THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

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"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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Page 269, line 14 from bottom, *for* externo *read* interno.
———, line 13 from bottom, *after* expanso *insert* externo.

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Page 31, line 11 from bottom, *for* this *read* fine.
—— 33, line 4 from top, *for* Pneunopomorum *read* Pneumonopomorum.
—— 46, line 4 from bottom, *for* columnari *read* columnare.
—— 57, line 16 from top, *for* Laminaria *read* Lamellaria.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND 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. 61. JANUARY 1853.

I.—*Observations on the* Solanaceæ. By John Miers, Esq., F.R.S., F.L.S.

It is now (October 1852) more than two years since I suspended my observations on the *Solanaceæ*, in expectation of the long promised monograph of M. Dunal, which has at length made its appearance in the 13th volume of the 'Prodromus' of M. De-Candolle. Several of the genera belonging to this family, as well as most of the species that I have enumerated at different intervals, are there recorded; but as their respective affinities, their distribution founded on peculiar features, and the differential characters of the divisions thus proposed, are not noticed in the slightest degree, I feel myself called upon to make some remarks on the subject. Considering how little was known of the real limits of the genera of the *Solanaceæ* a few years ago, aware of the confusion in which these were associated upon the most irreconcileable data, as witnessed in the latest distribution of the family in Endlicher's 'Genera Plantarum' and Don's 'Dictionary,' knowing that the species were ill-defined and ill-classified, and that a large proportion of undetermined plants were amassed in every herbarium, for want of the means of their discrimination, it was natural that a general satisfaction should be felt on the announcement, that M. Dunal was occupied in elaborating a monograph of the family for the 'Prodromus.' This ought, in regular order, to have preceded the *Scrophulariaceæ*, and to have appeared seven years ago: the intervening delay has therefore served only to increase a general anticipation of greater perfection in a work, proceeding from the hand of one who had written on the genera of the family and their affinities thirty-five years since, and who had made this order an object of his study during a great portion of his life. It cannot be concealed that its appearance has not answered the universal expectation, and that a feeling of disappointment has been generally felt among botanists on its perusal. All will unite in their acknowledgement to M. Dunal for the production of this laborious work, and will willingly excuse a large share of its imperfections, when it is known, that in his anxious endeavours to bring it to a close, he has laboured beyond his physical powers, persevering in this task under the pressure of long and continued illness. Still it is to be regretted, that circumstances should have operated to keep its distinguished author in ignorance of the facts and reasonings that have been published within the last few years. If, therefore, I now proceed to point out several inconsistencies in the distribution exhibited in this volume, I can truly affirm, that it is not from any desire to criticize the labours of M. Dunal, but to justify what is due to the advancement of science, and to support the inferences drawn and the facts collected by me towards the history of this family.

The great object of all scientific arrangement is to group together individuals possessing some common conspicuous features, by which they may be readily distinguished: these may again be subdivided by other partial characters into sections and subsections, but all such characters should be clearly definable.

The ordinal character of the *Solanaceæ*, as given by M. Dunal, like that of his predecessors, falls very far short of this desideratum, and the Conspectus of the classification is deficient of those tangible features that should serve the purpose of discrimination. Its limits are by far too general, embracing within its scope individuals belonging to other orders. In the character of the corolla, for instance, the more important features are neglected or merely hinted at, while others more especially selected are frequent among *Scrophulariaceæ* and other orders: hence they are of little value for distinguishing the precise family to which species belong. In the characters given of the structure of the seed and embryo, many peculiarities are altogether omitted, while others are inaccurately described: these will be more particularly noticed presently. In his Conspectus, M. Dunal divides the family into two tribes, the *Nolaneæ* and the *Solaneæ*, the latter being separated into nine subtribes, which are marked by very insufficient characters, as I shall hereafter explain. Of these subtribes the most numerous in genera is the *Solaneæ*, signalized by three principal features; 1. a regular corolla, an indication of little utility, as it exists equally in other tribes; 2. a bilocular berry; 3. a semicircular or spiral embryo, a feature also retained by other subtribes, and even here too its applicability as a test is rendered nugatory by the knowledge that *Juanulloa* and *Marckea* have a nearly straight embryo.

It is to be regretted that M. Dunal should have associated the *Nolanaceæ* with the *Solanaceæ*, from which they differ essentially in the structure of the pistil and the fruit. The *Scrophulariaceæ*, *Atropaceæ* and *Solanaceæ*, placed as I have suggested under more strictly defined and simple limits, form, together with some other families, a very manifest alliance, exhibiting the prominent characteristics of monopetalous flowers, with a pistillum consisting of a superior ovarium, a simple style, and a stigma generally entire or 2-lobed; the ovarium by the confluence of its carpels being normally 2-locular, with the cells placed always anteriorly and posteriorly in regard to the axis; and whenever the few known exceptions occur of more than two cells, these will be found to arise generally from an unusual extension of the placentæ, which always proceeding from the centre of the dissepiment, produce abnormally other spurious cells. Among the *Nolanaceæ*, the only genus that approaches this definition is *Grabowskya*, all others differing essentially in structure, but even in that genus the resemblance is more apparent than real. In the *Nolanaceæ*, the carpels constituting the pistillum are more numerous, and, excepting the case just mentioned, are always free, springing from a fleshy receptacle surrounded by distinct glands, and all receiving their fertilizing influence through the medium of one common style, that has no direct communication with the ovaria, but always indirectly, through the intermedium of a supporting gynobase, in the same manner as the *Borraginaceæ* and the *Labiatæ*. In *Grabowskya*, although the two component carpels are connate, the style apparently issuing from it does not spring from the summit, as in an ordinary pistillum, but may be traced down the axile line of their union to the base, and may be separated from the adherent carpels: the style therefore, though concealed below by the confluent carpels, is truly of gynobasic insertion. This essential difference in the structure of the pistil renders the union of the *Solanaceæ* and *Nolanaceæ* quite indefensible. Another peculiarity is constant in the *Nolanaceæ*, in which respect we find no parallel or analogy among the *Solanaceæ*: this consists in the fact, that whether the ripened nuts be unilocular or many-celled (the cells in all cases being 1-seeded), there is always seen at their basal point of attachment, one or more scars, each closing the entrance into a corresponding cell, which scar, in every case, represents the end of a kind of plug, evidently analogous to the strophiole (or Calomphala of Schrader), so conspicuous in the nuts of the *Borraginaceæ*. Another distinction will also be found to exist which has not been noticed by M. Dunal: in the *Solanaceæ* the extremity of the radicle never points immediately to the hilum, but is directed to a spot removed from it, and even where the embryo is straight, as in *Metternichia, Cestrum, Fabiana*, &c. Although the end of the radicle points to the bottom of the seed, the hilum is always lateral or marginal, at some little distance from the base: in *Nolanaceæ*, on the contrary, the extremity of the radicle always points to the strophiolar cavity in the base of the nut, and of course to the hilum, or place of its attachment to the gynobase. This forms another essential and constant difference between the two families. There is still one more material distinction in the structure of the pistillum arising out of the circumstances just mentioned. In the *Solanaceæ*, we always meet with numerous ovules in each cell, all attached to the placentæ springing from the dissepiment; in the *Nolanaceæ*, a single ovule only exists in each cell, and this is constantly erect and of basal origin.

Schlechtendal in 1832 (Linnæa, vii. 72) pointed out the analogy that exists in the genus *Nolana* to the families of the *Borraginaceæ* and *Solanaceæ*, admitting its greater affinity with the former, on account of the structure of its fruit and the æstivation of its corolla; but as a justification for those who might prefer placing it in *Solanaceæ*, it was argued by that able botanist, if the genus *Lycium*, which differs from other genera of this last-mentioned family in the æstivation of its corolla (the only exceptional case at that time known), be retained in this order, then there would be less difficulty in admitting *Nolana*, notwithstanding the very different structure of its fruit. Dr. Lindley, who first proposed this order in 1833, placed it near the *Convolvulaceæ*. G. Don (1837) was I believe the first who decidedly associated the *Nolanaceæ* as a tribe of the *Solanaceæ* (Dict. iv. 399), but he offered no reasons for this union. Endlicher in his 'Genera Plantarum' followed the views of Dr. Lindley, in attaching this group as a suborder of the *Convolvulaceæ*. Brongniart (1843) adopted the same views in regard to the affinity of the *Nolanaceæ*. A. de Jussieu (1844, Cours Elémentaire) equally confirmed the ideas of the before-mentioned botanists, in placing the *Nolanaceæ* in contiguity with the *Dichondreæ*, between the *Borraginaceæ* and *Convolvulaceæ*. In 1845 I adduced many facts and several additional reasons, why the *Nolanaceæ* should be placed in the system following the *Borraginaceæ* (Hook. Lond. Journ. Bot. iv. 366), which position was confirmed in the following year under the arrangement given by Prof. Lindley (Veg. Kingd. 654), where this order is placed in his Echial alliance with the *Borraginaceæ, Labiatæ* and others. The views of so experienced a botanist as M. Dunal must ever be received with respect, and will claim support from the mere prestige of his name, as well as from the high reputation of the great work to which he has contributed this important monograph; but we may be allowed to doubt the propriety of his determination, in placing the *Nolanaceæ*, as a tribe of the *Solanaceæ*, without refuting the reasons urged by so many botanists against the justness of this arrangement, or offering any arguments in favour of such an alliance. This classification may have originated in the too eager desire entertained by M. Dunal, in common with many botanists, to diminish as much as possible the number of natural orders, a very proper and meritorious caution, but when carried to excess, as in this instance, is productive of mischief; for by uniting several families into one, which are composed of very opposite and dissimilar characters, we destroy the very object we attempt to establish, viz. to mark the limits of distinction between different groups of plants. The selection of a few decided and constant characters, that can serve to distinguish each order, tribe or section, must infallibly tend to the greatest simplicity of arrangement; and if in accomplishing this purpose, we should thus be led to increase the number of families, in order to ensure the means of certain discrimination, it is indubitably better to do so, rather than, by pursuing the opposite extreme, to render all fixed landmarks useless. It was upon this conviction that I proposed (*huj. op.* iii. 163) to reduce the *Scrophulariaceæ* within more certain limits than Mr. Bentham had employed in his admirable monograph of the order in the 10th volume of the 'Prodromus' of M. DeCandolle, and also to confine the *Solanaceæ* within strictly definable bounds. The difficulty of establishing an obvious line of demarcation between these two great families, was there discussed at some length, when I showed how unsuccessful had been the attempts of botanists to remedy so manifest a defect in the system. Mr. Bentham, it is true, adopted with this view, the plan of associating the few aberrant cases then known, in a distinct tribe, his *Salpiglossideæ*: the heterogeneous features of that tribe have been fully demonstrated, proving that the attempted remedy has been wholly inefficacious: among the many instances that could be cited, it is only necessary to point out, how impossible it is to retain *Salpiglossis, Anthocercis, Schwenkia* and others in *Scrophulariaceæ*, while *Petunia, Nierembergia*, and numerous others are placed in *Solanaceæ*. At the time of Mr. Bentham's monograph the exceptional genera were few, but since that period they have become so multiplied as to equal in number those belonging to true *Solanaceæ*.

