5. *Helix Hodgsoni*, Blanford, MSS.

Testa anguste perforata, globoso-depressa, solidiuscula, radiato-striatula, superne striis minutissimis inconspicuis spiralibus sculpta, subtus nitidula, translucente, sub epidermide caduco, pallide corneo, albida; spira conoidea, apice obtuso, sutura impressa, leviter marginata; anfractibus 5, primis sensim crescentibus convexiusculis, ultimo ad peripheriam compresse convexo, subtus convexiusculo; apertura subobliqua, subquadrato-rotundato-lunari, peristomate tenui, recto, margine columellari subverticaliter descendente, superne reflexo, marginibus callo tenui junctis.

Diam. major vix 7, minor 6, axis $4\frac{1}{2}$ mill.

Habitat at Pankabari, in regione calidiori Terai.

A single worn specimen of this species is in the Collection. In form and many characters it so nearly tallies with a little undescribed shell which I collected at Mussoorie and Landour, that I feel much disposed to unite them; but the greater comparative solidity of the Darjiling specimen, the caducous epidermis, and the circumstance of the margins being united by a callus, of which there is no trace in any of my Western specimens, make it undesirable to confound them until a series of the Darjiling species can be had for comparison. The species was probably named by Mr. W. T. Blanford either after the distinguished engineer, Col. J. A. Hodgson, who first explored Darjiling, and wrote a paper on its topography, which was published in the 'Gleanings in Science,'—or after Mr. Brian H. Hodgson, formerly Resident at the court of Nipal, and latterly residing at Darjiling, whose diligent investigation of the Mammalia and Birds of those regions is well known to naturalists.

6. *Helix seposita*, nobis, n. s.

Testa imperforata, conoideo-globulosa, tenui, obsolete oblique striatula, albida, epidermide cornea induta; spira brevi, conoidea, apice obtuso, sutura impressiuscula; anfractibus 3, superne vix convexiusculis, ultimo magno, ventricoso, pene totam testam efformante, periomphalo leviter excavato; apertura magna, obliqua, rotundato-lunari, peristomate tenui, recto, margine columellari arcuatim descendente, vix expansiusculo.

Diam. major. 7, minor $5\frac{1}{2}$, axis 5 mill.; apert. long. $4\frac{1}{2}$, lat. 4 mill.

Habitat prope Darjiling. Detexit H. Blanford; communicavit W. Theobald, jun.

The Helicoid form of this shell and the absence of perforation make it doubtful whether it should be referred to *Helix* or *Vitrina*. No specimen is contained in Mr. W. T. Blanford's collection. The single example seen was received by Mr. Theobald from Mr. H. F. Blanford, and although uninjured in form, is evidently not in a fresh state.

7. *Helix Calpis*, nobis, n. s.

Testa perforata, ovato-globosa, regulariter oblique subremote impresso-striatula, polita, lutescente-cornea, lineis spiralibus pallidis cincta; spira ovato-conica, apice obtuso, sutura impressa; anfractibus $4\frac{1}{2}$ convexis, ultimo ventricoso, antice sensim descendente, verticaliter elongato, ad parietem horizontaliter complanato, circa perforationem excavato; apertura vix obliqua, verticaliter truncato-ovata, peristomate tenui, recto, margine columellari subverticali, expanso, revoluto-reflexo, perforationem satis magnum celante.

Diam. major. 4, long. $5\frac{1}{2}$ mill.; apert. long. 3, diam. 2 mill.

Habitat in valle Rungun, prope Darjiling.

The form of this shell is very peculiar, and in the adult has a distorted appearance, augmented by the flatness of the parietal region and by the lengthening of the last whorl towards the aperture. The young shell is conoid globose, and is regular in form. Four specimens in different stages of growth, and all more or less injured, were sent by Mr. W. T. Blanford, who thought it was a dwarf variety of my *H. radicicola*. He states that his largest specimen, found near Darjiling, measured—diam. major 5, minor 4, alt. 6 mill.

8. *Helix Pinacis*, nobis, n. s.

Testa sinistrorsa, late umbilicata, orbiculato-depressa, superne oblique scabre plicato-striata, liris confertis spiralibus, subtus striis obliquis flexuosis striisque spiralibus decussata, cornea, epidermide fusca, scabra (junioris ad carinam præsertim hispida) induta; spira planata, vix elevatiuscula, apice planato, sutura leviter impressa; anfractibus $7\frac{1}{2}$ planulatis, lente et arcte accrescentibus, ultimo antice breviter descendente, superne subcarinato, subtus valde convexo, circa umbilicum profundum, perspectivum, conicum, compressiusculo; apertura valde obliqua, lunari, peristomate expansiusculo, reflexo, albido, marginibus callo brevi, laminari, elevatiusculo, sinuato junctis.

Diam. major 14, minor $12\frac{1}{2}$, axis $4\frac{1}{2}$ mill.

Habitat raro in regione Sikkim in valle Rungun (4000 ped.), necnon prope Pankabari (1000 ped. alt.).

Nearly allied to *H. plectostoma*, B., and inhabiting a tract in the vicinity of Darjiling in company with that shell. Much larger than the largest Khasia variety of that species, it is distinguished by its much wider conical umbilicus, its depressed planulate spire, planate whorls, closer and more conspicuous spiral striæ on the under side, and by the compression of the base round the umbilicus.

As is the case in the Khasia Hills, there are two varieties of *Helix plectostoma* in size; but the largest of the Darjiling specimens does not equal in volume the small Khasia one which formed the type of my original description. Fresh Khasia specimens are furnished with a scabrous hispid epidermis, as well as the Darjiling varieties.

9. *Helix camura*, nobis, n. s.

Testa anguste umbilicata, conoideo-depressa, oblique rude rugoso-plicatula, sub lente minutissime granulata, subtus læviori, translucente, cornea; spira depresso-conoidea, lateribus planulatis, apice acutiusculo, sutura leviter impressa, junioris marginata; anfractibus $6\frac{1}{2}$ vix convexiusculis, ultimo compresse carinato, subserrulato, subtus convexo; apertura obliqua, transversim angulato-lunata, peristomate tenui, recto, margine basali valde arcuato, columellari expansiusculo.

Diam. major 22, minor 19, axis 10 mill.

Habitat in valle Rungun, prope Darjiling, rarior.

Nota. Junioris carina compressa marginata magis serrulata apparet.

This shell is allied to *H. Tugurium*, B., but is distinguished by its more depressed spire, flattened and not subconvex at the sides, its sharper keel, wider umbilicus, and by the roughly developed sculpture, quite unlike the delicately decussated oblique striæ of the previously known species, which occurs in the Rungun Valley as well as at Darjiling.

The young shells of *H. camura*, with the marginate and serrulate edge of the keel and suture, bear a wonderful resemblance to *H. Serrula*, B., of the Khasia range, but may be known by the absence of a prominent keel in the upper whorls, by the less developed costulation, the more contracted perforation, the non-exserted apex, the want of expansion and of thickening in the basal margin, and by the less oblique descent of the columellar margin of the aperture, which is moreover less depressed than in *H. Serrula*, and gives evident tokens of its immaturity.

10. *Helix ornatissima*, nobis, n. s.

Testa aperte perforata, subconoideo-depressa, superne oblique confertim et arcuatim costulato-striata, subtus lævigata, polita, obsolete radiato-striata, luteo-cornea, infra pallidiore; spira depresso-conoidea, lateribus planulatis, apice obtuso, sutura impressa submarginata; anfractibus 7 arcte et lente accrescentibus, convexiusculis, ultimo superne angulato, angulo ad marginem aperturæ obsoleto, antice vix descendente, subtus convexo; apertura obliqua, transversim lunata, peristomate recto, intus vix labiato, margine basali arcuato, antrorsum leviter projecto, breviter expansiusculo.

Diam. major 16, minor 14, axis 8 mill.

Habitat ad Pankabari (1000 ped. alt.), prope Darjiling.

The handsome and regular sculpture of this shell on the upper side, contrasted with the smoothness and polish of the lower side, together with the angularity of the rather highly placed periphery (as in the typical *H. decussata*, B.), are noticeable features. It inhabits the Sikkim portion of that narrow and lengthened unhealthy tract which stretches along the base of the lower Himalaya from Bhotan nearly to the Sutlej, and which is known throughout by the appellation of "Terái."

11. *Helix sequax*, nobis, n. s.

Testa perforata, subconoideo-depressa, fere tenui, oblique striatula, sub lente confertissime spiraliter obsolete striata, nitida, diaphana, livide olivaceo-cornea; spira depresso-conoidea, lateribus convexiusculis, apice obtuso, sutura impressa, subcanaliculato-marginata; anfractibus $5\frac{1}{2}$ convexiusculis, sensim accrescentibus, ultimo antice (ætate) vix descendente, ad peripheriam compresse rotundato, subtus convexiusculo, medio excavato; apertura obliqua, transversim lunata, peristomate tenui, recto, margine basali arcuato, columellari breviter reflexo.

Diam. major 18, minor 15, axis 7 mill.

Habitat copiose ad Darjiling et in valle Rungun (7000 et 4000 ped. alt.).

Several years ago, a series of specimens was sent to me by Mr. Robert Trotter, with other fine species procured by him at Darjiling, and described in former Numbers of the 'Annals.' The shell rarely attains the extreme size noted; and, from its fragility, the lip is seldom perfect. A livid greenish olivaceous tint is observable in most specimens, which, with the slight concavity of the sides of the spire, serves to distinguish the species at the first glance from others of the type of *Nanina vitrinoides*, Desh. Mr. W. T. Blanford found it at elevations varying from 4000 to 7000 feet, and states that it is also met with at the foot of the Khasia Hills; but I cannot find a specimen, among the immature Naninoid shells received from that quarter through Mr. Theobald, which can be with certainty assigned to this form.

12. *Helix Patane*, nobis, n. s.

Testa perforata, subconoideo-depressa, tenui, fragili, radiatim rugoso-striatula, nitidula, diaphana, lutescente-cornea; spira depresso-conoidea, apice nitido, hyalino, obtuso, sutura impressa; anfractibus 5 convexiusculis, lente accrescentibus, ultimo antice leviter descendente, ad peripheriam rotundato-compresso, subtus convexiusculo, ad periomphalum excavato; apertura obliqua, transverse lunata, peristomate tenui, acuto, margine basali arcuato, columellari breviter expanso.

Diam. major vix 9, minor 8, axis 4 mill.

Habitat ad Darjiling, rarissime.

Allied to the Tenasserim *H. Petasus*, B., but differing in its inferior lustre, irregular rugose sculpture, thinness, absence of labiation, and of margination at the suture. Mr. W. T. Blanford appears to have seen only the single specimen here described, and which, although taken in a dead state, is in fair condition.

13. *Vitrina planospira*, nobis, n. s.

Testa suborbiculato-depressa, peripheria rotundato-ovata, tenui, lævigata, obsolete arcuato-striatula, translucente, polita, cornea; spira convexiuscula, superne planata, sutura canaliculato-marginata; anfractibus 3, celeriter accrescentibus, ultimo antice depresso, leviter descendente, ad peripheriam compresse rotundato, subtus convexiusculo; apertura valde obliqua, ovato?-lunari, peristomate tenui, superne antrorsum arcuato, margine columellari valde arcuato.

Diam. major 14, minor 11, axis 5 mill.

Habitat ad Pankabari et in valle Rungun, *Vitrinæ Salii* consors, raro occurrens.

Only two dead and imperfect specimens were collected by Mr. W. T. Blanford. The species is remarkable for the sudden flatness of the upper part of the spire, and for the neat shallow canaliculate suture. It was found in company with a variety of the smaller and more convex *Vitrina Salius*, B., which Mr. Theobald had previously taken alive on the Khasia Hills.

Helix radicicola, B.

Var. major, solidiuscula, fasciis duabus castaneis ornata, superiori mediocri, prope suturam, inferiori lata, infra peripheriam; aperturæ margine dextro magis expanso.

Diam. major 16, minor 14, axis 13, long. 16 mill.; apert. intus long. 9, lat. 8 mill.

I have sought in vain for sufficient characters to separate this fine variety from the shell which I got at Landour, in a ravine not far to the eastward of the locality of *H. Rimicola*, and on the back of the same ridge. My best specimen, figured in Reeve's 'Iconica,' pl. 125. f. 753, was mislaid when I described the shell in the 'Annals' for Sept. 1848; and the expansion of the peristome at the base and right side was consequently omitted in that description. The greater size and solidity, and the coloured bands, of the Darjiling shell, are insufficient to constitute a species in the absence of a difference in form and sculpture. On a close examination of the Landour shell under a lens, obsolete bands of deeper and lighter tints may be detected.

The single adult specimen found by Mr. W. T. Blanford, at 4000 feet elevation in the Rungun Valley, is in a weathered state; but one of two specimens in a young state, with the periphery obtusely angulate, sent under a separate number, exhibits a surface of the same colour as Landour specimens, but with bands of chestnut broken up, on the lower whorl, into numerous narrow lines, especially on the under side; and there are vestiges of oblique sharply-edged epidermal striæ, indicating the abode of the young shell in very damp situations. In the adult Landour example the obtuse angle at the periphery disappears, as it does also in the large Darjiling variety.

Helix Barrakporensis, Pfr.

Two bleached and broken specimens of a small shell allied to *H. fastigiata*, Hutton, from the Western Himalaya, were found by Mr. W. T. Blanford at Pankabari and in the Rungun Valley, at elevations of 1000 and 4000 feet. They cannot be distinguished from Pfeiffer's *H. Barrakporensis*, of which specimens were sent to me by the late Dr. J. F. Bacon from Titalya, on the border of the Sikkim Terai, before the shell was seen by Dr. Pfeiffer; others were more recently taken by Capt. Hutton in the Dhoon Valley below Landour, and were transmitted to me by him under the MS. name of *Sivalensis*, H. The fresh shell is distinguished by its dark horn-colour as contrasted with the pale tint of the smaller *H. fastigiata*, by its conspicuous perforation, and by the want of margination at the suture observable in the latter species. At Mussoorie and Landour, *H. fastigiata* is not uncommon above 5000 and beyond 7000 feet elevation. I procured it most frequently creeping on the large wet leaves of *Saxifraga ciliata*, in damp and shady situations having a northern aspect.

The occurrence of *H. Barrakporensis* near Calcutta is more than doubtful. There is a country-house called "Titalya," near Barrakpore, which may have given rise to an error in the statement of the locality of the species.

Helix delibrata, B.

Of this shell, first found in the Khasia Hills, and again in the southern provinces of Burmah, Mr. W. T. Blanford has sent a decayed specimen which he procured at Pankabari (about 1000 feet elevation), at the foot of the great Himalayan chain, in a climate very similar to that of Terai Ghât and of its Burmese home. *Helix Castra*, B., accompanies it at each extremity of this lengthened and devious line. Mr. Blanford states that he had met with a single specimen of *H. Castra* in the hills S.W. of Balasore in Orissa, and remarks that no other instance has occurred of the detection of a Sikkim shell in the tract to the south of the Ganges.

Cheltenham, February 19, 1859.

Note.—There being already a *Helix Catinus*, Pfr., Mal. Blätter, 1856, the name conferred on the Moulmein shell (No. 4 of the memoir contained in the 'Annals' for March 1859, page 185) must be altered. I now designate the species as *Helix Cyclaspis*, B.

March 12, 1859.

XXIX.—*On some British* Diastylidæ.
By C. Spence Bate, Esq.

Among a very interesting batch of Crustacea recently sent to me by Mr. Robertson of Glasgow, the following appear of especial interest:—

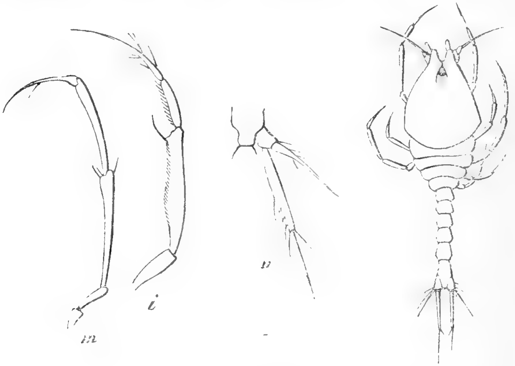
Bodotria arenosa, Goodsir. This specimen enables me to verify the general correctness of the author's figure, which, from want of examples, I was not able to do in my paper on the British Diastylidæ in the 'Ann. and Mag. of Nat. Hist.' for June 1856.

Cuma Edwardsii, Kröyer. This enables me to confirm the doubt expressed in that paper as to its being a *Cuma*. There are five segments of the pereion exposed behind the carapace, and the posterior pair of pleopoda have both their terminal rami double-articulated. In both these conditions it agrees with the genus *Vaunthomsonia*, recently described by me in the 'Natural History Review,' to which for the future we must consider *C. Edwardsii* to belong.

Cuma unguiculata, n. sp.

I have not yet had an opportunity of dissecting a specimen of the typical species of *Cuma*; but, assuming Goodsir's description to be correct, the present species appears to belong to that genus. The pair of antennæ have two articulations, and terminate in two or three long hairs. The gnathopoda and pereiopoda terminate in a long, curved, nail-like dactylos. The posterior pair of pleopoda have their peduncle very short, and the rami unequal, each terminating in a long fine hair, the internal longer and stouter than the external, and armed on the internal margin near the middle with two or three short teeth.

It was taken by Mr. Robertson "among some fibres of a nest of *Lima hians*; it was always covered with mud, which is difficult



Cuma unguiculata.
i, second gnathopod; *m*, third pereiopod; *u*, posterior pleopod.

to detach, and sluggish; it frequently pushes its tail up between its legs, thrusting it out below the head."

This species may be readily distinguished from any other by the shortness of the peduncle of the posterior pair of pleopoda and the strongly unguiculate character of the terminal spine on the pereiopoda, from which latter circumstance the name of the species is derived.

XXX.—*On the Natural Order* Styraceæ, *as distinguished from the* Symplocaceæ. By John Miers, F.R.S., F.L.S., &c.

[Continued from p. 146.]

I have adopted the opinion of Cavanilles in considering *Strigilia* distinct from *Styrax*, with which it has been associated by later botanists; the reasons for this conclusion will be presently stated. The former genus will comprise all the South American species of *Styrax* enumerated by DeCandolle. The Mexican species of the genus, from the imbricate æstivation of their corolla, appear to be congeneric with the North American and European forms.

In looking over the Hookerian herbarium, I noticed two or three species which I had no hesitation in referring to the *Cyrta* of Loureiro,—a genus placed by Endlicher as an aberrant form of the Order, and by DeCandolle excluded from the family solely on account of its superior ovary (Prodr. viii. 245): this reason is untenable, because in the structure of its ovary it offers no difference whatever from *Styrax* and *Strigilia*. I have examined *Cyrta* carefully, and find that it agrees with *Strigilia* in the almost coriaceous texture of its petals and in their valvate æstivation, in which respects both notably differ from *Styrax*.

Owing to the singularly different structure of the fruit and seed in *Halesia* and *Pterostyrax*, it appears desirable to restore the tribe *Halesieæ*. I do not see the propriety of retaining the tribe *Pamphilieæ*, which differs in no respect from the *Styracineæ*, except in having only one or two erect ovules in each placental division: we find in *Styrax Japonica* also two erect ovules in each cellule; so that there is no real character to justify the separation of *Pamphilia* and *Foveolaria* to form a distinct tribe. It is true that the former has only five stamens; but the latter, on the other hand, has the same number as *Strigilia*.

Hence I propose to divide the *Styraceæ* into two tribes, the limits of which may be thus defined:—

Tribus 1. STYRACINEÆ. Ovarium superum, 1-loculare, imo breviter 3-septatum; ovula plurima, erecta aut horizontalia. Fructus drupaceus, omnino superus, 1-locularis, pericarpio indehiscente aut 3-valvari. Semen unicum (rarissime 2), testa ossea, raphide infinitissime diviso in telam cottoneam e vasis numerosissimis spiralibus undique sparsis, et hinc cum endodermide solubili. — Genera *Styrax, Cyrta, Strigilia, Foveolaria, Pamphilia.*

Tribus 2. HALESIEÆ. Ovarium semisuperum, 1-loculare, imo breviter 4–5-septatum. Fructus inferus, alatus, pericarpio nuciformi indehiscente, centro omnino vacuo, locellis 1–2–3 parvis parietalibus osseis 1-spermis. Semen parvum, testa membranacea, raphide simplici ventrali.—Genera *Halesia, Pterostyrax.*

Many other genera have been placed in this family by different authors, all of which (if we except *Cyrta*) have been very properly excluded by Prof. A. DeCandolle in his 'Prodromus' (viii. 245). Among these is *Diclidanthera*, a genus which has lately been amply elucidated by Prof. von Martius in his 'Flora Brasiliensis' (fasc. xvii. p. 11. tab. 4), who, while placing it there among the *Ebenaceæ*, endeavours to show its nearer affinity towards *Polygalaceæ*. It appears to me to hold a different relationship, as I shall shortly demonstrate in a separate paper on this subject.

I will now proceed to offer the characters of each genus of this family in the succession above indicated, mostly derived from my own observations, prefacing each of them by a few remarks.

1. Styrax.

This genus is distinguished principally by the decided imbrication of its petals in æstivation, in which feature it differs from *Cyrta, Strigilia, Pamphilia,* and *Foveolaria*; its petals are thinner, larger, and more membranaceous in texture than in those genera, and in this respect, and in their æstivation, resemble those of *Halesia* and *Pterostyrax*. In the typical species, *S. officinalis,* the petals often exceed their normal number, five, being sometimes as many as six, seven, or eight. The filaments are longer in proportion to the anthers than in *Strigilia* and *Cyrta*; and in some species the stamens also differ from their normal number, ten, being sometimes as few as six or seven. The endocarp of the fruit is much thicker than in *Strigilia*.

Styrax, Tournef. Benzoin, *Hayn.* Lithocarpus, *Bl.*— *Calyx* campanulatus, marginé fere integro, vix 5-denticulato, persistens. *Petala* 5–6–7–8, oblonga, obtusa, extus tomentella, imo adhæsione filamentorum in tubum brevem conniventia, æstivatione plus minusve imbricata. *Stamina* 10, interdum abortu pauciora, uniserialia, petalis invicem alterna et opposita, alternis paullo brevioribus; *filamenta* linearia, compressa, cum petalis orta et iisdem imo laxe agglutinata; *antheræ* elongatæ, porrectæ, post dehiscentiam arcuatæ, 2-loculares, loculis parallelis, discretis, dorso per totam longitudinem ad filamentum adnatis, eo dimidio brevioribus, antrorsum rima longitudinali dehiscentibus. *Pollen* reticulatum, depresso-rotundatum, vel sub-3-gonum, angulis vesiculæ hiantibus. *Ovarium* liberum, subovatum, pariete imo tenui et sulcato, summo crassiusculo, intus ad basin sepimentis 3 rudimentariis ad placentam centralem brevem nexis, in carinis totidem parietalibus continuis, et intra stylum cavum percurrentibus, hoc modo superne omnino 1-loculare, et imo brevissime atque incomplete 3-locellatum; *ovula* circiter 9 (interdum pauciora) in quoque locello, crebriter 3-serialia, superiora (cum raphe interna) erecta, media (raphe supera) horizontalia, inferiora resupinatim pendula (cum raphe hinc externa), omnia in tuberculis totidem aut foveolis prominentibus placentæ carnosæ sessa. *Stylus* erectus, valde elongatus, ovario 5–6-plo longior, tenuis, stamina multo superans. *Stigma* obsolete 3-lobum. *Drupa* exsucca, ovato-globosa, tomentosa, calyce brevi immutato suffulta, et stylo persistente terminata, pericarpio coriaceo apice 3-valvatim hiante, 1-locularis, 1- rarissime 2–3-sperma. *Semen* erectum, loculo conforme, impressione carinarum endocarpii 3-sulcatum; *testa* crassiuscula, ossea, nitida, dura, ovulis abortivis circa hilum magnum basalem notata; *raphe* primo tubularis, compressa, ossea, hili basin perforans et mox in faciem internam testæ patescens, hinc breviter ramosa, et cito in filamentis innumerabilibus delicatissimis spiralibus cottoneo-implexis in telam araneiformem ubique producta; *integumentum intermedium* opacum, membranaceum; *integumentum internum* tenuiter membranaceum, ad priorem subadhæsum; *albumen* carnosum; *embryo* axilis, longitudine fere albuminis, *cotyledonibus* foliaceis, rotundato-ovatis, imo subcordatis, nervosis, *radicula* tereti infera duplo longioribus, et 6-plo latioribus.

Arbores *vel* frutices *in Europa, America boreali, Asia et Japonia crescentes, sæpe pilis stellulosis tomentosæ*; folia *alterna, integra, vel dentata, petiolata*; racemi *terminales, pluriflori, foliosi, vel bracteati aut axillares et pauciflori*; flores *albidi.*

Of the forty-five species of *Styrax* enumerated by DeCandolle, I have removed thirty-one into *Strigilia*, and five into *Cyrta*: to the remaining nine (some of which yet remain to be verified) must be added *S. odoratissimum*, Champ. (Hook. Kew Jo. Bot. iv. 304), *S. ellipticum* and *S. subpaniculatum*, Jungh. et Vriese (Walp. Rep. vi. 459). *S. Obassia*, from Japan, bears greatly the habit and inflorescence of *Pterostyrax*; but, as its fruit is said to be drupaceous, it must be referred to the tribe *Styracineæ*: its broadish rounded petals are much imbricated in æstivation. *S. odoratissimum*, from China, is a very distinct species; its corolla is also imbricated in æstivation, and its drupe is acutely mucronated, with a tendency to split at the base into three regular valves. *S. Benzoin* appears to differ from both in having very entire leaves and a compound raceme. I have not seen its flowers; but its fruit corresponds with that of *S. officinalis.*

2. Cyrta.

I have already alluded to the principal features that distinguish this genus from *Styrax*: its thicker and more ligneous pericarp opens at the apex and splits down to the base in three equal valves; the form of its much thicker petals and the manner of their æstivation are different from those in *Styrax*, *Halesia*, and *Pterostyrax*, being valvate or slightly introflexed, as in *Strigilia*, *Pamphilia*, and *Foveolaria*. I have drawn up its generic character from observation upon most of the under-mentioned species.

Cyrta, Loureiro.—*Flores* hermaphroditi. *Calyx* urceolato-cyathiformis, margine 5-dentatus, dentibus nervis prominulis decurrentibus hinc 5-carinatus, persistens. *Petala* 5, lineari-oblonga, acuta, crassiuscula, extus tomentella, intus glabra, imo adhæsione filamentorum breviter subconnata, æstivatione valvata, marginibus subinvolutis. *Stamina* 10, uniserialia, erecta, petalis æquilonga; *filamenta* linearia, angusta, complanata, pilosa, cum petalis orta, et ad eorundem basin breviter et laxe cohærentia, in æstivatione replicata; *antheræ* lineares, 2-lobæ, lobis parallelis ad filamentum angustiorem dorso adnatis et duplo vel triplo brevioribus, sæpe stellatim pilosis, antrorsum longitudinaliter dehiscentibus. *Ovarium* omnino superum, turbinatum, summo depressum, imo 10-sulcatum, calyce quadruplo brevius, tomentosum, 1-loculare, interne carinis 3 prominulis parietalibus e placenta libera brevi centrali orientibus, hinc brevissime pseudo-3-locellatum; *ovula* pauca, e basi erecta, in tuberculis totidem placentæ sessa. *Stylus* simplex, tenuis, glaber, longitudine staminum, summo paullo incrassatus et vacuus. *Stigma* obsolete 3-dentatum. *Drupa* sicca, coriacea, calyce immutato triplo breviori suffulta, turbinata, vel ovata, 1-locularis, 1-sperma, in valvis 3 æqualibus ab apice ad basin hians. *Semen* erectum, solitarium, subglobosum, structura omnino *Styracis*, nisi embryone magis obliquo.

Frutices *Asiatici*; folia *alterna, subintegra aut denticulata, dentibus sæpe glandulosis, petiolata*; racemi *sæpius terminales, foliosi aut bracteati.*

1. *Cyrta agrestis*, Lour. Coch. i. 278;—foliis ellipticis, utrinque acutis, distanter denticulatis, denticulis glandulosis, crassiusculis, glaberrimis, superne nitidis, valde reticulatis, subtus pallidioribus, sub lente venis obsolete stellato-pilosulis, petiolo brevissimo canaliculato; racemis terminalibus, multifloris.—China.—*v. s. in hb. Hook.* (Fortune.)

Folia 2 poll. longa, 9–11 lin. lata, petiolo vix 1 lin. longo. Racemus $1\frac{1}{2}$–2 poll. longus, 6–8-florus. Calyx urceolatus, sinuato-5-dentatus, 5-carinatus, tomentosus, 2 lin. longus, ore 2 lin. diam. Petala lineari-lanceolata, acuta, 7 lin. long., 1 lin. lat., extus tomentella, intus glabra, parallele nervosa, æstivatione valvata. Stamina 10, quorum 5 petalis alterna et æquilonga, 5 opposita vix breviora, 7 lin. long., filamenta complanata, imo in tubum $1\frac{1}{2}$ lin. long., subcohærentia, et hinc glabra, tunc libera, medio barbata, illinc glabra, connectivo extus stellato-tomentoso; antheræ lineares, dorso adnatæ, 3 lin. longæ. Ovarium oblongum, liberum, imo glabrum, superne pilis creberrimis sericeo-villosum, 1 lin. longum. Stylus tenuis, rectus, glaberrimus, 6 lin. longus; stigma obsoletum; pedicelli 5-angulati, superne crassiores, 4 lin. longi.

2. *Cyrta Finlaysoniana*. Styrax Finlaysonianum, *Wall. Cat.* 4403; *DC. Prodr.* viii. 261;—ramulis racemis calyceque tomentosis; foliis ellipticis, utrinque subobtusis, margine cre-

nulatis, fere integris, superne viridibus, glaberrimis (junioribus tomentellis), nervis parum eminentibus, venis transversis reticulatis, subtus pallidis, sparse et obsolete stellato-pilosis; racemis paucifloris, simplicibus, quam folium dimidio brevioribus, floribus stramineo-tomentellis, pedicellis calyce sub-brevioribus, calyce subhemisphærico, 5-denticulato.—India Orient.—*v. s. in hb. Wall.*

Folia 3–4¼ poll. longa, 1½–2 poll. lata, petiolus 3 lin. longus; racemi in ramulis imo foliosis terminales, circiter 6-flori.

3. *Cyrta luculenta.* Cyrta agrestis, *Ham., non Lour.* Styrax serrulatum, *Wall. var. β*;—foliis ovalibus vel ellipticis, utrinque acutis, glaberrimis, irregulariter denticulatis, dentibus glandulosis, superne fusco-viridibus nervis stramineis, inferne interdum pallidioribus, nervis venisque transversis prominentibus, in areolis (rudimento pilorum) punctulatis, petiolo tenui canaliculato, subtus tomentoso; racemis terminalibus et axillaribus floribusque pallide tomentellis.—Assam.—*v. s. in hb. Hook.* (Griffith, 286.)

Species valde distincta: folia 2½–4½ poll. longa, 14–16 lin. lata, petiolus 2–3 lin. longus; racemus 2–2½ poll. longus, 6–8-florus; fructus ovatus, calyce cupuliformi suffultus, tomentosus, 5 lin. longus, 4 lin. diam., styli vestigio apiculatus, pericarpio crasso lignoso e basi trivalvatim rimante, abortu monospermus.

4. *Cyrta Japonica.* Styrax Japonica, *Sieb. & Zuccar. Fl. Jap.* i. 53. tab. 23; *DC. Prodr.* viii. 266.—Japonia.

5. *Cyrta dealbata,* n. sp.;—foliis oblongis, acuminatis, imo obtusis, crassiusculis, subintegris, margine irregulariter crenulato-recurvo, superne glaberrimis, nervis rachique sulcato-impressis, subtus cano-pruinosis, nervis venisque transversis reticulatis prominulis, petiolo tereti, canaliculato, tomentoso; racemis multifloris, axillaribus et terminalibus, stramineo-albidis, pruinoso-tomentellis, calyce hemisphærico, fere integro, petalis 5, linearibus, acutis.—Malacca.—*v. s. in hb. Hook.* (Griffith.)

Folia 2½–3 poll. longa, 1¼–1½ poll. lata, petiolus 4 lin. longus; racemus 1¾ poll. longus; flores parvi, vix 5 lin. longi; calyx 1½ lin. longus; petala crassiuscula, linearia, intus fusca, glabra, parallele nervosa, vix linea lata, æstivatione valvata, demum reflexa.

6. *Cyrta suberifolia.* Styrax suberifolium, *Hook. & Arn., Beechey Voy.* 196, tab. 40; *DC. Prodr.* viii. 261; *Hook. Jo. Bot.* iv. 304.—Ad char. opt. in DC. Prodr. adde: fructu ovato, avellani magnitudine, in valvibus 3 ab apice ad basin hiante, semine

subgloboso.—China.—*v. s. in hb. Hook.* Hong-Kong (*Champion*).

Fructus subsphæricus, 6 lin. diam., calyce persistente suffultus.

7. *Cyrta virgata.* Styrax virgatum, *Wall.; DC. Prodr.* viii. 267. —India orient.—*v. s. in hb. Wall.* (*Cat.* 4400), Sylhet.—*in hb. Hook.* Khasya (*Griffith, Lobb*).—Bootan (*Griffith*, 2268).

8. *Cyrta serrulata.* Styrax serrulatum, *Roxb. Flor. Ind.* iii. 415; *DC. Prodr.* viii. 267 (excl. synon.).—India orient.—*v. s. in hb. Wall.* (*Cat.* 4400 B.)—*in hb. Hook.* Garhutty (*Simon*, 66).

Species præcedenti valde similis; in utraque, folia valde pallida, glabra, textura tenui, in *C. serrulata* apice longiuscule acuminata, dentibus magis perspicuis glandula tereti elongatis.

3. Strigilia.

In a preceding page my reasons are given for separating this genus from *Styrax.* The well-marked differences in character are quite in accordance with the geographical distribution of the species, which are all confined to the tropical parts of the South American continent, both on the western and eastern sides. It differs from *Styrax* in its more fleshy, almost coriaceous, and narrower petals, which are always acuminated and valvate in æstivation. The stamens are nearly the length of the petals; and the anther-lobes, which are parallel and linear, are attached by their entire length upon the filament, which exceeds them in breadth and around their apex; they are separated from one another by a narrow interval, and are only in a small degree shorter than the filaments, which hence appear extremely abbreviated, and which below the lobes are covered by a tuft of long, stiff, spreading hairs: the margins of the filaments are very laxly coherent, and loosely attached, for a very short interval, to the base of the petals. The fruit is oblong, sub-baccate, half enveloped by the free persistent calyx; the endocarp is easily separated from the rest of the thin indehiscent pericarp, and is thin, polished, and horny, and easily sectile into three valves, which are marked in the manner before described. Its testa is not so thick as in *Styrax* and *Cyrta*, and its embryo is longer and more erect. It agrees with *Cyrta* in the form and æstivation of its petals, but differs in its much longer anthers and in its indehiscent pericarp.

Strigilia, Cav. Foveolaria *in parte, R. & P.* Tremanthus, *Pers.* Epigenia, *Vell.* Styrax *in parte, A. DeCand. et aliorum.*—*Flores* hermaphroditi. *Calyx* tubulosus, obconicus, 5-carinatus, margine obsolete 5-denticulatus, demum paullo accrescens, omnino liber, persistens, et fructum laxe cingens. *Petala* 5, lineari-oblonga, crassiuscula, tomentosa, æstivatione valvata, cum staminibus imo laxe cohærentia, hinc pseudo-gamopetala, decidua. *Stamina* 10, uniserialia, cum petalis inserta, quorum 5 paullo longiora, petalis subbreviora et alternantia, 5 reliqua petalis opposita; *filamenta* linearia, complanata, antheris sæpissime latiora, stellato-pilosa, imo pilis simplicibus longis crebris barbata; *antheræ* 2-lobæ, longitudine fere filamentorum, lobis linearibus, segregatis, parallelis, dorso omnino adnatis, tenuiter membranaceis, sæpissime stellato-pilosis, rima antica longitudinaliter dehiscentibus. *Pollen* sub-3-gonum. *Ovarium* superum, rarius principio in torum paullulo immersum, cito emersum et omnino liberum, staminibus dimidio brevius, subturbinatum, imo sub-5-gonum, sæpissime apice depresso-conico 5-sulcato umbraculiformi incrassatum, summo omnino 1-loculare, imo plus minusve breviter 3-septato, septis in nervis 3 carinatis parietalibus intra stylum cavum percurrentibus, ad basin cum placentam centralem abbreviatam annexis et hinc locellos 3 incompletos mentientibus; *ovula* plurima, crebra, 6–10 in quoque locello, 2–3-serialia, in tuberculis totidem placentæ imo immersa, interdum (placenta brevissima) omnia erecta, vel (ista longiore) superiora erecta, intermedia horizontalia, inferiora resupinatione pendula, raphe ut in *Styrace* manifesta. *Stylus* erectus, imo crassior, et hinc cavus, stamina vix excedens. *Stigma* inconspicuum, brevissime 3-lobum, lobis divaricatis. *Drupa* subcarnosa, ovalis, calyce cupuliformi persistente semi-involuta, mesocarpio parco, carnoso, endocarpio tenuiter corneo, utrinque nitente, maculato, indehiscente, sed in valvis 3 facile sectili, valvis carina interna mediana signatis, 1-locularis, monosperma. *Semen* erectum, loculo conforme, carinis endocarpii 3-sulcatum, placenta persistente basali paullo lateraliter excentrica ovulis abortivis cincta suffultum, *hilo* majusculo signatum; *testa* ossea, fragilis, nitida, endodermide separabili, propter *raphen* hilum perforantem mox in vittas numerosas divisam e filis delicatissimis spiralibus numerosissimis compositas et in telam araneiformem ubique productam; *integumentum intermedium* submembranaceum, ad endodermidem solubilem agglutinatum; *integumentum internum* altero liberum, tenuissimum, cum albumine cohærens; *embryo* fere verticalis, *albumine* carnoso opalino paullo longiore inclusus, *cotyledonibus* ovatis, foliaceis, nervosis, *radicula* tereti infera duplo longioribus et 6-plo latioribus.

Arbores *Americæ tropicæ, sæpissime pilis stellatis tomentosæ;* folia *alterna, integerrima, crassiuscula, sæpius subtus argenteo-vel ochraceo tomentosa, valde reticulata, rarius glabra;* racemi *axillares, vel ramulos terminantes,* pedicellis *bracteatis,* 1-*floris;* flores *tomentosi.*

The species hitherto recorded are:—

1. *Strigilia oblonga,* DC. Prodr. i. 621. Styrax oblongum, *A. DC. Prodr.* viii. 261.—Peruvia, ad Chinchao et Pillao.
2. *Strigilia Guayanensis.* Styrax Guayanense, *A. DC. loc. cit.*—Guiana Britannica (*Schomb.* 965 *vel* 596).—Rio Amazon (*Spruce*).
3. *Strigilia pallida.* Styrax pallidum, *A. DC. l. c.*—Guiana Gallica (*Le Prieur,* 272).
4. *Strigilia acuminata.* Styrax acuminatum, *Pohl, Bras.* ii. 58. tab. 138; *A. DC. l. c.* p. 262.—Brasilia (Rio de Janeiro et Santa Catharina).
5. *Strigilia latifolia.* Styrax latifolium, *Pohl, l. c.* 60. tab. 140; *A. DC. l. c.* 262.—Brasilia (Prov. Minas Geraës).
6. *Strigilia camporum.* Styrax camporum, *Pohl, l.c.* 56. tab. 136; *A. DC. l. c.* 262.—Brasilia (Prov. Minas Geraës).
7. *Strigilia parvifolia.* Styrax parvifolium, *Pohl, l. c.* 53. tab. 133; *A. DC. l. c.* 262.—Brasilia (Prov. Minas Geraës).
8. *Strigilia subcordata.* Styrax subcordatum, *Moricand, A. DC. l. c.* 262.—Brasilia (Bahia).
9. *Strigilia alba.* Styrax album, *Spreng. Syst.* ii. 285; *A. DC. l. c.* 263.—Brasilia (Prov. Minas Geraës).
10. *Strigilia reticulata.* Styrax reticulatum, *Mart. Reis.* ii. 551; *A. DC. l. c.* 263.—Brasilia (Prov. Minas Geraës).
11. *Strigilia Gardneriana.* Styrax Gardnerianum, *A. DC. l. c.* 263.—Brasilia (Prov. Piauhy. *Gardn.* 1924).
12. *Strigilia florida.* Styrax floridum, *Pohl, l. c.* ii. 54. tab. 134; *A. DC. l. c.* 263.—Brasilia (Prov. Goyaz).
13. *Strigilia obliquinervia.* Styrax obliquinervium, *A. DC. l. c.* 263.—Brasilia (Prov. Minas Geraës. *Claussen,* 306).
14. *Strigilia nervosa.* Styrax nervosum, *A. DC. l. c.* 263.—Brasilia (Prov. Minas Geraës. *Claussen,* 303).
15. *Strigilia chrysastera.* Styrax chrysasterum, *Pohl, l. c.* ii. 59. tab. 139; *A. DC. l. c.* 264.—Brasilia (Prov. Goyaz).
16. *Strigilia Pohlii.* Styrax Pohlii, *A. DC. l. c.* 264. S. ferrugineum, *Pohl* (*non Nees & Mart.*) *l. c.* ii. 55. tab. 135.—Brasilia (Prov. Minas Geraës et S. Paölo).
17. *Strigilia longiflora.* Styrax longiflorum, *A. DC. l. c.* 264.—Brasilia (Prov. Bahia. *Blanchet,* 3458).
18. *Strigilia punctata.* Styrax punctatum, *A. DC. l. c.* 264.—Brasilia (Prov. Piauhy. *Gardn.* 2912).
19. *Strigilia aurea.* Styrax aureum, *Mart. Reis.* ii. 551; *A. DC. l. c.* 264.—Brasilia (Prov. Minas Geraës).
20. *Strigilia argentea.* Styrax argenteum, *Presl, Rel. Haenk.* ii. 61; *A. DC. l. c.* 264.—Mexico (Acapulco).
21. *Strigilia racemosa,* Cav. Diss. vii. 338, tab. 201. Styrax racemosum, *A. DC. l. c.* 265.—Peruvia.

22. *Strigilia ferruginea.* Styrax ferrugineum, *Nees & Mart. Nov. Act.* xi. 88; *A. DC. l. c.* 265.—Brasilia (Prov. Minas Geraës).
23. *Strigilia tomentosa.* Styrax tomentosum, *Bonpl. Pl. Æquin.* ii. 72. tab. 101; *H. B. K.* iii. 261; *A. DC. l. c.* 265.—Quito.
24. *Strigilia pauciflora.* Styrax pauciflorum, *A. DC. l. c.* 265.—Brasilia (Prov. Bahia. *Blanchet*, 1719).
25. *Strigilia ovata*, DC. Prodr. i. 621. Foveolaria ovata, *R. & P. Syst.* i. 100. Tremanthus ovatus, *Pers. Ench.* i. 467. Styrax ovatum, *A. DC. l. c.* 267.—Peruvia.
26. *Strigilia cordata*, DC. *l. c.* i. 621. Foveolaria cordata, *R. & P. Syst.* i. 99. Tremanthus cordatus, *Pers. Ench.* i. 467. Styrax cordatum, *A. DC. l. c.* 267.—Peruvia.
27. *Strigilia leprosa.* Styrax leprosum, *Hook. & Arn. Jo. Bot.* i. 282; *A. DC. l. c.* 268.—Brasilia (Prov. Rio Grande do Sul).
28. *Strigilia macrophylla.* Styrax macrophyllum, *Schott, Spr. Syst.* iv. 425; *A. DC. l. c.* 268; *Pohl, l. c.* ii. 61. tab. 141.—Brasilia.

Species glabræ.

29. *Strigilia glabrata.* Styrax glabratum, *Spreng. Syst.* iv. *Cur. post.* 406; *A. DC. l. c.* 266. Styrax eremophyllum, *Pohl. l. c.* 57. tab. 137. Epigenia integerrima, *Vill. Flor. Flum.* p. 183; *Ic.* iv. 137.—Brasilia (Prov. Rio de Janeiro).
30. *Strigilia Pavonii.* Styrax Pavonii, *A. DC. l. c.* 266.—Peruvia.
31. *Strigilia psilophylla.* Styrax psilophyllum, *A. DC. l. c.* 266. —Guiana Gallica.
32. *Strigilia leiophylla.* Styrax leiophyllum, *Nob. in Lindl. Veg. Kingd.* 593 *cum icone*;—foliis elliptico-oblongis, basi apiceque subacutis, acumine obtusiusculo, utrinque glaberrimis, in junioribus pilis raris stellatis sparsim donatis, superne lucidis, subtus læte viridibus, subtenuibus, costa media nervisque stramineis subprominulis superne immersis, transversim reticulato-venosis, integerrimis, margine tenui cartilagineo haud revoluto, petiolo sparse pilosulo, superne canaliculato; racemis axillaribus, petiolo 2–3-plo longioribus, 6–12-floris; pedicellis lepidotis, profunde 5-sulcatis, cum flore subæquilongis; floribus lepidoto-pruinosis; bacca ovali, calyce libero cupuliformi semi-inclusa.—Brasilia (in Montibus Organensibus, Prov. Rio de Janeiro). *v. v.*

Species mihi lecta, in fructu (Freixal), in flore (Valença); *S. glabratæ* cognata, tamen sat distincta, sed ita discrepat; folia plusquam dimidio longiora et fere 3-plo latiora, tenuicula, non coriacea, nullo modo pilosa; racemi 2-plo majores, pluriflori. Ramuli juniores lepidoti; folia 4–5 poll. longa, 2–2½ poll. lata, utrinque glaberrima, lucida; petiolus 6–8 lin. longus, lepidotus, canaliculatus; racemi axillares, simplices, 1½–2 poll. longi, 6–12-flori, pedicelli angulati, 4–5 lin. longi (in fructu 7 lin.), apice incrassati, calyceque granuloso-lepidoti, flavescentes; calyx tubulosus, $2\frac{1}{2}$ lin. longus, 2 lin. diam., margine fere integro, vix 5-denticulato, corollam arcte cingens. Corolla extus albida aut flavescens, lepidoto-pruinosa, in alabastro 5-angulata, æstivatione valvata; petala 5, linearia, 10 lin. longa, 1 lin. lata, intus callo apicali marginibusque tomentosis, medio glabra, parallele nervosa, crassiuscula; stamina 10, petalis breviora, filamenta 7 lin. longa, cum petalis orta, iisque imo laxe conglutinata, complanata, tenuia, linearia, antheris latiora, glabra, sed infra antheras fasciculo denso pilorum barbata; antheræ $3\frac{1}{2}$ lin. longæ, lobis sejunctis, parallelis, filamento omnino adnatis, pelliculares, sparse stellato-pilosæ. Ovarium depressum, apice subconico vel umbraculiforme 5-sulcatum, 1 lin. diam., albido-pruinosum, imo constrictum et hinc glabrum. Stylus tenuis, glaber, 9 lin. longus. Stigma subobsoletum. Bacca oblonga, flavido-viridis, glauco-pruinosa, 3 lin. longa, 4 lin. diam.*

The *Strigilia australis*, Juss., is *Pennantia Cunninghami*, Nob. (huj. op. ser. 2. ix. 491).

[To be continued.]

XXXI.—Spicilegia Entomologica.—III. *Note on the Pupa-case of a Coleopterous Insect from Northern China.* By Adam White, A.Z.D. British Museum, Corr. M.L.S. Lyons, &c.

[With a Plate.]

It would be well if some of the acumen displayed by that well-exercised army of Lepidoptera-collectors in this and other countries were shown by those who study and collect Coleoptera. To go no further than these islands: the Doubledays (the late Edward and his surviving brother Henry, of Epping)—the Standishes—Douglas—Stainton, and many others reared by Stainton's energy, example, and encouragement,—have done, and are doing, good work. Mr. Logan, of Duddingston in Scotland, who draws and observes well; Charles Turner, a keen observer, and the able Peter Bouchard (the two latter both excellent collectors) have done much to make us acquainted with the transformations of Lepidoptera. In other words, these and other observers have assisted greatly in clearing up the history of our Lepidoptera. Those most able observers, naturalists, and artists, John Curtis, F.L.S., and J. O.

* The structure of the seed is fully described in a preceding page (p. 131). A drawing of this species, with analytical details, will be given in 'Contributions to Botany,' plate 30.

Westwood, M.A. Oxon. (the former the finest entomological artist of any age), Mr. Waterhouse, Mr. Haliday, and Mr. Janson (keen observers and entomologists), have studied the larvæ of insects generally, especially of the Coleoptera, and of those species of Diptera and other orders which damage our crops or injure our fruits and trees; but yet an immense field lies before the young—lies before the old observer. The eggs, larvæ, and pupæ of *not* one out of fifty of our indigenous insects are known. Of the hundred and eighty thousand species, or so-called species of insects which inhabit the world, the metamorphoses of *not* one in two hundred and fifty are ascertained. The eggs, larvæ, and pupæ of whole families are still *desiderata*. What a blank! and yet each insect has a history as long as (I should say, longer than) that of the larva of the Goat-moth, so inimitably given by Lyonet, of the Cockchafer by Strauss-Durckheim, and of those insects so graphically, though more briefly, described by Léon Dufour, by John Curtis, by Westwood, Haliday, Candèze, Chapuis, Perris, Goureau, Guérin-Méneville, Audouin, Blanchard, and others. What a field lies open before men like Dr. Asa Fitch and Leconte of America—before future Abbots of Georgia—rising naturalists here, like Lubbock, Trimen, and others! How well has Frederick Smith studied the habits of our Hymenoptera!—a "busy bee," as "industrious" nearly as an ant, as indefatigable, though not so angular and "touchy," as a wasp, that naturalist is doing good work—work that will yet *tell*. It is to be hoped that Mr. Vernon Wollaston may find, and investigate, the larvæ and pupæ of some of the subjects of that magnificent work, the 'Insecta Maderensia,' now that he has so completely described the *imagines* of the Coleoptera of Madeira.

The work of the learned Drs. Candèze and Chapuis* on the larvæ of Coleoptera, with such additions as M. Coquerel and others have since made, shows how just the above observations are.

I have much pleasure in attracting the notice of naturalists to the cocoon of a species of Coleopterous insect from North China, the figures of which, by young Mr. Mintern, revised by Mr. Ford, render description less necessary.

In selecting, from one of those boxes sent by Mr. Fortune from Shang-hai and other parts of North China, such insects as were desiderata, I was struck with, and took, three flat pod-like cases, which, at the time, I judged to be the cases of some Trichopterous insect, allied to one of our "Caddis-worms." The cases

* "Catalogue des Larves des Coléoptères, connues jusqu'à ce jour, avec la description de plusieurs espèces nouvelles," par Drs. F. Chapuis et E. Candèze, in Mém. Soc. Roy. Liège, t. viii. (1853) pp. 341–622, with 9 plates.

were flat, greyish brown, of an oblong form, strangulated somewhat in the middle and rounded at the end,—much like the pods of one of the *Cruciferæ* in our gardens (an annual or biennial), whose seeds have flat rims, assisting to disperse the seed, or to buoy it up for a time, till at last it sinks. These pods looked also a little like two somewhat roundish flat ovals connected, with a distinct and smoother oval impression on the middle; they were formed of minute particles of yellowish and brownish matters, closely cemented; their outline was a little irregular; and they were not all shaped exactly alike. I put them away. On being approved by our Keeper, and recommended, the North China insects, like all the specimens of zoology, were ticketed and marked. What was my surprise to see a pair of pectinated antennæ and a head poking out from each of them! I did not see this when first I took them; and I am almost sure that the Coleopterous insects, whose heads they were, had emerged from the pupæ during the month or six weeks that had elapsed between the selection and the ticketing of these specimens. I opened one, and found it like the two valves of some bivalve shell, such as *Psammobia*. The inside was very smooth, and nicely lined with some insect secretion. Mr. Mintern's figures (Pl. VII. figs. 1 *a* & 1 *d*) will show this structure. Before entering on the description of the Beetle which constructs it, and which is figured on the plate (fig. 1), I may quote a passage from a note kindly sent me by Dr. Bowerbank, a friend who examined the structure with his well-exercised eye and mature judgment, and gave me the results of it in the following words:—

"My dear Sir,—The insect and its case, which you placed in my hands for examination, is a very interesting subject.

"The case is evidently constructed of pellets of excretions worked into a uniform stratum, with the intermixture of a few masses of extraneous matter, which may generally be distinguished from the deep-brown semitransparent globules of excrement by the difference of their colour, and their being more or less angular.

"The interior of the case is lined with extremely fine silky fibres $\frac{1}{9091}$ inch in diameter; they are disposed in curved bundles of parallel threads, crossing each other irregularly, so as to give the appearance of being fitted on to the surface,—the aspect of the whole being just such as would be produced by the larva spinning from its mouth a fine viscid thread, and fixing it by motions of its head right and left.

"Most truly yours,

"J. S. Bowerbank."

The insect I am about to describe belongs, I believe, to Lacordaire's 39th family, *Dascyllides,* and his second tribe, *Dascyllides vrais,* although it has some points connecting that family with the previous one, that of *Rhipicerides,* particularly the genus *Callirhipis* of Latreille. It differs essentially from Westwood's genus *Lichas,* established on a fine Elater-like insect found by Mr. John Bowring on Camellias in the island of Hong Kong. It comes in Section 1. of Lacordaire (Coléoptères, iv. p. 264), and may be named *Paralichas.*

The species I propose to name

Paralichas Guerinii. Pl. VII. fig. 1.

P. obscurus sericeo-velutinus; thorace pallido, maculis binis magnis dorsalibus nigris; elytris subsulcato-striatis, linea mediana longitudinali, præsertim sericea. Long. ♀ $5\frac{1}{2}$ lin., ♂ $4\frac{1}{2}$–5 lin.

Hab. China Borealis (Shang-hai). (Coll. Mus. Brit. R. Fortune.)

Head as wide as the thorax in front, decumbent, impressed behind; eyes rather large, round, somewhat prominent. The antennæ in the male have the joints, from the third to the tenth, with a longish branch proceeding from near the apex, and directed inwards; the last joint is long and linear. Jaws strong, curved, and with a single tooth before the pointed apex. Maxillary palpus with first joint very small; second and third elongate, about equal; third oblique at tip; fourth thick and cup-shaped; fifth conically elongated, and somewhat blunt at end. Labial palpi with terminal joint thickened, longish ovoid. Antennæ of female from the third to the ninth joints triangularly dilated, especially the fifth, sixth, seventh, eighth, and ninth joints, which have a tendency to pectination.

Thorax wider than long, somewhat narrower in front; fore edge straight, except at the angles, which project a little over the eyes, and form with the sides, which slope inwards and have a sharp lateral ridge, a kind of shelter for the head, which may be drawn almost entirely under it: the back of the thorax is very convex, especially on the fore part; hind edge bulging about the middle over the scutellum, widely sinuated on each side of the bulge; the posterior angles are sharp, and, when viewed from above, seem pointed towards the shoulder of the elytra; a transverse depression across the thorax, close to the hind edge. The thorax is brownish yellow, with two large brownish-black spots occupying nearly all the dorsal surface, and only separated by a narrow light-coloured line.

Scutellum rather wider than long, straight in front, rotundato-triangular on the sides and tip; yellow.

Elytra almost as long as abdomen, with nine or ten distinct impressed lines, the lateral and posterior margins slightly dilated, the shoulder with a hollow between the umbo and the side margin, evidently for the thorax-angle to work into, when the insect retracts itself. In some specimens the general surface is of a darkish brown, with the narrow dilated side margin and tip, and the suture, yellowish ochre; the dark brown is sometimes streaked with a dash of pale, and in some the greater part of the dorsal surface of the elytra is pale, with two broad streaks of brown, proceeding one from the shoulder and one from the base near the suture. The elytra are very closely punctured, and *seem* almost as if they were shagreened. Thorax and elytra covered with short pile, clearest and more silky on a line down the middle of each elytron.

Tarsi with the fifth joint as long as the first and second joints united; all the joints longer than wide, and thickly clothed beneath with coarse short hairs.

There are smaller specimens with paler elytra, and a blackish line near the lateral margin, interrupted before the tip, which has a black spot. I believe it to be the same.

I hope this insect may prove a nondescript; although, in this active age, when books have increased as describers have increased, it is very difficult, unless you rigidly restrict yourself to a very limited subject, to master even the nomenclature of it. I cannot find any description of the insect; it is named after my excellent friend M. Guérin-Méneville, whose kindness to me, a very young naturalist, when I visited Paris in 1841, I cannot forget. I have named it after him because it is allied to a family (the *Cebrionidæ*) the habits of one of which he discovered when a young man, at Toulon. I remember his giving me an account of his discovery. It was in 1812 that he found the *Cebrio gigas*, a well-known insect, fluttering over the grass in the evening, much as chafers do in this country. A close observation enabled him to find one of them, coupled with an insect without wings, which had her ovipositor protruded from a small hole in the ground, from 2 to $2\frac{1}{2}$ lines in diameter. This insect, now well known to be the female of *Cebrio*, had been described by Rossi as *Tenebrio dubius*. Olivier, from its having only ten joints to the antennæ, named it *Cebrio brevicornis*. Latreille had described it as the type of a genus, which he named *Hammonia*, and which, in one of the volumes of the 'Nouveau Dictionnaire d'Hist. Nat.,' published in the memorable year 1817, he regarded as an established genus. The late Professor Victor Audouin communicated to the French Entomological Society his observations on the species which he observed during his travels in the Eastern Pyrenees in 1833. He said that wet weather, to soften the ground, is necessary to enable the female to get her ovipositor out of the ground, and, when impregnated, to allow her to deposit her eggs.

I also remember M. Guérin telling me that he gave away in exchange the female *Cebrio* which he took, and which was among the rarest of the European Coleoptera at that time, as *Necrobia ruficollis* (or "Latreille's saviour," as it was called) had been formerly, when Bory St. Vincent and Dargelas rescued that eminent man, a prisoner in the dungeons of Bordeaux during the revolutionary earthquake, as recorded so graphically by Latreille in his 'Genera Crustaceorum et Insectorum.' It was as rare as *Drypta* used to be, or *Velleius dilatatus*, *Emus hirtus*, and *Adelops* are now, in this country. Young Guérin, since so distinguished, could not resist the offer of a specimen of the great *Buprestis gigas*, a common Brazilian insect. This circumstance has induced the writer to name this insect after the justly eminent French naturalist whose 'Iconographie du Règne Animale,' 'Magasin de Zoologie,' 'Revue et Magasin de Zoologie,' and articles in the 'Encyclopédie Méthodique,' in the 'Voyage de la Coquille,' and innumerable other works, extending over a long course of years, have given him that reputation which he has now so long and so deservedly enjoyed. His labours on insect œconomy, as applied to agriculture and the production of silk, and prevention of injury to articles of value, are much appreciated over the whole world. He has done for France what our Curtis and Westwood have done for the British empire,—*tres juncti in uno*. M. Guérin-Méneville, I may add, has illustrated, in his usual admirable way, the genus *Callirhipis* in the 2nd plate of the Insects of the 'Voyage de la Coquille,' fig. 4 (*C. Dejeanii*, Latr.), and has made this group a special object of study in a work quoted by Lacordaire.

I have named a larger species *Paralichas* (*Epilichas*) *Candezii*, after the acute and amiable Dr. Candèze, of Liège, to one of whose works I have alluded, but whose principal labours are on the very difficult group Elateridæ.

Paralichas Candezii.

P. rufo-flavus; elytris nigerrimis; thorace supra flavo piloso-hirtulo; antennis nigris, tenuioribus (quam in spec. præcedente), articulo basali rufescente; scutello rufescente; elytris delicatule punctatis, obsolete substriatis, subtus pedibusque rufo-flavis. Long. lin. $6\frac{1}{2}$.
Hab. China bor. (Shang-hai). Coll. Brit. Mus.

The tarsi have the first and fifth joints about equal in length;

the second, third, and fourth are short, transverse, and widest at top; the first four are hairy on the under side and edges; the second, third, and fourth are somewhat truncated at the end, and have traces of a horny pad. This may belong to a distinct genus, which may be known by this character and the more slim antennæ, with the pectination coming from nearer the base of each joint (*Epilichas*).

EXPLANATION OF PLATE VII.

Fig. 1. *Paralichas Guerinii*, male, magnified: 1 *a*, the case, of the natural size, with the insect's head and thorax exserted; 1 *b*, the case, of the natural size, open.

Figs. 1 *c.* and 1 *d.* show small portions of the case, highly magnified.
Fig. 1 *c.* represents a piece of the inside of the case.
Fig. 1 *d.* shows a portion of the coarser-grained outside.

Spicilegia Entomologica.—IV. *Diagnoses Coleopterorum quatuor.* Auctore A. White, in Mus. Brit. Auxiliario.

Distichocera (gen. *Kirbii*) Thomsonella, n. s. *D.* velutina, nigerrima; capite, thorace, scutello elytrisque albo sericeo maculatis; pedibus nigris, femoribus, apice nigro excepto, rubris (♂). Long. lin. 6½.

Hab. Australia. *D. maculicolli* minor.

Species quinta et cæteris, a Kirby et Newman descriptis, valde distincta. Nomen fert Dom. J. Thomson, auctoris 'Archives Entomologiques,' Coleopterophili celebris.

Stigmodera (gen. *Solieri*) Bakewellii, n. s. *S.* subcylindrica, *Sternoceræ* speciei subsimilis; elytris elongatis, simplicibus, punctato-striatis, luteis; thorace purpureo-flavo, cyaneo et viridi micante, rude et creberrime punctato; corpore subtus cæruleo-viridi fasciato; pedibus cæruleo-viridibus. Long. unc. 1, lin. 10.

Hab. Australia, in "Maillée scrub" (*Eucalyptus dumosus*). Mus. Brit. (Dom. R. Bakewell.)

Temnognatha (gen. *Solieri*) Imperatrix, n. s. *T.* elytris apice mucronatis, sutura etiam apiculata; thorace supra viridi metallico punctato, maculisque parvis coalescentibus lævibus aureo-flavis, lateribus subtus flavis, punctatis, punctis viridibus; elytris aureo-flavis, sutura, marginibus lateralibus (basi excepta) purpureo-nigris, ad medium dorsi maculis 3–4 parvis transversis purpureo-nigris; pedibus viridibus; corpore subtus flavo, viridi decorato. Long. unc. 1, lin. 6.

Hab. Australia (Swan River). (*Forsan* ab Hope seu Thomson nominata.)

Schizorhina (*Hemipharis* seu *Diaphonia*) Bakewellii, n. s. *S.* capite, corpore subtus pedibusque nigerrimis; thorace dorso lævigato, lateribus rufescenti-flavo late marginatis, medio fascia lata nigra; scutello et sutura nigris; elytris rufescenti-flavis; marginibus corporis supra pilis sericeo-albis notatis; pygidio transversim aciculato, apice emarginato. Long. unc. 1, lin. $5\frac{1}{2}$.

Hab. Australia, ad ripas Yarræ. Dom. Bakewell, in Mus. Brit.

Species, genera *Schizorhinam, Diaphoniam* et *Hemipharidem* annectans; thorax ante scutellum dilatatus est.

XXXII.—*Descriptions of new and little-known species of Ceylonese Nudibranchiate Mollusks.* By Dr. E. F. Kelaart.

Doris gloriosa, Kel.

Syn. *Doris marginata* (?), Leuckart.

Body nearly 3 inches long, oblong, of a pinkish colour, minutely dotted with red and white. Mantle large, oval, broad, when expanded entirely covering the foot. Back mottled with pink, red, and yellow, and minutely punctulated with red and yellow; edged broadly with white, then with a broad rich-red line; adjoining this is a whitish space; and carried round the mantle, near the body, is a still more brilliant blood-red line, with internal club-shaped prolongations of the same beautiful purple-red colour. Interspace and for about $\frac{1}{4}$ inch of breadth of the back, the mantle is again whitish, with shades of purple and yellow nearer the beautifully mottled back. The under side of the mantle has also a broad white edge, the rest brilliantly variegated with dotted purple, yellow, and red splashes. Branchiæ seven or eight, large, branched, each rising from a separate cavity in a circle about half an inch from a protruding yellow-coloured anal orifice. Plumes roseous, with red midribs. Dorsal tentacles large, clavate; apex pointed, slightly truncated, on inner edge laminated; colour pinkish and spotted with yellow; ridge of cavity spotted with yellow and red. Head large, protruding nearly $\frac{3}{4}$ inch from mantle. Mouth near the foot, situated in the centre of an oval projection; and on each side a long, broad, toothed leaflet or oral appendage, red and dotted like the head. Foot long, broad, with parallel sides, rounded and transversely split in front. It has a broad lemon-coloured edge, with transverse striæ; the rest pinkish red, not spotted; a dark-purple spot in centre, produced by the internal viscera.

This is by far the most beautiful species of *Doris* or Sea-nymph I have ever seen; and none but a good artist could do justice to its resplendent beauties. The large, ample surface of the mantle, with its soft snowy-white undulating edge, is best seen when the animal is swimming, and reflecting in the water the rich red folds near the golden-speckled back, on which is placed a broad circle of rosy-coloured feathery tufts. The live specimen, of which the above is but a faint description, was found under corals at low-water, near Fort Frederick. In another specimen from the same locality, the white edge of the mantle was replaced by a rich crimson-red, which coalesced with the inner red line, leaving a faint white line. Indeed, it is a question which of the two varieties looked more beautiful; at night, however, the palm of beauty was awarded to the red-margined specimen. They both lived for some days in a vivarium. When at rest, the mantle was turned inwards towards the back; in this position, the white and red lines were hidden by the broad rolls on each side, displaying the rich profusion of red and yellow dotted splashes and undulating lines of the under surface of the mantle. In fact, it then looked like another species; but it is only when the mantle is fully expanded and floating on the water that the unrivalled charms of this beautiful Sea-nymph are seen to perfection. In the young, the mantle extends round the head; and this may be mistaken for a distinct species. I have not had an opportunity of seeing the spawn of this species.

If this splendidly coloured Sea-nymph is identical with Leuckart's species, found in the Red Sea, and named *Doris marginata*, I should still prefer retaining the name I have given it, as *marginata* would apply equally well to several other species as to this.

Doris MacCarthyi, Kel.

Body nearly $2\frac{1}{2}$ inches long, dusky grey. Mantle long, narrow, dusky grey, bordered with a bright-blue line; edge crenulated, wavy. Dorsal tentacles long, conical, obtusely pointed, laminated obliquely for nearly two-thirds of their length, of a pale blue colour, with white streaks. Oral tentacles white, short, broad, and rounded. Branchial plumes twelve to fifteen, irregular, most of them of unequal length, pinnated, and a few trifurcated; others have a small cluster of plumes rising from the middle or extremity. Foot white, and nearly as long as the mantle.

This curious but elegant species is semigelatinous, and resembles a *Goniodoris*. Its narrow mantle scarcely covering the foot, the body is almost exposed.

I have dedicated this beautiful species to one who has always encouraged my pursuits in the field of natural history. To

Sir Charles MacCarthy, the Colonial Secretary of Ceylon, I feel grateful for that assistance which his position in the island enabled him to give me, whenever required; and I also feel thankful to him for the warm interest he has taken in my employment as naturalist to investigate the natural history of the Pearl Oysters.

Doris cœlestis, Kel.

Body white, $2\frac{3}{4}$ inches long, flattened. Mantle coriaceous, white, clouded with dark-purple minute rings, confluent or continuous with lighter-coloured purple rings set more widely apart. Dorsal tentacles white, long; apex clavate, lamellated, slightly truncated on the superior edge, pale green tipped with orange; margin of sheath orange or golden. Oral tentacles long, acutely pointed, white, minutely speckled with purple. Branchial plumes six, long, tripinnated, whitish; ribs purplish brown, edge of cavity orange. Foot white, shorter than mantle, grooved; lower lamella notched.

This beautiful purple-clouded *Doris* is of very retiring habits, and is scarcely ever seen moving. Obtained in August and September from rocks in Back Bay. Ova white, in three or four broad coils.

Doris funebris, Kel.

Body nearly $1\frac{3}{4}$ inch long, oblong, convex, of a waxy-white colour, and spotted with black. Mantle coriaceous, granular, of an ivory-white colour, and ornamented with jet-black spotted circles and half-rings or imperfect annular spotted figures. Dorsal tentacles large, clavate; apex black, laminated, without sheaths. Oral tentacles linear, white, tip black. Branchial plumes six, large and drooping, tripinnate, white and shaded lavender-grey; midribs of a dark brown colour. Foot waxy-white, spotted irregularly on the margin of the edges with small and large linear spots.

This elegant funereal-looking *Doris* is, with the mantle, about $2\frac{3}{4}$ inches long and $1\frac{1}{2}$ broad. Rarely seen. Lives for a long time in the aquarium. Deposits its ova in broad convoluted bands, which, when uncoiled, measure nearly 18 inches in length. A pair kept in the aquarium were seen to spawn in July. While one was depositing the band of ova on the side of the glass globe, the other kept watch, as it were, by moving in a circle round the former. The whole process lasted about half an hour.

The spots and markings of some specimens were of a dark brown colour. In others the spots were of an auburn colour.

Doris Gleniei, Kel.

Semigelatinous. Body nearly $1\frac{1}{2}$ inch long. Mantle broad, shorter than foot; above white, with a pinkish-yellow shade; a large, irregularly waved, deep-golden-coloured patch on the back, bordered and spotted with purplish red. The under surface of fore part of mantle of a beautiful light purple colour; there is also a purple line on each side of the white body. Dorsal tentacles white, with golden-coloured laminæ, long, conical, and pointed. Oral tentacles short, white. Branchial plumes seven to nine, short, lanceolate, pinnated, white, bordered with golden yellow. Foot pinkish white; edge pure white.

This beautiful species I have named after my friend the Rev. Owen Glenie, Colonial Chaplain of Trincomalee, who was often the cheerful companion of my zoological pursuits, and who will, I hope, on my departure from the island, continue those researches which he has so well begun.

This is, perhaps, next to *Trevelyana Ceylonica* ('Annals,' ser. 3. vol. i. p. 257) and *Doris gloriosa*, the most remarkably coloured species in Ceylon. Found in the Inner Harbour, in deep water, as also at Cottiar, opposite Fort Frederick.

Doris Leoparda, Kel.

Body $\frac{7}{8}$ inch long, grey-spotted. Mantle carneous, granular, grey, and spotted with dark grey and blackish circular spots, the latter in the central parts; each spot composed of smaller spots, separated from each other by white reticulations, seen more distinctly with the aid of a magnifier. Dorsal tentacles green, large, broad, ovate, lamellated for nearly the whole length. Oral tentacles short, linear, acutely pointed. Branchial plumes six, grey, speckled with darker grey; all united for nearly half the length, and the other half fringed with short plumes of a light green colour. Foot whitish, speckled, covered by the mantle.

This leopard-spotted *Doris* is of a regular oval form. Found in Dutch Bay, among coral rocks. Ova white.

Doris amabilis, Kel.

Body 4 lines long, oblong, narrow, convex, white, spotted with purple on the sides. Mantle smooth, white, with purplish-crimson spots; beneath white, not spotted. Dorsal tentacles of moderate length; apex conical, pointed, closely lamellated, of a golden-yellow colour. Branchial plumes five or six, small, bipinnate, white, with purple spots at their base; all retracted within a cavity without a rim. Head rounded, spotted with purple; on each side of the mouth a short linear tentacle, white. Foot narrow, longer than the mantle, slightly expanded in front, spotted with purple on the upper surface.

This lovely little *Doris* is rarely found. Two specimens, obtained in May, are still alive in a finger-glass, generally resting on the side of a stone. At night it crawls out of its hiding-place and creeps along the sides of the glass, and is sometimes seen floating on the surface of the water on its back. When touched with a feather, it adheres by its foot, and can be kept dangling in this position by the aid of the mucous thread secreted by the surface of the foot. Several *Eolidæ* were kept in the same vessel, and it has survived them all, though attacked repeatedly by them. Ova white, deposited on the side of the glass in a thread-like coil.

Doris fidelis, Kel.

Body $\frac{2}{3}$ inch long, narrow, convex, white. Mantle oblong, with parallel sides, shorter than the foot, of a waxy-white colour, the edge lined with red, and irregular, tooth-like, transverse, internal prolongations of the same colour; those on the sides longer, alternating with short ones. Branchial plumes seven or eight, black, lanceolate, pinnated, few-branched at tip. Dorsal tentacles oblong, flattened, pointed; apex black, lamellated. Oral tentacles small, acutely pointed. Foot white, narrow, slightly dilated in front and pointed posteriorly.

Found on coral rocks, at low-water mark, in August and September. This singularly marked species looks, when the tentacles and branchiæ are retracted, like a large bean. Its jet-black plumes and tentacles appear very conspicuously above the red-margined white mantle. It is very tenacious of life. Ova deposited in narrow white coils.

Doris pretiosa, Kel.

Body white, $\frac{2}{3}$ inch long. Mantle pale greenish yellow, very light-coloured on the sides, where there is also a bluish shade, closely speckled with small reddish-brown spots; margin marked with a narrow purple-red line and a light orange shade. Dorsal tentacles short, with reddish-purple apex, clavate, laminated. Oral tentacles triangular, sharp-pointed. Branchiæ short, pinnated, reddish purple. Foot white, shorter than mantle.

This gem-like elegant species is of the same size as *D. fidelis*, and not unlike it in appearance. The deep blood-red branchial plumes and the red-margined speckled cloak sufficiently separate it from the last species. They are both found in the same locality and at the same time. The characters of the young species are also very marked, as in the adult specimens.

Doris nivea, Kel.

Body $\frac{2}{3}$ inch long, convex, elliptical, snowy white. Mantle coriaceous, granular, white, occasionally seen speckled indistinctly with small grey spots. The purplish-coloured viscera seen through the opaline back. Dorsal tentacles pure white, short, conical, slightly pointed, lamellated at tip. Oral tentacles linear. Branchial plumes six or seven, white, bipinnate. Foot white, shorter than mantle.

This snowy-white opaline *Doris* is probably only a variety of *Doris pallida* of Leuckart, found by Rüppell in the Red Sea. It has not, however, all its characters; the cloak resembles that of *D. repanda* in some respects. It has white nerve-like lines on the margin. I have only seen one specimen, which lived for a few days.

Doris marmorata, Kel.

Body $2\frac{1}{2}$ inches long, oblong, convex, coriaceous, white, speckled reddish brown. Mantle broad and long, covering the foot, thick, hard, granular, marbled with black and reddish brown, and irregularly spotted with white. Under surface white, and mottled with irregular-shaped purplish-red spots. Branchial plumes six, united at base; superior half plumose, tripinnated, grey, and grizzled with brown. Dorsal tentacles large, clavate, laminated, brown, and speckled with white; sheaths granular. Head small. Oral tentacles long, linear, acutely pointed. Foot white, deeply notched and grooved in front, spotted with reddish brown.

This large marbled *Doris* lived only a few days. They are found on rocks near Fort Frederick, at low-water mark. Some are of a darker brown colour than others.

Doris cerisa, Kel.

Body $\frac{1}{3}$ inch long, convex, oval, of a vermilion-red colour. Mantle of a cherry-red colour, covering the foot. Branchial plumes six or seven, very small, straight and stiff, bipinnated, of a crimson-red colour. Dorsal tentacles small, conical, lamellated, purplish red, speckled with white, tip grey. Oral tentacles indistinctly seen. Foot pinkish.

I have only seen one specimen of this exceedingly pretty species. It lived for several months in a finger-glass. It cannot be mistaken for the young of any other Ceylonese species herein described. Ova red, in six narrow tape-like coils. The ova of *D. rubra* (mihi) are white.

Doris rufopunctata, Kel.

Body $\frac{3}{4}$ inch long, oval, compressed, of a white colour. Mantle coriaceous, of a light brick-red colour, and speckled with circular spots of a darker reddish-brown colour. Branchial plumes five, small, bipinnate, greyish-rufous, speckled. Dorsal tentacles short, clavate, pointed, laminated, without sheaths, of a rufous-brown colour. Oral tentacles white, linear. Foot whitish, short, grooved and notched in front, speckled with rusty. Under part of cloak whitish, and also speckled rusty.

This stiff-looking *Doris* is occasionally seen in a circular form. Rarely found, among pearl oysters. Very tenacious of life.

Doris grisea, Kel.

Body $1\frac{1}{2}$ inch long, gelatinous. Mantle of a dark ashy-brown colour, closely speckled with reddish-brown and white spots, and two or four longitudinal rows of larger blackish irregular spots. Tentacles clavate, laminated, ashy brown, speckled with white. Branchial plumes five, whitish, speckled with grey, tripinnate. Mouth surrounded with a white veil (?). Foot whitish, spotted with reddish brown, notched in the fore part, covered entirely by the mantle. Some specimens are more reddish-coloured than others. The young are nearly always more ashy-coloured.

A very common species, found from March to September at low-water, on rocks surrounding Fort Frederick, and also in the Inner Harbour. Lives a long time in the aquarium. Ova white, in three or four white coils. This *Doris* can elongate itself into the shape of a leech.

Doris papillosa, Kel.

Body $\frac{3}{4}$ inch long, white, brown-spotted. Mantle coriaceous, covered with large papillæ, each rising from a circular tubercular base or ring; buff, and spotted with dark reddish brown; a row of larger spots round the margin; a dark brown line runs from base of tentacles to branchiæ. Dorsal tentacles large; apex clavate, laminated, of a light green colour, speckled white. Oral tentacles short, linear. Foot whitish, and spotted with rusty brown, shorter than mantle. Branchial plumes six, short, tripinnated. Three posterior plumes rusty-coloured, anterior ones whitish.

This species resembles *Doris rufopunctata*; but its green dorsal tentacles and papillose tubercles on mantle sufficiently distinguish it from other species. Ova white, laid in four narrow waved coils.

Doris rubra, Kel.

Syn. *Doris Solea*?, Cuv.

Body $1\frac{1}{2}$ inch long, oblong, pellucid red. Mantle crimson-red, and maculated with irregularly-shaped dark brick-red or purple spots; those on the back larger. Tentacles large, clavate; apex red, laminated. Branchiæ six, of a light rose-colour, large, tripinnate; the two anterior ones smaller than the rest. Foot oblong, broad, of a pinkish-red colour, longer than mantle, rounded in front and transversely grooved; anterior lamina notched in centre. Oral tentacles linear. With mantle extended, nearly 3 inches.

This beautiful red species is found in great abundance in and out of the harbour of Trincomalee, and is generally seen on mossy rocks a few feet below the surface of the water. When confined in a glass vivarium, it becomes, nearly throughout, of a pellucid pinkish-white colour at night, which hue it retains till dawn, when it gradually assumes its brilliant-red diurnal costume. Spawns in the months of May and June; ova deposited in three or four large, white, ribbon-like convolutions.

Doris osseosa, Kel.

Body 1 inch long. Mantle hard, cartilaginous, granular and pitted; granules of a whitish colour; on the median line is a narrow ridge extending from base of tentacles to branchial plumes, which are four or five in number, emerging horizontally from under the posterior termination of dorsal ridge; in some specimens there is a large pitted protuberance on the centre of the ridge. Dorsal tentacles with large granular sheaths; apex conical, lamellated, of a pale green colour. Oral tentacles white. Foot small, narrow. Branchial plumes small, bipinnated.