As a desirable test towards the attainment of this great desideratum, I suggested the constant character of the æstivation of the corolla, which, combined with other well-selected features, will be found to reduce these two extensive orders within definable bounds: for this purpose, it is only requisite to detach from each their several aberrant cases, and comprise these in an intermediate family, where they are easily separable into tribes, distinguishable by marked peculiarities. M. Dunal does not seem to have been aware of this suggestion, or at least, no such expedient appears to have entered into his contemplation; and his ordinal diagnosis of the *Solanaceæ*, aggravated still further by the inclusion of the *Nolanaceæ*, is necessarily a combination of contradictory characters, repeating and increasing all the defects of his predecessors.

I will here recapitulate the more essential points suggested on a former occasion, when upon the principle then recommended, the Solanal alliance, excluding entirely the *Nolanaceæ*, but including the *Scrophulariaceæ*, will consist of individuals, marked by the leading characters just enumerated (*ante*, p. 3). Among these, the *Solanaceæ* will embrace those genera with a monopetalous corolla, having a 5-, rarely 4-partite border, the lobes of which (even under the unusual circumstance of the tube being oblique) are nearly regular and equal, and their margins always valvate or induplicato-valvate in æstivation: epipetalous stamens, alternate with, and equal to the number of the lobes, sometimes unequal in length and size, and the fifth very rarely sterile; anthers introrse, bursting by longitudinal slits or apical pores; an ovarium most generally 2-celled, rarely 3- to 5-locular, with a simple style and a 2-lobed or clavate stigma, often hollow; a fruit either capsular or baccate, 2-locular, rarely more-celled from the increment of the placentæ, albuminous seeds with an embryo, in the suborder *Curvembryeæ*, always slender, terete, and curved in a more or less annular or spiral form, in the suborder *Rectembryeæ*, short and straight, the radicle in all cases pointing, not to the base, but to the basal angle of the seed, and turned away to some short distance from the hilum, which is generally lateral and somewhat marginal, but never basal. They consist of plants, with alternate, often geminate, rarely pinnatifid leaves, with an inflorescence sometimes axillary, but more generally a little extra-axillary, or lateral, either single or fasciculated, or in different modifications of the cyme, panicle or corymb, under a mode of development called centrifugal.

The *Scrophulariaceæ* will consist of those genera, possessing a tubular corolla, more or less curved and irregular, with a 4- or 5-partite border, the lobes of which are generally unequal and bilabiate, and decidedly imbricate, never valvate, in æstivation; stamens two or four, didynamous, rarely five, or with a rudimentary fifth; anthers always introrse; an ovarium most generally bilocular, a simple style, with a stigma more or less bilabiate or 2-lobed; fruit almost always capsular, in a very few cases baccate, 2-locular, rarely more-celled, bursting in different ways, with placentæ proceeding from the dissepiment. Seeds albuminous, with an embryo quite straight, or but little curved, generally with the radicle pointed towards a basal hilum: in one solitary instance the embryo is perispherically curved, and in the *Rhinantheæ*, by an abnormal extension of the podosperm; the hilum appears somewhat lateral. In this very natural family, although the floral leaves are often alternate, the cauline leaves are most generally opposite, a circumstance that occurs only accidentally in *Solanaceæ*: the inflorescence is strictly axillary*.

The *Atropaceæ* will comprise all the anomalous exceptions to the foregoing rules in the *Solanaceæ* and *Scrophulariaceæ*, and will include plants with monopetalous flowers, with the tube often plicated longitudinally in bud, and a border often somewhat unequal, but seldom bilabiate, generally divided into five lobes, which are always either imbricately disposed in æstivation, or arranged under some modification between that form and the induplicate, but never valvate, the margins of each lobe being constantly free from the adjoining ones: they have generally five epipetalous fertile stamens, alternate with the lobes, one of them sometimes shorter, and very rarely three of them sterile: anthers generally introrse, sometimes extrorse, 2-lobed, usually with parallel cells bursting longitudinally, one of the lobes being occasionally sterile: ovarium 2-locular, rarely, with other spurious cells, caused by the abnormal growth of the placentæ, with ovules generally ascending, attached to fleshy placentæ adnate to the dissepiment, as in the two preceding families, a simple style, a bilobed stigma, often of a peculiar form: fruit either baccate or capsular: seeds generally reniform and compressed, with a lateral hilum, the embryo placed in albumen, and either straight or more or less curved, sometimes spiral, with the radicle, as in the *Solanaceæ*, always turned away from the more lateral hilum. Herbaceous plants or shrubs, with a habit similar to that of the *Solanaceæ*, with alternate, simple, geminate, or fasciculate leaves:

* The efficacy of this test may be applied to *Verbascum*, a genus of the *Scrophulariaceæ*, which offers so many anomalous characters, as to have induced many botanists to place it in *Solanaceæ*. On a former occasion I discussed this subject at some length (*huj. op.* iii. 181), when reasons were shown why a preponderance tended towards its position among the *Scrophulariaceæ* as determined by Mr. Bentham: to these I may now add the fact of the structure of the seed, in which the radicle of its straight embryo is directed towards its basal hilum.

inflorescence generally somewhat extra-axillary, and lateral in regard to the insertion of the petiole.

The distribution of the *Solanaceæ* and of the *Atropaceæ*, as proposed in this work (*huj. op.* iii. 164–178), like every first attempt of the kind, is sure to present many faults that will admit of correction, but it appears deserving of the attention of botanists as a general plan: it certainly effects the great desideratum of removing the obstacles that have always stood in the way of a satisfactory arrangement of the Solanal alliance, and it separates the genera into very natural groups, which we do not meet with in the system adopted by M. Dunal. Some observations on the peculiar features of each of these groups will be found in the pages referred to.

I now proceed to review in succession the value of the characters selected as the discriminating marks of the subtribes, in the arrangement followed by M. Dunal. There does not appear to me sufficient reason for separating the genus *Triguera* as a subtribe distinct from the *Solaneæ*. It is certainly a well-marked genus, possessing prominent characters, and differs only from the other genera of the latter subtribe in the slightly oblique form of its bell-shaped corolla; but, like others of the *Solaneæ*, its border has five equal and regular lobes, and agrees with them in æstivation; it has also five equal stamens, supported on a ring, as in *Cyphomandra*, but this ring is more free from the tube of the corolla; its anthers open by apical pores, as well as by lateral slits, as in some sections of *Solanum*; in the structure of the ovarium, its style and stigma, in its fruit, its placentation, its seed, and its embryo, there is nothing different from what we frequently meet with in *Solanum* itself. M. Dunal, on the authority of Cavanilles, states the fruit to be 4-locular, each cell producing only two seeds, which are superimposed. I found the fruit to be distinctly 2-locular, being divided by a single membranaceous dissepiment, with two or three seeds in each cell, fixed, as in *Solanum*, to fleshy placentæ adnate to the dissepiment. The seeds are reniform, compressed, large in proportion to the size of the fruit; but their paucity in each cell is a test of no value, for I found in *Withania* only a solitary seed perfected in each cell. There is not therefore a single character in *Triguera*, except the small obliquity of the tube of the corolla, that is not met with in other genera of the *Solaneæ**.

Among the subtribes *Solaneæ* and *Atropineæ* of M. Dunal, we

* I have observed in several other cases an equal degree of obliquity in the corolla. Among these may be instanced *Hyoscyamus pictus*, where it is quite as oblique and gibbous as in *Triguera*: the same fact is depicted in the plate given of *Hyoscyamus niger*, in Nees's Gen. Pl. Fl. Germ. figs. 5, 6 and 7.

find genera placed heterogeneously together, without regard to uniformity of character, and totally irrespective of the most important feature of æstivation. Thus, among the *Solaneæ*, which possess a valvate æstivation, is placed the genus *Nicandra*, with a corolla resembling that of a *Convolvulus*, the lobes of its border possessing a decidedly imbricated æstivation. The want of attention to this last-mentioned important character has, in the same manner, led to the confused association of several genuine sections: thus, among the *Atropineæ*, we find the very natural group of the *Jaboroseæ*, distinguished by a tubular corolla, which in most cases grows black in drying, always possessing a valvate æstivation and other very distinct characters, classed with *Atropa* and *Mandragora*, genera quite different from them and each other, and possessing a remarkably imbricate æstivation. Thus also in the *Lycineæ*, there is an equal amount of complication, for we see *Dunalia, Iochroma, Pœcilochroma, Acnistus*, and others with valvate æstivation, associated with several distinct groups that possess an imbricated æstivation: among these we find *Juanulloa, Solandra*, &c., and also *Marckea, Thinogeton*, &c., and all these again congregated with *Lycium*—groups perfectly distinct from one another. We meet with *Juanulloa* and *Marckea*, having almost a straight embryo, placed among a number of genera having a nearly annular embryo.

The genus *Thinogeton*, arranged by M. Dunal among his *Lycineæ*, is said to be closely allied to *Jaborosa, Himeranthus, Dorystigma* and *Trechonætes*, genera which he has singularly placed among his *Atropineæ*. This distinguished botanist can never have seen a specimen or drawing of *Thinogeton*, or he would never have ventured on such a conclusion: its affinity, as I have elsewhere shown, is toward *Scopolia, Physochlæna* and *Cacabus*, genera that I have placed with *Hyoscyamus*, on account of their many uniform characters, particularly that of the operculiform dehiscence of their fruit.

In M. Dunal's tribe of the *Datureæ*, we meet with a similar degree of irregularity, in the association of perfectly incompatible genera. Thus *Dictyocalyx* is placed here, while *Thinogeton* is arranged among the *Lycineæ*, and yet these two genera are identically the same. This genus with a spiral embryo, and *Datura* with a nearly annular embryo, are associated with *Solandra*, where the embryo is nearly straight or but slightly curved; in this respect M. Dunal has followed the example of older botanists, who, for no other reason that we can imagine, drew this conclusion, because in former times *Solandra grandiflora* was the *Datura scandens* of Plumier. *Solandra* is as totally distinct in habit from *Datura* as it is in structure; it is a climbing plant, with large coriaceous leaves and orange-coloured flowers of large size, with a thick fleshy corolla, having a ventricose funnel-shaped tube, and a border of five large fleshy lobes, which in æstivation are so deeply imbricated that they completely overlap one another. In *Datura*, on the contrary, the corolla is white or of a lurid blue, with a nearly entire or pentangular border; this in æstivation is plicated into five deep folds, which almost meet in the axis, and these folds are torsively and spirally twisted round the common centre, having their margins thus valvately coherent in juxtaposition: no two cases of more extreme difference could have been selected. On account of the very dissimilar æstivation of the corolla and other distinct features, the separation of *Solandra viridiflora* from this genus, as proposed by me under the name of *Dyssochroma*, has been acknowledged by M. A. DeCandolle in the Appendix (Prod. xiii. 689), although they are combined together in the body of the work. *Ectozoma* also, having a corolla with an imbricated æstivation, and which I have shown to be allied to *Juanulloa*, is also placed among the *Datureæ*, but for what reason is not explained: it has not the smallest relation with *Datura*. I shall in a separate memoir conclude the remarks I have to make on *Datura* and the genera allied to it, which I consider distinct, but which M. Dunal regards as mere sectional divisions of that genus.

Many objections may be made to M. Dunal's subtribe of *Hyoscyameæ*, formed only of the genera *Hyoscyamus* and *Scopolia*: this subtribe I have excluded from true *Solanaceæ* on account of the decided æstivation of the corolla. In the generic character of *Hyoscyamus*, this feature is represented as being plicated, not imbricated, and the description of the mode of placentation is quite at variance with my own observation; indeed the entire generic character given in the 'Prodromus' (p. 546), is a copy, verbatim, from the text of Dr. Putterlich in 'Nees's Gen. Pl. Flor. Germ.' On a former occasion (*huj. op.* v. 468) I showed that this description does not accord with the very clear and analytical details exhibited in the accompanying plate: the æstivation of the border, said to be plicate, is distinctly delineated as being quincuncially imbricate in figs. 3. and 21, and there is no indication of any plicature of the border in any of the other several figures of the corolla: the placentæ are stated in the text of that work, and of the 'Prodromus,' to be inserted on the dissepiment by a linear dorsal line, while the figures 19. and 28. exhibit broad lunated placentæ projecting into the cell, connected with a short membrane that emanates from the axis of the dissepiment: I find neither of these statements to accord with what I have seen in *Hyoscyamus pictus*, of which species I have examined scores of ovaria and capsules, in a living state, where I have invariably found the placentæ to be thick and fleshy, and completely adnate to the dissepiment. I have also, in the work above referred to, directed attention to the striking, fleshy, epigynous gland, which has been quite unnoticed by preceding observers, and it is singular that so remarkable a feature should have been omitted in the 'Prodromus.' The genus *Scopolia*, as enlarged by M. Dunal, is divided into four sections, *Datora*, *Physochlæna*, *Anisodus* and *Scopolia*, groups which appear to me all generically distinct. *Datora* evidently belongs to *Hyoscyamus* rather than to this genus. In *Scopolia*, judging from the plants I have seen growing in Kew Gardens, the inflorescence is always solitary, a single flower upon a long slender peduncle springing from between the two petioles of the geminate leaves of each distant axillary node of the main stem, and this feature is confirmed in the description of the same species by M. Dunal (Prodr. p. 556). Dr. Putterlich, however, in stating the flowers to be solitary and pseudo-axillary, adds that in reality it is terminal, from the centrifugal evolution of its 2–3-chotomous stem; I confess that I have been unable to distinguish this character: its calyx is urceolate, membranaceous, and regularly 5-toothed: the corolla has a somewhat broad, bell-shaped, almost cylindrical tube, with five very short erect lobes; and although the tube is plicated, the lobes are distinctly imbricated in æstivation: this last feature is acknowledged by Dr. Putterlich, but unnoticed by M. Dunal: the ovarium, at its base, is imbedded in an adnate, fleshy, 5-lobed disk, a character existing also in *Hyoscyamus* and its several allied genera: the capsule, invested by its thin persistent calyx, bursts by a small membranaceous, circumscissile operculum. In *Datora*, the type of which is the *Hyoscyamus muticus*, Linn., the inflorescence is described as "floribus apice ramorum racemoso-spicatis" as in *Hyoscyamus*: the calyx in like manner is tubular, 10-ribbed, with five long aciculate teeth; this also increases with the growth of the fruit, becomes rigid in texture, but more ventricose, while the withering teeth collapse and cover the inclosed capsule, instead of remaining erect and spinose: the corolla and stamens differ in no respect from those of *Hyoscyamus*: the operculum of the fruit is, in like manner, hard and hemispherical, with a chartaceous septum; indeed I cannot perceive from the descriptions, any single character different from that genus, except that the calyx becomes more ventricose, and the teeth, instead of remaining erect and rigid, collapse and wither over the enclosed capsule: there is nothing here, however, to justify its being placed in *Scopolia*: I am not sufficiently acquainted with the plants of this section to offer a decided opinion; but if it really differ generically from *Hyoscyamus*, it must remain a distinct genus (perhaps *Secarana*, from its Arabic name, for *Datora* is too near *Datura* to be permitted); but it appears to me far better to class the three species enumerated by M. Dunal as a mere section either of *Hyoscyamus* or of *Physochlæna*, as I suggested (*huj. op.* v. 473).

In regard to *Physochlæna*, many reasons have been offered (*huj. op.* v. 469) to show why it must be considered as a distinct genus: it cannot belong to *Scopolia*, its affinity being much stronger towards *Hyoscyamus*, especially the section last mentioned, on account of the character of its inflorescence, its tubular calyx, and its shorter and more campanulate corolla.

Anisodus, however, is so extremely different in all its characters, that it offers still less reason for being retained in *Scopolia*. The latter has a membranaceous urceolate calyx, one-third or one-fourth the length of the corolla, which is tubular or slightly funnel-shaped, thin in texture, with a border of five very short lobes, slightly imbricated in æstivation. In *Anisodus*, on the contrary, the calyx is extremely thick and fleshy in texture, broad, tubular, and somewhat ventricose, with ten thick, prominent nervures, and five obtuse teeth: this does not much enlarge, but it grows thick and rigid, assumes a very reticulated or cancellated appearance, and encloses the large oval berry, when its ten prominent thick nervures become ligneous; the corolla does not much exceed the calyx in length, is thick and fleshy in substance, broadly campanulate, with a border of five large rounded lobes, which overlap one another at base, and are deeply imbricated in æstivation, one lobe being larger and more interior than the others. In *Scopolia* the testa is tuberculosely rugous, in *Anisodus* it is smooth and slightly punctulated: in the former genus the stigma is capitate and obsoletely 2-lobed, the external surface being covered with short articulated hairs or papillæ; in the latter genus it is somewhat compressed and distinctly bilobed, with a simply rugous stigmatic surface: in *Scopolia*, the corolla is quite glabrous on both sides, as are also the filaments; in *Anisodus*, the inner surface is quite woolly, and the filaments are pubescent when in bud; in the former the fruit is quite capsular, thin in texture, 5-grooved with a torulose surface; its operculum is simple, soon falls off, and its seeds are affixed on an inconspicuous adnate placenta, attached to the dissepiment; in the latter genus the fruit is oval, smooth and thick, with a fleshy epicarp that hardens on the pericarp like an exsuccous berry, and the operculum only manifests itself after the decay of the dry fleshy covering; the seeds are aggregated upon a very large, globose, carnose, favose placenta, adnate to the dissepiment, and are half imbedded in its fleshy substance. In fine, there are more manifest generic distinctions between *Scopolia* and *Anisodus*, than between *Scopolia* and *Hyoscyamus*. In my enumeration of the genera composing my tribe *Hyoscyameæ* (*huj. op.*

iii. p. 166), *Anisodus* was not included, because I had not then observed the operculiform dehiscence of its fruit, a character that had not been previously recorded by any observer; but I rectified this subsequently (*huj. op.* vi. p. 37).

M. Dunal's tribe of the *Nicotianeæ* consists of the genera *Nicotiana, Lehmannia, Petunia, Leptophragma* and *Vestia*: the latter genus certainly bears no affinity towards the others: it was placed by me upon more solid grounds near *Fabiana,* in the true *Solanaceæ,* because of the valvate æstivation of its corolla, and of the resemblance in the structure of its fruit and seed: the other genera, by reason of the imbricate æstivation of the corolla, were placed by me in *Atropaceæ,* but the *Nicotianeæ* were kept as a tribe, distinct from the *Petunieæ,* because of the peculiar mode of æstivation of the corolla, of which diagrams were given in explanation (*huj. op.* iii. p. 173). The genus *Leptophragma* (Prodr. xiii. 578), founded on the *Salpiglossis prostrata,* Hook. & Arn., will not be found to be valid. In March 1846, I first hinted at the possibility that *Callibrachoa* would not be found to be distinct from *Petunia,* on which Mr. Bentham immediately suggested that both *Callibrachoa procumbens* and *Salpiglossis prostrata* would in all likelihood prove to be identical with my *Petunia anomala* (see note April 1846, Lond. Journ. Bot. v. 190). It will be seen from another note published in Feb. 1848 (Ill. South Am. Plants, i. 114), that having met with an opportunity of examining specimens of the two first-mentioned plants, I had found them to differ in no respect from *Petunia parviflora,* of which I have given a drawing, with ample analytical details, in plate 23. of my work referred to: I showed also it is identical with the *Lindernia Montevidensis,* Spr. The genus *Leptophragma,* now first established by M. Dunal upon a letter from Mr. Bentham of an old date, cannot therefore be retained, and *Leptophragma prostrata,* Benth., can only be considered as another synonym of *Petunia parviflora,* Juss., a plant that appears to have a widely extended range over the American hemisphere.

I have already offered several observations on the genus *Retzia* (*huj. op.* iii. p. 181), with which M. DeCandolle, on the authority of M. Dunal, classes *Lonchostoma,* Wikstr. To this I cannot accede, for neither the habit of the plant, nor the structure of the flower, bears any analogy towards the *Solanaceæ.* On some future occasion I will furnish the results of my analysis of these two genera, when I will offer a few additional remarks on the subject.

M. Dunal, in his subtribe *Fabianeæ,* has in an equal degree overlooked the character of æstivation, which is one of the most important and constant features of the genera of the Solanal alliance. This subtribe is made to consist of *Nierembergia*, *Bouchetia* and *Fabiana*. The latter genus only I consider to belong to *Solanaceæ*, on account of the valvate æstivation of its corolla. Of *Nierembergia* I have given several illustrations and copious analytical details, where the peculiar character of its æstivation has been fully shown. The genus *Bouchetia*, DC., now first published by M. Dunal, does not appear from the characters described (Prodr. 589) to differ in any respect from *Nierembergia*, and especially from *N. linifolia* and *anomala*, which are figured in plate 20. of my 'Illustrations,' and where the tube of the corolla is a little more swollen towards the summit, and the lobes of the border smaller than usual, as in the genus in question: in the latter species the insertion of the stamens is even lower than in *Bouchetia*.

Of the eleven species of *Fabiana* enumerated by M. Dunal, it is evident from the characters given that the five first mentioned only belong to the genus. *F. grandiflora* is probably one of the singular species of *Alona* (possibly *A. rostrata*) described by Prof. Lindley, or it may be a plant closely allied to, if not identical with, *Phrodus Bridgesii* (Ill. South Am. Plants, tab. 41). *F. squamuligera* is probably *Phrodus nodosus* (*loc. cit.* tab. 42 B). *F. thymifolia*, *F. Sellowiana* and *F. heterophylla*, none of which I have seen, appear, from the descriptions given of them, to belong to *Petunia*, as Dr. Sendtner has also concluded (Flor. Bras. part 6. pp. 175, 176).