This curiously formed *Doris* resembles a piece of bone, or piece of worm-eaten white stone. Its habits are those of the other *Doridæ*.

Doris Constantia, Kel.

Coriaceous. Body $\frac{3}{4}$ inch long, light yellow. Mantle yellowish brown, granular; dark-brown spots on the edge. Dorsal tentacles yellow, conical, swollen at the apex, laminated; tip produced, white. Oral tentacles small, linear. Branchial plumes whitish, five or six, small, bipinnate. Foot small, covered by the mantle. Under parts yellowish.

I have only seen one example of this species, which lived for many months in a vivarium. It came nightly to one of the oysters, and apparently fed on the back of the shells, upon the living atoms found there.

Doris luteola, Kel.

Semigelatinous. Body $\frac{3}{4}$ inch long. Mantle granular, yellowish and shaded with darker yellow. Dorsal tentacles long, black, lamellated at apex. Oral tentacles short, white. Branchial plumes long, bipinnate, greenish. Foot white, shorter than mantle.

This elegant species is found in shallow water; spawns in October. Ova light green, in two narrow tape-like convolutions.

Doris viperina, Kel.

Body 2 inches long, white. Mantle coriaceous, oval, covered with short spinous tubercles of a grey colour, and beautifully spotted with dark-grey and purplish-brown spots having a bluish shade. Under surface of mantle white, with purplish spots; a purplish line runs near the edge; border transversely streaked. Dorsal tentacles greenish-white, long, slightly truncated, with laminated clavate tips. Oral tentacles white, long, pointed. Branchial plumes six, short, broad, bipinnate, of a greenish-white colour. Foot oblong, entirely covered by the broad oval mantle; white, spotted with smaller purplish spots than those seen on the under surface of mantle.

Found in deep water, near the French Battery.

Doris atrata, Kel.

Body half an inch long and $\frac{1}{3}$ inch broad, ovate, convex, of a smoky-black colour. Mantle broad, when expanded covering the foot, smooth; edge semitransparent, the rest jet-black. Branchiæ eight, small, of a smoky-black colour, bipinnate; two sets, of four each, all entering the same cavity round the anus. Foot long, narrow, rounded in front, slightly projecting behind when in progression, of a pale smoky colour. Mouth indistinctly seen. Oral tentacles linear. Dorsal tentacles pellucid, with clavate apex, black; tips white, looking like eyes set on the tentacles. Ova white, in three or four small, narrow, tape-like coils.

This species may prove to be either identical with *Doris fumata* of Leuckart, or *D. fumosa* of Quoy et Gaim.,—the latter more probably, as the remarkable white-tipped tentacles (always present) could not have passed unobserved by Rüppell. The branchiæ, however, of *D. fumata* would appear to correspond with those of the Ceylonese species. The next species, too, which I regarded at one time as only a variety of *D. fumata*, must, I think, be considered distinct, as it was not found in April, with *D. atrata*, but subsequently, when the latter became scarce.

Doris atroviridis, Kel.

Body 10 lines long, of an invisible-green colour. Mantle broad, undulating, of a greenish-black colour; edge streaked with a pale crimson line. Tentacles and branchiæ as in *D. atrata*. Foot of a pale invisible green. Ova like those of the preceding species. Some of the specimens had the mantle indistinctly but regularly spotted with white; these spots, composed of several smaller spots round a centre, looked, through a magnifier, like little stars.

The young of this species is of a jet-black colour, with a broad brilliant crimson line round the edge of the *mantle* and *foot*. If I had not specimens of different ages to compare with, and to observe the gradual diminution of the intensity of the red line, till it became almost obsolete in the larger specimens, I should be inclined to consider the characters of the young to be those of a distinct species; so very great are the external differences of the young and older animals. The presence of the red line in the young of this species, and its non-existence in the young of *D. atrata*, still more confirm me in the opinion already advanced, that they are not identical species. Both are very sluggish in their habits; generally two or more lie locked in each other's embrace, under a stone or a coral branch. In confinement they live longer than any species I have had under observation.

Doris variabilis, Kel.

Body 6 lines long, pellucid green; the red viscera seen through it. Mantle greenish brown, and marked with longitudinal rows of reticulated whitish spots. Dorsal tentacles clavate, laminated, greenish brown, speckled; tip white. Branchial plumes eight, small, round a central cavity, tripinnate, brown, speckled with white. Foot pellucid green, shorter than mantle.

This species is found in great abundance on rocks in Dutch Bay, at low-water mark. They vary much in depth of colour, green, however, always prevailing. In habits like *D. atrata*.

Doris exanthemata, Kel.

Body 5 inches long, of a pinkish or light-purple colour. Mantle long, broad, covered with large and small, smooth, conical and rounded nodules, rising from smooth elevated bases. The upper surface is of a deep olive-brown colour, having several white splashes; edge of a lemon-colour. Under surface of mantle pinkish; and near the body there is a broad, undulating reddish band, terminating abruptly on each side below the foot, not unlike in appearance to some cutaneous disease. Dorsal tentacles long, pinkish and smooth for two-thirds of their length; apex clavate, laminated, truncated, of a pale brown colour. Oral tentacles long, conical, pinkish. Branchial plumes six, large, pendent, tripinnated; plumes pinkish red and speckled with white; midribs greenish. Foot much shorter than mantle, deeply grooved and notched in front, obtusely pointed posteriorly; of a light pink colour, except the edge, which is of a lemon-colour, with transverse striæ.

The whole animal gives one more the idea of a horrid disease than the charms of a Sea-nymph. This species is semigelatinous, and very glutinous on the surface, particularly the mantle. When dead, it rapidly dissolves, and cannot be preserved in spirits. The largest specimen I have seen measured 8 inches long and 5 inches broad. It will not live more than a few days in the aquarium. Ova of a beautiful red colour; coil $\frac{3}{4}$ inch broad and 18 inches in length. This species resembles *Doris carbunculosa*; but the smooth nodules and the red ova of the former will always be sufficient marks of distinction.

Doris carbunculosa, Kel.

Body nearly $4\frac{1}{2}$ inches long, oblong-oval, of a pinkish-purple colour. Mantle semigelatinous, broad and long, of an oval form, and purplish-brown colour, studded with numerous large warty nodules, and with larger ones rising from a raised *tubercular ringed* base: nodules of a deeper brown colour; some have also a greenish tinge, and others are variegated with white. Dorsal tentacles long, produced, clavate, truncated superiorly, laminated, of a pale purplish colour. Mouth with a small triangular-shaped veil. Branchial plumes five, large, broad and long, closely tripinnated, of a rusty-red colour grizzled with white. Foot short, oblong-oval, of a purplish-pink colour; sides of under surface veined, and of a pink colour.

The mantle of this inelegant *Doris* is not unlike some carbuncular formation. The under surface is pinkish and shaded with purple. It is a very unsightly object. The edge of the mantle of the young is mottled yellow. The whole animal is nearly 5 inches long and $3\frac{1}{2}$ broad in the centre. Ova white, deposited in a narrow tape-like form in four or five broad coils. The white ova alone sufficiently distinguish this ugly Sea-nymph from her rival, *D. exanthemata*.

Doris intecta, Kel.

Body $1\frac{1}{4}$ inch long. Mantle warty, of a dark brown colour, nearly black; on the medial line is a thick white pasty line. Dorsal tentacles brown, clavate, laminated. Oral tentacles long, linear, pointed, of a bright brown colour. Branchial plumes six, tripinnated, of a golden-brown colour. Foot golden brown, narrow, longer than mantle.

This warty *Doris* is easily distinguished from others of a brown colour by its rufous warty mantle and the dirty-white line on the back. Even the young have the white dorsal streak. Very common at low-water in the months of September and October.

Doris lanuginosa, Kel.

Body $\frac{1}{3}$ inch long, of a pale green colour. Mantle green, covered with short downy hair. Dorsal tentacles green, lamellated, pubescent. Oral tentacles not observed. Branchiæ ten or twelve, small, of a sap-green colour, bipinnated. Foot shorter than mantle, of a pale-green colour, transparent.

Of this downy species I have only seen one specimen; it lived only a few days. Found near Nicholson's Cove.

Doris spongiosa, Kel.

Semigelatinous. Body nearly $3\frac{1}{2}$ inches long. Mantle broad, oval, covering the foot in all parts, of a dull yellow-brown colour, deeply pitted; margin of pits granular, cavities spongiose. The whole upper surface of the mantle looks like the surface of some species of sponge; beneath of a darker yellow-brown colour. Dorsal tentacles large, with slightly truncated laminated apex; sheaths large, funnel-shaped, granular. Oral tentacles (?). Branchial plumes five, grey, drooping much, bipinnated. Foot broad, long.

This very curiously-formed *Doris* is found in deep water in the Inner Harbour. The young may be mistaken for a distinct species, from the lateral cavities or pits being deeper. The whole animal is nearly the size of *Doris exanthemata*.

Doris striata, Kel.

Coriaceous. Body $1\frac{1}{2}$ inch long. Mantle nearly smooth, white, with light-brown wavy streaks. Under surface white, with linear wavy streaks near the body. Dorsal tentacles with short, conical, laminated apex. Oral tentacles white, linear, pointed. Branchial plumes five or six, small, bipinnated, white streaked with brown. Foot pure white, narrow, oblong.

Found in Dutch Bay.

Doris corrugata, Kel.

Body nearly 1 inch long, oval, whitish. Mantle coriaceous, corrugated, and studded with small tubercles; those on the sides larger, and each with a spine; of a pale watery-green colour, black-spotted under surface, also greenish, and spotted with small dots. Dorsal tentacles short, open, greenish, lamellated. Branchial plumes grey, seven or eight, short, pinnated. Foot pale green, narrow, shorter than mantle. Oral tentacles short, triangular, pointed.

I have seen only one live specimen of this curious *Doris.*

Doris picta, Kel.

Coriaceous. Body $2\frac{1}{2}$ inches long. Mantle large, oval, entirely covering the foot; upper surface granular, of a yellowish-brown colour, splashed with large and small irregular brick-red spots; under surface white, and near the body painted with small and large bright-red spots. Dorsal tentacles clavate, laminated, slightly truncated; sheaths large, granular. Oral tentacles long, pointed, white, spotted with red. Foot broad, shorter than mantle, white.

This remarkably painted *Doris* is found in deep water. Occasionally it burrows in the sand, where it lies for hours, its plumes and dorsal tentacles alone being uncovered.

Doris bellicosa, Kel.

Coriaceous. Body $2\frac{1}{4}$ inches long. Mantle large, oval; upper surface granular and covered with small spines; of a dull brick-red or chocolate colour, and irregularly streaked with pale yellow; under surface of mantle white, splashed and spotted with chocolate. Branchial plumes six, large, bipinnated, of a dull rose-colour, and speckled with yellow in small specimens. Dorsal tentacles with small, clavate, pointed apex. Oral tentacles white, short, pointed. Foot broad, oval, of a dark red colour, with a pale whitish edge.

Found in deep water in the Inner Harbour of Trincomalee. The mantle of this species much resembles that of *D. picta*; but its spines and chocolate-coloured foot sufficiently distinguish it from that species, which has a white foot and beautifully painted under-side of mantle. They live for many months in a vivarium.

Doris castanea, Kel.

Carneous. Body $1\frac{1}{4}$ inch long. Mantle thick, granular and tubercular, of a reddish chestnut colour. Dorsal tentacles red, short, laminated; tip produced, whitish. Oral tentacles short, linear, pointed. Branchial plumes six (?), short, bipinnated, of a purplish colour. Under parts deep vermilion-red and speckled with darker red. Foot short, red.

Found near Sober Island, Trincomalee Harbour.

Subgenus Onchidoris.

Onchidoris Leachii, Blainv.

Carneous. Body oval, about $1\frac{1}{4}$ inch long. Mantle granular, and studded with filamentous granules; those on the posterior third of the mantle often large, and appearing like small branchial plumes. No dorsal tentacles. Two oral tentacles, which appear to protrude through notches from under the anterior edge of the mantle. The foot is broad, and occupies nearly the whole of the under part of the mantle. The anus opens on the under surface of the posterior part of the mantle. Orifice of the organs of generation on the right side.

Found on rocks in the Inner Harbour. I have scarcely any doubt that this is the *Onchidoris* described by Blainville from a specimen seen in the British Museum, whose habitat was not known.

The colour of the animal is a light grey, mottled with black spots in some specimens. In spirits, the filamentous granules are not seen; but when the animal is alive, they are distinctly apparent, and the contractile character of the filaments is very observable, especially in the larger ones.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

November 18, 1858.—Richard Owen, Esq., V.P., in the Chair.

"Further Observations on the Power exercised by the Actiniæ of our Shores in killing their prey." By R. M'Donnell, M.D. In a letter to W. Bowman, Esq., F.R.S.

In the course of last winter I had the honour, through your kindness, of making a communication to the Royal Society "On the Power exercised by the Actiniæ of our Shores in killing their prey;" allow me now, through the same medium, to correct the view which I was at that time led to adopt, that this power is due to electrical influence.

In the communication alluded to, the idea of these creatures being electrical was based on the fact, that when the nerve of a frog's limb, prepared after the manner of Matteucci's galvanoscopic frog, is seized by the tentacles of an Actinia, contractions of the muscles promptly ensue. It was admitted, however, that all attempts to produce deflection of the galvanometer-needle had failed, and this being the very doubtful state of the question, I ventured to look forward to the pleasure of making another communication on the subject when I had had further opportunities of examining the Actiniæ in health and vigour.

I have now had these opportunities, and have found that the most delicate electrometers are unaffected by these animals; and I conceive that by the following simple, and indeed obvious experiments, all idea of the Anemones of our coasts being electrical may be set aside.

A galvanoscopic frog's limb having been prepared, with the nerve as long as possible, it is laid on a piece of perfectly clear glass, so that the nerve hangs over the edge. The pendent nerve is lowered into the water containing an *Anthea,* and the nerve is brought in contact with *a single one* of the long tentacles of this creature; immediately vigorous contractions follow in the muscles of the limb; and if everything be left undisturbed, these twitchings will continue for some minutes after the nerve is withdrawn.

If, however, a thread be tied round the nerve, below the point where the tentacle of the Anthea had touched it, all twitchings at once cease. If the portion touched by the tentacle be snipped off, all twitchings also cease. Having thus repeatedly observed that contact between the nerve and a single tentacle was followed by muscular contractions, which at once ceased as soon as the portion of the nerve which had been in contact with the tentacle was removed, it occurred to me to try the effect of applying to the nerve a single tentacle removed from the body of an Anthea. I therefore had recourse to the following experiment:—The hind leg of a frog is separated from the body, the sciatic nerve dissected out carefully, so that the nerve be not crushed or injured, and the thigh cut away. The limb with the nerve thus dissected out as long as possible, is to be laid on a plate of clean glass; a silk thread is tied round the base of one of the tentacles of an Anthea, and the tentacle snipped off. The mere tentacle separated from the animal to which it belonged is drawn gently across the nerve, or laid upon it, at the upper part: immediately muscular contractions follow in the leg. These contractions cease at once if the portion of the nerve touched by the tentacle be cut off. There can, it seems, no longer be any doubt that the muscular contractions are excited, not by electricity, but by the irritant action of the urticating organs of the Anthea, which being more powerful in this respect than other Anemones, has been chosen for experiment, although other varieties give similar results.

I now see I was in error in supposing that the effect produced on the frog's limb by the Actiniæ could be transmitted along a wire. I presume that in preparing the experiment alluded to, which I performed in the open air, at the sea-side, some of the irritant materials of the Anemones, which I had possibly handled, had been brought by my fingers in contact with the nerves, and I was thus deceived.

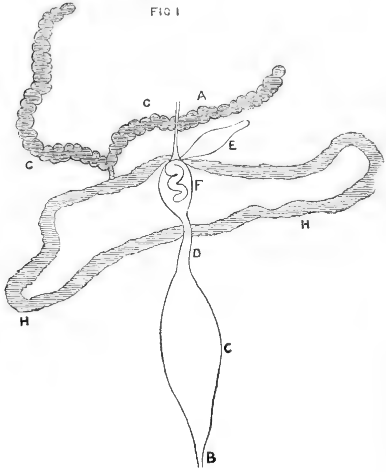
I am very happy, however, that I am myself the first to perceive and correct this error.

"On the Digestive and Nervous Systems of *Coccus hesperidum*." By John Lubbock, Esq., F.R.S., F.L.S., F.G.S.

In the early part of last spring I began to investigate the anatomy of this interesting little insect, with the intention of studying only the organs connected with the development of the ova and pseudova. It soon, however, became evident that the structure of the intestinal canal, on the one hand, had been entirely misunderstood by those who had previously examined it; and on the other, that the nervous system, far from being similar in all specimens, varied in the most extraordinary manner. It is therefore proposed in the present communication to give a very brief description of the digestive organs and of the nervous system.

Intestinal Canal.

(Magnified 30 diameters.)



Ramdohr and Leydig are the only two naturalists, so far as I know, who have published any original remarks on this subject.

Ramdohr says, "Die Speiseröhre kurz und enge. Der Magen vorn ein wenig erweitert, lang und völlig durchsichtig, so dass man die dunkeln Contenta darin sieht. . . . . Der Dunndarm ist leer, etwas weiter als der Magen, durchsichtig, bisweilen faltig. . . . Die Gallgefässe fehlen, wenigstens konnte ich nicht die geringste Spur davon entdecken." This description, however, has reference to *Chermes Alni*.

According to Leydig (Zeitschr. f. Wiss. Zool. v. tab. 1. fig. 1), the canal in *Coccus hesperidum* consists of a short œsophagus, a large stomach, and a long intestine. Into this intestine open four glands. Rather behind the middle of it are situated the two large, yellow hepatic glands, and in front of these open, on one side, a free, slightly curved cæcum, and on the other, a shorter cæcum coiled up and enclosed in a pyriform sac, which is continued into a tube, whose end is attached to the skin. This description is a singular mixture of truth and error, and Professor Leydig is so careful an observer that it was long before I could convince myself that he had made such a series of mistakes. His descriptions of the separate parts are indeed correct (though in my specimens the hepatic glands (G, G) were proportionally larger than in his figure), but he has entirely misunderstood the relations of the different organs.

The true œsophagus (fig. 1 A) is rather long and extremely narrow. It corresponds, I believe, to the tube *f* in Leydig's figure, which he considers as an appendage to the intestine. Following the œsophagus comes the pear-shaped bag (fig. 1 F), with its remarkable cellular, contorted, internal gland. Then there is a very short intestine (D, ilium) opening into the rectum (C), which Leydig has described as the stomach. The rectum is often found filled with fluid, as Leydig figures it, and varies in shape in different specimens; it contracts at its posterior end into a narrow tube, B (the œsophagus of Leydig), which opens into the vent on the upper side of the body.

At the anterior end of the pear-shaped crop or stomach are attached, besides the œsophagus, the two ends of the recurrent intestine (H), and the cæcum (E), which is generally swollen at its base, and is perhaps the equivalent of the sucking stomach.

The recurrent intestine is considered by Burmeister and Lacordaire to be part of the ventriculus, but in all insects the Malpighian vessels open into the duodenum, or, when this is wanting, into the ilium, close behind the pylorus; and as in the Homoptera they are attached to the recurrent intestine, it seems improper to consider this as part of the ventriculus. If the recurrent intestine be cut, a number of large cells, some with daughter-cells, exude from it.

According to Burmeister, the Malpighian vessels are never less than four in number; and according to Lacordaire, when there are only two, they are always attached by both ends; but in *C. hesperidum* there are but two, and they are attached only at one end.

It seems to me evident that M. Leydig must have detached the whole canal from the skin, and, in doing so, ruptured the recurrent intestine. In this case it would be very natural for him to regard the free end of the longer part as the anus. The large rectum he has evidently mistaken for the stomach, and the vent for the mouth. There would then remain the œsophagus, which he has correctly described as going to the skin.

I have repeatedly dissected out the intestinal canal without rupturing the recurrent intestine; and it may be observed that the structure of the whole digestive organs, as now described, is in accordance with that of the other Homoptera, which would not be the case if M. Leydig is correct.

M. Ramdohr examined *C. Alni,* but his description can hardly be correct, since it is scarcely possible that nearly allied species can differ so entirely in the arrangement of such important organs. Unless *Coccus Alni* does differ very much from *C. hesperidum,* he has made the same mistakes as M. Leydig, with the addition of having misunderstood or overlooked the hepatic glands, which perhaps he may have mistaken for ovaries.

The intestinal canal of *C. Persicæ* is formed on the same type as that of *C. hesperidum.*

Nervous System.

I do not propose to give a detailed account of the nervous system, and only allude to it in order to mention the great variations observed in different specimens. Figs. 2–9 represent different forms of the nervous system in *C. hesperidum,* and fig. 10 that of *C. Persicæ*: in all, the objects are magnified 60 diameters.

Leydig rightly describes the subœsophageal portion of the ganglionic column as being reduced to a large mass (fig. 2, &c. A), situated close behind the mouth. This ganglion generally emits, besides the commissure, three large nerves on each side, and its hinder extremity is continued into a still larger nervous column (C), which passes backward for rather more than ·014 of an inch without throwing off any branches. It then divides, and after a while each of the divisions again subdivides, so as to give off a rich plexus of nerves to the posterior part of the body.

The posterior pair of nerves (fig. 2, &c.) always throws off on its inner side, and not very far from its origin, a nerve (F) which I once traced and found to unite with one of the nerves derived from the main central chord. This nerve (F) is always present; but the point at which it leaves the main nerve (B) is very variable, being sometimes as much as ·014 of an inch from the subœsophageal ganglion, sometimes quite close to it. Indeed, in more than one instance it arose from the ganglion itself, and not from the nerve B (fig. 3).

In the divisions also of the central stem there are very great variations, which it would be endless to describe in detail. Perhaps the arrangement most generally met with, and that which I am inclined to regard as the type, on account of its presenting the nearest approach to symmetry, is that the main central chord separates, at about ·014 from its origin, into two equal branches, and these again, after a course of about ·01, divide dichotomously (fig. 2). In such a case the division of F from B generally takes place at a considerable distance from the ganglion.

I have, however, not met with many specimens presenting even this very limited amount of symmetry and regularity.

In fig. 4 we see the two divisions (G, G) of the central chord C divide almost immediately and yet not symmetrically. In fig. 5 the chord C divides into two unequal divisions, the smaller of which passes along for more than ·014 before it redivides, while the larger branch divides into three at a point only ·006 from its origin.

FIG. 2

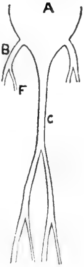


FIG. 3

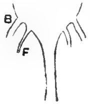


FIG. 4

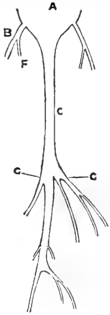


FIG. 6

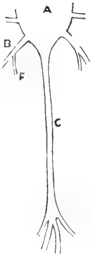


FIG. 5

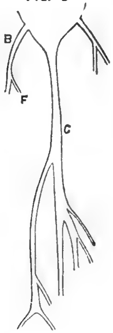


FIG. 7

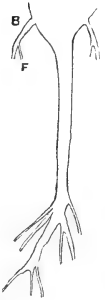


FIG. 9

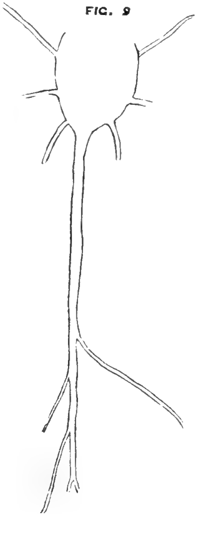


FIG. 10

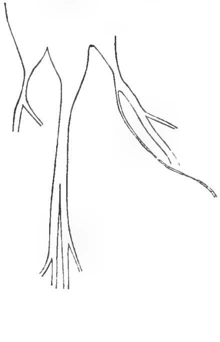
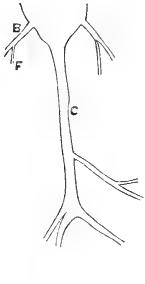


FIG. 8



In fig. 6, the central chord, just before its division into two branches, throws off on each side a small branchlet; in fig. 7 this happens only on one side. Finally, figs. 4 and 7 present us with some instances in which more than four branches are given off close to the first division of the great chord C.

But even in the case which I have above described as most typical, the symmetry is not in fact so great as it would at first sight appear to be, because the nerves on the two sides are frequently not of the same size. Thus, in fig. 2 each of the two branches of the main central stem divides, it is true, into two secondary branches, one of which is smaller than the other, but the two lesser branches are both upon the right side. If then, as is probable, we are justified in concluding that in each animal the ultimate nervous fibrils are of somewhat equal size, that they compose the greater part of the nerve, and that the corresponding organs of the two sides of the body receive an equal amount of nerves, it is evident that some of the parts which on the left side are supplied by the large outer branch must on the right side be connected with the median branch.

We see, therefore, that not only is the branching of the nerves absolutely irregular, and that of the two sides entirely unsymmetrical, but even the number of main stems proceeding from the ganglion is not always the same. This result has surprised me very much, since if any organs might have been expected to be almost invariable, I should have thought it would have been the nervous system. I believe that no parallel case has been described, nor do I even remember to have seen a description of any variation occurring in the larger nerves of any animal whatsoever. Considering, however, how great are the variations which occur here in the same species, it is evident that differences in the distribution of the nerves in nearly allied forms are in themselves no *proof* that such species were separately created.

Around the ganglionic masses are several large spherical bodies. These appear to be homologous with the "Zellenkörper," described by Leuckart as surrounding the supraœsophageal ganglion in the larva of *Melophagus*. He considers them also as homologous with similar organs which have been observed in the embryos of other insects by Heroldt and Kölliker*.

Dujardin (Ann. des Sci. Nat. 1850, 3 sér. vol. xiv. p. 202) describes the supraœsophageal ganglion of the worker-ants as consisting of several isolated parts, and I was at first inclined to consider these spherical bodies as also merely isolated parts of the ganglionic mass, in favour of which view it may be urged that fewer nerves than usual appear to proceed from this mass. The contents of the spherical bodies, however, under the influence of reagents, present an appearance different from that of the supraœsophageal mass.

The subœsophageal ganglion is very richly supplied with tracheæ, derived from two large stems which are attached to the front angles, and ramify from thence all over the mass.

* Die Fortpflanzung und Entwickelung der Pupiparen. Halle, 1858.

The supraœsophageal ganglion is a triangular mass with its apex behind: the two front corners terminate in large nerves.

The nervous system of *C. Persicæ* differs but little from that of *C. hesperidum*, and offers the same extraordinary amount of variation. The two species, however, could be at once distinguished by the superior size of the subœsophageal ganglion in *C. Persicæ*, in which species also the last pair of nerves (fig. 10) is given off more posteriorly, while both they and the central stem are considerably swollen at their origin, so as to give the hind margin of the ganglion a three-pronged outline.

ZOOLOGICAL SOCIETY.

July 27, 1858.—Dr. Gray, F.R.S., V.P., in the Chair.

On the Geographical Distribution of Reptiles. By Dr. Albert Günther.

[Concluded from p. 237.]

Part II.

On the Geographical Distribution of Batrachians.

In the accounts given of the geographical distribution of animals, we find only a few general statements in which divisions of the earth's surface are characterized for their Batrachio-fauna. The presence of tailed Batrachians in the northern parts of the globe, the scarcity of Batrachians in Africa, gigantic forms between the tropics, and the abundance of Tree-frogs in South America, form the general results of those attempts. The faunas of some provinces were most accurately composed; but I am not aware that the like has been attempted with respect to all the single parts of this suborder. The Batrachians are better adapted than Snakes to range over large spaces; and this is especially the case with some Batrachians of the northern temperate part of the globe. *Rana esculenta, Bufo vulgaris*, and *Hyla arborea* are spread over the whole space of Europe and Asia, belonging to the Palæarctic region; Cantor found them again south of Japan, on the Chinese island of Chusan. *Rana temporaria* reaches beyond even these parts, being equally spread over the temperate regions of the New World. But none of the species are to be called *cosmopolitan*; and the differences between the different creations are such, that we have not even a true *cosmopolitan genus*. In looking for genera with the widest range, we may mention *Rana, Bufo*, and *Hyla*—genera which exhibit also the widest-spread species.

Bufo is wanting only in Australia; the most numerous and largest of its species are met with in Tropical America. *Rana* is entirely wanting in Australia, and represented in the most northern parts of Tropical America by a single species only; the East Indies and Africa produce most of the species, some from the former region being distinguished by their gigantic size, but rivalled by *R. mugiens* from N. America,—some from the latter region being peculiar on account of their long and slender toes. *Hyla* is entirely wanting in the Æthiopian and Indian regions, and in the Arctic regions is represented only by a few but widely-spread species ; Tropical America and Australia, on the other hand, produce an exceedingly great number of specific forms. Therefore, in speaking of cosmopolitan genera in this paper, I mean those three genera severally with the restrictions mentioned.

Such a difference between the animal life of the New World and that of the Old, as pertains to other parts of the Animal Kingdom, is not to be observed in the Batrachians. Dissimilarity and similarity of the Batrachio-fauna depend upon the zones. Palæarctic and Nearctic regions resemble each other more than any third ; the same is the case with Australia and South America ; the Æthiopian region exhibits similarities with South America as well as with the East Indies, but more especially with the latter.

I. *Palæarctic Region.*

Characteristic forms.—*Pelodytes, Discoglossus, Alytes, Pelobates, Bombinator, Salamandra, Seiranota, Pleurodes, Bradybates, Ellipsoglossa, Geotriton, Onychodactylus, Triton, Euproctus, Sieboldia, Proteus* *.

Cosmopolitan genera excepted, we have only one genus common to another region—*Polypedates.*

We may assign to this region 15 species of tailless Batrachians and 30 of the *Urodela,* which gives on the average a single species to each 300,000 square miles. The region is distinguished by the production of a part of the tailed Batrachians, a group of the animal kingdom which must be considered peculiar to the Arctic regions both of the New and Old World †; and although the species of Urodeles of the New World must be considered as types of different genera, yet the families exhibit representatives in both the regions. Some of the species of Batrachians are known to be extremely local (*Pelodytes punctatus, Pelobates cultripes, Sieboldia, Proteus*) ; but other species and genera are spread over the whole space of this region, proving in the most striking manner the natural extent of this primary division. There is not a single tailed Batrachian known, from Tropical Africa ; but north of the Atlas we find *Salamandra maculosa* and *Pleurodes waltlii,* both inhabitants of Europe, and also a peculiar species, *Euproctus poireti.* As far as we know the western parts of Asia, belonging to this region, we meet species of Batrachians with all the characters of the true inhabitants of Europe ; and what forms we should find in the centre and in the eastern parts, with a better knowledge of these countries, is easily to be inferred by a glance at the Batrachian fauna of Japan. There we find—

Rana rugosa.	*Polypedates schlegelii.*	*Onychodactylus.*
—— *esculenta.*	*Hyla arborea.*	*Triton subcristatus.*
—— *temporaria.*	*Ellipsoglossa.*	*Sieboldia.*
Bufo vulgaris.	*Geotriton fuscus.*	

* Respecting the new denominations, I refer to my 'Catalogue of Batrachia Salientia in the Collection of the British Museum.'

† I quite agree with those naturalists who think the characters of *Cæcilia* and *Lepidosiren* sufficient for forming separate classes of *Vertebrata.*

Of the twelve species from these islands, five are identical with species in Europe, and one (*Triton subcristatus*) belongs to a European genus. Three genera of Urodeles are peculiar to Japan, *Sieboldia* being more closely allied to *Menopoma* from America than to any other genus. *Polypedates schlegelii* is a single representative of an East Indian genus, species of which, however, are also met with in Madagascar. Thus we find Japan supplied with Snakes from a tropical, and with Batrachians from an arctic region.

II. *Æthiopian Region.*

Characteristic forms.—*Dactylethra, Tomopterna, Heteroglossa, Stenorhynchus, Arthroleptis, Schismaderma, Hemisus, Breviceps, Chiromantis, Hyperolius, Leptopelis, Brachymerus.*

Forms common to other regions. — *Cystignathus, Hylarana, Polypedates.*

There are nearly 60 species known, all belonging to the *Anura*, which number would give a single species for every 200,000 square miles, or for each 70,000 square miles if we are allowed to refer the number of species only to the area of the more- or less-known parts,—a ratio which shows the great progress of our knowledge during the last few years. This region was said to be especially poor in Tree-frogs; and the reason for this was an overstated poverty of trees. The genus *Hyla* is here replaced by *Hyperolius*—as abundant in species as, or even proportionally more than *Hyla*: one species, *Hyla aubryi*, was believed to be a representative of true *Hyla*; but a closer examination has shown that even this species differs from it by having cylindrical diapophyses of the sacral vertebra, forming a separate genus, *Leptopelis*. If we add the other Æthiopian Batrachians living on trees, we find the number of the *Platydactyla* nearly one-half of that of the *Oxydactyla*—quite in accordance with the observation made on the Snakes of this region. There are so very few species of Batrachians known from Madagascar, that we are not yet enabled to compare its Batrachian fauna with that of the continent; and those few are all peculiar to this island.

III. *Indian Region.*

Characteristic forms.—*Oxyglossus, Leptobrachium, Megalophrys, Ceratophryne, Asterophrys, Uperodon, Diplopelma, Kalophrynus, Ixalus, Rhacophorus, Micrhyla, Kaloula.*

Forms common to other regions. — *Hylarana, Polypedates, Cornufer, Platymantis.*

The Indian region does not exhibit a greater abundance of Batrachians, in comparison with the Æthopian, such as we found to be the case with Snakes. The number of species is nearly the same. This is the more to be wondered at as the climate of the East Indies might be supposed to be most adequate to the life of *Anura*, and most productive of specific as well as of generic forms and of individuals. Moreover, the East Indies are comparatively well known; and the collection of the British Museum contains such a complete series of East Indian Batrachians, as considerably to increase the number of the species formerly known; nevertheless the fact appears to be, that this region is excessively productive of individuals (especially of certain species, as in Snakes), but that it is not in the same way rich in generic, and still less in specific forms. There is some resemblance in this respect to the Palæarctic region. We may state 60 as the number of species, which gives a single species to every 66,000 square miles.

All the Batrachians belong to the *Opisthoglossa*, not the half of which are *Platydactyla*. The true *Hyla* are wanting, and, as in Africa, replaced by genera without dilated processes of the sacral vertebra. Ceylon is comparatively rich in species; but as, in general, the Batrachians are adapted for spreading over a much greater space than other reptiles, we do not find so peculiar a fauna of them in this island. The following species are known to be found in Ceylon:—

Rana kuhlii.
—— *vittigera.*
—— *tigrina.*
—— *hexadactyla.*
—— *malabarica.*
Bufo melanostictus.
*—— *kelaartii.*

Ixalus variabilis.
*—— *leucorhinus.*
*—— *pœcilopleurus.*
—— *aurifasciatus.*
Polyped. microtympanum.
—— *maculatus.*
*—— *eques.*
Kaloula pulchra.

Only those species marked with an asterisk are peculiar, the others exhibiting not even remarkable varieties.

IV. *Australian Region.*

Characteristic forms.—*Myobatrachus, Limnodynastes, Chiroleptes, Heleioporus, Uperoleia, Pseudophryne, Chelydobatrachus, Litoria, Pelodryas.*

Forms common to other regions. — *Cystignathus, Hylarana, Cornufer, Platymantis.*

Of thirty species which are known to belong to this region, we have on the average a single species to each 100,000 square miles, and therefore only to each 33,000 square miles of the known part of Australia and its islands. Just the half of the species are *Opisthoglossa platydactyla.*

Australia produces one Batrachian without a tongue; and if there were known such a Batrachian from the Indian region, all the *Aglossa* would be equally distributed through the Tropical world, each part producing a peculiar type,—viz., Africa the genus *Dactylethra*, South America the genus *Pipa*, Australia that of *Myobatrachus*. Secondly, this region is distinguished by the total absence of true *Ranidæ* and *Bufonidæ*. Among other characteristic forms, *Pelodryas* especially deserves to be mentioned, representing the genus *Phyllomedusa* of the New World, but distinguished by a web between the toes. *Hylarana* extends, in one variety of *H. erythræa*, to the islands of the Pacific (S. Christoval); but the geographical distribution of this genus is far from being known. Respecting *Cystignathus*, see the notice given in the sixth Region. Finally, *Cornufer* and *Platymantis* respectively are known by two species, one of which belongs to islands of the Indian Archipelago, and the other to some of the Pacific. Thus the Bratrachio-fauna of this region, though offering well-distinguished generic forms, does not exhibit peculiar, general characters as a whole, such as we found to be the case with the Snakes. At present there is not known one Batrachian from New Zealand.

V. *Nearctic Region.*

Characteristic forms.—*Scaphiopus, Acris, Pseudacris, Notophthalmus, Taricha, Xiphonura, Ambystoma, Cylindrosoma, Desmognathus, Desmodactylus, Batrachoseps, Spelerpes, Œdipus, Ensatina, Axolotes, Protonopsis, Amphiuma, Menobranchus, Siren, Pseudobranchus.*

Forms common to other regions.—*Cystignathus, Engystoma.*

Schlegel, by trying to establish parallels between North and South America, was, I think, unfortunate in looking for respective representatives of both regions: parallels may be established between the Palæarctic and Nearctic region which are far more true and interesting.

If we allow 20 species of *Anura* and 50 of *Urodela* for this region, we have on an average one species to every 90,000 square miles, or about three species for the same area for which we found only one in the Palæarctic region. This greater abundance is due to a greater number of *Anura* as well as of *Urodela*; but if the Nearctic region has three times as many *Anura* as the Palæarctic in proportion to its area, it yet produces four times as many *Urodela*.

By repeated examinations of a great number of specimens I have convinced myself that the North American frog, called *Rana sylvatica*, does not form a distinct species from the *Rana temporaria* of the Old World. It is true that there may be found more differences than those of colour only, by examining a few specimens (for instance, in the size of tympanum); but if we look to a greater number of specimens, and compare them especially with those from the eastern parts of Asia, even those differences will be found to be levelled. Among those species which are the most common, we always find the greatest variations in form and colour. Among the European specimens themselves were found greater differences than those between European and American ones; and naturalists were induced to establish several species even for the European forms. The extremes of the variety *Rana oxyrhina* might be taken at the first glance for *Rana esculenta*; but on comparing them with other specimens of the same locality, we soon come to the point where it is impossible to decide to what form the specimen belongs. In like manner any naturalist, before whom might be placed one of the abovementioned specimens from Eastern Asia, would be at a loss to determine whether it were from the Old World or from the New. But are we at liberty to separate species or genera, only according to the soil where the beings are born, without finding sufficient external or, better, anatomical characters? As the palæontologist endeavours to show what organic forms reappear in a stratum above or below another, and where a new creation begins, so must the zoologist do in the horizontal distribution of animals on the earth's surface. Our *Rana esculenta* is represented by *Rana halecina*: specimens of the former exhibit sometimes quite the same coloration as that constantly found in *R. halecina*; but they invariably differ in the structure of the vocal organs. *Bufo vulgaris* of the Old World is represented in North America by *B. lentiginosus*, in South America by *B. chilensis*—all sufficiently distinguished by the structure of the skull. *Hyla arborea* has its representative in *H. euphorbiacea* from the table-land of Central America. Thus we find one of our most common *Anura* to be the same in the New World, and three others represented by closely allied species. Our fifth common species, *Bombinator igneus*, is a more local species, and has no representative in North America. No species of the *Urodela* is common to both regions, not even a genus; but in both we have not only such genera as are assigned by their structure either to living in water or on land, but also those intermediate forms which cannot properly be brought under either category. Among the *Urodela* with free gills or gill-openings, *Sieboldia* exhibits at least such similarities with *Menopoma*, and *Proteus* such with *Menobranchus*, that they may well be considered as representing each other in the two regions. Thus we find the Nearctic and Palæarctic regions nearer allied, in respect to their Batrachio-fauna, than they are to any other.

Cystignathus and *Engystoma* each exhibit one species in the southern parts of North America, these genera belonging, in fact, to the Tropics.

VI. *Neotropic Region.*

Characteristic forms.—*Pipa, Pseudis, Calyptocephalus, Cyclorhamphus, Pithecopsis, Limnocharis, Hylorhina, Pyxicephalus, Ceratophrys, Leiuperus, Pleurodema, Alsodes, Phryniscus, Brachycephalus, Rhinoderma, Atelopus, Engystoma, Otilophus, Elosia, Crossodactylus, Phyllobates, Hylodes, Nototrema, Opisthodelphys, Trachycephalus, Phyllomedusa, Hylaplesia, Rhinophrynus.*

Form common to other regions.—*Cystignathus.*

On the northern boundary of this region the Batrachio-fauna is mixed with Arctic forms, which is also the case as regards other members of the animal kingdom, without taking into account those animals which, living on mountains, find by this vertical elevation the condition of a more northern climate. The absence of the genus *Rana* may be pointed out as a character of this region; one species, however, which I think I have recognized as *R. Lecontii* of Girard, reaches, together with *Hyla versicolor*, into the South of Mexico, and is found in localities with *Bufo granulosus, Hylaplesia*, and *Rhinophrynus*. *Bufo chilensis* ranges along the western coasts to California. But putting aside these examples, we meet, on entering Mexico, that Batrachio-fauna by the abundance and peculiarity of which this region is widely distinguished beyond all the others. There we find the greatest number of species of *Bufo* and *Hyla*, and those peculiar tree-frogs with a pouch on the back for their progeny; and there also we meet with the single representative of the *Proteroglossa*. This region is the most productive in Batrachians, as we find the East Indies to be in Snakes. At least 110 species are known, giving one species for every 50,000 square miles, rather more than one-half of them belonging to the *Platydactyla*. South America produces one peculiar form of the Batrachians without tongue, *Pipa*—the more characteristic of this region, as it is, moreover, provided with pouches on the back, which are never met with in animals of any other part of the earth. If such a Batrachian were found in Australia (as I think will be realized), it would afford a strange point of analogy with the distribution of the Marsupial Mammals.

We find in several families genera which are distinguished by peculiar development in the structure of certain bones of the skeleton, especially of the bones of the skull: *Calyptocephalus, Ceratophrys, Cystignathus, Brachycephalus, Otilophus, Opisthodelphys, Trachycephalus*. Numerous are those forms of *Oxydactyla* as well as of *Platydactyla* which have no web between the toes, and which are in general peculiar to tropical regions. Two-thirds of the species of *Hyla* are found in Tropical America.

The genus *Cystignathus*, which I have mentioned as common to several regions, has most of its species in South America. Tschudi has separated a part of it by the name of *Pleurodema*, containing only South American species; I have done the same, uniting moreover a part of the Australian species under the name of *Limnodynastes*, whilst the other part, I find, has received a third generic name. But there remain still for *Cystignathus* South American and Æthiopian species; and these in fact, together with the separated species, form a very natural group—genus or family—which is spread over the Tropics, but not met with in the East Indies. If, on review, we ask to which of the other Tropical regions the Batrachio-fauna of South America is the most closely allied, we find that region to be Australia. Both regions agree in producing severally one Batrachian without tongue, and in producing *Cystignathidæ, Hylidæ*, and *Hylina* with paratoids, which forms are all wanting in the East Indies; they also agree in the absence of the large genus *Rana*, and of the *Polypedatidæ**. On the other hand, there is hardly one point of view in which we could find a relation between the Australian and East Indian regions; and thus the fact appears to be established, that Australia offers far more similarity, in its Batrachio-fauna to S. America than it does to the East Indies, on the western coasts as well as on the eastern, and also that the real intensity of species corresponds more with that in South America.

The West Indies exhibit a Batrachio-fauna the character of which quite agrees with that of S. America: there is, however, a greater distinction of the species, a few only being identical with those of the continent; and the genus *Hylodes* may be considered as nearly peculiar to these islands.

I now give a Schema similar to that for the Ophidians.

* There is in each region a single species; in South America *Elosia*, in New Guinea *Cornufer unicolor*.

SCHEMA BATRACHIORUM DISTRIBUTIONIS GEOGRAPHICÆ.

CREATIO NEOGEANA.	ORBIS TERRARUM.	CREATIO PALÆOGEANA.	
12,000,000 square miles, 180 species, $= \frac{1}{66,000}$.	45,000,000 square miles, 380 species, $= \frac{1}{120,000}$.	33,000,000 square miles, 200 species, $= \frac{1}{165,000}$.	

V. Regio Nearctica, 6,500,000 square miles, 70 species, $= \frac{1}{90,000}$.		I. Regio Palæarctica, 14,000,000 square miles, 45 species, $= \frac{1}{300,000}$.	
VI. Regio Neotropica, 5,500,000 square miles, 110 species, $= \frac{1}{50,000}$.	II. Regio Æthiopica, 12,000,000 square miles, 60 species, $= \frac{1}{200,000}$.	III. Regio Indica, 4,000,000 square miles, 60 species, $= \frac{1}{66,000}$.	IV. Regio Australiana, 3,000,000 square miles, 30 species, $= \frac{1}{100,000}$.

If, finally, we try to refer the number of species to the area of each region according as it is more or less known, the regions, according to their respective richness of forms, will stand thus:—

1. Australian region	=	1 : 33,000.
2. Neotropical region	=	1 : 50,000.
3. Indian region	=	1 : 66,000.
4. Æthiopian region	=	1 : 70,000.
5. Nearctic region	=	1 : 90,000.
6. Palæarctic region	=	1 : 250,000.

MISCELLANEOUS.

On the Urticating Powers of the Actiniæ *towards each other.* By William Brodrick, Esq.

The following facts may tend to illustrate the opinion held by Mr. Gosse and others, that the "acontia" or missile-filaments which so many of the Sea-anemones have the power of discharging when irritated, are truly weapons of offence, and capable of inflicting injury upon other animals,—an office which Mr. Lewes, in his 'Sea-side Studies,' altogether denied them.

A large specimen of *Sagartia Dianthus*, kept in a glass vessel together with many other Actiniæ and Madrepores, after remaining for some weeks upon an oyster-shell, relaxed its hold and sought a fresh locality. In doing this it moved against a small light-yellow variety of *S. Bellis*. At the point of contact, viz. the lower portion of the column of the *Dianthus*, numerous acontia, entirely enveloping the body of the *Bellis*, were discharged by the former animal: the *Bellis*, when removed the next day, was quite dead. On the following night the same thing occurred to a second and similar *Bellis*; and on a subsequent occasion, a *S. Troglodytes* and also a large specimen of *Caryophyllea Smithii* were destroyed in a like manner. Upon examination under a $\frac{1}{5}$th object-glass, the discharged acontia, *taken from the bodies* of the *Bellis* and Madrepore, were found to be those peculiar to *Dianthus*, containing vast numbers of the "cnidæ" from which the long wire (*ecthoræum*) is projected. The majority of these ecthoræa were somewhat altered from their usual appearance; the twisted—or, rather, waved—lower portion of the wire had a less regular form; and at the distance of about double the length of the capsule from that organ, a series of barbs were observed, varying in number from sixteen to eighteen. Not any of the shorter and more densely barbed cnidæ (somewhat similar to a bottle-brush) were visible. The *Bellis* had also discharged its acontia; these, however, were very easily recognized as distinct from those of the *Dianthus*, and did not appear to have penetrated, or in any way injured, the body of that animal. In every instance the victims sloughed away and became a mass of decomposition; though, in the case of the

Troglodytes and also of the Madrepore, there was some little vitality perceptible for two or three days in the least injured portions. Previous to the occurrence, they were all in perfect health.

Ilfracombe, March 19, 1859.

Observations on the Development and early Condition of the Pentastoma tænioides. By Professor LEUCKART, Giessen.

By a very interesting series of researches, Dr. Leuckart has been enabled to show that the *Pentastoma denticulatum* is nothing more nor less than the young condition of *P. tænioides.* The manner in which he proved this was as follows. Having obtained three apparently healthy dogs, he infected their nasal passages with some dozens of *P. denticulatum* taken from the abdominal cavity of a rabbit. On killing one of the infected dogs, at the end of six weeks, he found in its nose a few small specimens of *Pentastoma*, resembling in many respects the *P. tænioides.*

The second dog was kept alive until the end of the seventeenth week; and the result of this experiment was much more satisfactory, for no less than thirty-nine specimens of the Entozoa were found in it. The characters, too, of the specimens were so well marked, that there remained no doubt of their being *P. tænioides.* Nearly one-half were males (15–16 mm. long). The females were considerably larger than the males (26 mm.). The animals seemed to have already copulated, for the spermatheca of the females contained spermatozoa. The author thinks that at the time of impregnation the oviduct is but little developed, being in fact nothing more than a straight tube, not longer than the penis of the male. According to him, it is after copulation that the oviduct attains its enormous length.

The third dog was killed at the end of six months, and both its nose and frontal sinuses were found filled with *fully-developed Pentastoma tænioides.* Only two males were present, and these were not larger than those examined eight weeks previously. The females, on the other hand, were almost twice as long as when last seen; some of them now measured 65 mm.; their oviducts were fully grown, and contained eggs in the various stages of development.

The embryos of the *P. tænioides* have a similar form to those of the *P. proboscideum* described by Van Beneden, and have also a general resemblance to those of the *P. multicinctum* described by Harley.

Dr. Leuckart concludes from his researches that the *P. denticulatum* of the rabbit is the early condition of the *P. tænioides* of the dog, and that it takes about a year for the embryo to become transformed into the perfect animal.—*Notes from the Zeitschr. f. rat. Medic.,* Dritte R. Bd. iv. p. 78.

THE ANNALS

AND

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[THIRD SERIES.]

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XXXIII.—Robert Brown: *an Eloge*. By Dr. von Martius*.

Next to Linnæus stand three other names, ever memorable in the history of Botany—A. L. de Jussieu, A. P. DeCandolle, and Robert Brown. They inaugurated a new epoch, and smoothed its earlier course. The comprehensive genius of Linnæus had spread out the net of system over the whole world of individualized creation—established kingdoms, classes, orders, genera, and species with definite characters. A. L. de Jussieu gathered up the Vegetable Kingdom thus logically subdivided by Linnæus, and, by the synthesis of happily divined essential characters, joined its scattered members together into what is called the "Natural System." This was a glorious edifice, but incomplete—in some parts only as it were sketched out. The last sixty years have been occupied in its further elaboration; while DeCandolle extended the boundaries, R. Brown added to its depth and height.

The evolutive nature of plants turned the mind of Brown in the direction of analytical investigation; he penetrated the inmost recesses of vegetable organization, and, in its rudimentary and early conditions, seized the essence and the laws of its morphology. No one has equalled him in knowledge of the structures of the vegetable kingdom. He detected similarity when concealed, and he separated that which had merely the appearance of likeness. He sympathetically demonstrated the hidden relations between the most diversified forms. He laid a sure foundation for Phytogeography by pointing out the existence of laws in the numerical relations of plants, according to different zones and countries. He threw light from all sides upon that great domain of creation, the vegetable kingdom, so

* Translated by Arthur Henfrey, F.R.S. &c.

important to man,—even upon its now lost structures, existing in former epochs. Robert Brown was, in fullness as well as depth of knowledge, and in intellectual mastery of it, *the greatest botanist* (*Pflanzenkenner*) the world has yet produced. All his works bear the stamp of profundity and veracity. When the patriarch of German naturalists, Alex. von Humboldt, named him "*Botanicorum facile princeps*," every follower of the science joyfully and gratefully acquiesced.

The epoch of R. Brown may be termed that of botanical Peripatetics. Extensive travels were undertaken, the most distant countries and seas examined. Men botanized—investigated and reflected while they roamed. The "world of plants"—the variegated, thousand-fold transformed mantle of the earth—was brought under survey as in a bird's-eye view, and the orderly-arranged and systematized material delivered over to the inquirers of another generation—Aporetics we may term these—for the investigation of the *nature*, life, and action of *the Plant*. The activity of the former was turned to direct observation; they were what are called describing systematists. The task of the latter was to observe with all the appliances of the study and the laboratory,—to experiment, to weigh, to calculate, to drag to light the entangled laws of the seemingly, but only seemingly, simple life of plants.

Botany, as a collegiate study, had its origin in the ancient Doctrine of Simples; its cultivators were principally medical men. Such was the case in R. Brown's instance also. But, like every creative genius, he has contributed to open new paths leading out beyond those former problems. In these paths physicists and chemists dealing with vegetable physiology will penetrate the more certainly into the mysteries of vegetable life the more truly they apply and make use of the rich acquisitions of his genius.

Robert Brown was the son of the Rev. James Brown, afterwards a consecrated bishop of the Scottish episcopal church, and he first saw light at Montrose, on the 21st December, 1773. His mother's maiden name was Taylor. He received his earliest instruction in his parents' house, and the higher preparation for academic study (of which the lad himself very early made his own choice) in Marischal College, Aberdeen. In the University of that town he also commenced his medical studies, which he continued in Edinburgh, and terminated in the year 1795. He attended the lectures of Prof. Rutherford, but soon took an independent path, making it his object to investigate closely the then imperfectly known flora of his native country. In the very same year he entered a Scotch militia regiment, the Fifeshire Fencibles, as ensign and assistant-surgeon, and remained with it in Ireland until he left the military service.

An inconspicuous plant with which he there became acquainted (*Eriocaulon septangulare,* the only European representative of an especially American order) caused his life to be diverted into the exclusive service of botany; for, accompanying a recruiting party of his regiment to London in the summer of the year 1798, and visiting his friend Dr. Withering at Edgbaston, near Birmingham, on the road the latter caused him to introduce himself, with that plant and his researches upon it, to Dr. Dryander. This learned botanist, librarian to Sir Joseph Banks, astonished at the minuteness of the investigation and the fullness of the conclusions derived therefrom, recommended the young military surgeon as a future Master in Botany; and Sir Joseph Banks from this time forward showed him a paternal kindness. He welcomed him as a regular guest at the celebrated literary breakfasts, during his five months' stay in London, and in December 1800 proposed him to the Government as Naturalist to the naval Exploring Expedition to New Holland, under Capt. Flinders, then just fitting out. Robert Brown, at this call, gave up at once the military career, came again to London at Christmas, 1800, and on the 18th of July, 1801, sailed in the 'Investigator,' from Spithead, to the newly discovered quarter of the globe, whose wonders and rarities had not been exhausted by the Forsters and Sir Joseph Banks. In December the expedition reached Cape Lewin, on the S.W. point of the Australian continent. The survey was commenced at King George's Sound, and continued eastwards; on the east coast (New South Wales) the intertropical regions were especially investigated, and several islands and tracts of the Gulf of Carpentaria on the north coast. Ferdinand Bauer, the most accurate and skilful botanical painter of his time, who had passed through excellent training in Vienna with Jacquin, and in Greece (1786–7) as Sibthorp's associate, accompanied the expedition as draughtsman; Sir John Franklin, the lost Polar navigator, was one of the midshipmen. The vessel being brought to Port Jackson in July 1803, and declared no longer sea-worthy, Flinders returned home, with the results of his surveys, to obtain a new vessel. He did not reach England until long after; since, in spite of a passport from the French Government, he was kept in the Mauritius for six years as a prisoner of war. During this time, R. Brown, with Ferd. Bauer, continued the botanical investigation of New South Wales, and studied the vegetation of Kent Island in Bass's Straits, and of Van Diemen's Land, returning to England, in October 1805, with a treasure of 3900 species of plants, his manuscripts, and 1600 drawings of plants. The Linnæan Society of London appointed R. Brown its librarian; and when, in the year 1810, Dryander died, Sir Joseph Banks committed to him the charge of his private library and natural-history collections. This high-minded patron of science appreciated the genius and character of his young friend, and made a provision for him, after his own death, by means of an annuity, besides a life-interest in his collections, which were subsequently to become the property of the British Museum.

Surrounded by the most abundant literary adjuncts, Robert Brown now laboured at the remarkable flora which he had brought from the newly disclosed quarter of the globe. In the year 1810 appeared the first part of the 'Flora Novæ Hollandiæ,' a work which astonishes by the accuracy of the details, the depth of research, the unusual reach of the combinations, and the felicitous tact in the discovery of commanding points of view. Here was to be found an almost inexhaustible source of new ideas and hints for the theory of systematic characters and the affinities of plants. The natural method, which had up to that time found few adherents, gained from it a new foundation and sympathy and an exalted influence. But while scientific men called this work a *liber aureus*, and accepted it with unmixed praise, as marking a new epoch, a critic in the Edinburgh Review found fault with its latinity, and the author withdrew it from circulation*; so that its extraordinary importance was first clearly displayed on the continent through the reprint in Oken's 'Isis,' and a second edition by Nees von Esenbeck. Unhappily the work has remained unfinished; the description of new Proteaceæ alone appeared as a Supplement (1830); and Robert Brown only once more resolved upon an independent work, the 'Plantæ Javanicæ Rariores,' which he published in connexion with his friends Thomas Horsfield and John J. Bennett (1838–1852).

However, he undertook a number of monographic investigations, the results of which he published either as treatises in the Transactions of learned Societies, or as appendices to Reports of Voyages and Travels. In these he selected the most difficult subjects. The materials—frequently in a very fragmentary condition—from the least accessible parts of tropical Africa, could only have been made so important and fruitful by a genius like Robert Brown. The influence of these works upon the progress of botanical science in all its branches has been extraordinary.

* [The statement here repeated by our excellent author, although frequently made during Mr. Brown's life, and vouched for by high authority, is, we have reason to believe, founded in error. The original edition of the 'Prodromus' remained for many years in the hands of the publishers; and the remaining copies were at last withdrawn from sale only because Mr. Brown was desirous of keeping them in reserve to be given as presents to those botanists to whom he thought they might be most useful.—A. H.]

The morphology, development, geography, statistics, and the history both of living and extinct plants, were enriched by numberless facts and by conclusions of canonic authority. The surest proof of the truth of these is found in the fact that the minds of botanists have become so imbued with them, that, in continuing such researches, we do not recur in detail to them and their derivation, but use them like self-evident propositions.

Not one of those essential parts of the plant, on whose manifold forms and combinations depends the glorious wealth of the vegetable kingdom, was passed over by the searching eye of Robert Brown. From the microscopic germ of the Moss and the vegetable ovule, to the flower—from the stamen and its pollen to the carpel and the fruit, he examined and compared all the organs, in plants of the most diverse orders and in all stages of development. Governed by the deepest sense of natural truth and natural relations, he established the soundest views upon the nature and developmental history of these organs. Thus he vastly contributed to the consolidation of that theory (morphology) which gives to systematic botany its true claim to rank among the sciences.

In these morphological researches of Robert Brown, there was a peculiar affinity to the spirit of the Germans. This is a deep-rooted cause of the powerful influence which he has exerted upon botany in our country. While—nay, before the morphological ideas called into life by Goethe's 'Metamorphosis of Plants' had spread among us, and, developed by such men as Nees v. Esenbeck, Röper, Ernst Meyer, Link, Alex. Braun, and many others, had passed into the schools,—Robert Brown, in far New Holland, carried forward by countless observations, had already arrived, as it were unconsciously, at similar views, which may be traced like a red thread running through all his determinations.

A more superficial reason why R. Brown's doctrines fell upon grateful soil in Germany, lay in the diffusion of his writings in a German translation (1825–1834), by which Nees von Esenbeck earned great credit. [A few later treatises, not included in this collection, have been introduced into German literature, principally by Schnizlein, in the 'Flora.']

In his earliest writings, Robert Brown had drawn attention to the importance of the early conditions and the development, in reference to the characterization of the Orders of Plants and the elaboration of the Natural System. In following out this path, and particularly in making a penetrating inquiry into the phænomena in the vegetable ovule and in the pollen, he contributed in an important degree to clear up the previously obscure theory of the reproductive organs of plants. After Amici (1823) had discovered the tubular elongation of the pollen-grain, Robert Brown (1831–1833) raised the physiological import of the pollen-tube to the rank of a certainty, by demonstrating that it penetrated through the canal of the style into the cavity of the ovary, down to the nucleus of the then open ovule. This fact, the high importance of which was acknowledged by the Royal Society of London by the award of the Copley medal, inaugurated a new phase in our views of the sexes and sexual functions in plants. It may be called the pole round which turn a series of the most celebrated researches of modern botany. These refined researches, only possible with the assistance of the wonderful improvements of the microscope, have strongly excited the minds of our epoch. It suffices to recall the great number—there are more than thirty—of those who have with more or less profit pursued researches in the same path, to indicate how universally the bearing of this investigation has been recognized. These researches have been extended beyond their original goal—the impregnation of Angiospermous plants—to include the Cryptogamia in their sphere, and have in many points enlarged the field of view in the allied region of the animal kingdom. They already reveal deeply-seated relations of living things in those mysterious grades of creation, which were scarcely dreamt of less than half a century ago. Not without a sense of joy and reverence do we look upon these researches, in which truth and error are interwoven; but truth, ever victorious at last, and securing to us a higher knowledge, becomes the common property of all.

Even before these results had been worked out through so many great difficulties, Robert Brown's advancement of the higher systematic botany had been fully appreciated. This, the organic coordination of the vegetable kingdom, acquired at his hands abundance of new facts and important fundamental principles. Indeed we may say that the 'Natural System' first became natural by his labours. No other botanist possessed so rich an experience of the most multiform structures of plants, which he could apply under such sound morphological ideas towards the erection of the Natural System. Hence any one comparing the renowned fundamental work of A. L. de Jussieu with recent systematic writings, must be astonished by the numerous and radical alterations and improvements which he everywhere finds stamped with the name of Robert Brown. The comprehensive works of DeCandolle and Meisner also remind us, on nearly every page, of the fertile activity of the great master. In England, the two Hookers, Lindley (whose meritorious labours have in so important a degree cooperated in the diffusion of the natural method), Robert Wight, Wallich, and others, have borne testimony to the efforts of their friend and countryman. In North America, the valuable writings of Asa Gray and Torrey were heralds of his fame.

It would be a grateful task to trace the course of all these morphological, physiological, and systematic labours in their details, to show where they took their rise, where they ended, and how, in their passage into the common stock of knowledge, they have rarely been combated by other men of science, but for the most part adopted, continued, and expanded; but this is not the place for such a fragment of the practical history of Botany.

The writings of Robert Brown, as correctly remarked by an English botanist following close in his footsteps, John J. Bennett, are *conciones ad clerum*; they deal with the most profound and important principles of the laws of form and development,—problems which, in part proposed by himself, are brought out into the fullest light, to undergo the scrutiny of every doubt and every scientific objection. It is significant, that the most important of them were satisfactorily solved in his epoch, during his eighty-five years' life.

Where he was not bound, as in descriptive works, to a rigid systematic style, he ran into a discursive manner, which renders his works difficult of study by the uninitiated, but exerts a peculiar charm over the instructed mind. To his rich and mobile genius every striking fact suggested a crowd of others, often from the most remote fields—sometimes as contradictions and objections, sometimes confirming, illustrating, or expanding it; so that he transports the initiated reader as it were into the great garden of Nature, and leads him at once from flower to flower and from truth to truth. Hence, in reading, as a classic, to our advanced pupils many of his treatises overflowing with general ideas (for instance, on the Compositæ, the plants of tropical Africa, or on *Kingia*), explaining and illustrating them by demonstrations, we have partaken of the full youthful transport of intellectual voyages of discovery.

But I must not prolong these reflections on the scientific aspect of this extraordinary man, since the fairest and most glorious aspect—his moral nature—remains to be sketched. Robert Brown united *all the moral qualities which belong to the searcher of Nature,* of so pure and strong a quality, that his personal character renders him an exemplar beyond the mere circle of his contemporaries. He was more than a modern naturalist. In the full harmony of his nature, he impressed us with the image of an ancient philosopher and sage. Robert Brown was a truly great and good man. Love of truth above all things, calmness, sincerity, modesty, tender sensibility, and goodness of heart—these features of his character stood constantly under the government of a penetrating and massive judgment. So energetically did these characteristics regulate his activity as inquirer and author, that we may affirm that every act of his investigations and every assertion in his writings bear the stamp of this perfectly balanced character.

It is indeed often the case that an extraordinary intellect rests, like a column, upon a slender moral foundation; but Robert Brown's rose, like a pyramid, from a broad and strong base. In recognition of this worthy combination, all naturalists offered to his intellect admiration—to his character reverence and love.

The deepest principle in the nature of this gifted man was the *love of truth.* No sympathy could, even for a moment, overcome this love. The sense of truth was as it were the medium of his peace of mind. Hence arose that quiet calmness, that tranquillity and circumspection in his researches, and that reserve which was even interpreted by the ignorant as artifice or egotism. He knew far more than he ventured to say; yet from no one oftener fell the words "I do not know." Much that is clear to superficial and more easily satisfied minds, appeared to his deeply-penetrating gaze still full of unresolved problems; but where he was certain of his matter, his pleasure in imparting it increased with the difficulty of the subject.

It has been objected to his writings that they are obscure. Passages which have drawn down this reproof may rather be indicated as expressions of that caution and conscientiousness which dreads to give occasion to misconception or error. And it would be difficult to find a botanist to whom it has so rarely happened to retract or correct his assertions; very frequently, indeed, he strengthens his later views by reference to his earlier publications.

He was more sensitive to scientific and literary censure than to praise and acknowledgment,—and this not all from pride, but on account of his instinctive love of truth. What he dreaded was not his own mistakes, but the reproach that he had not been sufficiently cautious and conscientious in the inquiry. This moral earnestness armed him in the defence of what he believed to be correct. There only was he seen moved from his tranquillity where injustice or intentional error was to be combated. His indignation was aroused, not by human weakness but by perversity. He was the soul of honour—hence accustomed to expose knavery and low-mindedness, and to judge it inexorably. No one held more firmly his own intellectual property; but no one more strictly respected that of others. Reputation not based on genuine desert he lightly esteemed; but it was a matter of conscience with him to bring forward neglected merit. The praiseworthy he praised in plain words; but to admire mediocrity, to gather a band of hangers-on about him, he shrank from as a treason to the truth and worth of a votary of science. Truly, if all naturalists were endowed with the same moral force, the path of science would be smoother and less tortuous.

Robert Brown reverenced every created thing; he had deep sympathy with all suffering, in whatever stage of creation it occurred. He doubted whether man is justified in inflicting physical pain in that sphere where it is the greatest evil, even for the sake of truth. The higher privilege of man, he thought, was rather to mitigate the pains of body and mind. He possessed the moral courage energetically to succour his suffering fellows. He has been known to carry help and comfort to the beds of the sick and dying, for months together, even under great hardships. To friends in difficulty he proved himself the most considerate counsellor and helper, capable of any sacrifice.

In this kind of self-devotion lay his greatest strength. Robert Brown was no man of business or energetic office-bearer; he had neither taste nor skill for administrative work; even from the business of correspondence he, like the great mineralogist, Abraham Werner, shrank into an indolence which he himself sometimes ridiculed and sometimes lamented. His field was that kind of observation which Herschel has called 'passive.' To examine the object as deeply and completely as possible—to study, reflect, and contemplate, in the most complete abstraction from the every-day world—in this he recognized his destination. He was unmarried—the last of his family—and so he sat whole nights in his arm-chair, reading and thinking. In this seclusion he took the most lively interest in every movement of science and literature. No important publication, either in French or English literature, was neglected by him. Frequent was the surprise excited by the fineness and penetration of his judgment on subjects scarcely imagined to be accessible to him. In his remarkably powerful memory were stored up thousands of anecdotes. In regard to the history of English literature, he might have been termed a living edition of D'Israeli's 'Curiosities of Literature.' He talked on most subjects—rarely, however, on politics, never on religion. He was a great narrator, with a fund of engaging humour; and he could listen, which he did with half-closed eyes, in quiet sympathetic enjoyment.

It has been thought strange that a man of such extraordinary scientific importance, to whom was offered the homage of the whole world (he was one of the eight Associates of the French Institute, received the honorary diploma of a Doctor of Laws from the University of Oxford in 1832, and, at Humboldt's suggestion, received the Order of Merit from King Frederick

William IV. of Prussia), played no prominent part in public life, in the brilliant society of London. Some have thought this caused by neglect: quite erroneously; for he refused invitations to the Botanical Chairs of the Universities of Aberdeen, Edinburgh, and Glasgow, the last in favour of his friend Sir W. J. Hooker; and his Sovereign conferred on him a pension for scientific merit, during the ministry of Sir Robert Peel.

Without inclination or vocation for the elementary exposition of his science—unsusceptible, not indeed to the higher fame, but to the allurements of popularity or the glitter of a public position—he chose the quiet, unostentatious path of life. "He always moved," so says one of his oldest friends, "between two vertical lines, which kept him separated from the great world,—between an unexampled modesty and the most acute sympathy for the sufferings of others; thus he appeared to me, not to speak of his high intellectual endowments, the most remarkable man I have ever known." Frugal, and content with the familiar intercourse of a few true friends, he passed his life in the unpretending circumstances in which he had been left by his patron Sir Joseph Banks. He made over to the British Museum in 1827 the collections in which he had received a life-interest, and he officiated as their Keeper after he ceased to be Librarian to the Linnæan Society. He became a Fellow of the Royal Society as long ago as 1810; of the Linnæan Society in 1822; he entered its Council in 1823; in 1828 he was named Vice-President, and in 1849 was called to the Presidency as successor to the Bishop of Norwich, which post he resigned, on account of his advanced age, in 1853.

The most distinguished botanists of Great Britain were ever flocking to Robert Brown, glad to listen to his views and to obtain his counsel. In his numerous journeys in France, Germany, Italy, and the North, he had made friends with many of his continental *collaborateurs*. From this literary intercourse, from the stores of the rarest objects of living and extinct vegetation which flowed to the renowned inquirer dwelling in the great centre of civilized life, and from the comprehensive study of all important publications, he continually drew new draughts of knowledge, and, with a rare power of memory, remained master of it to the end.

His death, then, could not but overcome every botanist with the sorrowful thought that the most noble and blameless representative of their science had departed,—that the focus of a fruitful epoch was extinguished.

The physical frame of this extraordinary man had the Anglo-Saxon type strongly expressed. His imposing form was tall and slender, his step firm and quick; and he stooped only at a very advanced age. Up to his latest years Robert Brown enjoyed unusual activity, and that wonderfully acute sight which formed part of his nature. He died on the 10th of June, 1858, in the full possession of an unclouded intellect, in the calm serenity of those happy ones whom we may even here account among the immortal. On the 15th of June his remains were consigned to the earth, surrounded by Australian flowers, at Kensal Green Cemetery, where his friends and colleagues, Charles König, David Don, Menzies, and Wallich, were at rest. The marble-like bust of the departed displayed to his friends once more (so writes one of the oldest of them), refined to a surprising beauty, in his delicately but strongly marked features, the exalted image of a profoundly inquiring spirit tranquilly reposing. "He died," so continues Dr. Boott, "in the quiet scene of his long and celebrated labours, where the library of Sir Joseph Banks formerly lined the walls. Forty years ago I had first become acquainted with him in that very place; and ever had he remained the same true, plain, sincere, gentle, good-hearted man. The only change was that which Time works in us all."

XXXIV.—*On the Identity in Structure and Composition of the so-called Seed-like Body of* Spongilla *with the Winter-egg of the* Bryozoa; *and the presence of Starch-granules in each.* By H. J. Carter, Esq., Bombay.

[With a Plate.]

Ever since the Spongiadæ have been studied, it has been a desideratum to find out something directly connecting them with either one or the other of the great organic kingdoms; and latterly, since they have been proved, by their resemblances, habits, and composition, to belong to the animal kingdom, the great object has been to find out something in them directly connective with one of its lower types; for until this be done, zoologists will continue to look upon them strangely, and botanists will of course have nothing to do with them whatever. Moreover, until a homological leading-point with animals be established in them, the nomenclature that should be adopted for their component parts cannot be chosen, since in many of these they resemble plants and animals respectively so much, that it is difficult to decide whether the part should be named according to the nomenclature of one or the other. Thus the reproductive bodies have been called by some "ovules," by others "sporidia," "sporangia;" and a third class, to avoid falling into either mistake, have called them "capsules," "spherulæ," "seed-like bodies," &c. The latter term I myself have chiefly used; but within the last three months I have considered them more particularly like sporangia, and hence have suggested this as more suitable for them*. They have also been compared by some to the "winter-eggs" of Polypes; and this indeed was the most fortunate conjecture of all, for, as will presently be seen, they are almost identical with them in every respect. Before, however, entering upon the comparative descriptions of these bodies in *Spongilla* and the freshwater Bryozoa, it is desirable that I should briefly describe the structure of *Spongilla* itself, that the reader may know exactly what is now presented for his information.

To obtain an idea of the structure of *Spongilla*, we have only to conceive a branch of canals to which are attached a number of spherical bodies like a bunch of grapes, and this branch, &c., imbedded in a gelatinous mass charged with spicules and permeated in all directions with another class of canals opening on the surface of the gelatinous mass by numerous holes, into the internal parts of which dip the spherical bodies. We have now to enclose all this, except the end of the branch, within a delicate soft membrane, like a bag or veil, perforated with apertures, and kept at a distance from the gelatinous mass, &c., by bundles of spicules projecting from the latter. Add to this a rush of the water (in which the *Spongilla* may be growing), with any nutritive particles that may be suspended in it, in through the apertures of the enclosing membrane; then into the canals of the gelatinous mass; then the particles being caught up by the spherical bodies, which are respectively covered with a cortical layer of monociliated and unciliated polymorphic cells for this purpose; then the nutritive particles undergoing digestion in these polymorphic cells, as in *Amœbæ*; and, finally, the ingesta in like manner discharged into the branch of canals to which the spherical bodies are attached;—and we have the type of *Spongilla*, that is, the first portion of *Spongilla* which grows from the "seed-like body." Afterwards, when the *Spongilla* has attained a larger size, it consists of a number of such typical portions agglomerated undistinguishably and inseparably into an amorphous mass; hence it is only when the *Spongilla* is first grown from the seed-like body, or probably from the ciliated gemmule, that it can well be studied elementarily†.

It may now be asked, What are these spherical bodies? Are they each animals of the *Spongilla*, and analogous to the polypes of a polypidom; or is this typical portion to be considered a single animal, and the spherical bodies as the digesting organs situated in the cavities of the gelatinous mass, as a stomach,

* Annals, vol. iii. p. 13, 1859.

† For a more detailed description of *Spongilla*, see 'Annals,' vol. xx. p. 21, 1857.

with the branch of canals as a vent? It is to this that we shall direct our attention more particularly hereafter.

Meanwhile, when the portion of *Spongilla* has much increased in size, the older portions begin to bear the reproductive bodies to which I have alluded; and this brings us at once to the subject of my communication.

The reproductive bodies of *Spongilla* are of two kinds, viz. the seed-like bodies, which I shall henceforth term "ova," and ciliated gemmules; but it is the former, viz. the "ova," with which we are most concerned now, and to the structure and composition of which we are about to direct our attention, in comparison with the "winter-egg" of the Bryozoa.

Nothing characterizes the species of the amorphous *Spongillæ* so well as the form and surrounding spicules of the seed-like body or ovum; and it was during my examination of one of them for this purpose, that I perceived the identity with the "winter-egg" of the Bryozoa to which I have alluded. The species to which this ovum belonged, I, in 1848, provisionally termed "*Spongilla friabilis* *;" but on a set of specimens (which I had sent home) reaching Mr. Bowerbank, he observed that this was different from *S. friabilis*, and referred the question to me, in 1854, with both the branched and amorphous species of England,—kindly proposing, in the event of my being of the same opinion as himself, to do me the honour of calling the Bombay species after me. At the time, however, I was much occupied in official duties, and I could only just examine these species cursorily, but sufficiently for me to come to the same opinion as Mr. Bowerbank; and having replied to him accordingly, I felt quite content to leave the question for ultimate decision in his hands, knowing them to be much abler in these matters than my own; and since then, up to the time of my writing this, I have heard nothing further from him on this particular subject, nor have I recurred to it myself.

During the last month, however, I have taken up the two English specimens and the Bombay species for more careful comparison, and find not only that all three are different (which no doubt Mr. Bowerbank will notice in his forthcoming work on the "Spongiadæ"), but that the seed-like body of the Bombay species is so identical in structure and composition with the "winter-egg" of a Bryozoon (*Lophopus*) which abounds in the same freshwater tank with it, that the leading homology between some part of *Spongilla* and of the lower Invertebrata, for which I have been so long seeking, is thus established. It is also worthy of prefatory remark, that, in the month of May last, I found

* Annals, vol. iv., 1849.

Plumatella repens, Van Ben.*, growing on a floating cork in the midst of *Spongilla cinerea* and *S. Meyeni,* which were spreading themselves over the same body; and in the tank where now the *Lophopus* abounds, *Spongilla Carteri* (for such I shall henceforth term this species, in accordance with Mr. Bowerbank's proposition) is also growing in the greatest profusion, almost to the total exclusion of all the other species. Let us now proceed to the description of the ovum and winter-egg of these organisms respectively, commencing with the former.

Ovum of Spongilla Carteri. Pl. VIII. figs. 1–7.

Matured form spherical, presenting a round infundibuliform hilum or hole leading into the interior, to which in many instances the remains of a funiculus may be seen to be attached. composed from without inwards of—1st, a coating of loose, smooth, slightly curved, pointed, silicious spicula; 2nd, a cellular coat, spherical, of equal thickness all round, except where pierced by the hilum, consisting of thin horny cells arranged in hexagonal columns in contact with each other on all sides, and perpendicular to the surface of (3rd) a coriaceous coat, spherical, thick, tough, horny, of a yellow colour, which encloses a great number of spherical transparent cells partially filled with refractive granules, among which are starch-grains.

When the ovum is crushed, the spherical transparent cells, which are very thin, burst by watery endosmose; and then their granular contents are seen to consist of a number of transparent, refractive, compressed, lenticular cells, which vary in size from 2-5400ths of an inch, which is the long diameter of the largest, to immeasurable minuteness; while the latter, for a considerable time after issuing, keep up a continued vibratory motion (like the recently ejected mucus-granules of living cells generally) around the former, which remain stationary. The larger granules or cells also frequently present one and sometimes two smaller ones attached to them, indicative of their multiplication being produced by budding.

On the other hand, the starch-grains, which resemble those of wheat, being subelliptical, compressed, thin, and marked with concentric circular lines, vary in number and size, being frequently much larger than the spherical cells in which they are originally formed, and from this passing down to immeasurable minuteness, and occasionally into amorphous starch. Sometimes a large starch-grain may be seen still within the spherical cell

* *P. stricta,* Allman, 'Freshwater Polyzoa,' p. 99, Ray Society's Publications.

in which it was formed, when the latter much exceeds the average size of these cells, and the starch-grain appears to be developed at the expense of the refractive granules, which at such times are considerably reduced in number, if not in some cases altogether absent. On other occasions the large grain is replaced by a great number of minute ones, as indicated by the application of iodine, and lastly, as just stated, by amorphous starch.

At an early period of the ovum (that is, long before the cellular coat is formed), the spherical cells, though already filled with the refractive granules, are few in number and subpolymorphic; hence it may be reasonably inferred that their multiplication as the ovum increases in size is produced by fission: the younger the ovum, the more polymorphic and resistent are these cells, while the older it becomes, the more they are attenuated, and thus the more rapidly they burst by endosmose after liberation.

Winter-egg of Lophopus —— ? Pl. VIII. figs. 8–15.