Under *Cestrum*, M. Dunal considers *Habrothamnus* merely as a section of that genus, but in his 'Conspectus' he places them as distinct genera. For a long while I was doubtful on the subject; but on a more careful examination of living plants, an essential difference was found to exist in the floral structure, which was indicated by their habit: these differences were enumerated on a former occasion (*huj. op.* vi. 181).

[To be continued.]

II.—*Descriptions of some newly discovered species of* Araneidea. By John Blackwall, F.L.S.

Tribe OCTONOCULINA.

Family Salticidæ.

Genus *Salticus*, Latr.

Salticus reticulatus.

Length of the female $\frac{1}{10}$th of an inch; length of the cephalothorax $\frac{1}{13}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{24}$; length of a posterior leg $\frac{1}{9}$; length of a leg of the second pair $\frac{1}{16}$.

Legs robust, provided with hairs, and two parallel rows of large, sessile spines on the inferior surface of the tibiæ and metatarsi of the first and second pairs; they are of a pale yellowish brown hue, with obscure, dark annuli at the joints; the fourth pair is the longest, then the first, which a little surpasses the third pair, and the second pair is the shortest; each tarsus is terminated by two curved claws, below which there is a small scopula. The palpi resemble the legs in colour. Cephalo-thorax large, nearly quadrilateral, thinly clothed with hairs, somewhat glossy, depressed before, abruptly sloped behind, and projects beyond the base of the falces, which are small, conical, and rather inclined towards the sternum: maxillæ short, straight, enlarged and rounded at the extremity: lip triangular: sternum oblong heart-shaped. These parts are of a yellowish brown colour; the sternum is the palest, and the lateral margins of the cephalo-thorax and the region of the eyes have a brownish black tint. Eyes disposed in three rows, constituting three sides of a square, in front and on the sides of the cephalo-thorax; the intermediate eyes of the anterior row are greatly larger, and the intermediate eye of each lateral row is much smaller than the rest. Abdomen oviform, hairy, moderately convex above, projecting over the base of the cephalo-thorax; it is of a pale yellow-brown colour, reticulated and streaked with brownish black lines, a series of pale yellow-brown and brownish black angular lines, disposed alternately, and having their vertices directed forwards, extending along the middle of the upper part; the under part is the least distinctly marked, and the hue of the branchial opercula is yellowish white; the sexual organs have a longitudinal septum in the middle, and their colour is red-brown.

Specimens of this minute *Salticus* were found among moss growing in woods on the slopes of Gallt y Rhyg, a mountain near Oakland, in Denbighshire. The female is adult in autumn.

Family Thomisidæ.

Genus *Thomisus*, Walck.

Thomisus versutus.

Length of the female $\frac{1}{5}$th of an inch; length of the cephalo-thorax $\frac{1}{10}$; breadth $\frac{1}{12}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{1}{4}\frac{1}{8}$; length of a leg of the third pair $\frac{1}{8}$.

Legs provided with short hairs and strong spines, two parallel rows of the latter being conspicuous on the inferior surface of the tibiæ and metatarsi of the first and second pairs, which are much longer and more robust than the third and fourth pairs; the first pair is rather longer than the second, and the third pair is the shortest; each tarsus is terminated by two curved, black claws, dentated near the base: the palpi, which are short, are supplied with hairs and spines, and have a small, curved, black claw at their extremity: the cephalo-thorax is convex, compressed before, and rounded on the sides and in front; it slopes abruptly behind, is without an indentation in the median line, and on its frontal margin there is a row of strong bristles directed forwards: the falces are short, strong, subconical, vertical, and have some bristles in front, towards the inner side: the maxillæ are slender, convex near the base, pointed at the extremity, and inclined towards the lip, which is triangular: the sternum is heart-shaped. These parts are of a pale yellowish brown colour; the cephalo-thorax has a brownish black band extending backwards from each lateral pair of eyes, and narrow, yellowish white margins, and the lip has an oblong, dark brown spot near its base. Eyes disposed on the anterior part of the cephalo-thorax in two curved, transverse rows, forming a crescent whose convex side is in front; the eyes of each lateral pair, which are seated on a tubercle, are much larger than the intermediate ones, those of the anterior row being the largest of the eight. Abdomen depressed, corrugated, particularly on the sides, much broader at the posterior than at the anterior extremity, the latter, which appears as if cut in a straight line across, projecting over the base of the cephalo-thorax; very short hairs are sparingly distributed over its surface, and it is of a yellowish gray colour freckled with brown, a broad, dentated band, which is bordered laterally with red-brown, extending along the middle of the upper part; the anterior part of this band comprises five conspicuous, brown depressions; the anterior ones describe a triangle whose vertex is directed forwards, and the other two are situated parallel to its base; two obscure, brown lines, forming a very acute angle whose vertex is directed backwards, occur between the depressions constituting the two posterior pairs; the sexual organs have a dark reddish brown tint; and the colour of the branchial opercula is pale yellow.

The male is much smaller, darker coloured, and less distinctly marked than the female. The cephalo-thorax has a red-brown tint, the band directed backwards from each lateral pair of eyes is black, and the lateral margins are yellowish white. The legs and sternum are of a red-brown colour, the latter being marbled with a deeper shade of red-brown. The falces have a brownish black hue, with a red-brown mark in front which extends to the outer side. The maxillæ and lip have a dark brown tint, their extremities being the palest. The axillary and humeral joints of the palpi are of a dark brown colour tinged with red, the cubital and radial joints are of a red-brown hue tinged with dark brown, and the digital joint has a dark brown tint; the radial joint is larger than the cubital, and projects from its extremity, on the outer side, two bifid apophyses; one branch of the superior apophysis is prominent, and the other is in close contact with the base of the digital joint, which is oval, convex and hairy externally, concave within, comprising the palpal organs; these organs are highly developed, complex in structure, with a pointed, prominent process at their base, and have a brownish black tint. The upper part of the abdomen is of a red-brown colour interspersed with a few black spots; it is palest in the medial line, but the design of the broad, dentated band is almost obliterated; the frontal margin and a band extending along each side have a yellowish white tint, and the under part is of a pale red-brown colour.

The abdomen of both sexes, when adolescent, is of a pale yellow colour, with a few black spots on the upper part.

Adult and immature individuals of this species of *Thomisus* were discovered among grass growing in and near woods at Oakland in August 1852.

Family LINYPHIIDÆ.

Genus *Linyphia*, Latr.

Linyphia Meadii.

Length of the female $\frac{1}{8}$th of an inch; length of the cephalo-thorax $\frac{1}{14}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{17}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{6}$.

Cephalo-thorax oval, convex, glossy, with slight furrows on the sides converging towards the middle, and an indentation in the medial line: falces powerful, conical, nearly vertical, divergent at the extremities, and armed with teeth on the inner surface: maxillæ straight, with the exterior angle, at the extremity, curvilinear: legs and palpi provided with hairs and fine spines. These parts are of a light yellow-brown colour, the legs and palpi being rather the palest. Lip semicircular and prominent at the apex: sternum short, broad, and heart-shaped. These parts are browner than the cephalo-thorax, the margins of the sternum being the darkest. The first pair of legs is the longest, the second pair rather surpasses the fourth, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and slightly pectinated, and the inferior one is inflected near its base. Eyes seated on black spots; the four intermediate ones describe a trapezoid whose anterior side is the shortest, and those of each lateral pair are placed obliquely on a small tubercle and are nearly contiguous; the anterior eyes of the trapezoid are the smallest of the eight. Abdomen oviform, thinly clothed with hairs, convex above, projecting over the base of the cephalo-thorax; it is of a dull olive-green colour, with a series of obscure, pale yellowish brown, oblique streaks on each side of the medial line of the upper part, and a band of the same hue extending along each side; a large, prominent, red-brown process, connected with the anterior margin of the sexual organs, is directed backwards; and the colour of the branchial opercula is pale yellow.

The sexes are similar in colour, but the abdomen of the male is slenderer than that of the female, and its maxillæ are slightly inclined towards the lip. The cubital and radial joints of the palpi are short, the latter being most produced at its extremity, on the inner side; the digital joint is somewhat oval, with a large lobe on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, prominent, complex in structure, with a large process at their base consisting of three parts; the superior one, which is curved at its extremity, is in contact with the radial joint, on the outer side, and the other two are directed downwards, the one which is situated nearer to the inner side and is the slenderer and more curved having a projection on the outside of its curvature and another within, nearer to its base; a short, prominent, curved process, whose point is in contact with a small, semitransparent membrane, occurs at the extremity of these organs, and their colour is red-brown of various shades. The convex sides of the digital joints are directed towards each other.

I have much pleasure in naming this species after R. H. Meade, Esq., of Bradford, in Yorkshire; a naturalist to whose kindness I am indebted for opportunities of describing several newly discovered indigenous spiders, and of examining numerous interesting specimens of Araneidea, both British and foreign.

Early in May 1852, adult individuals of both sexes of *Linyphia Meadii* were taken by Mr. Meade under a stone in a pasture at Low Moor, near Bradford.

Linyphia anthracina.

Length of the female $\frac{1}{8}$th of an inch; length of the cephalo-thorax $\frac{1}{20}$; 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 $\frac{3}{20}$.

Cephalo-thorax oval, convex, glossy, with an indentation in the medial line: falces powerful, conical, armed with a few teeth on the inner surface, and inclined towards the sternum, which is heart-shaped, convex and glossy: maxillæ straight, with the exterior angle, at the extremity, curvilinear: lip semicircular and prominent at the apex. These parts are of a very dark brown colour. The four intermediate eyes describe a trapezoid whose anterior side is the shortest, and those of each lateral pair are seated obliquely on a tubercle and are nearly contiguous; the anterior eyes of the trapezoid are the smallest of the eight. Legs long, slender, provided with hairs and a few fine spines, and, with the palpi, of a bright yellowish red hue. The first pair of legs is the longest, the second pair surpasses the fourth, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and slightly pectinated, and the inferior one is inflected near its base. Abdomen oviform, glossy, black, sparingly supplied with hairs, convex above, projecting over the base of the cephalo-thorax; the sexual organs have a dark brown hue; a prominent process is connected with their superior and another with their inferior margin; the former, which is the larger, is nearly semicircular, concave within, and has a longitudinal septum in the middle; the inferior one is somewhat enlarged at its extremity and directed backwards.

This species, which appears to be nearly allied to *Linyphia nigella*, was received in July 1852 from Mr. R. H. Meade, who captured it near Bradford; and in November, in the same year, Mr. Meade transmitted to me an adult female *Linyphia anthracina*, which had been sent to him from Southgate, in Middlesex.

Linyphia pulla.

Length of the female $\frac{1}{9}$th of an inch; length of the cephalo-thorax $\frac{1}{20}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{20}$; length of an anterior leg $\frac{11}{48}$; length of a leg of the third pair $\frac{3}{20}$.

Cephalo-thorax oval, convex, glossy, with an indentation in the medial line: falces powerful, conical, armed with a few teeth on the inner surface, slightly divergent at their extremities, and inclined towards the sternum, which is heart-shaped: maxillæ straight, with the exterior angle, at the extremity, curvilinear: lip semicircular and prominent at the apex. These parts are of a brown-black colour, the sternum, lip, and lateral margins of the cephalo-thorax being the darkest, and the falces having a tinge of red. The four intermediate eyes describe a trapezoid whose anterior side is the shortest, and those of each lateral pair are seated obliquely on a tubercle and are almost contiguous; the posterior eyes of the trapezoid are the largest, and the anterior ones much the smallest of the eight. Legs long, slender, provided with hairs and a few fine spines, and of a light yellow-brown hue; the first pair is the longest, then the second, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and slightly pectinated, and the inferior one is inflected near its base. The palpi have a dark brown tint, with the exception of the humeral joint, which has a yellowish brown hue. Abdomen oviform, glossy, sparingly clothed with short hairs, convex above, projecting over the base of the cephalo-thorax; it is of a brown-black colour, with a sharply dentated, pale yellow-brown band extending along the middle of its upper part, and a rather obscure line of the same hue on each side of its anterior extremity: the sexual organs have a thin longitudinal septum in the middle, a small process connected with their posterior margin, which is directed backwards, and their colour, with that of the branchial opercula, is yellowish brown. The medial, dentated band is much less perfectly defined in some individuals than in others.

The form of the male is slighter than that of the female and its colour is darker, the dentated band in the medial line of the upper part of the abdomen being rather obscure. The cubital and radial joints of its palpi are short, and the latter, which is the stronger, is somewhat produced at its extremity, on the inner side; the digital joint is of an irregular oval figure, having a slender, curved process at its base, on the outer side, and a large lobe near its extremity, on the inner side; it is convex and hairy externally, concave within, comprising the palpal organs; these organs are very highly developed, prominent, complicated in structure, with two strong, curved spines at their extremity, one of which describes a circle and comprises within its circumvolution some light-coloured membrane and the recurved point of the other spine; they are of a dark brown hue tinged with red. The convex sides of the digital joints are directed towards each other.

Both sexes of this spider, in a state of maturity, were discovered by Mr. R. H. Meade in Nab Wood, near Bingley, in Yorkshire, in 1852, and an adult female, which had been taken at Southgate, was forwarded to me by Mr. Meade towards the close of the same year.

Linyphia alacris.

Length of the female $\frac{1}{10}$th of an inch; length of the cephalo-thorax $\frac{1}{16}$; breadth $\frac{1}{24}$; breadth of the abdomen $\frac{1}{22}$; length of an anterior leg $\frac{11}{48}$; length of a leg of the third pair $\frac{1}{6}$.

Cephalo-thorax oval, convex, glossy, with an indentation in the medial line: falces powerful, conical, rather divergent at the extremities, armed with teeth on the inner surface, and inclined towards the sternum: legs long, slender, and provided with hairs and a few fine spines. These parts, with the palpi, are of a pale yellowish brown colour, the lateral margins of the cephalo-thorax being darkish. Maxillæ straight, with the exterior angle, at the extremity, curvilinear: lip semicircular and prominent at the apex: sternum broad, convex, glossy, and heart-shaped. These parts have a dark brown hue, the maxillæ being the palest. The first pair of legs is the longest, then the second, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and slightly pectinated, and the inferior one is inflected near its base. Eyes seated on black spots; the four intermediate ones describe a trapezoid whose anterior side is the shortest, and those of each lateral pair are placed obliquely on a tubercle and are nearly contiguous; the anterior eyes of the trapezoid are seated on a small protuberance and are much the least of the eight. Abdomen oviform, pointed at the spinners, thinly clothed with hairs, glossy, convex above, projecting over the base of the cephalo-thorax; the upper part is of a yellowish brown colour mottled with dull white; a narrow, dentated, black band extends along the middle, whose continuity is frequently interrupted, or broken into black spots, about one-third of its length above the spinners, and from these spots fine oblique lines of the same hue pass to the sides, which, with the under part, have a brown-black tint; a yellowish brown band mottled with dull white extends along each side, and the two unite above the anus; the sexual organs are highly developed and very prominent; there is a process connected with their superior margin which is enlarged at its extremity and curved downwards, and a minute one occurs on the inferior margin; their colour is brown faintly tinged with red. Some individuals have the medial, dentated band much more perfectly defined than others.

In their colours and in the design formed by them the sexes closely resemble each other, but the male is rather smaller than the female, and the anterior part of its cephalo-thorax, where the eyes are seated, is provided with porrect hairs. The humeral joint of its palpi is moderately long; the cubital joint is short, and has a long bristle projecting from its extremity, in front; the radial, which is larger than the cubital joint, has a long bristle projecting from its base, in front, and is gibbous underneath; the digital joint is somewhat oval, having two lobes on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, prominent, complex with projecting points and processes, one of the latter, situated near the middle, and another on the inner side, which is slightly bifid at its extremity, being the most conspicuous; their colour is red-brown.

Mr. R. H. Meade found specimens of this *Linyphia* in May 1852, in a wood near Bingley, and in the neighbourhood of Bradford, in Yorkshire.

Linyphia ericæa.

Length of the female $\frac{1}{10}$th of an inch; length of the cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{32}$; breadth of the abdomen $\frac{1}{20}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{3}{20}$.

Eyes seated on black spots; the four intermediate ones describe a trapezoid whose anterior side is the shortest, and those of each lateral pair are placed obliquely on a small tubercle and are almost contiguous; the anterior eyes of the trapezoid are seated on a slight protuberance, and are much the smallest of the eight. Cephalo-thorax oval, convex, glossy, with an indentation in the medial line: falces conical, vertical, somewhat divergent at their extremities, and armed with teeth on the inner surface: maxillæ slightly inclined towards the lip, which is semicircular and prominent at the apex: sternum convex and heart-shaped: legs and palpi long, slender, and provided with hairs and fine spines. These parts have a yellowish brown colour, with the exception of the base of the lip, which has a dark brown hue. The first pair of legs is the longest, then the second pair, which a little surpasses the fourth, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and slightly pectinated, and the inferior one is inflected near its base. Abdomen oviform, glossy, sparingly clothed with hairs, pointed at the spinners, convex above, projecting over the base of the cephalo-thorax; it is of a pale yellow-brown colour, the under part being the darkest; and the sexual organs, which are of a red-brown hue and are very prominent, have a longitudinal process in the middle, which is enlarged at its extremity.

The male is much smaller than the female, but it closely resembles her in colour. The cubital and radial joints of its palpi are short, the latter being the larger; the digital joint is oval, with a small lobe on the outer side; it is convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, prominent, complex in structure, with a small crescent-shaped process near their base, on the outer side, whose superior limb is terminated by an acute point which is almost in contact with the extremity of the radial joint; these organs are of a red-brown colour.

Specimens of this small species of *Linyphia* have been found in moss growing among heath in woods about Oakland, and at the roots of heath on Bingley Moor, in Yorkshire. Two adult males and an immature female, captured in the latter locality, were received from Mr. R. H. Meade in October 1852.

Genus *Neriëne*, Blackw.

Neriëne agrestis.

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

Legs hairy; the fourth pair is the longest, the first pair rather surpasses the second, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and slightly pectinated, and the inferior one is inflected near its base: cephalo-thorax oval, convex, glossy, with an indentation in the medial line: falces conical, convex in front, near to the base, armed with teeth on the inner surface, and slightly inclined towards the sternum, which is broad, rather convex, glossy, and heart-shaped: maxillæ enlarged where the palpi are inserted, and inclined towards the lip, which is short, broad, semicircular, and prominent at the apex. These parts, with the palpi, are of a brown colour; the lip, sternum, and anterior part of the cephalo-thorax, where the eyes are situated, being the darkest, and the legs and palpi, which are much the palest, having a yellowish or pale reddish tinge. The four intermediate eyes describe a trapezoid whose anterior side is the shortest, and those of each lateral pair are seated obliquely on a minute tubercle and are contiguous; the anterior eyes of the trapezoid are the smallest of the eight. Abdomen oviform, glossy, sparingly clothed with hairs, convex above, projecting over the base of the cephalo-thorax; it is of a dark brown colour tinged with olive, the medial line of the upper part, in some individuals, being the palest; the sexual organs have a dark reddish brown tint; and the colour of the branchial opercula is yellowish brown.

The male is much smaller than the female, but it resembles her in colour. The cubital and radial joints of the palpi are short; the latter, which is the larger, projects two very minute apophyses from its extremity; one, situated in front, is crescent-shaped, the cusps being acute; and the other, which is shorter and more obtuse, occurs on the under side; the digital joint has a short oval form; it is convex and hairy externally, concave within, comprising the palpal organs; they are moderately developed, prominent, complex in structure, with a small, curved, black spine at their extremity, whose point terminates in a prominent, semitransparent membrane, and are of a red-brown colour.

This species, which is closely allied to *Neriëne fusca*, occurs among herbage and under stones in pastures near woods at Oakland. The sexes are adult in autumn.

Neriëne vigilax.

Length of the male $\frac{1}{11}$th of an inch; length of the cephalo-thorax $\frac{1}{20}$; breadth $\frac{1}{30}$; breadth of the abdomen $\frac{1}{24}$; length of a posterior leg $\frac{1}{8}$; length of a leg of the third pair $\frac{1}{11}$.

Legs hairy and of a red colour tinged with brown; the fourth pair is the longest, then the first, and the third pair is the shortest; each tarsus is terminated by three claws; the two superior ones are curved and pectinated, and the inferior one is inflected near its base. Cephalo-thorax oval, convex, glossy, with a slight indentation in the medial line; it has a dark brown tint, the lateral margins being the darkest. Falces conical, armed with fine teeth on the inner surface, and slightly inclined towards the sternum, which is broad, somewhat convex, glossy, and heart-shaped. Maxillæ enlarged at the base, where the palpi are inserted, and inclined towards the lip, which is semicircular. The colour of the falces and maxillæ is pale brown tinged with red, and that of the sternum and lip dark brown. The four intermediate eyes describe a trapezoid whose anterior side is the shortest, and those constituting each lateral pair are seated obliquely on a small tubercle and are contiguous; the anterior eyes of the trapezoid are the smallest of the eight. The palpi have a yellowish brown hue; the cubital and radial joints are short, and the latter projects two apophyses from its extremity; the larger one curves outward in front of the digital joint, and the smaller one, which is acute, is situated underneath; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs; these organs are highly developed, prominent, complicated in structure, with a black, filiform spine at their extremity, on the outer side, which is enveloped in delicate membrane and curved in a circular form; their colour is reddish brown. The abdomen is oviform, black, thinly clothed with hairs, convex above, projecting a little over the base of the cephalo-thorax; and the branchial opercula have a yellowish brown hue.