Matured form compressed, oval, slightly bent upon itself both transversely and longitudinally like the brim of a hat, convex and elliptical in the centre, but more so on one side than the other, thinning all round towards the margin, which is slightly irregular and bordered at the ends *only* by cirrhous appendages. Composed from without inwards of—1st, the cirrhous appendages; 2nd, a cellular coat, flat, unequal in thickness, consisting of thin horny cells arranged in long or short hexangular prisms according to their position, in lateral contact with each other on all sides, and perpendicular to the surface of (3rd) a coriaceous coat, subelliptical, and surrounded subequatorially by a thin rim of the same substance, which is extended to the margin of the egg all round, and thus divides the cellular coat horizontally into two parts, enclosing a great number of spherical transparent cells filled with minute refractive granules, among which are starch-grains.

When the "winter-egg" is crushed, the spherical transparent cells, which are very thin, burst by watery endosmose; and then their contents are seen to consist of refractive granules, apparently of an elongated elliptical form, which vary in size from 1-21600th of an inch, which is the length of the largest, to immeasurable minuteness, and all present, on issuing, the vibratory motion noticed in the minute granules of the spherical cells of *Spongilla*, to which I have already alluded; but even the largest of these granules are too small for me to state whether, like the larger refractive granules of *Spongilla*, they also present the appearance of budding.

As regards the starch-grains and the multiplication of the spherical cells, the same remarks that I have made with reference to these points in the ovum of *Spongilla* are equally applicable here, so I need not repeat them; but whether the spherical cells, like those of *Spongilla*, possess subpolymorphism at an early period, or not, I am ignorant: undoubtedly their coats are more resistent when young than after the "egg" is matured; for they are hardly to be seen on crushing the latter, while they remain for some time entire after similar liberation from the young "egg." The starch-grains are more or less present at all periods in which I have examined these bodies.

Besides the proper coats of the winter-egg of *Lophopus*, there is a transparent ciliated one, which bears cells containing yellow matter; and it is through this that it remains attached to the "funiculus" until matured, when it becomes deciduous. By "funiculus" here, I mean the cord-like appendage on which those eggs as well as the spermatozoa are developed, and which extends from the end of the stomach to some point of fixation on the inner aspect of the tunic.

Observations.—Having thus described the ovum of *Spongilla Carteri* and the winter-egg of *Lophopus* ——?, it now only remains to compare them; and in doing this we observe that almost the only points of difference are in form and size. There is certainly no hilum in the matured winter-egg of the Bryozoon that I can discover: nor is this needed; for the issue of its contents under development are provided for in another way, viz. by its separation into halves through the horizontal plane which is formed by the extension of the coriaceous coat equatorially to the margin of the "egg." Again, in the cellular coat the only difference is, that in the ovum of *Spongilla* the hexagonal columns are composed of several cells, while in the winter-egg of the Bryozoon they are composed only of one elongated cell each; there is also a slight difference in the appearance of the terminations of these columns on the surface (as may be seen by a reference to figs. 2 and 9), but otherwise not in form, size, or general regularity. Much difference, however, in size exists in the spherical transparent cells of the interior, and in the size of their contained refractive granules, which are by far the largest in *Spongilla*: but this appears to be the only difference; in both organisms they are refractive, and, under iodine, assume no other than a light-yellow tinge.

Thus the cirrhous appendages may be compared to the coating of small spicula; the cellular coats are essentially the same; the coriaceous coats the same; and the spherical transparent cells of the interior, with their refractive granules and starch-grains, apparently the same.

I have not been able to detect a ciliated envelope on the ovum of *Spongilla*; but it is very probable, from the ciliated character of this organism generally, that there may be one here also in the early part of its development; while the first appearance of the ovum itself, as a white point consisting of a transparent capsule filled with a few spherical transparent cells charged with refractive granules, and its subsequent development in all stages, so correspond with those of the winter-egg of the Bryozoon, that the most scrupulous observer can hardly object to their being considered essentially homologues.

Thus we are now enabled to see the resemblance of the structure surrounding the ova of *Spongilla Meyeni* and *S. plumosa* (which I have long since shown to consist of an incrustation or coat of amorphous matter, and short straight amphidisk-spicules arranged vertically on the coriaceous coat*) to the cellular coat of the winter-egg of the Bryozoa.

We have yet, however, to compare the development of *Spongilla* and *Lophopus* as they issue from these ova respectively; and this brings us back to the consideration of the question whether the piece of *Spongilla*, as I have described it, and as it always appears after exit from the ovum of *Spongilla*, is to be regarded as a congeries of animals or a single one. If we wish for an instance of a plurality of individuals in an allied organism being developed from a single ovum at once, we have it in the three which issue at once from the winter-egg of *Lophopus crystallinus*, which are contained under the same tunic or in the same pouch†; if where the ovum sends forth six or seven embryos at the same time, but separate, we have it in the egg of *Nais filiformis*, &c. If, on the other hand, we are to regard these as so many buds on a common stock, or flowers on a plant, then must we regard the typical portion of *Spongilla* described, as a single animal. The real nature or homology of the spherical bodies attached to the branch of efferent canals, however, not being yet established, it would be useless now to carry this comparison further.

Of what import are the refractive granules in the spherical transparent cells of the ovum of *Spongilla* and the winter-egg of the Bryozoa, is another interesting question. Undoubtedly the former with their budding closely resemble the refractive yelk-granules of *Nais fusca*‡, while they are equally like the refractive cells and granules of the *Euglenæ*§, and also those of the resting-

* Annals, vol. iv. pl. 3. fig. 6, 1849.

† Dumortier and Van Beneden, *op. cit.* pl. 6. fig. 24.

‡ Annals, vol. ii. p. 13, pl. 3. fig. 51, 1858.

§ Annals, vol. xvii. pl. 9. fig. 11; vol. xviii. pl. 6. fig. 56; and vol. xx. pl. 1. fig. 16.

spore of *Œdogonium*. Again, all these cells present the same brown-yellow tinge on the application of iodine, except those of *Œdogonium*, which generally, though not when newly developed, become violet and almost blue.

Now there can be no doubt that those of *Spongilla*, when forcibly ejected into distilled water, in a convenient vessel, where all precaution possible has been taken to keep out other foreign matter, gradually disappear, and are followed, about the fifth day, by a number of monociliated and unciliated proteiform cells; while, on the other hand, the same refractive cells issuing from the ovum in the natural way, disappear after the same number of days, and are followed, in the mass of young *Spongilla*, by the presence of exactly the same kind of monociliated and unciliated proteiform cells; lastly, if the issue of the sponge-substance from the ovum be watched, the larger refractive granules will be seen to make their appearance in the amorphous gelatinous mass, for the most part in groups, indicative of these groups being still in the spherical transparent cells, and thus remaining so, appear to become developed, *pari passu* with the other parts of the mass, into the spherical bodies which I have before stated to be attached to the branch of efferent canals, and to be covered cortically with small monociliated and unciliated proteiform cells; so that altogether it at first appears as if some at least of these refractive granules did really pass directly into proteiform cells; and such has heretofore been my opinion; but since I have seen the globules of oil in a blighted spore of *Spirogyra* apparently become covered with, and subsequently give way to the vital influence of, an inconceivably thin film of protoplasm, and thus ultimately become transformed into a litter of polymorphic monads, it certainly has struck me that the refractive cells of *Spongilla* may also be oleaginous in their contents, and might thus become transformed into the young proteiform cells. If so, then the identity of these refractive cells with the refractive cells of the resting-spore of *Œdogonium*, although the latter are amylaceous, is explicable by the fact that during the development of polymorphic monads by another way from the cell-contents of *Spirogyra*, which I have some time since described*, the starch itself frequently passes first into a refractive substance like oil, and then becomes assimilated into the protoplasm of the monads,—while in the spores of the Algæ (*Œdogonium* among the rest), where there are drops of oil as well as starch-granules, the latter may be transformed into protoplasm in the same or another way; but this does not matter here, as both pass into protoplasm in the development of the new plant, and thus lead to the inference that the material of

* Annals, vol. xix. p. 262, 1857.

the refractive granules of the ovum of *Spongilla* is only another form of aliment instead of starch, which, under the vitali-catalytic influence of a thin film of protoplasm, passes into a like material endowed with a specific form and peculiar properties. Such, *en passant* (for this is not the place to go deeply into the subject), is the theoretical view that I am now inclined to take of the import of these refractive granules in development, viz. that they become assimilated by amœbous films of protoplasm spreading over them, and thus pass into the monociliated and unciliated proteiform cells.

The fact of the monociliated and unciliated cells being produced from the contents of the ovum of *Spongilla* when they are forcibly ejected as well as when they issue in the natural way (that is, under development), is also corroborative of the view that not only the polymorphic contents of the cells of the Algæ, but (as I have shown) those also of the egg of *Nais**, do take on these forms of themselves under certain circumstances—when the specific figurating power which held the protoplasm together in its proper course appears to be arrested, and not from the presence of the germs of any foreign organism, as some of the German algologists affirm, from which I am glad to find Prof. Henfrey at least withholding his concurrence†. The moving protoplasm of the internode of *Nitella* is chiefly composed of delicate polymorphic cells, which, the moment the green layer is broken up by a transverse section of the tube, seize and enclose some of the cells of this layer as the whole of the contents are issuing together into the water; and it is when the green discoid cells are in the protoplasm of the interior of the polymorphic cells that they sometimes exhibit the rapid rotatory motion first noticed by Donné ‡, and which appears to be produced by this protoplasm. Thus it is that under other circumstances, when the green layer is broken down or gives way under the entirety of the cell-wall of the internode, the polymorphic cells of the moving protoplasm fill themselves with the cells of the green layer, which, generally containing a large amount of starch, thus afford material for assimilation into the protoplasm that ultimately becomes divided up into a litter of polymorphic monociliated monads, which also, in accordance with the views of the German algologists to whom I have alluded (for it is only a favourable instance for examination of what under certain circumstances takes place in the cells of all the freshwater Algæ, so far as my observation extends), should be regarded as the progeny of a foreign organism. To me there

* Annals, vol. ii. pl. 4. fig. 45, 1858.

† Quart. Journ. Microscop. Sc. No. 26, p. 27, 1859.

‡ Annals, vol. xvii. p. 107, 1856.

appears very little difference between the development of the monociliated and unciliated polymorphic cells which takes place from the refractive granules of the ovum of *Spongilla* when the latter are forcibly ejected, and the development of monads produced from the contents of the internode of *Nitella* in the way which I have mentioned; while the fact of the former being identical with the same kind of cells developed in the natural way, goes far to prove that those developed from the contents of the internode of the latter do not belong to a foreign organism.

Since the above was written, I have had the good fortune to meet with a copy of Professor Allman's Monograph on the Polyzoa, published by the Ray Society in 1856; and I find that he also produced a distinctly pink colour, indicative of the presence of cellulose, by the addition of iodine to the ectocyst or tunic of *Plumatella repens* (p. 15), as Kölliker and Löwig had done in the mantle of the Tunicata,—thus showing that starch is almost as generally distributed in *Lophopus* as in *Spongilla*, although until latterly I have denied its existence in the ova of the latter, probably because the large grains are not to be found in every specimen.

But the most important part of this excellent work, to which I have to allude here, is the unquestionable decision at which Professor Allman has arrived respecting the nature of the "winter-egg" of the Polyzoa, which he finds not to be an ovum, but an encapsuled gemma, "in which the developmental activity remains for a period latent." Thus, as there is no doubting the fact, for Prof. Allman has seen the true ovum and its development in *Alcyonella fungosa* (p. 32) in addition to the "winter-egg," we must again alter our views of the nature of the seed-like body of *Spongilla*, and, regarding it in the light of this high authority, adopt for it the term of "statoblast," which Prof. Allman has applied to the "winter-egg" of the Polyzoa. The ovum and spermatozoa of *Spongilla*, therefore, still remain to be discovered.

In reference to the "geographical distribution" of the Freshwater Polyzoa, the same author states that they have not been mentioned as existing in the tanks of India; but since his work has appeared, I have described and figured a species like *Flustra*, which was sent to me by the Rev. S. Hislop, who discovered it in a freshwater tank at Nagpoor, in Central India, in April 1857, and sent it to me in the following November*; just previous to which, I had found a marine *Paludicella* in the brackish water of the marshes; and since that, I have observed the *Plumatella* and *Lophopus* above mentioned in the freshwater tanks of the island

* Annals, vol. i. p. 169, 1858.

of Bombay, where no doubt there are more, for I did not particularly look for these, and have not yet had time to look for others.

The marine *Paludicella*, or rather Polyzoon, belonging to Prof. Allman's suborder "Cyclostomata" (for the tentacular sheath is wholly evaginated during the extrusion of the animal), which lives in the brackish water of the marshes of Bombay, as just stated, accumulates itself round rushes (*Scirpus*), accompanied by numerous species of Vorticellina, among which is that beautiful and interesting *Vaginicola* described and called by Dr. S. Wright "*Lagotia viridis**"—interesting because, although no more than an invaginated *Stentor*, its lip is so prolonged into two slips surrounded by cilia, moving in the same manner and performing the same offices as those of the tentacula of the Polyzoa, that it no doubt forms the first step from the Vorticellina to these animals.

I have already stated where I found the *Plumatella*, which appears to be *P. repens*, Van Ben., and *P. stricta*, Allm., as it is repent and has exactly the same form of statoblast.

The *Lophopus* is essentially *L. crystallinus*, but with a different form of statoblast, so that it is probably a new species; but this I leave others who are acquainted with the freshwater Polyzoa better than myself to determine, merely observing that, should it be considered a new species, the form of the statoblast will afford the chief distinguishing character, as it does in the amorphous *Spongillæ*, which is another point of resemblance between these two organisms. [But why is Prof. Allman's figure of the statoblast of *L. crystallinus* elliptical and without spines†, while that figured by Dumortier and Van Beneden is orbicular and with spines‡?] I have not, however, been able to trace the gelatinous envelope, which Prof. Allman calls the "ectocyst," beyond the base of the cœnœcium or polypidom of this *Lophopus*, where it looks to me like the deciduous tunic of the first or original group, although I have had the opportunity of examining the cœnœcium on bodies (the shells of *Paludina Bengalensis*) from which it has never been removed. The group no doubt can move from place to place, if necessary; but its habit is to remain fixed. I have seen a single animal, too, crawling on its disk or lophophore by means of its tentacula, which then appeared to adhere to the glass in a suctorial manner.

On the following point, however, I, with much diffidence, differ from Prof. Allman, viz. where he feels inclined to identify the Xanthidia with the sporangia of Desmidieæ rather than with the statoblasts of the Polyzoa, in opposition to Turpin's views

* Edinb. New Phil. Journ. vol. vii., 1858.

† *Op. cit.* ‡ Polyp. comp. d'Eau douce, pl. 6. fig. 22, 1842.

(p. 67), since I presume that both allude to the Xanthidia; for Prof. Allman states himself that the Polyzoa are frequently associated with *Spongilla,* and in Bombay they may be considered the only associates of this organism: they not only abound in the same tanks, but they live and thrive imbedded in the surface of *Spongilla,* which is destruction to any other organism; nay, more, the statoblasts, under certain circumstances, may be found imbedded in the midst of the statoblasts at the base of the *Spongilla,* whither they have probably been carried by the inward currents, after having fallen into the oscula as they were discharged from the *Lophopus.* Now, when we know that these animals are the associates of the Sponges, that the latter are petrified into flints in the chalk, &c., in which flints these Xanthidia are found, and that the Desmidieæ are not to be found except by accident where the Sponges are, not being of the same habitat, it does seem to me, while all three bodies, viz. the *orbicular* statoblasts with marginal spines, sporangia of Desmidieæ, and Xanthidia, are extremely alike, that the probabilities, if not the actual forms, are more in favour of the Xanthidia being the petrified orbicular statoblasts of the Polyzoa than the petrified sporangia of Desmidieæ.

P.S. On placing some vertical sections of the statoblast of the *Lophopus* in Canada balsam for examination, I find that the "equatorial plane" round the coriaceous coat was a deception: there is a plane; but it is formed by the contact of the upper with the lower layer of cells of the cellular coat, and not by an extension of the coriaceous coat, as seen in fig. 10, where the thick dark line, *c*, should be represented by a very thin light one, and the cells resting *perpendicularly* on it.

Bombay, Feb. 1859.

EXPLANATION OF PLATE VIII.

N.B. In order to convey an idea of the relative proportion of the figures, as they are intended for comparison, several have been drawn on the same scale. Thus, figs. 1, 3, 8 & 10 are on the scale of 1-48th to 1-1880th of an inch; figs. 2, 4, 9 & 11 on that of 1-6th to 1-1880th of an inch, that is, eight times greater than the foregoing; and figs. 5, 6, 7, and 12, 13, 14 on the scale of 1-12th to 1-5400th of an inch.

Fig. 1. *Spongilla Carteri,* Bowerbank, statoblast of, about 1-31st of an inch in diameter: *a,* coating of small spicula; *b,* surface of cellular coat (here the ends of the hexagonal columns have been drawn circular, to save time and trouble); *c,* hilum or infundibuliform hole leading into the cavity of the coriaceous coat (see fig. 3 *d*).

Fig. 2. Ditto, ditto, portion of the surface of the cellular coat, more magnified, showing the hexagonal form of the cells,—a little more regular than it is in nature.

Fig. 3. *Spongilla Carteri,* thin section of, passing through the hilum: *a,* cellular coat composed of hexagonal columns of cells, of which see a more magnified view in fig. 4; *b,* coriaceous coat; *c,* spherical cells, of which see one more magnified, fig. 5; *d,* hilum; *e,* funiculus entire; sometimes the cellular coat is prolonged over the funiculus.

Fig. 4. Ditto, ditto, vertical portion of the cellular coat, more magnified, showing that the hexagonal columns are composed of polygonal (heptahexahedral?) cells: *a,* coriaceous coat.

Fig. 5. Ditto, ditto, spherical cell of, with granular contents, more magnified.

Fig. 6. Ditto, ditto, portion of granular contents of spherical cell separate: *a,* larger granules, lenticular and bearing buds (?).

Fig. 7. Ditto, ditto; starch-grains of different sizes from the interior of the coriaceous coat, originally formed in the spherical cells.

Fig. 8. *Lophopus* ——?, winter-egg or statoblast of, about 1-27th of an inch long: *a,* cellular coat (here also the cells have been made round, to save time and trouble); *b,* coriaceous coat; *c,* cirrhous appendages.

Fig. 9. Ditto, ditto, portion of surface of cellular coat, more magnified, showing the hexagonal form of the cells: *a,* circular area of the centre which is more transparent than the rest, thus causing the end of the hexagonal cell to differ slightly from that of *Spongilla,* fig. 2.

Fig. 10. Ditto, ditto, thin vertical section of, through the centre longitudinally: *a,* coriaceous coat or cell; *b,* spherical cells of ditto; *c,* equatorial rim round ditto, extending to the margin of the statoblast; *d,* cellular coat.

Fig. 11. Ditto, ditto, vertical portion of cellular coat, more magnified, to show that the hexagonal columns are composed of single cells, instead of a plurality of cells, as in *Spongilla.*

Fig. 12. Ditto, ditto, spherical cell with contents more magnified.

Fig. 13. Ditto, ditto, portion of granules of, separate.

Fig. 14. Ditto, ditto, starch-grains of different sizes from the cavity of the coriaceous coat, originally formed in the spherical cells.

Fig. 15. Ditto, ditto, cirrhous appendages of, more magnified.

Bombay, Feb. 9, 1859.

XXXV.—*Researches on the Intestinal Worms.* By Prof. P. J. Van Beneden*.

The Academy of Sciences at Paris proposed, as the subject of a prize-essay, to determine by observation and experiment the development of the intestinal worms, and the modes by which they are transferred from one animal to another. It was required also, by well-established facts of anatomy and embryology, to illustrate the natural affinities of these worms.

* An abstract, by Prof. J. Van der Hoeven, of the 'Mémoire sur les Vers intestinaux' par P. J. Van Beneden, Docteur en Sciences et en Médecine, Professeur de Zoologie et d'Anatomie comparée à l'Université de Louvain, &c. Avec 27 planches. Mémoire qui a obtenu de l'Institut de France (Académie des Sciences) le grand prix des Sciences physiques pour l'année 1853. Paris, J. B. Baillière et fils, 1859. in-4°.

The Louvain Professor, Van Beneden, responded to this prize-question by an extensive work, which saw the light towards the end of the past year. It cannot be a matter devoid of interest if we give succinctly an outline of the principal contents of this prize-memoir. Intestinal worms, by their presence in man, are often the cause of various disturbances in the bodily functions, whilst the peculiarities they offer in their organization, propagation, and vital phænomena are of much importance for general physiology.

In his introduction the author considers the class of intestinal worms, and their orders or groups, as they were adopted by Cuvier in his 'Règne Animal.' The class must first be divested of foreign intermixture. Such a heterogeneous element, especially, is formed by the *Lerneæ* (*gill-worms,* as they are often named), parasites of fishes, which attach themselves not only to the gills, but to other parts also, where the skin is thin. It had become probable, thirty years ago, when Cuvier published the second edition of his 'Zoology,' that these animals form the transition to certain Crustaceans; but that they really do belong to the Crustaceans was first established, not long after, by the investigations of V. Nordmann, and is now generally recognized. Another foreign adjunct is formed by the genus *Pentastoma,* which also quits the egg in the form of an articulate animal with articulate feet, and, by retrogression of organization, assumes as it grows a similarity in form to a worm; it was placed alternately amongst the Trematodes and amongst the Nematoïds, but found its true place in neither of these two groups. It was not until the early state of the Pentastomes had been made known that the true affinity of this genus became apparent.

After the elimination of these foreign constituents, the class of intestinal worms, as Cuvier accepted it, still contains four groups, the Nematoïds, the Echinorhynchs (*Acanthocephala*), the Trematodes, and the Cestoïds. That we do not subjoin a fifth group, that of the *Cystica,* or vesicular worms, is a result of the discoveries of the last eight years, which have shown that it rests only upon youthful, undeveloped species of Cestoïds.

The limited time appointed by the Academy for answering their prize-question did not allow the author to busy himself with a complete and extended investigation of all the divisions of the intestinal worms. He confined himself especially to the Cestoïds and Trematodes, and desires that what he has advanced respecting the Nematoïds and thorn-headed worms should be regarded as a sample merely, and as such has subjoined it in a supplement to his work.

The first part of the treatise is devoted to the description of some species of the principal genera of the Trematode and Cestoïd worms; then follow the anatomy and history of development of these worms. The Trematodes are divided into two groups, founded on the mode of life and the development, which appear to be very natural and happily imagined. Some are *ectoparasitic*; they live nearly all on the gills of fishes, and attach themselves by one or even many sucking-disks situated at the back part of the body.

To these belong *Tristoma* and *Polystoma* of Rudolphi, and various other genera adopted by modern writers. They appear to undergo no metamorphosis, and are named by V. Beneden *Trématodes monogénèses.* The second group, of which the genus *Distoma* may stand as an example, contains the Trematodes that live in the interior of the body, and attach themselves by a sucker in the fore part or the middle of their body. They are here named *Trématodes digénèses,* an appellation borrowed from their mode of development; they proceed from eggs or from germs, in successive and alternating generative stages.

Of the group of *Trématodes monogénèses* the author treats of *Udonella Caligorum, Epibdella Hippoglossi, Epibdella Sciænæ,* V. Beneden, *Diplozoon paradoxum, Octobothrium lanceolatum, Octobothrium Merlangi, Axine Belones, Onchocotyle appendiculata, Onchocotyle borealis, Calceostoma elegans,* V. Beneden, *Gyrodactylus auriculatus,* and *Gyrodactylus elegans.* Of these worms, *Calceostoma* forms a new genus, described here for the first time. *Calceostoma elegans* was found by V. Beneden on the gills of *Sciæna Aquila.* [It must be a typographical error when at p. 60 we read, "n'ayant qu'un dixième de millimètre de longueur;" the figure, pl. 7. fig. 1, of natural size, indicates a length of 10 or 11 mm.] The body is elongate, and has at the fore part a foliaceous expansion, whilst behind it ends in a large sucker, to which a stylet with two pairs of curved hooklets is attached; the anterior pair turn their points forwards, the posterior backwards; by these four points the worm is firmly attached to the tissue of the gills of the fish. On *Gyrodactylus* (a genus of worms that live on the gills of freshwater fishes), V. Beneden confutes the opinion of V. Siebold, that here there is change of generative forms (*Generationswechsel*). *Gyrodactylus* is viviparous; and the young ones, with the two large hooks on the posterior sucker, can be distinguished through the skin within the body of the mother. Two similar embryos, at different stages of development, seen by V. Siebold in a *Gyrodactylus,* were incorrectly supposed by him to be daughter and granddaughter, whilst, according to V. Beneden, they were two sisters. Here there is no producing by germs, as in the sporocysts of the Distomes. For the *Trématodes digénèses,* to which *Di-*

stoma belongs, are propagated in two ways—by germs in the non-sexual generation, and by eggs in the sexual. These are small and very numerous. The embryo is always covered with cilia (this form is named *Proscolex*), and for a time lives freely in the water. From this embryo a vermiform creature proceeds that might almost be named a germ-sac (sporocyst); it lives parasitically in closed cavities, and is named *Scolex* by our author. The numerous germs which are developed in this germ-sac, and are provided with a filiform appendage, a tail, again live freely in water. They are the well-known *Cercariæ*—here named *Proglottis*; they enclose themselves in a cyst, and, losing their tail, are now changed into *Distomata*, which again live parasitically, but in cavities of the body that open freely outwards, as in the respiratory organs or the intestinal canal.

Of these *Trématodes digénèses* the following species are here described: *Monostoma mutabile*, *Monostoma verrucosum*, *Amphistoma subclavatum*, *Distoma militare*, *Distoma echinatum*, *Distoma retusum*, *Distoma clavigerum*, *Distoma tereticolle*, *Distoma filicolle* (*Monostoma filicolle*), Rud., *Distoma Okenii*, Kölliker, and *Nematobothrium filarina*. Of most of these the different forms of embryos, sporocysts, and cercariæ are given. To *Distoma militare* V. Beneden refers the *Cercaria pacifica*, which Steenstrup had figured in his well-known work on alternating propagation; the sporocysts and cercariæ are met with in *Paludina vivipara*, whilst the *Distoma*-form is found in the intestinal canal of *Anatidæ* and other water-birds, and of snipes. The *cercaria*-forms of *Distoma retusum* and *D. clavigerum* have been confounded under the name of *Cercaria armata*. Of *Distoma filicolle* two are commonly found in one cyst, on *Brama Raji* of the Mediterranean Sea; they are very unequally developed: the one ends in a wide sac, which is bent into a curve, and resembles the body of a larva of the cockchafer; the other is thin, and was supposed by Rudolphi to be an imperfect specimen—the neck without the body of the worm (Synopsis Entozoor. p. 348). *Nematobothrium* is a new genus, found, like the above-named genus *Calceostoma*, by V. Beneden on *Sciæna Aquila*. It is a long, thin, soft worm (about 1 metre long), which, rolled up into a pellet, lives under the skin near the gills. This worm forms as it were the transition to the Cestoïds. V. Beneden could not discover any intestinal canal, but thinks that it may have been present in some earlier state of existence, before the sexual organs were entirely developed.

With the Cestoïds or tape-worms, V. Beneden adopts a similar distinction or division as with the Trematodes. According to him, they may be distinguished as *Cestoïdes monogénèses* and *Cestoïdes digénèses*. To the first belongs the genus *Caryophyllæus* alone

—a worm from the intestinal canal of the *Cyprini*, already described by Pallas, Bloch, and Goeze, and here illustrated by new figures (pl. 14) and anatomical descriptions. The rest of the tape-worms are '*digénèses*.' It was known, from an earlier work of V. Beneden, published in 1850 by the Belgian Academy of Sciences, that our author does not regard the tape-worms as simple but as compound animals, formed of as many animals as there are joints of the body. The *Vermis cucurbitinus* (the joint which, separated from a *Tænia*, is rejected with the excrement) is the perfect worm (here named *Proglottis*); the joint contains all the organs which serve for the perpetuation of the species.

Amongst the *Cestoïdes digénèses* our author first distinguishes two primary divisions, the *Bothriadés* and the *Téniadés*. Of the first, which principally live in fishes, there are here noticed the genera *Echeneibothrium*, V. Beneden (to the species formerly made known by our author he here adds a new one from *Raja Batis*, namely *Echeneib. dubium*), *Phyllobothrium*, V. Beneden, *Anthobothrium*, V. Beneden (new species, *Anthobothrium perfectum* and *Anthob. giganteum*), *Tetrarhynchus*, Rud. (new species, *Tetrarh. tenuis* and *Tetrarh. Erinaceus*), *Echinobothrium*, V. Beneden, *Tricuspidaria*, and *Ligula*. Under *Tænia*, the author remarks that the species which live in fishes appear never to have hooks at the fore part of the head; also that in vegetable-feeding mammals *Tæniæ* occur mostly without hooks. Under *Tænia solium* the author records his experiments, in which, after giving the eggs of this tape-worm to a pig, *Cysticercus cellulosæ* was produced; he records also the experiments with eggs of *Tænia cœnurus* from the dog (conducted also by Eschricht and Leuckart), by which sheep at the end of seventeen days showed the first symptoms of vertiginous disease. This tape-worm of the dog agrees, according to V. Beneden, with *Tænia serrata*. Very conclusive experiments on the production of this *Tænia serrata*, after the use of *Cysticercus pisiformis*, were performed by him on various dogs, which were opened in Paris in the presence of Milne-Edwards, Quatrefages, and Valenciennes: Van Beneden predicted in which of the dogs the tape-worms would be found (those, namely, which had swallowed the said *Cysticercus**). A very small species, found in dogs, *Tænia nana*, is a production of *Echinococcus*. Under the genus *Tænia* the author announces two new species, *Tænia Gallinulæ* and *Tænia melanocephala*,—the first met with in a water-hen (*Gallinula chloropus*), the last in a mandril.

The second part of Van Beneden's work treats of the anatomy of

* Note ajoutée aux pp. 154–157: "L'expérience paraissait décisive aux yeux de tout le monde excepté à M. Valenciennes."

the Trematode and Cestoïd worms. The chief difference between the two consists in the presence of an intestinal canal in the first, and its absence in the last. Both orders of worms are hermaphrodite, and the organs of propagation are greatly developed. An internal impregnation of the eggs cannot occur, since there is no immediate connexion between the male and female organs*. A remarkable peculiarity deserves mention—that the eggs are formed by two distinct organs, of which the one secretes the germ-vesicles (*germigène*), the other the vitelline cells of the egg (*vitellogène*). We may here notice a slight historical inaccuracy which our author commits when he asserts (p. 192) that O. Schmidt in 1848 first discovered this formation of the germ-vesicle and of the vitelline globule in distinct organs in the *Turbellariæ rhabdocœlæ*. It had been noticed earlier, as I think, by C. Th. v. Siebold in Trematodes, and suspected in Cestoïds also, before it was observed in *Turbellariæ*†. The eggs of Trematodes are sometimes moulded into a definite form in a special organ named by our author *ootype*.

That system of canals divided into branches and connected with a contractile bladder at the posterior extremity of the body, which was at one time regarded as a vascular system, at another as a respiratory system, is conceived by V. Beneden to be for the secretion of urine (urea ?).

In those Trematodes which exhibit alternating stages of generation, the embryo, on leaving the egg, is surrounded by a covering of cilia. In the Cestoïds, Van Beneden has never observed anything like this. Here, on the contrary, hooks are observed, six in number, which have nothing in common with those hooks which afterwards form a circle round the head in the tape-worms; they occur also in species of *Tæniæ* in which this circle of hooks is wanting (*Tæniæ inermes*). In the embryos of *Ligula* and *Bothriocephalus* these hooks are absent; and also in *Tetrarhynchus* Van Beneden has sought for them in vain. These hooks work like digging or boring instruments, of which the embryo avails itself to perforate the walls and pass into the cavity of the body in which it is about to affix itself as a parasite. Van Beneden gives a very perspicuous account of the action of these organs. Two of them are placed in the middle, and push or glide forwards and backwards, working like the snout of the mole as it digs in the ground; the two pairs of lateral hooks move outwards and inwards to make a way through the tissues, as the fore feet of the mole push the loosened earth aside. The vesicle of the *Cysticerci* is nothing else than the body of the embryo of the Cestoïds. Stein was the first to

* Contrary to the assertion of C. Th. v. Siebold.

† See Müller's Archiv, 1836, pp. 235, 236.

announce that the hooks of the embryo are still to be found in the sac of these cystic worms. All Cestoïds have such a vesicle at first; but in some species it continues very small, whilst in others it is more and more developed, and attains a remarkable size. In the *Tæniæ* it falls off when the tape-worm has found its final resting-place; but in *Tetrarhynchus* it persists. The vesicular or cystic worms are by no means morbid and accidental modifications of tape-worms; the tape-worm which is developed in a carnivorous animal must first have lived as a vesicular worm in another herbivorous animal. The vesicular worm is the *proscolex*, the head of the tape-worm the *scolex*; and by genital propagation and growth the so-named joints are formed, which represent the highest and perfect form of the species.

The third part of the work contains investigations respecting certain Nematoïds, as *Mermis nigrescens* and *Echinorhynchus acus*. With the exception of *Filaria Mustelarum*, Rud., from the lungs of the pole-cat (pl. 23), and *Prosthecosacter inflexus*, Diesing, from the wind-pipe of the narwhal, all the Nematoïds treated of by V. Beneden are from the class of fishes (*Proleptus gordioides*, V. Ben., *Spiropterina coronata*, V. Ben., three species of *Dacnites*, and *Cucullanus elegans*).

Mermis nigrescens, a thread-worm, which once, in the beginning of summer, after a stormy night, appeared suddenly in astonishing quantity in the gardens of Louvain, lives as a parasite in the cockchafer. Probably, in consequence of the rain, the worms were expelled from these insects. All the individuals were female. The black colour of these thread-worms is to be ascribed to the eggs. In the eggs the embryo may be already distinguished; and by cautious pressure the shell was successfully burst, and the embryo set at liberty to move freely. *Mermis* is thus viviparous; the embryo has already the form of the perfect animal. There is no metamorphosis, in the ordinary sense, in the *Gordiacea* or the thread-worms, any more than *digénèse*. Neither does *digénèse* appear to occur in the thorn-headed worms. The observations, however, are hitherto far from numerous, and even not quite complete.

The fourth part of the work is dedicated to the theory of propagation by means of alternating stages of generation. Within the last few years, few terms have been more frequently repeated in physiology and embryology than that of "*Generationswechsel.*" Since 1842, when the Danish naturalist Steenstrup, then a young man, and unknown beyond his own country, published his Academical Essay on that subject, a multitude of works, of greater or less extent, on the same subject have seen the light.

In conversation, however, it has often seemed to us that the term is better known than the essence of the facts and the general views founded on them; otherwise "*Generationswechsel*" would not, as I remember once to have read and sometimes to have heard, be confounded with *metamorphosis*.

Metamorphosis has reference to one and the same individual, which leaves the egg under a form different from that of the mother, but in different periods of its life approaches more nearly to this, and, as a full-grown animal, wholly attains it, as is seen in many insects and in frogs. In "change of generation" the mother brings forth a young one that is unlike herself, and remains unlike, but from which a progeny proceeds, which either itself or in its young ones returns to the original form of the mother. Quite unknown the facts were not, on which Steenstrup founded his speculation; but he has the unmistakeable merit of having brought them under a common point of view. Already had Chamisso, in *Salpæ*, observed a *proles gregaria* which alternates with a *proles solitaria**; observations on the origin of *Cercariæ* from "yellow worms" had been published by Bojanus and Von Baer; and the singular propagation of leaf-lice (*Aphides*) without impregnation, in numerous successive generations during summer, had been made known by C. Bonnet in the last century. Between Steenstrup and Van Beneden a contest has arisen respecting this theory, which (much to be regretted) has been conducted not without some acrimony. Van Beneden desires to substitute the name *digénèse* for *Generationswechsel*, and regards the essence of the phænomenon to reside, not so much in the form of the body in the different stages of generation as in the propagation by germs and by eggs—an *agamic* and a sexual propagation. It is not to be denied that Steenstrup did not clearly place this in the foreground; but that it was overlooked by him, I would not venture to assert. At all events, it must be admitted that Van Beneden, though under another name, has very clearly developed and placed in a fuller light the phænomenon to which Steenstrup drew attention, and also in particular has happily applied it to the Cestoïds. In regard to the intestinal worms, also, he has had much success in illustrating its true significance. We will here quote a passage to exemplify the lively style of the Louvain Professor, so well adapted to the explanation of the phænomena:—

* A. de Chamisso, De Animalibus quibusdam e classe Vermium. Fasciculus 1. De Salpa. Berolini, 1819, 4to. I may here notice a slight inaccuracy in the author of the work before us. He speaks (p. 289) of Meyen's observations on *Salpæ*, and adds, "Les *biphores* (*Salpæ*) furent de nouveau étudiés peu de temps après par Chamisso." Meyen's observations were, on the contrary, made fourteen or fifteen years later than those of Chamisso.

"Sur des centaines ou des millions d'œufs que chaque individu pond à l'époque de sa maturité, il n'y a que bien peu qui arrivent à leur destination; et parmi les embryons qui éclosent, la grande majorité périt au milieu de mille dangers qui les assaillent à cette époque de la vie. Pour vivre, il faut que le jeune animal trouve son gîte et s'installe dans sa cabane; c'est une citadelle vivante dont chaque parasite doit faire le siège; si l'assiégeant a réussi dans l'assaut, chaque embryon engendre à lui seul une armée, et toute la place est envahie. C'est le cheval de Troie qui cache ses soldats dans son flanc. Ainsi le premier embryon qui parvient à sa destination met au jour une et quelquefois plusieurs générations, et ces générations, nées dans la place, ne devant plus faire le siège, sont complètement dépourvues des organes propres à la locomotion et à l'assaut; ne devant plus changer de milieu, elles n'éprouvent pas d'autres besoins que ceux de la nutrition et de la perpétuation.

"Ce n'est pas tout, il y a souvent un second siège à faire; car ce n'est pas toujours dans cette première place que l'espèce prend ses attributs sexuels. A cet effet une nouvelle génération agame surgit de la précédente et porte des organes de locomotion comme la grand'-mère; si cette nouvelle génération s'introduit à son tour dans la seconde place, chaque individu se débarrasse de ses appareils de siège et se loge de manière à pouvoir attendre patiemment la fin de sa mission.

"Une fois casé dans sa nouvelle demeure, son rôle change entièrement; ce soldat si actif et si plein de vie s'endort au fond de son kyste, et ne se reveille que quand sa prison vivante, c'est-à-dire l'hôte qui l'a hébergé, est dévoré par un autre animal. Ici son patron disparait sous l'action dissolvante du suc gastrique; sa loge même se dissout dans l'estomac, mais sans action dissolvante sur l'organisme vivant, le suc de l'estomac, et peut-être la chaleur du nouveau milieu, le tire de son état d'engourdissement, et il commence une nouvelle vie. De l'estomac il se rend dans l'intestin et de-là il peut envahir les canaux biliaires, le foie, le poumon, et tous les organes, en un mot, qui dépendent de l'appareil digestif. Une fois introduit dans son appartement définitif, le parasite s'accroît avec rapidité, grandit souvent considérablement au bout de quelques heures, l'appareil sexuel se montre avec tous ses attributs, et des milliers d'œufs vont se semer sur la route de nouveaux patrons." (pp. 303, 304.)

This is the history of the *Distomes*:—From the egg proceeds an embryo covered with vibratile cilia; this embryo or this larva endeavours to fix itself within some freshwater mollusk; in this mollusk the larva brings forth a *sporocyst*—a form which properly is a sac with germs. These germs become *cercariæ*, which swim freely about, and often strive to penetrate into some species of fish; when once this is effected, they lose their tail and cover themselves with a cyst. The fish which affords them an abode, when swallowed by some carnivorous animal, is dissolved in its stomach; and the *Cercaria,* which was concealed in its cyst, awakes as a *Distoma* in the stomach or intestine of its new host. It is only in this last abode that the *Distoma* attains its fully-developed sexual organs. Thus the *Cercaria* undergoes a metamorphosis, like an insect; but the *Cercaria* itself was produced from a *Distoma,* not by *metamorphosis* or change of form, but by *Generationswechsel* or change of generation.

The fifth part of the work is dedicated to the consideration of the transmissions or migrations of intestinal worms. Our plan does not permit us to dwell long on it. The interesting facts relating to *Tæniæ* are now generally known through the observations of Küchenmeister, V. Siebold, Leuckart, and others. It cannot be denied that our author, by his announcement that the *Tetrarhynchi* of osseous fishes pass into *Rhynchobothrius* in the stomach of cartilaginous fishes (*Plagiostomes*), *i. e.* the Rays and Sharks, has a claim to the discovery of the regular transplanting of worms; it was shortly afterwards succeeded by the remarkable discoveries respecting the *Tæniæ.*

The sixth and last part of the work before us contains considerations respecting the systematic arrangement of worms. It is well known that Van Beneden is not disposed to unite the ringed worms (*Annulata*) with the *Condylopoda,* as Cuvier did, by including in his type of articulate animals both these divisions of the animal kingdom. He comes to the conclusion that the animals which Linnæus named worms ought again to be conjoined. This division of the animal kingdom would then contain the Mollusks and Radiates of Cuvier besides the Annulata. These animals, named by Van Beneden *allocotylés,* form, according to him, six classes—Mollusks, Worms, Echinoderms, Polyps (with which he unites the Acalephs), Foraminifera, and Infusoria. The intestinal worms, no longer regarded as a distinct class, are by him united with the so-named ringed worms and *Turbellariæ.* He divides this class of worms into four groups —*Annélides, Nématoïdes, Phyllides,* and *Térétularides.* To the *Nématoïdes* belong, amongst the previously so-named *Entozoa,* the *Nematoïdea* and *Acanthocephala*; to the *Phyllides* the *Trematoda* and *Cestoïdea,* which here are placed in the neighbourhood of the Leeches.

The beautiful figures which are annexed to this work have all been delineated by the author himself; they form not only an ornament, but an essential part of it. In the last plate an ideal figure of the organization of a Cestoïd is given, which corresponds with plate B in the treatise published by the Academy of Brussels in 1850; and by the side of it a similar ideal figure of a Trematode is now added. The work deserves to be perused and studied, and must always be recorded with honour amongst the zoological and anatomical literature of our age.

[This notice, by the Leyden Professor of Zoology, is translated from the 'Nederlandsch Tijdschrift voor Geneeskunde,' 1859.]

XXXVI.—*Descriptions of three new species of Sertularian Zoophytes.* By JOSHUA ALDER, Esq.

[With three Plates.]

Plumularia halecioides. Pl. XII.

Polypary about an inch high, irregularly branched. Stem compound, giving off branches, which are also compound for a part of their length, becoming single as they rise upwards, and having two joints above the insertion of each branchlet or pinna; pinnæ alternate, frequently short, terminating in a single cell, but in full-grown and luxuriant specimens extending to a greater length, and bearing three or four rather distant, moderately sized, cup-formed cells on the upper side. There are two, or occasionally three, joints at the origin of each pinna, as well as between the cells, and a small tubule above and another below each cell. Sometimes there is a tubule on the stem above the origin of the pinna. The polypes are rather large in proportion to the cell, rising a little out of it, and having from fourteen to eighteen muricated tentacles. The ovicapsules are large, ovate, with a broad truncated top, and are strongly ribbed or wrinkled transversely; they are set on the stem singly or in clusters by a very short pedicle.

I found two specimens of this very distinct and beautiful little *Plumularia* on stones near low-water mark, at Cullercoats, Northumberland, in the summer of 1857, and again met with it at the same place in the following year. Mr. Albany Hancock has also obtained it at Roker, on the Durham coast. In its young state, or when partially denuded of its cells, it has very much the appearance of a *Halecium,* which genus it resembles in its mode of growth. The ovicapsules are similar to those of *Campanularia Johnstoni*—the only instance within my knowledge of this form of capsule being found in a *Plumularia.* Pressed between plates of glass, the capsules showed the ova in a very early stage. I unfortunately did not succeed in keeping the specimens alive so as to observe their further development.

Halecium labrosum. Pl. XIII.

Polypary between 3 and 4 inches high, irregularly branched and rather flaccid. Stem compounded of several tubes, and fixed at the base by numerous fibres; the larger branches compound and generally dividing dichotomously, bearing alternate branchlets or pinnæ; jointed, and more or less ringed or transversely wrinkled above each joint. The cells arise singly or in pairs below the joints, and are also jointed and ringed at the base, above which a short tubular portion bears the cell, which is moderately deep and much expanded and everted at the margin. Capsules ovate, broad below and obtusely pointed above, without any tubular aperture; they are of a purplish-brown colour, and set unilaterally on the stem by a short pedicle of about two rings.

This *Halecium* has occurred to me occasionally from deep water on the Northumberland coast; but I have never had an opportunity of seeing it alive. Its distinctness from the other British species, however, cannot be doubted. It differs from *H. halecinum* in its more lax and irregular mode of growth, as well as in colour, which has somewhat of a purplish hue when fresh. The branches, too, are more ringed and wrinkled, and the capsules more regularly and broadly ovate, than in that species*. But the best distinction is found in the form of the cell, which is deeper than in any of the other species, and has a remarkably expanded lip, which usually turns over at the margin. I may here remark that what Dr. Johnston calls the cell in this genus consists of two portions, the upper and shallower of which constitutes the true cell, and contains the polype. The cells in this species, as in others of the genus, are often seen to rise one within the other, occasioned probably by the polype being renewed at intervals, and each fresh polype forming a new cell within the old one.

I have met with what appears to be the young of this species, parasitical on *Tubularia indivisa* and *Sertularia abietina.* In this state it is remarkably delicate and beautiful, and might be taken for a distinct species. The stems rise from a creeping fibre, and are very strongly and profusely ringed; they give off branches from the base of each cell, and sometimes two from one cell.

A specimen of the adult form, without capsules, has been sent me by Mr. Macdonald of Elgin, obtained in the Moray Frith; and Mr. Barlee has also met with it lately in Shetland.

* It has been pointed out by Mr. Hincks, that the male and female capsules are of different forms in *H. halecinum.* Should this be the case in other members of the genus, those of *H. labrosum* now described may belong to the former sex.

Halecium nanum. Pl. XIV.

Polypary creeping over the surface of *Sargassum bacciferum* and forming an irregular network of fibres, throwing up short stunted stems at each bifurcation or intersection. The stems consist of little more than the tubular portion or pedicles of the cells, which arise above each other in a zigzag order, each springing alternately from the side of the last. The cells are broad and shallow, and scarcely at all expanded at the rim. The portion of the stem beneath each cell is nearly of the same width as the latter, short, a little wrinkled at the base, and having a single joint near its junction with the cell below. Frequently there is only a single cell at each joint of the creeping fibre, or a succession of cells developed one within the other. The ovicapsules are very large, and generally set in clusters of two or three together on the stem or the sides of the cells; they are irregularly ovate, bulging out more on one side than the other, and terminated by an oblique aperture with two lips; they are fixed by short pedicles of two or three rings. Height of stem seldom above $\frac{1}{10}$th of an inch.

This curious little parasite of the Gulf-weed is worthy of notice from its showing an interesting variation in size and form in a genus of which so few species are yet known, and those nearly all inhabiting the British shores.

It appears to have hitherto escaped observation, unless it is the "*Campanularia?*" very imperfectly figured (but not described) in Dana's 'Zoophytes of the United States' Exploring Expedition,' p. 690, pl. 61. f. 9.

The specimen from which the present description and accompanying figures were taken was found on Gulf-weed collected by Mr. William Wright in lat. 34° 48′ north and long. 34° 25′ west, and presented to me by his brother, Mr. Joseph Wright, of the Newcastle Museum.

EXPLANATION OF THE PLATES.

Plate XII.

Figs. 1 & 2. *Plumularia halecioides,* natural size and magnified.
Fig. 3. A portion more highly magnified.
Fig. 4. Ovicapsules.
Fig. 5. A portion of the compound stem.

Plate XIII.

Fig. 1. *Halecium labrosum,* natural size.
Fig. 2. A portion magnified: *a,* capsules.
Fig. 3. A portion of a variety magnified.

PLATE XIV.

Fig. 1. *Halecium nanum*, natural size.
Fig. 2. A portion magnified, showing its mode of creeping over the *Sargassum*.
Figs. 3 & 4. The stems, with cells and ovicapsules, more highly magnified.

XXXVII.—*Notices of British Fungi.* By the Rev. M. J. BERKELEY, M.A., F.L.S., and C. E. BROOME, Esq.

[Continued from vol. xiii. 2nd Series, p. 469.]

[With three Plates.]

785. *Agaricus* (Lepiota) *gliodermus*, Fr. Hymenomycetes, p. 31. Amongst sticks, &c. Wothorpe Grove, Stamford, Aug. 1857, M. J. B.

A very beautiful species, of which we have a figure copied from the collection of drawings of Hymenomycetes now deposited by Fries in the Swedish Museum at Stockholm.

786. *A.* (Tricholoma) *bufonius*, Fr. Ep. p. 40 (Bull. t. 545. f. 2). Coed Coch, Denbighshire, Nov. 1858, Mrs. Wynne.

This interesting addition to our flora was made by Mrs. Wynne, of Coed Coch, who has been induced to study the Agarics in consequence of the beauty and profusion in which they are produced in her neighbourhood.

787. *A.* (Tricholoma) *cinerascens*, Bull. t. 428. f. 2. In woods. Mossburnford (Jedburgh), Aug. 1857, A. Jerdon, Esq.

Cæspitose; pileus 2–3 inches across, convex, of a dirty pale ochre, slightly streaked with watery lines, firm but not brittle, clothed with very obscure matted down; flesh thin, white. Stem curved, slightly streaked, tinged like the pileus, paler above and slightly pulverulent, solid, stringy. Gills moderately distant, at first attenuated behind, at length rounded and easily separating, as in *Paxillus involutus*, white or very slightly ochraceous, stained like the pileus when old and bruised, very slightly anastomosing behind. Spores certainly not cinereous. Smell rather disagreeable, pungent; the stem, however, when broken, smells like new meal.

788. *A.* (Mycena) *pelliculosus*, Fr. Ep. p. 116. Mossburnford, Oct. 25, 1858, A. Jerdon, Esq.

Remarkable amongst its allies for the viscid separable cuticle.

789. *A.* (Entoloma) *Placenta*, Batsch, f. 18; Fr. Ep. p. 144. On the ground in pastures. Swanage, Dorsetshire, Oct. 1857, C. E. B.

790. *A.* (Entoloma) *elodes*, Fr. Ep. p. 144. On heathy pastures. Denbighshire, M. J. B.

Pileus and stems livid. Smell like that of fresh meal.

791. *A.* (Leptonia) *euchrous,* Fr. Ep. p. 153; b. *cæspitosus,* Pers. Syn. p. 343. On alder. Mossburnford, A. Jerdon, Esq.

792. *A.* (Hebeloma) *lucifugus,* Fr. El. p. 177. On the ground in woods. Wothorpe, Norths., Sept. 1857, M. J. B.

**A.* (Flammula) *flavidus,* Schæff. t. 35; Fr. Ep. 187. Abundant on lime stumps. Colleyweston, Norths., Oct. 25, 1858, M. J. B.

793. *A.* (Psalliota) *albocyaneus,* Fr. Ep. p. 219; Pers. Myc. Eur. t. 29. f. 2, 3. On dung in grassy pastures. Swanage, Oct. 1857, C. E. B. Apethorpe, Nov. 1858, M. J. B.

Resembling *A. æruginosus,* but more delicate and softer. Both species sometimes occur together. There is little or no difference in the spores.

794. *A.* (Hypholoma) *dispersus,* Fr. Ep. p. 222. On the ground. Mossburnford, A. Jerdon, Esq.

*795. *A.* (Psilocybe) *cernuus,* Müll. Fl. Dan. t. 1008 (not 1005). About the roots of an ash-tree. Apethorpe, Dec. 1858, M. J. B.

The species described under this name in the 'English Flora' has a veil, and therefore is not a *Psilocybe.*

796. *A.* (Panæolus) *Phalænarum,* Fr. Ep. p. 235. On horse-dung in a stable; abundant. Apethorpe, Norths., Sept. 6, 1858, M. J. B.

797. *Cortinarius* (Hygrocybe) *acutus,* Fr. Ep. p. 314. In fir woods. Mossburnford, A. Jerdon, Esq.

Mr. Jerdon's specimens are cæspitose. The species has the habit of *Galera.*

798. *Hygrophorus obrusseus,* Fr. Ep. p. 331. Mossburnford, Oct. 2, 1858, A. Jerdon, Esq.

Remarkable for its bright gold-coloured pileus and adnate ventricose gills.

**Lactarius pyrogalus,* Fr. Ep. p. 339. Abundant at Coed Coch, 1858, Mrs. Wynne.

799. *L. mitissimus,* Fr. Ep. p. 345. In woods. Coed Coch, Mrs. Wynne.

**Russula nigricans,* Fr. Ep. p. 350.

This is *A. adustus,* Eng. Fl., which is known by its coarse habit, and from parts of the plant becoming red when bruised.

800. *R. adusta,* Fr. Ep. p. 350. On the ground in woods. Coed Coch, M. J. B.

Well distinguished by its comparatively thin crowded gills, and other points.

801. *Cantharellus umbonatus,* Fr. Ep. p. 365. Mossburnford, Oct. 2, 1858, A. Jerdon, Esq.

Possibly not uncommon; but the general appearance is so like that of some Agaric, that it may be easily overlooked.

802. *Marasmius Wynnei,* n. s. Inodorus; pileo carnoso convexo-plano umbonato lilacino-fusco, stipite fistuloso subconcolori furfuraceo, lamellis crassis distantibus adnexis læticoloribus.

Amongst twigs, &c. Coed Coch, Denbighshire, Mrs. Wynne.

Gregarious or cæspitose. Pileus 1–1½ inch across, variously tinged with brown and lilac, not rapidly changing colour, umbonate, slightly fleshy. Stem 2 inches high, 1½ line thick, rather paler than the pileus, fistulose, furfuraceous, springing from a white mycelium, but by no means strigose or tawny at the base. Gills distant, thick, moderately broad, adnexed, beautifully tinged with lilac; interstices even.

One of the most beautiful of Fungi, and apparently quite distinct from *M. fusco-purpureus,* of which Fries thinks it may be a form destitute of strigæ. The pileus does not, however, rapidly change colour, as in that species; the stem is not of a blackish purple, neither is it smooth, and the lilac tint is very striking.

803. *M. spodoleucus,* n. s. Conchiformis, resupinatus, margine liberato, supra cinereus, subfurfuraceus; stipite prorsus nullo; hymenio albo, lamellis paucis; interstitiis lævibus.

On dead elm twigs. Batheaston, Jan. 1859, C. E. B.

About 2 lines across, resupinate, altogether stemless, conchiform, margin free, arched; above cinereous, pulverulent, or slightly furfuraceous. Hymenium white, very even. Gills few, narrow, entire, so short as to leave a naked space at the base.

A most elegant little species, and very distinct.

804. *Boletus badius,* Fr. Ep. p. 411.

Near Birmingham, Mr. Matthews, Oct. 31, 1857.

805. *Polyporus* (Mesopus) *Schweinitzii,* Fr. Ep. p. 433. About the roots of fir-trees. Dorsetshire, C. E. B.

It occurs with a central stem, and also imbricated, and varies in the thickness of the tomentose coat. Sometimes it resembles closely *P. Herbergii* of Rostkovius, to which species we referred it, till a large specimen was found with a central stem. The imbricated specimens are precisely what we have from Fries under the name of *Pol. Schweinitzii* var. *dimidiatus.*

806. *P.* (Anodermei) *chioneus,* Fr. Ep. p. 453. On dead wood. Mossburnford, A. Jerdon, Esq.; Bathford (on fir), C. E. B., Dec. 1858.

The specimens are named on the authority of Fries.

807. *P.* (Inodermei) *Wynnei,* n. s. Confluenti-multiplex, pileo postice adnato effuso reflexo tenui alutaceo lineato-sericeo, poris parvis angulatis albis.

Running over twigs, grass, &c. Coed Coch, Denbighshire; New Brighton, Cheshire, M. J. B.

Thin, incrusting various substances, with the margin more or less broadly reflected, tan-coloured, sericeous, and marked with raised lines; pores $\frac{1}{96}$ inch across, angular, white, acquiring a slight tint like that of the pileus in drying.

This species has somewhat the habit of *P. amorphus*, but is not of so fleshy a texture. Specimens have been submitted to Fries, who says that he is unacquainted with the species, and I have therefore no hesitation in proposing it as new.

808. *Hydnum gelatinosum*, Scop. Fr. Ep. p. 512. On dead wood. Weybridge, F. Currey, Esq.

809. *Thelephora anthochroa*, Fr. Ep. p. 544, var. *versicolor*. On dead sycamore. Wothorpe, M. J. B.

The full-grown plant is just like authentic specimens from Fries; the young plant, however, is not at all brick-coloured, but variously tinted with fugitive shades of lilac and brown. It must therefore be considered, for the present, as a remarkable variety.

810. *Tremella frondosa*, Bull. t. 499. f. T; Fr. Ep. p. 588. At the base of a living oak-tree. Wothorpe, M. J. B.

Perhaps the finest of our *Tremellæ*, and, when fresh, of a peculiar pale pinkish yellow.

**T. indecorata*, Sommerfeldt. On oak. Mossburnford, A. Jerdon, Esq.

811. *Exidia saccharina*, Fr. Ep. p. 591. On Scotch fir. Mossburnford, A. Jerdon, Esq.

**Hydnangium carotæcolor*, B. & B. Ann. of Nat. Hist. vol. xiii. p. 351. Ballard's Down, Swanage, Nov. 7, 1857, C. E. B.

812. *Phoma eriophorum*, n. s. Peritheciis globosis liberis, primum pallidis, demum nigrescentibus, deorsum tomentosis e mycelio similari oriundis.

On Spanish chestnuts, C. E. B.

Perithecia at first white, globose, clothed more or less with white or yellowish cottony down, like that of the mycelium from which they spring; at length dark; but when seen by transmitted light, reddish. Spores very abundant, white, slightly curved, ·00025 inch long.

A very distinct species.

813. *P. devastatrix*, n. s. Peritheciis minutissimis punctiformibus nigris globosis, sporis oblongis 2–3-nucleatis.

On Lobelias. Shrublands, Suffolk, Aug. 1856.

This minute species, all but invisible to the naked eye, was most destructive in the gardens of Sir W. Middleton in 1856. The perithecia are globose, and perforated with a minute round aperture; the spores oblong, hyaline, containing from two to three nuclei, and ·0004–·00033 inch long.

814. *Excipula fusispora*, n. s. Minuta, aterrima, setis rigidis vestita; sporis fusiformibus multiseptatis, articulis mediis obscurioribus.

On the under side of the bark of *Clematis Vitalba*. Batheaston, Jan. 1859, C. E. B.

Forming very minute black specks; perithecia clothed with dense, slightly waved, continuous setæ; spores curved, fusiform, ·002 inch long, multiseptate, the two extreme articulations hyaline, the others rather darker, and generally containing a globose nucleus.

Plate IX. fig. 1. Spores on their filiform sporophores magnified.

815. *Sporodesmium uniseptatum*, n. s. Sporis obovatis uniseptatis, breviter pedicellatis cæspitosis, articulo inferiore breviore.

On *Clematis Vitalba*. Batheaston, Jan. 1859, C. E. B.

Forming minute dark specks consisting of obovate, uniseptate, shortly pedicellate spores, ·0005 inch long, the lower articulation of which is much the shorter, and narrow. As seen by transmitted light, they have a slight vinous tinge.

Plate IX. fig. 2. *a*. Plant slightly magnified; *b*. spores on their sporophores highly magnified.

816. *Bactridium Helvellæ*, B. & B.; *Didymaria Helvellæ*, Cord. Fasc. 6. fig. 24.

On the hymenium of *Peziza testacea*. Batheaston, Dec. 1858, C. E. B.

Spores at length 5–7-septate, ·0025 inch long.

Corda's figure gives an excellent representation of our plant in an early stage of growth; but at length it acquires several septa, and cannot be distinguished from *Bactridium*.

Plate IX. fig. 3. Spores highly magnified.

817. *Stachybotrys atra*, Cord. Fasc. 1. p. 21, fig. 278. On millboard. Batheaston, C. E. B.

This is very like *Sporocybe lobulata*, Berk., which evidently belongs to the same genus; but the spores are not in any stage echinulate, nor are they so broad.

Haplographium, n. g.

Flocci atri non fasciculato-stipati, articulati; sporæ concatenatæ, hyalinæ.

Distinguished from *Graphium* by its stem consisting of a single thread, and from *Penicillium* by this being carbonized.

818. *H. delicatum*, n. s. Capitulis parvis, subolivaceis; sporis oblongis.

On dead stumps with *Monotospora sphærocephala*. Batheaston, C. E. B.

Mixed with the black *Monotospora*, it forms a subolivaceous stratum; flocci black, mostly simple, but occasionally slightly divided; heads small, composed of subdichotomous threads consisting of oblong sublinear spores about 0·0002 inch long.

Graphium tenuissimum, Corda, and *Periconia chlorocephala*, Fries, belong evidently to the same genus. It is to be observed that in *H. delicatum* the flocci, when squeezed, often split longitudinally, though they are not in the slightest degree compound.

Plate IX. fig. 4. Plant magnified.

819. *Monotospora sphærocephala*, n. s. Stratum effusum nigerrimum; floccis simplicibus, sporis globosis lævibus.

On a dead stump. Batheaston, Dec. 1858.

Forming a dense black stratum; flocci black, moderately thick, with two or three septa; spores globose, terminal, even, ·001 inch in diameter, sometimes seated on a swollen base.

This is very near *Monotospora megalospora*, B. & B., but the spores are globose, not obovate, and smaller.

Plate IX. fig. 5. Plant magnified.

820. *Dendryphium comosum*, Wallr. Fl. Crypt. vol. ii. p. 300; Cord. i. p. 21, fig. 279.

On dead nettle stems. Batheaston, December 1858, C. E. B.

The base of the flocci is sometimes sheathed, as in the genus *Sporochisma*.

821. *Oïdium æquivocum*, Berk. & Br.; *Torula æquivoca*, Cord. Fasc. 2. tab. 9. f. 37. On *Polyporus Schweinitzii*. Dorsetshire, Rev. J. H. Austen.

Our plant seems to be precisely that of Corda, which was developed on the spores of *Selenosporium Hippocastani*, of which he was observing the germination.

821*. *Psilonia nivea*, Fr. Syst. vol. iii. p. 450.

On the bark of a beech-tree. Brington, Huntingdonshire, P. Fernie, Esq.

Remarkable for its curled flocci, which sometimes resemble unrolled spiral vessels.

822. *Arthrobotryum atrum*, n. s. Stipite brevi; sporis magnis apicibus hyalinis; articulis inæqualibus.

On dead nettle stems. Batheaston, Dec. 1858, C. E. B.

Minute. Stem short, composed of simple articulated threads, which are swollen above, and terminate in subelliptic, very obtuse, unequally-articulated spores, which are dark in the centre and hyaline at the extremities, ·001–·0015 inch long, exclusive of the swollen base.

This very beautiful plant is evidently congeneric with *A. stilboideum*, Cesati, figured, but not described, in 'Hedwigia,' and is readily distinguished by the much larger spores.

Plate IX. fig. 6. *a*. Plant magnified; *b*. spores and threads more highly magnified.

823. *Ægerita candida,* Pers. Syn. p. 684.

On willows in damp marshy ground. King's Cliffe, M. J. B.

We have little doubt that *Æ. perpusilla,* Desm., is merely this species. As no complete analysis has been given, we subjoin a figure. There is certainly no peridium, and the genus is typically a compact *Oïdium.* Dr. Greville figures the spores of *Æ. candida* as globose; but, beautiful as the figures of the Scottish Cryptogamic Flora are, the more minute details are often incorrect. Spores ·0006–·0005 inch long.

PLATE IX. fig. 7. A portion of the plant.

824. *Pilacre Petersii,* Berk. & Curt. Stipite breviore candido; capitulo magno, floccis subrectis.

On hornbeam. Hainault Forest, C. E. B.

Stem 2 lines high, white; head 1–2 lines or more across; threads anastomosing, far less flexuous than in *P. faginea.* Spores snuff-coloured, about ·0002 inch across. When fresh, it has a smell like that of some *Hypericum.*

This species was originally found in Alabama by Mr. T. M. Peters, and is No. 3811 of Mr. Curtis's Collection. It differs essentially in its white stem and large head. The threads perhaps vary in character. The spores in both are nearly the same. In habit the species resembles a little *Nyctalis.*

825. *Helvella esculenta,* Pers. Comm. p. 64. On sandy ground. Weybridge Heath, Apr. 11, 1855, F. Currey, Esq.

826. *Peziza lutescens,* Hedw. Musc. Frond. ii. t. 9. fig. 3. On dead sticks amongst moss. Mossburnford, A. Jerdon, Esq.

**P. testacea,* Moug. Fr. El. ii. p. 11. On the cotton lining of a dress exposed to decay. Batheaston, Dec. 1858.

Asci broad; sporidia biseriate, ·008 inch long, elliptic, at first smooth, then minutely echinulate.

827. *Cordyceps alutacea,* Fr. Summ. p. 381. On gorse roots. Swanage, Nov. 1857, C. E. B.

A very singular form.

828. *C. purpurea,* Fr. Syst. ii. p. 325. On ergoted wheat. King's Cliffe, M. J. B.

828*. *C. microcephala,* Tul. On ergoted seeds of the common reed, F. Currey, Esq.

C. Hookeri, Kl., is probably referable to this species.

829. *Hypocrea Vitalbæ,* n. s. Minuta fusca convexa sublobata, peritheciis ovatis; ascis cylindrico-clavatis; sporidiis biseriatis triseptatis torulosis fusiformibus utrinque appendiculatis hyalinis.

On *Clematis Vitalba.* Batheaston, C. E. B.

Forming minute groups of brown, convex, sometimes slightly lobed or confluent stromata; perithecia ovate; ostiola obsolete;

asci cylindrical clavate; sporidia ·0022–·0025 inch long, ·00025 wide, fusiform, triseptate, hyaline, torulose, elongated at either end into a slender setiform appendage.

Allied to *H. rufa*, but differing altogether in its fruit.

Plate IX. fig. 8. *a*. Plant, natural size when moist; *b*. vertical section magnified; *c*. portion of ditto more highly magnified; *d*. ascus and sporidia.

830. *Hypoxylon succenturiatum*, B. & B.; *Sphæria succenturiata*, Tode, Fung. Meck. fig. 109. On oak. Weybridge, Sept. 1856, F. Currey.

Asci linear; sporidia brown, uniseriate, oblong, obtuse, ·0005–·0006 inch long.

831. *Diatrype* (Lignosæ) *undulata*, Fr. Summ. p. 385. Rudloe, Wilts., Feb. 1843, C. E. B.

What is usually considered as *D. undulata* is merely a form of *D. stigma* characterized by its short sausage-shaped sporidia. The specimens here referred to that species have the same external characters, but different fruit. Asci linear; sporidia uniseriate, subovate, pointed at one end, at length triseptate, ·0004–·0007 inch long.

Plate IX. fig. 9. Asci and sporidia magnified.

832. *D.* (Lignosæ) *dryophila*, Currey in Linn. Trans. vol. xxii. p. 269 (cum ic.). On dead oak twigs.

Asci linear. Sporidia uniseriate, dark, oblong, narrow, ·0004–·0006 inch long, sometimes binucleate.

833. *D.* (Lignosæ) *nucleata*, Currey, *l. c.* p. 270 (cum ic.). On furze. Weybridge, F. Currey, Esq.

Sporidia linear, acuminate, constricted in the centre, 4-nucleate, ·0007–·0008 inch long.

834. *D.* (Lignosæ) *varians*, Currey, *l. c.* (cum ic.). On dead twigs. Eltham, F. Currey, Esq.

Sporidia biseriate, colourless, obtuse, constricted in the middle, uniseptate, ·0006 inch long, cymbiform when seen laterally; varying much in width.

The position of this species, as Mr. Currey remarks, is doubtful. The bark, in which the perithecia are immersed, is scarcely at all changed.

835. *D.* (Lignosæ) *denigrans*, Curr. *l. c.* (cum ic.).

Sporidia dark, elliptic, ·0005 inch long.

836. *D.* (Lignosæ) *Badhami*, Curr. *l. c.* (cum ic.).

Sporidia narrow, subelliptic, 3–4-nucleate, appendiculate at either end, ·0005–·0006 inch long.

837. *D.* (Lignosæ) *inæqualis*, Curr. *l. c.* On furze. Weybridge, F. Currey, Esq.

Sporidia greenish, obtuse, constricted in the middle, uniseptate, ·0006 inch long.

This appears to be nearer to *Circumscriptæ* than *Lignosæ*; but our specimens are in bad condition.

838. *D.* (Versatiles) *sordida,* B. & B. On oak twigs. Weybridge, Sept. 1856, F. Currey.

Sporidia oblong, very obtuse, uniseptate, constricted at the septum, ·001 inch long, germinating at two lateral points on either articulation.

This is what Mr. Currey refers to *Sphæria angulata* in his paper in the 'Linn. Trans.;' but the plant of Fries has oblong curved sporidia, and belongs to the *Incusæ*. *Sphæria sordida,* P., is now a species of *Melogramma*.

839. *D.* (Versatiles) *quercina,* Fr. Summ. p. 385; *Sphæria quercina,* Pers. Disp. Meth. p. 2. On oak branches. Rudloe, &c., C. E. B. & M. J. B.

Asci clavate; sporidia lanceolate or subcymbiform, ·0018 inch long; endochrome quadripartite.

It is very doubtful whether *V. arcuata,* Currey, is more than a form of this; it is clearly not a true *Valsa*. The fructification is very like that of *Melogramma Quercuum* (Moug. & Nest. no. 770). The species given by Desmazières is merely *D. verrucæformis*.

840. *D.* (Versatiles) *Hystrix,* Fr. Summ. p. 385; *Sphæria Hystrix,* Tode, Fung. Meck. f. 127. On bark. Cornwall, J. Ralfs, Esq.

Sporidia sausage-shaped, 0·0002 inch long.

The species, of which the sporidia are figured by Mr. Currey, was gathered in Italy, and marked by De Notaris, and is something very different.

841. *D.* (Versatiles) *pyrrhocystis,* n. s. Irregularis, disco plano l. concavo, ostiolis nigris punctato; stromate pallido; peritheciis rufulis; sporidiis ellipticis uniseptatis binucleatis.

On hazel twigs. Batheaston, C. E. B., March 1854.

Irregular; disc plane or concave, studded with the black shining ostiola; stroma within pallid; perithecia brown; asci clavate; sporidia biseriate, ·001 inch long, elliptic, obtuse or slightly pointed, uniseptate, slightly constricted, with two large nuclei.

The brown perithecia, pallid stroma, and peculiar fruit are the characteristics of this species.

Plate IX. fig. 10. Asci and sporidia magnified.

842. *D.* (Concrescentes) *incarcerata,* n. s. Cortici immersa, epidermidem discutiens; peritheciis globosis, ostiolis conicis elongatis; ascis clavatis; sporidiis biseriatis oblongis utrinque acutis medio constrictis uniseptatis 4-nucleatis.

On rose stems. Twycross, Rev. A. Bloxam.

Immersed in the brown inner bark, casting off the cuticle; perithecia globose; ostiola conical, elongated; asci clavate; sporidia ·0005 inch long, biseriate, oblong, pointed at either extremity, constricted in the centre, uniseptate, quadrinucleate.

Fruit exactly like that represented by Currey under *S. enteroleuca.*

843. *D.* (Concrescentes) *stipata,* Curr. in Linn. Trans. vol. xxii. p. 274. On elm. F. Currey, Esq.

Allied more nearly to *D. elevata* than to *D. stellulata.* Sporidia sausage-shaped, ·0007–·0009 inch long. Mr. Currey finds them sometimes reaching ·001.

844. *D.* (Concrescentes) *elevata,* Berk. & Br.; *Sphæria elevata,* Berk. Decades, no. 71.

On dead twigs of *Euonymus.* Batheaston, Jan. 1852, C. E. B.

Asci clavate; sporidia numerous, sausage-shaped, 0·0003–0·00035 long. Our measurement does not accord with Mr. Currey's, though our figure of the fruit does in other respects.

845. *D.* (Circumscriptæ) *corniculata,* B. & B.; *Sphæria corniculata,* Ehr. Cr. Exs. no. 300. On dead branches. Lucknam, Wilts., C. E. B., March 26, 1850.

Asci clavate, containing eight sausage-shaped sporidia, ·0004–·0005 inch long.

846. *D.* (Circumscriptæ) *cincta,* B. & B.; *Valsa cincta,* Curr. *l. c.* fig. 135 (not 185, as in text).

On twigs. Blackheath, F. Currey, Esq.

Sporidia dark, obtuse, constricted in the middle, uniseptate, ·0007 inch long.

This is certainly not a true *Valsa.* In fruit it approaches *S. Notarisii,* Mont. & Dur., but not in the ostiola. It appears to grow on some *Robinia.*

847. *Valsa* (Circumscriptæ) *syngenesia,* Fr. Summ. p. 411; *Sphæria syngenesia,* Fr. Obs. ii. t. 7. f. 1. On elder. Elmhurst, March 1852, C. E. B.; Clifton, Notts., M. J. B.

Our plant is exactly what is figured by Fries. In Mr. Currey's plant the sporidia are elliptic-acuminate, with a quadripartite endochrome; in ours they are minute and sausage-shaped.

848. *V.* (Circumscriptæ) *Cratægi,* Curr. Tr. Linn. Soc. xxii. p. 278. On dead hawthorn twigs. Blackheath, &c., F. Currey, Esq.

The figure of the spores, as given by Mr. Currey, accords with what we have seen in the early stage of growth; but at length they are strongly constricted, uniseptate, with two distinct nuclei in each articulation, and ·0006 inch long, which accords with his measurement. It cannot, then, be any form of *Valsa stilbostoma.*

**V.* (Incusæ) *angulata,* Fr. Summ. p. 411. On *Cytisus Laburnum.* Lambley, Notts., M. J. B.

Desmazières finds, in Fries, no. 72, which in our specimen is without fruit, sausage-shaped sporidia.

849. *V.* (Incusæ) *taleola,* Fr. Summ. p. 411. Common on dead oak branches.

Asci linear; sporidia uniseriate elliptic when young, broadly lanceolate rather irregular and uniseptate when mature, ·0008–·001 inch long. Mr. Currey's *S. taleola* is identical with *S. leiphæmia,* and different from this, which belongs to a different section.

Plate IX. fig. 11. *a.* Ascus with young fruit and paraphysis magnified; *b.* young fruit magnified; *c.* mature fruit magnified.

850. *V.* (Incusæ) *dryina,* Curr. *l. c.* p. 278. On dead oak branches. Weybridge, F. Currey, Esq.

Sporidia oblong, strongly curved, ·0003 inch long.

851. *V.* (Obvallatæ) *Platanigera,* n. s. Disco minuto albido; peritheciis paucis, ostiolis obscuris; ascis clavatis; sporidiis lanceolatis minutis.

On plane. Leicestershire, Rev. A. Bloxam.

Perithecia 4–7 in a group, globose, subdecumbent, neck about the same length, oblique; disk small, white; ostiola obscure; asci clavate; sporidia hyaline, lanceolate, ·0007 inch long.

An obscure but distinct species.

Plate IX. fig. 12. *a.* Single perithecium magnified; *b.* ascus; *c.* sporidia.

852. *V.* (Obvallatæ) *tetratrupha,* n. s. Pustulis minutis; peritheciis ovatis; ascis linearibus; sporidiis quaternis fenestratis.

On twigs of alder. Batheaston, Feb. 1852, C. E. B.

Forming minute pustules which pierce the cuticle by means of a flat pallid disk studded with black ostiola; asci linear; sporidia four, ·0009–·001 inch long, yellow-brown, oblong, at first uni- triseptate, at length fenestrate.

Fruit strongly resembling that of *S. elongata.*

Plate X. fig. 13. Ascus and sporidium magnified.

853. *V.* (Obvallatæ) *fenestrata,* n. s. Peritheciis fuscis, ostiolis obsoletis; sporidiis elliptico-oblongis uni- triseptatis utrinque appendiculatis fenestratis.

On dead oak twigs. Orton Wood, Leicestershire, Rev. A. Bloxam. On alder. Spye Park, March 1859.

Perithecia forming little pustules, brownish; disk narrow; ostiola obsolete; sporidia ·002 inch long, elliptic-oblong, uniseptate, with a small appendage at either extremity; endochrome divided into innumerable cells; septum at length obsolete, and surface of the sporidia granulated. In the plant on alder, sporidia ·002–·003 inch long. There are sometimes three septa, and the appendages are more acute.

PLATE X. fig. 14. *a.* Mature and immature sporidia magnified; *b.* sporidium from the plant on alder.

854. *V.* (Obvallatæ) *tetraploa*, Berk. & Curt. MSS. Peritheciis congestis, ostiolis 20–30 cæspitem compactum efformantibus, subquadrisulcatis; sporidiis minutis oblongis curvis.

On dead sticks. Elmhurst, Feb. 1850, C. E. B.

Perithecia 20–30, crowded, their ostiola, which are mostly quadrisulcate, forming a little close tuft. Sporidia minute, sausage-shaped.

A very common species in the United States, occurring on many different kinds of wood.

855. *V.* (Obvallatæ) *rhodophila*, n. s. Pustulis minutis convexis epidermidem discretum elevantibus; ostiolis minutis lævibus nitidulis; ascis clavatis; sporidiis octonis oblongis curvis.

On dead rose twigs. Orton Wood, Leicestershire, Rev. A. Bloxam.

Pustules minute, lifting up the cuticle, which separates from them; disk convex; ostiola minute, shining, even; asci clavate, containing eight sausage-shaped sporidia, ·0004 inch long.

856. *V.* (Obvallatæ) *querna*, Curr. *l. c.* p. 279. On oak twigs. F. Currey, Esq.

Sporidia oblong, slightly curved, ·0002–·0003 inch long.

857. *V.* (Obvallatæ) *biconica*, Curr. *l. c.* Weybridge, F. Currey, Esq.

Sporidia biconical, ·0011–·0012 inch long.

858. *V.* (Obvallatæ) *pulchra*, Curr. *l. c.*

Sporidia elliptic, greenish, slightly constricted in the middle and slightly acuminate at either end, uniseptate.

859. *V.* (Obvallatæ) *tetraspora*, Currey, *l. c.* On willow. Weybridge, Jan., F. Currey, Esq.

Sporidia four in each ascus, sausage-shaped, obtuse, ·0008 inch long.

860. *V.* (Obvallatæ) *intexta*, Curr. *l. c.* On oak. Weybridge, F. Currey, Esq.

Sporidia interwoven, filiform, very long.

861. *V.* (Circinatæ) *bitorulosa*, n. s. Peritheciis suboctonis brunneolis subpulverulentis; collibus decumbentibus rectis ostiolis confluentibus; sporidiis uniseptatis, septo articulisque binucleatis constrictis.

On hornbeam. Elmhurst, Dec. 1851, C. E. B.