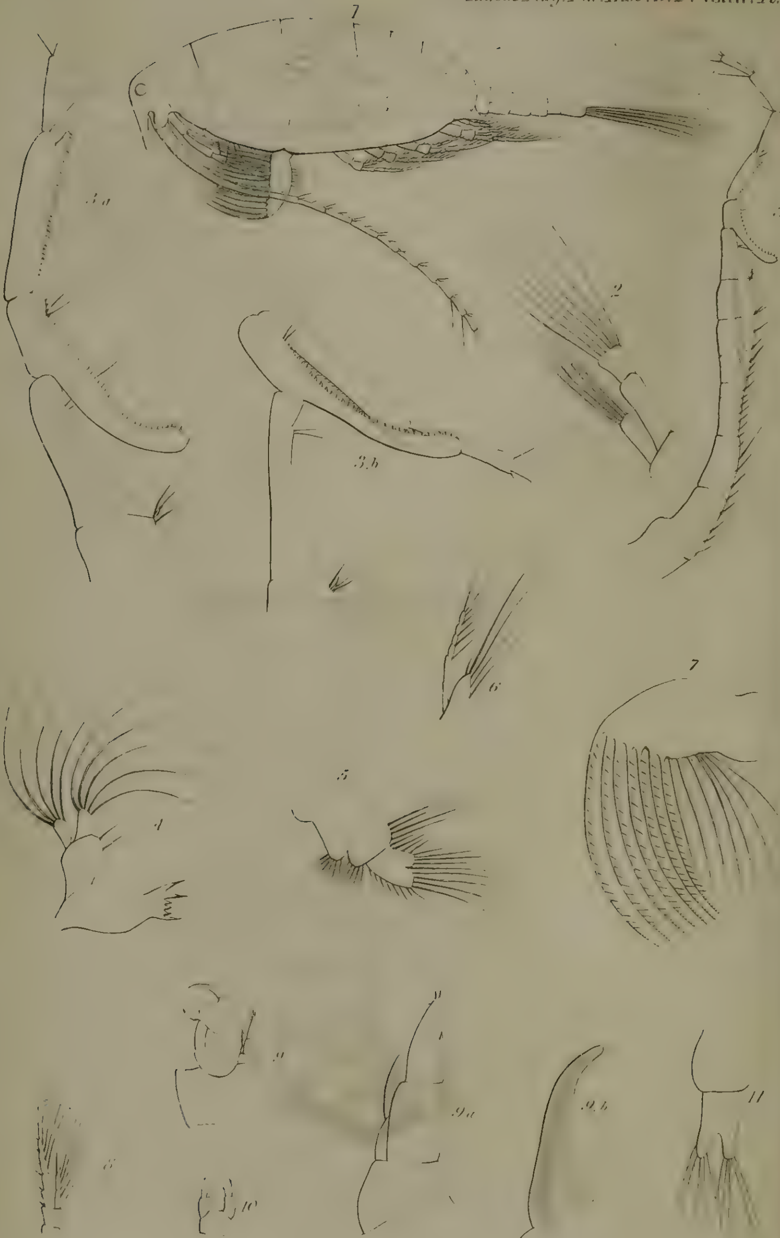
An adult male of this species was found running on a gravel walk at Oakland in July 1852.

Genus *Walckenaëra*, Blackw.

Walckenaëra exilis.

Length of the male $\frac{1}{20}$th of an inch; length of the cephalo-thorax $\frac{1}{26}$; breadth $\frac{1}{30}$; breadth of the abdomen $\frac{1}{36}$; length of an anterior leg $\frac{1}{12}$; length of a leg of the third pair $\frac{1}{20}$.

Cephalo-thorax oval, convex, glossy, elevated before, depressed behind, with a narrow indentation directed backwards from each



J. Lubbock delin.

J. De C. Sowerby sc.

lateral pair of eyes, and of a dark brown colour. Falces small, conical, armed with teeth on the inner surface, and inclined towards the sternum, which is heart-shaped: maxillæ inclined towards the lip, which is semicircular and prominent at the apex: legs moderately long and hairy; the anterior and posterior pairs are the longest and 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. These parts are of a pale brown hue, the falces being the darkest and the sternum having a tinge of green. The four intermediate eyes describe a narrow, oblong trapezoid, whose anterior side is the shortest, and those of each lateral pair are seated obliquely on a small tubercle and are contiguous; the lateral eyes are the largest, and the two anterior ones of the trapezoid are the smallest of the eight. The palpi resemble the legs in colour, with the exception of the radial and digital joints, which have a dark brown tint; the radial is stronger than the cubital joint, and projects two pointed apophyses from its extremity, in front; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, prominent, complicated in structure, with a short, curved, black, projecting spine at their extremity, and are of a brown colour tinged with red. Abdomen small, oviform, hairy, convex above, projecting over the base of the cephalothorax; it is of a yellowish brown colour, with obscure marks of a deeper shade.

A specimen of this minute *Walckenaëra*, in a state of maturity, was discovered among moss growing at the root of an oak in a wood on the northern slope of Gallt y Rhyg in October 1852.

III.—*Description of a new genus of* Calanidæ.

By John Lubbock, Esq.

[With a Plate.]

Genus Labidocera. (λαβὶς, *forceps*, and *κεραla, antenna.*)

Rostrum furcatum; *antenna antica* maris *dextra* geniculans, tumida, articulis quarto et quinto magna serrata lamella instructis. *Oculi* superiores duo, magni, distantes. Oculi inferiores nulli. *Cephalothorax* 7-articulatus. *Maxillipedes externi*, grandes, setis longis setulosis. *Pes posticus maris dexter*, crassus, prehensilis.

Rostrum forked; superior right male antenna prehensile, swollen, the ninth and tenth joints furnished each with a large serrated plate. Eyes two, large, distant. Cephalothorax 7-jointed. External maxillipeds large, bearing long setose hairs. Right male thoracic leg, of the fifth pair, swollen, prehensile.

I have after much hesitation described this as a new genus, on account of the number and position of the eyes, and of the very remarkable structure of the ninth and tenth joints of the right male antenna.

From *Calanus,* Dana; *Scribella,* Dana; *Acartia,* Dana; *Euchæta,* Dana, and *Undina,* Dana, it differs in having the right male antenna prehensile.

From *Calanus, Scribella, Euchæta, Undina, Caudace,* Dana; *Cyclopsina,* Dana, and *Catopia,* Dana, in having two large distant eyes.

From *Acartia,* in having the right fifth leg in the male prehensile, and two instead of four eyes.

From *Pontella,* Dana, in having two large distant eyes instead of three.

From *Cetochilus,* M.-Ed., in having the right fifth leg in the male prehensile.

From *Anomalocera,* Tem., in having two eyes in both sexes.

And from all these genera in the structure of the superior right male antenna.

Cephalothorax: 7-jointed; the first three large and nearly equal, the next four gradually diminished in size.

Eyes: large, distant, one on each side of the head; alike in both sexes.

Between the two anterior antennæ is a rounded projection analogous to that which in the neighbouring genera contains the inferior eye; in *Labidocera,* however, the eye itself is absent, at least Mr. Darwin, who examined the mouth when they were fresh, did not observe it, and had it been coloured like the other two he could not have overlooked it; and besides, though I could easily dissect out the lenses of the superior eyes, I could not find one here*.

Anterior antennæ: female and left male simple, 24-jointed, like those of *Pontella,* &c.

The right male antenna consists of 13 joints. The 1st, 2nd, and 3rd joints, counting from the apex, are simple, long and narrow; the first terminated by a few short hairs, the second and third bearing each a long hair at the apex. The fourth long, narrow, and produced forward into a dentated plate; closely applied to, and rather longer than, the joint itself. The

* The colouring matter of the eyes of Entomostracans must differ chemically from that of the *Zoeæ, Gammari,* &c., for in Mr. Darwin's specimens (which have been in spirits of wine nearly twenty years) the colour in the former was entirely destroyed, while that of the latter was unaltered.

fifth short and produced backwards in form of a strong plate, as long as the sixth joint, turned outwards, and knobbed at the end and strongly serrated, which forms with the corresponding plate of the fourth joint a most beautiful prehensile apparatus (Pl. I. fig. 3, 3 *a* open, 3 *b* closed), whose action will be presently described. The sixth joint is as long as the plate of the fifth, narrow at the apex, and gradually increasing in size to the base. The outer margin is straight, the inner rather curved and bearing two pairs of hairs; the 7th, 8th, and 9th are short and broad, their breadth exceeding their length; the 10th is longer and narrower; the 11th, 12th, and 13th the same length but broader; the 7th, 8th, 9th, 10th, 11th, and 12th with a row of hairs externally.

Rising at the exterior basal angle of the ninth joint a strong voluntary muscle passes through the 8th, 7th, 6th, and is inserted into the apex of the fifth joint; the action of which is to draw back the apex of the fifth joint towards the sixth (fig. 3 *b*), which throws the serrated plate forwards and towards the plate of the tenth joint.

This antenna is coloured and extended in front of the animal, while the right is colourless and doubled down close to the body.

Second pair of antennæ (fig. 2) consist of three joints, the apical rather swollen at the end and bearing a tuft of hairs; the basal supporting a simple appendage not quite so long as the second joint of the other branch, and also terminated by a tuft of hairs.

Mandibles (fig. 4). Strong, six-toothed, the two external teeth the largest, and each terminated by a small spine, the sixth longer than the rest and more like a stout spine; bearing a large palpus, which is provided at its apex with two lobes, nearly equal, and each terminated by a tuft of long, setose hairs.

Internal maxillipeds (fig. 5) consist of a basal joint bearing two lobes, each with several strong setose hairs; opposite the lobes is another tuft of longer, also setose hairs, between which and the lobes is attached an oval plate, deeply notched at the extremity, and likewise bearing setose hairs at the apex.

Second pair of maxillipeds (fig. 6). A small triangular lobe with a few long setose hairs at the extremity, and a long, simple, six-jointed palpus, also terminated by a tuft of hairs.

External maxillipeds (fig. 7). Large, bearing many long, stout, slightly curved hairs setose internally, and showing traces of being three-jointed. The extremity of the seven external hairs is curiously crenated.

Thoracic legs. The first four pair (fig. 8) consist of a two-jointed basal part, where arise a long three-jointed and a shorter two-jointed branch, both clothed internally and at the apex with long setose hairs, and the outer branch also bearing several short, stout spines externally, and showing traces of other joints.

Fifth pair of thoracic legs. Female. Small, simple, consisting of a basal joint, bearing two, a large and a smaller, simple slightly curved pointed joints; the outer and larger one bearing one or two small, short spines (fig. 10).

Male (fig. 9). The right leg in the male is large and prehensile; the first joint somewhat pentagonal, broad; the second simple, cylindrical; the third very much swollen at the apex, containing a very powerful muscle, bearing at its external basal angle a large spine, which, with the claw articulated at the corresponding apical angle, forms a very powerful prehensile apparatus. The left simpler, smaller leg (fig. 9 *a*) is three-jointed and gradually tapers to the apex, where there are two, a longer and a shorter, strong, slightly bent spines. Internally at its apex it bears a tuft of very fine short hairs. Attached to the basal joint is a two-jointed appendage, not so long as the leg itself, and whose second joint is very curiously ringed (the rings however, at least at the base, do not go quite across), and evidently extensible, as in some specimens it was much longer and thinner than in others. In it (fig. 9 *b*) was a wide vessel containing a brown pulpy substance, but I could not trace it quite to the apex (though as far as the second ring), nor see any opening, which, considering the minuteness of the object, is not perhaps to be wondered at. Mr. Darwin and Dr. Baird* both regard this organ, on account of its structure and position, as the penis, in support of which it may be remarked, that Mr. Darwin observed that this pair of legs was frequently moved and retained irritability longer than any other part of the body, which appears to indicate them as the seat of some important function, which can hardly be any other than that we have assigned to them, more especially as the female organs of generation in other animals are most retentive of irritability. The penis in all Cirrhipeds is also ringed.

Neither Dana nor Milne-Edwards have noticed any organ similar to this in any of the neighbouring genera; so it is probable that in them it is not so much developed.

Abdomen (figs. 1 & 11) is four-jointed in the male and two-jointed in the female, and, like that of *Pontella*, &c., gives off two caudal lamellæ, each provided at the end with a few long plumose hairs.

The anus is, I believe, situated between the lamellæ, as I have traced the intestine thus far, and Mr. Darwin noticed its peristaltic motion in the abdomen.

* Both of whom have very kindly given me the benefit of their advice in drawing up this paper.

Labidocera Darwinii.

There being as yet only one species in this family no specific description need be given.

Colour blue-green, sometimes with brown spots. $\frac{1}{10}$th inch in length.

Hab. Atlantic Ocean, lat. 38° south, in the open sea off the coast of Patagonia.

I received the specimens from Mr. Darwin, to whom I am indebted for great kindness and advice, and who has kindly permitted me to call it after him.

EXPLANATION OF PLATE I.

Fig. 1. *Labidocera Darwinii.* Male.
Fig. 2. Second pair of antennæ.
Fig. 3. Anterior antenna. 3 *a.* Prehensile apparatus open. 3 *b.* Ditto closed.
Fig. 4. Mandible.
Fig. 5. First pair of maxillipeds.
Fig. 6. Second ditto.
Fig. 7. Third ditto.
Fig. 8. Thoracic leg: 1st, 2nd, 3rd, and 4th pair.
Fig. 9. Posterior thoracic legs. Male. 9 *a.* Left leg more magnified to show the penis. 9 *b.* Apical joint of penis.
Fig. 10. Posterior thoracic legs. Female.
Fig. 11. Abdomen. Female.

IV.—*Characters of several* Helices *from West Australia and the Mauritius; with Notes on some species of* Cyclostoma *from Borneo.* By W. H. Benson, Esq.

1. *Helix plectilis,* nobis, n. s. Bm

Testa subobtecte perforata, globulosa, albida, opaca, valde rugosa, superne rugis perobliquis elevatis, angulato-flexuosis, irregularibus, subtus versus umbilicum rectis, radiatis, munita; spira elevatiuscula, suturis distinctis, apice obtuso; anfractibus 4, convexis, ultimo antice deflexo; apertura circulari, perobliqua, peristomate undique expanso, reflexiusculo, subcontinuo, marginibus approximatis, conniventibus, callo lato junctis, columellari late reflexo, umbilicum plus minusve obtegente.

Diam. major 15, minor 12, axis 10 mill.

Hab. ad oras sinus "Shark's Bay" dicti Australiæ Occidentalis.

Remarkable for the bold, deeply fretted sculpture of the upper side, extending below the periphery, and then merging into moderate radiating folds. In form it wonderfully resembles *H. nivosa*, Sow., of Porto Santo, but differs in the partly covered umbilicus, the expansion and reflexion of the peristome, the circular aperture, which reminds the observer of that of *H. spiriplana*, and the more remarkable sculpture, in which the crumpled wrinkles are again obsoletely punctate. It seems to have some characters in common with the larger species *H. Janellei*, Le Guill., an inhabitant of Northern Australia.

2. *Helix Tescorum*, nobis, n. s.

Testa imperforata, globosa, oblique striata, albida, solidiuscula, spira convexa, suturis impressis, apice obtusiusculo; anfractibus 5, ultimo antice descendente, ventricoso; apertura obliqua, rotundato-lunata, peristomate expansiusculo, intus leviter incrassato, margine columellari dilatato, appresso, pallide luteo.

Diam. major 20, minor 18, axis 14 mill.

Hab. cum præcedente ad sinum Shark's Bay.

The single specimen which I have of this shell is apparently in a subfossil state; and, in finer condition, may possibly exhibit more colour. It has quite the habit of the European group *Archelix* of Albers, and is closely allied to the Madeiran *H. punctulata*.

3. *Helix cygnea*, nobis, n. s.

Testa late umbilicata, orbiculato-depressa, cornea, costulis radiatis obliquis remotiusculis munita; spira vix convexiuscula, suturis excavatis, apice planato; anfractibus $4\frac{1}{2}$ convexis, ultimo rotundato; apertura subverticali, rotundato-lunata; peristomate acuto; umbilico perspectivo.

Diam. major 4, minor $3\frac{1}{2}$, axis $1\frac{1}{2}$ mill.

Hab. ad vicum Perth, Fluvii Cygnorum Australiæ Occidentalis. Teste Dr. J. F. Bacon.

Distinguished from *H. sublesta* by the more distant ribs, wider umbilicus, colour, and larger size; from *H. Juloidea*, Forbes, of the eastern coast of Australia, by its more distant ribs and want of concavity on the upper side.

4. *Helix sublesta*, nobis, n. s.

Testa sublate umbilicata, orbiculato-depressa, supra rufo-cornea, subtus cornea, minutissime costulato-striata, superne planiuscula, suturis impressis; anfractibus 4, ultimo depressiusculo, rotundato; apertura verticali, rotundato-lunata; peristomate acuto; umbilico perspectivo.

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

Hab. prope urbem Freemantle Fluvii Cygnorum.

Differs from *H. Juloidea*, Forbes, by its narrower umbilicus, and the want of concavity in the spire; from *H. cygnea* by the first-mentioned feature and the sculpture. It is nearly allied to my little Cape species *H. Sabuletorum*, 'Annals,' vol. vii. p. 105; but is at once distinguished by the absence of the distant plicæ, which, at intervals, graduate the striation in that species.

These little shells, and the larger *H. vorticialis* of the Cape, which has a concave spire like *H. Juloidea*, affect sandy maritime tracts of widely separated portions of the southern temperate zone.

Helix Australis, Menke, the Australian representative of the littoral *Helix Capensis* of Southern Africa, is assigned to the neighbourhood of Swan River. Dr. Bacon, an assiduous and practised collector, has, however, failed to meet with it there, although his attention was particularly directed to it. *Bulimus Melo*, Quoy, was obtained by him near Freemantle, on sand-banks within 20 yards of the sea; and *B. indutus*, Menke, a species not figured in 'Conchologia Iconica,' and there confounded with the American *B. Tupacii*, occurred to him, more inland, in the vicinity of Perth, amongst limestone rocks and bushes, together with an occasional example of *B. bulla*, Menke.

5. *Helix suffulta*, nobis, n. s.

Testa imperforata, turbinato-depressa, albida, supra radiatim minutissime costulato-striata, striis subtus curvatis, mitioribus; spira depresso-conoidea, apice obtusiusculo; anfractibus $5\frac{1}{2}$ arcte convolutis, ultimo rotundato; apertura lunata, leviter obliqua, peristomate expansiusculo, superne prope insertionem prorsum subangulato, margine columellari subdilatato, reflexiusculo, intus dente prominente ad finem exteriorem plicæ obliquæ sito, munito, superne periomphalum excavatum, umbilicum fingentem, penetrante.
Diam. major 8, minor 7, axis 5 mill.
Hab. in insula Mauritii. Teste Sir D. W. Barclay.

This species is singular on account of the construction of the aperture and base of the shell, which recall the structure of the same parts in the Jamaican group which includes *H. Cookiana* and *torrefacta*. In this condition it is probable that the species may have a coloured epidermis. It belongs to the toothed insular group which includes *H. Monodonta*, Grat., a shell, which cannot, as conjectured by Pfeiffer, be merged in his *H. stylodon*; but a change of name becomes requisite on account of the previous employment of the term by Lea. The following is a more extended description of the shell than the brief characters quoted from Grateloup by Pfeiffer.

H. albidens, Bens.

Testa imperforata, depressa, oblique radiato-striata, non nitente, fusco-cornea, fascia castanea, inferiori pallida adnata, cincta; spira depresso-conoidea, apice obtuso, sutura impressa; anfractibus $6\frac{1}{2}$ angustis, ultimo rotundato; apertura lunata, vix obliqua; peristomate acuto, margine columellari calloso, albido, obliquo, abrupte truncato, dentem efformante.

Diam. major 17, minor 15, axis 9 mill.

Syn. *Helix Monodonta*, Grat., nec Lea.

Hab. ad Moka, Insulæ Mauritii, rarissime. Teste Sir D. W. Barclay.

The structure of the tooth is more conspicuous in the young shell, before the columella has become thickened by the callous enamel, and it appears to be caused by the abrupt termination of a winding plait on the columella.

I am indebted to Dr. Traill for specimens of the Bornean species of *Cyclostoma* described in pp. 269–270 of the 10th volume of the 'Annals,' and for information regarding the localities of those and some other species collected by himself.

C. Anostoma, nobis, was found by him in the depths of the forest on the island of Labuan, invariably on the leaves of trees.

C. 4-filosum, nobis. Pulo Pappan, near Labuan, among dead leaves, on clayey ground. It is difficult of detection from being always covered with a coating of clay.

C. vitreum, Lesson. This widely spread species, which is met with from the Straits of Malacca to the islets on the N.E. coast of Australia, is met with in Pulo Pappan, as in the Frankland Isles, on leaves of trees.

C. sericatum, Pfr. Pulo Daat, near Labuan, on leaves of trees.

Pterocyclos biciliatus, Mousson (*Cycl. Charbonnieri*, Recluz, Jour. Conch. 1851). Sarawak, Borneo, brought by the Dyaks, and containing generally eight or ten eggs.

Mr. Metcalfe had already announced (Zool. Proc. 1851) that *Pt. biciliatus* of Mousson was a native of Borneo, and not of Burmah, as supposed by Mousson. It is clear, from Recluz's figure and detailed description, that it is the same as *Cycl.* (*Pterocyclos*) *Charbonnieri*, brought by Dr. Charbonnier from Borneo. The faint indentation noticed by Mr. Metcalfe at the upper part of the aperture is shown, in perfect specimens, to represent the true wing of *Pterocyclos*; and underneath is the obsolete sinus, corresponding to that observable in *Pt. hispidus*, Pearson (*spiraculum*, Sow.), which is also provided with a similar retroverted tube in the suture, behind the aperture. Recluz notices this structure of the peristome, but erroneously considered it to be the indication of a second, but imperfect canal. *Pt. hispidus* and *Pt. biciliatus* have another feature in common in a hispid epidermis; but in the smaller species this is developed into long bristles on the double keel. They both deviate from the true type of *Pterocyclos*, especially *Pt. biciliatus*, in which, as remarked by Recluz, the operculum resembles a small pulley, instead of being cup-shaped as in the more typical species.