Concealed by the cuticle; perithecia globose, collapsed, circinating, about eight in a group, with straight decumbent necks and confluent ostiola; asci clavate; sporidia biseriate, ·0007–

·0008 inch long, uniseptate, constricted strongly at the septum and in the centre of each of the binucleate articulations.

The fruit somewhat resembles that of *Valsa faginea*, Currey, but is larger and more constricted.

Plate X. fig. 15. Ascus and sporidia magnified.

*V. (Circinatæ) *chrysostroma*, Fr. Summ. p. 412; *S. xanthostroma*, Mont. On hornbeam. Lucknam.

The Lucknam plant is just that of Desm. 1756. The sporidia, however, when fully developed, are uniseptate and strongly constricted in the centre. Montagne's name is preoccupied by Schweinitz.

Plate X. fig. 16. Sporidia magnified.

862. *V.* (Circinatæ) *aglæostoma*, n. s. Peritheciis ovatis, ostiolis nitidis congestis; sporidiis oblongis 4-septatis torulosis.

On elm twigs. Rev. A. Bloxam, Leicestershire.

Perithecia in groups of from four to six, ovate; ostiola crowded, cylindrical, shining; sporidia oblong, 4-septate, constricted at each septum, ·0008–·001 inch long.

Resembling somewhat *V. hypodermia*, but differing essentially in the fruit and in other points.

Plate X. fig. 17. Ascus and sporidia magnified.

*V. (Circinatæ) *hypodermia*, Fr. Summ. p. 410. On elm twigs. Common.

Sporidia sausage-shaped, ·001 inch long. Spermatia on branched septate threads, almost linear, ·00015 inch long.

Plate X. fig. 18. *a*. Spores magnified; *b*. spermatia on their threads.

863. *V.* (Circinatæ) *Innesii*, Curr. *l. c.* p. 281.

Sporidia colourless, thrice constricted, acute at either end, ·001–·0012 inch long, often appendiculate.

864. *V.* (Circinatæ) *faginea*, Curr. *l. c.* Eltham, Oct., F. Currey, Esq.

Sporidia colourless, elliptic-acuminate, constricted in the middle and irregular, ·0005 inch long.

865. *V.* (Circinatæ) *Tiliaginea*, Currey in Phil. Trans. 1857, p. 546 (sub *Sphæria*). On lime twigs. Blackheath, F. Currey, Esq.

Remarkable for the green disk above the perithecia.

866. *V.* (Circinatæ) *vestita*, Fr., Currey in Phil. Trans. 1857, p. 546. On dead twigs. F. Currey, Esq.

Sporidia elliptic, transversely and longitudinally septate, ·0006–·0008 inch long.

867. *V.* (Incusæ) *concamerata*, Curr. *l. c.* p. 277. On oak twigs. F. Currey, Esq.

Sporidia oblong, curved, ·0004 inch long.

868. *Sphæria* (Cæspitosæ) *Saubinetii,* Mont. Syll. On herbaceous stems, Twycross, Rev. A. Bloxam. On elm twigs, Batheaston, C. E. B.

This has the violet walls of *S. pulicaris,* but the fruit is much larger. The Batheaston plant may be considered as a variety with ovate perithecia and rather large sporidia. In Mr. Bloxam's plant they are ·001 inch long; in the Batheaston plant ·0012, and at length torulose.

869. *S.* (Cæspitosæ) *nigerrima,* Blox., Curr. *l. c.* p. 272. Parasitic on several species of *Diatrype.* Gopsall, Rev. A. Bloxam. Mossburnford, A. Jerdon, Esq. St. Catharine's, near Bath, C. E. B.

Asci clavate; sporidia biseriate, hyaline, subelliptic, but often swollen on one side like the frustules of *Eunotia,* at length multiseptate, with one or two vertical dissepiments, $\cdot 0008\dot{3}$–·0005 inch long.

The perithecia are sprinkled over with short stiff bristles; they appear at first like the ostiola of the *Diatrype,* in consequence of which the species is included by Currey in *Versatiles.* It approaches very near to *Dothidea.*

Plate X. fig. 19. *a.* Perithecia magnified; *b.* ascus; *c.* sporidia magnified.

870. *S.* (Cæspitosæ) *barbula,* n. s. Cæspitosa; peritheciis globosis collapsis subtiliter pilosis; sporidiis oblongis uniseptatis.

On bark of pine. Wraxall, March 1845.

Forming little tufts; perithecia globose, collapsed when dry, astomatous, clothed with a few short scattered hairs; sporidia oblong or subelliptic, ·0005 inch long, uniseptate.

Perhaps too near to *S. Chætomium,* Cord. *S. helicospora,* B. & B., and *S. Eres,* B. & B., are allies.

Plate X. fig. 20. Sporidia magnified.

871. *S.* (Cæspitosæ) *apotheciorum,* Mass. Lich. p. 26, fig. 41. On *Parmelia subfusca.* Benarth, Conway, 1851, Rev. C. Babington.

Fruit just like that of *Phacopsis varia,* Tul.

872. *S.* (Villosæ) *callimorpha,* Mont. Syll. p. 227. On brambles. Leicestershire, Rev. A. Bloxam.

873. *S.* (Denudatæ) *rhytidodes,* n. s. Gregaria atra; peritheciis e mycelio maculæformi oriundis subglobosis rugoso-sulcatis; ostiolo papillæformi; ascis elongatis; sporidiis biserialibus 3–6-septatis torulosis.

On ash pollards. Batheaston, Jan. 1852, C. E. B.

Mycelium black, forming dark stains, on which are seated subglobose laterally sulcate perithecia with a papillæform ostiolum; asci elongato-clavate; sporidia biseriate, ·001–$\cdot 001\dot{3}$ inch long, cymbiform.

Allied to *S. pulvis pyrius*; but the fruit is different, in addition to other characters.

PLATE X. fig. 21. *a.* Single perithecium magnified; *b.* ascus and sporidia more highly magnified; *c.* threads of mycelium within tissue of matrix.

874. *S.* (Denudatæ) *vesticola*, n. s. Peritheciis gregariis ovatis obliquis sursum attenuatis deorsum subvestitis; ascis linearibus; sporidiis limoniiformibus nigris.

On the lining of an old gown, with *Peziza testacea.* Batheaston, Dec. 1858, C. E. B.

Perithecia gregarious, olive-black, ovate, attenuated above, oblique, rough below, with a few obscure flocci or furfuraceous prominences. Asci linear; sporidia at first concatenated, then free, lemon-shaped, ·0007 inch long, germinating at either extremity.

This has many points in common with *Schizothecium fimicola*, Corda. The asci are soon absorbed; and then the structure is just what Corda figures. The shape of the perithecia is the same; but there is no fissure.

Mr. Currey suggests that this may be a form of *S. coprophila*, Fr. In that species, however, we find filiform sporidia. It is true that in filiform multinucleate sporidia the endochrome of the upper articulation sometimes undergoes a change analogous to that which takes place in some Algæ; and therefore Rabenhorst's *S. coprophila* may be the same as ours, though it presents dark elliptic instead of filiform hyaline sporidia. In the present plant, however, no such change takes place.

875. *S.* (Pertusæ) *Jenynsii.* Peritheciis semi-immersis subpruinosis, ostiolis conicis l. cylindricis; ascis clavatis; sporidiis cymbiformibus demum triseptatis.

On dead wood. Bottisham, Sept. 29, 1823, Rev. L. Jenyns. Batheaston, Dec. 1851, C. E. B.

Half-immersed in the wood, but not accompanied by any black stain; perithecia subpruinose or rugose; ostiola conical or cylindrical, sometimes slightly compressed. Asci clavate; sporidia biseriate, ·0012 inch long, cymbiform, at length triseptate.

PLATE X. fig. 22. *a.* Ascus; *b.* sporidia magnified.

876. *S.* (Pertusæ) *pœcilostoma*, n. s. Peritheciis semiliberis subglobosis opacis; ostiolo variabili, obsoleto, conico, cylindrico; ascis brevibus; sporidiis cymbiformibus acutis.

On twigs of *Ulex.* Twycross, Rev. A. Bloxam.

Perithecia quite free above, subglobose, opake; ostiolum very variable in form, obsolete, conical, compressed or abruptly cylindrical. Asci clavate, short; sporidia ·001 inch long, cymbiform, acute at either extremity, or even appendiculate, containing four nuclei.

Allied to *S. Jenynsii,* but more freely developed, smaller, with shorter asci and smaller sporidia. We have only seen them without septa, which they probably acquire in age.

PLATE X. fig. 23. Ascus and sporidia magnified.

877. *S.* (Pertusæ) *brachythele,* n. s. Peritheciis semi-immersis globosis, ostiolo brevi papillæformi; ascis cylindricis; sporidiis magnis subfusiformibus centro constrictis 1–5-septatis.

On decorticated elder. Batheaston, Feb. 1859.

Perithecia rather large, scattered, half-immersed, globose, attenuated above into a short papillæform ostiolum; asci cylindrical; sporidia ·0013 inch long, subfusiform, with one side more convex when seen laterally, strongly constricted in the centre, at first uniseptate, at length 3–5-septate; endochrome dark.

PLATE X. fig. 24. Sporidia magnified.

878. *S.* (Pertusæ) *pertusa,* Fr. Syst. vol. ii. p. 464, var. Batheaston. On boards of elm, &c. Elmhurst, Dec. 1851; St. Catharine's, Feb. 1852, C. E. B.

Differing from the typical form in not having any black stain. Asci clavate, elongated. Sporidia biseriate, oblongo-lanceolate, for the most part strongly constricted in the centre, uniseptate, ·0007–·0008 inch long; each articulation containing two nuclei. Occasionally two additional septa are formed, and the sporidia are curved, and either even or constricted at the commissures. In every case they are much smaller than those of *S. Jenynsii.* Unfortunately we have no analysis of the typical form of *S. pertusa.*

PLATE X. fig. 25. *a.* Ascus magnified; *b.* sporidia in various conditions, magnified.

879. *S.* (Pertusæ) *Aspegrenii,* Fr. in Kze. Myc. Heft 2. p. 40. On blackthorn. Orton Wood, Leicestershire, Rev. A. Bloxam.

Asci linear; sporidia uniseriate, but not concatenate, oblong, triseptate, enucleate, ·0008 inch long.

PLATE XI. fig. 26. Ascus and sporidia magnified.

880. *S.* (Platystomæ) *excipuliformis,* Fr. Syst. vol. ii. p. 469, var. On dead wood. King's Cliffe, &c., M. J. B.

Sporidia fusiform, curved, with about six septa, ·0012 inch long; commissures not constricted. The typical form, published by Fries in 'Scleromycetes Suecicæ,' has sporidia of precisely the same shape, but twice as long. We find them sometimes ·0028 inch long. Asci apparently uniseriate.

PLATE XI. fig. 26*. Sporidium from 'Scl. Suec.,' magnified.

881. *S.* (Platystomæ) *angustilabra*, n. s. Peritheciis semi-immersis rugulosis; ostiolo angusto compresso; sporidiis fusiformibus appendiculatis curvatis uniseptatis 4–6-nucleatis.

On gorse. Leicestershire, Rev. A. Bloxam.

Perithecia half-immersed, rugulose, somewhat elongated; ostiolum compressed, narrow; asci clavate; sporidia biseriate, ·0018–·0016 inch long, fusiform, curved, uniseptate, constricted at the septum, each articulation containing from two to three nuclei, and terminating in a hyaline point.

Differing from *S. excipuliformis* in the structure of the spores, which are possibly at length multiseptate; but, if so, they are at first composed of two very elongated cones apposed to each other at their bases, and strongly constricted at the commissure.

PLATE XI. fig. 27. Sporidia magnified.

**S.* (Platystomæ) *macrostoma*, Tode, Fung. Meck. f. 76, 77. On dead holly twigs. Spye Park, April 19, 1850, C. E. B.

Sporidia ·0008 inch long, oblong, torulose, triseptate. Very like those of *S. Aspegrenii.*

882. *S.* (Ceratostomæ) *lampadophora*, n. s. Peritheciis gregariis globosis sordide pruinosis, collo longo flexuoso irregulari; sporidiis fusiformibus curvis multiseptatis.

On decayed wood. Batheaston, Oct. 1855; Combe Hay, April 1855, C. E. B.

Gregarious; perithecia middle-sized, globose, brownish, pulverulent or subtomentose; neck elongated, irregular, flexuous; sporidia lineari-fusiform, ·003 inch long, multiseptate.

A very fine species, with the habit of *S. rostrata*; but that has minute sausage-shaped sporidia.

PLATE XI. fig. 28. Sporidia magnified.

883. *S.* (Ceratostomæ) *ligneola*, n. s. Peritheciis globosis subglaucis glabris demersis, collo elongato obtuso; sporidiis ellipticis uniseptatis.

On decayed oak. Portbury, Somerset, Jan. 1845, C. E. B.

Perithecia scattered, immersed in the wood, globose, smooth, black with a slight glaucous bloom; neck about as long as the perithecia, obtuse; sporidia ·0003–·0004 inch long, binucleate, at length uniseptate.

Resembling young *S. cirrhosa*, but perfectly smooth and glaucous, and by no means fibrillose.

PLATE XI. fig. 29. Sporidia magnified.

884. *S.* (Obtectæ) *Glis*, Berk. & Curr. Peritheciis mediis depressis sub epidermide nidulantibus astomis; mycelio amplo tomentoso fusco; sporidiis oblongis curvis obtusissimis quadrinucleatis.

On oak twigs. Weybridge, Sept. 1856, F. Currey, Completely concealed by the cuticle, which shows when removed a dense mycelium containing numerous depressed astomatous perithecia. Sporidia ·0008–·0009 inch long, sausage-shaped, very obtuse, quadrinucleate.

Intermediate between *S. lanata* and *S. hirta*, the former of which has very large perithecia and minute curved sporidia.

885. *S.* (Obtectæ) *hemitapha*, n. s. Peritheciis globosis semi immersis opacis e macula alba oriundis; ostiolo papillæformi; sporidiis elliptico-oblongis triseptatis.

On felled oak. St. Catharine's, Bath, Feb. 1852, C. E. B.

Growing on white bleached spots; perithecia globose, the upper half free, opake, not shining; ostiolum small, papilliform; asci lineari-clavate; sporidia biseriate, ·00125 inch long, oblong elliptic, at length triseptate, but not torulose.

Very near to *S. hypotephra*, but there are no cinereous spots; the perithecia are half-exposed, and the sporidia larger.

Plate XI. fig. 30. Sporidia magnified.

886. *S.* (Obtectæ) *unicaudata*, n. s. Peritheciis minutis subtectis subglobosis collabentibus; sporidiis clavatis quadriseptatis deorsum caudatis.

On *Clematis Vitalba*. Batheaston, C. E. B.

Scattered beneath the cuticle, subglobose, collapsed when dry; asci oblong, but varying in form according to the pressure of the sporidia; sporidia ·0015 inch long, clavate, triseptate; the upper articulation hyaline, the three following brownish, often containing a globose nucleus; appendage, or fifth articulation, hyaline, gradually tapering or constricted near the tip. Very rarely there are four brown articulations.

A very curious and distinct, though obscure species. The fruit resembles that of *S. Massalongi*, Mont.

Plate XI. fig. 31. Ascus and sporidia magnified.

887. *S.* (Obtectæ) *oblitescens*, n. s. Peritheciis depressis tectis, ostiolo obscuro; ascis linearibus elongatis; sporidiis oblongo-ellipticis obtusissimis uniseptatis.

On dead twigs of *Cornus*. Spye Park, Jan. 29, 1851.

Perithecia covered by the cuticle, depressed, moderately large; asci cylindrical, elongated; sporidia uniseriate, oblongo-elliptic, very obtuse, uniseptate, slightly constricted at the commissure, ·0005 inch long; paraphyses linear, some of them containing one or two sporidia.

This species has somewhat the habit of *S. mamillana*. The cuticle is also occasionally discoloured above the perithecia. The fruit, however, of that species is very different, the sporidia being cymbiform and triseptate.

Plate XI. fig. 32. *a.* Asci magnified; *b.* sporidia magnified.

888. *S.* (Obtectæ) *melina*, n. s. Subcuticularis globosa; ostiolo minuto; ascis sublinearibus; sporidiis uniserialibus cymbiformibus triseptatis.

On dead ash twigs. Batheaston, March 1850.

Perithecia immersed in the bark, which is stained brown immediately above them, piercing the cuticle by a minute ostiolum; asci elongated, linear, obtuse; sporidia uniseriate, subcymbiform when seen laterally, triseptate, ·0009 inch long.

Plate XI. fig. 33. *a.* Ascus magnified; *b.* sporidia seen laterally and dorsally.

**S.* (Obtectæ) *clypeata*, Nees, Syst. f. 355. On dead *Epilobium*. Batheaston, March 20, 1851.

Asci linear; sporidia uniseriate, oblong, ·0008 inch long, 4–5-septate.

889. *S.* (Obtectæ) *anserina*, Pers. Ic. et Desc. t. 1. fig. 8. Shrewsbury, Rev. W. A. Leighton.

Mr. Leighton's specimens have sublinear asci, and elliptic uniseptate uniseriate sporidia ·0008–·001 inch long. The sporidia in fact resemble the common type of *Diplodia*.

890. *S.* (Obturatæ) *obliterans*, n. s. Peritheciis sparsis, fibris matricis dealbatis semitectis, collabentibus astomis; ascis cylindrico-clavatis, sporidiis uniserialibus obovatis triseptatis, septis demum obliteratis.

On bare fir poles. Batheaston, March 22, 1850.

Scattered, half-covered by the bleached fibres of the wood, collapsing, astomous; asci cylindrico-clavate; sporidia ·0007 inch long, uniseriate, obovate, triseptate; septa at length obliterated, their position being still indicated by a slight constriction.

Plate XI. fig. 34. *a.* Ascus magnified; *b.* sporidia magnified.

891. *S.* (Caulicolæ) *planiuscula*, n. s. Sparsa complanata, ostiolo obscuro; ascis clavatis; sporidiis biserialibus oblongis uniseptatis centro irregulariter incrassatis.

On dead stems of herbaceous plants. Ashley, Wilts., 1853, C. E. B.

Minute, scattered, covered by the cuticle, depressed, with an obscure ostiolum; asci clavate; sporidia biseriate, oblong, uniseptate, slightly but irregularly swollen at the commissure, the one articulation generally being more swollen than the other, ·0006 inch long.

Plate XI. fig. 35. Sporidia magnified.

892. *S.* (Caulicolæ) *Lunariæ*, n. s. Gregaria; peritheciis atris subglobosis, ostiolo tantum papillæformi epidermidem penetrante; ascis linearibus; sporidiis biseriatis oblongis triseptatis.

On dried pods of *Lunaria rediviva*. King's Cliffe, M. J. B.

Gregarious, minute, black, subglobose, piercing the cuticle by the papilliform ostiolum; asci short, linear, obtuse; sporidia ·001 inch long, biseriate, oblong, acute or obtuse, very slightly curved, triseptate; articulation slightly torulose.

PLATE XI. fig. 36. Sporidia magnified.

893. *S.* (Foliicolæ) *anarithma*, n. s. Sparsa obtecta; peritheciis globosis ostiolo minuto papillæformi; ascis clavatis; sporidiis biserialibus sublanceolatis uniseptatis medio constrictis.

On *Aira cæspitosa*. Batheaston, March 1854; Bowood, Oct. 1853, C. E. B.

Scattered, minute; perithecia globose, penetrating the cuticle by the small papilliform ostiolum; asci clavate; sporidia biseriate, sublanceolate, strongly constricted in the centre, and uniseptate, ·0012 inch long.

There is apparently another species on the same leaves with an obscure ostiolum, and the sporidia of a slightly different shape and ·0008–·0009 inch long. We have not, however, seen this in perfection, and therefore for the present omit it.

PLATE XI. fig. 37. Sporidia magnified.

894. *Melogramma rubro-notatum*, n. s. Peritheciis confluentibus, ostiolo papillæformi lateritio; ascis linearibus; sporidiis oblongis 3-septatis.

On elm bark. King's Cliffe, Dec. 1852, M. J. B.

At first, bursting through the cuticle and forming distinct round patches, which, however, at length run together into a nearly uniform mass; perithecia confluent; ostiolum papilliform, perforated, the perforation surrounded with brick-red meal; asci linear; sporidia uniseriate, oblong, ·0006 inch long, triseptate.

A very remarkable species. When the red meal is rubbed off, it looks as if it belonged to the tribe Concrescentes.

895. *M. oligosporum*, n. s. Peritheciis opacis rugosiusculis; ostiolis demum pertusis; ascis clavatis; sporidiis magnis paucis breviter fusiformibus.

Twycross, Rev. A. Bloxam.

Forming roundish patches bursting through the cuticle; perithecia opake, rather rough; asci clavate; sporidia shortly fusiform, ·0022 inch long, at first surrounded by a hyaline border, changing from uniseptate to triseptate; dissepiments, especially the central one, constricted.

PLATE XI. fig. 38. Ascus and sporidia magnified.

896. *Nectria Helminthicola*, n. s. Carnea minuta globosa parasitica glabra; ascis sursum angustioribus; sporidiis biquadrinucleatis.

Parasitic on some large species of *Helminthosporium*. Batheaston, Jan. 1859, C. E. B.

Scarcely visible to the naked eye, globose, flesh-coloured, smooth; asci generally attenuated upwards, often curved; sporidia hyaline, with two to four nuclei, and consequently either uniseptate or ultimately triseptate, ·0006–·00056 inch long.

897. *N. graminicola*, n. s. Peritheciis ovatis sparsis demum collapsis rubris; sporidiis fusiformibus uniseptatis.

On *Aira cæspitosa*. Batheaston, Jan. 1850, C. E. B.

Scattered over the dead leaves, ovate, red, at length collapsed; sporidia fusiform, ·0007–·0008 inch long.

Closely resembling *N. Peziza*; but the sporidia in that species are broadly elliptic, ·0006 inch long. It is possible that the nuclei in the sporidia of *N. graminicola* are indications of two more septa.

Plate XI. fig. 40. Sporidia magnified.

898. *N. Rousseliana*, Mont. Syll. p. 224. On box leaves. Twycross, Rev. A. Bloxam.

Var. *viridis*. Peritheciis siccis atro-viridibus, madidis prasiis ovatis pilis sparsis hyalinis obsitis; sporidiis ellipticis.

On the under side of box leaves. Batheaston, C. E. B.

When dry, presenting nearly black specks, when moistened, green; perithecia beset with scattered hyaline hairs; sporidia elliptic, ·0007 inch long, hyaline.

Our plant resembles that of Montagne so closely, except in colour, that we do not like, without further opportunity of studying it, to keep it distinct. Both are probably the same thing with *Sphæria fulva*, Fr. Elench.

Chætostroma Buxi, Cord., is apparently a state of the same species. See Debat's curious memoir in 'Ann. des Sci. Nat.' vol. ix. 1858, where the transition from *Psilonia Buxi* into a *Nectria* is all but demonstrated.

899. *Dothidea tetraspora*, n. s. Stromate pulvinato; cellulis immersis l. subprominentibus; ascis cylindricis tetrasporis; sporidiis uniseriatis uniseptatis obovatis medio constrictis.

On dead twigs of *Daphne Laureola* and *Ulex*. Mossburnford, A. Jerdon, Esq., Feb. 1859.

Stroma pulvinate, black, either quite even or studded with the projecting cells; asci cylindrical, containing four sporidia arranged in a single row; sporidia ·001–·0013 inch long, obovate, uniseptate, yellow-brown, the lower articulation generally shorter and narrower. Very rarely there is a third septum.

Plate XI. fig. 39. Ascus and sporidia magnified.

900. *Capnodium elongatum*. Berk. & Desm. Journ. Hort. Soc. vol. iv. p. 251. On spurs of living pear-trees. Cornwall, Sir C. Lemon.

We find in the British specimens both stylospores and asci. The latter, however, are not sufficiently perfect to contain full-grown sporidia. The stylospores are exactly like those figured in the 'Horticultural Journal.' As regards the sporidia, we must wait for better information. The genus, at any rate, is new to this country.

[To be continued.]

XXXVIII.—*On Sexual Differences found in Bones of some Recent and Fossil Species of Frogs and Fishes.* By Dr. Albert Günther.

[With two Plates.]

The production of the following paper has been induced by an examination of several fossil remains of Batrachians in the Collection of the British Museum; they were procured near Lagoa Santa (Brazil), in localities containing remains of those fossil South American mammals which have been described by Lund, Owen, Gervais, &c., and are unequivocally in a truly fossil state. Nevertheless I am induced to believe, from comparison with the skeletons of living species, that the fossil remains which I shall here discuss *do not belong to species different from the recent.* Being unaware of the existence of any description of the skeletons either of the fossil or living animals, I think it the more necessary to give one, as we shall find a new proof how important is the knowledge of sexual differences existing in the osteology of living species, in many instances of determining fossil remains.

There are, first, two skulls, in a more or less perfect condition, and two fragments of maxillary bones. Although differing in form, and still more in size, they both belong to the same species, *Ceratophrys cornuta.* I have compared them with the male and female of their descendants of our period, and have found that the latter present exactly the same differences in the structure of the head.

The skull of *Ceratophrys* is distinguished by its complete ossification, by its excessively firm structure, by the tubercular surface of all the upper parts, and by the extraordinary development of bones belonging to the dermo-skeleton, surrounding the eye and forming an orbit, *externally* completely closed: nearly all the sutures seem to disappear in early age.

The skull, which I believe to be that of a male *Ceratophrys cornuta** (Pl. XV. fig. A), is broadest between the articular ex-

* For comparison with *Ceratophrys ornata,* see the figure given by Hallowell, Journ. Nat. Sc. Ac. Philad. 4th series, vol. iii. pl. 36, under the name of *Trigonophrys rugosa.* There is another figure on the same plate (right-hand, bottom), probably representing a restored skull of *Ceratophrys cornuta;* but there is no reference whatever to it in the text.

tremities of the tympanic bones ($24\frac{1}{2}'''$), longest in its median diameter ($18'''$), and highest in a vertical from a prominent crest of the os petrosum ($9\frac{1}{2}'''$). The latter extraordinary elevation of the posterior part of the skull is not only effected by the crest above mentioned, but chiefly by a most powerful development of the tympanic bone. Thus the upper surface of the skull, instead of being flat, as in other frogs, descends steeply to the margins of the jaws. In viewing the skull from behind, we find that the *occipital vertebra* itself is as much depressed and low as in other frogs, leaving beneath a wide free space for the pharynx, spacious enough to admit the passage of the largest prey which these gigantic frogs are capable of holding. The sutures between the *exoccipital* and the neighbouring bones have entirely disappeared. There is, immediately below and at the exterior of each of the condyli, a very distinct opening for the passage of *nn. vagus* and *glossopharyngeus*; above and externally, a thick and obtuse process—probably the place of junction of the exoccipital and os petrosum, and homologous with the *crista occipitalis* of the Carnivora; it affords a broad base for the insertion of the *musc. temporalis* on the anterior side, and for that of a part of the muscles of the neck on the posterior. This process is relatively larger in *Cystignathus*. The ossified dermal plate*, which covers the parietal region, projects with a sharp edge, somewhat above the process mentioned, forming a small recess below. The *os petrosum* is stronger than in any other Batrachian. We may distinguish in it three portions—one joining the occipital, and two for the suspension of the tympanic. The former, or internal portion, passes at the base of the skull, without visible interruption or suture, into that of the other side and into the basioccipital; it is anteriorly excavated, with a large round foramen for the *n. trigeminus*, and has a low crest at the pharyngeal side. The two outer portions, a superior and an inferior, which in other frogs form a more or less deep fork, are here united by a thin bony plate with a very small opening, which is closed in the living animal by a cartilage. The superior portion widens very much above, and is covered with a broad bony dermal plate, which projects posteriorly in a very prominent crest†, and extends anteriorly over the mastoid process; at its inner side it emits a bony bridge reaching to the frontal bones and separating, from

* The dermal plates form, in fact, one continuous covering of the upper surface of the skull; but the description will be clearer by describing separately certain portions of it corresponding to the bones hidden beneath.

† This crest is entirely absent in other Batrachians, but well developed in the order of the Chelonii, in which, however, it has a longitudinal direction, whilst here it is transversal.

that large open space which in other frogs represents an imperfect orbita, a smaller part—the *fossa temporalis*. This superior portion of the petrosal has moreover posteriorly a notch between its prominent posterior ridge and the thick process of the exoccipital. Immediately below is the entrance of the organ of hearing. The *basioccipital* is remarkable from its lateral branches forming a rather acute anterior angle with the longitudinal axis of the bone; in *Cystignathus*, for instance, these branches are directed backwards, so as to form an obtuse anterior angle; in *Rana* and *Cultripes* the angle is a right one. The lateral parts of the brain-capsule are entirely ossified, and apparently formed by the basioccipital. The bone itself is very narrow, and its lower part a slightly rounded ridge. The *parietal* and *frontal* bones are not to be distinguished from one another; they present a surface equally covered with tubercles; by emitting on each side, behind the orbit, a process to meet the bony bridge from the *os petrosum*, they appear twice as broad as between the orbits; at the latter place they are very slightly concave, and three-quarters the width of the orbit. The part situated in front of the orbits, and corresponding to the *ossa frontalia anteriora*, widens again, and emits laterally an anterior bony bridge to join the maxillary and the mastoid processes: this bridge, likewise present in other frogs, is here very solid, and covered with a granulated dermal plate furrowed by a deep groove going from the anterior and inferior angle of the orbit to the nasal opening, and forming a channel for a blood-vessel and a nerve in the living animal; it is more or less visible in most of the species of Chelonii*. At the lower side of the skull the *palatine* bone corresponds to the bridge described; it is furnished with a sharp longitudinal ridge, slightly denticulated. In front of the bridge is situated the nasal opening; irregularly quadrilateral at the outside, it appears more rounded and semicircular in the cavity of the mouth. The exterior opening is narrow in comparison with other frogs, as a part of it is covered by a bony plate ascending from the maxillary, and as the ethmoid, the anterior part of the frontal, and the maxillary form one solid bridge. The *ethmoid* is separated from the neighbouring bones by still visible sutures; it is perforated in front by two very distinct openings (for the *n. olfactorius*), and emits on each side a process $5'''$ long and slightly arched, with the convexity in front; each process extends laterally to the posterior end of the suture, which is formed by the maxillary and intermaxillary bones. At the outside of the skull these processes are hidden beneath the bony plate in the middle of the fore-

* Cf. e.g. the skull of *Macroclemmys Temminckii*, Gray, Catal. Shield Rept. pl. 38. f. 2.

head, and those ascending from the maxillary; but there remains, near the origin of the process, a narrow and smooth groove leading to the posterior part of the nasal cavity. The *vomerine* bones cover the greater part of the ethmoid from beneath, and are similar in form and parallel to this bone, being arched, and extending nearly to the extremity of the ethmoidal processes. In the middle of their length they are furnished with a short ridge projecting into the choana, and armed with two irregular denticulations. The *intermaxillary* is lost. The *maxillary* bone is very slightly arched, and tapers where it meets the hypo-tympanic; it is armed with a series of teeth, compressed, pointed, and closely set *. The bone itself is smooth; but there is joined with it a tubercular dermal plate, which covers the whole cheek and is in immediate contiguity with the broad mastoid process; it is slightly excavated, and exhibits posteriorly a deeper triangular groove with elevated lateral ridges. The *tympanic* bone is most powerfully developed; a separated hypo-tympanic cannot be distinguished; its articular extremity and the two apophyses, which in other frogs are angularly bent and separated from one another, form here one straight broad bone, obliquely directed backwards, posteriorly convex, anteriorly deeply excavated; the articular extremity has two prominent condyles, with a groove between; the pterygoid process is broad, and united with the maxillary without the slightest suture; finally, the mastoid process, $3'''$ broad, extends downwards to the maxillary, thus completing a bony ring for the eye, and separating from the orbit another elliptical free space (*fossa zygomatica*). A similar structure is known in *Cultripes provincialis*† and *Calyptocephalus Gayi*, respecting which I shall have more to say in the course of this paper. The *mandibular* is lost.

The skull of the *female* (Pl. XV. figs. B. & C.) is the largest among the Tailless Batrachians, even larger than that of those species such as *Bufo agua*, which surpass *Ceratophrys dorsata* in the size of the body; it is nearly three times as large as that of the male, and relatively somewhat shorter and broader; its greatest breadth is a little before the articular extremities of the tympanic bones, and amounts to $41'''$‡, its greatest length to $25'''$, its greatest height

* Prof. Owen (Osteol. Catal. i. p. 121) describes the maxillary bones of *Ceratophrys* as edentulous; but the skeleton from which the description was made belongs to *Bufo agua*,—and the other smaller skeleton, which is also referred to *Ceratophrys*, to another South American species of *Bufo* —probably to *Bufo* (*Otilophus*) *margaritifer*, male.

† *Pelobates fuscus* does not exhibit a temporal arch or an externally closed orbit; therefore the separation into two genera appears to be justified. The peculiar structure of the skulls of these Batrachians is briefly mentioned also in the 'Erpétologie générale' of Duméril and Bibron.

‡ The greatest breadth of the skull of a female, observed by Wied von Neuwied, is 2 inches 11 lines only. Wied, Beitr. i. p. 586.

to 17'''. It differs from the skull of the male in the following details: the *foramen occipitale magnum* is relatively broader and lower; the process of the exoccipital is compressed, and projects as a rather sharp ridge; the crest of the external superior portion of the os petrosum is much more developed, and elevated above the level of the skull, whilst the bridge which separates the orbit from the fossa temporalis is not much broader than in the male. The vertex is relatively narrower, and the interspace between the eyes more excavated; likewise the whole cavity of the mouth, viewed from beneath, is more concave and deeper. The maxillary bone is equally broad in its whole length, and exhibits an obsolete suture where it meets the hypo-tympanic; the tympanic bone is bent more outwards; and the fossa zygomatica is larger, irregularly four-sided, anteriorly with an obtuse angle, and posteriorly with an acute one. The orbit is relatively much smaller. The anterior part of the facial bones is lost.

All these differences—differences of form—are exactly the same as between the male and female of the living species. For the purposes of future comparison, the following dimensions are added:—

	Male. lines.	Female. lines.
Greatest length of the skull	18	25
,, breadth of the skull	$24\frac{1}{2}$	41
,, height of the skull	$9\frac{1}{2}$	17
Depth of the foramen occipitale magnum	2	2
Width of the foramen occipitale magnum	$2\frac{1}{4}$	$3\frac{1}{2}$
Greatest distance between the fossæ temporales	8	$10\frac{1}{3}$
Smallest distance between the orbits	$4\frac{1}{3}$	7
Distance between the foramen occipitale magnum and the extremity of the ethmoid	$13\frac{1}{3}$	$20\frac{1}{2}$
Breadth of the bridge between fossa temporalis and orbit	$1\frac{1}{3}$	$1\frac{3}{4}$
,, ,, ,, fossa zygomatica and orbit	3	5
,, ,, ,, ,, ,, and temporalis	$5\frac{1}{2}$	8
,, ,, ,, orbit and nasal opening	2	$4\frac{1}{2}$
Diameter of the orbit	$5\frac{1}{2}$	$6\frac{2}{3}$
Distance between the outer extremities of the palatine bones	$14\frac{1}{3}$	25

The peculiar and solid structure of the skull of *Ceratophrys*, deviating from most of the Tailless Batrachians, is in immediate connexion with the mode of life of these large frogs. They are said to feed on other frogs, on birds, mice, young rats, &c.*: I myself found, in the stomach of one of these animals, an entirely uninjured *Cystignathus ocellatus*† *half the size of its destroyer*. It is reported by Dalton that frogs were successfully introduced from the continent of tropical America into some of the West Indian islands, because they were known to be very useful destroyers of the rats. I think that the Horn-frog is much

* Wied, Beiträge, i. p. 589. † Dum. & Bibr. viii. p. 437.

more likely to have given rise to this opinion than some of the large species of *Cystignathus*. In the first place, it is by the exceedingly wide cleft and the enormous cavity of the mouth that the Horn-frog is enabled to seize such large animals. We will compare in this respect the skull of a female *Cystignathus labyrinthicus*, which in the size of the body *rather exceeded* that of the female Horn-frog, the skull of which I have described:—

	Horn-frog.	Cyst. lab.
Greatest width of the cavity of the mouth	31 lines	23 lines.
„ length of ditto	25 „	20 „
„ depth of ditto	14 „	6 „

As the other dimensions show the same ratio in both skulls, we find the cavity of the mouth in the Horn-frog nearly four times as spacious as in the other. The teeth cannot have more than a subordinate office in holding the struggling animals: as they are present in the upper jaw only, relatively short, and not hook-like, as in the Snakes, they would be of no use at all but for the mandibula, by which an object may be pressed so firmly against the series of teeth, that, as Tilesius relates, deep impressions were found on a pencil seized by the animal. Thus the principal effect in holding the prey is produced by the muscular strength of the mandible (together with that important cooperation of the tongue common to all the Anura). Received in the cavity of the mouth, the prey is unable to overcome the strength of the elevators of the mandible; consequently we find especially those parts of the skull which serve for the insertion of these muscles exceedingly developed and powerful, viz. the tympanic and the neighbouring bones. Further to support the weight of the skull and to afford a strong base for its muscular functions, the hinder portion is furnished with strong crests and processes for the muscles of the neck. The skull of *Ceratophrys*, compared with that of other Anura, is modified in the same way as that of a Carnivorous Mammal from that of an Herbivorous. There we find a strong zygomatic arch and an elevated parietal crest—here the tympanic bone and the front part of the occipital crest are adapted to the same purpose; there we have the hinder portion of the skull elevated by the crest of the occipital bone alone—here by a broad process of the *os petrosum* besides.

Moreover, the other parts of the skull, which are not in immediate relation with the process of feeding, are necessarily likewise strengthened, and form a striking contrast with the same parts in other Anura, where portions of the bones remain cartilaginous through life, or are thin, flexible, and joined together only by a fibrous tissue, which may easily be destroyed. This great strength of the bones in *Ceratophrys* is caused not only by an increased deposition of inorganic matter in the bones themselves, but also by bony plates, of decidedly dermal nature, and so joined to the primary bones that they appear to be parts of them. The most interesting part of this dermal structure is that which, coming from the mastoid process, separates the fossæ temporalis and zygomatica from the orbit. But this separation is merely external; internally these cavities form one only, as in the other Anura.

If we look for a similar structure of the bones surrounding the eye in other cold-blooded Vertebrata, we must compare it with the temporal bridge of the *Chelonii* and many *Saurii*, and the infraorbital arch of most of the *Teleostei* and *Ganoidei*—the former being formed by primary bones of the skull, the latter being considered as part of the dermo-skeleton. In *Ceratophrys*, *Cultripes*, and *Calyptocephalus*, we have elements homologous with both. Having skulls of adult animals only, I am not enabled to show the boundary-line between the endo- and exo-skeleton in all the parts; but an examination of the young will undoubtedly show that the *base* of this bony ring round the orbit is formed by bones homologous with the posterior frontal, os zygomaticum, and processus mastoideus, as in *Chelonii* and *Saurii* *, and that it is completed and *covered by dermal plates* situated between the frontal and maxillary bone,—homologous with the infraorbital arch of Fishes. Even the external similarity of the skull of the Batrachians mentioned, to that of the *Chelonii*, is very great: the temporal bridge is relatively narrow in *Ceratophrys*, leaving posteriorly a distinct round open space (the fossa temporalis), with a free entrance from the upper surface of the skull; it is exactly the same in the skull of *Testudo*, *Emys*, &c. In *Cultripes provincialis* the bridge is very broad†, covering the fossa temporalis above, and leaving an entrance from the back part of the skull only: it is exactly similar in the skull of *Chelonia* ‡, where the os frontale posterius extends behind further than in any other Tortoise. In *Calyp-*

* The arrangement of the bones forming the temporal arch varies a little. In many *Chelonii* and most of the *Saurii* it is formed by the os frontale posterius, zygomaticum, and quadrato-jugale (Stann. und Siebold, Zoot. Vert. p. 159). In a skull of *Emys Dhongoka*, I find the bones very well separated from one another by sutures. The bridge is here formed by the os frontale posterius, a zygomatic bone divided into two parts, and by a part of the os quadrato-jugale, likewise separated from the posterior part by a suture. These sutures are not very distinctly marked in the figure given in Dr. Gray's Cat. Shield Reptiles, t. 36. f. 1.

† Cf. Dugès, Recherch. Batrac. p. 15, pl. 2. f. 11, 13. In a specimen in the British Museum, the temporal arch is not quite so large as it is figured by Dugès, yet fully covering the groove beneath. This, however, may depend on age.

‡ This similarity has been observed also by Bibron (cf. Dum. & Bib. viii. p. 448); but he refers it to *Calyptocephalus*.

tocephalus Gayi the arch is still broader, and joined with the os petrosum throughout its length, so that the fossa temporalis is perfectly closed behind. Such a development of the os frontale posterius is not known in Tortoises. But, on the other hand, the skull of *Calyptocephalus* approaches more closely those of other frogs in having considerable portions not ossified, especially on the side of the brain-capsule.

The ossified dermal covering of the temporal bridge and of the ring round the lower and anterior part of the orbit is, I think, homologous with the infraorbital arch in Fishes. The similarity is greatest with *Trigla* and its allied genera, where the dermal plate is likewise broad, granular, covering the cheek, but joined to the opercular apparatus, whilst here it is attached to the maxillary arch.

The two next bones of these fossil Batrachians *are two hind legs*; they appear rather too slender to belong to *Ceratophrys*; and as the humeral bone, next to be described, decidedly belongs to *Cystignathus*, there can be little uncertainty in determining the genus to which they should be referred. But the crura of the three large species living in South America are so much like one another, and the form of these fossil bones agrees so well with them, that it is impossible to determine the species, if it is not allowed to refer at least the larger fossil to the same individual, part of which has been the humerus, which, we shall see, belongs to *Cystignathus labyrinthicus*. They possess no peculiar interest: the original separation into two bones (tibia and fibula) is still visible externally from longitudinal grooves at the extremities; at the upper extremity of the bone the groove is deeper posteriorly, at the lower anteriorly; at both extremities the bone is broader; the inner side is nearly straight, and has an angular ridge nearly throughout its length; the outer side is more rounded and curved. There is anteriorly, a little below the middle of the length, a large *foramen nutritium*, and posteriorly another, situated somewhat above the middle. The larger of the bones is from the right side of a full-grown individual, and is 31‴ long without the condyles; the smaller is from the left side of a half-grown individual, and is 24‴ long. In both, the condyles at the lower extremity are lost.

Far more interesting is the next bone, *a left humerus*, the three lower quarters of which are preserved (Pl. XV. fig. D.); it is distinguished by three high and sharp ridges; one of them arises from the *tuberculum major*, is thick and slightly channel-shaped, and runs along the anterior and interior side of the bone downwards to the lower third (spina tuberculi majoris); the two other ridges are at the opposite side, and arise from the lower extremity of the bone; they are very compressed and thin, convergent, and form, from the middle of the bone upwards, one high ridge, which is lost before reaching the caput humeri. To which of the South American species is this bone to be referred? A similar structure of the humerus has only been known in *Cystignathus ocellatus.* Spix* has described this species under a new name, *C. pachypus.* Without knowing the osteological peculiarity, he chose this name from the externally visible strength of the upper arm; and he was well aware of the fact of a sexual difference, neglected by all subsequent naturalists. He observes, "humero maris intumido," and "fœmina differt a mare femore pedis anterioris non incrassato." Prof. Stannius † first mentions the internal structure in these words:—"In *C. pachypus* the humerus is peculiarly developed in breadth, becoming a nearly flat bone." We find it more accurately described by Prof. Owen ‡. In this species, namely (Pl. XV. fig. G.), the two hinder ridges are enormous, and form a broad crescent-shaped plate, the breadth of which exceeds twice that of the central bone; there is, moreover, a fourth ridge at the hinder side of the bone, convergent with the other one descending from the caput humeri. A comparison of several skeletons has now shown me *that this structure is peculiar to the male only,* whilst the bone of the female is framed as in other frogs, viz. exhibiting the spina tuberculi majoris alone. It is evident at the first glance that our fossil does not represent a bone of the latter species, whilst it perfectly agrees with the humerus of a male *C. labyrinthicus* (fig. E.), with some slight differences of size, and perhaps of age. In the female of *C. labyrinthicus* (fig. F.) the humerus is formed as in *C. ocellatus.* It must be mentioned, that neither in *Ceratophrys* nor in the Australian *Cystignathidæ* does a similar osteological difference of the sexes exist. The physiological relation of this structure to the process of propagation is as clear as the development of the rudimentary thumb and of the second metacarpal bone in the males of many Anura. The second metacarpal bone has, besides, in several species of *Cystignathus,* an external acute conical spur.

Such sexual differences, conspicuous in parts of the skeleton, occur in all the classes of Vertebrata, and certainly are of great importance to the palæontologist. Some years ago, I pointed out that *the thick ray in the ventral fins of the Tench* (*Tinca vulgaris*) is a sexual peculiarity of the male, not present in the female §,—an observation which has been latterly adopted and confirmed by Heckel ||. I was not then aware, nor has it been observed by

* Spec. nov. Test. Ran. p. 26.
† Stannius und Siebold, Vergl. Anat. Reptil. p. 143. nota 1.
‡ Osteol. Catal. i. p. 120.
§ Neckarfische, p. 51.
|| Heckel und Kner, Süsswasserfische Oestr. p. 77.

the latter ichthyologist, *that this difference extends also to the pubic bones.* In the *male* (Pl. XVI. fig. A. A'.), the pubic bones are convergent towards each other, and generally not perfectly symmetrical in shape. The anterior portion of each of them is composed of two broad horizontal plates, one above the other, united for the greater part of their length, but separated by a narrow fissure anteriorly. The *upper plate* is concave, spoon-like, broadest anteriorly, and terminates posteriorly in a thick oval knob, to which are joined the first two rays: the first thin, small, rudimentary, without phalangeal joints; the second extremely thick and cuneiform. There is a stout metatarsal part at its base, situated along the inner side of the first rudimentary ray; its length is nearly one-third of the entire ray. The *lower plate* is twice as broad as the upper. The posterior portion of the pubic bone is irregularly three-sided, broadest behind; its upper angle especially is thick and rounded. The broadest side of this portion has an oblique direction to the longitudinal axis of the pelvis.

Comparing these pubic bones with those of a *female* (Pl. XVI. fig. B. B'.), we find the latter not deviating from the form usual in other species of *Leuciscus*: namely, each of them has more the appearance of a single bone, with a longitudinal ridge and with a deep and wide notch in front; they are more parallel to one another or slightly convergent. In specimens of the same size, the pubic bone of the male is $1\frac{1}{2}$ as broad as that of the female. The point where the first two rays articulate is not much thickened, and these rays themselves are only half as stout as in the male. The posterior processes of the pubic bones are similarly shaped, but only half as large; and their broadest side has a horizontal direction.

Prof. Troschel* described and figured, in the same year in which I published the observation on the externally visible sexual difference of the Tench, one of those remarkably well-preserved freshwater fishes from the Braunkohle of the Siebengebirge. He found therein the same structure of one of the rays of the ventral fins and the broad pubic bones; and not being aware of the peculiarity of this part in the Tench, he called the fish *Leuciscus tarsiger*, or *Tarsichthys elegans*. I think the specimens on which this species is founded are males of a species of *Tinca*. *Leuciscus macrurus*, Agass., certainly is a different species, and not the female of *Tarsichthys*, having much larger scales, similar in size to those of *Leuciscus vulgaris*. But *Tarsichthys elegans* agrees, moreover, in other respects with *Tinca*. Most of the European *Leucisci* have nine rays in the ventral fins, whilst *Tinca vulgaris*, like *Tarsichthys*, has ten, or, in fact,

* Verhand. Niederrhein. Vereins, xi. pl. 1. f. 2, 3.

eleven, the first short rudimentary ray being a true ray, and present in the living and extinct species. Troschel has rightly marked it; but he has mistaken it for a part of the first thick ray, so that this appeared to have two metatarsal bones, one at the side of the other. The fossil fish differs from *Tinca* in having the dorsal fin decidedly more advanced towards the head, and the caudal fin forked; but if we consider, on the other hand, the thickness of the rays in general and the small size of the scales (also expressly mentioned by Prof. Troschel), we are nevertheless obliged to acknowledge its close affinity to the recent genus*.

This sexual difference in the Tench appears to be in connexion with the propagation. In the season of spawning I usually found the base of the ventrals, in old males, inflamed, and even excoriated and bleeding. At that time of the year they are compelled continually to rub the belly upon places where the spawn is deposited by the females; and they are so passionate, that they continue to do so, even if caught, on the bottom of the vessel in which they are kept.

XXXIX.—*New* Helicidæ *collected by* W. Theobald, Esq., jun., *in Burmah and the Khasia Hills, and described by* W. H. Benson, Esq.

1. *Helix Acris*, nobis, n. s.

Testa anguste umbilicata, elevato-conica, trochiformi, oblique striatula, obsolete granulosa, subtus minutissime spiraliter striata, albida; spira elongato-conica, lateribus planis, apice obtusiusculo, sutura leviter impressa; anfractibus $6\frac{1}{2}$ planulatis, ultimo vix descendente, ad peripheriam acute carinato, basi planiusculo; apertura valde obliqua, tetragono-lunata, peristomate superne expansiusculo, subtus expanso, reflexiusculo, margine columellari late angulato-reflexo, umbilicum partim celante.

Diam. major 10, minor 9, axis 9 mill.

Habitat ad Teria Ghát montium Khasiæ, raro.

It approaches the larger *H. Capitium*, B., of the hill region south of the Gangetic angle; but, besides the absence of the peculiar colouring of that species, it is distinguished by its more elongate and regular conical form and by the flatter base. The single specimen examined is much weathered, so that the sculpture and colour may eventually require an amended description. There is a faint rufous tint, not to be detected elsewhere, towards the termination of the keel. The spire is more attenuate than

* Specimens of *Tarsichthys elegans* from the same locality (Siebengebirge), in the British Museum Collection, and specimens collected by myself at that place, exactly agree with Prof. Troschel's description and figure.

that of the Javanese *H. Conus*, Ph., from which its umbilicus and the form of the aperture sufficiently distinguish it. I had affixed the MS. name of *Puellula* to this shell in my report to Mr. Theobald; but, on account of its similarity to *H. Puella* of the late Mr. W. J. Broderip, I have deemed it advisable to adopt a more distinct and expressive designation on publishing a description.

2. *Helix Galea*, nobis, n. s.

Testa vix perforata, conica, trochiformi, oblique striatula, striis confertissimis spiralibus granulosis decussata, albida (decorticata); spira regulariter conica, apice acutiusculo, sutura impressiuscula, submarginata; anfractibus 7, superioribus convexiusculis, tum planulatis, ultimo non descendente, acute carinato, subtus planulato, prope carinam leviter excavato; apertura valde obliqua, transversa, anguste angulari-lunata, peristomatis margine superiori recto, basali arcuato, intus incrassato, columellari superne reflexiusculo perforationem subtegente.

Diam. major vix 9, minor 8, axis $5\frac{1}{2}$ mill.

Habitat ad Teria Ghát, raro occurrens.

This species is shorter in proportion to its height than the Javanese *H. Conus*, and may easily be distinguished by the last whorl not descending. The shell is much weathered; the sculpture is indistinct and the colour uncertain in the single specimen submitted to my examination.

3. *Helix Petasus*, nobis, n. s.

Testa perforata, orbiculato-convexa, radiato-striatula, nitida, translucente, cornea; spira brevi, convexiuscula, apice elevatiusculo, obtuso, sutura leviter canaliculata; anfractibus 6 convexiusculis, lente accrescentibus, ultimo ad peripheriam valde rotundato, subtus convexo; apertura subverticali, late lunata, peristomate intus ad marginem ipsum albo-labiato, margine basali arcuato, columellari ad perforationem brevissime reflexo.

Diam. major 10, minor 9, axis 4 mill.

Var. spira convexiori: Diam. major $9\frac{1}{2}$, minor 9, axis $4\frac{1}{2}$ mill.

Habitat ad Phie Thán, vallis Tenasserim.

A small polished Nanina of the vitrinoid type, notable chiefly for its shallow canaliculate suture, and for the labiation, which is so even with the edge of the lip, at the base, as to give a solid appearance to the shell.

4. *Helix Cauisa*, nobis, n. s.

Testa perforata, conoideo-depressa, solidula, oblique striatula, striis minutissimis confertissimis spiralibus sub lente signata, nitidula, fulvescenti-cornea, subtus pallidiori; spira conoidea, sutura im-

pressa, submarginata, apice obtuso, hyalino; anfractibus 5 convexiusculis, ultimo ad peripheriam valde rotundato; apertura obliqua, subrotundato-lunari, peristomate acuto, recto, margine columellari breviter expanso-reflexo.
Diam. major 7, minor 6, axis 4 mill.
Habitat ad Phie Thán, vallis Tenasserim.

A small Nanina-like species, with no very prominent character besides the minute spiral sculpture.

5. *Helix Molecula,* nobis, n. s.

Testa anguste perforata, conoideo-globosa, tenui, obsolete radiato-striata, nitida, fusco- vel castaneo-cornea; spira conoidea, lateribus convexiusculis, sutura impressa, submarginata, apice obtuso; anfractibus $5\frac{1}{2}$ arcte convolutis, convexiusculis, ultimo ad peripheriam rotundato, subtus convexo; apertura vix obliqua, late lunari, peristomate recto, acuto, margine columellari anguste reflexo.
Diam. major vix 5, minor 4, axis 3 mill.
Habitat ad Rangoon, satis copiose.

A minute shell with a more conoid spire and more closely wound whorls than *H. Causia.* It is altogether deficient in the spiral striæ which distinguish that species.

6. *Helix forabilis,* nobis, n. s.

Testa subanguste et profunde umbilicata, conoideo-semiglobosa, oblique striatula, cornea; spira depresso-conoidea, apice elevatiusculo, obtuso, sutura impressa; anfractibus 6 convexiusculis, ultimo non descendente, ad ambitum rotundato, circa umbilicum vix perspectivum carinato, carina spirali, intrante; apertura leviter obliqua, rotundato-lunata, peristomate recto ?, acuto ?, marginibus callo tenui junctis, columellari breviter reflexo, cum basali angulum fere rectum efformante.
Diam. major 8, minor 7, axis 4 mill.
Habitat ad Phie Thán.

The single specimen obtained for examination is not in good order, and the aperture is clearly defective. Notwithstanding these disadvantages, the formation of the umbilicus, with its carinated edge continued along the whorls within the cavity, and the consequently angular base of the columella present such peculiar features, that the form runs no risk of being confounded with any other known species, and is certain of recognition when it may again be met with.

7. *Helix Acerra,* nobis, n. s.

Testa perforata, orbiculato-depressa, tenui, obscure radiato-striatula, pallide cornea, vix nitente; spira planata, apice vix elevatiusculo, obtuso, sutura impressiuscula, tenui-marginata; anfractibus $6\frac{1}{2}$

angustis, arcte convolutis, planulatis, ultimo superne convexiusculo, ad peripheriam superne angulato-compresso, subtus convexo; apertura vix obliqua, late lunari, angustiori, peristomate tenui, acuto, margine basali arcuato, columellari oblique descendente, superne breviter reflexo.

Diam. major 28, minor 25, axis 9 mill.

Habitat in valle Tenasserim, et ad urbem Mergui, satis frequens.

A thin Nanina, distinguished at first sight from *decussata* and other allies of *N. vitrinoides* by its more depressed form, flattened spire, and more compressed periphery, independently of the great difference between its sculpture and that of *H. decussata*, B. From *resplendens*, Ph., of the Tenasserim region it is separated by its spread orbicular form, its flatness above, and by its compressed periphery obsoletely angled towards the upper part of the last whorl. A single specimen, not quite fresh, was received for description.

8. *Helix perpaula*, nobis, n. s.

Testa perforata, depresso-globosa, oblique striatula, sub epidermide cornea albida; spira conoideo-convexa, apice obtuso, sutura impressa; anfractibus $4\frac{1}{2}$ sensim crescentibus, convexiusculis, ultimo rotundato, subtus convexo; apertura obliqua, rotundato-lunari, peristomate recto, acuto, margine columellari reflexo, suboblique descendente, basali arcuato.

Diam. major 2, minor $1\frac{2}{3}$, axis $1\frac{1}{3}$ mill.

Habitat ad Phie Thán, raro.

Allied to *H. Molecula*; but, besides its much smaller size, it is more globose. The single specimen received is much weathered. It is probably translucent and polished when fresh. The spire is less conoid, and the whorls not so closely wound as in *H. Bullula*, Hutton, of the Western Himalaya.

9. *Helix pauxillula*, nobis, n. s.

Testa minute perforata, depressa, striatula, striis confertis minutissimis spiralibus utrinque ornata, diaphana, nitente, pallide cornea; spira convexiuscula, apice obtuso, sutura profundiuscula; anfractibus 4 sensim crescentibus, convexiusculis, ultimo subtus convexo; apertura obliqua, sublate lunari, peristomate recto, acuto, margine columellari arcuatim descendente, superne expanso; periomphalo excavato.

Diam. major 2, minor $1\frac{1}{2}$, axis $\frac{2}{3}$ mill.

Habitat ad Thyet Mio, nec raro.

This minute shell, when examined under the microscope, exhibits a beautiful and well-pronounced spiral sculpture, which, in addition to its flatter spire and smaller number of whorls, assists in distinguishing it from the Western Himalayan *H. planiuscula*, Hutton.

10. *Helix scalpturita*, nobis, n. s.

Testa umbilicata, globoso-depressa, striatula, confertim spiraliter acuducto-striata, nitidiuscula, albida, versus apicem et antice pallide rufescente, aliquando unifasciata; spira conoidea, apice obtuso, sutura impressa; anfractibus $5\frac{1}{2}$ sensim accrescentibus, convexiusculis, ultimo rotundato, antice parum breviter descendente; apertura obliqua, rotundato-lunata, peristomate tenui, expansiusculo, margine columellari dilatato-expanso, umbilicum angustum profundum partim celante.

Diam. major 22, minor 19, axis 14 mill.

Var. depressior: Diam. major $20\frac{1}{2}$, minor 18, axis 11 mill.

Habitat in regno Ava, teste Prof. Oldham.

Independently of size, colour, and greater solidity, there would be little to distinguish this shell from the true *H. similaris*, Fér., were it not for its peculiar sculpture. A still more depressed and smaller variety than that of which the measurement is given, was found by Mr. Theobald at Thyet Mio or Prome, in company with *H. similaris* of the ordinary form and size, and having the horn-coloured epidermis minutely wrinkled as in the Pinang shell. *H. similaris* also occurs in the neighbourhood of Dacca in Bengal, in Southern India, where Dr. Jerdon found it scarce, in China, and most plentifully on the hills of Moka in the Mauritius, creeping even on the wood work of the country-houses. Dr. Theodore Cantor is the authority for its occurrence at Macao and Pulo Pinang, from both of which places he favoured me with specimens. If its Brazilian habitat be correctly given, it is the most widely-spread tropical Helix known. *H. scalpturita* is named from its shallow *scratched* sculpture.

11. *Helix levicula*, nobis, n. s.

Testa angustissime perforata, globoso-depressa, tenui, oblique striatula, striis spiralibus obsoletis sub lente vix decussata, polita, subdiaphana, luteo-cornea; spira convexiuscula, apice vix elevatiusculo, obtuso, sutura impressa, marginata; anfractibus 3 celeriter accrescentibus, ultimo antice majori, subtus convexo-subconoideo, peripheria superne subangulato-rotundato; apertura obliqua, magna, rotundato-quadrato-lunari, peristomate acuto, superne antrorsum arcuato, margine columellari subverticali, superne breviter reflexo, umbilicum subtegente, basali leviter arcuato.

Diam. major 7, minor $5\frac{1}{2}$, axis $3\frac{1}{2}$ mill.; apert. 4 longa, $4\frac{1}{2}$ mill. lata.

Habitat ad Phie Thán, raro occurrens.

Described from a single specimen in Mr. Theobald's collection. Were it not for the presence of the perforation, the shell might be easily ascribed to *Vitrina*. It has close relations with two species, which are nevertheless quite distinct, collected in Pulo Pinang by Dr. Cantor, and by Dr. Jerdon in Southern India.

A shell was obtained by Mr. Theobald at Thyet Mio, which, in form and sculpture, has a great resemblance to M. Albert Mousson's Madura *Helix squamulosa*—only $4\frac{1}{2}$ whorls being present, and the aperture imperfect; the narrower umbilicus may be due to the immature state of the Burmese shell. I cannot, therefore, without further information, venture to describe it under the provisional name* communicated by letter to its discoverer. It is here indicated in the hope that it may be deemed worthy of search by future collectors.

Two other small Helices were met with by Mr. Theobald at Thyet Mio and Phie Thán; and a minute species, with an open umbilicus, at Rangoon. These are in such a defective state as to render them unfit for description, any attempt at which would probably lead to confusion.

Helix climacterica, nobis.

Journ. As. Soc. Calcutta, 1836, vol. v. p. 352.

This species was taken at Teria Ghát, in good condition, by Mr. Theobald. It is covered by an olivaceous epidermis strongly plicate obliquely on the upper side, the folds extending a little way below the keel. My original specimen was decorticate.

Ejusdem varietas ? nana.

Testa minore, carina obtusiori, sutura impressa; anfractibus 7 convexiusculis, ultimo subtus convexiori.

Diam. major 15, minor 14, axis 8 mill.

A single weathered specimen of this shell has been examined. It may possibly prove to be a distinct but allied species when a series of perfect specimens can be examined; but I do not consider its separation advisable without further information respecting it.

On reviewing the shells from the Burmese Territory described in this and former numbers of the 'Annals,' it appears that of the genus *Helix* alone twenty-one new species have been obtained by Mr. Theobald, in addition to four novel forms in a state too imperfect for description, and that two others have been contributed by Professor Oldham, making a total of twenty-three de-

* On further consideration it appears probable that this shell is nothing more than an immature and decayed specimen of the variety of *H. rotatoria*, V. d. Busch, which I formerly noted as occurring lower down the Irawadi, at Akouktoung. There it appears to be associated with a variety of *H. tapeina*, B., which has been confounded with *H. rotatoria* by observers unacquainted with the typical form. The relations of the Javanese species with *H. squamulosa* are very close.

scribed *Helices.* From the Khasia Hills, Mr. Theobald's researches have furnished four species previously unknown, besides fixing the exact localities of those described from the same quarter twenty-three years ago.

Mr. Theobald has, moreover, either already published, or is about to publish in an Indian Journal, under the names of *Helix Castor* and *H. Pollux,* two shells which I consider to be in an immature condition. One of these I have no hesitation in referring to the young of *H. Oxytes,* B.; the other, if not the young of a variety of that shell with a more conoid spire, is possibly that of *H. Cymatium,* B., discovered by Dr. Cantor in the island called Pulo Lancavi, or of *H. Chevalieri,* Souleyet, an inhabitant of the Malayan Peninsula, and which, if found also in the Khasia Hills, will not extend through a longer range of country than *H. Castra,* B., has been proved to occupy at certain distant intervals.

An examination of the young of *H. Cycloplax,* B., the Darjiling ally of *Oxytes,* in which Mr. W. Blanford considered, though with some hesitation, that he had detected a new shell, confirms my opinion that these large sharply-keeled specimens are in a state which demands caution in dealing with them as distinct species.

Cheltenham, March 25th 1859.

XL.—*Description of a new* Bulimus *from Jerusalem.* By W. H. Benson, Esq.

Bulimus Benjamiticus, Roth, MSS.

Testa perforata, subulato-turrita, solidula, oblique rugose subplicato-striata, ferruginea, circa aperturam albida; spira sensim decrescente, satis gracili, apice obtuso, sutura profundiuscula; anfractibus 6 subconvexis, ultimo $\frac{1}{3}$ longitudinis æquante, subtus rotundato; apertura obliqua, ovali, peristomate recto, acuto, marginibus callo tenui junctis, columellari superne lato, expanso.

Long. $7\frac{1}{2}$, diam. 3, apert. long. $2\frac{1}{2}$ mill.

Habitat prope Hierosolymam. Detexit Dr. Roth; specimen descriptum invenit Dom. E. Atkinson.

The late Dr. Roth first discovered this species while in company with Mr. Edward Atkinson, a surgeon residing at Jerusalem, by whom two specimens were subsequently obtained, one of which was transmitted to the Leeds Philosophical Institution, with a request that it might be published under Dr. Roth's manuscript designation.

The shell has certain relations with *Bulimus acutus,* Müll., but may at first sight be distinguished from the young of that species, provided with only six whorls, by the absence of any angle at the periphery, its greater solidity, larger perforation, more convex whorls, more slender spire, and by the greater obliquity of the striation. The aperture is not quite perfect; and the shell has evidently been buried in a ferruginous soil, with the colour of which it has become stained.

M. Albert Mousson, in a Memoir on Professor Bellardi's shells, notices *B. acutus* as found at Sayd, as well as *Pupa Granum*, which had not previously been observed so far to the eastward. A dead specimen or two of the latter shell, found by Mr. Atkinson in the sand of the Brook Kedron, near Marsabba, accompanied *B. Benjamiticus*, and, not having been previously noticed in the vicinity of Jerusalem, was supposed to be a new species. Like the shell taken by myself in Provence, and the specimens which occur near Villa Franca, in the neighbourhood of Nice, it possesses a parietal tubercle at the angle of the insertion of the outer lip,—a feature omitted in the characters contained in the 2nd volume of Dr. Pfeiffer's Monograph, where only seven teeth and plicæ are assigned to the aperture.

The discovery of these two shells near Jerusalem in a living state, will be necessary to prove that they are not subfossil relics of a past æra. They are discoveries of a more recent date than the publication, in 1855, of Dr. Roth's 'Spicilegium.'

Cheltenham, April 1st, 1859.

XLI.—*On the Natural Order* Styraceæ, *as distinguished from the* Symplocaceæ. By John Miers, F.R.S., F.L.S. &c.

[Continued from p. 284.]

4. Pamphilia.

This genus scarcely differs from *Strigilia*, the principal point of distinction being the suppression of one-half of its stamens, which are only five in number, and alternate with the petals; they are only two-thirds the length of the petals, and the anthers are one-third the length of the filaments: these last are membranaceous, broad, nearly double the breadth of the adnate anther-cells, forming an expanded thin border round the sides and apex of the anthers. The anthers are sometimes deficient of pollen, in which case they cohere slightly by their margins into a tube, from the bottom of the anthers to the base; but when polliniferous, they are distinct and free, a character of frequent occurrence in *Strigilia*: they are glabrous, except along a dorsal median nerve, which is stellately pilose. The ovary is depressed and turbinate, corresponding in its internal structure with that of *Strigilia* in all respects, except that it has only a single erect ovule in each pseudo-cell. The fruit I have not seen, nor does it appear to be yet known. The following amended generic character is founded upon my own observations :—

Pamphilia, Mart.—*Flores* hermaphroditi aut subpolygami. *Calyx* campanulatus, crasso-coriaceus, extus dense tomentosus, margine 5-denticulatus. *Petala* 5, oblonga, crassa, tomento stellato dense velutina, apice inflexa, æstivatione valvata, imo adhæsione staminum breviter connata. *Stamina* 5, hypogyna, petalis alterna et paullo breviora; *filamenta* latissima, complanata, membranacea, antheris duplo longiora et latiora, glabra, imo plus minusve breviter sese et cum petalis laxe adhærentia, apice obtusa et retusa; *antheræ* oblongæ, dorso ad filamenta adnatæ, 2-lobæ, lobis linearibus parallelis paullo segregatis, rima longitudinali antice dehiscentibus, valvis membranaceis, glabris; (*stamina sterilia* fertilibus omnino similia, sed infra antheras in tubum cohærentia, tubo cum petalis laxe agglutinato, antherarum locellis vacuis). *Pollen* ovatum, 3-sulcatum, reticulatum. *Ovarium* depresso-turbinatum, albido-tomentosum, calyce tertio brevius, superne 1-loculare, imo pseudo-3-loculare, septis cum nervis totidem parietalibus continuis; *ovula* 3, e basi erecta, in locellis solitaria. *Stylus* teres, longitudine staminum, erectus, glaber. *Stigma* obsolete 3-lobum. *Fructus* ignotus.

Arbusculæ *Brasilienses ramulis, foliis subtus, racemis calycibusque pilis fasciculatis rubiginoso-tomentosæ*; folia *alterna, elliptica, coriacea, integra, subtus tomentosa, nervis venisque reticulatis valde prominentibus, juniora superne pubescentia, adulta glabra*; racemi *simplices, axillares, foliis sub-breviores,* pedicellis *alternis, calyce brevioribus*; flores *parvi*; petala *externe albido-tomentella, intus glabra.*

1. *Pamphilia aurea,* A. DC. Prodr. viii. 271.—Brasilia (Prov. Minas Geraës. *Claussen,* 184).

2. *Pamphilia styracifolia,* A. DC. *loc. cit.* 271; Delessert, Icon. Sel. v. 18. tab. 42.—Brasilia (Prov. Minas Geraës. *Claussen,* 135; *Gardner,* 4994).—*v. s.*

I have two specimens of the latter species, one collected by Claussen, the other by Gardner: in the latter the anther-cells are entirely void of pollen, and the filaments below them are united into a monadelphous tube: in Claussen's specimen the filaments are distinct, and free nearly to the base, as shown in Delessert's excellent representation; the anthers are polliniferous. The ovary is ovuligerous, as in Gardner's plant. It is therefore most probable that in *P. aurea* the union of the filaments for nearly their whole length, as described by Prof. DeCandolle, is a sexual, not a general character.

5. Foveolaria.

This genus was established by Ruiz and Pavon upon five Peruvian species: of these, Prof. A. DeCandolle rejects four, which he refers to *Styrax* (*Strigilia*), retaining only *F. ferruginea*; of the latter, an excellent figure is given in Delessert's 'Icones Selectæ,' v. tab. 43, the detailed analysis of which, and the description in the 'Prodromus,' constitute all the knowledge we have concerning it. As I have never seen a specimen, I cannot form a decided opinion of the validity of the genus. Like *Pamphilia*, it is distinguishable from *Strigilia* in its ovary having only a solitary erect ovule in each pseudo-cell; but it differs again from *Pamphilia* in having, like *Strigilia*, 10 stamens. Its chief differential character, that of its monadelphous stamens, as I have suggested in *Pamphilia*, is probably only a sexual feature, and not more than a lax agglutination of the margins of the filaments: that of its free ovary is common to *Strigilia* and all the genera of the *Styracineæ*. It resembles *Pamphilia* greatly in habit, and appears to differ from it and *Strigilia* only in the characters above mentioned. If, therefore, its ovules be sometimes more than one in each division, as Prof. DeCandolle suspects, there would not then remain a single feature to distinguish the genus from *Strigilia*.

From the materials above cited I have drawn up its generic character as follows:—

Foveolaria, R. & P. Tremanthus, *Pers.*—*Flores* subpolygami. *Calyx* campanulatus, crasso-coriaceus, extus densiter tomentosus, margine 5-denticulatus. *Petala* 5, oblonga, crassa, calyce 2-plo longiora, extus tomentosa, imo (adhæsione staminum) breviter connata, æstivatione valvata, apice inflexa. *Stamina* 10, uniserialia; *filamenta* lata, membranacea, antheris sesquilonga, dorso pubescentia, imo sese et cum petalis laxe in tubum connata; *antheræ* lineari-oblongæ, dorso ad filamenta adnatæ, 2-lobæ, lobis linearibus, parallelis, distinctis, rima longitudinali dehiscentibus. *Ovarium* ovoideum, sericeum, superne 1-loculare, imo brevissime pseudo-3-locellatum, septis cum nervis totidem parietalibus continuis; *ovula* in quoque locello 1 (vel interdum 2) e basi erecta. *Stylus* cum ovario continuus, gradatim attenuatus, pilosulus, longitudine staminum. *Stigma* breviter 3-lobum. *Bacca* ovoidea, calyce suffulta, 1-locularis. *Semina* 1 vel 2, imo ovulis sterilibus notata, structura *Strigiliæ*.

Frutex *elatus, Peruvianus, ramis racemis calycibus foliisque subtus* *ferrugineo-tomentosis, pilis fasciculatis*; folia *alterna, oblongo-elliptica, integra, utrinque obtusa, coriacea, superne glabra*; racemi *axillares, simplices, foliis duplo longiores*; pedicelli *alterni, calyce breviores*; flores *parvi*.

1. *Foveolaria ferruginea*, R. & P. Syst. 100; DC. Prodr. viii. 272; Deless. Icon. Sel. v. 19. tab. 43. Tremanthus ferrugineus, *Pers. Ench.* i. 467. Strigilia racemosa, *DC. Prodr.* i. 621 (*non Cav.*).—Peruvia.

6. Halesia.

I have already given full details of the structure of the ovary in this genus, of the curious mode of development of its ovules, and the growth of its fruit and seed, all of which show clearly, notwithstanding these anomalous appearances, that it belongs truly to *Styraceæ*. In habit, the species bear great external resemblance to those of *Styrax*; the petals are of the same form, colour, and size, the æstivation of the corolla is similar, and in their stamens there is a remarkable resemblance: but the flowers are not racemose, as in that genus; on the contrary, they grow upon slender, drooping, solitary peduncles, which are few, and fasciculated at the ends of the terminal branchlets, appearing in the axils of the fallen leaves of the previous year's growth, before the new leaves sprout, so that the branchlets then bear the semblance of racemes; but before the fall of the corolla, other young branchlets grow out of the axils with great rapidity, to a considerable length, producing fresh leaves in abundance, which completely destroy the racemose appearance of the branchlets. The peduncles are longer than the flowers, which resemble those of *Styrax officinalis*. In their structure the anthers quite conform to those of *Styrax* and *Strigilia*, the two parallel linear lobes being separated by a considerable interval, quite adnate for their entire length upon a more or less broad ligular filament, very thin and membranous in texture, and bursting inwardly by a longitudinal fissure: the filaments continue broad and compressed to their base, where they are laxly connate for a short distance, and at the same time they slightly agglutinate together the bottom of the claws of the petals—all being easily separated without any laceration of the parts; indeed before the flower fades they become detached from one another of their own accord; it is therefore incorrect to describe the corolla as monopetalous, and the stamens as monadelphous. I have observed that in *H. tetraptera* the style is simple throughout its entire length; but in *H. diptera* it most frequently (but not always) divides into three distinct thread-like portions for a considerable distance from the summit. There is generally much symmetry in the number of its parts: in *H. tetraptera* the calyx is 4-toothed, the petals four in number, and the stamens eight or twelve; in *H. diptera* the same numbers prevail, the stamens not exceeding eight; but in the latter species there are sometimes five teeth in the calyx, and in such case there are five, rarely six petals, and the number of stamens is diminished to seven or six; but these are probably only exceptional occurrences. The style is conical and hollow at its base for about a quarter of its length upwards, the three or four parietal nervures continued from the inner surface of the ovary extending along the sides of this hollow cavity. The structure of the ovary, and the singular mode of its development and growth, have been minutely described in a preceding page (137). From these observations, which are in great part novel, I have drawn up the following character of the genus.

Halesia, Ellis.—*Flores* hermaphroditi. *Calyx* parvus, turbinatus, ovario adnatus, margine libero hinc breviter 4–5-denticulatus, dentibus acutis, erectis, nervis medianis cum carinis totidem decurrentibus continuis. *Petala* 4–5, dentibus calycinis alterna, ampla, lata, cuneato-oblonga, tenuiter membranacea, adhæsione staminum imo brevissime agglutinata, æstivatione valde imbricata. *Stamina* 8 vel 12, sæpe 10, uniseriata, subæqualia, petalis paullo breviora; *filamenta* compressa, loriformia, imo cum petalis laxe agglutinata, interdum libera; *antheræ* introrsæ, summis filamentorum omnino adnatæ, et iis 5-plo breviores, 2-lobæ, lobis discretis, parallelis, linearibus, rima longitudinali dehiscentibus. *Pollen* 3-gonum, angulis bulla signatum. *Ovarium* turbinatum, semisuperum, dimidium inferius calyci adnatum, hinc post anthesin cito elongatum et valde auctum; dimidium superius non augescens, hinc conicum, liberum, stylo continuum, immutatum, et fructu coronante persistens; 1-loculare, imo septulis 4–5 brevibus radiantibus ad placentam centralem e basi ortam nexis, et cum carinis totidem internis prominulis parietalibus intra stylum percurrentibus continuis, hoc modo breviter 4–5-locellatum, locellis superne apertis et lobis calycinis oppositis: *ovula* oblonga, 4 ad 8 in quoque locello, ad placentam biseriatim funiculis brevibus affixa, superiora erecta, inferiora pendula, fere omnia abortientia; (exinde prolatione fundi ovarii obtingit ut locelli spurii 3 (unico evanido) jampridem basilares, mox parietales eveniunt; isti in principio aperti, dein membrana clausi, sæpe cum pericarpio osseo indurescant). *Stylus* filiformis, imo incrassatus et cavus, stamina paullo superans, integer, aut apice 3-fidus. *Stigma* simplex, fere obsoletum. *Fructus* oblongus, siccus, indehiscens, apice summo persistente ovarii coronatus, 2–4-alatus, alis amplis, æqualibus, vel alternatim minoribus, e nervis calycinis oriundis. *Nux* ossea, fusiformis, 8-sulcata, centro 1-locularis, parieti interno (e locellis modo supradicto translatis et clausis) 1–3-locellata, locellis monospermis. *Semen* erectum vel suspensum, exarillatum, cylindricum; *funiculus* brevis; *testa* cuticularis, ad pericarpium laxe adhærens, *raphide* simplici sublaterali notata; *integumentum internum* tenuissimum, versus hilum filamento brevi donatum, et ad alteram extremitatem *chalaza* lineari transversali signatum. *Embryo* in *albuminem* carnosum parcum paullulo longiorem inclusus, subteres; *radicula* teres, *cotyledonibus* vix latioribus linearibus fere æquilonga.

Frutices *Americæ septentrionalis, aspectu* Styracis; folia *alterna, ovata, acuta, integra vel glanduloso-denticulata, decidua*; flores *laterales, ex axillis annotinis aphyllis orti, solitarii, vel sæpius terni, fasciculati, pilis stellatis tomentosi*, pedicellis *elongatis, nutantibus.*

1. *Halesia tetraptera*, Ellis, Phil. Trans. li. p. 931. tab. 22; Linn. Sp. 636; Cav. Diss. vi. p. 338. tab. 186; Gaertner, Fruct. i. 160. tab. 32. fig. 2; Bot. Mag. tab. 910; Lam. Ill. t. 404; Mich. Fl. Bor. ii. p. 40; Pursh, Fl. N. Amer. ii. p. 449; Lod. Bot. Cab. t. 1173; A. DC. Prodr. viii. p. 269;—ramulis subangulatis, cortice in fibrillis solubili; foliis ellipticis, acuminatis, serrulatis, dentibus glandulosis, membranaceis, reticulatis, junioribus pubescentibus, adultis fere glabris, costa nervis venisque molliter subpilosulis, læte viridibus, subtus pallidioribus, nervis stramineis ibi prominulis, petiolo subtenui, tereti, canaliculato, puberulo; floribus 3–4-fasciculatis, ex axillis aphyllis annotinis, cum pedicellis articulatis; pedicello flori æquilongo, nutante, tomentoso; calycis tubo glabro, dentibus obtusiusculis, pubescentibus; petalis late obovatis, glabris; staminibus 12, filamentis late membranaceis, demum canaliculatis, molliter puberulis, imo cum petalis brevissime agglutinatis; stylo glabro, staminibus longiore, stigmate fere obsoleto; fructu 4-ptero.—In Carolina, Georgia, et Florida. —*v. v. in hort. Kew.*

The above diagnosis, differing in some respects from that given by Prof. DeCandolle, is drawn from my own observation upon a tree that has been growing in Kew Gardens from the time of Aiton. The leaves are $4\frac{1}{2}$–$5\frac{1}{2}$ inches long, 2–$2\frac{3}{4}$ inches broad, upon a petiole 6 lines in length. The peduncles are from 4–6 lines long. The calyx here is distinctly articulated upon the peduncle, and is always glabrous, though its teeth and the peduncle are tomentose, while, I believe, in the American specimens the calyx is wholly tomentose, as described in the 'Prodromus;' the whole flower is indeed only half the size of those in specimens from the United States, so that we may infer that it constitutes perhaps a distinct variety. The petals here are 6 lines long and 4 lines broad, narrowing gradually to the base into a claw, and are quite glabrous; in native specimens they are sparsely clothed on both sides with stellated hairs, and in the bud tomentose externally. The stamens are 4 lines long, the anthers 1 line, the cells linear, parallel, and separated by a distinct interval; each filament is perfectly glabrous, tubularly hollow, sub-4-gonous, and marked by a nervure along its back; the termination of this tube is fleshy, forming a roundish linear connective, upon which the anther-cells are dorsally adnate for their entire length. In the American specimens the stamens are 6 lines long, the anther-cells being 2 lines in length; but then the filaments are much broader, consisting of a thin simple membrane with a central nervure, and they are sparsely stellately pilose; those in the bud appear to adhere together by their margins for their whole length, but on the opening of the petals they separate from one another almost to the base, and even there they are detachable by a slight force. The style is 7 lines long, slender, continuous with the free conical summit of the ovary, and, like it, perfectly glabrous; in the American specimens the style is pubescent. The internal structure of the ovary has been fully described; the placenta in this instance rises to $\frac{1}{4}$ the length of the internal space, four ovules in two series being found in each of the four basal divisions, two erect and two pendent. The fruit is from 1–$1\frac{1}{4}$ inch long, and $\frac{5}{8}$–$\frac{3}{4}$ inch broad across the wings, which are equal.

2. *Halesia diptera*, Linn. Sp. 636; Cav. Diss. vi. 338. tab. 187; Mich. Fl. Bor. Amer. ii. 40; Pursh, N. Am. Fl. ii. 450; Lod. Bot. Cab. t. 1172; A. DC. Prodr. viii. 270;—ramulis subangulatis, cortice in fibrillis longis rimoso; foliis oblongo-ovatis, acumine angustato, imo acutis, margine denticulatis, dentibus glandulosis, supra læte viridibus, subglabris, subtus pallidioribus, obsolete puberulis, margine ciliatis (junioribus pubescentibus), petiolo canaliculato vix puberulo; floribus 3–4 majoribus, et ut in præcedente in axillis annotinis aphyllis præcocibus, pedicellis flore brevioribus, nutantibus, et cum calyce tomentosis; calycis dentibus acutis, petalis 4–5, sparse molliter puberulis, staminibus 8, filamentis latis, membranaceis, glabris, imo vix agglutinatis; ovario semisupero, tomentoso, stylo hinc usque ad medium puberulo, superne glabro, et sæpissime in filis 3 tenuibus fisso; fructu semper alis 2 latis,

2–3 obsoletis aut angustissimis.—In Carolina, Georgia, et Florida.—*v. v. in hort. Kew.*

The tree from which the above diagnosis has been drawn has always been considered by every one attached to Kew Gardens as the *Styrax grandifolium* of Aiton. Mr. Smith, who has been in that establishment for a period of thirty years, says that when he first went there this tree was understood to be Aiton's plant above mentioned; but although differing essentially in character, no one during this interval has suspected it to be otherwise than the species mentioned. Last year I watched its growth, with the hope of finding for examination the fruit of an American species of *Styrax*; but, to my surprise, I found it to belong to *Halesia*, when I was assured that it had never been known to produce fruit before. On comparing it with authentic native specimens of *Halesia diptera*, I am unable to distinguish any specific difference between them; but as many essential discrepancies exist in the published accounts of the plant, I have given the above diagnosis from my own observations. I find one peculiarity in the leaves which does not appear to have been noticed: they are serrato-denticulated, and each tooth is terminated by a distinct stipitate gland, as I have noticed in some species of *Cyrta*. The tree scarcely exceeds 8 or 10 feet in height—little more than half the size of *H. tetraptera*, and is more frondose. Its leaves are from $3\frac{1}{2}$–4 inches long and $2\frac{1}{2}$–$2\frac{3}{4}$ inches broad, upon a petiole of 6 or 7 lines in length. Its peduncles are not articulated with the calyx; they are 6 lines long; the calyx is 1 line; the petals are 10 or 12 lines long and 3–4 lines broad, tapering towards the base. The stamens are 8 or 9 lines long; the filaments broad and membranaceous, quite glabrous; the anthers 2 lines in length: in the bud the filaments adhere by their margins for their whole length; but when the flower is expanded they are free nearly to the base, afterwards quite unconnected, and also unattached to the petals. The upper free moiety of the ovary is conical, tomentose, and continuous with the style, which is slender, pubescent, and 9 or 10 lines in length. It frequently occurs that the style becomes deeply trifid, being divided for a third of its length into three fine threads,—a circumstance that does not occur in *H. tetraptera*, nor is it anywhere recorded of this species. The placenta rises to near the middle of the cell of the ovary; and it bears a greater number of ovules than the former species. The fruit has only two opposite wings, the others being almost obsolete; it measures $1\frac{1}{4}$ inch in length and $\frac{3}{4}$ inch in breadth: the nut is fusiform, as in the other species. The parts of the flower, though generally 4-merous, are very frequently 5-merous, so that this character alone ceases to form a distinction between *Halesia* and *Pterostyrax* *.

3. *Halesia parviflora*, Mich. Fl. Bor. Amer. ii. 40; Lindl. Bot. Reg. tab. 952; A. DC. Prodr. viii. 270.—In Florida et Georgia.

7. Pterostyrax.

We have no knowledge of this genus beyond the description of Zuccarini in Sieber's 'Flora Japonica,' where the typical species is figured. Having seen a specimen in flower in Sir William Hooker's herbarium, I am enabled to speak of it with more confidence. The character, as given by Zuccarini, agrees well with the structure of the flower in *Halesia*, differing in no respect except in the pentamerous disposition of its parts; but even that distinction I have shown to be of no value, because we sometimes meet with five petals in *Halesia*, while in *Pterostyrax corymbosa* I have found some of the flowers with only four teeth in the calyx, with four petals and eight stamens, all resembling in size, shape, and structure those of *Halesia*, the ovary being at the same time of similar form, and in like manner 4-locellate at its base; indeed I can perceive no difference whatever in the structure of the tetramerous flowers of *Pterostyrax* and those of *Halesia*. There is, however, a considerable disparity in their respective habits; and this appears to constitute the principal generic distinction. Zuccarini describes the calyx as having five nervures between the lobes; but he omits all mention of the carinate nervures, which, proceeding from the points of the teeth, run down decurrently along the pedicel, exactly as in *Halesia*; in the latter genus we find the same intermediate nervures as are ascribed to *Pterostyrax*. The petals are spathulately oblong, membranaceous, and free to the base, as in *Halesia diptera*; and I find their æstivation to be quincuncially imbricate, not sinistrorsely convolute, as stated. The stamens are quite similar in form to those of the species last mentioned, the filaments being broad, flat, membranaceous, and pubescent, slightly cohering together at the base, and even there being separable by the slightest force: the anthers are a very little broader than the filaments, the parallel cells separated by an interval, and dorsally adnate to the filaments, not affixed to them by their base, as they are described to be. As in *Halesia*, the ovary is half-superior, and in like manner has a central placenta rising to the middle, leaving the upper moiety 1-locular, its lower portion being divided into four or five divisions, which, branching from the

* Analytical figures, showing the floral and carpological structure in these two species, will be given in the 'Contributions,' plate 31.

placenta, are continuous with as many parietal nervures that run up into the hollow style. The fruit of *Pterostyrax* is much smaller, scarcely more than one-fourth the size of that of *Halesia,* and its nut is much thinner in substance; but its structure is quite analogous, leaving little doubt that it has undergone the same peculiar mode of growth and development as that before described in the latter genus. In the only seed-vessel I have seen, the seeds were destroyed by age. The habit of *Pterostyrax corymbosum* is more like that of *Styrax Obassia,* its leaves having the same kind of deep sharp serratures: its inflorescence, as in *Styrax,* is racemose, the racemes being many-flowered, and axillary as well as terminal in the young branchlets. Its flowers are smaller than those of *Halesia tetraptera,* and about one-third the size of those of *H. diptera.*

The following generic character has been framed from my own observations :—

PTEROSTYRAX, Sieb. et Zucc.—*Flores* hermaphroditi. *Calyx* parvus, turbinatus, ovario adnatus, margine libero, hic 4–5-dentatus, dentibus acutis, medio nervis decurrenti-carinatis. *Petala* 4–5, dentibus calycinis alterna, spathulato-oblonga, tenuiter membranacea, sublibera, æstivatione imbricata. *Stamina* numero petalorum dupla, uniseriata, subæqualia, petalis paullo breviora; *filamenta* late loriformia, membranacea, sublibera, vel basi laxe agglutinata, 1-nervia, intus stellato-pilosula, extus glabra; *antheræ* introrsæ, summo filamentorum omnino adnatæ, et iis 5-plo breviores, 2-lobæ, lobis discretis, parallelis, rima longitudinali dehiscentibus. *Pollen* trigonum, angulis bulla rotunda notatum. *Ovarium* turbinatum, semisuperum, dimidium inferius calyce adnatum, hinc post anthesin cito deorsum elongatum, et valde auctum; dimidium superius non augescens, hinc conicum, liberum, immutatum, fructum coronans; 1-loculare, imo septulis 4–5 brevibus ad placentam centralem e basi ortam nexis, et cum carinis totidem internis prominulis parietalibus intra stylum percurrentibus continuis, hoc modo breviter 4–5-locellatum, locellis superne apertis, et lobis calycinis oppositis; *ovula* ad placentam centralem in quoque locello 2-seriatim affixa, inferiora pendula, superiora erecta, fere omnia abortientia. *Stylus* simplex, staminibus longior. *Stigma* clavatum, summo 4–5-denticulatum. *Fructus* oblongus, siccus, indehiscens, 4–5-alatus, alis interdum fere obsoletis, apice summo persistente ovarii coronatus; structura *Halesiæ* omnino similis, sed minor, et substantia nucis tenuior.

Frutices *Japonicæ habitu* Styracis, *pilis stellatis tomentellis;* folia *alterna, acuminato-ovata, argute glanduloso-serrulata;*

inflorescentia *racemosa*; racemuli *in ramis novellis axillares et terminales*.

1. *Pterostyrax corymbosum*, Sieb. et Zucc. Fl. Japon. i. p. 94. tab. 47; A. DC. Prodr. viii. p. 269.—In Japoniæ merid. montosis.

2. *Pterostyrax micranthum*, Sieb. et Zucc.; Walpers, Ann. i. 500. —In Japonia.

3. *Pterostyrax hispidum*, Sieb. et Zucc.; Walpers, Ann. i. 500.— In Japonia.

XLII.—Spicilegia Apterologica.—I. *Description of some Myriapoda of the genus* Zephronia (*J. E. Gray*), *in the Collection of the British Museum.* By Adam White, A.Z.D. British Museum.

[With a Plate.]

The genus *Zephronia* contains Millipedes from Ceylon, Borneo, Natal, Madagascar, and other Asiatic and African places, beside which our little "Pill-beetle" (*Glomeris marginata*) is a tiny dwarf. Mr. Arthur Adams, F.L.S., the Naturalist of H.M.S. 'Samarang,' mentions that, in the moist woods of Borneo, he, Sir Edward Belcher, and Rajah Brooke found "great treasure" of them among decaying vegetable matter. He found at the same time some parasitic plants (perhaps of the *Rafflesia* group), which he could not preserve, but which were vividly present to his memory, as he described them. Some of the *Zephroniæ* he brought, though in bad condition, were very distinct. I purpose here to describe two or three species, now in the Museum Collection.

The genus *Zephronia* is a very well-marked one, first recorded by Dr. Gray in Griffith's edition of Cuvier's 'Animal Kingdom.' Exclusive of the head, the body consists of twelve segments, and a plate, which may or may not be taken as a thirteenth segment, though I am inclined to regard it as belonging rather to the head than to the body. Professor Brandt has divided the group into two genera, to which he has given the names of *Sphærotherium* and *Sphæropæus**. He places them in his Section *b.* of the division Pentazonia; the section is characterized by the numerous eyes being arranged in two groups, one on each side of the head, by the antennæ being inserted on the sides of the head, and by the number of segments, to which I have already alluded. His genus *Sphærotherium* contains species

* Bulletin de la Société Imperiale des Naturalistes de Moscou, vi. p. 198 (1833).

with seven-jointed antennæ, in which the sixth or penultimate joint is oblong generally, a little longer than the fifth, the last the least of all, and truncated at the tip; while in *Sphæropæus* the antennæ are six-jointed, the penultimate is short, and the last is the largest, is oblong, and is rounded at the tip. My friend Professor Gervais* has judiciously (so I think) reduced these two genera of the able Russian naturalist into one, retaining Dr. Gray's excellent name of *Zephronia*.

1. *Zephronia Actæon*, n. s. Pl. VII. figs. 5, 5 *a* & 5 *b*.

Z. gigantea, nitida, polita, livido-flava; capite postice et inter oculos sparsissime punctato, antice plus punctulato; segmentis punctatissimis, punctis fere confluentibus, marginibus posticis lævibus subpunctulatis; segmentis 8, 9, 10 et undecimo lateribus abrupte sectis.
Hab. Madagascar (Madame Ida Pfeiffer).

This comes near *Zephronia hippocastanum*, Gervais (*l. c.* 83); the last ring of the abdomen has on the side, at the base, a slight notch, or rather the basal edge projects beyond the general margin; the nuchal plate is very smooth and has scarcely any punctures; the front margin is only slightly waved; the eyes of each group are closer on the inner part of the squarish mass, into which they are accumulated.

2. *Zephronia* (Sphærop.) *pulverea*, n. s. Pl. VII. figs. 4, 4 *a*, & 4 *b*.

Z. obscure fusco-pulverea, linea dorsali mediana interrupta, lævissima; segmentis crusta, terræ pulveri simili, densissime tectis, segmento apicali postice lobato-angulato, lævissimo, et cavato.
Hab. in Afr. mer. (Port Natal).

Head and cervical plate shining, smooth, deeply and irregularly punctured; head between the eyes with two longitudinal depressions; eyes granularly beaded like mulberries.

Last segment smooth and polished, except at the base, where it is dull and pulverose, hollowed behind; edge somewhat waved on each side, behind roundly lobed.

This species is allied to *Z. dorsalis*, Gervais, *l. c.* p. 79.

3. *Zephronia* (Sphærop.) *versicolor*, n.s. Pl. VII. figs. 3, 3 *a*, & 3 *b*.

Z. lævis, nitida, lutea, nigro irregulariter plagiata et maculata; oculis, antennis pedibusque (in mortuis exemplis) pallide viridibus; capitis segmento nuchali lateribus acuminatis, antice medio sublobato.
Hab. Ceylon.

This species may be known by its luteous-yellow colour, blotched and spotted with black, each specimen varying in marking; the head, on the face, is punctured with distant points,

* Walckenaer et Gervais, Aptères, iv. p. 75 (1847).

some of which are subobsolete; the upper ridge of the face has about 8–10 little short spines, 4-5 on each side, near the eyes; the vertical plate is smooth, with a widely rounded outline behind, very narrow and sharp over each eye, then in front, with a wide sinus on each side and a broad rounded lobe in the middle.

The eyes, antennæ, and legs are of a pale greenish hue; and doubtless, when the creature is alive, these hues are much brighter and must contrast. It was collected at Peradenia by Mr. Thwaites.

4. *Zephronia* (Sphæroth.) *De Lacyi*, n. s. Pl. VII. figs. 2 & 2 *a*.

Z. politissima, postice subangustata, supra olivaceo-cinerea, segmentis singulis postice flavo marginatis.

Hab. in Nova Zealandia.

Named in compliment to my brother-in-law, Mr. De Lacy, of Alma Cottage, Ravensbourne, Otago, New Zealand, a gentleman very fond of natural history, and who studies it in his New Zealand home.

This species is very highly polished, and has a few scattered punctures on each segment, only visible by turning the *Zephronia* about. It is of a delicate pale greyish-olive hue, perhaps greenish when alive, the segments narrowly margined with yellow. Nuchal plate margined in front, and with a crescent-like impressed line close to the anterior margin, circle outwards. The body is shortish, and the last segments are gradually narrowed. The last segment, before the hinder margin, has a widish paler band. The legs and under side are yellowish. It is a pretty and very distinct species, the first I have seen from New Zealand. In one specimen the segments are curiously mottled with pale yellowish patches.

The *complete* figures are of the size of nature; the others are magnified, and were carefully drawn by young Mr. Mintern, the pupil of Mr. Ford, who directed him when drawing the objects.

XLIII.—*On* Mr. Jeffreys's '*Gleanings in British Conchology,*' *published in the* '*Annals of Natural History*' *for January and August* 1858 *and for January and February* 1859. By Wm. Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, 7 Norfolk Crescent, Bath.

Mr. Gwyn Jeffreys, my fellow-labourer in the Molluscan fields, favoured me very lately with a couple of days' visit, to inspect my collection of British shells, and to gratify me with the sight of some of his own rarities. In so fruitful a field for divergence of opinion, we differed and agreed again and again.

This conference, if you are pleased to allow me a little space in your valuable Journal, will afford the opportunity I have wished for to make some remarks on Mr. Jeffreys's "Gleanings in British Conchology." I have very partially consulted that gentleman on the observations I am about to offer; for when the interests of science, as I think, are jeopardized, it at once becomes the duty of the faithful observer to attempt to correct error; and the more independently we exercise our opinions and judgment, the better we shall succeed in searching out the truth, and procuring the explanations and corrections which science requires.

That I may not exceed the ample limits you have afforded me, I shall on this occasion only apply my remarks to those species that appear to have the more pressing claims for attention, and which, if passed over any longer without correction, may prejudice this branch of science.

Mr. Jeffreys, in his "Gleanings" in the January 'Annals' for 1858, 3rd series, vol. i. pp. 39–48. pl. 2. f. 2, has introduced a new species with the appellation of *Diodonta Barleei*, captured by Mr. Barlee off Arran Isle, county Galway. I was entirely unacquainted with this, as I supposed, Irish species, until Mr. Jeffreys, seeing some minute bivalves of *Diplodonta rotundata* on one of my tablets, declared that they did not belong to that species, but were *Diodonta Barleei*; he made a minute of them, and the new habitat, Exmouth. I was greatly surprised at this very unexpected determination, and on Mr. Jeffreys's departure I instituted a careful examination of his discovery that my minute specimens of *Diplodonta* were the *Diodonta Barleei*. I found that Mr. Jeffreys had fallen into an error, and that my shells were without doubt *Diplodonta rotundata*; they presented all, even the minute attributes of that species, as the cardinal teeth, the absence of lateral ones, the adductor muscles connected, as in it, by the circular pallial impression, showing in the most decided manner its entirety, and absence of the siphonal scar, which denotes that posterior tubes do not exist in this animal—and that fact I have shown in my *own* sketch of *D. rotundata*, figured in the 'British Mollusca,' and accompanied by a description of the soft parts,—whereas in the true *Diodonta* the siphonal scar is deep, and more conspicuously pronounced than usual, denoting the presence of long siphons. My series of closed and open examples from $\frac{1}{20}$th to $\frac{4}{20}$ths of an inch, with a series of older shells, incontestably corroborate this determination. The question that naturally arose on this discovery was this,—Has Mr. Jeffreys mistaken my young *Diplodonta rotundata* for the *Diodonta Barleei*? To ascertain this, I wrote to Mr. Barlee for specimens; but I failed to obtain them. I then applied to Mr. Jeffreys for an example: this was forwarded; and after an interchange of the minute shells in question, and having opened Mr. Jeffreys's example, and compared the dentition, muscular and pallial impressions, and absence of siphonal scar, with mine, I instantly perceived that my young *Diplodonta rotundata* and his young shells of the supposed *Diodonta Barleei* were identical. I pointed out to Mr. Jeffreys the impossibility of his so-called *Diodonta* being that genus, from the absence of the siphonal scar. After a correspondence, I suggested to that gentleman that he had better at once withdraw a supposititious object, and attribute it and the description and figure in the 'Annals' to an accidental error that all conchologists may occasionally be subject to. Mr. Jeffreys wrote to me as follows:—"Perhaps you are right about the *Diodonta Barleei*, at least to this extent, that I believe on reconsideration it may be a *Diplodonta*."

We must now turn our attention to the "Gleanings" in the August 'Annals' for 1858, 3rd series, vol. ii. pp. 117–133.

Rissoa cimicoides (the *R. sculpta* of the 'British Mollusca'). This species has not been taken at Exmouth, as Mr. Jeffreys states in a subsequent portion of the "Gleanings:" the error of that habitat has arisen from seeing the specimens received from Mr. Damon on my tablet of *Rissoa reticulata* (Mont.), as at first view I thought them a mere variety of that species.

Aporrhaïs pes-carbonis. I have always thought it a dwarf variety of *A. pes-pelecani*. Mr. Barlee's distinctive characters of these two objects are not of specific value, being dependent as to colour on locality, food, depth of water, and other circumstances. As to the different appearances, in the two objects, of the head, tentacula, proboscis, and foot, they are often very fallacious specific characters; these organs are in constant vibration, and their changes are incessant: the tentacula often appear to have a line running down their centres; this, as if by magic, disappears at the will of the animal, until it is reproduced by volition. There are the same capricious phases in the proboscidal apparatus as regards its rotundity and flatness; but these momentary mutations have no valid specific import; there must be persistent and substantial differences of structure for the foundation of species.

Being on the subject of distinction of species, I may mention that some naturalists think that if animals of general resemblance, but which are nevertheless distinguished by certain variations of contour, live together, and preserve their respective differences, from that fact they are probably distinct. I dissent from this supposition in its full extent; for the animals in question may be typical species, with their varieties, and of course are certainly not distinct. The argument of animals living together neither proves identity nor distinction; but these gentlemen will not abandon their views of distinction, which is the cause why so many spurious objects, resting on very slight differences of contour (especially amongst the *Chemnitziæ*, under which term the *Odostomiæ* and *Eulimellæ* of some authors are included, as in my 'Brit. Mar. Test. Moll.,' I have shown that the two are identical with the *Chemnitziæ*), have been introduced into our books, which, after a short time, are discovered to be mere varieties of a particular type.

As a final exposition of the doctrine I have mentioned, I may state that it is insisted on, that the *A. pes-carbonis*, which presents no difference but of size from the *A. pes-pelecani*, is a distinct species, from the fact of the two being found together, and each preserving its respective variation of *major* and *minor*. But I ask, why may not a dwarf variety of a type live with its chief as a variety, without being invested with the attributes of distinctness? The two may be distinct; but I have, I think, as good reason to believe that they may be varieties of the same species.

Rissoa pulcherrima. I have a series of this, which, I think, proves that it is one of the endless varieties of the *R. inconspicua*.

Cerithiopsis pulchella. I have it from Mr. Jeffreys, and think it a variety of a very variable species, the *C. tubercularis*.

Buccinum Humphreysianum is one of the innumerable varieties of *B. undatum*. I refer to my observations on *A. pes-carbonis* to show that Mr. Barlee's distinctive characters are not valid.

Triton nodiferus. Those who believe this to be a British species have much more faith than I can lay claim to.

Triton cutaceus. We must admit this species into the British list, at least as a Channel Isle production, as on this day (31st of March, 1859) my friend Mr. Barlee, the fortunate possessor of the identical specimen mentioned in the "Gleanings," submitted it to my inspection at my house in Bath, and assured me that Dr. Lukis and himself personally dredged it, in a living state, off Guernsey. It is in perfect condition, with the operculum, and appears to me to be less than a half-grown shell. It is barely possible that it may have been dropped from the bottom of a vessel from the Mediterranean: we hope that more examples may occur, to put an end to every doubt. I formerly possessed Dr. Turton's full-grown shells of this species; but I always considered them as exotic; it is, however, stated that they have on other occasions occurred in the Channel. Prof. Forbes and Mr. Hanley regarded them as exotic.

With respect to the "Gleanings" inserted in the January Number of the 'Annals' for 1859, 3rd series, vol. iii. pp. 30–43, I have to observe that *Kellia lactea* is not distinct from *K. suborbicularis*; the former is usually found in the mud of old bivalves, the latter in the cavities of rocks; they are mere varieties of each other. I find no difference in their dentition.

Lepton sulcatulum appears to be a good species—that is, on *shell* examination.

Mytilus Galloprovincialis, taken in the Bristol Channel*, and the *M. ungulatus*, from the Gouliot Caves at Guernsey, both of which are figured in the January Number of the 'Annals' for 1859, and of the latter of which Mr. Jeffreys presented me with a specimen,

* I have this 21st of April procured, in Bath, the finest *live* specimens from the Scottish coasts, *viâ* Bristol; and I have some reason to believe that this mention of Bristol has been the cause of the Bristol Channel being erroneously assigned as its habitat.

from Hayle in Cornwall, are, I think, only large examples of the common *M. edulis,* of which that gentleman sent me a large valve from Exmouth to compare with them. I could not, however, perceive any differences beyond those slight ones that are always to be seen even in the same species. I may observe that the animal of the *Mytili* varies greatly, from the influence of locality and from the changes of aspect arising from the different seasons of the year,—so much so, indeed, that the mere conchologist often mistakes two phases of the same for distinct species.

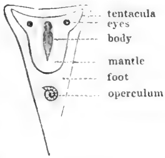
I now come to the "Gleanings" in the February 'Annals' for 1859, 3rd series, vol. iii. pp. 106–120.

Jeffreysia? Gulsonæ. This is my *Chem. Gulsonæ,* the shell of which I described in the second series of the 'Annals,' vol. vi. p. 458, and the animal in vol. viii. p. 108 of the same series. I am quite at a loss to discover upon what principle Mr. Jeffreys (even with a ? affixed) has placed in his *own* genus this species, first published by myself. Mr. Jeffreys has only examined the shell; but I have seen both the shell and the animal; and though the torpidity of the latter did not allow me to be so certain of its characters as I could wish, still I am enabled to say, *positively,* that it is not a *Jeffreysia,* as the operculum of that genus is of a very peculiar form, and differs decidedly in structure from that of my *Chemnitzia Gulsonæ.*

Euomphalus nitidissimus (*Skenea? nitidissima* of British authors). Mr. Jeffreys also states that he has no doubt it is the *Truncatella atomus* of Philippi, Moll. Sicil. ii. p. 134, pl. 24. f. 5. I do not believe that so accurate an observer has committed the blunder attributed to him by Mr. Jeffreys, of having described and figured his animal with tentacula, if they had not existed. I think that gentleman is in error, and I shall show that he has done Philippi an injustice; and I have no doubt, on some subsequent re-examination of the animal of the *T. atomus,* it will be found to accord with his indices. Every one knows the deceptive appearances of minute creatures, from the effects of light, water, and their constant vibrations, when under microscopic examination. From the mention of the cilia in Mr. Jeffreys's report, I very much think that the tentacula of his animals (at all times "*perbrevia,*" teste Philippi) were not protruded; for if they had been, the cilia would have clothed them—as in the *Rissoæ* and most other Gasteropoda, which have these delicate aids, for tact, of greater or less length; and in consequence, the long terminal cilia alone on each side of the rounded lobes, as figured, were visible.

I have observed that, though animals may apparently be lively, sulkiness or their will often predominates as to particular organs: in the *Chemnitziæ* and *Rissoæ* the tentacula are often retracted; and I have watched for hours before I could obtain a view of them, their cilia being only visible at their terminations; these, in some species, are very long, of which fact I have pointed out examples in my 'Brit. Mar. Test. Moll.' I am surprised to find that Mr. Jeffreys was not aware that any mollusk possesses the peculiar cilia that fringe the veil or anterior part of the head of this animal.

I will now proceed to corroborate the correctness of Philippi's figure to a point of certainty which I think it will be difficult to impeach. I have softened many of these minute creatures in their shells; and by bruising the anterior portion and carefully removing the spoil from the head and neck, I have seen the short, broad, triangular, divergent tentacula, with the very large eyes fixed at the centre of their bases, brought so prominently to view by moisture, and in such fair relief, that it was impossible to have any doubt as to the presence of tentacula as described and figured by Philippi. I was so struck with this interesting sight, that I obtained the assistance of an excellent lady-artist, to give me, by the aid of the half-inch object-glass of the microscope, the sketch, of which the woodcut is a copy, very largely magnified, *minus* the cilia, which, from their delicacy, were invisible from collapse; she produced in a few minutes, from her own view, an almost facsimile of Philippi's figure. The head, which undoubtedly exists, was hidden under the mantle; but its presence was betrayed by the minute tumour. It appears quite clear that Mr. Jeffreys has delineated his animal with rounded lobes, or, in other words, with the tentacula retracted, instead of those described above, and figured in the woodcut as protruded. Mr. Jeffreys's description of the animal is also contrary to its organization, in stating that the eyes are fixed *on* the "veil" (mantle): this is not so, though these and the tentacula, being seen through the tenuity of the "veil," have the appearance of being fixed on it; but the body, head, foot, the eyes, and tentacula form no part of the veil or mantle, which is only their envelope when they are in retraction and quietude, and from whence they are protruded when in action.



Mr. Jeffreys, in his miscellaneous remarks, charges Philippi with more mistakes respecting the animals of *Truncatella truncatula* and *T. littorea.* I beg to say I have examined both alive, and fully described them in my 'Brit. Mar. Test. Moll.,' and I find that Philippi is correct, except in saying "operculum simplex, non spirale." But surely the most fastidious can hardly find fault with so venial an error, when the objects are so minute as scarcely to be visible with the naked eye; they do not exceed in length more than from $\frac{1}{40}$th to $\frac{1}{80}$th of an inch; and we must recollect that the optical appliances of his time were very inferior to those of the present day.

With respect to *T. atomus*, I may state that the excellent view of the organs I have succeeded in obtaining from the moistened specimens enables me to say, without doubt, that it is, as Philippi states, a congener of *T. truncatula, T. littorea*, and, I think, of *Assiminia Grayana.* (See my 'Brit. Mar. Test. Moll.') I will now mention some of the coincidences of this little tribe: the tentacula of all are of a precisely similar character—very short, broad, and triangular, being united at their bases, with the very large eyes inserted in them, at varying distances from their points—not on prominences; the characters of the operculum agree in all, being, even in the globoso-conic and discoid, somewhat elongated, with, at the base, a paucispiral $1\frac{1}{2}$ volution, and finely striated to a point short of the outer margin. I have them all mounted. Again, they are all strictly littoral species, though by mistake they have been stated to have occurred at sea. These are striking resemblances as to the organization of the soft parts; but, strange to say, they *all* differ in the form of the shell, one being cylindrically elongated, two globosely conic, and the fourth discoid.

This is another instance, amongst others, in which the form of the shells does not assist us in discriminating their respective species. Though I object generally to the change of old generic and specific names, I think that the present generic title of *Truncatella* points too exclusively to one of its species, and it might be advantageously changed: this is an exceptional case: I would therefore propose that this very interesting group, in which *all* the animals, though the shells differ, are identical in every essential character, should bear the generic appellation of *Assiminia* (Gray, Leach); but if Dr. Gray should think it inexpedient to allow of any enlargement of the generic characters of *Assiminia* to receive Philippi's three species (viz. *T. littorea*, *T. truncatula*, and *T. atomus*), I defer to such high authority. And then Philippi's genus *Truncatella* must receive his three original species, unless only the conic *T. littorea* be transferred to *Assiminia*; in that case the *T. truncatula* would stand as the type of the genus: still we must have a new one for *T. atomus* (certainly not *Euomphalus*). Even such an arrangement will have its inconveniences, from the animals being identical, though inhabiting differently formed shells. This last observation is Philippi's, who observes, in his 'Moll. Sicil.' vol. i. p. 133, "This animal inhabits different shells, viz. those that are subcylindrically decollated, globoso-conic, and even discoidal."

Mr. Jeffreys appears to have drawn largely on his imagination in considering this minute species the *last living* representative of the fossil *Euomphali*, and in comparing it with *E. pentangulatus*. The characters of our little shell do not agree with the fossils, especially with respect to the aperture; but any of the *Planorbes*, or even our discoid *Rissoa* (*Skenea Planorbis*), have more pretension, if any at all exist, to be called the living representative of the *Euomphali* than our little *Truncatella atomus*: both the above-named are flat on one surface and umbilicated on the other; and in many of the *Planorbes* the aperture is subangular, as in *Euomphalus*, but in the *T. atomus* it is suborbicular. I hope this summer to see the animal alive, and I have no doubt that it will bear me out in the observations I have offered*.

* I should be greatly obliged by any gentleman sending me, by the *post*, some of these minute animals, as soon as captured, to Bath, before the 20th of May, 1859, and after that date, to Exmouth, Devon; they should be put in an ounce-and-a-half bottle, quite full of fresh clear sea-water, enclosed in a tin cylinder; for the cost of which and postage, I would forward a Post-Office order. I have omitted to state that these minute creatures, not exceeding, with their shells, $\frac{1}{40}$th of an inch in diameter, are a littoral species, and feed on the *Codium tomentosum* or other minute Algæ in the rock-pools.

To find them, put the Algæ in a sieve, in a pan of sea-water, with

I hope I have succeeded in rescuing the *T. atomus* of the excellent Philippi from being supplanted by Mr. Jeffreys in consequence of his fanciful idea that, because it is discoid, flat above, and umbilicated beneath, it must be the last living representative of the *fossil Euomphali.* These are the only data given for a substitution which I must consider destitute of foundation.

I shall now terminate this rapid sketch of some of the notices in the "Gleanings" by giving an account of the *Chemnitziæ,* which are generally termed by Mr. Jeffreys *Odostomiæ,* and are largely mentioned in them, and have been kept back for the convenience of considering them in a collective form.

These Pyramidellidan genera and species, though they have been more sedulously looked after than any other division by the British naturalist, are in a confused and unsatisfactory position, resulting from the constant endeavour of conchologists to constitute species from the almost imperceptible differences in the form and contour of these minute objects, without considering, in the genera I have mentioned, the excessive versatility of the variations of their species. Mr. Jeffreys, at our late conference, gave me some specimen-types of his own constituted species, and afforded me the opportunity of inspecting the remainder, of which examples could not be spared. The result of a searching examination and comparison with my own examples has satisfied me that his own peculiar species, *O. alba, O. albella, O. dubia, O. rissoides,* and *O. Lukisii,* are only diminutive subvarieties of a singular dwarf variety of my *Chemnitzia pallida,* which is the *O. eulimoides* of some authors, and by far the most variable species of the genus,—indeed so much so, that it is difficult to find two similar examples; even Mr. Jeffreys has appended to it five varieties, *a, b, c, d, e,* in his paper in the 'Annals,' 2nd ser. vol. ii. p. 335. I have compared the animal of this new dwarf variety with the typical *Chem. pallida,* and found it identical, both in respect to the organs, and the operculum, which latter appendage differs from that of every other *Chemnitzia*; and, with the reservation of the incidents that may arise from a re-examination, I propose to name it *Chem. pallida* var. *nana* et *protea,* as, out of my very numerous suite, more than half are of such dissimilar forms, that they might constitute species with more justice than many that figure in our books. This protean squadron is the littoral phase of the *Chem. pallida,* and if ever found at sea in deep water, has been transferred thither by the tides and currents. I hope this summer to be enabled to remodel the *Chemnitziæ,* so that collectors may easily identify these objects, which now puzzle them so much, that Mr. Jeffreys wrote me word that he has had hundreds of shells of these genera and species sent him to name and identify. What does this prove, but that the characters are so slight and superficial as to defy discrimination? It will be asked, may not the animals I consider as varieties live with the dwarf variety of the "*pallida*" as species? I answer, the differences are too partial and

meshes large enough to let them pass through, when the Algæ are moved about carefully, into another very fine sieve placed under the first, from which they may be collected by the aid of a lens and a camel's-hair brush.

insufficient for specialties, as, if they were acknowledged, the entire units of this protean variety must be promoted to the rank of species. I do not contend that good species may not be found in company; for the *Chem. Sandvicensis*, *Ch. plicata*, and others are often seen with it; but their characters are so decided as to admit of no doubt of their distinctness.

Mr. Jeffreys, in the "Gleanings," says that I have found a specimen of Mr. Alder's *O. nitida*: I thought so too; but on examination after his departure, it turned out to be one of my protean dwarf "*pallida*."

I cannot admit that the *O. turrita* (Jeffreys) has been taken by me at Exmouth; the shells he has mistaken for his object are varieties of *Chem. acuta*, the animal of which I have often examined.

Mr. Jeffreys, speaking of his *O. minima* in the January "Annals" for 1858, Pl. 2. f. 3, says its nearest ally is perhaps *O. cylindrica*: he is quite right. I showed him, under the microscope, at my house, that it was an undoubted slender *O. cylindrica*; but he seemed indisposed to concur with me.

In the notice of the above articles, I trust I have not outstepped the bounds of a fair and legitimate commentary.

I am, Gentlemen,

Your most obedient Servant,

WM. CLARK.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

November 18, 1858.—Richard Owen, Esq., V.P., in the Chair.

"On the Theory of the Vertebrate Skull," being an Abstract of the Croonian Lecture. By Thomas H. Huxley, Esq., F.R.S.

(Abstract.)

I apprehend that it has been, and is, too often forgotten that the phrase "Theory of the Skull" is ordinarily employed to denote the answers to two very different questions:—the first, Are all vertebrate skulls constructed upon one and the same plan? the second, Is such plan, supposing it to exist, identical with that of the vertebral column?

It is also forgotten that, to a certain extent, these are independent questions; for, though an affirmative answer to the latter implies the like reply to the former, the converse proposition by no means holds good, an affirmative response to the first question being perfectly consistent with a negative to the second *.

* There is a wide difference, too, in the relative importance of either question to the student of comparative anatomy. Unless it can be shown that a general identity of construction pervades the multiform varieties of vertebrate skulls, a concise, uniform, and consistent nomenclature becomes an impossibility, and the anatomist loses at one blow the most important of aids to memory, and the most influential of stimulants to research. The second question, on the other hand, though highly interesting, might be settled either one way or the other without exerting any very important influence on the practice of comparative anatomy.

As there are two problems, so there are two methods of obtaining their solution. Employing the one, the observer compares together a long series of the skulls and vertebral columns of adult *Vertebrata*, determining, in this way, the corresponding parts of those which are most widely dissimilar, by the interpolation of transitional gradations of structure. Using the other method, the investigator traces back skull and vertebral column to their earliest embryonic states, and determines the identity of parts by their developmental relations.

It were unwise to exalt either of these methods at the expense of its fellow, or to be other than thankful that more roads than one lead us to the attainment of truth. Each, it must be borne in mind, has its especial value and its particular applicability, though at the same time it should not be forgotten that to one, and to one only, can the *ultimate* appeal be made, in the discussion of morphological questions. For, seeing that living organisms not only *are*, but *become*, and that all their parts pass through a series of states before they reach their adult condition, it necessarily follows that it is impossible to say that two parts are homologous, or have the same morphological relations to the rest of the organism, unless we know, not only that there is no essential difference in these relations in the adult condition, but that there is no essential difference in the course by which they arrive at that condition. The study of the gradations of structure presented by a series of living beings may have the utmost value in suggesting homologies, but the study of development alone can finally demonstrate them.

Before the year 1837, the philosophers who were occupied with the Theory of the Skull, confined themselves, almost wholly, to the first-mentioned mode of investigation, which may be termed the "method of gradations." If they made use of the second method at all, they went no further than the tracing of the process of ossification, which is but a small, and by no means the most important, part of the whole series of developmental phenomena presented by either the skull or the vertebral column.

But between the years 1836 and 1839, the appearance of three or four remarkable Essays, by Reichert, Hallmann, and Rathke*, inaugurated a new epoch in the history of the Theory of the Skull. Hallmann's work on the Temporal Bone is especially remarkable for the mass of facts which it contains, and for that clearness of insight into the architecture of the skull, which enabled him to determine the homologies of some of the most important bones of its upper arch throughout the vertebral series. Rathke showed the singular nature of the primordial cranial axis; and Reichert pointed out in what way alone the character of its lower arches could be determined. For the

* The titles of these works are,—Reichert, 'De Embryonum arcubus sic dictis Branchialibus,' 1836, which I have not seen; the same writer's essay, 'Ueber die Visceralbogen der Wirbelthiere im Allgemeinen,' Müller's Archiv, 1837. Hallmann, 'Die vergleichende Osteologie des Schläfenbeins,' 1837. Rathke, 'Entwickelungsgeschichte der Natter,' 1839. I regret that, in spite of all efforts, I have hitherto been unable to procure a copy of another very important work of Rathke's, the 'Programm,' contained in the "Vierter Bericht von dem naturwissenschaftlichen Seminär zu Königsberg."

first time, the student of the morphology of the skull was provided with a criterion of the truth or falsity of his speculations; and that criterion was shown to be Development.

My present object is to lay before you a brief statement of some of the most important results to which the following out of the lines of inquiry opened up by these eminent men seems to lead. Much of what I have to say is directed towards no other end than the revival and justification of their views,—a purpose the more worthy and the more useful, since, with one or two honourable exceptions—I allude more particularly to the recent admirable essays of Prof. Goodsir—later writers on the Theory of the Skull have given a retrograde impulse to inquiry, and have thrown obscurity and confusion upon that which twenty years ago had been made plain and clear.

I have said that the first question which offers itself is, whether all vertebrate skulls are or are not, constructed upon a common plan; and in entering upon this inquiry I shall assume (what will be readily granted) that, if it can be proved that the same chief parts, arranged in the same way, are to be detected in the skulls of a Sheep, a Bird, a Turtle, and a Carp, the problem will be solved affirmatively—so far, at any rate, as the osseous cranium is concerned.

[The author describes the general arrangement of the bony elements in the cranium of the Sheep, and proceeds to compare it with that of the Bird.]

Composition of the Skull of a Bird (fig. 1).

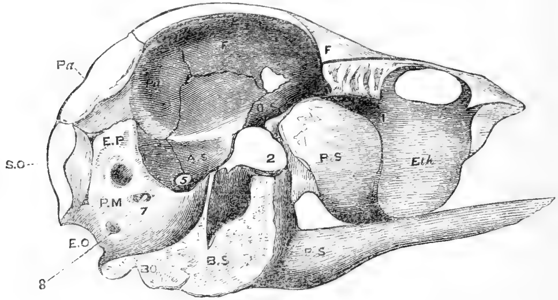


Fig. 1.—Longitudinal section of the Skull of a young Ostrich.

In this and the following sections of Crania the letters have the same meaning.

B.O. Basioccipital.
B.S. Basisphenoid.
P.S. Presphenoid.
Eth. Ethmoid (lamina perpendicularis).
E.O. Exoccipital.
M. Mastoid.
P. or P.S. Petrosal.
P.M. Petromastoid.

A.S. Alisphenoid.
O.S. Orbitosphenoid.
Pf. Prefrontal.
Sq. Squamosal.
Ep. Epiotic.
S.O. Supraoccipital.
Pa. Parietal.
F. Frontal.

Foramina for nerves.
1. Olfactory; 2. optic; 3 &4. oculomotor and pathetic nerves; 5. third division of trigeminal; 7. portio dura and mollis; 8. pneumogastric; Epiph. Pineal gland, or epiphysis cerebri.

In most adult birds, as is well known, the bones of the cranium have coalesced so completely as to be undistinguishable. But in the chick, and to a greater or less extent, in the adult struthious bird, the boundaries of the various bones are obvious enough; and I will therefore select for comparison with the mammalian skull that of an ostrich, and that of a young chicken.

The craniofacial axis of the bird has the same general figure as that of the sheep, consisting of a thick, solid, median portion, lodging the sella turcica; of a posterior, horizontally, and of an anterior, vertically, expanded division; but it is comparatively shorter and thicker in correspondence with the greater shortness, in proportion to its depth, of the cranial cavity. The sella turcica is very deep, and its front wall is very thick. The lower and anterior half of this wall is produced into a long tapering process, which extends forwards far beyond the anterior limit of the bony lamina perpendicularis of the ethmoid, to end in a point.

Overlying this process, and articulated with more than the posterior half of its upper surface, there is, in the ostrich, a strong, thick, vertical, bony plate, narrower in front and behind than in the middle, and below than above. A curved vertical ridge on each lateral surface marks the line of its greatest transverse diameter, and seems to indicate a primitive division of the mass into two parts, an anterior and a posterior. The latter is connected above with the bony plates representing the orbitosphenoids. The former exhibits on each side, posteriorly and superiorly, a groove, in which the olfactory nerve rests and, above this, expands into an arched process, which supports the anterior extremity of the frontal bone. Anteriorly, the superior end of the bone widens into a rhomboidal plate, which appears externally between the nasal bones. These anterior and posterior processes of the superior edge of the bone are connected by a delicate ridge, which passes from one to the other above, but leaves an irregular oval gap below.

The anterior edge of the bony plate in question is continued into the unossified septum narium, which below supports the delicate bony representative of the vomer.

In the chick, the whole of the parts just described are unossified, but the composition and structure of the rest of the axis is essentially the same as in the ostrich.

It is not difficult to identify in the craniofacial axis of the bird, parts corresponding with those which have been shown to exist in the mammal. In the chick, the basioccipital can be readily separated from the basisphenoid. The latter has the same relation to the sella turcica in the bird as in the mammal; and only differs from it in that singular beak-like process, into which its inferior portion is prolonged anteriorly, and which is produced, according to Kölliker *, by the coalescence with the basisphenoid of a distinct ossification, which is developed in the presphenoidal cartilage and partially represents the presphenoid of the mammal. The rest of the presphe-

* Berichte von der Königlichen Zool. Anstalt zu Würzburg, 1849, p. 40.

noidal cartilage is more or less completely ossified, and appears to be represented in the ostrich by that part of the "vertical bony plate" which lies behind the curved ridge referred to above; while that part of the plate which is situated in front of the ridge, answers to the lamina perpendicularis of the ethmoid.

Nothing can be more variable, in fact, than the mode in which the ossification of the presphenoidal and ethmoidal portions of the craniofacial axis takes place in birds; while nothing is more constant than the general form preserved by these regions, and their relation to other parts, irrespectively of the manner in which ossification takes place in them. And in these respects birds do but typify the rest of the oviparous *Vertebrata*.

If we compare the inferolateral walls of the ostrich's cranium with those of the sheep, we find the most singular correspondences. Posteriorly are the exoccipitals, which contribute to form the single condyloid head for articulation with the atlas, but otherwise present no important differences. In front of the exoccipital lies a considerable bony mass, which unites, internally and inferiorly, with the basioccipital and basisphenoid bones, and posteriorly is confluent with the exoccipitals. Its anterior margin is distinguishable into two portions, a superior and an inferior, which meet at an obtuse angle. The anterior inferior portion articulates with the alisphenoid; the anterior superior portion with the parietal. The anterior, posterior, and inferior relations of this bone are therefore the same as those of the petromastoid of the sheep.

Superiorly and posteriorly, a well-marked groove (which, however, is not a suture) appears to indicate the line of demarcation between the supraoccipital and this bone, whose pointed upper extremity appears consequently to be wedged in between the supraoccipital and the parietal.

The par vagum passes out between the bony mass under description and the exoccipital; the third division of the trigeminal leaves the skull between it and the alisphenoid. The portio dura and the portio mollis enter it by foramina very similarly disposed to those in the sheep. Superiorly there is a fossa on the inner face of the bone, which corresponds with a more shallow depression in the sheep, and, like it, supports a lobe of the cerebellum. Finally, the anterior inferior edge of the bone traverses the middle of the fossa which receives the mesencephalon. In every relation of importance, therefore, this bony mass corresponds exactly with the petromastoid of the sheep, while it differs from it only in its union with the exoccipitals and the supraoccipital posteriorly, and its contact with the craniofacial axis below.

If from the ostrich we turn to the young chick (fig. 2), the condition of this part of the walls of the skull will be found to be still more instructive. The general connexions of the corresponding bony mass, Pt. M. Ep., are as in the ostrich; but while it is even more evident that the groove appearing to separate its upper end from the supraoccipital is no longer a real suture (whatever it may have been), a most distinct and clear suture, of which no trace is visible in the ostrich's skull, traverses the bone at a much lower point, dividing it into an inferior larger piece, united with the exoccipital, and a superior portion, anchylosed with the supraoccipital. The latter contains the upper portions of the superior and external semicircular canals.

Moreover, on endeavouring to separate the inferior bone from the exoccipital, it readily parts along a plane which traverses the fenestra ovalis externally, and the anterior boundary of the foramen of exit of the par vagum internally. The posterior smaller portion remains firmly adherent to the exoccipital, while the other larger portion comes away as a distinct bone.

The latter answers exactly to the mammalian petrosal, while the small posterior segment corresponds with the mammalian mastoid. Like that of the mammal, it is eventually anchylosed with the petrosal; but unlike that of the mammal, it is also, and indeed at an earlier period, confluent with the exoccipital.

Thus, to return to the ostrich's skull, the bony mass interposed between the exoccipital, supraoccipital and parietal bones, and the craniofacial axis, is in reality composed of three bones, an anterior (petrosal), a posterior (mastoid), and a third, which is distinct from the petrosal and mastoid in the chick, but is anchylosed with them in the ostrich, and which has as yet received no name. I shall term it, from its position with respect to the organ of hearing, the epiotic bone, "os epioticum*."

The homology of the bone here called petrosal, with that of the mammal, is admitted by all anatomists. The bone which lies immediately in front of the petrosal is, with a no less fortunate unanimity, admitted to be the homologue of the mammalian alisphenoid. But it is worthy of particular remark, in reference to the shifting of the relative positions of the lateral elements of the cranial wall, which has been imagined to take place in the Ovipara, in consequence of the supposed invariable disappearance of the squamosal from the interior of their skulls; that although precisely the same bones are visible on the inner surface of the cranial cavity in the ostrich as in the sheep, the squamosal being absent in both, yet in the ostrich the third division of the trigeminal does not pass through the middle of the alisphenoid, but between it and the petrosal.

The orbitosphenoids appear like mere processes of the presphenoid, and their relation to the optic nerves is altered in the same way (when compared with the corresponding bones in the sheep) as that of the alisphenoids to the trigeminal, that is to say, the nerves pass behind, and not through them.

The superior series of bones in the cranial wall is exactly the same as in the sheep, and the parietals are distinct in the young ostrich, as in the lamb.

Attached to the exterior of the skull of the ostrich are, as in the sheep, several bones; but the appearance of some of these is widely different from that of the parts which correspond with them

* My reasons for considering this osseous element to be distinct from the supraoccipital will be given below.

in the mammal. This is least the case with the largest and uppermost of these bones, which lies upon the parietal above, the alisphenoid in front, and the exoccipital behind; while internally it is in relation with the petromastoid.

This bone lies immediately above an articular surface, which is furnished to the os quadratum by the petrosal, and more remotely it helps to roof-in the tympanic cavity, but takes no share in the formation of the fenestra ovalis. It sends a free pointed process downwards and forwards, which does not articulate with the jugal. Except in this particular, however, the bone in question resembles in every essential relation the squamosal of the sheep, while to the same extent it differs from the mastoid of that animal.

I have stated that in the ostrich this bone does not appear upon the inner surface of the wall of the skull, and in this respect, while it resembles the squamosal of the sheep and Ruminants generally, it differs from that of most other *Mammalia*, in which the squamosal makes its appearance in the interior of the skull, between the parietal, frontal, alisphenoid and petrosal bones, and so contributes more or less largely to the completion of the cranial wall.

But it has been most strangely forgotten that the relations of the bone in question in birds are by no means always those which obtain in the ostrich. In the young of the commonest and most accessible of domestic birds, in the chicken, the squamosal may be readily seen to enter largely into the cranial wall,—a rhomboidal portion of its anterior and internal surface being interposed in front of the petrosal, between this bone, the parietal, the frontal, and the alisphenoid (Sq. fig. 2).

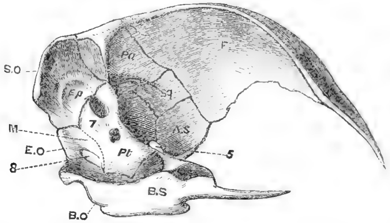


Fig. 2.—Longitudinal section of the Skull of a young Chicken.

There is therefore not a single relation (save the connexion of the jugal) in which this bone does not resemble the squamosal of the *Mammalia*—there is not one in which it does not differ from their mastoid.

The second bone applied externally to the cranium in the bird, is that large and important structure, the os quadratum, which intervenes between the petrosal and squamosal bones above, and the articular portion of the lower jaw below,—which articulates with the pterygoid internally and with the quadratojugal externally, which gives attachment to a part of the tympanic membrane posteriorly, and which is very generally termed the tympanic bone, from its supposed homology with the bone so named in the *Mammalia*. The resemblance to the tympanic bone, however, hardly extends beyond its relation to the tympanic membrane; for in no other of the particulars mentioned above do the connexions of the two bones correspond. The tympanic of the mammal does *not* articulate with the lower jaw, nor with the pterygoid *, nor with the jugal or quadratojugal. On the other hand, if the connexions of the tympanic membrane were sufficient to determine the point, not only the quadratum, but the articular element of the lower jaw, and even some cranial bones, must be regarded as tympanic.

Again, if we trace the modifications which the tympanic bone undergoes in the mammalian series, we find that in those mammals, such as *Echidna* and *Ornithorhynchus*, which approach nearest to the *Ovipara*, and which should therefore furnish us with some hint of the modifications to which the tympanic bone is destined in that group, the bone, so far from increasing in size and importance, and taking on some of the connexions which it exhibits in the oviparous *Vertebrata*, absolutely diminishes and becomes rudimentary, so that the vast bony capsule of the placental mammal is reduced, in the Monotreme, to a mere bony ring.

But it is no less worthy of remark, that in these very same animals the malleus and incus have attained dimensions out of all proportion to those which they exhibit in other mammals, and that they even contribute to the support of the tympanic membrane.

So far, therefore, from being prepared by the study of those *Mammalia* which most nearly approach the *Ovipara*, to find, in the most highly organized of the latter, an immense os tympanicum, with a vanishing malleus and incus, we are, on the contrary, led to anticipate the disappearance of the tympanicum, and the further enlargement of the ossicula auditûs. Thus far the cautious application of the method of gradations leads us, and leads us rightly—though the demonstration of the justice of its adumbrations can only be obtained by the application of the criterion of development.

It is twenty-one years since this criterion was applied by Reichert. Since his results were published, they have been, in their main features, verified and adopted by Rathke, the first embryologist of his age; and yet they are ignored, and the quadratum of the bird is assumed to be the tympanic of the mammal, in some of the most recent, if not the newest discussions of the subject. Reichert and Rathke have proved, that in the course of the development of either a mammal or a bird, a slender cartilaginous rod makes its appearance in the first visceral arch, and eventually unites with its fellow, at a point corresponding with the future symphysis of the lower jaw. Superiorly, this rod is connected with the outer surface of the cartilage,

* Though the pterygoid comes close to it in *Monotremata*.

in which the petrosal bone subsequently makes its appearance. Near its proximal end, the rod-like "mandibular cartilage" sends off another slender cartilaginous process, which extends forwards parallel with the base of the skull. With the progress of development, ossification takes place in the last-named cartilage, and converts it, anteriorly, into the palatine, and posteriorly, into the pterygoid bone. The mandibular cartilage itself becomes divided into two portions, a short, proximal, and a long, distal, by an articulation which makes its appearance just below the junction of the pterygopalatine cartilage. The long distal division is termed, from the name of its original discoverer, Meckel's cartilage. It lengthens, and an ossific deposit takes place around, but, at first, not in it. The proximal division in the mammal ossifies, but usually loses its connexion with the pterygoid, remains very small, and becomes the incus. In the bird the corresponding part enlarges, ossifies, and becomes the os quadratum, retaining its primitive connexion with the pterygoid. In the mammal, the proximal end of Meckel's cartilage ossifies and becomes the malleus, while the rest ultimately disappears. The ossific mass which is formed around Meckel's cartilage remains quite distinct from the proximal end of that cartilage, or the malleus, gradually acquires the form of the ramus of the lower jaw, and

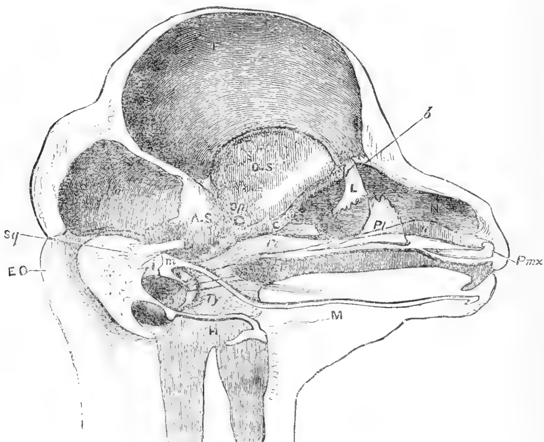


Fig. 3.—Dissection of the cranium and face of a fœtal lamb 2 inches long. The letters have the same signification as elsewhere, except N. Nasal capsules. *a. b. c.* Septum narium. L. Lacrymal. Pl. Palatine. Eu. Arrow indicating the course of the Eustachian tube. *i.* Incus. *m.* Malleus. M. Meckel's cartilage. H. Hyoid. Ps. Petrosal. Ty. Tympanic.

eventually developes a condyle which comes into contact, and articulates, with the squamosal. In the bird, on the contrary, the ramus of the jaw unites with the ossified proximal end of Meckel's cartilage, which becomes anchylosed with the ramus; but retaining its moveable connexion with the quadratum (or representative of the incus), receives the name of the articular piece of the jaw. The rest of Meckel's cartilage disappears.

Thus the primitive composition of the mandibular cartilaginous arch is the same in the bird as in the mammal; in each, the arch becomes subdivided into an incudal and a Meckelian portion; in each, the incudal and the adjacent extremity of the Meckelian cartilage ossify, while the rest of the cartilaginous arch disappears and is replaced by a bony ramus deposited round it. But from this point the mammal and the bird diverge. In the former, the incudal and Meckelian elements are so completely applied to the purposes of the organ of hearing, that they are no longer capable of supporting the ramus, which eventually comes into contact with the squamosal bone. In the latter, they only subserve audition so far as they help to support the tympanic membrane, their predominant function being the support of the jaw.

The tympanic bone of every mammal is, at first, a flat, thin, curved plate of osseous matter, which appears on the outer side of the proximal end of Meckel's cartilage, but is as completely independent of it as is the ramus of the jaw of the rest of that cartilage. In most birds it has no bony representative.

It is clear, then, as Professor Goodsir* has particularly stated, that the os quadratum of the bird is the homologue of the incus of the mammal, and has nothing to do with the tympanic bone; while the apparently missing malleus of the mammal is to be found in the os articulare of the lower jaw of the bird.

It would lead me too far were I to pursue the comparison of the bird's skull with that of the mammal further. But sufficient has been said, I trust, to prove that, so far as the cranium proper is concerned, there is the most wonderful harmony in the structure of the two, not a part existing in the one which is not readily discoverable in the same position, and performing the same essential functions, in the other. I have the more willingly occupied a considerable time in the demonstration of this great fact, because it must be universally admitted that the bones which I have termed petrous, squamosal, mastoid, quadratum, articulare in the bird, are the homologues of particular bones in other oviparous *Vertebrata*, and consequently, if these determinations are correct in the bird, their extension to the other *Ovipara* is a logical necessity. But the determination of these bones throughout the vertebrate series is the keystone of every theory of the skull—it is the point upon which all further reasoning must turn; and therefore it is to them, in considering the skulls of the other *Ovipara*, that I shall more particularly confine myself.

* Reichert, however, had already clearly declared this important homology in his 'Entwickelungsgeschichte des Kopfes,' p. 195.

Composition of the Skull of the Turtle.

It has been seen that in birds the presphenoid, ethmoid, and orbitosphenoid regions are subject to singular irregularities in the mode and extent of their ossification. In the turtle, not only are the parts of the cranium which correspond with these bones unossified, but its walls remain cartilaginous for a still greater extent. In fact, if a vertical section be made through the longitudinal axis of a turtle's skull, it will be observed that a comparatively small extent of the cranial wall, visible from within, is formed by bone, and that the large anterior moiety is entirely cartilaginous and unossified. The anterior part of the posterior, bony, moiety of the cranial wall is formed by a bone (Pt.), whose long, vertical, anterior-inferior margin forms the posterior boundary of the foramen by which the third division of the trigeminal nerve makes its exit from the skull. The anterior and superior margin of the bone is very short, and articulates with the parietal bone. The superior margin is inclined backwards, and articulates with the supraoccipital. The posterior margin is straight, and abuts against a cartilaginous plate interposed between this bone and that which succeeds it. The inner face of the bone is, as it were, cut short and replaced by this cartilage, whence the inferior edge is also short and is connected only with the basisphenoid, and not with the basioccipital. The anterior margin of the bone corresponds with the middle of the mesencephalon, while its inner face presents apertures for the portio dura and portio mollis. The posterior margin of its outer face forms half the circumference of the fenestra ovalis, and it contains the anterior and inferior portions

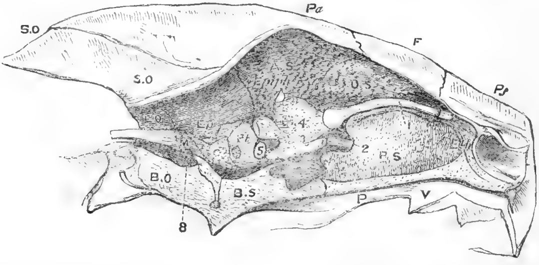


Fig. 4.—Longitudinal section of the Skull of a Turtle (*Chelone mydas*), exhibiting the relations of the brain to the cranial walls. The dotted parts marked AS. OS. PS. and Eth. are cartilaginous.

of the labyrinth. Thus, with the exception of the absence of an inferior connexion with the basioccipital,—a circumstance fully explained by the persistence in a cartilaginous state of part of the bone,—it corresponds in the closest manner with the petrosal of the bird. I confess I cannot comprehend how those who admit the homology of the bone called petrosal in the bird with that called petrosal in the mammal (as all anatomists do), can deny that the bone in question is also the petrosal, and affirm it to be an alisphenoid. The general adoption of such a view would, I do not hesitate to say, throw the Theory of the Skull into a state of hopeless confusion, and render a consistent terminology impossible. Where then is the alisphenoid? I reply, that it is unossified. The posterior portion of the cartilaginous side-wall of the skull, in fact, unites with the parietal, the petrosal, and the basisphenoid, just in the same way as the bony alisphenoid of the bird unites with those bones. Furthermore, as in the bird, it bounds the foramen for the third division of the trigeminal nerve anteriorly, and is specially perforated by the second division of the fifth, while the optic and the other divisions of the fifth pass out in front of or through its anterior margin.

Not only is the alisphenoid cartilaginous, but the orbitosphenoid is in the same condition, and a great vertical plate of cartilage represents the whole anterior part of the craniofacial axis, or the presphenoid and ethmovomerine bones*. It has been imagined, indeed, that the rostrum-like termination of the basisphenoid represents the presphenoid, but I think this comes of studying dry skulls. Those who compare a section of the fresh skull of a turtle with the like section of the skull of a lamb, will hardly fail to admit that the rostrum of the basisphenoid in the turtle is exactly represented by that part of the sheep's basisphenoid which forms the anterior and inferior boundary of the sella turcica, and that the suture between the basisphenoid and the presphenoid in the sheep corresponds precisely with the line of junction between the rostrum of the basisphenoid and the presphenoidal cartilage in the turtle.

Connected with the posterior edge of the petrosal by the cartilaginous plate, which has been referred to above, and between this and the exoccipital, there appears, on the inner aspect of the longitudinal section of the turtle's skull, a narrow plate of bone connected above with the supraoccipital, behind with the exoccipital, below with the basioccipital, and leaving between its posterior margin and the exoccipital an aperture whereby the par vagum leaves the skull. In fact, except in being separated from the petrosal by cartilage, this bone presents all the characters of the mastoid of the bird, which it further resembles in forming one-half of the circumference of the fenestra ovalis. In other respects it is more like the mastoid of the sheep, for it is not anchylosed with the exoccipital; it is produced externally into a great bony apophysis, which gives attachment to the representative of the digastric muscle; and it is largely visible external to the exoccipital, when the skull is viewed from behind. Indeed, the resemblance to the mastoid of the mammal is more striking than that to the corresponding bone in the bird. And I think it is hardly possible for any unprejudiced person to rise from the comparison of the chelonian skull with that of the mammal, with any doubt on his mind as to the homology of the two bones.

When the sheep's skull is viewed from behind, the posterior half

* Compare Kölliker's account of the primordial skull of a young turtle in the 'Bericht von der Königl. Zool. Anstalt zu Würzburg,' 1849.

of the squamosal is seen entering into its outer boundary above the mastoid. On regarding the turtle's skull in the same way, there is seen, occupying the same position, the bone which Cuvier, as I venture to think, most unfortunately, named "mastoid." But if the arguments brought forward above be, as I believe, with Hallmann, they are, irrefragable, this bone cannot be the mastoid; and I can discover no valid reason why it should not be regarded as what its position and relations naturally suggest it to be—the squamosal. Its connexions with the mastoid, petrosal, and quadratum are essentially the same as those of the squamosal in the bird and the mammal. The quadratum and articulare of the turtle are on all hands admitted to be the homologues of the similarly-named bones in the bird, and therefore all the reasonings which applied to the one apply to the other. When the petrosal, mastoid, and squamosal are determined in the turtle, they are determined in all the *Reptilia*. But the *Crocodilia, Lacertilia*, and *Ophidia* differ from the turtle and *Chelonia* generally, in that their mastoid is, as in the bird, anchylosed with the exoccipital. The squamosal, again, which in the *Crocodilia* essentially resembles that of the turtle, becomes a slender and elongated bone in the *Lacertilia*, and still more in the *Ophidia*, in which the quadratum is carried at its extremity *.

With respect to the skull of Fishes, the following extracts contain the most important of the views put forth by Prof. Huxley.

In discussing the structure of the skull of the Carp, Prof. Huxley remarks:—When viewed from within, the foramen ovale is seen to be, as in the bird, a mere conjugational foramen between the alisphenoid and the bone which follows it; and on an external view, the third division of the trigeminal is seen to pass entirely in front of the last-named bone.

The minutest scrutiny of the relations of this bone only strengthens the conviction suggested by the first view of it, that it is the homologue of the petrosal of birds, and therefore of mammals and reptiles. As in the bird, the anterior margin of the fish's petrosal is divided into a superior and an inferior portion, which meet at an angle, the superior portion articulating with the parietal (and squamosal), the inferior with the alisphenoid. Inferiorly the petrosal articulates with the basisphenoid, and, to a small extent, with the basioccipital. Posteriorly it articulates with a bone through which the pneumogastric passes, and which, guided by the analogy of most *Reptilia*, of *Amphibia*, and of birds, I believe to represent the coalesced or connate mastoid and exoccipital. The bone lodges the anterior part of the auditory labyrinth; its middle region corresponds with the middle of the mesencephalon. But as it does not separate the auditory organ from the cavity of the skull, it naturally presents no foramina corresponding with those through which the portio dura and portio mollis pass in Abranchiate *Vertebrata* and *Amphibia*. There is one relation of the petrosal in the

* See for the manner in which this is brought about, Rathke's 'Entwick. d. Natter.' Rathke, it should be said, regards this bone as the *tympanicum*, but its primitive place and mode of origin are those of the squamosal of the mammal.

fish, however, in which it seems to differ from that of any of the oviparous *Vertebrata* hitherto described. Superiorly and posteriorly, in fact, it does not unite with the supraoccipital, which is small, comparatively insignificant, and occupies the middle of the posterior and superior region of the skull, but with a large and distinct bone which forms the internal of the two posterolateral angles of the skull, unites internally with the supraoccipital, anteriorly with the parietal and petrosal, inferiorly with the conjoined mastoid and exoccipital. It is the bone which was called "occipital externe" by Cuvier; and he and others have supposed it to be the homologue of that bone in the turtle which, following Hallmann, I have endeavoured to prove to be the mastoid. As I have already shown, the true mastoid of the fish must be sought elsewhere, and consequently the Cuvierian determination is inadmissible. And I must confess, that if our comparisons be confined to adult *Vertebrata*, the only conclusion which can be arrived at seems to be, that this bone is peculiar to fishes.

But a remarkable and interesting observation of Rathke, combined with the peculiar structure of the skull of the chick described above, leads me to believe that when their development is fully worked out, we shall find a distinct representative of this bone in many, if not all, vertebrate crania.

In his account of the development of *Coluber natrix*, Rathke states that three centres of ossification make their appearance in that part of the cartilaginous wall of the cranium which immediately surrounds the auditory labyrinth. One of these is anterior, and becomes the petrosal; one is posterior, and eventually unites with the exoccipital; the third is superior, and in the end coalesces with the supraoccipital. The posterior ossification clearly represents the mastoid, and it is most interesting to find it, in this early condition, as distinct as in the Chelonian.

The superior ossification has only to increase in size and remain distinct in the same way as the mastoid of the turtle remains distinct, to occupy the precise position of the "occipital externe" of the fish. But, further, it is most important to remark, that when this primarily distinct bone has coalesced with the supraoccipital, it stands in just the same relation to that bone, to the petrosal, to the mastoid and to the semicircular canals, in the snake, as that lateral element, early confluent or connate with the supraoccipital in the chick, which I have termed the "os epioticum." I believe, then, that this "os epioticum," distinct in the young snake, but afterwards confluent with the supraoccipital, and becoming what may be termed the epiotic ala of that bone in the adult, is the homologue of the corresponding bone, or confluent ala of the supraoccipital, in birds and reptiles, while in the fish it remains distinct, and constitutes the "occipital externe."

On examining the region in which these bones (those of the palato-suspensorial apparatus) are eventually found, in an embryonic fish, I discovered, in their place, a delicate inverted cartilaginous arch, attached anteriorly, by a very slender pedicle, to the angles of the ethmoidal cartilage, and posteriorly connected by a much thicker crus with the anterior portion of that part of the cranial wall which encloses the auditory organ (fig. 5).

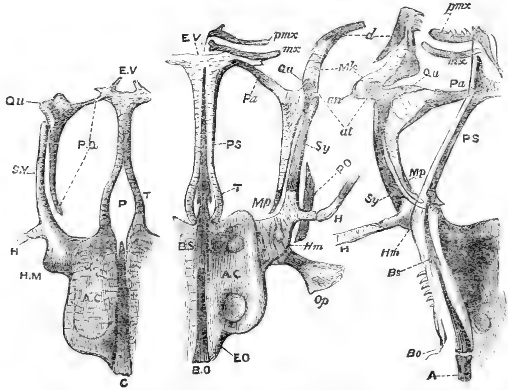


Fig. 5.—Cranium and face of young *Gasterostei* at different ages. The left-hand figure is a view of the base of the skull of a very young fish. The middle figure represents the under aspect, and the right-hand figure, a side view of a longitudinal section, of a more advanced Stickleback's skull.

C. Notochord. P. Pituitary space. AC. Auditory capsules. T. Trabeculæ cranii. E.V. Ethmovomerine cartilage. P.Q. Palatoquadrate arch. Qu. Quadratum. S.Y. or Sy. Symplectic. H. Hyoidean arc. H.M. Hyomandibular cartilage. The other letters have the same signification as in the preceding figures, except *pmx*. Premaxilla. *mx*. Maxilla. *d*. Dentale. *an*. Angulare. *at*. Articulare. M*k*. Meckel's cartilage.

The crown of the inverted arch exhibits an articular condyle for the cartilaginous rudiment of the mandible. The posterior crus is not, as it appears at first, a single continuous mass, but is composed of two perfectly distinct pieces of cartilage applied together by their edges. The anterior of these juxtaposed pieces is continuous below with the condyle-bearing crown of the arch, and with its anterior crus or pedicle (P.Q.); it is inclined backwards and upwards, and terminates close to the base of the skull in a free pointed extremity.

The posterior piece (S.Y. H.M.), on the other hand, has its broad and narrow ends turned in the opposite direction. Distally, or below, it is a slender cylindrical rod terminating in a rounded free extremity behind, but close to, the condyle for the mandible; above, it gradually widens and becomes connected with the cranial walls. On its posterior edge there is a convexity which articulates with the rudimentary operculum, and below this it gives off a short styloid process, to which the cartilaginous cornu of the hyoid is articulated. Thus the cartilaginous arch, which stretches from the auditory capsule to the ethmo-presphenoidal cartilage, consists, in reality, of two perfectly distinct and separate portions—the anterior division V-shaped, having its anterior crus fixed and its posterior crus free above; the posterior, styliform, parallel with the posterior leg of the V, and free below. The anterior division supports the mandibular cartilage, the posterior the hyoidean cornu.

As ossification takes place, that part of the anterior crus of the V-shaped cartilage which is attached to the ethmo-presphenoidal cartilage becomes the *palatine*; its angle becomes the *jugal*; between these two the *transverse* and *pterygoidien* (represented by only one bone in *Gasterosteus*) are developed in and around the anterior crus: the *tympanal* arises in the same way around the free end of the posterior crus. Thus these bones constitute an assemblage which is at first quite distinct from the other elements of the suspensorium, and immediately supports the mandibular cartilage.

The proximal end (H.M.) of the posterior styliform division gradually becomes articulated with the cranial walls, and, ossifying, is converted into the *temporal*. The distal cylindrical end (S.Y.) becomes surrounded by an osseous sheath, which at first leaves its distal end unenclosed. The bone thus formed is the *symplectique*, which is at first free, but eventually becomes enclosed within a sheath furnished to it by the *jugal*, and so strengthens the union of the two divisions of the arch already established by the junction of the *tympanal* with the *temporal*. The *symplectique* and *temporal* do not meet, but leave between them a cartilaginous space, whence the supporting pedicle of the hyoid, which ossifies and becomes the *osselet styloide*, arises.

The operculum, suboperculum, interoperculum, and preoperculum are not developed from the primitive cartilaginous arch, but make their appearance as osseous deposits in the branchiostegal membrane, behind, and on the outer side of, the posterior crus.

If we turn to the higher *Vertebrata*, we find, as I have stated above, that, at an early period of their embryonic existence, they also present a cartilaginous arch, stretching from the ethmo-presphenoidal cartilage to the auditory capsule, and supporting the mandibular or Meckelian cartilage on the condyle furnished by its inverted crown. The anterior part of the anterior crus of this arch becomes the palatine bone, which is therefore truly the homologue of the fish's *palatine*. The posterior part of it becomes the pterygoid, which therefore is the homologue of the *pterygoidien* (and *transverse*?) of the fish.

The produced crown of the arch in the higher *Vertebrata* becomes either the incus, or its equivalent, the quadratum. I therefore entertain no doubt that the *jugal* is really the homologue of the quadratum of other oviparous *Vertebrata*. That the *tympanal* has no relation whatsoever with the bone of the same name in the higher *Vertebrata* is indubitable; and I am unable to discover among them any representative of it. It seems to me to be an essentially piscine bone, to be regarded either as a dismemberment of the quadratum or of the pterygoid. It may be termed the "metapterygoid."

Still less do I find among the higher *Vertebrata* in their adult state, any representative of the posterior division of the suspensor, constituted by the *temporal* and *symplectique*. It is quite clear that the *temporal* is not, as Cuvier's name would indicate, the homologue of the squamosal. The whole course of its development would negative such an idea, even if we had not a squamosal already; and I shall therefore henceforward term it, from its function of affording support to both the hyoid and mandibular arches, the hyomandibular bone, "os hyomandibulare," while the other bone of this division may well retain the name of symplectic.

It is commonly supposed that the hyomandibular, symplectic, metapterygoid, and quadrate are all to be regarded as mere subdivisions of the quadratum of the higher *Vertebrata*. Such a view, however, completely ignores, and fails to explain, the connexion of the hyoidean arch with the hyomandibular bone. In no one of the higher *Vertebrata* does such a connexion ever obtain between any part of the quadratum and the hyoid, which are quite distinct, and attached separately to the walls of the cranium, in even young embryos of the abranchiate *Vertebrata*.

If the pterygoid, transverse, and metapterygoid of the fish were anchylosed into one bone, or if the corresponding region of the primitive cartilage were continuously ossified, the result would be a bone perfectly similar to the pterygoid of the frog; and I entertain no doubt that the amphibian pterygoid does really represent these bones.

The inferior ossification in the batrachian suspensorium certainly answers to the quadratum, in *Triton*—whether it should be regarded partly or wholly as a quadrato-jugale in the frog seems to be a question of no great moment—inasmuch as we may be quite sure that the lower end of the frog's suspensorium represents the quadrate or incudal element in other *Vertebrata*.

Thus it would seem, that in the manner in which the lower jaw is connected with the cranium, *Pisces* and *Amphibia*, as in so many other particulars, agree with one another, and differ from *Reptilia* and *Aves* on the one hand as much as they do from *Mammalia* on the other. And the difference consists mainly, as might be anticipated, in the large development in the branchiate *Vertebrata* of a structure which aborts in the abranchiate classes. A most interesting series of modifications, all tending to approximate the ramus of the mandible more closely to the skull *, is observable as we pass from the fish to the mammal. In the first, the two are separated by the hyomandibular, the quadrate, and the articular elements, the first of which becomes shortened in the *Amphibia*. In the oviparous abranchiate *Vertebrata* the cranium and the ramus are separated only by the quadratum and the articulare, the hyomandibulare having disappeared. Finally, in the mammal, the quadratum and the articulare are applied to new functions, and the ramus comes into direct contact with the cranium.

The operculum, suboperculum, and interoperculum appear to me to be specially piscine structures, having no unquestionable representatives in the higher *Vertebrata*. Much might be said in favour

* Of course in a morphological sense. Whether they are more or less distant in actual space, is not the question.

of the identification of the preoperculum with the tympanic bone; but there are many arguments on the other side, and at present I do not see my way to the formation of a definite conclusion on this subject.

If the conclusions which I have brought forward are correct, the following propositions are true of all the bony skulls of *Vertebrata*.

1. Their axis contains at most five distinct bones, which are, from before backwards, the basioccipital, the basisphenoid, the presphenoid, the ethmoid, and the vomer; but any of these bones, except the basisphenoid, may be represented by cartilage, and they may anchylose to an indefinite extent; so that the number distinguishable as separate bones in any skull cannot be predicated. The craniofacial axis invariably presents the same regions, but the histological character of these regions may vary.

2. Their roof contains at most, leaving Wormian bones out of consideration, five bones (supraoccipital, parietals and frontals), or seven, if we include the epiotic bones in the roof. The number falls below this in particular cases, for the same reason as that given for the apparent variations in composition of the axis.

3. Their inferolateral wall contains at most six pairs of bones (exoccipitals, mastoids, petrosals, alisphenoids, orbitosphenoids, prefrontals), whose apparent number, however, is affected by the same causes.

4. The axial bones have definite relations to the brain and nerves. The basioccipital lies behind the pituitary body, the basisphenoid beneath it, the presphenoid in front of it. In fact the pituitary body may be regarded as marking the organic centre, as it were, of the skull—its relations to the axial cranial bones being the same, as far as I am aware, in all *Vertebrata*.

The olfactory nerves pass on either side of the ethmoid, which bounds the cranial cavity in front, the greater part of its substance and that of the vomer being outside the cranial cavity.

5. The lateral bones have definite relations to the brain, nerves, and organs of sense. The exoccipital lies behind the exit of the par vagum; the mastoid lies in front of it; the petrosal lies behind the exit of the third division of the trigeminal; the alisphenoid lies in front of it; though either bone may, to a certain slight extent, encroach on the province of the other. The optic nerve passes out more or less in front of the alisphenoid, and behind, or through, the orbitosphenoid.

The organ of hearing is always bounded in front by the petrosal bone, which limits the anterior moiety of the fenestra ovalis.

The organs of smell always lie on each side of the ethmovomerine part of the axis.

The greater part, or the whole, of the petrosal lies behind the centre of the mesencephalon.

6. The attachment of the mandibular arch to the skull is never situated further forward than the posterior boundary of the exit of the trigeminal; consequently it cannot belong to any segment of the skull in front of the petrosal.

But if propositions of this generality can be enunciated with regard to all bony vertebrate skulls, it is needless to seek for further evidence of their unity of plan. These propositions are the expression of that plan, and might, if one so pleased, be thrown into a diagrammatic form. There is no harm in calling such a convenient diagram the 'Archetype' of the skull, but I prefer to avoid a word whose connotation is so fundamentally opposed to the spirit of modern science.

Thus, I conceive, the study of the mode in which the skulls of vertebrate animals are developed, demonstrates the great truth which is foreshadowed by a careful and comprehensive examination of the gradations of form which they present in their adult state; namely, that they are all constructed upon one plan; that they differ, indeed, in the extent to which this plan is modified, but that all these modifications are foreshadowed in the series of conditions through which the skull of any one of the higher *Vertebrata* passes.

But if these conclusions be correct, the first problem which I proposed—Are all vertebrate skulls constructed upon a common plan? —is solved affirmatively.

We have thus attained to a theory or general expression of the laws of structure of the skull. All vertebrate skulls are originally alike; in all (save *Amphioxus*?) the base of the primitive cranium undergoes the mesocephalic flexure, behind which the notochord terminates, while immediately in front of it, the pituitary body is developed; in all, the cartilaginous cranium has primarily the same structure,—a basal plate enveloping the end of the notochord and sending forth three processes, of which one is short and median, while the other two, the lateral trabeculæ, pass on each side of the space, on which the pituitary body rests, and unite in front of it; in all, the mandibular arch is primarily attached behind the level of the pituitary space, and the auditory capsules are enveloped by a cartilaginous mass, continuous with the basal plate between them. The amount of further development to which the primary skull may attain varies, and no distinct ossifications at all may take place in it; but when such ossification does occur, the same bones are developed in similar relations to the primitive cartilaginous skull. But the theory of the skull thus enunciated is not a 'vertebral theory'; one may have a perfectly clear notion of the unity of organization of all skulls without thinking of vertebræ.

So much for the first problem before us. I now proceed to the second question, Given the existence of a common plan of organization of all vertebrate skulls; is this plan the same as that of a spinal column?

To deal properly with this question, we must know what is the plan of organization of a spinal column; and that can be learnt only by a careful study of its development, as well as of its adult modifications. Indeed, the latter are unintelligible without a knowledge of the former.

It is impossible to form a clear conception of the essential nature of the process of development of a spinal column, or to compare it with that of the skull, unless we analyse very carefully, and distinguish from one another, the successive steps of that process.

1. The primary changes of form exhibited by the blastoderm in the region of the spinal column, are, in all the *Vertebrata* whose development has yet been studied, precisely the same. Two ridges, the "laminæ dorsales," bounding a narrow elongated groove, rise up and eventually unite with one another so as to enclose a cavity—the neural canal. External to the junction of the laminæ dorsales with the blastoderm, the latter is converted more or less completely into the "laminæ ventrales," which become incurved, unite, and eventually enclose the visceral cavity.

A transverse section of the embryo in this state shows a very thin and narrow median plate, separating the neural canal above from the hæmal or visceral canal below, and passing on each side into thickened masses of blastoderm, which give rise to the laminæ dorsales on the one hand, and to the laminæ ventrales on the other.

For convenience of description, I shall term the median plate the "diaphysial plate," and the lateral ridges the "paraphysial thickenings."

2. The primary histological differentiations which take place in the rudimentary spinal column just described, are the same in all *Vertebrata*.

A long filament, composed of indifferent tissue, makes its appearance in the middle of the diaphysial plate, and constitutes the notochord, or chorda dorsalis.

Next, the substance of the paraphysial thickenings undergoes a certain change of tissue at regular intervals, so that they acquire a segmented appearance; solid, broad, darker masses of blastema lying opposite one another in each paraphysial thickening, and being separated by clear, narrow interspaces.

These segments are what the Germans term "Urwirbel," or "primitive vertebræ;" a somewhat misleading name, as they are in every way distinct from what are commonly understood under the name of "vertebræ," even if we use that word in its broadest signification. Professor Goodsir's terms of *Somatomes* for the segments and *Metasomatomes* for their interspaces, appear to me to be well worthy of adoption as the equivalents of these "Urwirbel."

3. The next step in the development of a vertebral column is the histological differentiation of the somatomes. Leaving out of consideration the epithelial and other minor tissues, it may be said that each somatome gives rise to (*a*) epiaxial muscles, (*b*) a nerve and its ganglion, (*c*) the blastema for a vertebral centrum and its neural and hæmal arches, and (*d*) possibly hypaxial muscles; while the metasomatome becomes for the greater part of its extent an "intermuscular septum."

It is unnecessary for my present purpose to trace out particularly the development of any of these parts, except the centrum and its arches.

The blastema, which is specially intended for these parts, appears, in a distinct form, first, in the paraphysial thickenings, and then extends inwards above and below, so as gradually to enclose the notochord in a sheath, while, externally, it passes in the posterior half of each somatome, upwards into the neural arches, and downwards into the hæmal arches.

4. In some *Vertebrata* the spinal column never gets beyond this stage, nor even so far; but for the present it will be well to confine our attention to those which become completely ossified. In these chondrification is the next step. The blastema of the centra and its prolongations becomes converted into cartilage, but not continuously. On the contrary, at points corresponding with the intervals between every pair of metasomatomes, or with the middle of each somatome, the cartilage is replaced by more or less fibrous tissue. As a consequence, the cartilaginous sheath of the notochord is now divided into regular segments, which alternate with the somatomes, so that each metasomatome abuts upon the middle of one of these cartilaginous vertebral centra.

In every centrum it is necessary to distinguish three tracts or regions:—1. A diaphysial region immediately surrounding the notochord. 2. Two paraphysial regions lying in the paraphysial thickenings. The paraphysial regions give rise to the cartilaginous neural and hæmal semi-arcs, which are primitively continuous with them; so that all parts of the vertebra form one connected whole.

The neural semi-arcs eventually unite in the middle line, and ordinarily send a prolongation upwards from their junction. The hæmal semi-arcs also tend to unite below, but in a somewhat different manner.

5. The last step in the development of the vertebra is the differentiation of its various parts from one another, and their final metamorphosis into their adult form. The notochord, which primitively traversed the centra and the intercentra (intervertebral ligaments, synovial membranes, or the like, between the centra), becomes more or less completely obliterated.

The distal, larger part of the hæmal semi-arc is commonly distinguished from its proximal, smaller part by the conversion of its cartilage into osseous or other tissue, and thus the semi-arc becomes separated into a rib and an articular surface or process, for the head of that rib, to which last the term *Parapophysis* may be conveniently restricted.

In the dorsal vertebræ of many *Vertebrata*, the neural semi-arc sends out a process, the *Diapophysis*, which is eventually met by a corresponding outgrowth of the rib, its so-called tubercle, and the two become firmly connected together.

When ossification occurs, it is a very general, if not invariable rule, that an annular deposit around the notochord takes place in the centrum. I term this the *Diaphysis* of the vertebra. In some fishes a distinct centre of ossification appears in each paraphysial region, and this may be termed the *Paraphysis* of the vertebra.

In mammals each end of the vertebra ossifies from a distinct point, and constitutes a central *Epiphysis* of the vertebra; and in many *Vertebrata* a part of the under surface of a centrum ossifies separately as a distinct *Hypophysis*. It is another very general, if not invariable rule, that a distinct centre of ossification appears in, or on, each neural semi-arc or *Neurapophysis*, and passes upwards, into the spine or *Metaneurapophysis*; downwards, to unite sooner or later with the diaphysis, or diaphysis and paraphysis; and outwards into the diapophysis.

It is doubtful whether the paraphysis appears as a distinct osseous element in any *Vertebrata* above the class of fishes, in very few of which even is it distinguishable in the adult state. Consequently in the higher *Vertebrata* the paraphysial region is ossified, either from the diaphysis or from the neurapophysis, or from both; and a suture exists for a longer or shorter time at the point of junction of the neural and central ossifications. I will term this the *Neurocentral suture*. Its position is no certain or constant indication of the nature of the parts above or below it, for it may vary in the same vertebral column from the base of the neurapophysis to the junction of the paraphysial with the diaphysial region of the centrum.

The number of the centres of ossification in each distal portion of the hæmal semi-arc may vary greatly; the uppermost is called a *Pleurapophysis*, the lower, *Hæmapophyses* and *Met-hæmapophyses*.

Besides these primary centres of ossification of a vertebra, there are others of less constancy. Thus the ends of the metaneurapophyses, diapophyses, and zygapophyses in many *Mammalia* are ossified from distinct centres; and in the caudal region of many of the higher *Vertebrata*, outgrowths of the centra unite below to enclose the caudal vessels, and ossify as distinct apophyses.

If the development of the skull be now compared with that of the spinal column, it is found that (1) the very earliest changes undergone by the blastoderm in each are almost identical. The primitive groove extends to the extremity of the future cranial cavity; its lateral walls are continuous with the laminæ dorsales, and these pass into laminæ ventrales, also continuous with those of the spinal region. The laminæ dorsales of the head become the cranial walls and enclose the cerebrum—the continuation of the myelon; the laminæ ventrales give rise to the boundaries of the future buccal and pharyngeal cavities.

2. But at this point the identity of the skull with the spinal column ceases, and the very earliest steps in histological differentiation exhibit the fundamental differences between the two. For, in the first place, in no instance save the *Amphioxus*, has the notochord as yet been traced through the whole of the floor of the cranial cavity. In no other embryo has it been yet seen to extend beyond the middle vesicle of the cerebrum, or in other words, beyond the level of the rudiment of the infundibulum and pituitary body.

In the second place, the division into somatomes, in all known vertebrate embryos, stops short at the posterior boundary of the skull, and no trace of such segmentation has yet been observed in the head itself.

3. Apparently as a consequence of these fundamental differences, the further course of the development of the skull is in many respects very different from that of a vertebral column. Chondri-

fication takes place continuously on each side of the notochord, and beyond it, the two trabeculæ cranii, unlike anything in the spinal column, extend along the base of the cranium. No distinct cartilaginous centra, and consequently no intercentra, are ever developed. The occipital arch is developed in a manner remotely similar to that in which the neurapophysial processes are formed; but the walls of the auditory capsules, which lie in front of them, and which give rise to some of the parts, most confidently regarded as neurapophyses by the advocates of the current vertebral theories of the skull, are utterly unlike neurapophyses in their origin.

So, if we seek for hæmal semi-arcs, we find something very like them, arising from the substance of the basis cranii beneath the auditory cartilage; but there is none connected with the occipital cartilage, and none with the rudiment of the alisphenoid. The palatopterygoid cartilage might be regarded as the hæmal semi-arc of the presphenoidal region, though the grounds for so doing are not very strong; but the premaxillary cartilage is something quite without parallel in the spinal column.

4. The mode of ossification of the skull, and the ultimate arrangement of its distinct bony elements, are at once curiously like, and singularly unlike, those presented by the spinal column. The basioccipital is ossified precisely after the manner of a vertebral centrum. Bony matter is deposited around the notochord, and gradually extends through the substance of the cartilaginous rudiment of the part.

The combined basi- and pre-sphenoid in *Pisces* and *Amphibia* is an ossific deposit, which takes place on the under surface of the basal cartilage in front of the basioccipital, and extends thence completely beneath the pituitary interspace as far as the ethmoid. It might be paralleled by the subchordal ossification in the coccyx of the frog, or by the cortical ossification of the atlas in many higher *Vertebrata*, if it really underlay a portion of the notochord; but at the very utmost the notochord only extends into its posterior extremity.

In some of the higher *Vertebrata*, as the snake, the osseous basisphenoid arises in the substance of its cartilaginous rudiment, while the osseous presphenoid underlies its cartilage. In others, both bones appear to arise directly in their cartilaginous forerunners. But nothing can be more irregular than the mode of ossification of the presphenoid, ethmoid and vomer in the vertebrate series, or less like the very constant and regular course of ossification of true vertebral centra.

With respect to the ossification of the lateral and superior constituents of the skull, the development of the exoccipital and supraoccipital does, without doubt, present a very close analogy to that of the separate pieces of the neural arch of some vertebræ in, *e.g.*, a crocodile. The alisphenoids and orbitosphenoids follow in the train of the exoccipitals; but I know not where in the spinal column we are to find a parallel for the double parietals and frontals. But waiving this difficulty, and supposing, for the sake of argument, as was supposed by Oken, that the basisphenoid, alisphenoid, and parietals, the presphenoid, orbitosphenoids, and frontals represent the elements of two vertebral centra and neural arches, what is to be made of the petrous and mastoid bones?

The difficulty has been eluded by terming the petrosal a "sense-capsule," the mastoid a "parapophysis." But I apprehend that neither of these explanations can be received for a moment by those who are acquainted with the development of the skull, or with the true homologues of the bones in question in the vertebrate series, or who think that scientific terms should always possess a well-defined and single meaning.

What, in fact, is the origin of the petrous and mastoid bones? There is much reason for believing (according to Remak's late observations) that the membranous labyrinth is primarily an involution of the sensory or epidermic layer of the blastoderm; but however this may be, it is quite certain that the auditory organ is, primarily, altogether independent of the walls of the skull, and that it may be detached without causing any lesion of them, in young embryos.

It is also quite certain that this membranous labyrinth becomes invested by a coat of cartilage continuous with the cranial wall; but I do not know that there is evidence, at present, to enable one to say positively, whether this cartilaginous auditory capsule is formed independently around the labyrinth, and then unites with the cranium, or whether it is an outgrowth from the cranial walls, which invests and encloses the labyrinth. If the latter be the case, a consistent vertebral theory of the skull must account for all the bones developed out of the auditory capsule; if the former, it must exclude them all, as parts of an extra-vertebral sensory skeleton.

Now the bones developed in the capsule are, in front, the petrosal; behind, the mastoid; above, the epiotic. The first-named bone is admitted, by the most zealous advocates of the vertebral theory, to be a neurapophysis, in all oviparous *Vertebrata*. Hence they are also bound to admit that, for three centra below and three neural spines bounding the cranial cavity above, there are four pairs of neural arches. More than this, I do not see how it is to be denied that the true mastoid is the morphological equivalent of the petrosal; and in that case there would be five neurapophyses to three centra and three neural spines. Furthermore, it is precisely to these two superfluous elements that the only two clear and obvious hæmal arches, the mandibular and hyoid, are attached.

I confess I do not perceive how it is possible, fairly and consistently, to reconcile these facts with any existing theory of the vertebrate composition of the skull, except by drawing *ad libitum* upon the *Deus ex machinâ* of the speculator,—imaginary "confluences," "connations," "irrelative repetitions," and shiftings of position—by whose skilful application it would not be difficult to devise half a dozen very pretty vertebral theories, all equally true, in the course of a summer's day.

Those who, like myself, are unable to see the propriety and advantage of introducing into science any ideal conception which is other than the simplest possible generalized expression of observed facts, and who view with extreme aversion any attempt to introduce the phraseology and mode of thought of an obsolete and scholastic realism into biology, will, I think, agree with me, not only in the negative conclusion, that the doctrine of the vertebral composition of the skull is not proven, but in the positive belief, that the relation of the skull to the spinal column is quite different from that of one part of the vertebral column to another.

The fallacy involved in the vertebral theory of the skull is like that which, before Von Bär, infested our notions of the relations between fishes and mammals. The mammal was imagined to be a modified fish, whereas, in truth, fish and mammal start from a common point, and each follows its own road thence. So I conceive what the facts teach us is this:—the spinal column and the skull start from the same primitive condition—a common central plate with its laminæ dorsales and ventrales—whence they immediately begin to diverge.

The spinal column in all cases becomes segmented into its somatomes; and, in the great majority of cases, distinct centra and intercentra are developed, enclosing the notochord more or less completely.

The cranium never becomes segmented into somatomes; distinct centra and intercentra, like those of the spinal column, are never developed in it. Much of the basis cranii lies beyond the notochord.

In the process of ossification there is a certain analogy between the spinal column and the cranium, but that analogy becomes weaker and weaker as we proceed towards the anterior end of the skull.

Thus it may be right to say that there is a primitive identity of structure between the spinal or vertebral column and the skull; but it is no more true that the adult skull is a modified vertebral column, than it would be to affirm that the vertebral column is a modified skull*.

While firmly entertaining this belief, however, I by no means wish to deny the interest and importance of inquiries into the analogies which obtain between the segments which enter into the composition of the ossified cranium, and the vertebræ of an ossified spinal column. But all such inquiries must start with the recognition of the fundamental truths furnished by the study of development, which, as our knowledge at present stands, appear to me to be summed up in the following propositions:—

1. The notochord of the vertebrate embryo ends in that region of the basis cranii which ultimately lies behind the centre of the basisphenoid bone.

2. The basis cranii is never segmented.

3. The lamina perpendicularis of the ethmoid has the same morphological value as the presphenoid.

4. The petrosal has the same morphological value as the mastoid; if one is not an integral part of the skull, neither is the other.

5. The nasal bones are not neurapophyses.

6. The branchial arches have the same morphological value as the hyoid, and the latter as the mandibular arc.

* I feel sure that I met with this phrase somewhere, but I cannot recollect its author.

7. The mandibular arc is primitively attached behind the point of exit from the skull, of the third division of the fifth nerve.

8. The premaxilla is originally totally distinct from the palato-maxillary arcade.

9. The pectoral arch is originally totally distinct from the skull.

Starting on this basis, it might not be difficult to show that the perfectly ossified skull is divisible into a series of segments, whose *analogy* with vertebræ is closer the nearer they lie to the occipital region; but the relation is an analogy and not an affinity, and these cephalic sclerotomes are not vertebræ.

GEOLOGICAL SOCIETY.

March 9, 1859.—Sir C. Lyell, V.P., in the Chair.

"On the Vegetable Structures in Coal." By J. W. Dawson, LL.D., F.G.S., Principal of M'Gill College, Montreal.

After referring to the labours of others in the elucidation of the history of coal, the author remarks that in ordinary bituminous coal we recognize by the unaided eye laminæ of a compact and more or less lustrous appearance, separated by uneven films and layers of fibrous anthracite or mineral charcoal. As these two kinds of material differ to some extent in origin and state of preservation, and in the methods of study applicable to them, he proceeds to treat of his subject under two heads:—1st. The structures preserved in the state of mineral charcoal. This substance consists of fragments of prosenchymatous and vasiform tissues in a carbonized state, somewhat flattened by pressure, and more or less impregnated with bituminous and mineral matters derived from the surrounding mass. It has resulted from the *subaërial* decay of vegetable matter; whilst the compact coal is the product of *subaqueous* putrefaction, modified by heat and exposure to air. The author proceeded (after describing the methods used by him in examining mineral charcoal and coal) to describe the tissues of Cryptogamous plants in the state of mineral charcoal. Among these he mentions *Lepidodendron* and *Ulodendron,* also disintegrated vascular bundles from the petioles of Ferns, the veins of Stigmarian leaves, and from some roots or stipes. He then describes tissues of Gymnospermous plants in the state of mineral charcoal; especially wood with discigerous fibres and also with scalariform tissue, such as that of *Stigmaria* and *Calamodendron*; and the author remarks that probably the so-called cycadeous tissue hitherto met with in the coal has belonged to *Sigillariæ*.

The next chief heading of the paper has reference to structures preserved in the layers of compact coal, which constitutes a far larger proportion of the mass than the mineral charcoal does. The laminæ of pitch- or cherry-coal, says Dr. Dawson, when carefully traced over the surfaces of accumulation, are found to present the outline of flattened trunks. This is also true to a certain extent of the finer varieties of slate-coal; but the coarse coal appears to consist of extensive laminæ of disintegrated vegetable matter mixed with mud. When the coal (especially the more shaly varieties) is held obliquely under a strong light, in the manner recommended by Goeppert, the surfaces of the laminæ of coal present the forms of many well-known coal-plants, as *Sigillaria, Stigmaria, Poacites* (or *Nœggerathia*), *Lepidodendron, Ulodendron*, and rough bark, perhaps of Conifers. When the coal is traced upward into the roof-shales, we often find the laminæ of compact coal represented by flattened coaly trunks and leaves, now rendered distinct by being separated by clay.

The relation of erect trees to the mass of the coal, and the state of preservation in which the wood and bark of these trees occur,—the microscopic appearances of coal,—the abundance of cortical tissue in the coal, associated with remains of herbaceous plants, leaves, &c., are next treated of.

The author offers the following general conclusions:—

(1) With respect to the plants which have contributed the vegetable matter of the coal, these are principally the *Sigillariæ* and *Calamiteæ*, but especially the former.

(2) The woody matter of the axes of *Sigillariæ* and *Calamiteæ* and of coniferous trunks, as well as the scalariform tissues of the axes of the *Lepidodendreæ* and *Ulodendreæ*, and the woody and vascular bundles of Ferns, appear principally in the state of mineral charcoal. The outer cortical envelope of these plants, together with such portions of their wood and of herbaceous plants and foliage as were submerged without subaërial decay, occur as compact coal of various degrees of purity, the cortical matter, owing to its greater resistance to aqueous infiltration, affording the purest coal. The relative amounts of all these substances found in the states of mineral charcoal and compact coal depend principally upon the greater or less prevalence of subaërial decay occasioned by greater or less dryness of the swampy flats on which the coal accumulated.

(3) The structure of the coal accords with the view that its materials were accumulated by growth without any driftage of materials. The *Sigillariæ* and *Calamiteæ*, tall and branchless, and clothed only with rigid linear leaves, formed dense groves and jungles, in which the stumps and fallen trunks of dead trees became resolved by decay into shells of bark and loose fragments of rotten wood, which currents must have swept away, but which the most gentle inundations, or even heavy rains, could scatter in layers over the surface, where they gradually became imbedded in a mass of roots, fallen leaves, and herbaceous plants.

(4) The rate of accumulation of coal was very slow. The climate of the period, in the northern temperate zone, was of such a character that the true conifers show rings of growth not larger, or much less distinct, than those of many of their northern congeners*. The *Sigillariæ* and *Calamites* were not, as often supposed, succulent plants. The former had, it is true, a very thick cellular inner bark; but their dense woody axes, their thick and nearly imperishable outer bark, their scanty and rigid foliage would indicate no very rapid growth. In the case of *Sigillariæ*, the variations in the leaf-scars in different parts of the trunk, the intercalation of new ridges at the

* Paper on Fossils from Nova Scotia, Proc. Geol. Soc. 1847.

surface representing that of new woody wedges in the axis, the transverse marks left by the successive stages of upward growth, all indicate that at least several years must have been required for the growth of stems of moderate size. The enormous roots of these trees, and the conditions of the coal-swamps, must have exempted them from the danger of being overthrown by violence. They probably fell, in successive generations, from natural decay; and, making every allowance for other materials, we may safely assert that every foot of thickness of pure bituminous coal implies the quiet growth and fall of at least fifty generations of *Sigillariæ*, and therefore an undisturbed condition of forest-growth enduring through many centuries. Further, there is evidence that an immense amount of loose parenchymatous tissue, and even of wood, perished by decay; and we do not know to what extent even the most durable tissues may have disappeared in this way; so that in many coal-seams we may have only a very small part of the vegetable matter produced.

Lastly. The results stated in this paper refer to coal-beds of the middle coal-measures. A few facts which I have observed lead me to believe that in the thin seams of the lower coal-measures remains of *Nœggerathia* and *Lepidodendron* are more abundant than in those of the middle coal-measures*. In the upper coal-measures similar modifications may be expected. These differences have been to a certain extent ascertained by Goeppert for some of the coal-beds of Silesia, and by Lesquereux for those of Ohio; but the subject is deserving of further investigation, more especially by the means proposed in this paper, and which I hope, should time and opportunity permit, to apply to the seventy-six successive coal-beds of the South Joggins.

ZOOLOGICAL SOCIETY.

July 27, 1858.—Dr. Gray, F.R.S., V.P., in the Chair.

Description of Riama, a New Genus of Lizards, forming a distinct Family. By Dr. John Edward Gray, F.R.S., F.L.S., V.P.Z.S., Pres. Ent. Soc. etc.

Mr. Louis Fraser has lately sent to the British Museum a considerable series of Lizards, Snakes, and Toads and Frogs from Guayaquil, in spirits. Among other interesting species is an annulated Lizard, which, as it cannot be referred to any of the existing families, and has a very peculiar external appearance, must at the same time be considered as the type of a new genus and new family.

This Lizard belongs to the section of *Cyclosauræ*, which have a distinct longitudinal fold along each side like the *Zonuridæ*; but it differs from the animal of that family in all the scales of the body and tail being elongate, four-sided, placed in transverse rings and regular longitudinal series, like the scales of the *Amphisbænidæ*, while

* I may refer to my late paper on Devonian Plants from Canada for an example of a still older coal made up principally of remains of Lycopodiaceous plants of the genus *Psilophyton*.

the scales of the back and tail of the *Zonuridæ* are all rhombic and more or less distinctly keeled. It differs from the *Amphisbænidæ* in having an elongated head, four distinct moderately strong limbs (each furnished with five toes armed with claws), and broad square shields on the central part of the belly and tail.

It differs from the genera of the *Chalcidæ* in the position of the nostril (which in the genera of this family is large and placed in the suture between the lower edge of the nasal and the upper edge of the labial shield), and in the presence of exposed ears, which in that family are entirely hidden under the skin.

These animals have the general form of the Lizards—their elongated head furnished with regular shields, well developed eyes covered with eyelids, well developed legs and feet, and a bifid tongue with acute lobes, combined with small regular square or rather elongated four-sided scales forming rings round the body. The scales of the different rings are arranged in regular longitudinal series, smooth, impressed, not imbricate one over the other, but like those of *Amphisbæna*: indeed on looking at its back it might be almost taken for an *Amphisbæna* furnished with short legs; but, unlike those animals, the scales of the middle of the belly and the middle of the under side of the body are of the same length, but twice as wide, as the other scales, forming equal-sided square shields like those of the true *Lacertidæ.*

Their general appearance would lead one to the idea that they may form a group intermediate between the *Amphisbæna* and the *Zonuriform Lizards,* but evidently more nearly allied to the latter.

Family Riamidæ.

The characters of the genus.

Genus Riama.

Head elongate, with regular shields; labial shield short, broad. Chin and gullet with large shields. Tongue scaly; apex bifid; lobes acute. Nostrils lateral, in the front part of a single plate. Eyes distinct, furnished with eyelids. Ears sunken, covered with small scales. Throat with several distinct collars, the hinder largest. Body and tail elongate, cylindrical; sides with a narrow impressed groove extending from the axilla to the groin. The scales of the back, sides of the belly, and upper part and sides of the tail, square, elongate, four-sided, narrow, placed in equal-sized regular transverse rings and longitudinal series; of the middle of the belly and under side of the tail broader (about twice as broad as the others), square. Legs four, short, moderately strong. Toes 5 · 5: the front short, subequal, claws short, blunt; the hind ones unequal; the inner very short, rudimentary; the outer elongate, placed lower on the foot than the rest, claws longer, acute. Femoral pores few, distinct. Tail elongate, cylindrical, rather fusiform, tapering to a fine point. Vent with two arched series of squarish shields in front.

The rings of dorsal scales are rather interrupted over the vertebral line: on the nape between the shoulders and on the front part of the back there is a line, or two or three series, of small scales; but these gradually become fewer and fewer, and in the hinder part of the back the rings of scales are only interrupted by a very narrow sinuous impressed line, which terminates over the loins. I am not certain whether this interruption of the rings is a character common to the genus, or a peculiarity of the individual under examination; it is not to be observed on the upper surface of the tail. A very narrow, indistinct, impressed line is generally to be observed in the same situation in the genus *Chirotes*, and in some specimens of *Amphisbæna*.

The fronts of the fore legs and thighs are furnished with large flat shields; the rest of the legs, groin, and axillæ are covered with small granular scales. The head has three single shields, the second and third being separated by a frontal pair, placed between the hinder parts of the last of the three pairs of superciliaries; the sides of the head are covered with three pairs of large polygonal shields; the temples with small polygonal shields.

Riama unicolor.

Uniform lead-coloured in spirits. Tail longer than the body and head, tapering to a fine point.

Hab. Ecuador (*Mr. Louis Fraser*).

Length: body and head $2\frac{1}{2}$, tail $3\frac{1}{4}$ inches.

It may be observed, that though the genera of the family *Chalcidæ* all agree in the form and situation of the nostrils between the nasal and labial shields, and in the absence of the external ear, they present two very distinct forms of scaling, forming at least two tribes. Thus:—

1. The scales elongate, subquadrate, pointed behind; the scales in the rings alternating with each other, the points of the scales of one ring being opposite to the suture between the scales in the next ring.—*Brachypodina*: *Brachypus*.

2. The scales elongate, subquadrate, truncated at the end; the scales of the different rings opposite each other, forming longitudinal as well as transverse lines. The ventral and subcaudal shields broader than the rest.—*Chalcidina*: *Chalcis*—the first having the shield like *Chirocolidæ* and *Anadiadæ*, and the second like *Cercosauridæ* and the genus *Riama* here described.

Another genus of this family, named *Bachia*, which is not in the British Museum, is described as having narrow, smooth, six-sided shields on the back, in nineteen longitudinal series.

November 9, 1858.—Dr. Gray, F.R.S., V. P., in the Chair.

Characters of Five New Species of American Birds. By Philip Lutley Sclater, M.A.

1. Euchlornis frontalis.

Psittaceo-viridis, fronte et gutture flavis; alis caudaque intus nigris, extus viridi limbatis; secundariis albo anguste termina-

tis: ventre medio flavo variegato: rostro fuscescenti-nigro, pedibus pallide flavis.

Long. tota 6·5, alæ 3·3, caudæ 2·5.

Hab. Bolivia (*Bridges*).

Mus. Derbiano.

I have enumerated the seven known species of this beautiful group, under the description of *Euchlornis melanolæma*, in the 'Annals of Natural History' for June 1856. I there used the generic name *Pipreola* for them, thinking then that Swainson's *Pipreola chlorolepidota* probably belonged to the genus. But after again considering Swainson's description, I must acknowledge that the point is very doubtful, and, until it is cleared up, it is perhaps better to employ De Filippi's term *Euchlornis* for the genus.

It is easy to recognize the present species of *Euchlornis* by its yellow front and blackish bill, which are possessed by no other member of the group. In size it is also inferior to all except *Euchlornis Sclateri*, Cornalia. The only example I have ever seen was procured by Bridges in Bolivia, and received through Mr. Cuming by the late Lord Derby in 1846. It now ornaments the Derby Museum at Liverpool, and has been lent me, along with some other rare S. American birds, through the liberality of the Trustees of that Institution, so that I now have the pleasure of submitting it to the examination of the Society.

2. Turdus leucauchen.

Supra nigricanti-cinereus, alis et cauda saturatioribus; capite toto et gula nigris, hac albo striata; collo antico pure albo; abdomine toto pallide cinereo, ventre medio crissoque albis; tectricibus subalaribus pallide ochracescentibus; rostro flavo, pedibus pallide brunneis.

Long. tota 9·0, alæ 4·6, caudæ 3·8.

Hab. In Guatemala.

Mus. P. L. S.

This is one of the numerous allies of *Turdus crotopezus* of Brazil and *T. assimilis* of Mexico. It is however a very distinct species, easily recognizable amongst them by its dark cinereous colour, conspicuously white neck-mark, and yellow bill. My example was obtained from Mr. Leadbeater. Others similar are in Mr. Gould's collection.

3. Geothlypis speciosa.

Saturate flavo-oleaginea; capite, præcipue ad latera, cum regione auriculari nigris; alarum remigibus fusco-nigris: subtus vivide flava, lateribus brunnescentioribus, tectricibus subalaribus flavis; rostro nigro, pedibus nigricanti-carneis. ♀ *Supra olivacea unicolor, subtus brunnescenti-flava, lateraliter olivascens.*

Long. tota 5·3, alæ 2·4, caudæ 2·3.

Hab. In Mexico.

I found an adult male, a young male, and a female of this pretty Yellow-throat among some duplicates lately obtained by exchange from the Museum of Geneva, which were out of the fine collection made by M. de Saussure during his recent travels in Mexico. These specimens had been wrongly identified with *Geothlypis trichas*, from which the black head of the male and want of the white band, not to speak of minor differences, render it easily distinguishable. The female, however, is not unlike the female of *G. trichas*, but of a more brownish yellow below. In form this species is rather more tenuirostral, and the tarsi, toes, and claws are slightly longer. The third primary is slightly shorter than the fourth and fifth.

4. Cyclorhis flavipectus.

Olivaceo-viridis; capite cinereo, pileo saturatiore; fronte, loris et superciliis elongatis rubris: subtus læte flavus, mento summo, ventre crissoque pure albis; rostri mandibula superiore brunnea, inferiore nigro-plumbea, apice pallescente; pedibus pallide carneis.

Long. tota 6·0, alæ 2·8, caudæ 2·2.

Hab. In ins. Trinit., Venezuela; et rep. Nov. Grenad.

Until I obtained examples of the true *Cyclorhis guianensis* from Guiana and Cayenne, I mistook the present bird for that species. On comparison they are quite distinct, the *Cyclorhis guianensis* having the head pure cinereous, the yellow colour below confined to the fore-neck and sides of the breast and of a different tinge, and the legs lead-colour, and being besides of smaller dimensions. Of the present bird I have examples from Trinidad, from Venezuela collected by M. Aug. Sallé between La Guayra and Caraccas, from S. Martha received from M. Verreaux, and from Bogota collections.

I now recognize at least six distinct species of this purely Neotropical group (some of which have been sadly confounded together by modern systematists), each occupying a distinct geographic area, namely—

1. *guianensis*, (Gm.), ex Guiana et Brazil. Bor.
2. *nigrirostris*, Lafr., ex Nov. Gren. int.
3. *flavipectus*, mihi, ex Trinit. ins. Venezuela et Nov. Gren. littorali.
4. *flaviventris*, Lafr., ex Guatemala et Mex. Merid.
5. *ochrocephala*, Tsch., ex Bras. Mer. Orient.
6. *viridis*, Vieill., ex Paraguaya et Boliv.

The last two species are very different, as may be seen at a glance, and yet have been always confounded together. In the Brazilian species the bill is of a pale reddish horn-colour. In the Paraguay and Bolivian species it is much more elevated and compressed, and has a large dark lead-coloured blotch at the base.

5. Cinclodes bifasciatus.

Supra fulvescenti-brunneus, superciliis elongatis albis; alis nigricanti-brunneis albo bifasciatis, tectricibus omnibus dorso concoloribus; cauda nigra, rectricibus tribus extimis albo terminatis: subtus grisescenti-albus; hypochondriis, ventre imo et *crisso pallide rufescentibus: rostro nigro, mandibula inferiore ad basin brunnescente, pedibus brunneis.*

Long. tota 8·0, alæ 4·1, caudæ 3·3, tarsi 1·2.

Hab. In Bolivia (*Bridges*).

Mus. Derbiano et Brit.

This fine species of *Cinclodes* is quite typical in form, though it departs somewhat in colouring from the uniform appearance of *Cinclodes patagonicus* and its allies. In this respect it approaches *Cinclodes palliatus* (Tsch.), and I was at first almost inclined to believe that it might be referable to that species. It is in fact just reconcileable with the characters as given in Tschudi's 'Conspectus Avium' (Wiegm. Arch. 1844, p. 281). But turning to the 'Fauna Peruana,' we find a plate representing a bird with the *apical* portion of all the tail-feathers white. On the other hand, in the letterpress of the same work, the tail-feathers are described "*an der Basalhälfte rein weiss, im übrigen verlaufen schwarz*," and in the following sentence "*Schwanz schwarz*." I cannot undertake to reconcile these three conflicting accounts of the colouring of the tail-feathers; but if any one of the three be correct*, the present bird must be quite different. It may further be noticed that the underside of Tschudi's species is represented both by figure and description as "*pure white*." The two white bands in the wing of *Cinclodes bifasciatus* are formed, one by the bend of the wing and distinct exterior edging of the feathers of the spurious wing being white, and the second by a broad white space, which occupies the basal portion of all the secondaries except the outermost, and passes obliquely across the inner primaries, terminating at the fourth from the outside, and leaving the three outer primaries wholly unmarked. The fourth primary is marked only on the inner web. There is a specimen of this bird in the British Museum, from the same source as the bird described.

MISCELLANEOUS.

On the Stomachal Filaments of the Medusæ. By D. Fritz Müller.

In the higher Discophora, in the families of the Rhizostomidæ, Medusidæ, Pelagidæ, and Charybdeidæ, we have long been acquainted with groups of tentaculiform filaments, endowed with a slow vermiform movement, covered with vibratile cilia, and more or less abundantly furnished with urticating organs. They appear to occur in all the members of the above families, and to constitute the only character by which these are distinguished from the lower Medusæ (*Cryptocarpæ*, Eschsch., *Gymnophthalmata*, Forbes).

The opinions as to the import of these filaments are various. Their presence in the vicinity of the generative organs in the first three families caused them to be regarded as tentaculiform appendages of these, and consequently as connected with the generative function.

* For other instances of the untrustworthiness of the plates of Tschudi's book, see P. Z. S. 1851, p. 248, & 1858, p. 75. Dr. Günther informs me that the *Batrachia* there figured are also quite unrecognizable.

Gegenbaur, who describes them in *Nausithoë* and *Charybdea* as hollow filaments standing in connexion with the cavity of the stomach, regards them as reservoirs of the fluids moving in the gastro-vascular system. Milne-Edwards indicates them as biliary canals in *Charybdea.* Leuckart compares them with the mesenterial filaments of the *Actiniæ,* indicated by him as kidney-like secretory organs. In all cases, however, they seem to have been regarded as hollow, and as opening freely from the gastro-vascular system, outwardly or into the several cavities.

The author had the opportunity of observing these filaments in two species of *Tamoya,* in a *Rhizostoma,* and in a large *Chrysaora.* In *Tamoya* the generative organs are situated in the wide lateral pouches of the stomach, at a distance from the group of stomachal filaments, which are visible to the naked eye as opake streaks in the membrane of the stomach; in this case, therefore, we cannot suppose that there is any close relation between the organs. In all four species the filaments are *solid,* and *directed into the cavity of the stomach*: the latter fact is especially easy of proof in *Chrysaora,* in which the filaments attain a length of several inches; the former is rendered particularly distinct by treatment with solution of chromic acid, when the cortical layer may easily be brushed off from the solid central cord, which is transparent, and, in fresh filaments, certainly appears like a cavity. This renders Gegenbaur's explanation impossible as regards the species observed by the author.

It appeared to him more probable that the stomachal filaments were connected with digestion. To confirm or contradict this supposition, he removed the groups of filaments from a living *Tamoya hoplonema,* laid them on some muscles from the claw of a Crab and a fragment of the posterior part of an *Alpheus,* and poured over them a little sea-water. Corresponding pieces were laid in pure sea-water. The latter had undergone no perceptible change in ten or twelve hours; but of the flesh under the influence of the stomachal filaments, that of the *Alpheus* was completely, and that of the Crab almost completely, dissolved to form a turbid fluid: the blackish-green shell of the *Alpheus* had become reddish; a slimy residue on the chitinous plate, from which the muscles of the Crab's claw arise, still exhibited its muscular nature under the microscope. The filaments still continued fresh, their cilia were vibrating, and they showed the ordinary slow vermiform movement.

The author considers it more probable that the filaments produce a peculiar secretion different from that of the rest of the stomach, than that they serve merely to increase the digestive surface of the stomach, as he found on the surface of the filaments and in the surrounding fluid, in *Tamoya,* irregular roundish corpuscles, of 0·01 mill. in diameter, with dark outlines, which did not occur in the other parts of the stomach.

The occurrence of urticating organs in these filaments is very remarkable. In *Tamoya, Chrysaora,* &c., they may perhaps serve for the destruction of living prey; but what is their office in the central cavity of the polystomatous Rhizostomidæ, which is far removed from the orifices of the anus?—*Siebold und Kölliker's Zeitschrift,* Dec. 20, 1858, p. 542.

Tenacity of Life in Snails.

Mr. B. M. Wright has lately sent to the British Museum two living examples of the Desert Snail, *Helix desertorum*, which appear to have been dormant for the last four years. They were collected by Mr. Vernèdi, of Treherne House, Hampstead, who states that in May 1854, on his transit through the Desert of Egypt, and while stopping at one of the stations, he found a heap of thorn bushes, such as the camels eat, lying in a corner of the building; these bushes were rather thickly studded with the snail-shells, so that in a few minutes he picked off fifteen or twenty specimens, which he carried home and locked up in a drawer. They remained undisturbed till the present month, when two were given to Mr. Wright, who tried with success the experiment of reviving them; and afterwards Mr. Vernèdi himself succeeded with two of the others.

Sept. 20, 1858.

April 1859.

In June 1855, I received from Mr. Wilton two specimens of *Helix candidissima*, and one of *H. aperta*, which I placed in a glass box, intending to test their tenacity of life. They remained quiescent, without food or change of air, until November 1856, when they were immersed in water and revived for a few hours, but returned to their former dormant condition without taking any food. In July 1857 the *Helix aperta* was required for dissection; and at the same time another individual of *H. candidissima* and one of *H. vermicularis* were placed in the box. These dates were in each case written on the shells with pencil. Last Michaelmas (1858) the experiment terminated, unintentionally; for, having conveyed the box to the Museum, the snails were all excited to activity by the warmth of my pocket and the shaking they experienced. They are still alive, under a bell-glass, along with the Desert snails before mentioned, and specimens of two examples of *Helix serpentina*, brought from Pisa by Mr. Hamilton, and several of *Helix vulgata*, from Madeira, by Mr. J. Y. Johnson.—S. P. Woodward.

On a new species of Synallaxis *from the Republic of Ecuador.* By Philip Lutley Sclater, M.A.

Synallaxis antisiensis.

Supra terricolori-brunnea; loris, ciliis et striga superciliari albis; pileo, alis extus et caudâ rufis: subtus dilutior, gutture et pectore antico albis, hoc sensim ventrem versus cinerascente; rostro carneo, supra nigricante; pedibus nigricanti-fuscis.

Long. tota 6·1, alæ 2·8, caudæ 3·0.

Cuenca, Nov. 1857, 1 specimen. "Irides hazel; legs and feet greenish; nails flesh-coloured. Climbs up and down and round the branches of trees like a *Certhia*."

This apparently new *Synallaxis* is most nearly allied to *S. pallida*, Max., but may be distinguished by its larger size, white throat, and earthy-brown plumage.—*Proc. Zool. Soc.* Nov. 9, 1858.

THE ANNALS

AND

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[THIRD SERIES.]

No. 18. JUNE 1859.

XLIV.—*On the Increase of Madrepores.* By Mrs. THYNNE. With Notes by P. H. GOSSE, F.R.S.

[With a Plate.]

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

GENTLEMEN,

We know so little of the reproduction of our native *Caryophylliacea*, that any mite of authentic information on the subject would be welcomed by the zoologist. A series of observations, therefore, so extensive as those recorded in the following Notes, so uninterrupted, so fortunate in their results, and so intelligently watched, cannot but be of great value. The MS. was kindly put into my hands by the lady who observed the facts, about three years since, with the generous permission to use it as I saw good. I had intended, in consequence, to enrich the pages of my 'Actinologia Britannica' with these memoirs; but I find that I could do so only by considerably abridging them; and as I judge that their scientific value is such that they ought to be published *in extenso*, I beg to hand them to you.

I add a few words of comment of my own at the end of the Notes, together with a letter from Mrs. Thynne, containing additional evidence.

I am, Gentlemen,
Your obedient Servant,
P. H. GOSSE.

Torquay, April 6, 1859.

On the Increase of Madrepores. By Mrs. THYNNE.

1. In the autumn of 1846, when touring through Devonshire, I first met with the living Madrepore. Having for many years derived much pleasure from the study of geology, I felt

great interest in seeing a *living* species of little creatures so intimately connected with that science. I procured about thirty of them, to watch and admire during a few weeks' residence at Torquay, and felt so much desire to show them to a friend in London, that I determined to try whether they would not survive the journey, though it was rendered more difficult by my intention of passing three weeks at Clifton on my way to town. I provided myself with a new stone jar in basket-work, and six gallons of pure sea-water taken from a deep part of the Channel. With a needle and thread I fixed the Madrepores on a large sponge, that there might be no damage from collision, and then placed them in a glass jar filled to the brim with water, and tied down with a bladder. This method was perfectly successful. During the journey, I had the great pleasure of seeing them expand their tentacula most happily; and they arrived both at Clifton and London in a most flourishing state. My next consideration was as to the possibility of keeping them alive, and this I accomplished in the following manner. I placed them in glass bowls, holding about three pints of water each, which I changed every other day; and as I could not have a continual supply sufficient for such a demand, I thought of having it aërated by pouring it backwards and forwards through a small watering-pot, before an open window, for half or three-quarters of an hour, between each time of using it. This was doubtless a fatiguing process; but I had a little maid, who, besides being anxious to oblige me, *thought it rather an amusement*; so that as the service was cheerfully performed, it was also done well; and the exertion was diminished by her standing for only ten minutes or a quarter of an hour at one time. At the expiration of three months, although I could discover no deterioration of the water, I thought it safe to send my stone jar to be refilled; and this I continued to do so long as I kept a collection in London.

2. For six or seven months the little Madrepores had no other food than the water supplied; but, as they then looked rather thin, I fed them with boiled shrimps cut very fine, which soon restored them to their usual beauty.

3. In the spring of 1847, I wished to try whether I could adjust the balance between animal and vegetable life, and sent for shells and small pieces of rock, to which living sea-weed was attached: on these shells, &c., were sure to be many Zoophytes and other animals, so that I obtained a very various and curious collection of marine creatures. I had a quantity of microscopic Corallines, which multiplied very fast; *Serpulæ*, that rapidly elongated their stony cases; some Annelides, *Ophiuræ*, and a great many beautiful little things for which I could find no name.

4. On one piece of rock was the first germ of a living Sponge. I watched the shooting forth of its spicula with the greatest interest. It was of very fine texture, and grew to the size of a hazel nut. In the course of the next winter, from want of motion in the water, it had become so covered with dust, that I did not know whether it was alive or dead; but in the following June, a bright spot appeared on one side, and it threw forth a sporule, which attached itself to the rock; and in a short time a full-grown young Sponge stood beside its parent.

5. I placed this Sponge in a darkened room, and found the spicula grew most on whichever side was turned to the light. From this time I regularly placed sea-weed in my glass bowls; but, as I was afraid I might not keep the exact balance required, *I still had the water refreshed by aëration.*

6. I do not know from which, or whether it was from both causes, that my little flock continued to thrive so much; but I had not many deaths, and they might be from natural causes. A *Nereis* propagated by gemmation*, and the *Caryophylliæ* regularly threw out their ova at the usual season. These ova lay quietly upon whatever they were thrown on for one or two days, when they began to rotate, at first slowly, and then more quickly; but I could not secure them, as they were so fine that they passed through or adhered to anything through which I strained the water; in the mass, to the naked eye, they looked like fine dust.

7. A week or two after one of these ejectments of ova, I discovered with my glass what I at first thought were minute clusters of ova, though, on touching them, I found they were really the pearl-like tips of two young Madrepores; but as the piece of rock on which they were fixed had not been in my possession many weeks, I could not decide whether they were born in the ocean, or were derived from ova which might have adhered. However, as they grew in years, they so exactly resembled one of the older ones, both in the *precise shade of colour* and the central star, that I felt convinced that they were truly town-bred. The Madrepores vary so much in their shade of colour, that (excepting the pure white ones) I never procured two full-grown ones *exactly* alike, both in the centre and the outward part.

8. In this manner I maintained my marine collection in London for nearly three years; and it was examined by very many professed naturalists and other persons interested in natural

* It was the lower [hinder] part of the animal which came to separate existence. Two red spots, which afterwards became eyes, were the first indications of change. [This mode of increase among the *Annelida*, which has been denied by a modern naturalist, I have myself repeatedly witnessed in different species of *Nereis*, *Syllis*, and *Nais*.—P. H. G.]

history during two or three months in the spring of 1849. After this time, I went to reside by the sea-side for eight months in the year. I then took my favourites with me, and pursued my researches in the marine kingdom under ordinary circumstances. The two young Madrepores were not in my collection in 1849; they were hatched when I again had it with me in London for a few months in the spring of 1850.

Some Account of the earliest years of two Madrepores.

[Extracts from a Note-book.]

9. London, April 11th, 1850.—This morning I discovered with my glass, on a small piece of rock to which a Madrepore was attached, two minute spots, which I thought were clusters of ova. On touching them with the feathered part of a pen, they were apparently instantly transformed into specks of yellow jelly, scarcely visible to the naked eye. Further observations enabled me to decide that what I had mistaken for clusters of ova were the white tips of the tentacula of two young Madrepores.

10. April 20th.—I wished to ascertain whether my young Madrepores would yet take any visible food. I scraped some boiled shrimp to powder, and, when their tiny tentacula were expanded, let it fall through the water, and was greatly amused to see with what avidity they seized it. They were far more voracious than the old ones.

11. Tenby, June 12th.—I left London June 8th, and took the Madrepores with me; they have borne a journey to Tenby in safety.

12. September 30th.—My young Madrepores have undoubtedly increased in size, without, as yet, having formed any polypidom; they are three times as large as the full-grown ones, and, when fully expanded, would cover a half-crown piece. Can this extraordinary growth arise from their having been kept warmer and better fed than they might have been in their natural state? They have also the power of locomotion, though they are not actively disposed; and the only exertion they have made has been to remove out of the way of each other, or of any piece of sea-weed or other obstruction that appeared to interfere with their comfortable enlargement. I have changed their water every morning, and fed them every other day with shrimps, prawns, or raw mussels cut very fine. They thrive best on raw mussels.

13. October 3rd.—One of the young Madrepores has opened its mouth to an extraordinary width, and will not close it upon food that I place within it. Still, its colour is so clear, and it altogether looks so healthy, that I have (perhaps rashly) asserted

to a laughing friend that it is quite well, notwithstanding its singular appearance.

14. October 5th.—The mouth is so distended, that a fourpenny piece might be laid inside it. Indeed, the creature would have taken the form of a ring, were it not for the skin or integument which is the lower part of the animal covering the surface of the rock. It appears also as though it were going to tear itself asunder into four unequal portions; and the white convoluted threads, or vermiform filaments, of which they have such an abundance, lie on the base beyond the edge of the mouth (see Pl. XVII. fig. 1). I suppose it must really be dying; or can it be a form of spontaneous fission?

15. October 6th.—The little creature is now nearly torn asunder. In one part it is only united by an attenuated thread, which the least movement of the water would break. On this thread are the tips of two tentacula (fig. 2).

16. October 7th.—The thread is quite broken, and the two ends which it united have curled round to meet those parts which are dividing on the right and left. Part of the base is rent, and the opposite division is much narrower (fig. 3).

17. October 9th.—The base is rent in two, and the division at the top is quite broken. The two ends have turned round to meet those parts which are breaking on the right and left. These four parts stand opposite each other—a large one and a small one at present slightly united (figs. 4 and 5).

18. October 12th.—The pair on the right have quite separated, and the ends of each portion have become united by a new membrane, which was at first dirty white, but is now beginning to assume the beautiful bright apricot-colour of the other part of the little creature. The pair on the left are not yet quite asunder. They have the appearance of four distinct Madrepores, though not of the same size. Each one takes food that is presented to it, though the mouth is at present entirely on one side, part of it being formed of the new membrane (figs. 6 and 7).

19. October 25th.—The mouth is becoming more in the centre; tips of new tentacula are developing on the new membrane, and also many more between the old tentacula (fig. 8).

The second Madrepore is passing through the same process of spontaneous fission.

20. December 16th.—The mouth of the Madrepores is now about half-way towards the centre. They have removed more than an inch from each other. The smallest Madrepore, after its subdivision, Oct. 12th, contained sixteen old tentacula, as I have drawn it (fig. 7); at the present date it has eighty-five.

21. March 22nd, 1851.—Tomorrow I leave Tenby for London;

and I have decided upon leaving my Madrepores in the care of a servant, who I hope will follow my directions. As I am afraid to trust her discretion in feeding them, I have desired the water to be changed twice every day instead. They will no doubt find plenty of sustenance in the water at this season. They are all in excellent health, but much larger than any adult British Madrepore. The mouth is now quite in the centre.

22. June 20th.—I have returned to Tenby, and find the little Madrepores quite well; a further fission has taken place—several of them have again subdivided into *four*; and, from their appearance, I am convinced all might have done so, had they been left to themselves; but the servant was so alarmed at their "coming to pieces," as she thought, that she surrounded them with little pieces of rock, to keep them together. This was a fatal mistake, as it prevented their having space to separate; but it *did* answer the purpose *she* intended,—for some of them in consequence divided only into *two* and others into *three*. I make a drawing of one which has divided into *three*, and which evidently shows the intention of nature (fig. 9).

23. However, I have many perfect specimens, and I hope they will indicate what the others would have been. There are at present no symptoms of their becoming fixtures; but whilst subdivision continues, I should suppose the period for doing so cannot have arrived. In anything further I may have to relate, I shall call those which divided into four, perfect specimens, and the others imperfect ones. They are now more than twelve months old.

24. June 25th.—I have now a curious circumstance to describe: a perfect specimen had attached itself on one side to one of the small pieces of rock the servant had placed to prevent separation (on which account I did not remove it), and the opposite side adhered to the main rock. The central part of the little creature was unattached, and rather hollow. The mouth was still quite on one side, and the new part, which had grown after the last division, had not yet assumed the darker hue of the older portion. By accident the little piece of rock had been slightly moved, and the animal inconveniently stretched. It did not detach itself from one end or the other, as I should have thought it would have done, but immediately commenced subdivision, first in the centre of the older portion, and then on each side of the new part (fig. 10). In two days the process was complete; and I have now three perfect Madrepores for that individual one; one of them is composed entirely of the new part, and is a complete speck, *all pale in colour*; another is attached to the loose piece of rock, and the other to the main rock.

25. June 27th.—On a perfect specimen I find a gemmule, a

perfect young one, which, when expanded, is nearly the size of a small pea, and has fifteen tentacula; it is attached to the lower membrane of the mother Madrepore, which is turned up (Pl. XVII. fig. 11)*. The Madrepores seldom adhere so closely to the rock, and with such a fine, firm edge, as the Actiniæ do. Sometimes the young one withdraws into the parent, and then a darkish spot is all that is visible.

26. July 1st.—I find two other gemmules, one on a perfect specimen, the other on an imperfect one.

27. July 6th.—A perfect specimen has again divided—this time into two parts. Two of the imperfect ones have also now divided, as they should have done earlier.

28. July 12th.—Another gemma on a perfect specimen.

29. July 15th.—A perfect specimen, on which is a gemma, has subdivided into two. The gemma expanded itself most happily during the process, and seemed quite unconscious of any disturbance. All the gemmæ grow from the lowest [basal] membrane of the Madrepore, the same as the first I described [§ 25].

30. July 27th.—Another perfect specimen, on which is also a gemmule, has divided into three parts. It appeared to make a most decided effort to separate into four. I thought the one mentioned July 6th did so: this time, three is the result. In their natural state, the motion of the water must assist the fission.

31. August 6th.—Since my last date, the imperfect specimen, on which was a gemmule, and another perfect specimen, on which was also a gemmule, have both divided into three portions, the gemmules, as before, evincing no consciousness of the occurrence.

32. August 10th.—One of the portions of the perfect specimen which I described as dividing into two parts (July 6th) has again separated into two; and the last of my imperfect ones has subdivided since my last date. The gemmules assist in finding food for themselves—at least I judge so from the occasionally rapid contraction of the tentacula; and they take mussel with much avidity if I give it them. I think they also share the sustenance provided by the mother, as when I feed her, they dilate themselves afterwards in the same manner.

33. August 15th.—I see in three of the gemmules a little knot of vermiform filaments; but they are large in proportion to the little animal, so that I cannot decide whether they belong to the parent or the young one. The outer covering of the young ones is so very transparent, that I can see any opake object within them. . . .

* Apparently the base reverted at its edge.—P. H. G.

34. August 18th.—One of the gemmules has divided into two parts; one half has separated from the parent, and has twenty-five tentacula, and the mouth on one side, as when the older ones divide; the other half remains attached to the mother.

35. September 1st.—Another gemmule has disengaged itself from the parent. In this instance it has left no twin brother behind. It has thirty-four tentacula fully developed, and there are white spots where others are coming.

36. September 16th.—Another gemma. The little speck of a Madrepore composed entirely of new growth, which I described June 25th, has grown to the size of a fourpenny piece, and has just subdivided again into four.

37. October 11th.—The gemmule described as separating from the parent (Sept. 1st) has subdivided into two parts.

38. October 19th.—My little flock increases daily. I have now eighty-three Madrepores, seven of which are gemmules. The gemmules resemble the others in a very short time. I know them apart only from their situations. I shall be curious to see whether they become fixtures at the same time.

39. October 24th.—The half of the gemmule mentioned (August 18th) as remaining attached to the parent has separated from it.

40. December 7th.—The half of the gemmule which separated from the parent (August 18th) is now dividing into three. The other half, which detached itself October 24th, is at the same time dividing into two. Therefore this first gemmule, which I discovered June 27th, has now multiplied into five.

41. In looking over my Notes, I find I have omitted to mention an appearance peculiar to the young Madrepores: they have, all of them more or less, between the several rows of tentacula and the mouth, patches of a milk-white fluid or substance; it first appears in minute specks, which by multiplying or uniting form variously shaped patches, in some cases almost covering the entire space between the several rows of tentacula and the mouth, and in others forming a broken or sometimes connected ring, of uneven width, just within the tentacula. In many of them it is so dense that it looks quite like chalk. After fission, the new part is at first without it, but it soon appears. The gemmules also have it very early. Can this be the material for the future polypidom? All my young Madrepores have four circles of tentacula.

42. Feb. 18th, 1852.—During the day, seven of my *adult* Madrepores have at intervals been ejecting a whitish-blue fluid, resembling wood-smoke*. By first elevating the mouth and

* This was doubtless the spermatic fluid of the males. See my 'Actinologia Britannica,' pp. 99 and 100.—P. H. G.

then suddenly contracting it, they throw a stream three or four inches from them, which falls slowly through the water to the bottom of the glass bowl, where it looks like mist resting on the glass. A few eggs are occasionally thrown out with it. One would think they had some curious sympathy with each other, that so many of them should be similarly engaged exactly at the same moment. I find it mentioned in Dr. Johnston's 'British Zoophytes' that the ova of the *Caryophyllia* are discharged through openings between the tentacula. My observation does not confirm this, as I have frequently seen the eggs within the tentacula so close as to be in masses; but they have always been expelled from them by retraction, and invariably escaped through the mouth. The season for discharging the ova is between January and March.

43. Of the adult Madrepores that I procured at Torquay six years since, some have died, perhaps from the course of nature; but others have very much grown. They have enlarged their polypidoms, and the tentacula are an inch long.

44. May 2nd, 1852.—I have now 278 young Madrepores, derived from those two mentioned April 11th, 1850; and they are still subdividing so fast, that every day adds materially to their number. A marble bath is the only "suitable accommodation" (as house agents say) that I can think of for such a rapidly increasing family. However, I am unable to see the result, as I am obliged to leave the coast, and my thoughts and leisure will be so entirely occupied with more serious duties, that I cannot encumber myself with even a part of my flock. I shall therefore commit my much-admired little favourites to the ocean, in the sheltered and rocky cove of Waterwinch, and hope they will form a colony on these shores. In future years, should opportunity occur, I shall make a point of looking after them. They have at present given no sign of forming a polypidom, unless the white patches I have described can be considered an indication; and they are now two years old: but as my adults have considerably enlarged and elongated their habitations under the same treatment, I think I may conclude that the young ones would have formed one also, had the natural period for so doing arrived.

45. The Madrepores thus appear to have three modes of reproduction: in the course of the first year, by spontaneous fission; during the second, by very frequent fission (every few weeks), and by gemmules also; and when adult, by ova. I am not surprised at the rapid growth of the coral islands.

46. It is very evident that the young Madrepores have not arrived at maturity, though they are two years old, as the ten-

tacles, though very abundant in number, are shorter and more slender than those of the adults.

47. When the adult Madrepores become old or unhealthy, the tentacles diminish in number; those nearest the mouth disappear first. I have had some with only one circle on the outer edge. They do not live long in this state; perhaps one reason may be that they have fewer means of procuring food.

48. I was formerly rather surprised at the very different sizes of the adult Madrepores. I have some with the polypidom not more than a quarter of an inch in diameter, and I used to consider whether they could be juveniles; but sometimes the height of the stem [column] seemed to preclude such an inference, and yet in all save size they appeared alike. Now I fancy I understand it. They probably divide as long as possible; and occasionally, from roughness of the rock, some very small portions are left, with perhaps not six of the old tentacula (I had *one* with only three of the old tentacula, and yet it became perfect); then, when by the law of their nature they are compelled to fix their habitation for life, such little creatures can only form or require proportionate polypidoms, though they are quite as old, and of the same species, as those of larger size.

Annotations on the above. By P. H. Gosse.

In the foregoing observations, Mrs. Thynne has assumed that the two animals whose growth and repeated subdivision she has so graphically sketched were Madrepores of the species so common on the Devonshire coast, and known to naturalists as *Cyathina* (or *Caryophyllia*) *Smithii*. On reference to § 7, we find that she did not actually witness the origination of these two specimens, but found them, in a very infantile state, on a piece of rock which had been introduced into her aquarium subsequently to the original Torquay *Caryophylliæ*. The growth of Madrepores through a period exceeding two years, and the attainment by them of dimensions far exceeding those of any specimen of undoubted *Caryophyllia* on record, without the least apparent tendency to form a *corallum*, were facts so new and strange—to me at least—that I could not help scrutinizing with some scepticism the evidence of the assumed identity of species.

Moreover, I had by me some coloured drawings which I had carefully taken from the specimen of *Corynactis heterocera* which Mr. Thompson had described in the 'Annals of Nat. Hist.' for April 1855, and was forcibly struck with the resemblance borne by Mrs. Thynne's figures to that soft-bodied Caryophylliacean, in size, form, colour, and general appearance and arrangement of the tentacles; while in some points the figures in question differed from the *Corynactis* and agreed with *Caryophyllia.*

Under these circumstances the suspicion occurred to me, that possibly the young animals whose history she had pursued might have had no connexion with her *Caryophylliæ*, but were the progeny of either the above-named or some other allied, but as yet unrecorded, species of *Corynactis**. And this suspicion I took the liberty of suggesting to my kind informant, with my drawings of the *Corynactis*, for her consideration. I was favoured, in reply, with the following communication from that lady, which certainly does seem to warrant the correctness of her conclusions:—

Mrs. Thynne to Mr. Gosse.

7 West Mall, Clifton, April 12th, 1856.

"...... You understood my Notes quite right, in that I said my young *Caryophylliæ* did not, during two years, form any corallum; and I am much shocked you should suppose I could think amiss *any* question or doubt that has arisen in your mind, as my observations are of course liable to error; and though I feel sure no naturalist who had seen them would have hesitated as to their species, now you mention it, I am not surprised that any one who had not, should do so. I will give you a further description of them, and *my* reasons for believing them true *Caryophylliæ*; and if you still think I am mistaken, I shall probably pronounce you the better judge.

"I first discovered the *two* embryos (therefore I had double evidence) with a lens, whilst they were still microscopic objects, in a large glass bowl, in which were no other animals than adult *Caryophylliæ*, which had been ejecting ova for two months previously. They were fixed on a piece of rock I had received from Torquay in the course of the spring, to which sea-weed was attached; and it might perhaps be this bunch of sea-weed which harboured the ova, and prevented them from being lost when the water was changed. As they grew larger, they did not merely bear a *general* resemblance to the adults, but I really may say they were *identical* with the fleshy part of all of them, except in colour; and in this particular they so closely resembled *one*, that I *concluded* it was the mother. They were also so identical with *each other* as well as with this presumed parent, that, after the divisions became frequent, and in their positions they had become mixed together on the rocks, I was no longer able to

* I use the generic name under which the animal has been recognized; but it will require to be separated from *Corynactis*, and associated generically with another form, which I hope soon to describe.

distinguish between them, and often regretted I had not placed them in separate aquaria, that I might have seen whether each had multiplied in about the same degree. Wherever they came from, therefore, I think they must have been the offspring of the same parent.

"The point that raises the doubt in your mind as to their being really *Caryophylliæ*, is the absolute *fact* that they did not during two years form any corallum, or give any indication of doing so, unless the chalk-like patches which occurred in the course of the second year [§ 41] could be considered such. This same fact also perplexed me very much; and I should have thought that perhaps they would not form one at all *in captivity*, only that they were so vigorous, and their proceedings seemed so natural —the first year, fission only; the second, fission combined with gemmules: and they did not look as though they had come to maturity; for the tentacles, though most redundant in quantity, were shorter and more slender than the full-grown ones. Then some of the adults enlarged *their* corallums*, and everything else appeared so thriving. The aquarium abounded with *Serpulæ*, that secreted their calcareous coverings; and my arrangements seemed to give such general satisfaction, that even the *Ophiuræ* usually forgot their suicidal propensities. I had also two *Medusæ*, of a species not described by Mr. Forbes, which lived a long time.

"I have never seen a living specimen of any species of *Corynactis*, nor read Mr. Thompson's description of it, but think it extremely probable, as you suggest, that it may be an immature form of Madrepore†. Your very beautiful drawing does not *exactly* represent my specimens. They had no marginal tubercles; and the tentacles of the *Caryophylliæ*, both young and old, are also of the same shape—an opake white knobbed tip, with a most delicate, transparent, *granulated* tube tapering towards the knobbed tip‡. To the naked eye the tube looks transparent, with opake white spiral lines; it is only with the microscope one discovers that the apparent lines are granules. The *Caryophylliæ* throw off no mucus, and are much softer-looking, finer in texture, and more semitransparent than any Sea-Anemones I have seen. I do not know whether the *Corynactis* shares these beauties. If the *Caryophylliæ* really do, as I suppose, in their natural state, remain two years or more without forming a corallum, they would certainly be found so, if attention were

* Thus there was no want of lime in solution in the water.—P. H. G.

† I had suggested this as an alternative just possible, but do not consider it as at all probable.—P. H. G.

‡ This minute structure of the tentacles is conclusive against the animals having been *Corynactis heterocera*.

directed to the subject and search were made; and it can only be owing to the comparative rarity of the little creatures that they have not been observed before *. . . . . ."

EXPLANATION OF PLATE XVII.

Fig. 1. One of the young Madrepores, on Oct. 5th, 1850, seen from above; nat. size.
Fig. 2. The same, on Oct. 6th.
Fig. 3. The same dividing, Oct. 7th.
Fig. 4. The same divided, and ready to divide again, Oct. 9th.
Fig. 5. The right-hand moiety, on the same date, viewed in perspective.
Figs. 6, 7. The same moiety, Oct. 12th, now become two, viewed in different conditions; about twice the nat. size.
Fig. 8. The larger of the last division, Oct. 25th, showing the development of new tentacula (expressed by the inner circle of dots); twice nat. size.
Fig. 9. Threefold division of one specimen, June 15th, 1851.
Fig. 10. A specimen attached to two pieces of rock, June 25th.
Fig. 11. Another, with a young one developing by gemmation from its upturned base, June 27th.

[Mrs. Thynne wishes it to be understood that the figures are not finished drawings, but slight outlines made to assist memory; correct, however, though rough.]

XLV.—*The Estuary of the Mersey considered as a Locality for Nudibranchiate Mollusca.* By Cuthbert Collingwood, M.A., F.L.S., &c.

Although every district has its variety of natural productions, whether terrestrial, fluviatile, or marine, still there is usually some family which predominates in each locality, giving it a peculiar character, and in which it may be regarded as, at least comparatively, rich.

The marine fauna of Liverpool is by no means destitute of interest in other families, and possesses an ample share of zoophytal productions in particular; but it is more especially in the Nudibranchiate Mollusca that its riches appear. Of this remarkable and lovely family it may be said to possess more than an average share, including some of unusual interest. The present paper will only take cognizance of the Mersey mouth and estuary; but by extending our researches to the neighbouring estuary of the Dee, we find within ten miles of us fresh rarities and beauties. It must also be taken into consideration that

* And yet at this time (1859) hundreds, perhaps even thousands, of individuals of *Caryophyllia Smithii* are taken annually by the Torquay and Ilfracombe collectors, of various sizes and colours, while not a single example has been found without a corallum.—P. H. G.

the workers in this department are few, and perhaps do not number more than a dozen for the whole district, among whom Messrs. Price and Byerley and Dr. Edwards deserve honourable mention. I think I may say that a more systematic working of the coast is going on now than has been the case for some time past; and we may hope still to add to the following catalogue of 21 species. Already, in the present spring, two species have been added to the local list, and a third to the Mersey proper, notwithstanding that the weather has been most unfavourable for shore operations, the boisterous winds and cold conspiring to drive the animals to lower depths. To the record of each species are appended remarks and notices of peculiarities, whether local or otherwise.

Doris tuberculata.—This is perhaps one of the most unattractive, though nearly the largest of the Nudibranchs, and requires little remark. It is not uncommon upon the Cheshire side of the Mersey; and I have picked it up at Egremont, New Brighton, and Monk's Ferry from early spring to late autumn. Its usual size is three inches to three inches and a half, and its colour somewhat various, being either of a pure lemon-yellow, a bright orange, or sometimes blotched with green, pink, or brown. It is very sluggish, and seldom lives more than a few days in captivity.

Doris Johnstoni.—This is by no means a common *Doris* in any locality, and is here a very rare one. In company with Dr. Edwards, we found one at Monk's Ferry on August 12th of last year, the only one, that I am aware of, which has been taken in the Mersey. Our specimen was of a bright yellow colour, and about an inch and a half long. The only other recorded specimen from this neighbourhood was taken in the Dee estuary, at Hilbre Island. The spicula of this species are very elegant, consisting of a broad embossed plate with a double and beautifully serrated edge, terminating abruptly in a blunt apex.

Doris proxima.—This pretty little *Doris* is peculiar to the estuary of the Mersey, where it was first discovered by my friend Mr. Price. It is extremely like *D. aspera* in general aspect, and requires a critical eye to discriminate it at first; but a little practice makes them readily distinguishable with a lens; for the tubercles upon the cloak of the latter are more rounded and club-shaped,—of the former rather fusiform, especially towards the sides. But should there be any doubt from an external examination, the tongue presents so marked a difference in the two species that it would at once decide the question; and even when the animal has been far gone in decay, and the tongue difficult to find, I have been satisfied of the species from an examination of the spicula, having never seen in *D. proxima* the three-cornered spicula so characteristic of *D. aspera*. *Doris proxima* is scattered in considerable numbers all along the Cheshire shore of the Mersey estuary, from Monk's Ferry to New Brighton, but is nowhere very abundant. It is usually about half an inch long, though sometimes met with very minute, and varies in colour from white to various shades of yellow and orange. It spawns early in March. I do not think the *Doris aspera* is found here, and have hitherto searched for it in vain. It appears to be replaced by this allied species.

Doris bilamellata.—This is perhaps the most common Nudibranch in our estuary, and may be found in the utmost profusion, especially in early spring, its chief spawning season being in February and March. At that period the stony ground beside Egremont, and that in the neighbourhood of the railway pier at Monk's Ferry, literally swarm with this species, and are spotted in all directions with the white ribands of spawn. These two localities are separated by a distance of about 2½ miles, the latter being most distant from the sea; and a considerable difference exists between the specimens of *Doris bilamellata* inhabiting the two spots. At Egremont they are all of a large size, being from an inch to an inch and a half long, and more or less mottled with a rich dark brown; but at Monk's Ferry an entirely different variety occurs: here none of them exceed three-fourths of an inch in length, and many are much smaller, while the dark brown mottling gives place to a much lighter colour; and even this is in some specimens almost entirely absent, and they become of a dull white. So great a persistent difference in the individuals of one species separated by so short a distance is very remarkable, and would almost seem to give some colour to the idea that they are distinct species. Messrs. Alder and Hancock, however, were unable to fix upon any distinguishing character on which they could rely. At Monk's Ferry they swarm over the lower part of the slip, so that passengers landing from the steamers at low water unconsciously trample them and their ribands of spawn under foot.

Doris pilosa.—A common and widely distributed species, but by no means one of the most abundant of the Mersey Nudibranchs. It is a pretty little *Doris*, and one which varies very considerably in appearance, within the limits of species, not only in colour, but in general aspect. Mr. Price informs me that at Monk's Ferry he has found it of a pale lilac, and even white, spawning upon *Fucus serratus*. A deep purplish-black variety also occurs in the Mersey; but I have met with only one or two specimens during the last twelve months. When not in motion, it bears a great resemblance to a miniature hedgehog. This species, as well as *D. proxima* and some Eolids, have a habit of crawling out of the water in which they are placed; so that some hours afterwards it is not unusual to find them literally "high and *dry*" upon the edge of the vessel, and, of course, dead.

Polycera ocellata.—Of the genus *Polycera* we may reckon two species, though by no means commonly met with. The above, which, however, very closely resembles the next, is the least rare, and has been not unfrequently taken on the Egremont shore and elsewhere. I have not met with it during the last twelve months.

Polycera Lessonii.—All that can be said of this, is that our excellent naturalist, my friend Mr. I. Byerley, has taken one in the dredge, off the North Cheshire coast, outside the Mersey mouth; so that no doubt it exists near us. But although the Mersey shores offer a rich feast for the naturalist, the dredging is anything but satisfactory, and experience has only resulted in laying aside the dredge to a great extent, and trusting to the sea-boots.

Ancula cristata.—A lovely species, which I am glad to say is one of our common Nudibranchs, especially on the Egremont shore. It is here found under stones, in company with other species to be mentioned presently; and the little light speck ensconced in a crevice bears but a faint resemblance to the graceful creature into which it expands when placed in the water. No figure can do justice to the beautiful frosted silvery appearance of the branchial plumes, or the delicate transparent whiteness of the body; and as it is an active little animal and constantly in motion, its beauties are readily viewed even without the aid of a glass. Placed in the aquarium, they have lived for some weeks, marching freely about and traversing all parts of the tank. They were numerous early in the last February at Egremont; but they appear to congregate on small circumscribed patches of stones, so that it is not always easy to hit upon the exact spot.

Tritonia Hombergii.—A magnificent animal, and the largest of our Nudibranchs; but being a deep-sea species, the wonder is not that it has only occurred once or twice, but that it has been picked up at all upon the shore. Alder and Hancock state that it is seldom obtained except by the dredge or trawl. It has, however, been taken on the western shore of the Mersey, near its mouth; and I have myself picked it up on the shore of Hilbre Island, in the Dee estuary. Its great size, its very complex tentacles, and its numerous tree-like tufts arranged all along the sides, conspire to render it a creature once seen not soon forgotten.

Tritonia plebeia, another deep-sea species, has been taken in the dredge outside the Mersey mouth.

Dendronotus arborescens.—This very remarkable and beautiful animal is one of the most common and widely distributed Nudibranchs of the Mersey. It occurs more or less in all the localities frequented by the zoologist both upon the Lancashire and Cheshire shores, but is in the greatest profusion in the hottest part of the summer. The spot where I have found it in the greatest numbers is a remarkable one, and worth recording. The old landing-stage from which the ferry steamers run, is a ponderous barge-like structure supported upon iron pontoons, which are capable of being withdrawn individually. On the land side of these pontoons, and in the crevices between them, vast quantities of *Tubularia indivisa* and mussels accumulate and flourish, so that from time to time it is necessary to withdraw the pontoons one by one and scrape them with iron scoops, in order to rid them of the masses which choke them up. This *Tubularia* affords food and harbour to a vast number of animals, including several species of Nudibranchs; and among them *Dendronotus arborescens* is conspicuous. In company with my indefatigable friend Dr. Edwards, on a fine day in the month of August last, we gathered specimens of *Dendronotus* from this spot as fast as we might pick blackberries from a hedge; so that in a quarter of an hour we found ourselves possessed of upwards of forty fine full-sized specimens. It is not, however, at all times of the year that they are to be found in this profusion. On the 9th of February last I visited the same spot, and found *Tubularia* indeed in the most magnificent condition, with pendent clusters of oviform gemmules an inch long; but though I searched long and diligently, no trace of *Dendronotus* could I find. Indeed, the first specimen of the season made its appearance, on the verge of low-water at Egremont, on the 5th of the present month. This species is very sluggish in its movements, and will not live more than a day or two after its capture. Whether it requires a constant supply of the heads of *Tubularia* for its sustenance, or a constant renewal of sea-water for its respiration, I am not aware; perhaps both. We have pale-yellow as well as rich-brown varieties.

Doto coronata.—This is the only species of *Doto* hitherto met with in the Mersey, but is very common and widely distributed. Along the Cheshire shore of the estuary it is in great abundance, especially at Egremont and New Brighton, where it may be found upon the under side of stones (the larger the better) all the year round, as well as upon fronds of *Laomedea gelatinosa*, which is our commonest zoophyte. I have counted a score upon a single large stone. On the Liverpool side it may be found upon the *Tubularia* of the landing-stage. I have never found one, however, half an inch long,—the average size being a quarter of an inch, and the largest three-eighths. They are very variously coloured, seldom pale, and sometimes very richly marked, the largest specimen I have seen being also the darkest. In the aquarium this species exists longer than any other mentioned in the present paper, and remains attached to corallines for weeks and even months, moving about but little, and freely depositing its minute ribands of spawn.

Eolis papillosa.—We have at least eight species of *Eolis* proper, of which this is the largest and one of the least beautiful. It is found pretty generally distributed upon the shores of the Mersey; but being usually of a sooty colour, it is not readily distinguishable without special search. At the present time the spawn of this species is pretty abundant on the Cheshire shore, in the form of long convoluted cords upon the sides of stones; but the animal itself is comparatively seldom seen. I have never tried to keep this species in the aquarium, for its anti-actinial propensities are too well known; but in a small separate vessel of water it remains almost motionless, and dies in two or three days, perhaps for want of food. *Eolis papillosa* is a very protean species, and has been known under many synonyms. In the 'Annals of Nat. Hist.' (vol. ix. p. 34), an *Eolis* is described by Messrs. Alder and Hancock, under the specific name of *obtusalis,* which sometimes occurs upon the Egremont shore. This differs from the ordinary form of *E. papillosa* in being less than one-third the size and of a much lighter colour. But more extended observation led the ingenious authors to discard it as a species, and to consider it as a variety of *Eolis papillosa.*

Eolis coronata.—Of all the species of the genus *Eolis,* I know of none which combines elegance of form with delicacy of colouring in a more eminent degree than this; and it is the most common *Eolis* found in the Mersey. It may be taken in nearly all the localities, and all the year round, adhering to the under side of stones. It is a very active species, constantly moving about or swimming, with its foot uppermost, on the surface of the water, by a graceful but mysterious method of propulsion. It most resembles *Eolis Drummondi* in external appearance, but may be at once discriminated from it by the delicate dash of ultramarine which exists in the papillæ. In the aquarium it lives for some weeks, freely depositing its little convoluted circlets of spawn. Mr. Byerley informs me that, a few years since, some specimens found on the Egremont shore were sent to Mr. Alder, who pronounced them to be the darkest-coloured examples which had come under his notice. In the Mersey it seldom exceeds an inch in length.

Eolis Drummondi.—Next to the last, if not as common, is this species, which vies with it in elegance of form, though hardly perhaps in richness of colouring. It is met with in nearly all the localities, and at all seasons. The specimens found in the Mersey are usually of a fine brick-red colour and about an inch long; but at Leasowe, about two miles from its mouth, Dr. Edwards and myself have found them fully an inch and a half long, but of a paler colour. These large specimens much resemble *E. papillosa* in aspect, and are scarcely so handsome as the smaller ones. Indeed, in the Nudibranchiate family, we might almost say that size and beauty are in inverse proportion to one another; under a low magnifying power the minuter species exhibit delicacy of tint and texture far outrivalling those which do not require a glass for their examination. The *Eolis Drummondi* is one of the most active of the genus, constantly walking about, waving its long and most graceful tentacles, or swimming on the surface, and when disturbed, erecting by a sudden movement all the papillæ upon its back, "like quills upon the fretful porcupine." The papillæ of this and some other species, especially of *E. picta*, often fall off when the animal is about to die; and I have observed, in the case of *E. Drummondi*, a persistent vitality in the separated parts. For some time after they have fallen, the papillæ exhibit a vermicular motion, which, when examined under the microscope, is seen to be a general contraction, independent of any artificial stimulus.

Eolis Landsburgii.—It is gratifying to me to be able to record the estuary of the Mersey as a new locality for this exquisite little Nudibranch. As Dr. Edwards and myself were examining the Egremont shore at the beginning of the present month, the former picked up a specimen of the above *Eolis*. The very rich amethystine colour of the body at once referred it to the species *Landsburgii*; but on comparing it with the figure given by Alder and Hancock, we were a little puzzled by certain discrepancies. In the first place, the colour both of the body and papillæ was very much deeper and richer in our specimen than in the plate; that, however, was of minor importance. Secondly, the papillæ were much more numerous, as well as longer and more elegantly formed, than were those of the specimen figured; but on referring to their Appendix, the authors tell us that their figure was taken from an immature individual, the only one then known. The most striking difference, however, was in the tentacles. The specimen figured has the dorsal tentacles rather long, slender, and linear, and the oral tentacles a little longer than the dorsal; but in our specimen the oral tentacles were very short and thick, with transverse wavy markings, while the dorsal were nearly three times as long, arched forward, and presenting an outline not unlike an ibex-horn. This gave the animal so different an appearance that, having watched it for some hours and finding no change, I began to think it might be a new species; and as it seemed to be getting less lively, I made a careful coloured drawing of it, which kept me up till a late hour in the morning—intending, in case it died in the night, at all events to have Mr. Alder's opinion on the matter. Altogether it was six hours under observation, during which time the tentacles were as I have described them. The first glance bestowed upon it in the morning, however, dispelled the illusion; for it was crawling actively about in the vessel in which I had placed it—its tentacles no longer short and corrugated, but long and smooth, agreeing exactly with the description given by Messrs. Alder and Hancock, and the oral now exceeding the dorsal tentacles in length. It is probable that the strong light thrown upon it for examination with a low power of the microscope had produced the retraction of the tentacles which had so altered its appearance; and although I several times removed it for awhile from the light, it seemed to require some hours of darkness to restore it to its natural form. Another peculiarity of form of this specimen, and which I have not observed in any other *Eolis*, was that the posterior end of the body suddenly narrowed behind the last papillæ, and bore superiorly two or three small but very distinct and transparent papular elevations.

It was placed in the aquarium, where it lived a few days, after which it appeared to melt away; the papillæ fell off, and their rich-red colouring matter, imbibed by a multitude of eel-like creatures swarming about the mollusk, gave them all a similar tint. Its length was four-tenths of an inch.

Eolis concinna.—The only locality recorded for this small species by Messrs. Alder and Hancock is Whitley, Northumberland. To this I can add the Egremont shore, where, in February last, I found two specimens upon fronds of *Laomedea gelatinosa*, in company with other small species of Nudibranchs. I did not see their spawn, which by Mr. Alder's specimens was deposited out of the usual spiral form. They were about one-fifth of an inch long.

Eolis aurantiaca.—We have here a variety of this species, found upon the *Tubularia* growing upon the pontoons of the landing-stage in company with *Dendronotus, Doto coronata, Eolis coronata,* and *papillosa*, &c. The individuals taken in that locality were short and thick, the papillæ few and club-shaped, and very easily broken off. Altogether they were the least graceful Eolids which I have met with; and although they appeared to agree rather with Alder and Hancock's *Eolis aurantiaca* than with any other, still there was a difficulty—viz. that they were pale specimens, entirely free from any orange colour. I therefore forwarded some to Mr. Alder, who kindly wrote me word that he believed them to be specimens of *Eolis aurantiaca*, which they had found to vary considerably in colour since it received the name. The orange tip, however, though not invariable, is one of the most constant characters. The same species is found upon the Cheshire shore.

Eolis picta.—This very handsome species has been found by Dr. Edwards and myself in two localities, viz. Egremont, and under stones between New Brighton and Leasowe. At the former place I found large and richly coloured specimens fully three-quarters of an inch long. The papillæ of *Eolis picta,* though thick, are by no means without grace, and very buoyant; the animal itself is very active.

Eolis despecta.—I found this pretty little *Eolis* in February last, upon fronds of *Laomedea gelatinosa* growing in the rocky pools at Egremont, midway between high- and low-water mark. They were here in considerable numbers, in company with *Doto coronata* and one or two specimens of *Eolis concinna.* I have since found them not unfrequent in the same locality—well-marked individuals, in which the olive-green wavy line down the back and the pink ring round the tips of the eight papillæ were conspicuous. Its usual companion and allied species, *Eolis exigua,* I have hitherto searched for in vain. The length of my specimens was about one-sixth of an inch.

Embletonia pallida.—The last species of Nudibranch which I have to mention as occurring in the Mersey is a minute one, of which no figure appears in Alder and Hancock's work. It was described by them in the 'Annals' for August 1854, from specimens discovered by Mr. Price among sea-weeds upon the Birkenhead shore. "It differs," they say, "from the other British species in having a double series of papillæ on each side; the tentacles, too, are placed much nearer together; and the oral lobes are small and indistinct, being united over the head in front into a semicircular veil." Its length was only $\frac{1}{10}$ inch.

It certainly appears that the less common Nudibranchs are more or less gregarious in their habits. Among those who search for them, very different impressions are received regarding their numbers. One person may find several, and may record them as common, while another equally good searcher may be unsuccessful in finding any, and pronounces them very rare; the fact is that, for some reason or other, a certain section of these little creatures affect particular spots on the shore, and there resort in some numbers. If a person happen to pitch upon that spot, he may find several; another may pass a yard or two on one side or the other, and find none. The truth will probably lie between the two, and such species are most likely neither very rare nor very common; such are *Eolis picta,* and *Ancula cristata.* Some species, again, are widely dispersed over the whole coast, and even these congregate in particular spots in preference to others, though it is sometimes difficult to assign a cause for such assemblages; such are *Doris bilamellata, Doto coronata,* &c. Another group appear seldom or never to centralize themselves, being found at intervals over all the shore, such as *Eolis coronata* and *Drummondi* and *Doris proxima*; while a fourth section may be regarded as purely accidental visitors to the beach, being inhabitants of deeper water, such as *Tritonia Hombergii.*

There is therefore a great advantage in searching in company; for what is one upon a vast sea-shore! and how small a proportion of the stores upon a rocky beach can one person examine in the short duration of an unusual ebb! Not only is there a double chance of finding when two are at work, but the probability of a successful hunt is vastly increased by systematic and friendly combination.

46 Nelson Street, Liverpool,
April 18, 1859.

XLVI.—*On the* Pithécheir mélanure *of F. Cuvier.* By J. Van der Hoeven*.

In the year 1833, F. Cuvier published a figure derived from the French traveller and naturalist, Alfred Duvaucel, who had died some years previously at Madras. To this figure no notes had been appended by the traveller; and Cuvier was uncertain whether the species of mammal which it represented was from the north of Bengal or from the eastern parts of Sumatra. He named this species *Pithécheir mélanure,* and placed it, with some hesitation, amongst the Rodents†.

I am not aware that since that time anything relating to this species of mammal has been published. The *Rijks* Museum of Natural History has for several years been in possession of two specimens that seem to belong to this species—or at least, beyond doubt, stand in its neighbourhood. The only difference that I can discover appears to consist in the colour of the tail, which is not black, so that the name *mélanure* is not applicable to this animal. Still, this difference is perhaps to be attributed to the artist alone; at all events, it is of small significance.

The name *Pithécheir* may probably refer to the ape-like hands of the hinder extremities, and, by a bold contraction, stand for *Pithecochirus.*

* From the 'Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, Afdeeling *Natuurkunde,*' Deel ix. bl. 50.

† Histoire naturelle des Mammifères, avec figures coloriées, par M. Geoffroy Sainte-Hilaire et M. Fréderic Cuvier. Fol. Livraison 66.

Both the specimens in the Leyden Museum were derived from the Sunda Islands, the one from Java, the other from Sumatra. They have quite the air of a large species of the genus *Mus* proper, for instance *Mus decumanus*. The entire length of the animals, tail included, is full $3\frac{1}{2}$ decimetres. The fore feet have four fingers, and a short rudiment of a thumb with flat nail; the hind feet have the thumb somewhat free, standing apart from the other fingers, with a flat nail. The nails of the other fingers are sharp, curved, and pressed flat laterally. The tail is hairy at the base, elsewhere covered with rings of horny scales of an elongate quadrilateral form. The colour of the hair is red-brown on the back, yellowish grey along the sides, and towards the belly lighter (in the specimen from Java, whitish). Some long dark-brown bristles are set on the upper lip; they attain a length of 7 centimetres.

The skull is wanting. We can, however, scarcely entertain any doubt as to its form; and the teeth must resemble those of other species of the genus *Mus*, to which, in our opinion, the so-named *Pithécheir* must be referred, and of which this animal appears to form not more than a subgenus, or only an aberrant species, chiefly distinguished by the disposition of the hind feet, in which the thumb somewhat resembles that of the marsupial genus *Didelphis*. In the mean time, a positive determination can alone be given when the skull and teeth shall have become known to us. These short notes may serve to indicate the home of the *Pithécheir*, and at the same time perhaps supply an inducement to naturalists who happen to be in Java and Sumatra to turn their attention to this species of animal.

The specimen from Java is 0·360 metre long, of which the head forms about 0·048, the tail 0·175. The larger specimen from Sumatra is of a lighter red colour; it has a length of 0·395, of which the tail forms 0·186. The length of the tail is thus, in both specimens, somewhat less than the head and trunk together, and is to the whole length of the animal as 6 : 13, or thereabout. But these measurements, taken from stuffed skins, have only a relative value, and do not merit unlimited confidence.

XLVII.—*Characters of a new Burmese* Streptaxis *and of two forms belonging to a peculiar section of* Helix *collected by* Captain Richard H. Sankey, Madras Engineers. By W. H. Benson, Esq.

A small packet of shells, hastily collected in the vicinity of Moulmein, in the Tenasserim Provinces, by Capt. Sankey, during the most unfavourable period of the year, bears fresh testimony to the abundance and variety of the testaceous productions of that locality, and proves that it has been far from exhausted by the zealous researches made by Mr. Theobald and the American missionaries. Out of thirteen species sent, three are undescribed; and among the remaining ten appear *Helix pylaica*, *Megalomastoma gravidum*, *Pupina artata*, B., living examples of *Helix Achatina*, Gray, and a most beautiful specimen of the rare *Rhaphaulus Chrysalis*, Pfr., taken in a living state with the operculum, and with the tube in a much finer state of preservation than in Mr. Theobald's weathered specimen, noted in the 'Annals' for July 1856. The costulate surface of the shell exhibits a rich chestnut colour; the broadly expanded and sulcate peristome has a livid flesh-coloured tinge; the tube and back of the reflected peristome are whitish; and the neat, concave, five-spired, horny operculum presents a polished, resplendent yellowish horn-coloured surface.

I have some reason for believing that most, if not all of these shells, were collected in the neighbourhood of the stalactitic caverns in a singularly perforated limestone hill at Damathá, about twelve miles N.E. of Moulmein. Cavernous limestone in warm climates seems to be generally favourable to the production of land-shells of unusual forms. Of this we have examples in the cavern near Turon in Cochin China, and in that of Lubong Angin, near Sarawak in Borneo, explored by Mr. Hugh Low.

1. *Streptaxis Sankeyi*, B., n. s.

Testa oblique umbilicata, rhomboideo-ovata, confertissime costulato-striata, albida; spira vix laterali, depresso-conoidea, sutura impressa, apice obtusiusculo; anfractibus 7, primis 5 regularibus, subplanatis, antepenultimo subacute carinato, carina subtus compressa, 2 ultimis breviter deviantibus, ultimi basi circa umbilicum compressa; apertura obliqua, truncato-ovata, subtriangulari, lamella 1 parietali submediana prominente, breviter intrante, superne callo elevato ad labrum juncta, peristomate expanso, reflexo, marginibus subtus convergentibus, dextro superne attenuato, sinuato.

Diam. major 10, minor $6\frac{1}{4}$, axis 7 mill.

Habitat prope Moulmein.

Nearly related to the Mergui shell, *Str. exacuta*, Gould, but well distinguished by its more compact and upright form, open umbilicus, the absence of a second angular parietal fold, the want of compression of the keel on the upper side of the antepenultimate whorl, and in having, although smaller, an additional whorl.

In Mr. Cuming's specimen of *Str. exacuta* the antepenultimate keeled whorl suddenly increases in breadth in front, whereas in *Str. Sankeyi* the increase is gradual and regular in that part.

The form and obliquity of the aperture differ in the two shells; and the Mergui species is deficient in the compression of the base observable in the Moulmein shell. The same costulate striation prevails, and the apical whorls are smooth in both species. A single specimen of this very interesting form was obtained. It increases the number of known Tenasserim species to three.

2. *Helix Calias*, B., n. s.

Testa anguste umbilicata, orbiculato-depressa, oblique striatula, nitidula, pallide cornea; spira planata, apice saliente, sutura marginata, canaliculata, anfractibus 5 subconvexis, sensim accrescentibus, ultimo ad ambitum rotundato, subtus convexiusculo; apertura lunata, subverticali, peristomate recto, acuto, tenui, margine columellari primo oblique, tum verticaliter descendente, calloso, superne breviter expansiusculo, cum basali angulum fere rectum efformante, eo carinam acutam horizontalem circum umbilicum perspectivum ambientem, et spiraliter intrantem, emittente.

Diam. major 9, minor $7\frac{1}{2}$, axis 4 mill.

Habitat prope Moulmein.

Less than a month had elapsed from the date of my paper announcing the peculiar formation of the columellar lip and umbilicus in the Tenasserim *Helix forabilis*, B., when this shell reached me by the overland route, presenting, with a very different form, the same characteristic pillar lip and horizontal spiral keel at the umbilicus, on which I had so confidently relied for the future recognition of that species when it might be met with in a more perfect condition. The shell next to be described offers a still more exaggerated development of the same type at the basal angle; and, taken together, these shells may justly be regarded as types of a peculiar Southern Burmese section of the Naninoid group. In order to distinguish it from the forms named by Albers, Pfeiffer, and others, this section may, with the following characters, be designated by the term

Sophina, B.

Testa Naninoidea; columella callosa, declivis, cum margine basali angulum efformans, angulo, nonnunquam rimato, carinam, plus minusve acutam, umbilicalem emittente.

3. *Helix schistostelis*, B., n. s.

Testa perforata, globoso-depressa, tenui, irregulariter striatula, striis confertissimis spiralibus superne decussata, translucente, nitente, pallide cornea; spira brevi, apice elevatiusculo, obtuso, sutura impressa, marginata; anfractibus $4\frac{1}{2}$–$5\frac{1}{2}$, superne et infra convexiusculis, ambitu rotundato; apertura subrotundato-lunari, peristomate tenui, recto, acuto, margine columellari subverticaliter

descendente, calloso, triangulato-reflexiusculo, cum basali angulum effformante, ad angulum acute et profunde inciso; periomphalo pone rimam oblique compresso vel obtuse carinato.
Sp. descript. diam. major 11, minor 10, axis $6\frac{1}{2}$ mill.
Majoris imperfecti diam. major 16, minor $13\frac{1}{2}$, axis $8\frac{1}{2}$ mill.
Habitat prope Moulmein.

The singular rift at the base of the columella in this species reminds the observer of some of the *Helicinidæ**; yet the aspect of the shell and its evident affinity to *H. Calias* and *H. forabilis* proclaim its relation to *Helix*. The attention of the discoverer has been called to the acquisition of living specimens at a more favourable season, and to the observation of the main external characters of the animal.

Cheltenham, April 30th, 1859.

XLVIII.—*On the Nomenclature of the* Foraminifera. By W. K. Parker, M. Micr. Soc., and T. R. Jones, F.G.S.

I. *On the Species enumerated by Linnæus and Gmelin.*

In our former paper descriptive of some *Foraminifera* from the coast of Norway (Ann. & Mag. Nat. Hist. ser. 2. vol. xix. p. 273), we offered some general observations on the character and relations of these minute Rhizopodous creatures, especially pointing out the wide limits within which the species range under innumerable varieties of form and features. In this and some other papers which we hope to communicate from time to time, we propose to attempt the definition of some at least of the specific forms, and to settle the correct nomenclature of this interesting Microzoan group. In carrying out our intention of determining the true specific characters of the *Foraminifera*, we have necessarily had to compare the figures given by the older naturalists both with each other and with the more modern drawings published by others, as well as with the numerous specimens which we have of late been able to gather.

The principles which guide us in this examination have been already dwelt upon in the memoir above referred to, as well as in the paper on the *Miliolitidæ* by one of us in the 'Quarterly Journal of Microscopical Science,' No. 23. p. 53. We especially refer the reader to the introductory portions of the memoirs by

* The columellar slit in *Helix schistostelis* represents the corresponding feature in *Alcadia*, Gray, while the umbilical keel and columellar rift bear an analogical resemblance to those observable in *Stoastoma*, Adams. These two operculated genera inhabit the West Indies. The North American construction of *Helix pylaica*, B., was noticed in a former paper on Burmese *Helices*.

Carpenter* and Williamson† for a concise account of the progress of research in relation to the *Foraminifera,* and for able expositions of the principles which should guide the zoologist in working out the nature and history of their specific groups.

As one of our objects has been especially to determine the rightful specific names, we have commenced with the Linnæan names as given in the 12th edition of the 'Systema Naturæ‡.'

In the 12th edition, fifteen reputed species are enumerated; with one exception, they are grouped as "Nautili," coiled and straight; the other form is placed amongst the "Serpulæ." All of these species we can more or less easily recognize amongst our known forms, either by the aid of the figures in older works referred to, or by the description given.

Here we must give more credit to the older naturalists and the artists whom they employed than they have received at the hands of some, for their engravings of the *Foraminifera.* The style is always harsh; but frequently, when the figures have been carefully reproduced by tracings (the linear shadings being replaced by pencil-tints) and the lateral ground-shadows omitted, the specimens stand out as fair as in modern lithographs; and though sometimes deficient of a delicate characteristic, such as that of the septal aperture, yet they are always true as to outline and general features.

We have been able to refer to all the original figures quoted by Linnæus and Gmelin. In the case of Spengler's figures, as it happens that the first volume of the "Nye Samling" of the Danish Transactions in the British Museum is without the plates, and as we cannot find another copy of this work in London, we should have been without the means of thus closely completing the task we set ourselves, had not Prof. Forchhammer, of Copenhagen, most kindly and promptly acceded to our request that he would favour us with a pencil-copy of Spengler's figures. Our thanks are especially due to this eminent Danish naturalist for his courteous and energetic fulfilment of the request with which we troubled him. We may mention that some of Spengler's figures, reduced in size, are engraved in Wood's 'Catalogue of Shells,' pl. 13.

The generic terms applicable to these Linnæan species having been established at a much later date, by Defrance, Lamarck,

* Philos. Transact. 1856, pp. 181 & 547.

† Monograph Recent Foram. Gt. Britain, Ray Soc. 1858.

‡ According to Mr. Williamson (Monograph, p. 101), "Previous editions contain the Polythalamia ('Nautili') enumerated by other writers; but in the 9th, Linnæus separates them into species; in the 10th he gives them specific names; and in the 12th he attaches to them the synonyms of other authors."

D'Orbigny, and others, we have here appropriated them on the plan which we shall hereafter explain.

The idea that seems to have been present in Linnæus's mind when grouping these little Polythalamous shells had reference to the diminution of the coiled condition of form in passing from the Nautiloid *Cristellaria Calcar* to the moniliform and rod-like *Nodosaria Radicula* and *N. Fascia*. In this arrangement the relative position of the specific forms has seldom more than a distant relation to their typical value. We therefore do not bind ourselves to the acceptance of the first named of an allied group, as indicative of the typical value of such specific forms. Thus, in the Nodosarian forms, Nos. 281–288, which belong to one type-species, we do not choose either *Nodosaria Radicula* (the simplest) or *Nod. Raphanistrum* (the most perfect form), but *N. Raphanus*, which, among those that Linnæus catalogued, is the best as a well-developed model of Nodosarian growth, combining all the essential characters of the group,—the other Linnæan names being retained for the several varieties, to be used for the purpose of reference if occasion requires.

For a similar reason, we do not accept as a type-name for the species either *Planorbulina rugosa* (No. 277) or *Peneroplis umbilicatus* (No. 278), these being well adapted for the varieties for which they were respectively intended, whilst the type-forms of the species to which they belong will severally retain the names of *Pl. farcta* and *P. planatus* given to them by others.

In Mr. S. Hanley's 'Ipsa Linnæi Conchylia' (1855) are remarks on the "Nautili" of the 'Syst. Nat.,' as determined from Linné's manuscripts and Collection. These notices, though avowedly less elaborate than the remarks on the mollusks in the same volume, are very valuable, and bear witness to the author's acumen and conscientious care. In the new edition of Wood's 'Catalogue of Shells' (1856), Mr. Hanley has also removed many difficulties in the study of the Foraminifera figured in the works of the older naturalists, by most carefully tracing out "the pictorial synonymy" of the several species there illustrated, as far as the limits imposed by the character of the work permitted. We have to express our personal obligation to Mr. Hanley for favouring us with much assistance in our study of the Linnæan species.

(**A.**) Linné's *Nautilus Calcar* (1162. 274), being a well-developed symmetrical form, is a good type of the *Cristellariæ*. From this lenticular form we have divergent modifications, some of which affect the globular, others the discoidal and the crozier-like forms. The last of these are generally known as *Marginu-*

linæ. *C. cultrata* and *C. Cassis* are lenticular and discoidal shells with a marginal crest or keel very variable in extent. The terms *Robulina, Saracenaria,* and *Planularia* have been applied to some of the Cristellarian varieties.

In essential characters of structure and mode of growth, the *Cristellaria* and *Nodosaria* are one; and the *Glandulinæ, Lingulinæ, Dentalinæ, Rimulinæ, Vaginulinæ, Marginulinæ, Dimorphinæ, Flabellinæ,* and *Frondiculariæ* of authors necessarily fall in the same category. We propose to use the term *Nodosarina* as expressive of the type-species, including all the above. We adopt *Cristellaria* and *Nodosaria* as subspecific appellations,—the former comprising the spiral (or Nautiloid, Marginuline, and Flabelline) forms; the latter taking those that have a rectilinear or only slightly curvilinear arrangement of the loculi. It is impossible, however, to make a strict line of demarcation between the approximate members of the group, since the straight, the curved, and the spiral lose themselves in each other,—the amount of curvature and of spirality, and the greater or less closeness of the whorls being varying characters.

Cristellaria Calcar and its multitudinous varieties have a very wide geographical range, and occur fossil in the tertiary, cretaceous, oolitic, liassic, and upper triassic* strata. The finest living *Cristellariæ* occur in the Adriatic, and the finest fossil specimens in the tertiaries of Italy, Spain, and San Domingo. Large individuals, however, have been met with on the Norway coast, on the coast of New York, and on the Abrolhos Bank. Moderate-sized specimens are extremely numerous in the London Clay and in the Chalk. For the synonymy of *C. Calcar*, see our paper in the 'Annals,' *loc. cit.*, and especially Williamson's 'Monograph,' p. 29.

(**B.** *a.*) Of the *Nodosariæ* we find several varieties enumerated by Linnæus. The first in his list is *Nautilus obliquus* (1163. 281), established on a curved, tapering, ribbed *Nodosaria* figured by Gualtieri (Index Test. pl. 19. fig. N). *N. Raphanistrum* (1163. 282) and *N. Raphanus* (1164. 283) follow. These are slightly varying forms of the common, straight, ribbed *Nodosaria*,—the chambers varying in their relative number and their globosity (or, rather, in the closeness of their setting-on), the aperture varying from a central to a sublateral or excentric position, and the riblets varying in relative size and number.

The figures, by Plancus, Gualtieri, and Ledermüller, on which Linné founded his species, or which he referred to as synonymous, show these variations; and scarcely two individuals of this group of *Nodosariæ* can be found in nature presenting identical conditions in these respects; but all vary from the

* We have lately discovered numerous *Foraminifera* in the greenish clays of the New Red series near Derby.

moniliform to the fusiform and the cylindrical, from the sulcated to the many-ribbed, and from the straight to the curved,—showing, in this last circumstance, that *N. obliquus*, above referred to, is also one of the same variable group. *Nautilus Fascia* (1164. 286) is also a straight *Nodosaria* (figured by Gualtieri) with riblets, but possessing raised seams around the shell at the sutures of the chambers—a character that does not remove it from its congeners, this limbation or raised condition of the septal lines being an ordinary condition among the *Nodosarinæ* and other groups of *Foraminifera*, dependent on exogenous shell-growth, and not of specific value. *Nautilus Granum* (1164. 284) appears, from Linné's description, to be a short, straight, and ribbed *Nodosaria*, with oblique aperture, and thus represents a very common form of *Nodosaria* passing into the so-called *Glandulina*. Shells constructed similarly to the foregoing, but smooth, or nearly so, are named *Nodosaria Radicula* (Linn.) and *N. dentalina* (Lam.); and some compressed forms with obliquely-set chambers constitute the variety *N. Legumen* (Linn.).

The ribbed *Nodosariæ* (*N. obliqua, N. Raphanistrum, N. Raphanus, N. Fascia*, and *N. Granum*) and those destitute of ornament are only modifications of one variety, well typified by *N. Raphanus*, into or from which all the others may be traced, whether short and tapering or long and cylindrical, flattened, or subcylindrical, or like the well-grown *Nodosaria Raphanistrum*. In company with *N. Raphanistrum* we always find (as, for instance, in the tertiary sandy clays of Turin and Malaga) an immense variety of the forms above enumerated; and although *N. Raphanistrum* stands pre-eminently as the best-grown and most symmetrical, yet, on the principle which we intend to follow, of letting the published trivial names of the *Foraminifera* remain as indicative of the *species, subspecies*, and *varieties* intended by the authors who established them, and of adopting for the names of leading species and subspecies the appellations already given to the forms best exhibiting the typical characters (being therein guided by chronological circumstances when synonyms exist), we here adopt as the name of the subspecies *Nodosaria* that which Linnæus gave to the variety which best combines all the characters of the group.

Mr. Hanley has satisfactorily determined the *Nodosaria* denominated *Raphanistrum* by Linnæus, and has figured it in the 'Ipsa Linn. Conch.' pl. 5. f. 4. This proves to be the *Nodosaria Bacillum* of Defrance (Dict. Sc. Nat.) and the *N. æqualis* of Sowerby ('Genera' and 'Manual'). It was published in the 10th edition of the 'Syst. Nat.' without any reference to a figure; but in the 12th edition Linné referred to Ledermüller's pl. 4. f. *x* posterior, as the best published representation. This, though a dwarfish form, serves to link *N. Raphanus* with *N. Raphanistrum*.

(**B.** *b.*) A smooth *Nodosaria* appears in Linné's catalogue (1164. 285) as *Nautilus Radicula*. This is a very common form—the simple Nodosarian type—consisting of a series of smooth, gradually increasing, globose chambers, having the peculiar shell-tissue and the distinctive aperture belonging to the species. *Nodosaria Radicula* passes, by insensible gradations, on the one hand into the short, lumpy, Glanduline condition, and on the other into the elongate forms, moniliform or subcylindrical, straight or curved; it also frequently occurs flattened, becoming a *Lingulina*. In either case it puts on more or less freely the little raised lines or riblets of exogenous shell-matter which constitute the characteristic ornamentation of the *Nodosarinæ*. Had we chosen to adopt the simpler form of a species as the type (as Prof. Williamson has been inclined to do), *N. Radicula* would have well served for this purpose.

The delicate tapering and curved *Nodosariæ*, of which *Dentalina communis*, D'Orb., is a well-known form, do not appear to have been recognized by Linnæus or by Gmelin, although Ledermüller figured them in his 'Mikroskopische Augen- und Gemüths-Ergötzung,' 1761, pl. 4. figs. *o*, *p*, & pl. 8. fig. *l*. This form has been ranked by Lamarck as a species under the name *Nodosaria dentalina*, which we shall find useful.

The *Nodosariæ*, ribbed, smooth, and dentaline, are abundant in the Mediterranean and on most sea-coasts at certain depths; they abound in the London Clay, Chalk, Gault, and in the Kimmeridge, Oxford, Lias, and Upper Trias Clays. *Nodosariæ* occur also in the Carboniferous and Permian rocks. They are very fine in some of the Italian and Spanish tertiary beds and in those of San Domingo. In the Chalk and Gault also some fine individuals frequently occur.

(**B.** *c.*) *Nautilus Legumen* (1164. 288) is the well-marked *Nodosaria* (*Vaginulina*) *Legumen*. The *Vaginulinæ*, with their compressed obliquely-set chambers and lateral aperture, are conveniently separated from *Nodosaria* proper; but no real divisional line exists between the *Vaginulina* and *Nodosaria* (through the Dentaline forms) on one side, and *Cristellaria* (through the Marginulines) on the other.

The *Vaginulinæ* have a similar range to that of the *Nodosariæ*, excepting that they have not yet been found in any older rock than the Upper Trias.

(**C.**) Linné's *Nautilus crispus* (1162. 275), the *Polystomella* of Lamarck, is an easily recognizable form under variously modified conditions, chiefly as to its thickness and its sculpture; and it occurs on every coast.

(**D.**) *Nautilus Beccarii* (1162. 276) is the common form of the *Rotalia Beccarii* of the Mediterranean and Atlantic. This species has a world-wide range under many strikingly different modifications, which still retain their own peculiarities of structure, mode of growth, and ornamentation.

(E.) *Nautilus rugosus* (1162. 277) is not safely determinable, there being no figures to refer to, and the description being applicable to several Foraminifers. It appears most like the *Planulina Ariminensis* or the *Operculina complanata.* It is from the South Sea.

(F.) *Nautilus umbilicatus* (1163. 278) and *N. Semilituus* (1163. 280) are varieties of a species of *Peneroplis,* the type being the *Peneroplis planatus* (D'Orb.), a passable figure of which is given by Schröter in his 'Neue Litterat.' (1784), vol. i. pl. 1. fig. 7. Another specimen figured on the same plate (fig. 9) is a narrower form of *P. Semilituus,* the chambers being nearly cylindrical, and the shell well representing a crozier (*Lituus*); the *P. Semilituus* has its chambers flattened, so that the staff and head of the "crozier" are no longer formed of a cylindrical body; *P. umbilicatus* is also flattened, and does not possess the straight portion of the shell, being nautiloid, and representing only the head of the crozier, flattened; lastly, *P. planatus* has its latter chambers widely flattened out, and resembles in outline a bonnet rather than a crozier *.

D'Orbigny's *Dendritina* is also a true *Peneroplis,* without the straight portion, and not flattened. Some of the *Spirolinæ* of authors are *Peneroplides* with stick-like crozier-forms (some, however, belong to *Lituola*).

[*Nautilus Siphunculus* (1164. 287) has nothing to do with *Foraminifera,* but probably belongs to the *Serpulæ.* Soldani figures numerous specimens ("Tubuli armillati," &c.) varying in details; 'Testac. ac Zooph.' pl. 27.]

(G.) *Serpula Seminulum* (1264. 791) is the *Quinqueloculina Seminulum,*—a good type for the vastly numerous group of quinqueloculine *Miliolæ,* which occur in every sea.

Gmelin's edition of the 'Systema Naturæ' (1788) contains seven names of *Foraminifera* in addition to those given by Linnæus. These were determined on the evidences afforded by figures and descriptions by Spengler, Schröter, and Gronovius.

(H.) *Rotalia* (*Calcarina*) *Spengleri* is the *Nautilus Spengleri* (Gmelin, 3371. 10). This shell has been well figured also by Schröter (from the Adriatic), and by Fichtel and Moll (from the Indian and Red Seas). Spengler's specimen (Danske Skrift. N. S. vol. i. pl. 2. f. 9 *a–c*) was from Amboyna.

Lamarck's *Siderolites calcitrapoides* (Anim. sans Vertèb. vol. vii. p. 624) is the same species, from Maestricht.

* It has already been observed by Mr. Hanley (Ipsa Linn. Conch. p. 158) that Montagu's *N. Semilituus* is not that of Linnæus (after Plancus in Fabius Colonna's 'Phytobasis').

Calcarina Defrancii, D'Orb., from the Red Sea (Ann. Sc. Nat. vol. vii. p. 276. no. 3), is a delicate compressed variety of *Calcarina Spengleri,* with the spire apparent. Spengler figures this elegant form (*op. cit.* pl. 1. f. 3 *a–d*) from Coromandel.

Calcarina Calcar (D'Orb. Ann. Sc. Nat. vii. p. 276. no. 1; and Modèles, no. 34. 2e livraison), from Martinique, Isle of France, and Madagascar, is a variety of the same, with shorter spines. *Rotalia armata,* D'Orb. (Ann. Sc. Nat. vii. p. 273. no. 22; and Modèles, no. 70), from Cayenne and Martinique, and fossil at Chavagnes (Maine-et-Loire), near Nantes, and near Bordeaux, is a short-spined variety of the same species.

D'Orbigny gives three other names to forms of *Calcarina,* without figures or descriptions; they are from Port Jackson, the Isle of France, Rawack, and the Mariannes Islands.

Deshayes's *Calcarina rarispina* (Lyell's 'Manual,' 5th edit. p. 228. f. 236), from Grignon, is the same as *Rotalia armata,* D'Orb.

Calcarina is a subgeneric form of *Rotalia.*

Calcarina Spengleri has a wide distribution in the Mediterranean and tropical seas, and occurs fossil in the Eocene Tertiaries of France and in the Chalk of Maestricht.

[A form that has been mistaken for the *Calcarina Spengleri,* but more allied to the Sponges in its mode of growth, occurs fossil at Palermo, San Domingo, &c., and recent at the Fiji Isles and New Zealand.]

(**I.**) *Nautilus unguiculatus* (3372. 11), founded on Spengler's specimen (Kong. Danske Vid. Selsk. Skrift. Nye Saml. vol. i. p. 381. pl. 2. f. 9 *d*), is a six-spined *Polystomella crispa,* from the East Indies. This beautiful variety (*P. Regina,* D'Orb.) is not common. It occurs fossil in the Vienna Tertiaries, and in the Eocene beds at Baljik, Bulgaria, on the Black Sea. (See Wood's Cat. pl. 13. f. 18.)

(**J.**) *Nautilus Lituus* (3372. 13), figured and described by Spengler (as *Nautilus rectus*), from the Red Sea, is a delicate *Peneroplis* with narrow subcylindrical chambers throughout,—forming a small crozier-like body, instead of the flatter and bonnet-like shell of *P. planatus* (see Wood's Cat. pl. 13. f. 20). It is the *Spirolina cylindracea* of Lamarck, and is common in the Mediterranean and Indian Seas, and in the Grignon Tertiaries. Spengler has figured two other intermediate varieties of *Peneroplis* (*op. cit.* pl. 1. f. 4, 5), both from the Red Sea. *P. planatus* is widely distributed in the warmer seas.

(**K.**) *Nautilus inæqualis* (3373. 20), founded on Spengler's figure and description (*Nautilus rectus*), is a straight, attenuated form of *Vertebralina* (*Articulina*) *striata.* It is from the Red Sea. (See Wood's Cat. pl. 13. f. 32.) This uniserial form of *Vertebralina* is common in the Red Sea, and in the Tertiary beds at Baljik and Grignon.

(**L.**) *Serpula nautiloides* (3739. 1) is undoubtedly, as shown by

Schröter's figure (Neue Litterat. vol. iii. p. 283, pl. 3. figs. 22, 23), an attached specimen (with the lower side of the chambers imperfect) of that form of *Lituola* which we termed *Placopsilina* in our memoir on some *Foraminifera* from Norway (*op. cit.* p. 29). It was found affixed to the "Madrepora prolifera" from the coast of Norway.

Lituola nautiloides is one of an immense group of varieties, of which the type is *Lituola nautiloidea*, Lamarck. These are found in every sea, and very frequently in the fossil state; they occur both fixed and free.

(**M.**) *Nautilus helicites* (3371.6), figured by Schröter (Vollständige Einleitung, &c. vol. iv. (1784) pp. 368 & 377, pl. 10. fig. 2), is possibly an *Amphistegina*. It is from the Chalk of Maestricht.

(**N.**) *Nautilus Beccarii β. ammonoides* (Gmelin, 3370.4; Gronov. Zoophyl. 1781, p. 282, and Tabularum Explic. p. v. pl. 19. figs. 5, 6) and *N. Balthicus* (Gmelin, 3370.5; Schröter, Naturforscher, 1782, vol. xvii. p. 120; and 'Einleitung Conch.' vol. i. p. 20) are referable to the Foraminifer usually known as *Operculina complanata*, Basterot, sp., which is the best form of this variety, and attains a large size at the Philippine Isles and New Zealand, and occurs also in the Mediterranean and Atlantic, and abundantly in some of the tertiary strata. Gronovius's specimens were in sea-sand from Bengal; Schröter's from the Baltic, attached to the root of a Fucus. *Operculina* is a subgeneric form of *Nummulina*.

Tabular List of the Foraminifera *enumerated by* Linné *and* Gmelin.

Linnæan Names.	Typical Species and Subspecies.		
Nautilus Calcar, *L.*	Cristellaria Calcar		Nodosarina.
—— obliquus, *L.*	Nodosaria (Dentalina)	N. Raphanus	Nodosarina.
—— Raphanistrum, *L.*	Nodosaria	N. Raphanus	Nodosarina.
—— Raphanus, *L.*	Nodosaria	N. Raphanus	Nodosarina.
—— Fascia, *L.*	Nodosaria	N. Raphanus	Nodosarina.
—— Granum, *L.*	Nodosaria	N. Raphanus	Nodosarina.
—— Radicula, *L.*	Nodosaria	N. Raphanus	Nodosarina.
—— Legumen, *L.*	Vaginulina (Dentalina)	N. Raphanus	Nodosarina.
—— crispus, *L.*	Polystomella crispa.		
—— Beccarii, *L.*	Rotalia Beccarii.		
—— rugosus, *L.*	[?Planulina Ariminensis *vel* Operculina complanata?]		
—— umbilicatus, *L.*	Peneroplis	P. planatus.	
—— Semilituus, *L.*	Peneroplis	P. planatus.	
Serpula Seminulum, *L.*	Miliola (Quinqueloculina) Seminulum.		
Nautilus Spengleri, *Gm.*	Rotalia (Calcarina) Spengleri.		
—— unguiculatus, *Gm.*	Polystomella crispa.		
—— Lituus, *Gm.*	Peneroplis planatus.		
—— inæqualis, *Gm.*	Vertebralina (Articulina) striata.		
Serpula nautiloides, *Schr.*	Lituola (Placopsilina) nautiloidea.		
Nautilus helicites, *Schr.*	[?Amphistegina *vel* Operculina?]		
—— Beccarii β. ammonoides, *Gm.*	Nummulina (Operculina) complanata.		
—— ammonoides, *Gron.*	Nummulina (Operculina) complanata.		
—— Balthicus, *Schr.*	Nummulina (Operculina) complanata.		

XLIX.—*Remarks on the use of the Signs of Accent and Quantity as Guides to the Pronunciation of Words derived from the Classical Languages, with particular reference to Zoological and Botanical Terms.* By R. G. Latham, M.D., F.R.S. &c.

The text upon which the following remarks have suggested themselves is the "Accentuated List of the British Lepidoptera," with Hints on the Derivation of the Names," published by the Entomological Societies of Oxford and Cambridge; a useful contribution to scientific terminology—useful, and satisfied with being so. It admits that naturalists may be unlearned, and provides for those who, with a love for botany or zoology, may have been denied the advantage of a classical education. That there are many such is well known; and it is also well known that they have no love for committing themselves to the utterance of Latin and Greek names in the presence of investigators who are more erudite (though, perhaps, less scientific) than themselves. As a rule, their pronunciation is inaccurate. It is inaccurate without being uniform—for the ways of going wrong are many. Meanwhile, any directions toward the right are welcome.

In the realities of educational life there is no such thing as a book for unlearned men—at least no such thing as a good one. There are make-shifts and make-believes *ad infinitum*; but there is no such an entity as an actual book. Some are written down to the supposed level of the reader—all that are so written being useless and offensive. Others are encumbered with extraneous matter, and, so encumbered, err on the side of bulk and superfluity. Very rarely is there anything like consistency in the supply of information.

The work under notice supposes a certain amount of ignorance—ignorance of certain accents and certain quantities. It meets this; and it meets it well. That the work is both a safe and reliable guide, is neither more nor less than what we expect from the places and persons whence it has proceeded.

It is likely, from its very merits, to be the model on which a long line of successors may be formed. For this reason the principles of its notation (for thus we may generalize our expression of the principle upon which we use the signs of accent and quantity as guides to pronunciation) may be criticised.

In the mind of the present writer, the distinction between accent and quantity has neither been sufficiently attended to nor sufficiently neglected. This is because, in many respects, they are decidedly contrasted with, and opposed to, each other; whilst, at the same time—paradoxical as it may appear—they are, for the majority of practical purposes, convertible. That inadvertence on these points should occur, is not to be wondered at. Professional grammarians—men who deal with the purely philological questions of metre and syllabification—with few exceptions, confound them.

In English Latin (by which I mean Latin as pronounced by Englishmen) there is, in practice, no such a thing as quantity; so that the sign by which it is denoted is, in nine cases out of ten, superfluous. *Mark the accent, and the quantity will take care of itself.*

I say that there is no such a thing in English Latin as quantity. I ought rather to have said that

English quantities are not Latin quantities.

In Latin, the length of the syllable is determined by the length of the *vowels and consonants combined.* A long vowel, if followed in the same word by another (*i. e.* if followed by no consonant), is short. A short vowel, if followed by two consonants, is long. In English, on the other hand, long vowels make long, whilst short vowels make short, syllables; so that the quantity of a syllable in English is determined by the quantity of the vowel. The *i* in *pius* is short in Latin. In English it is long. The *e* in *mend* is short in English, long in Latin.

This, however, is not all. There is, besides, the following metrical paradox. A syllable may be made long by the very fact of its being short. It is the practice of the English language to signify the shortness of a vowel by doubling the consonant that follows. Hence we get such words as *pitted, knotty, massive,* &c.—words in which no one considers that the consonant is actually doubled. For do we not pronounce *pitted* and *pitied* alike? Consonants that appear double to the *eye* are common enough. Really double consonants—consonants that sound double to the ear—are rarities, occurring in one class of words only—viz. in compounds whereof the first element ends with the same sound with which the second begins, as *soul-less, book-case,* &c.

The doubling, then, of the consonant is a conventional mode of expressing the shortness of the vowel that precedes, and it addresses itself to the eye rather than the ear.

But does it address itself to the *eye* only? If it did, *pitied* and *pitted,* being sounded alike, would also be of the same quantity. We know, however, that to the English writer of Latin verses they are not so. We know that the first is short (*pĭtied*), the latter long (*pītted*). For all this, they are sounded alike: so that the difference in quantity (which, as a metrical fact, really exists) is, to a great degree, conventional. At any rate, we arrive at it by a secondary process. We know how the word is spelt; and we know that certain modes of spelling give certain rules of metre. Our senses here are regulated by our experience.

Let a classical scholar hear the first line of the Eclogues read—

Patulæ tu Tityre, &c.,

and he will be shocked. He will also believe that the shock fell on his ear. Yet his ear was unhurt. No sense was offended. The thing which was shocked was his knowledge of the rules of prosody—nothing more. To English ears there is no such a thing as quantity—not even in hexameters and pentameters. There is no such thing as quantity except so far as it is accentual also. Hence come the following phænomena—no less true than strange,—viz. (1) that any classical metre written according to the rules of quantity gives (within certain narrow limits) a regular recurrence of accents; and (2) that, setting aside such shocks as affect our knowledge of the rules of prosody, verses written according to their accents only give metrical results. English hexameters (such as they are) are thus written.

In the inferences from these remarks there are two assumptions: 1st, that the old-fashioned mode of pronunciation be adhered to; 2nd, that when we pronounce Greek and Latin words as they are pronounced in the recitation of Greek and Latin poetry, we are as accurate as we need be. It is by means of these two assumptions that we pronounce *Tityre* and *patulæ* alike; and I argue that we are free to do so. As far as the ear is concerned, the *a* is as long as the *i*, on the strength of the double *t* which is supposed to come after it. It *does* not indeed so come; but if it did, the sound would be the same, the quantity different (for is not *patulæ* pronounced *pattule* ?). It would be a quantity, however, to the eye only.

This pronunciation, however, may be said to be exploded; for do not most men under fifty draw the distinction which is here said to be neglected? Do not the majority make, or fancy they make, a distinction between the two words just quoted? They may or they may not. It is only certain that, subject to the test just indicated, it is immaterial what they do. Nine-tenths of the best modern Latin verses were written under the old system—a system based not upon our ear, but on our knowledge of certain rules.

Now it is assumed that the accuracy sufficient for English Latin is all the accuracy required. Ask for more, and you get into complex and difficult questions respecting the pronunciation of a dead language. Do what we will, we cannot, on one side, pronounce the Latin like the ancient Romans. Do what we will, so long as we keep our accents right, we cannot (speaking Latin after the fashion of Englishmen) err in the way of quantity—at least, not to the ear. A short vowel still gives a long syllable; for the consonant which follows it is supposed to be doubled.

Let it be admitted, then, that, for practical purposes, *Tityre* and *patulæ* may be pronounced alike, and the necessity of a large class of marks is avoided. Why write, as the first word in the book is written, *Pāpiliō'nidæ*? Whether the initial syllable be sounded *papp-* or *pape-* is indifferent. So it is whether the fourth be uttered as *-own-*, or *-onn-*. *As far as the ear is concerned*, they are both long, because the consonant is doubled. In Greek, πᾰππιλλιόννιδαι is as long as πᾱπιλλιώνιδαι.

Then comes *Machā'on*, where the sign of quantity is again useless, the accent alone being sufficient to prevent us saying either *Mákkaon* or *Makaón*. The *a* is the *a* in *fate*. We could not sound it as the *a* in *fat* if we would.

Pīeridæ.—What does the quantity tell us here? That the *i* is pronounced as the *i* in the Greek πίονος, rather than as the *i* in the Latin *pius*. But, in English Latin, we pronounce both alike. Surely *Pi'eris* and *Pie'ridæ* tell us all that is needed.

Cratæ'gī.—Whether long or short, the *i* is pronounced the same.

Sinā'pis, Rā'pæ, and *Nā'pi.*—The (¯) here prevents us from saying *Ráppæ* and *Náppi*. It would certainly be inelegant and unusual to do so. Tested, however, by the ear, the words *ráppæ* and *náppi* take just the same place in an English Latin verse as *rápe-æ* and *nápe-i*. Is any one likely to say *sináppis*? Perhaps. There are those who say *Dianna* for *Diana*. It is very wrong to do so—wrong, not to say vulgar. For the purposes of metre, however, one is as good as the other; and herein (as aforesaid) lies the test. The real false quantities would be *Díana* and *sínnapis*; but against these the accent protects us. Nor is the danger of saying *sináppis* considerable. Those who say *Diánna* are those who connect it with *Anna* and would, probably, spell it with two *n's*.

Cardamī'nēs.—All that the first (¯) does here is to prevent us saying *cardami'nnes*. The real false quantity would be *carda'mmines*. The accent, however, guards against this.

The second (¯) is useful. It is certainly better to say *cardamín-ees* than *cardamín-ess*, because the *e* is from the Greek η. And this gives us a rule. Let the (¯) be used to distinguish η from ε, and ω from ο, and in no other case. I would not say that it is necessary to use it even here. It is better, however, to say *Macháōn* than *Macháŏn*. By a parity of reasoning, the (˘), rejected in the work before us, is sometimes useful. Let it be used in those derivatives where ε replaces η, and ο replaces ω;

e. g. having written *Machaōn,* write, as its derivative, *Machaŏnidæ* —*i. e.* if the word be wanted.

This is the utmost for which the signs of quantity are wanted for English Latin. I do not say that they are wanted even for this.

One of the mechanical inconveniences arising from the use of the signs of quantity is this—when a long syllable is accented, two signs fall upon it. To remedy this, the work before us considers that the stress is to be laid on the syllable *preceding the accent.* Yet, if an accent mean anything, it means that the stress fall on the syllable which it stands *over.*

A few remarks upon words like *Pīeridæ,* where the accent was omitted.—Here two short syllables come between two long ones. No accent, however, is placed over either. Evidently, quantity and accent are so far supposed to coincide, that the accentuation of a short vowel is supposed to make it look like a long one. It is a matter of fact, that if, on a word like *Cassiŏpe,* we lay an accent on the last syllable but one, we shock the ears of scholars, especially metrical ones. Does it, however, lengthen the vowel? The editors of the work in question seem to think that it does, and, much more consistent than scholars in general, hesitate to throw it back upon the preceding syllable, which is short also. Metrists have no such objection; their practice being to say *Cassíope* without detriment to the vowel. The entomologists, then, are the more consistent.

They are, however, more consistent than they need be. If an accent is wanted, it may fall on the shortest of all possible syllables. Granting, however, that *Cassiópe* (whether the *o* be sounded as in *nōte* or *nŏt*) is repugnant to metre, and *Cassíope* to theory, what is their remedy? It is certainly true that *Cássiope* is pronounceable. Pope writes—

"Like twinkling stars the *miscellanies* o'er."

No man reads this *miscéllanies*; few read it *míscellánies.* The mass say *mis'cellanies.* Doing this, they make the word a quadrisyllable; for less than this would fall short of the demands of the metre. They also utter a word which makes *Cas'siope* possible. Is *Cássiope,* however, the sound? Probably not. And here the authors must speak for themselves :—

"Take, *e. g., Cassiope* and *Corticea* : in words like the former of these, in which the last syllable is long, there is no greater difficulty of pronunciation in laying the stress upon the first syllable than upon the second."

True! but this implies that we say *Cássiopé.* Is *-e,* however, one bit the longer for being accented, or can it bear one iota more of accent for being long? No. Take *-at* from *peat,* and

-t from *pet,* and the result is *pe*—just as long or just as short in one case as the other.

The same power of accenting the first syllable is "particularly the case in those words in which the vowel *i* can assume the power of *y*. Latin scholars are divided as to the proper accentuation of *mulieres, Tulliola,* and others: though custom is in favour of *muli'eres, mul'ieres* appears to be more correct." Be it so. Let *mulieres* be *múlyeres.* What becomes, however, of the fourth syllable? The word is no quadrisyllable at all. What is meant is this:—not that certain quadrisyllables with two short vowels in the middle are difficult to accentuate, but that they are certain words of which it is difficult to say whether they are trisyllables or quadrisyllables.

For all practical purposes, however, words like *Cassiope* are quadrisyllables. They are, in the way of metre, choriambics; and a choriambic is a quadrisyllable foot. They were pronounced *Cassíope,* &c., by English writers of Latin verses—when Latin verses were written well.

Let the pronunciation which was good enough for Vincent Bourne and the contributors to the Musæ Etonenses be good enough for the entomologists, and all that they will then have to do is not to pronounce *cratægum* like *stratagem, cardamines* like *Theramenes,* and *vice versâ.* Against this, accent will ensure them—accent single-handed and without any sign of quantity—*Cardamínes, Therámenes, cratǽgum, strátagem.*

L.—*Descriptions of new and little-known species of Ceylonese Nudibranchiate Mollusks.* By Dr. E. F. Kelaart*.

[Concluded from p. 304.]

Fam. Tritoniadæ.

Genus Melibœa, Rang.

Animal elongated, with a narrow channeled foot and long slender tail; sides of the back with pairs of tuberculated lobes, easily deciduous. Tentacles cylindrical, retractile into long trumpet-shaped sheaths. Head covered by a lobe-like veil. Sexual orifices behind right tentacle; excretory behind first gill on the right side.—*Woodward.*

Melibœa viridis, Kel.

Animal gelatinous, transparent, of a greenish vitreous colour. Body covered with hairy filaments. Head small, nearly cir-

* From the Journal of the Ceylon Branch of the Royal Asiatic Society for 1858.

cular, covered with filaments. Veil large and very expansive; circular opening lined with cilia. Tentacles two, about $\frac{3}{8}$ths of an inch long; capsule small, covered with filaments. Branchiæ six or seven on each side, unequal, wedge-shaped, placed alternately; base broad, slightly pedunculated, covered with cilia and filaments, giving it a very hairy appearance; base brown; the other parts greenish and speckled with dirty white. Foot narrow, of a pinkish colour on the edge; upper surface covered with short filaments. Nearly 3 inches long.

Found on weeds near Inner Harbour; not common; swims very actively. The veil over the head is used as a net, doubtless to entangle its prey. The opening is very dilatable. Deposits its white ova in a flat mass.

Scyllæa (?) *Dracæna*, Kel.

Animal green, elongated, narrow. No mantle. Two tentacles placed anteriorly on the side of the head, non-retractile; tentacles folded or cylindrical, slightly granular. On the centre of the back there are *three* unequal, wing-like, denticulated lobes, of a green colour, with tooth-like processes, tipped with red; sides of the posterior half of body also toothed, with two lines of small, pointed, red-tipped tubercles. Foot narrow, channeled. Mouth protected by two small semi-orbicular flaps or veils. Orifice on right side. Length nearly 1 inch.

I have some doubts as to the propriety of placing this species under the genus *Scyllæa*. I could not discover any tufted branchiæ on the surface of the dorsal lobes. I propose naming this genus (closely allied to *Glaucus*), if new, in honour of Dr. Templeton, late of the Royal Artillery (brother of the Belfast Naturalist), who has contributed considerably to the fauna of Ceylon.

I have found only one specimen, on a branch of sea-weed. It looked at first like a piece of green weed, but on placing it in fresh sea-water the lobes expanded and waved about very briskly. The red tips of the lobes contrasted beautifully with the bright green of the animal. It lived only a few hours.

Polycera (?) *ceylonica*, Kel.

Body $\frac{1}{2}$ inch long. No distinct mantle. Head covered by a membranous fimbriated veil; the long filaments slightly toothed. Veil continuous, with narrow membranous expansions on the sides of the body, which are united at the tail. Large fimbriated filaments also on the sides of the body. A membranous crest runs on the medial line of back. Dorsal tentacles retractile within a sheath, clavate, laminated, incurved at the tip; brown, white-tipped. Oral tentacles white, broad and short. Branchial plumes five, short, bipinnated, retractile, placed in a circle in the centre of the back, near the third pair of dorsal filaments. Colour above bright orange-red; beneath whitish, with red specks seen through the transparent foot. Ova bright red, in narrow coils. The whole animal is scarcely 1 inch long, and its broadest part not more than $\frac{3}{8}$ths of an inch.

I have placed this species, very doubtfully, under the head of *Polycera*. I believe there is sufficient reason to make a new genus of this pretty little creature. The transparent membranous expansion is fully extended when the animal swims, which it does more freely than any known species. For ten or fifteen minutes it will keep floating and moving its body like an eel in the water. Very rare; a few specimens lived for many months in my vivarium.

Fam. **Eolidæ.**

Animal with papillose gills arranged along the sides of the back. Tentacles sheathless, non-retractile. Lingual teeth 0·1·0. Ramifications of the stomach and liver extending into the dorsal papillæ. Excretory orifices on the right side. Skin smooth, without spicula. No distinct mantle.

Eolis Husseyi*, Kel.

Tentacles four; both pairs of the same form, but the anterior ones longer, of a limpid orange hue tipped with white. Back of a dull orange-brown colour; a triangular white space behind the dorsal tentacle. Branchiæ numerous, in three rows on each side of body, white and ringed with light purple; tip white. Foot dilated anteriorly; no lateral processes.

Rare. Named in memory of a departed and beloved companion of my earliest scientific labours.

Eolis bicolor, Kel.

Body $\frac{3}{8}$ inch long, slender, waxy white; a dusky spot on neck anterior to dorsal tentacles. Dorsal tentacles short, smooth, transparent white at base, corrugated or laminated at apex, of a deep orange-red colour, becoming darker at the tip. Oral tentacles twice as long, pellucid white throughout, tapering, curved. Head small, rounded. Branchiæ medium-sized, narrow, acutely pointed, white with a subterminal orange-red ring, apex waxy white; they are set in six or

* Etym. Æolis, daughter of Æolus.

seven small clusters, the anterior ones composed of thirty-four or more branchiæ; the others of two, rarely of three; becoming smaller as they approach the tail. Foot linear, white, transparent, slightly expanded in front.

Found among sea-weed in Back Bay, Trincomalee.

Eolis effulgens, Kel.

Tentacles four; two dorsal moderately long, laminated obliquely, dark orange tipped with white; the two anterior ones orange, with a whitish spot in centre and tipped with white; a dark shade behind dorsal tentacle. Branchiæ in five or six clusters on each side of back, the anterior clusters consisting of twelve or fifteen narrow obtusely pointed branchiæ; orange-red at base, ringed with white and orange, tip white, a bluish line running longitudinally for nearly two-thirds of its length.

Found in great number in Dutch Bay, and other parts of the sea near Fort Frederick. Spawns in June and July. Ova white, in narrow thready coils.

Eolis Paulinæ, Kel.

Tentacles four; two dorsal red, wrinkled; the two terminal tentacles pinkish, tip red, base white. Branchiæ reddish, numerous, short; the anterior ones have a whitish central ring and are tipped with red; the posterior ones of a redder colour, more broadly tipped with red, the central white ring less distinct. Foot expanded, with a short triangular-pointed process. Length $3\frac{1}{2}$ lines.

Eolis tristis, Kel.

Four tentacles; two dorsal about half the size of the two anterior ones, white with blackish rings. Body white; an interrupted blackish line on each side of back. Branchiæ in clusters of three or four, short, pointed, white, and ringed with black. Foot slightly expanded, and notched anteriorly. Length about 3 lines.

Found on sea-weed in one of my aquaria. Ova white.

Eolis nodulosa, Kel.

Four tentacles; opake white; dorsal long, pyramidal-pointed, with three nodular rings; oral tentacles short, narrow-pointed, white with a yellowish shade. Head and back white. Branchiæ in five small clusters on each side, long, nodular, obtusely pointed, opake white, and spotted indistinctly with light orange-brown; base darker. Foot slightly contracted anteriorly. Length about $\frac{1}{2}$ an inch.

Eolis Smedleyi, Kel.

Dorsal tentacles pyramidal, ringed, of a dusky grey colour; oral tentacles long, pointed, white, with a central red ring. Branchiæ in five small clusters on each side; the anterior pair the largest. Papillæ short, conical, white, and ringed with grey. Foot long, with anterior tentacular processes. Length 4 or 5 lines.

I have named this species in remembrance of one who was a frequent visitor of my "Aquarian establishment," and who took a warm and friendly interest in all my scientific pursuits. This small *Eolis* was discovered on some sea-weed growing in a vivarium.

Genus Proctonotus, A. and H.

Animal oblong, depressed, pointed behind. Dorsal tentacles two, linear, simple, with eyes at their base behind; oral tentacles short. Head covered by a small semilunar veil; mouth with horny jaws; gills papillose, on ridges down the sides of the back and round the head in front; vent dorsal.—*Woodward.*

Proctonotus orientalis, Kel.

Animal semigelatinous, greenish. Dorsal tentacles two, bifurcated and retractile; oral tentacles short, pointed. Branchiæ: four or five rows on each side of body, those nearest the body smaller; wedge-shaped, rounded superiorly, flattened; green, spotted with grey and green. Branchiæ carried round the head in two or three rows; middle ones longer; all of the same shape. Foot broad, long, grooved beneath. Length $2\frac{1}{2}$ inches. Ova white, in waved thread-like coils.

This exceedingly interesting animal may perhaps occupy a new generic place, as I do not observe the *bifurcated dorsal branchiæ* noticed in the other species of the genus *Proctonotus*. When coiled up, it looks like a flower with green petals.

Found in Trincomalee, in May and July.

Pterochilus viridis, Kel.

Animal light green. Length $\frac{1}{2}$ inch. Tentacles two, simple, long, pointed. Head with small lateral lobes. Branchiæ very numerous, closely set, long, linear, acutely pointed, green, and spotted with darker green and grey. Foot linear.

Found on sea-weeds, and, owing to its colour, not easily recognized. Lives for a long time in confinement. Ova green.

Fam. **Elysiadæ.**

Genus Elysia, Risso.

Animal elliptical, depressed, with wing-like lateral expansions. Tentacles simple, with sessile eyes behind them. Foot narrow.

Elysia grandifolia, Kel.

Head and body light green; white-, and occasionally black-spotted. Head and neck naked. Tentacles two, folded longitudinally on side of head; bronzed green, tip brown. Buccal tentacles two, small. Membranous wing-like expansion on each side of body, broad anteriorly, acutely pointed posteriorly, and united at the tail. Membrane green, edged with a black and a golden-yellow line. No distinct foot. Orifice on the back (?). Mouth beneath.

The whole animal gives one the idea of a large leaf; and when moving, that of a butterfly. Found on sea-weed. Some are more than 3 inches long; greatest transverse diameter, with wings expanded, $2\frac{1}{2}$ inches. Distinct veins, filled with fluid, seen on the wings; the heart pulsating on the centre of the back. I have some doubts as to the propriety of placing this interesting creature in the genus *Elysia*. If on further investigation it is found that it does not belong to any known genus, I propose naming it *Hydropsyche**.

Elysia punctata, Kel.

Smaller than the last species, largest specimen seen measuring $1\frac{1}{2}$ inch. Animal of a lighter green colour. Tentacles dark brown, spotted with white. Back whitish green, dotted with black and green. Edge of mantle black, and shaded with golden; under surface of wings tubercular, and dotted with black.

Found on sea-weed. Not easily distinguished from the young of *E. grandifolia*.

Elysia cærulea, Kel.

Tentacles two; blue, with a central red ring, tip blackish. Body and wings blue; under part of head and fore part of foot red; edge of wing lined with black and red lines, the latter outermost.

This is a very small beautiful species, about $\frac{3}{4}$ inch long; when the wings are folded, it is not thicker than a crow's quill. Found on sea-weed in the Inner Harbour. All three species have the same generic characters, and doubtless belong to the same genus.

* This name is already used for a genus of Trichopterous Insects.—W. S. D.

Order INFEROBRANCHIATA.

Genus Phyllidia, Cuv.

Animal oblong, covered with a coriaceous tuberculated mantle. Dorsal tentacles clavate, retractile into cavities near the front of the mantle. Mouth with two tentacles. Foot broadly oval. Gills forming a series of laminæ extending the entire length of both sides. Excretory orifice in the middle line, near the posterior end of the back, or between the mantle and foot. Reproductive organs on the right side. Stomach simple, membranous.

Phyllidia zeylanica, Kel.

Mantle tubercular, salmon-coloured; three continuous black lines run round the whole length; the internal one broader, taking within its circuit the dorsal tentacles and anal orifice; two other lines run parallel to this all round the mantle, the outer one narrowest. Dorsal tentacles large, conical, pointed, circularly laminated at the upper half, which is of a black colour. The two oral tentacles small, black. Foot whitish, notched in front; the blackish viscera seen through. Branchiæ whitish on the sides of the body except in front. Anal opening on a black-coloured tube, behind which there are four or five large tubercles, of the same form as those on the other parts of the mantle. Length 1 inch; $\frac{1}{8}$ inch broad.

Very rare.

Genus Diphyllidia, Cuv.

Syn. *Linguella*, Blainv.

Animal oblong. Mantle ample. Gills limited to the hinder two-thirds of the body. Head with minute tentacles and a lobe-like veil. Vent at the right side, behind the reproductive orifices? Lingual teeth 30·1·30.

Diphyllidia formosa, Kel.

Body pink. Mantle leaf-like, dark purple, with purplish-black shades; edge yellow, streaked longitudinally with golden yellow (broad lines alternating with very delicate narrow ones). Veil purple-black, except the anterior edge; beneath, of a lively pink colour. Foot pink, grooved in the median line of posterior half. Branchiæ buff; a whitish spot on anterior third of plumes. Dorsal tentacles emerging through notches on anterior edge of mantle; tentacles red, with blackish tips and sides. No oral tentacle. Length $2\frac{1}{2}$ inches; $1\frac{1}{4}$ inch broad.

This very beautiful species is found in deep water. It occasionally buries itself in sand, with only the head and tentacles exposed, and lies for hours in this position.

Order TECTIBRANCHIATA.

Animal usually provided with a shell both in the larva and adult state. Branchiæ covered by the shell or mantle. Sexes united.

Fam. **Pleurobranchidæ.**

Genus PLEUROBRANCHUS, Cuv.

Animal oblong, fleshy, convex above, with a very large and overspreading mantle. Foot large, equally outspreading, and thus leaving a wide canal all round the body. Head distinct, furnished with a veil, uniting on each side with the borders of the foot, and with two tubular tentacles, which are split anteriorly; mouth at the extremity of a proboscis. Branchiæ composed of a double row of lamellæ, forming a plume on the posterior right side, between the mantle and the foot. Anus carried by a small tube behind the branchiæ. Organs of generation in front. Shell sometimes rudimentary, membranous, with a tolerably distinct apex hidden in the thickness of the mantle.—*Woodward.*

Pleurobranchus citrinus ?, Rüppell.

Orange-red. Mantle darker than the other parts of the animal, and speckled with whitish spots. About 1 inch in length. Ova reddish, in circular broad coils.

Very common in Trincomalee. Found at low-water, on coral stones and sea-weed, nearly throughout the year. Spawns in May, June, and July.

Pleurobranchus reticulatus ?, Gmel.

Pale orange-red, reticulated mantle, and spotted with purple. About 2 inches long.

Found near Fort Frederick, Trincomalee, in shallow water, among rocks.

Pleurobranchus zeylanicus, Kel.

Pale yellow, splashed with darker yellow and brown, and minutely spotted with rusty brown. About 2 inches long.

Rare; found in Back Bay.

Pleurobranchus purpureus, Kel.

Deep reddish purple. Mantle very dark purple, and spotted with still darker purple. There is a bright white zigzag line on each side of the back of some large specimens. Length nearly 6 inches; 4 inches broad.

The young is of a lighter purple, and may be mistaken for another species.

Found in deep water, Trincomalee.

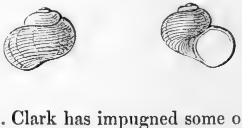
LI.—*Notes on British Mollusca, in answer to* Mr. William Clark's *Remarks on "Gleanings in British Conchology."* By J. Gwyn Jeffreys, Esq., F.R.S.

To the Editors of the Annals of Natural History.

Gentlemen,

However much I may differ from Mr. Clark as to the limits of specific and varietal distinction in the British Mollusca, I quite agree with him in thinking that a free and independent discussion of the subject must tend to promote the cause of science, and ultimately to elicit the truth. *Exoriatur aliquis* who may be able to solve some of these difficult problems!

In the 'Annals' for March last, p. 192, Mr. Clark has stepped forward to the rescue of a species which he named *Trochus Cutlerianus*, but which I referred to the *T. exilis* of Philippi. I still consider these species to be synonymous and identical; and my opinion is founded on the examination and comparison of many hundred specimens, all of which appeared to me consistent with Philippi's description and figure. The comparative size of specimens and the number of whorls differ in every univalve shell according to locality and age; and with respect to form, I believe it will be found that the annexed figures (which are from the accurate pencil of Mr. Sowerby) agree much better with the one given by Philippi than the figures in the 'British Mollusca,' to which Mr. Clark has appealed, but which manifestly differ from each other.



In the 'Annals' for this month Mr. Clark has impugned some of my discoveries, as well as those of Linnæus, Lamarck, Forbes and Hanley, Mr. Alder, and Mr. Bennett; and I will answer his remarks on each *seriatim*.

Page 407. *Diodonta Barleei.* I am now satisfied, on reconsideration, that this is not a good species, but the fry of *Diplodonta rotundata*. The form of young and adult individuals is so totally different (in the one being triangular, and in the other suborbicular), that it was only through the kindness of Mr. Searles Wood, who fortunately had the requisite series of Crag specimens, that I was enabled to reconcile this difference; neither my own collection of recent shells, nor any of those made by my numerous friends and correspondents furnishing any intermediate gradation of size between half-grown specimens and the fry. To Mr. Clark I therefore acknowledge myself indebted for the suggestion which has led to the correction of this error. I had intended to do this in my next paper.

Page 408. *Aporrhaïs pes-carbonis.* Mr. Barlee assured me that the specimens of this now well-known species and of *A. pes-pelecani*, from a careful comparison of which he supplied me with the information which I communicated as to the difference in the animals, were taken *together*; so that the doubts raised by Mr. Clark fall to the ground. These species differ as to the shell not merely in size (which Mr. Clark supposes the only point of distinction), but also in the form of the digitations of the outer lip in *A. pes-carbonis* (the posterior one being generally produced beyond the tip of the spire), in the whorls being more swollen, in the apex being more blunt, and in having a well-defined but narrow umbilicus. I suspect it is the *Chenopus desciscens* of Philippi (ii. 185. t. xxvii. f. 7), and not his *C. Serresianus.* One of my specimens has five digitations, and exactly agrees with the figure of Philippi above quoted.

Page 409. *Rissoa pulcherrima, Cerithiopsis pulchella, Buccinum Humphreysianum.* Mr. Clark is of course at full liberty to entertain and express his own opinion as to the validity of all or any of these species; but I do not believe that any other conchologist coincides in it.

Triton nodiferus. My belief that this is a British species is founded on the fact that Mr. Lukis is a gentleman of unquestionable veracity and accuracy; and I see no more reason to doubt its being indigenous than *T. cutaceus* or *Murex erinaceus.*

Triton cutaceus. Mr. Clark's idea was quite new to me, and I imagine it was equally so to your other readers, that it is the habit of this or any analogous species to adhere to the bottom of a vessel! Another live and adult specimen has recently been taken in Guernsey, a notice of which will appear in due time with other discoveries.

Kellia lactea. It occurs in the same habitat, and even in the same stones, as *K. suborbicularis.* I would recommend Mr. Clark to reconsider his decision.

Mytilus Galloprovincialis and *M. ungulatus.* I cannot dispute the fact that Mr. Clark thinks differently from other naturalists; but I may remind him and your readers that the specimens from the Channel Isles, upon which my remarks were founded, were taken in the *same* locality and at the *same* season of the year—in fact, within a space of 10 yards and 10 minutes from each other. "The animal of the *Mytili* [doubtless] varies greatly," owing to the causes assigned by Mr. Clark, as well as to the circumstance that the genus contains many species.

Page 410. *Jeffreysia ? Gulsonæ.* Until the animal is known, the generic position of this species can only be assigned on conchological grounds; and these grounds have been so fully discussed before in the 'Annals,' that it is unnecessary to recapitulate them. The only character it appears to have in common with *Odostomia* or *Chemnitzia* is that of being a turbinated Gasteropod. Mr. Clark ought not, however, to allow your readers to suppose that I founded the genus *Jeffreysia*; and I should be sorry to be deemed capable of such an egregious act of vanity as to affix my own name to any genus or species.

Euomphalus nitidissimus. It is scarcely worth while contrasting the drawing (fig. 16. pl. 3. Ann. ser. 3. vol. iii.), which is confirmed by that of M. Deshayes, of a living and active animal with the sketch, made by a lady-artist for Mr. Clark, of the dried remains of another animal of the same kind. What Mr. Clark supposed to be tentacula must have been the shrivelled lobes of the veil, although it is not quite clear what he means by the "veil;" for in one part of his remarks (p. 410) he considers it to be synonymous with the "anterior part of the head," while in the next page he identifies it with the "mantle." Dr. Gray has clearly pointed out, in the 'Annals' (ser. 2. vol. xvi. p. 422, and same series, vol. xviii. p. 419), that *Truncatella* and *Assiminia* are totally different animals, especially in the form of the tentacula and position of the eyes. The shells in every case correspond with the animals. As to the form of the aperture of the shell, it must be borne in mind that, although *Euomphalus pentangulatus* is the *typical* species, the aperture in many other species of that genus is suborbicular, while *E. Rota*, and especially the variety *tricarinata* of Webster, has the aperture slightly subangular. Mr. Clark does not take any notice of the peculiar tongue or lingual riband of this curious mollusk—a character which is admitted by all good conchologists to form an essential element of generic distinction. With respect to the question whether these tiny creatures can properly be referred to the extinct genus *Euomphalus*, which contains species of a comparatively much larger size, I will subjoin an extract from Sir Roderick Murchison's invaluable work, 'Siluria' (3rd ed. p. 464), in which he says, as to *Pterygotus Anglicus* and *P. problematicus*, "In the 'Quarterly Journal of the Geological Society,' vol. xii. p. 28, Professor Huxley has given reasons for considering these great Crustacea (the former estimated to have been 7 or 8 feet in length!) to be of a type nearly resembling some of the smallest of our living Decapod Crustacea (*Alauna, Bodotria, Cuma*, &c.), and as even showing great similarity to the larval state of the higher forms." This is a very suggestive idea, which may lead to most interesting and important results. In the event of its being considered advisable to form a new genus for the reception of these anomalous mollusks, I would venture to propose the name of *Omalogyra*.

In answer to Mr. Clark's remarks on the species of *Odostomia* or *Chemnitzia*, it appears to me quite a waste of time to go again over the same ground; but I may observe that a card of shells which he obligingly gave me as a variety of *Odostomia acuta*, contained also several *O. turrita* or *striolata*, which differs from the first-named species in having a blunt instead of a tapering and sharp-pointed spire, in the penultimate whorl being rather prominent (giving the shell a somewhat fusiform appearance), in the contracted aperture, in being spirally striated, and especially in wanting the distinct and deep umbilicus, which invariably characterizes *O. acuta* in every variation and stage of growth.

I am, Gentlemen,
Your most faithful Servant,
J. GWYN JEFFREYS.

1 Montagu Square, London,
May 1859.

P.S. Since the above was written, I have received a letter from my friend Mr. Alder, which contains some remarks so apposite and valuable, on the presumption of specific distinction in animals which live together but differ from each other in form, that I will, with his permission, transcribe them. Mr. Clark's ideas on this subject will be found at page 408 in last month's number of the 'Annals.' Mr. Alder says—"The argument from two forms living together under the same circumstances, is good, I think, as a presumptive proof that they constitute distinct species. The general idea of a species is, that the individuals are the progeny of a common stock, freely breeding together, and producing their like in uninterrupted succession, without mixing with other species (at least in a state of nature). If, therefore, two nearly allied forms live together under the same circumstances, without showing any intermediate forms, the presumption is that they are specifically distinct. This, I think, is a fair argument, resting on the belief that mere varieties will breed together when they come in contact, and that they are generally the result of different external circumstances, and gradually return to the typical form when those circumstances are removed."

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

December 9, 1858.—Sir Benjamin Collins Brodie, Bart., President, in the Chair.

"On the Ova and Pseudova of Insects." By John Lubbock, Esq., F.R.S., F.L.S., F.G.S.

In the 'Philosophical Transactions' for 1857, I endeavoured to show that the agamic eggs of *Daphnia* are formed upon the same type, and consist of the same parts, as any other egg. My object in undertaking the investigation, of which the present paper is the result, was to determine whether the same held good of the agamic eggs or pseudova of *Coccus*, *Cynips*, and other insects. This inquiry was the more interesting, because Prof. Huxley had found several differences between the ovarian products of the oviparous and viviparous Aphides; and because, according to Prof. Leydig, the development of the pseudova in *Coccus* was extremely peculiar.

My examination of *Coccus* was concluded, and the results committed to paper, in the early part of June last; but I then found that so little was known, especially in this country, about the development of insect-eggs generally, that I withheld my notes from publication, in order to add to them some account of the process of true egg-formation in the Insecta, which would enable me to point out more satisfactorily the differences between, or the identity of, these two processes.

In all female insects there are two ovaries, each consisting of at least two egg-tubes opening into a common chamber, the uterus. The egg originates and attains to nearly its full size in the egg-tube, and it is therefore with this portion of the generative organs that we are now mainly concerned.

The egg-tubes differ very much in number and length. In all the larger orders, except perhaps the Lepidoptera and Heteroptera, some species have very few, while others possess a great many. Thus in Coleoptera, *Lytta vesicatoria* has a great many, *Lixus* has only two; in Orthoptera, *Acheta domestica* has a great many, while in a small *Locusta* I only found six; in Neuroptera, *Libellula* has a great many, *Psocus* only five; of the Diptera, the majority have many, *Melophagus* only two; in Homoptera, *Coccus* has a great many, while *Aphis Padi* has only three; in Hymenoptera, *Apis mellifica* has about 170, and *Chelonus* has only two; and even in so small a group as the Dermaptera, *Labidura gigantea* has, according to Léon Dufour, only five, while *Forficula auricularia* has a great number.

The number of egg-germs in each egg-tube differs also very much. The Lepidoptera, in which the number of egg-tubes is very small, have a great number of egg-germs in each, while the Homoptera, in which the egg-tubes are so numerous, have very few egg-germs in each tube. On the other hand, in Heteroptera, the number varies very little; while in Coleoptera, Hymenoptera, and Diptera, it differs greatly, though not so much as that of the egg-tubes. The number of egg-germs is, however, by no means so easy to determine as that of the egg-tubes. It is probable that in each species the number is definite, except perhaps where it is very numerous, as, for instance, in certain Lepidoptera which have more than a hundred. In most egg-tubes, however, the egg-germs become so "small by degrees," that it is almost impossible to say exactly how many there are.

Each egg-tube consists generally, if not always, of two membranes. The outer or muscular one is very evident in Hymenoptera, Geodephaga, Diptera, and indeed in most insects, but in some cases I could not distinguish it. The inner membrane is delicate and structureless. On its inner side lies a layer of epithelial cells, which in most parts form a continuous layer; but in those insects which have a group of vitelligenous cells between each of the egg-germs, they are at these parts more sparingly distributed.

These epithelial cells probably take an active part in the secretion of the yolk in all insects, and are the principal, if not the only organs which form the yolk in Orthoptera, *Pulex*, and the Libellulina.

Between each of the egg-germs in Lepidoptera, Diptera, Hymenoptera, Geodephaga, Hydradephaga, and Neuroptera (except the Libellulina), is situated a group of large cells. These were first noticed by Herold, who described them as rings; Stein, however, is no doubt correct in asserting that they are the secretors of the yolk, and I therefore agree with Prof. Huxley in calling them vitelligenous cells. Hermann Meyer, who was followed in this respect by Dr. Allan Thomson, considered them as aborted eggs, an opinion, however, which is quite untenable. A cursory examination of an egg-tube of any Lepidopterous or Hymenopterous insect will show, that although the vitelligenous cells increase individually in size, as does the yolk-mass, yet that the latter constantly grows at the expense of the former*, which become gradually fewer in number, and finally disappear altogether.

Stein has observed, that in *Acilius sulcatus*, in which the yolk is brightly coloured, the vitelligenous cells are of the same hue. Prof. Huxley has observed in *Aphis*, and I have found in certain Hemiptera, as in *Nepa* for instance, a canal leading down from the terminal chamber into the egg-tube, and which can be for no other purpose than to convey the yolk-matter to the growing eggs.

Finally, if, as Stein also remarks, we press the vitelligenous cells or nuclei out of one of the egg-chambers, we shall generally find some of them in which the cell-wall is almost entirely absorbed, so that on the application of slight pressure the contents spread in all directions.

In its earliest stage, however, the egg-cell cannot be distinguished from the vitelligenous cells, and at the upper part of the egg-tube of any Heteropterous or Dipterous insect will be found cells which are neither vitelligenous cells nor egg-cells, but which are apparently capable, under certain circumstances, of becoming either the one or the other.

Dr. Carpenter has suggested to me that these vitelligenous cells are perhaps analogous to the "yolk-segments" of *Purpura*, and this idea throws, I think, some light on the very remarkable phænomena presented by that genus.

The separation of the egg-germs from the vitelligenous organs is a condition found in many Worms, in some Crustacea, as for instance in *Cyclops*, and probably in the Cirrhipedes.

Our knowledge of the modes of egg-formation in the Insecta is perhaps hardly sufficient to enable us to generalize upon it as yet with much confidence. As far, however, as we at present are aware, alternate groups of large vitelligenous cells are found in all Lepidoptera, Diptera, Hymenoptera, Neuroptera (except Libellulina), Geodephaga, and Hydradephaga. The large vitelligenous cells are contained in a terminal chamber in other Coleoptera, Homoptera, and Heteroptera, whilst apparently they are absent in Orthoptera, Libellulina, and *Pulex*.

This curious subdivision of the Insecta is not exactly that which would be given by any other characters. It is, however, remarkable, that the mode of formation of the thorax would divide the Insecta into two groups very nearly equivalent to those just mentioned, except as far as regards the Geodephaga and Hydradephaga.

In fact, the Coleoptera, Orthoptera, Dermaptera, and Hemiptera

* See Lacordaire, Introd. à l'Entomologie, ii. p. 386.

have a very large prothorax, while this segment is small in the Lepidoptera, Diptera, Hymenoptera, and most Neuroptera. In the Libellulina, however, it is distinct from the rest of the thorax and considerably developed.

In the Orthopterna, Libellulia, and the genus *Pulex*, we find the simplest type of egg-formation which occurs among the Insecta, the large vitelligenous cells being entirely absent, and their functions probably monopolized, instead of being only shared, by the layer of epithelial cells.

The macula germinativa, which is in fact the nucleus of the germinal vesicle, has in the Orthoptera, as usual, the form of a small round vesicle.

In *Œstrus* the germinal vesicle contains several small vesicles, one of which grows much larger than the remainder, and becomes the macula germinativa.

In *Pulex* the germinal vesicle is dark, and the macula germinativa, which is very distinct in the young egg-germs, soon disappears.

In the Coleoptera (except the Geodephaga and Hydradephaga), the Homoptera, and the Hemiptera, each egg-tube ends in a large terminal chamber, full of round cells, each of which can apparently become either an egg-cell or a vitelligenous cell.

In *Nepa* and some other forms, I found, as Prof. Huxley first discovered in *Aphis*, a duct or passage leading down from the terminal chamber to the egg-germs. In one specimen there were four distinct ducts, so that probably each egg-germ has a separate yolk-duct.

In *Nepa* there is a large lateral projection at the anterior end of each egg, and it is always on the same side as the germinal vesicle; but this latter varies from side to side without any apparent regularity.

In the common Earwig, the egg-tubes are short and numerous; each consists of a large, lower chamber, which is more or less pear-shaped, and two or three other chambers, but slightly separated from one another, bent down on the lower chamber, and so short and small as to resemble very closely the stalk to the pear.

Each egg-germ in this insect consists of two parts—an egg-cell containing the germinal vesicle and the yolk, and a vitelligenous cell. The vitelligenous cell has no distinct nucleus, and in the small stalk-like part of the egg-tube is double the size of the egg-cell, which at this period contains the germinal vesicle, but not as yet any yolk-matter. In this part of the egg-tube it sometimes appeared as if there were two vitelligenous cells to one egg-cell. In the large lower egg-germ this is never the case. In this part of the egg-tube the vitelligenous cell is still larger than the egg-cell, which however grows larger, both absolutely and relatively, until it almost fills the egg-chamber.

The yolk-mass in the lower egg-germ consists of dark granules and oil-globules surrounding the germinal vesicle, which generally contains two or three minute cell-like vesicles. The contents of the vitelligenous cell are light brown, granular, and in part arranged in somewhat cylindrical masses, which lie generally rather transversely to the egg-tube, and do not appear to have any firm boundaries. At least, I was never able to isolate them, except after applying reagents, as, for instance, acetic acid, and then only sometimes, and with difficulty. They then appeared to be somewhat elliptic in shape.

From M. Léon Dufour's description, the ovary in *Labidura gigantea* is entirely unlike that of *Forficula*.

The egg-formation in *Forficula* is not the least remarkable peculiarity of this extraordinary genus, and does not at all resemble that of either the Coleoptera or the Orthoptera.

The Neuroptera (except the Libellulina) offer the next step towards the type which prevails in the Lepidoptera, Hymenoptera, and Diptera.

In these four orders, and in the Geodephaga and Hydradephaga, each egg-chamber contains, at its upper end, a group of large vitelligenous cells, which are generally few in number in the Neuroptera, rather more numerous in the Diptera, and still more so in the Geodephaga, Hydradephaga, and Hymenoptera.

In all these six groups, except the Diptera, each egg-chamber is divided into two parts by a transverse constriction, which separates the vitelligenous cells from the germinal vesicle and the yolk surrounding it. At first, the lower division of the egg-chamber is quite small, but it grows gradually larger at the expense of the upper part.

In the Diptera the egg-chamber is not divided into two smaller chambers, but has a rounded or oval form, and contains a number of vitelligenous cells, the lowest of which becomes darker from the formation of granular yolk-matter, and thus forms the egg-cell. Its nucleus becomes the germinal vesicle. The wall of the egg-cell gradually disappears, and the yolk-mass being enlarged by the yolk secreted by the vitelligenous cells, continues to increase until it occupies the whole egg-chamber.

Between each egg-germ, in the Diptera, the egg-tube becomes extremely narrow, which is not so much the case in other Insecta. It is remarkable that *Pulex*, which is in many respects nearly allied to the Diptera, should differ from them so greatly in the mode of egg-formation.

The germinal vesicle in the Carabidæ generally contains, besides the macula germinativa, several small vesicles, which indeed are sometimes very numerous. In *Carabus violaceus*, the macula itself appeared to consist of many small oval masses, and in one specimen the macula appeared to have broken up, and the constituent bodies were floating about loose in the germinal vesicle. From these observations, and from what has been mentioned as occurring in *Pulex*, I am disposed to think that the first embryonic cells, at least in Insecta, appear in this manner.

According to M. Léon Dufour, *Chelonus oculator*, one of the small Ichneumonidæ, possesses no ovary nor eggs, but merely four long tubes leading into as many matrices, containing a great number of living embryos, or perhaps nymphs. I examined several specimens, and found the female generative organs quite in accordance with his descriptions and figure. They are, however, undoubtedly true ovaries, though the thickness of the outer membrane gives them a deceptive appearance. If the egg-tubes are torn asunder, egg-germs will be found in them, as in the corresponding organs of any other Hymenopterous insect, and presenting as usual a transverse constriction, with the vitelligenous cells in the upper division.

In the four matrices the eggs are cylindrical and somewhat curved, and under the action of water, one end of each swells up considerably. In this they present an approach to that form which attains its greatest development in *Cynips*.

The ovaries of *Coccus hesperidum* have been rightly described by Prof. Leydig as consisting of a long tube on each side opening by a very short oviduct into the egg-canal. The whole surface of the tube is covered with egg-germs in all stages of development. The collateral glands are very small in *C. hesperidum*, but are well developed in *C. Persicæ*.

In its earliest stage the egg-follicle is a simple projection of the ovarian wall, which becomes gradually pear-shaped, and may then be seen to consist of a structureless outer membrane, a layer of epithelial cells, and three vitelligenous cells, with very delicate walls.

The walls of these cells soon disappear, and even the nuclei are often scarcely distinguishable, but acetic acid will generally make them more visible. Leuckart has given a correct account of these bodies, and indeed of the whole process; but Leydig apparently mistook them for germinal vesicles.

The epithelial cells line the membrane constituting the egg-follicle. As usual, they are columnar in the lower chamber and flattened and scattered in the upper. They contain a circular nucleus. The action of water causes them, and indeed the whole upper chamber, to swell considerably. The columnar epithelial cells of the lower chamber contain generally small greenish globules, apparently identical with the small oil-globules which form so large a part of the yolk, which is, I therefore suppose, in part secreted by them.

The germinal vesicle makes its appearance after the vitelligenous cells, and generally after the egg-follicle has lost its original pyriform shape. It is about ·0008 in diameter. The macula germinativa is single, and somewhat granular in appearance.

The oil-globules make their appearance about the same time as the germinal vesicle, and soon become the most conspicuous part of the egg. They are at first very small, but in a mature egg the larger ones are as much as ·0016 in diameter. The oil-globules may often be seen with their sides much flattened by mutual pressure, and must therefore possess a somewhat compact pellicle.

Very soon after the appearance of the first oil-globules, the egg-follicle loses its pear-shaped form, the basal part swells, and is separated from the apical part containing the nuclei of the vitelligenous cells by a constriction. It now perfectly resembles the egg-chamber of any ordinary insect, in consisting of an upper chamber containing the vitelligenous cells, and a lower chamber devoted to the germinal vesicle and the yolk.

According to M. Leydig, the constriction gradually disappears, and the egg finally occupies both chambers; but this is incorrect, and M. Leuckart is right in asserting that the vitelligenous cells disappear, and the upper chamber becomes atrophied, so that the mature egg lies in the lower chamber only. This process is exactly that which the analogy of other insects would lead us to expect.

The general cavity of the body of the female *Coccus* always contains an immense number of oval green cells, apparently of a parasitic nature. They are $\frac{1}{8000}$ in length, and vary in breadth, but on an average are about $\frac{3}{8000}$. *Coccus Persicæ* contains a number of similar bodies, which however are cylindrical. Almost always, immediately after the disappearance of the vitelligenous cells, two or three masses of these cells may be found at the lower part of the upper chamber, and soon after in the egg itself. It is difficult to understand why these cells should appear at so definite a period in the history of the egg-formation. Prof. Huxley has pointed out to me that Dr. V. Wittich has already described a Conferva found in hen's eggs. It does not, however, seem clear that these eggs would have arrived at maturity, and I believe that the parasites of *Coccus* are the first which have ever been known to exist in eggs without impeding their development.

The mature egg contains numerous vitelline spherules, which are from $\frac{2}{8000}$ to $\frac{7}{8000}$ in diameter, and offer every appearance of true cells, except that they contain no nucleus.

The mature egg is a light-green ovate mass, about $\frac{25}{2000}$ in length and $\frac{28}{2000}$ in breadth, and possesses apparently only one envelope. It contains a well-formed embryo before it leaves the ovary, and is hatched, I believe, only a few hours after being laid. According to M. Leydig, the first trace of the embryo arises at the free or cephalic end, but my observations have led me to the opposite conclusion.

C. Persicæ differs from *C. hesperidum* in being decidedly oviparous; that is to say, the eggs, when deposited, do not contain an embryo, and remain under the protection of the mother some time before being hatched. This difference probably makes them require a stronger egg-shell, and accordingly we find the collateral glands more developed. In most respects, however, the egg-development is very similar in these two species; but the egg-follicles are smaller and neater in *C. Persicæ* than in the former species, and the vitelligenous cells are five or seven in number instead of three, spherical, and very distinct.

In *Cynips lignicola*, the ovary consists of a number of egg-tubes which fall into a common oviduct, and each of which contains thirteen eggs.

This species has in the last few years become very common in the South-west of England, but as yet only females have been discovered.

It is fair to assume, therefore, that the eggs are agamic, or adopting Prof. Huxley's name, pseudova. Nevertheless, there is absolutely nothing, so far as our knowledge at present extends, to distinguish the egg-formation from that which occurs in any other Hymenopterous insect.

The mature egg of *Cynips* is indeed of a very remarkable shape, as it consists of a long tube with a small swelling at one end, and a larger one at the other, in which the yolk is situated. The larger end occupies the usual place of the egg, but as the tube elongates, the smaller end pushes its way up the egg-tube, which elongates considerably; and, finally, all the large ends are at the lower end, and the small ones at the upper end, of the egg-tube, which gives the ovary a curious appearance. Even after the egg is fully formed, a slight pressure will bring the germinal vesicle into view.

Many of the Lepidoptera have presented us with cases of Parthenogenesis, and in these instances there is no reason to suppose that the formation of the eggs differs from the usual type. The same holds good in *Solenobia lichenella,* in which agamic eggs are the rule, instead of the exception.

In the Hive-bee also, the early development of the ova and of the pseudova must apparently be identical, since it would appear that in an impregnated female, the ovarian product has already left the ovary before it is decided whether it is to become an ovum or a pseudovum, and whether it is to give birth to a male or to a female.

It is, therefore, I think, proved that we must not look in the ovarian egg for differences necessarily depending on sexual influence, but that we shall find them, if anywhere, in the subsequent stages of egg-development.

Prof. Huxley and Leuckart have recently shown, that whereas the vitelligenous cells are well developed in the oviparous *Aphides,* they are much less apparent in the agamic or viviparous forms; so much so indeed as to make these naturalists doubt whether they take any part in the secretion of the yolk. While waiting for the publication of Prof. Huxley's observations, I have paid but little attention to the *Aphides*; but it struck me as a curious coincidence, that, in *Coccus* also, while the vitelligenous cells are very distinct in the oviparous *C. Persicæ,* they are much less apparent in the almost viviparous *C. hesperidum.* It would of course be highly unphilosophical to draw any conclusion from four instances; but it will be curious if the same connection between oviparity, and the presence of well-developed vitelligenous cells on the one hand, and viviparity, with less developed vitelligenous cells on the other, is found to prevail in other species.

It has been generally stated that all species of *Aphides* are, in spring and summer, self-fertile and viviparous, and become in autumn oviparous, while the eggs require impregnation. I cannot, however, help thinking it probable, that in cold and in mountainous regions, where at any period of the year frosts may occur, we shall find species which are always oviparous (as indeed is said to be the case with *Aphis Abietis*); while in tropical regions, where frosts are unknown and leaves are less often deciduous, other species may occur which are naturally viviparous all through the year, and whether or not they have undergone impregnation.

GEOLOGICAL SOCIETY.

February 23, 1859.—L. Horner, Esq., in the Chair.

"On a new species of *Dicynodon* (*D. Murrayi*) from near Colesberg, South Africa." By Prof. T. H. Huxley, F.R.S., Sec. G.S.

For the original specimen from which Prof. Huxley first (in the spring of last year) obtained evidence of the existence of this species, he was indebted to the Rev. H. M. White, of Andover, who subsequently put the author in communication with the discoverer of the fossil, Mr. J. A. Murray; and the latter gentleman having written to his father, resident in South Africa, obtained for Prof. Huxley a large quantity of similar fossil remains. One specimen in particular, having been carefully chiselled out by Mr. Dew, afforded a complete skull of this peculiar and previously undescribed species of *Dicynodon*.

The author described the distinctive features of this skull in detail. *Dicynodon Murrayi* is distinguished from all the already known species by the following characters:—

1. The plane of the upper anterior face of the nasal and premaxillary bones would, if produced, cut that of the upper face of the parietal at an angle of about 90°.

2. The supratemporal fossæ are much longer from within outwards than from before backwards, owing partly to the shortness of the parietal region.

3. The alveoli of the tusks, the transverse section of which is circular, commence immediately under the nasal aperture, and extend forwards and downwards parallel with the plane of the nasal and upper part of the premaxillary bones, and do not leave their sockets until they have passed beyond the level of the posterior end of the symphysis of the lower jaw.

4. The nasal apertures are altogether in front of the orbits.

5. The length of the upper jaw in front of the nasal apertures is certainly equal to one-third, and probably to one-half, the whole length of the skull, which is between 6 and 7 inches.

6. The os quadratum is about half as long as the skull.

These peculiarities are regarded as sufficient to distinguish *Dicynodon Murrayi* from all others; and the author stated that he should reserve the description of many other anatomical features, which are probably more or less common to other Dicynodons, such as the bony sclerotic, the bony interorbital septum and vomer, the characters of the humerus, of the pelvis, and of the ribs, for another paper, in which other Dicynodont remains will be considered.

March 23, 1859.—Prof. J. Phillips, President, in the Chair.

1. "On some Amphibian and Reptilian Remains from South Africa and Australia." By Thomas H. Huxley, F.R.S., Sec. G.S., Prof. of Natural History, Government School of Mines.

The author described in the first place the remains of a small

Labyrinthodont Amphibian, which he proposed to call *Micropholis Stowii*. The fossil was discovered by Mr. Stow, and accompanied that gentleman's paper "On some Fossils from South Africa," read before the Society on the 17th of November last, on which occasion Prof. Huxley expressed the opinion that it would prove to be an Amphibian, and probably a Labyrinthodont.

It had been found impossible to work out the back part of the skull, so as to exhibit the occipital condyles; but the characters of the few cranial bones which remain, of the teeth, and of the lower jaw, and the traces of a largely developed hyoidean apparatus, afforded sufficiently convincing evidence of the affinities of *Micropholis*.

The generic appellation is based on the occurrence of numerous minute polygonal bony scutes on the integument of the under surface of the head; in which character *Micropholis* has a remote resemblance to *Archegosaurus*. The scutes, however, are very different in their aspect from those of the last-named genus.

Micropholis has little resemblance to any European Labyrinthodonts, except *Metopias*, and the singular so-called "*Labyrinthodon Bucklandi*," from the Trias of Warwickshire, to the peculiarities of which the author alluded, proposing to consider it as the type of a new genus, which might be termed "*Dasyceps*."

On the other hand, there are two southern forms of Labyrinthodont, which exhibit many similarities to *Micropholis*. These are the *Brachyops laticeps* of Prof. Owen, from Central India, and a new form allied to *Brachyops*, but distinct from it, from Australia. This last was described, and named *Bothriceps australis*.

The author stated that he was not prepared to draw any very decided conclusion, as to the age of the Karoo- or Dicynodon-beds, from the fact of the occurrence of Labyrinthodont *Amphibia* in them, inasmuch as the Labyrinthodonts range from the Lower Lias to the Carboniferous formation inclusive; and *Micropholis* is unlike any of the Labyrinthodonts whose precise age is known.

The fragmentary remains of a young reptile, which were found associated with *Micropholis*, were stated by Prof. Huxley to be undoubtedly those of a *Dicynodon*. Of this, however, and of a small Dicynodont skull from the same locality, he promised to speak on a future occasion.

The second part of the paper consisted of a description of the structure of the cranium, of the sclerotic ring, of a fragmentary sacrum, and of the humerus of the new species of *Dicynodon* (*D. Murrayi*) from near Colesberg, which was characterized at a previous meeting of the Society (February 23). Particular attention was directed to the unusually complete ossification of the cranio-facial axis, and to the striking resemblance in the structure of the bony walls of the olfactory apparatus to that which obtains in Birds. Prof. Huxley, in conclusion, gave a sketch of the general proportions of the *Dicynodon*, so far as the evidence as yet obtained allows a judgment to be formed, and particularly alluded to the existence of a long series of caudal vertebræ. Specimens of the fossil wood found with the remains of *D. Murrayi* had been submitted to Dr. Hooker, and declared by him to be coniferous.

2. " On *Rhamphorhynchus Bucklandi*, a Pterosaurian from the Stonesfield Slate." By Thomas H. Huxley, F.R.S., Sec. G.S., Prof. of Natural History, Government School of Mines.

The author based his account of this Pterosaurian upon a fine fragment of a lower jaw, discovered by the Earl of Ducie in the quarries of Sarsden, near Chipping Norton,—on a coracoid bone from the Stonesfield slate, in the collection of the Museum of Practical Geology,—on a large fragment of a lower jaw in the Museum of the Society, and a very fine specimen of a lower jaw in the Museum of the College of Surgeons. The ascription of the coracoid to the same species as that to which the jaws belong was admitted to be hypothetical; but their proportions agree sufficiently well to give probability to the supposition. Furthermore, the author did not suppose it to be absolutely demonstrable that the jaws and coracoid in question, supposing them to be of one species, were of the same species as those Pterosaurian remains discovered by Dr. Buckland in the Stonesfield slate many years ago, and (though never described) named after him *Pterodactylus Bucklandi*; but, as a specific name unaccompanied by a description is of no authority, and as there is no evidence of the existence of more than one species of Pterosaurian in the Stonesfield slate, it seemed that the adoption of the specific name *Bucklandi* would have the least tendency to create confusion.

These remains prove that the Stonesfield Pterosaurian belonged to the genus *Rhamphorhynchus* of Von Meyer, and that it had nearly twice the size of the liassic *Dimorphodon macronyx*. The mandible of *R. Bucklandi* is remarkable for its stoutness and the depth of its rami towards the symphysis, which is short and produced into a stout, curved, median, edentulous rostrum. The teeth are similar in form, flattened and sharp-pointed, distinct, and not more than seven in number on each side: the last tooth is situated rather behind the junction of the middle with the posterior third of the jaw. The author took occasion to refer incidentally to some undescribed peculiarities in the structure of the coracoid of *Dimorphodon macronyx*.

3. " On a Fossil Bird and a Fossil Cetacean from New Zealand." By Thomas H. Huxley, F.R.S., Sec. G.S., Prof. of Natural History, Government School of Mines.

These remains were, the right tarso-metatarsal bone of a member of the Penguin family, allied to *Eudyptes*, but indicating a bird of much larger size than any living species of that genus, larger indeed than even the largest *Aptenodytes*, and to which the name of *Palæudyptes antarcticus* was given,—and the left humerus of a small cetacean, more nearly resembling that of the common Porpoise than that of any other member of the order (*Balæna*, *Balænoptera*, *Monodon*, *Delphinus*, *Orca*, *Hyperoodon*) with which the author had been able to compare it. Nevertheless, as there are very marked differences between the fossil humerus and that of *Phocæna*, Prof. Huxley named the species *Phocænopsis Mantelli*. Mr. W. Mantell, F.G.S., to whom the author was indebted for the opportunity of examining these bones, stated that the beds whence they were obtained were certainly of Tertiary age, and of much earlier date than the epoch of the *Dinornis*, which he considered to have been contemporaneous with man. The *Palæudyptes* was from an older bed than the *Phocænopsis*.

Prof. Huxley drew attention to the remarkable fact that a genus so closely allied to the Penguins which now inhabit New Zealand, and are entirely confined to the Southern Hemisphere, should have existed at so remote an epoch in the same locality.

4. "On the Dermal Armour of *Crocodilus Hastingsiæ*." By Thomas H. Huxley, F.R.S., Sec. G.S., Prof. of Natural History, Government School of Mines.

The author, after briefly mentioning the very complete armour of articulated dorsal and ventral scutes which he had recently discovered (and described before the Linnæan Society) in two of the three living genera of *Alligatoridæ*, viz. *Caiman* and *Jacare*, showed that similar scutes are found associated with the remains of *Crocodilus Hastingsiæ*, a very fine skull and some scutes of which reptile, from Hordwell, kindly lent to Prof. Huxley by Mr. S. Laing, F.G.S., were exhibited. With respect to the suggestion of Prof. Owen, that the *Alligator Hantoniensis* might possibly be a variety of *Crocodilus Hastingsiæ*, the author stated that he had observed in several specimens of the recent *Crocodilus palustris*, which by its straight premaxillo-maxillary suture and the general form of its skull most nearly approaches *C. Hastingsiæ*, a tendency to assume the Alligator character of a pit, instead of a groove, for the reception of the mandibular canine. Sometimes there is a pit on one side and a groove on the other, and sometimes incomplete pits on both sides in this Crocodile. *Crocodilus Hastingsiæ* still more nearly approaches the *Alligatoridæ* in the number of its teeth and in the characters of the dermal armour now described; so that the probability of its occasionally assuming the Alligatorian dental pits on both sides is greatly increased.

MISCELLANEOUS.

On the Difficulty of defining the Species of Mollusca. By Dr. J. E. Gray, F.R.S. &c.

In a former notice, I showed two instances where two specimens of European terrestrial Mollusca, which so greatly resemble one another as in each case to be regarded by most recent authors as only slight varieties of the same species, proved, by the examination of their teeth, to be very distinct species—so distinct that they must have very different habits and manners.

The paper by Mr. Hancock on the organization of the Brachiopoda, just published in the 'Philosophical Transactions,' affords two instances of a similar character, where shells of very much the same external appearance—so much so that he regarded them as varieties of the same species—proved to contain animals of a very different organization, showing that they were the shells of very distinct species of Mollusca,—as, for example, *Lingula Anatina* (t. 64) and *Lingula affinis* (t. 66), and the two shells which he describes as *Waldheimia australis* (t. 52. f. 1) and *W. australis*, var. (t. 52. f. 3).

These examples, showing that the animals, which are very alike in external appearance, and even having the same shell, are distinct when their internal structure is anatomically examined,—and that shells, which are so much alike that they would only be regarded as varieties of the same kind, have animals with very different organic characters when they are more minutely compared,—should, I think, make us much more careful than we have been in deciding what are and what are not distinct species, from the comparison of the shell alone, and especially where we have only fossil specimens in a more or less imperfect state to compare with recent ones, or *vice versâ*.

It is for this reason that I have been disinclined to regard the species of *Crepidula*, found in so many and such distant stations, as the same species, though they may have the same external form, and may offer the same varieties when found under similar circumstances, as on the outside or inside of shells, or when clustered on each other.

I am for the same reason inclined to doubt whether the polypidoms of different Zoophytes or Polyzoa really belong to the same species of animal, though no external difference can be discovered between the polypidoms of specimens brought from very different and distant stations. If this be the case with living species, which are sent to us in a comparatively perfect state, how much more reason for caution when we are comparing fossil with recent specimens, or fossil specimens with each other!

Saxicava *a Byssus-spinner*. By F. H. West, Esq.

On the 14th of April, I placed a full-sized specimen of *Saxicava rugosa* in my tank, where it remained for more than a fortnight, lying helplessly on its back, but evidently healthy, and during the latter part of the time having the foot pretty constantly protruded. I then made a rude hole in a piece of old wood, and placed the *Saxicava* in it, with the ventral surface downwards, in the hope that it might excavate a more suitable dwelling for itself. In the course of the following week, I examined it and removed it from the cavity, but saw nothing of consequence. Two days later, however, though the creature did not seem to have burrowed any further into the wood, it was firmly fixed in its burrow, though *how*, did not appear. On the 12th of May I cut away the wood very carefully from the under side as far as the point of attachment, and found, as I suspected, that the *Saxicava* had *fixed itself by a true byssus to the* wood. The byssus consisted of not more than half-a-dozen threads, but bore a tolerable strain without breaking. I have not broken the byssus; the threads are pretty close together at the point of attachment, which is perhaps two lines in width, and not spread over a wide base, as is often the case with the Mussel. I have returned the animal to the tank, in the hope that it may either shorten its hold, or adapt its position to its altered circumstances.

Leeds, May 18th, 1859.

Fertile Hybrids of two species of Insects. By M. Guérin-Méneville.

Last year I succeeded in getting some females of *Bombyx Cynthia* fecundated by males of *Bombyx Arrindia*, and *vice versâ*; and the eggs laid by them produced caterpillars. These caterpillars, reared last autumn, have shown nearly all the characters of *Bombyx Cynthia,* which is the wilder and more vigorous of the two species. Their cocoons, although resembling a little those of *Bombyx Arrindia* by their deeper colour, conducted themselves in the same manner as those of *Bombyx Cynthia*; that is to say, being kept in a similar temperature, the moths did not come out in the winter, as those of *Bombyx Arrindia* constantly do. However, the influence of this latter species has been felt from this first generation; for, having placed some hybrid cocoons in the reptile-room of the Museum, where the temperature is never below 13° Centigrade, the moths came out at the end of March, whilst those of *Bombyx Cynthia* proper, which I had placed by their side for comparison, have not stirred yet. The moths produced by this hybridation show on the whole, as their caterpillars have done, more of the character of *B. Cynthia* than of *B. Arrindia.* They are larger; their abdomen is brown, with white tufts,—not white, as in *B. Arrindia*; the band across their wings is edged with rosy atoms instead of whitish-grey, as in *B. Arrindia*: however, they resemble this species inasmuch as their wings are of a browner and deeper colour than those of *B. Cynthia.* The species which predominates physically is *B. Cynthia*: but morally, so to speak, the influence of the other species has been more strongly felt; for the hybrids of the two categories give caterpillars which, although resembling those of *B. Cynthia,* are less wild or more domestic, which assimilates them to the caterpillars of *B. Arrindia.* These hybrids take from *B. Arrindia* the faculty of leaving their cocoons earlier, without, however, continually coming out during winter; and it is worthy of note that the hybrids obtained from the female *B. Cynthia* and male *B. Arrindia* have come out a few days earlier than the opposite hybrids.

I may add that these hybrids are polyphagous, as nearly all the *Bombyces* are; for they may be fed with teazel-leaves, as well as the ordinary silk-worms, which have been fed at all times with lettuce, Scorzonera, goat's-beard, bind-weed, elm, rose-tree, and privet-leaves, &c.—*Comptes Rendus,* April 11, 1859.

The Victoria regia *used as Food.*

On the Riachuelo, which empties into the Parana nine miles below Corrientes, I was fortunate in obtaining some rare birds, and in seeing—what alone would have repaid for a longer journey—the queen of the *Nymphæaceæ* upon its native waters. Extensive shallow lagoons—pure and limpid—were gemmed with islands of the *Victoria regia* or 'Mais del Agua' (corn of the water), as it is called in the country; for it is not only the queen of the floral tribes, but ministers to the necessities of man. Its seeds, which are about the size of a large buck-shot, consist of a thin shell enclosing a white mealy substance. They are gathered by the Correntinos, and pounded into meal, from which they make excellent and nutritious bread.—*Page's 'La Plata, the Argentine Confederation, and Paraguay.'* New York, 1859.

On the Coiling of Tendrils. By Prof. Asa Gray.

As much as twenty years ago, Mohl suggested that the coiling of tendrils "resulted from an *irritability* excited by contact." In 1850 he remarked that this view has had no particular approval to boast of, yet that nothing better has been put in its place. And in another paragraph of his admirable little treatise on the Vegetable Cell contributed to Wagner's Cyclopædia of Physiology) he briefly says, "In my opinion, a dull irritability exists in the stems of twining plants and in tendrils." In other words, he suggests that the phænomenon is of the same nature, and owns the same cause (whatever that may be) as the closing of the leaves of the Sensitive-plant at the touch, and a variety of similar movements observed in plants. The object of this note is to remark that the correctness of this view may be readily demonstrated.

For the tendrils in several common plants will coil up more or less promptly after being touched, or brought with a slight force into contact with a foreign body, and in some plants the movement of coiling is rapid enough to be directly seen by the eye; indeed, is considerably quicker than is needful for being visible. And, to complete the parallel, as the leaves of the Sensitive-plant, and the like, after closing by irritation, resume after a while their ordinary expanded position, so the tendrils, in two species of the *Cucurbitaceæ*, or Squash family, experimented upon, after coiling in consequence of a touch, will uncoil into a straight position in the course of an hour; then they will coil up at a second touch, often more quickly than before; and this may be repeated three or four times in the course of six or seven hours.

My cursory observations have been principally made upon the Bur-Cucumber (*Sicyos angulatus*). To see the movement well, full-grown and outstretched tendrils, which have not reached any support, should be selected, and a warm day: 77° Fahr. is high enough.

A tendril which was straight, except a slight hook at the tip, on being gently touched once or twice with a piece of wood on the upper side, coiled at the end into $2\frac{1}{2}$-3 turns within a minute and a half. The motion began after an interval of several seconds; and fully half of the coiling was quick enough to be very distinctly seen. After a little more than an hour had elapsed, it was found to be straight again. The contact was repeated, timing the result by the second-hand of a watch. The coiling began within four seconds, and made one circle and a quarter in about four seconds. It had straightened again in an hour and five minutes (perhaps sooner, but it was then observed); and it coiled the third time on being touched rather firmly, but not so quickly as before, viz. $1\frac{1}{4}$ turns in half a minute. I have indications of the same movement in the tendrils of the grape-vine; but a favourable day has not occurred for the experiment since my attention was accidentally directed to the subject. I have reason to think that the movement is caused by a contraction of the cells on the concave side of the coil, but I have not had an opportunity for making a decisive experiment.—*Proceedings of the American Academy of Arts and Sciences,* vol. iv. p. 98, Aug. 1858.

On the Habits of the Scythrops Novæ Hollandiæ. By George Bennett, Esq. In a Letter to J. Gould, F.R.S. &c.

"I send you a few notes on the *Scythrops Novæ Hollandiæ*, or Hornbill Cuckoo of the Colonists, which, perhaps, you may think worth bringing under the notice of the Zoological Society.

"A few years since, a fine female specimen was shot in the Botanical Garden at Sydney; and from the notes I took at the time I find that the peculiarity of its mode of flight induced me to mistake it for a Hawk; for it wheeled about, occasionally hovered very high in the air, and then gradually descending, continued its flight close to the tops of the lofty *Eucalypti*, *Casuarinæ*, and other large trees, as if for the purpose of capturing insects, more especially the *Tettigonia* or Locust, which at that season of the year (January) were very numerous. It also whirled round the trees in circles and from branch to branch, apparently to capture the Tettigonias and other insects during their flight; and I further observed that it often darted down and took its prey among the foliage and on the trunks of the large *Eucalypti*, occasionally making a screaming noise and hovering with its wings expanded to the utmost, at a short distance above the trees, precisely as a hawk does. After making these various evolutions and securing its morning meal, it quietly perched itself on the very lofty branch where it was shot. On examining the stomach, it was found to contain Gold Beetles (*Anoplognathus*) and *Tettigoniæ* in great numbers. A young specimen formerly in the possession of Mr. Wall, the Curator of the Australian Museum, and now in the well-arranged and extensive aviary of Mr. Alfred Denison at Government House, Sydney, is in excellent health after recovering from a broken wing and broken leg.

"I observe you mention in your 'Birds of Australia' that a specimen was presented to you by Lady Dowling, being one of two taken from the branch of a tree while being fed by birds not of their own species,—an important fact, as showing the parasitic habits of the bird. Now as the Scythrops is regarded as a member of the *Cuculidæ,* anything which tends to confirm the propriety of placing it in that group must be considered of great interest; I have much pleasure, therefore, in telling you that when the young Scythrops was introduced into Mr. Denison's aviary it was placed in a compartment already occupied by a *Dacelo gigantea,* and, doubtless feeling hungry after its journey, immediately opened its mouth to be fed; and its wants were readily attended to by the *Dacelo,* who with great kindness took a piece of meat, and after sufficiently preparing it by beating it about until it was in a tender and pappy state, placed it carefully in the gaping mouth of the young *Scythrops*; this feeding-process continued until the bird was capable of attending to its own wants, which it now does, feeding in company with the *Dacelo* in the usual manner. When I saw it in the morning it was perched upon the most elevated resting place in the aviary, occasionally raising itself, flapping its wings, and then quietly settling down again after the manner of Hawks in confinement, and presenting much the appearance of a member of that tribe of birds. It comes down for food every morning, and immediately returns to its elevated perch. Judging from what I saw of this specimen, I should imagine that the bird might be very readily tamed and would bear confinement very well. In the young state the bird is destitute of the scarlet orbits so conspicuous in the adult."—*Proc. Zool. Soc.* Nov. 9, 1858.

On a Nematoid Worm living parasitically in the Egg of Limax griseus. By A. Barthélemy.

The author has found numerous specimens of a small Nematoid worm in the eggs of *Limax griseus*—sometimes one, sometimes three or four in an egg. In the earlier stages their development appears to correspond with that of the embryo of the Slug; they execute pretty lively movements, and usually keep at a certain distance from the embryo of the mollusk. One was seen attached to the vesicle by which the head of the future mollusk is surmounted. At last the worms destroy the embryo, when the walls of the egg become flattened, and the enclosed worms are found arrived at their maximum of development: they are very transparent, and allow their structure to be easly traced by simple microscopic examination. It differs so much from known types, that the author regards it as forming a new genus, *Ascaroides,* the species being *A. Limacis.*

The worm is present in the egg at the moment of its deposition; and the examination of the slugs whose eggs were infested showed the worms in the intestine and ovaries, still filled with vitelline granules, and always accompanied by a very small monadiform Infusorium. The little worms are thus introduced into the eggs of the slug while these are still in course of formation.—*Comptes Rendus,* 24th January 1859, p. 230.

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END OF THE THIRD VOLUME.

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„ 5,	11	„	... ...	„	1	4	0

The "Transactions" contain the following articles:—

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1. On the M'Horr Antelope. By E. T. Bennett, Esq.
2. On the Nervous System of *Beroë Pileus*, Lam.; and on the Structure of its Cilia. By Robert E. Grant, M.D.
3. Observations on the Laws which appear to influence the Assumption and Changes of Plumage in Birds. By William Yarrell, Esq., F.L.S. & Z.S.
4. On the Structure and Characters of *Loligopsis*, and Account of a new Species (*Lol. guttata*, Grant) from the Indian Seas. By Robert E. Grant, M.D.
5. On the Characters and Description of a new Genus of Carnivora, called *Cynictis*. By W. Ogilby, Esq., A.M.
6. On the *Chinchillidæ*, a Family of Herbivorous Rodentia, and on a new Genus referable to it. By E. T. Bennett, Esq., F.L.S., Sec. Z.S.
7. On the Sacculated Form of Stomach as it exists in the Genus *Semnopithecus*, F. Cuv. By Richard Owen, Esq., F.Z.S.
8. Description, with some additional particulars, of the *Apteryx Australis* of Shaw. By William Yarrell, Esq., F.L.S. & Z.S.
9. On the Anatomy of the *Sepiola vulgaris*, Leach; and Account of a new Species (*Sep. stenodactyla*, Grant) from the Coast of Mauritius. By Robert E. Grant, M.D.
10. On a new Genus in the Family of *Corvidæ*. By Mr. John Gould, F.L.S. Communicated by the Secretary.
11. Characters and Descriptions of several new Genera and Species of Coleopterous Insects. By the Rev. F. W. Hope, A.M.
12. Observations on the Neck of the Three-toed Sloth, *Bradypus tridactylus*, Linn. By Thomas Bell, Esq., F.R.S.
13. On the Anatomy of the Concave Hornbill, *Buceros cavatus*, Lath. By Richard Owen, Esq., F.Z.S.
14. Description of a new Genus of Acanthopterygian Fishes. By the Rev. R. T. Lowe, B.A., Corr. Memb. Z.S.
15. On the Anatomy of the Cheetah, *Felis jubata*, Schreb. By Richard Owen, Esq., F.Z.S.
16. Notice of a Mammiferous Animal from Madagascar, constituting a new form among the Viverridous Carnivora. By E. T. Bennett, Esq., F.L.S.
17. Descriptions of some new Species of Cuvier's Family of *Brachiopoda*. By W. J. Broderip, Esq.
18. On the Anatomy of the *Brachiopoda* of Cuvier, and more especially of the Genera *Terebratula* and *Orbicula*. By Richard Owen, Esq., F.Z.S.
19. Some account of the Maneless Lion of Guzerat. By Capt. Walter Smee, of the Bombay Army, F.Z.S.
20. Description of a new Species of the Genus *Eurylaimus* of Dr. Horsfield. By Mr. John Gould, F.L.S.
21. A few Remarks tending to illustrate the Natural History of two Annulose Genera, viz. *Urania* of Fabricius and *Mygale* of Walckenaer. By W. S. MacLeay, Esq., F.Z.S. &c.
22. Descriptions of some new Species of *Calyptræidæ*. By W. J. Broderip, Esq.
23. On the Anatomy of the *Calyptræidæ*. By Richard Owen, Esq., F.Z.S.

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5. Some Observations on the Economy of an Insect destructive to Turnips. By William Yarrell, Esq.
6. Mémoire sur une nouvelle Espèce de Poisson du Genre *Histiophore*, de la Mer Rouge. Par M. E. Rüppell, M.D.
7. On the Genus *Octodon*, and on its relations with *Ctenomys*, Blainv., and *Poëphagomys*, F. Cuv., including a Description of a new Species of *Ctenomys*. By E. T. Bennett, Esq., F.L.S.
8. On the Anatomy of the Lamellibranchiate Conchifera. By Robert Garner, Esq., F.L.S.
9. Descriptions of some new and rare *Cephalopoda*. By Richard Owen, Esq., F.R.S.
10. Mémoire sur les Gerboises et les Gerbilles. Par M. Fred. Cuvier.
11. Description of a new Genus of Mammiferous Animals from Australia, belonging probably to the Order *Marsupialia*. By George R. Waterhouse, Esq.
12. Descriptions of several new Species of Insects belonging to the Family of the Sacred Beetles. By J. O. Westwood, Esq., F.L.S. &c.
13. Osteological Contributions to the Natural History of the Orang-Utans (*Simia*, Erxleben). By Richard Owen, Esq., F.R.S. &c.
14. A Synopsis of the Fishes of Madeira; with the principal Synonyms, Portuguese Names, and Characters of the new Genera and Species. By the Rev. R. T. Lowe, M.A.
15. Observations on the Genus *Galictis* (Bell), with the Description of a new Species. By Thomas Bell, Esq., V.P.Z.S., F.R.S. &c.
16. On a new Subgenus of Fishes, allied to *Ophidium*. By William Thompson, Esq.
17. Description of a new Species of Antelope. By Capt. W. C. Harris.
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19. On a new Genus of Insectivorous Mammalia. By W. C. L. Martin, Esq., F.L.S.
20. On the Anatomy of the Southern Apteryx (*Apteryx Australis*, Shaw). By Richard Owen, Esq., F.R.S. &c.
21. Observations upon Pelagic Serpents. By Dr. Theodore Cantor.
22. Outlines of a Classification of the *Marsupialia*. By Richard Owen, Esq., F.R.S. &c.
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24. On the Skull of the North American Badger, *Meles Labradoria* of Authors. By George R. Waterhouse, Esq.
25. On the Fishes of the Dukhun. By Lieut.-Col. W. H. Sykes, F.R.S. &c.
26. On the Osteology of the *Marsupialia*. By Richard Owen, Esq., F.R.S. &c.

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1. Supplement to "A Synopsis of the Fishes of Madeira." By the Rev. R. T. Lowe, M.A.
2. Notes on the Birth of the Giraffe at the Zoological Society's Gardens, and Description of the Fœtal Membranes and of some of the natural and morbid appearances observed in the Dissection of the Young Animal. By Richard Owen, Esq., F.R.S. &c.
3. Notice of a fragment of the Femur of a Gigantic Bird of New Zealand. By Richard Owen, Esq., F.R.S. &c.
4. Monograph of the Hollow-horned Ruminants. Part I. By William Ogilby, Esq., M.A.

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Vol. IV. Part 2. 1852.

3. On the Anatomy of the Indian Rhinoceros (*Rh. unicornis*, L.). By Professor Owen, F.R.S., F.Z.S. &c.
4. On *Dinornis* (Part V.): containing a Description of the Skull and Beak of a large Species of *Dinornis*, of the Cranium of an immature specimen of *Dinornis giganteus* (?), and of Crania of Species of *Palapteryx*. By Professor Owen, F.R.S., F.Z.S. &c.
5. Notice of the Discovery by Mr. Walter Mantell in the Middle Island of New Zealand, of a living specimen of the *Notornis*, a Bird of the Rail family, allied to *Brachypteryx*, and hitherto unknown to Naturalists, except in a Fossil state. By Gideon Algernon Mantell, Esq., LL.D., F.R.S. &c.
6. Remarks on *Notornis Mantellii*. By J. Gould, F.R.S.

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7. Osteological Contributions to the Natural History of the Chimpanzees (*Troglodytes*) and Orangs (*Pithecus*). No. IV. Description of the Cranium of an Adult Male Gorilla from the River Danger, West Coast of Africa, indicative of a variety of the Great Chimpanzee (*Troglodytes Gorilla*), with Remarks on the Capacity of the Cranium and other characters shown by sections of the Skull, in the Orangs (*Pithecus*), Chimpanzees (*Troglodytes*), and in different varieties of the Human Race. By Professor Owen, F.R.S., F.Z.S. &c.

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8. Osteological Contributions to the Natural History of the Chimpanzees (*Troglodytes*) and Orangs (*Pithecus*). No. V. Comparison of the Lower Jaw and Vertebral Column of the *Troglodytes Gorilla, Troglodytes niger, Pithecus Satyrus,* and different varieties of the Human Race. By Professor Owen, F.R.S., F.Z.S. &c.
9. On the Anatomy of the Great Anteater (*Myrmecophaga jubata*, Linn.). By Professor Owen, F.R.S., F.Z.S. &c.
10. On *Dinornis* (Part VI.): containing a Description of the Bones of the Leg of *Dinornis* (*Palapteryx*) *struthioides* and of *Dinornis gracilis*, Owen. By Professor Owen, F.R.S., F.Z.S. &c.

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11. On *Dinornis* (Part VII.): containing a Description of the Bones of the Leg and Foot of *Dinornis elephantopus,* Owen. By Professor Owen, F.R.S., V.P.Z.S. &c.
12. On *Dinornis* (Part VIII.): containing a Description of the Skeleton of the *Dinornis elephantopus,* Owen. By Professor Owen, F.R.S., V.P.Z.S. &c.
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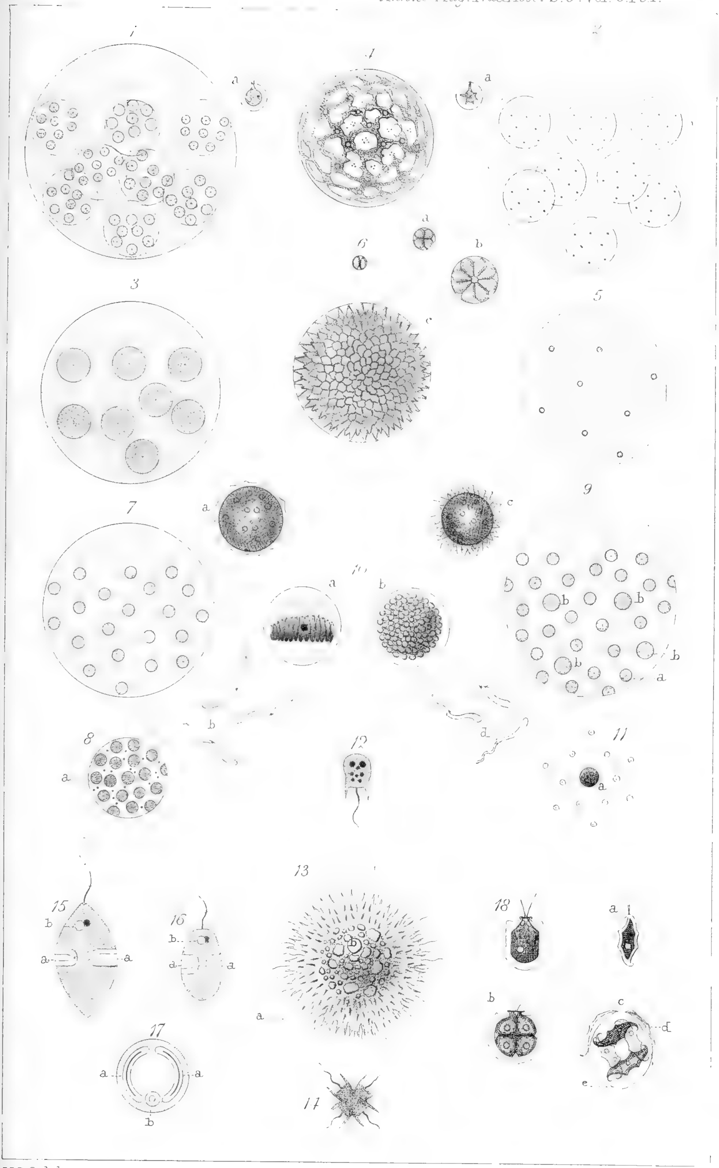
14. On the Anatomy of the Great Anteater (*Myrmecophaga jubata,* Linn.). Part II. By Professor Owen, F.R.S., V.P.Z.S. &c.

PHILIP LUTLEY SCLATER,
Secretary.

11, Hanover Square,
May 29th, 1859.



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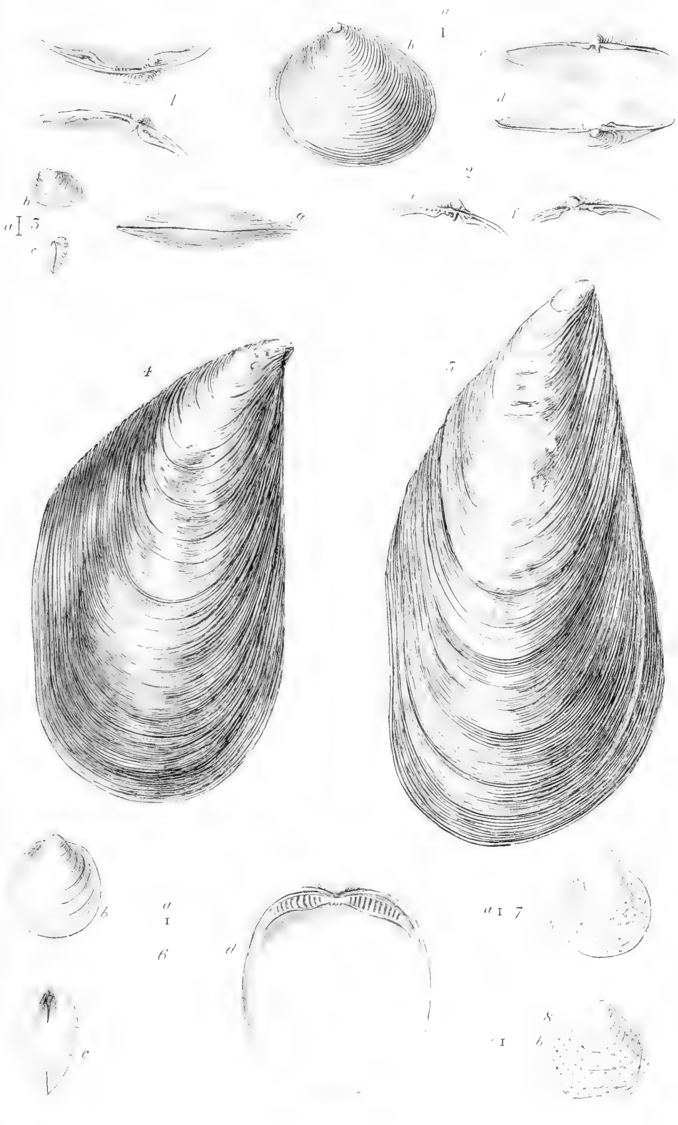

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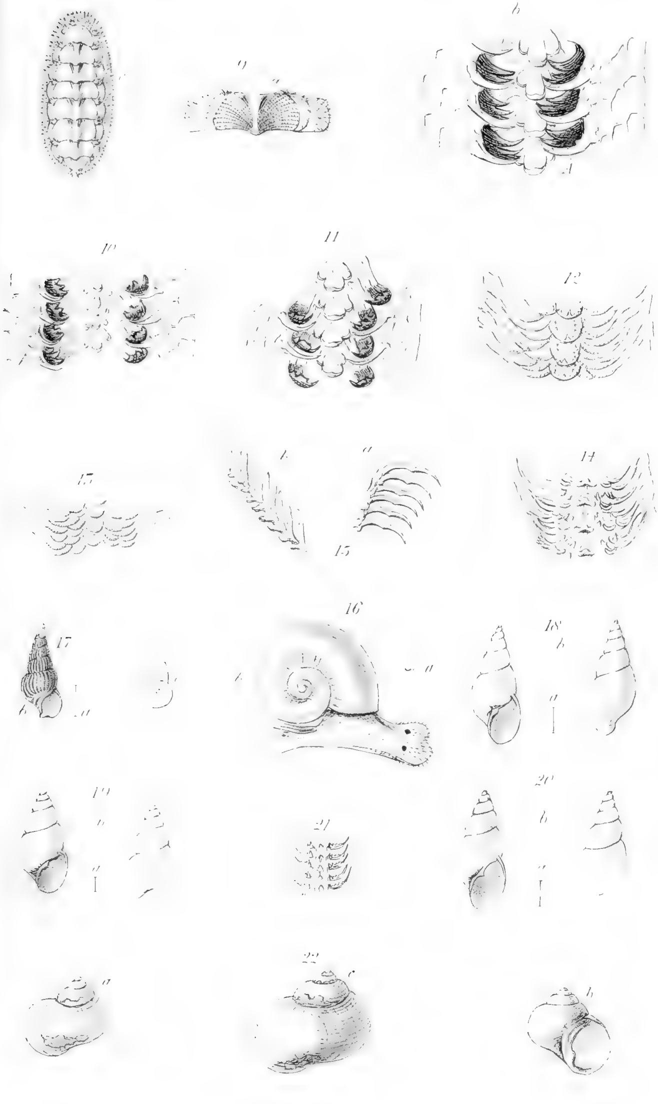

F. C. Lukis & L. E. Collings. del

J. De C. Sowerby. sc.

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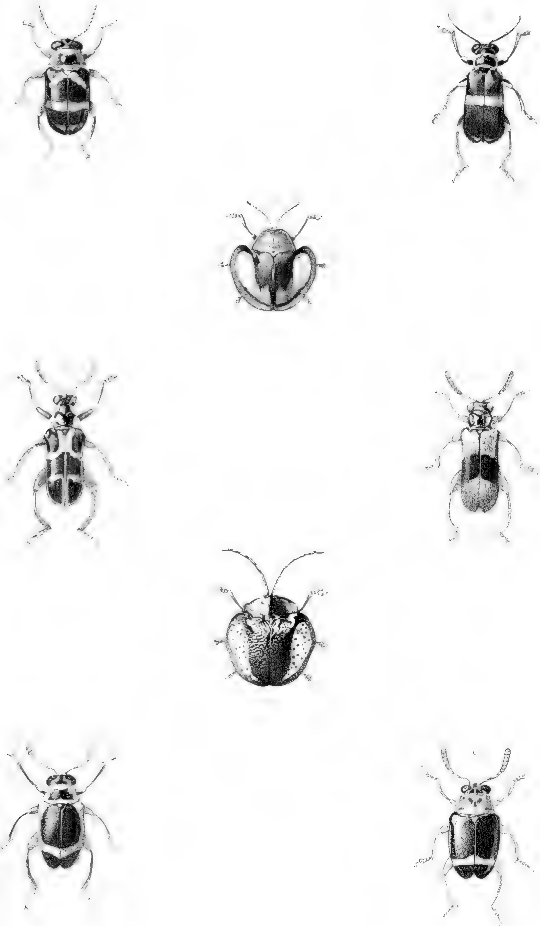
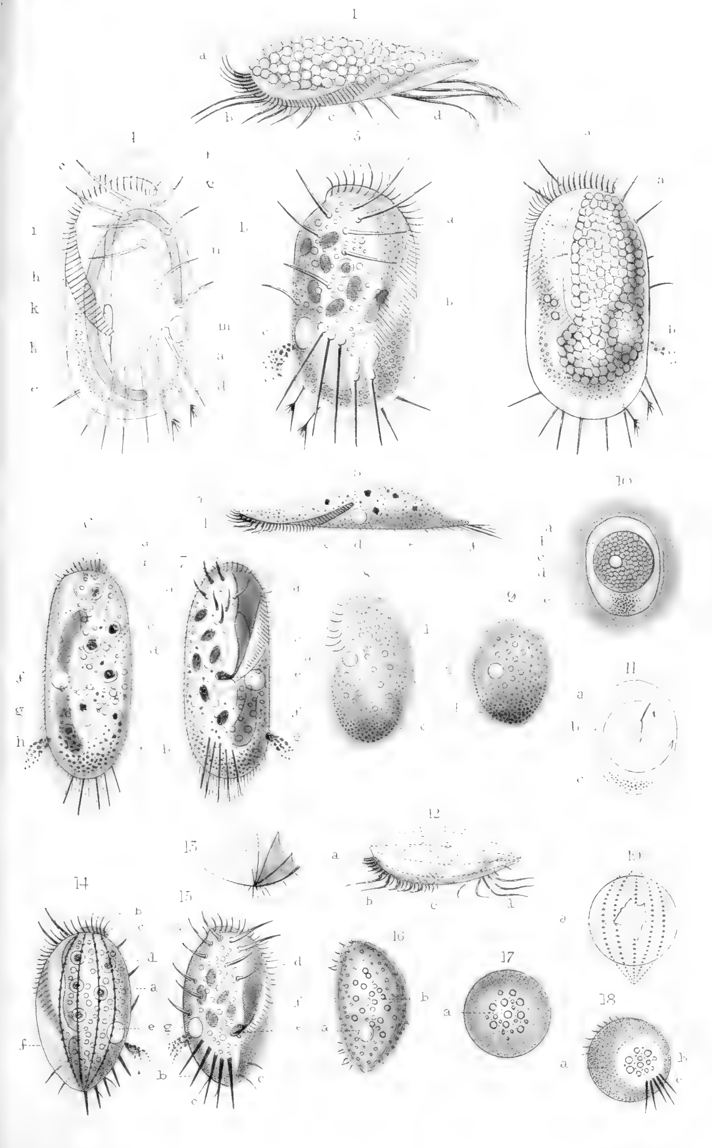
J. Basire sc.





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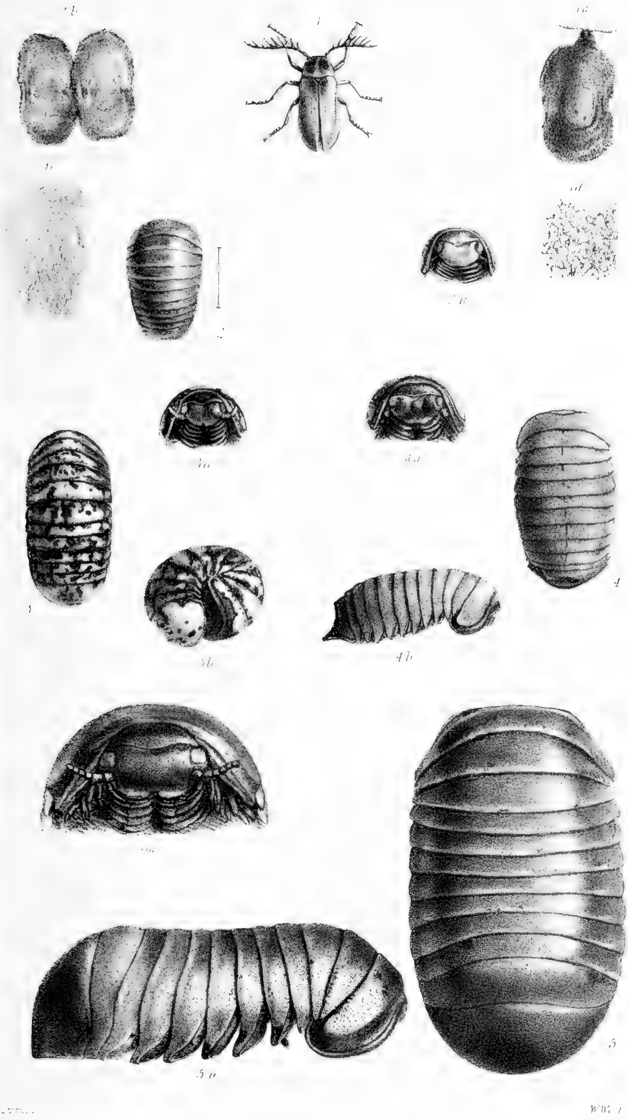

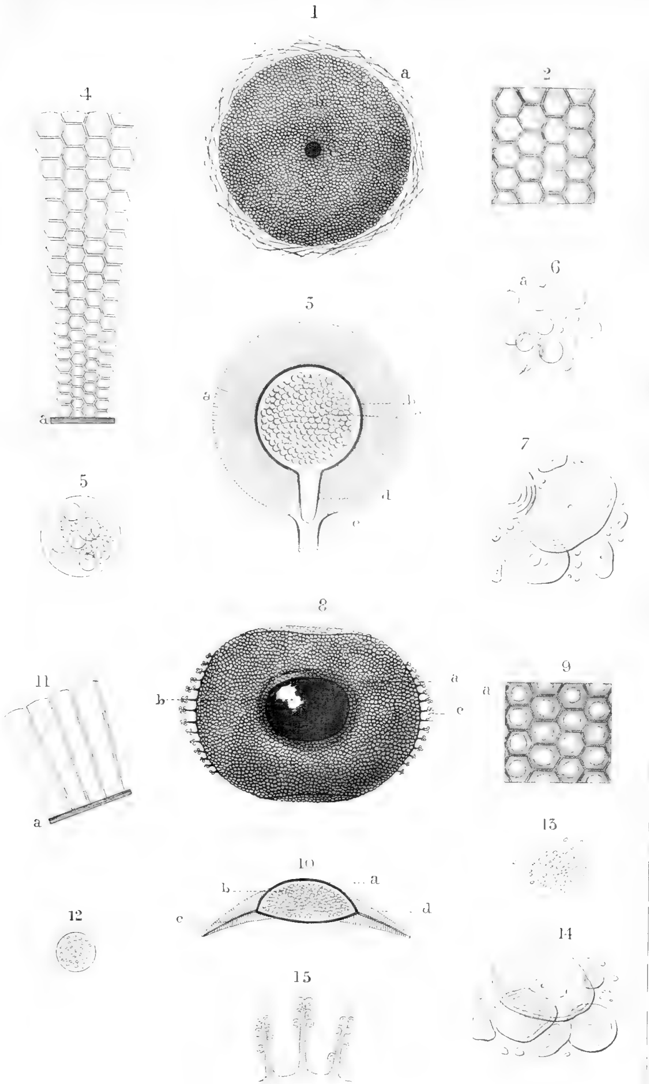

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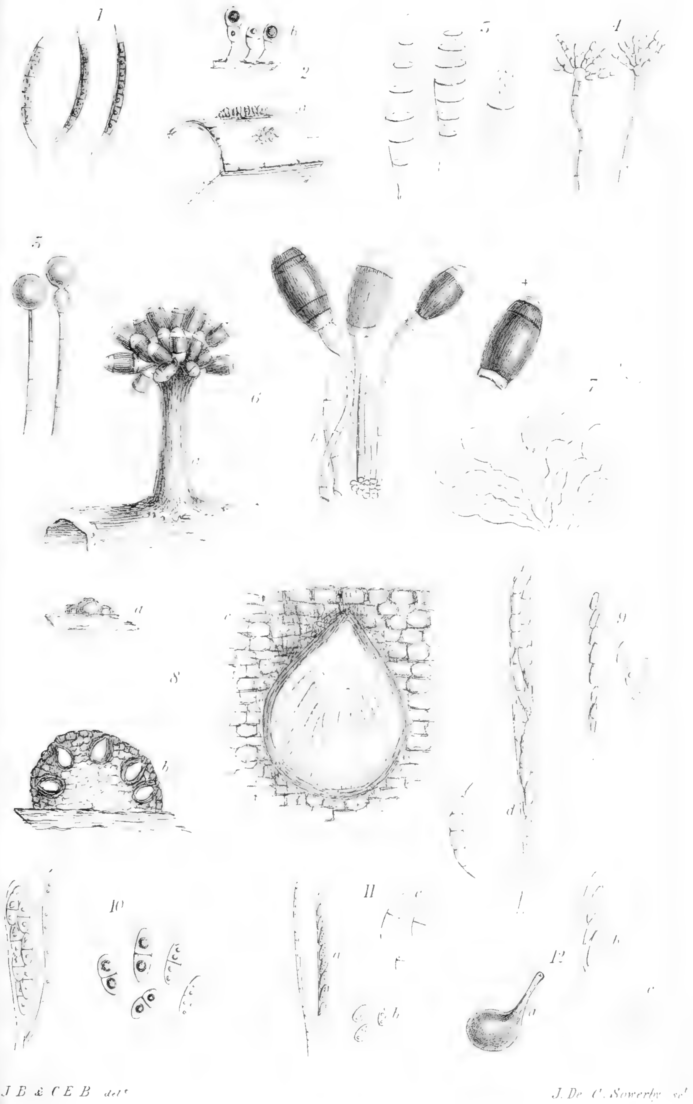

M J B & C E B del.

J. De C. Sowerby sc.

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J. De C. Sowerby sc.

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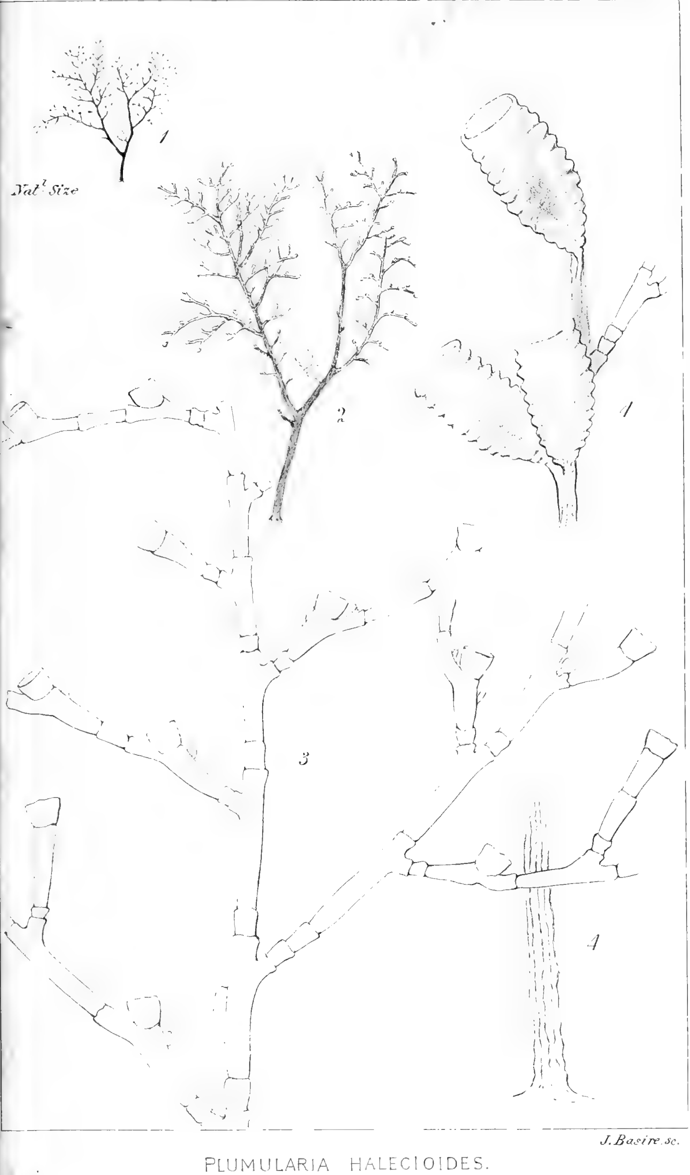
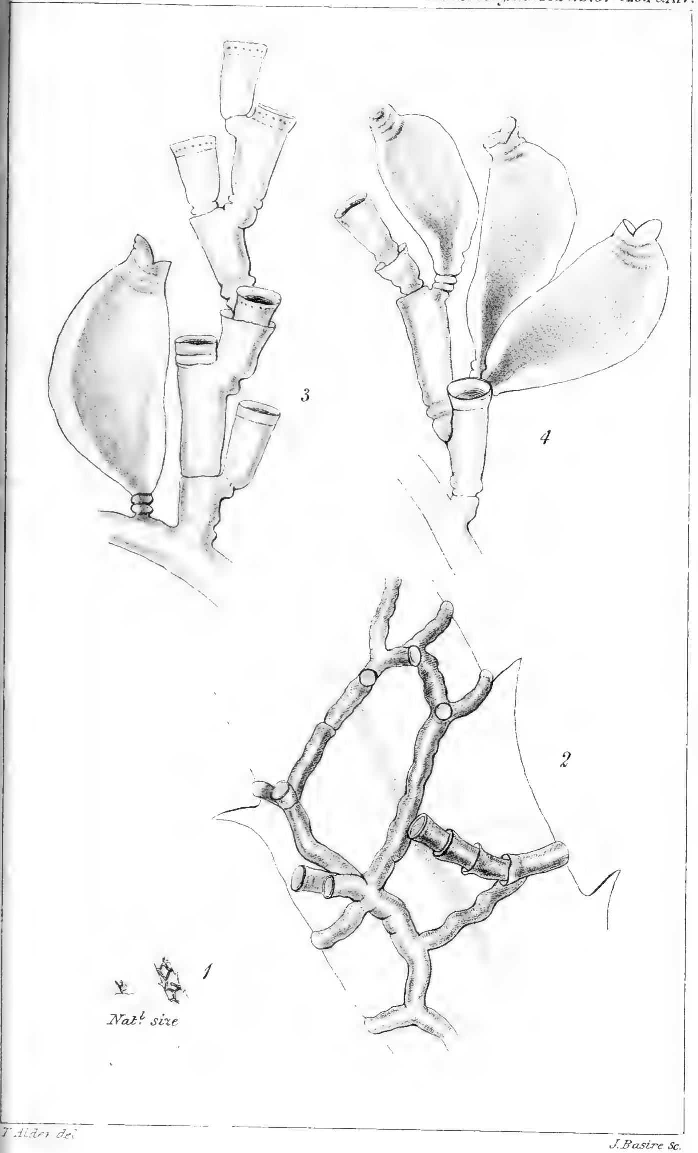


J. Basire sc.

PLUMULARIA HALECIOIDES.

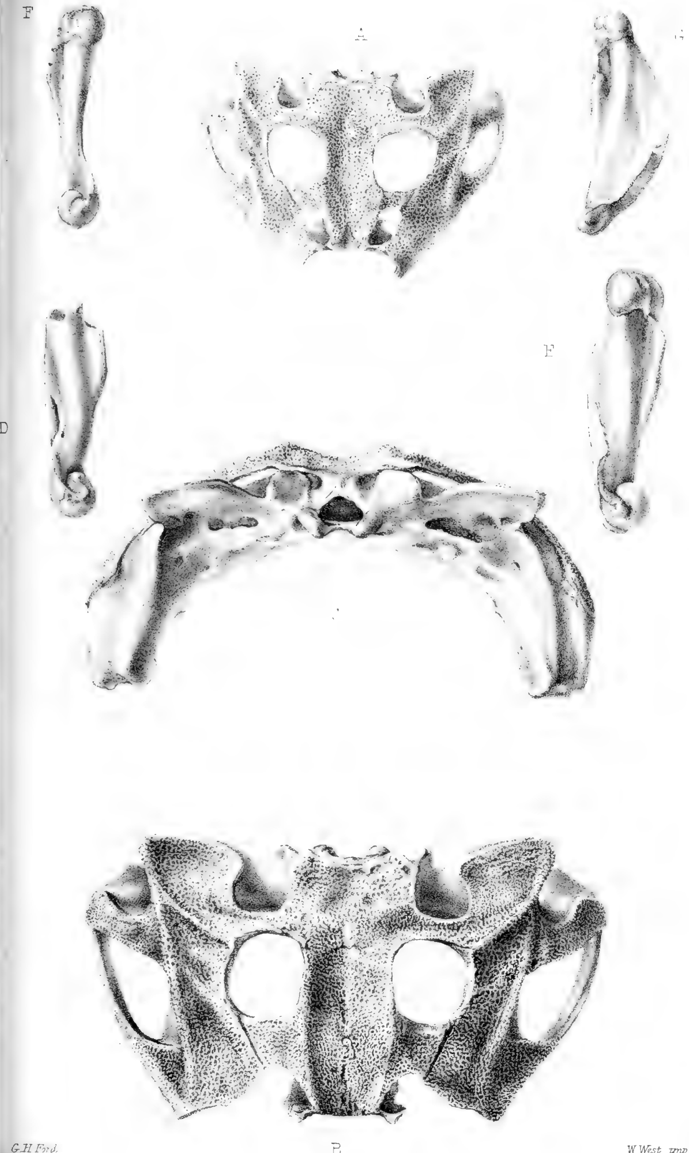
T. Alder del. J. Basire, sc.

HALECIUM LABROSUM

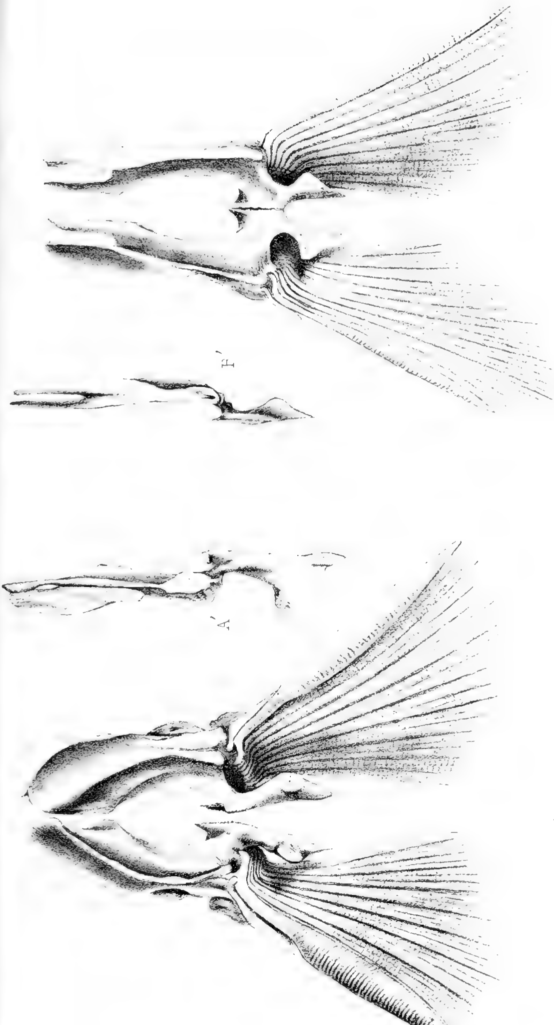


T. Alder del. J. Basire Sc.

HALECIUM NANUM



G.H Ford. B W West imp



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Dr Günther del. G.H. Ford.

W. West imp.

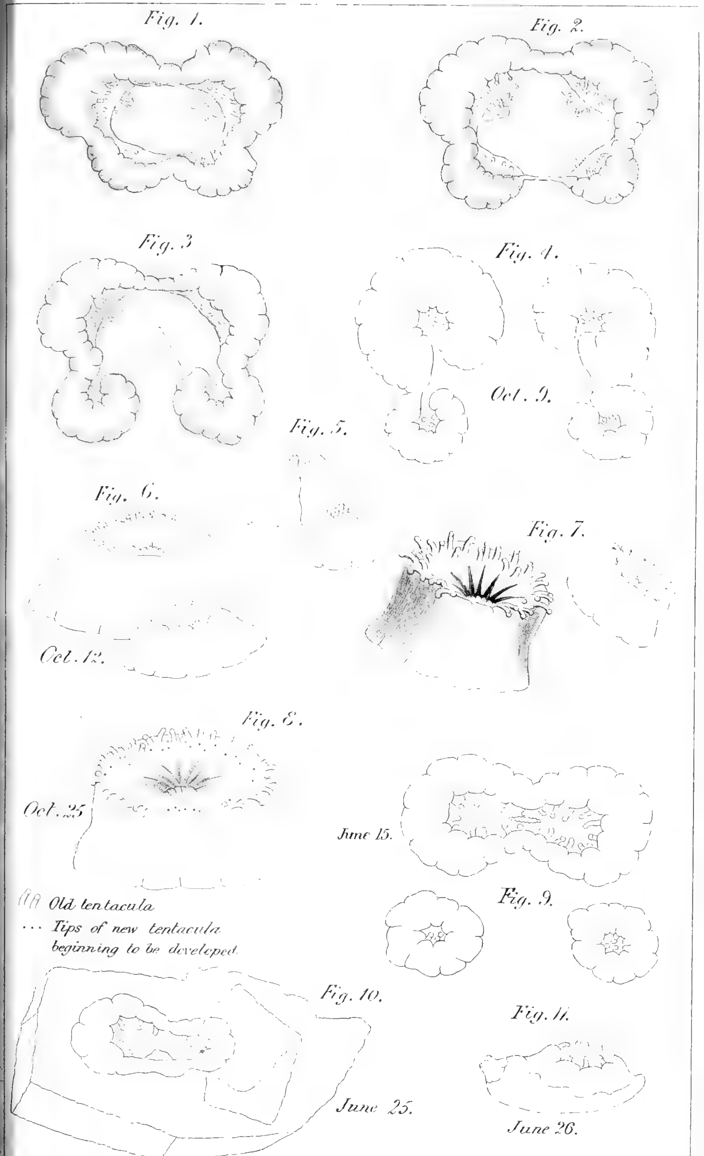
Fig. 1.
Fig. 2.
Fig. 3
Fig. 4.
Oct. 9.
Fig. 5.
Fig. 6.
Oct. 12.
Fig. 7.
Fig. 8.
Oct. 25
June 15.
Fig. 9.
Old tentacula
... Tips of new tentacula beginning to be developed.
Fig. 10.
June 25.
Fig. 11.
June 26.

J. Basire, sc.