Malvern, November 29, 1852.

Note.—In a copy of Pfeiffer's 'Monographia Pneunopomorum' just received, I find an amended description of his *Cyclotus Taylorianus* (Zeitschr. 1851), to which, in a subsequent note (p. 50), he assigns *C. Charbonnieri* as a synonym, and remarks that *Pterocyclos biciliatus*, Mousson, is closely allied to it, if not identical. A comparison with the specimen at Zürich will decide. If identical, the name *Taylorianus* must give way to Mousson's designation. The structure of the shell is that of a *Pterocyclos*. The operculum shows it to be an aberrant species, but does not quite conform to that of *Cyclotus*.—W. H. B.

December 22, 1852.

V.—*A Revision of the Genera of some of the Families of Conchifera or Bivalve Shells.* By J. E. Gray, Ph.D., F.R.S., V.P.Z.S. &c.

Several of the families of Bivalve Mollusca are well circumscribed, and the genera of other families are well defined, but one of the problems of systematic malacology is the arrangement of the families into groups and into a natural series. Each character which has in succession been chosen, and, indeed, each group of characters which has hitherto been studied and used for this purpose, appears to fail when an extensive series of the animals and their shells have come under examination for the purpose of verifying the system proposed. Under these circumstances, I have thought it desirable to turn my attention to the examination of the smaller groups or families, and to attempt to divide them into natural sections and genera, until some fortunate combination of circumstances should show the systematic zoologist how the families can be placed in a more natural series than the provisional one now adopted. Following out this idea, I have lately, at various times, studied the species of certain families of bivalve shells which appear most to require revision, considering this the more necessary as these shells have hitherto been divided in a most unequal manner. Some genera, as *Cardium*, *Mactra*, *Tellina*, &c., are magazines, containing very many kinds; while many other genera of bivalve shells have been established on a single species, having some slight modification in its cardinal teeth, or some anomalous external form, which, when compared with other species of the family, is not of so much importance as the peculiarities in the shells offered by many kinds which have been left as species in these large genera, or is of less importance, when we consider the change in the organization of the animal, which must produce the character selected for the purpose of separating them from their allies;—differences which are constantly overlooked in the study of the species of the larger genera.

Hitherto modern conchologists seem, on principle, to have avoided the examination, revision, and analysis of the genera of these shells; as I cannot call to mind a single author, either in England or abroad, who has within the last ten or twelve years published any paper on a single family of bivalve shells except myself; indeed they remain nearly in the state they were left by Lamarck, except as far as regards the description of certain isolated genera formed for a few and often a single newly discovered species.

This apparent neglect of the subject has most probably arisen from the difficulty of studying the species of the genera in detail, without having the facility of examining a large number of the specimens of each species in their various states of growth at the same time, and of moving them about, so as to see how the species of the family or genus agree with or differ from each other at a single view,—a kind of examination which the small drawers of the cabinet generally used do not well afford. The British Museum collection, where all the specimens of the different species are attached and arranged in the same position on moveable boards, affords me, in common with any other conchologist who is willing to study it, greater facilities for this kind of comparison than any other collection I have seen either in this country or on the continent. It is probably the facilities which this collection has afforded me for studying the affinities of the genera and families of shells, that have induced so many of the most scientific conchologists to receive with such kindness the observations on the genera and families of shells published in the 'Synopsis' of the British Museum for 1840 and 1842, and my papers on the genera of *Veneridæ, Mactradæ, Anomiadæ, Placuniadæ, Pholadidæ,* &c., which have been published in the various journals.

It is this attention, and the hope of forwarding the study of a very favourite part of malacology, which have induced me to send the following synoptical revision of the genera of certain families of Bivalves for insertion in the 'Annals,' premising that in the Catalogue of the Bivalve Mollusca now in progress, the characters of the genera will be given in greater detail.

I may here observe, that I regard the shortness of the character as an advantage, enabling the student easily to identify the group of genera and the genus to which any particular species under examination belongs. It is the custom of many zoologists to give extended characters of the genera and long descriptions of the species. This is an advantage when only a single genus of a family, or only a single or a few species of a genus, are described; but, in a work on all the species of a family, if each kind was so described and characterized, whose life would be long enough to read and identify the animal now known in the different Museums? Mr. William MacLeay has well observed, "The modern art of describing is too long, often insuperably long, while human life remains as short as ever." (Illus. Zool. South Africa, 54.) The system of long descriptions is not required, when all, or even the greater number of the species of a family or genus has been personally examined, and especially when they, or the greater part of them, are present at the same time before the eyes of the author, as is the case with most families of animals in the British Museum. Then the characters which divide them into smaller groups, and these groups again into genera, soon present themselves to the student, and the characters thus discovered are as easily arranged in a tabulated form. Hence, that which would be very difficult, indeed almost impossible for a person to do with a small collection, or only with the descriptions of others before him, becomes comparatively easy to one who has a large and well-arranged collection at his command, and with common care, the short comparative descriptions of a naturalist with such advantages are and ought to be very superior to the long characters and detailed descriptions of one who has only a few specimens, or the descriptions given in books, for comparison.

The value of both the short character and the long description must depend on the accuracy and observant faculties of the describer; but there is less liability to error in the short character than in the long description; for to make the former, the author must submit the species to an accurate examination and rigid comparison, which must draw his attention to those parts of the animal or shell which are least liable to vary, and hence afford the best character to separate the species; while the describer of an individual specimen, who is likely only to be attracted by the more prominent peculiarities of the species, may overlook the most characteristic particular. This is well illustrated in M. F. Cuvier's work on Mammalia, where every individual has at least one, and often three or four pages of description, and in the most, the character which distinguishes it from its congener, if there is any other species of the genus, is not given. Again, in Schönherr's work on *Curculionidæ,* in which seven large volumes of close type are filled with the descriptions of the species of the Linnæan genus *Curculio,* each species occupies a page or more; and at the end of the description the reader is informed that such a species is very distinct from a certain other one, as will be seen by the description; yet, when the descriptions are compared word by word with one another, they are so exactly alike, that one is at a loss to conceive what the difference between the two species can be.

In making a long description of a species of a natural genus, the characters which are common to the different allied species must be repeated, and it is very difficult in reading the descriptions, without a very accurate comparison, to seize on the essential character of the species under examination, and therefore it is generally considered necessary to append to a long description observations pointing out how the species described differs from its allies, all of which trouble is avoided by a well-considered short character prepared after the examination and comparison of the allied species.

On the other hand, a short analytic character, either of a genus or a species, is not so short and incomplete as it at first appears; for in examining and comparing a genus of shells with the character, it should be compared first with the character of the family, and then with all the sections and divisions until we arrive at the generic character, and that character may be said to contain the short essential character of the genus, combined with the character of all the previous divisions and sections; and if these were written out together and repeated in each genus, each of them would be found to be furnished with a character of considerable length. It is exactly the same with the species. This is the chief advantage of the analytic method of characterizing the genera and species, that the characters common to two or more genera or species need not be repeated for each.

Fam. 1. VENERIDÆ, Gray, Syn. B.M. 1842, 74.

I propose to confine this family to the genera which have the hinder lateral tooth compressed and forming a part of the margin of the shell, and the mantle lobes free. This will exclude *Cyprina*, *Petricola* and *Glauconome*, which I believe form the types of distinct families, and the genera *Capsa* and *Diplodonta*, which I think ought to be removed to *Tellinidæ*. The family so restricted may be divided thus:—

A. *Foot lunate, inferior; siphons united; shell orbicular.*

1. Dosinia. 2. Cyclina (Lucinopsis).

B. *Foot lanceolate anterior; siphons partly united; shell ovate, triangular or oblong.*

a. *Anterior lateral tooth distinct; cardinal teeth triangular; shell ovate.* Meretricina.

* *Hinder cardinal tooth cross-grooved or torn.*

3. Meretrix. 4. Cuneus. 5. Grateloupia. 6. Trigona.

** *Hinder cardinal tooth smooth.*

7. Dione. 8. Venus. 9. Circe.

b. *Anterior lateral teeth none; cardinal teeth triangular; shell ovate.*

10. Chione (and Mercenaria). 11. Anomalocardia.

c. *Anterior lateral teeth none; cardinal teeth compressed; shell oblong.*

12. Tapes (Saxidomus and Rupellaria part.). 13. Clementia.

Fam. 2. CYPRINADÆ.

Shell ovate, cordate, covered with a hard dull brown periostraca. The hinge-teeth 3·3, triangular; the front of left valve conical, rugose, like the anterior lateral tooth of *Venus*; the hinder of left valve very thin, compressed; the middle of right valve compressed; the hinder very broad, with a deep groove; anterior lateral tooth none; hinder of right valve compressed, separated from the dorsal margin by a deep groove. Siphonal inflection none, or very slightly truncate. Mantle lobes free beneath. Siphons very short (Müller, Zool. Dan.).

These shells have much the appearance of *Astartidæ* and *Glossidæ*, but the teeth and form are more like *Veneridæ*.

1. *Cyprina*, Lamk., Gray, Proc. Zool. Soc. 1847, n. 545.

Fam. 3. GLAUCONOMIDÆ.

Shell oblong, covered with a hard green periostraca extending beyond the edge. Hinge-teeth 3·3; right valve, two anterior small, conical, bent up; hinder very oblique, elongate, bifid; left valve, anterior small, middle rather oblique, larger, bifid; hinder very oblique, small, laminar. Ligament external, marginal; fulcrum moderate. Lateral teeth none. Siphonal inflection very narrow elongate, ascends obliquely towards the back of the shell, and with a rough muscular scar at the inner end.

Animal —— ?

The *Glauconomidæ* differ from the *Veneridæ* in the form and disposition of the teeth, in their freshwater habitation, and in being covered with a hard green periostraca, which, from its external appearance, seems evidently to cover the siphons as in *Myadæ* and *Solenidæ*.

They differ from *Solenidæ* in having more teeth in the hinge, and in the teeth being very differently disposed.

1. *Glauconome*, Gray, *l. c.* n. 549*. The freshwater streams of Asia.

Fam. 4. PETRICOLIDÆ.

Shell ovate, white, covered with a thin hard periostraca. The cardinal teeth 2·2 (one often obsolete), bent up as if coming from the inner surface of the shell under the umbo, the middle one deeply bifid; lateral teeth none, or rudimentary, marginal. Siphonal inflection deep, rounded. Mantle lobes united, with a small anterior slit. Siphons two, elongate, united at the base. Aperture ciliated. Foot small, thin, cylindrical, with a distinct byssus.

1. *Petricola*, Lamk., Gray, *l. c.* no. 556. Cardinal teeth rather compressed. *P. Lithophaga*, Lamk.

This shell must not be confounded with the boring *Tapes* = (*Rupellaria*, Bellev.), which have three regular compressed teeth on each valve.

2. *Naranio*. Shell ovate, equivalve, inequilateral, swollen, rugose, tubercular, costated behind; umbo anterior. Cardinal teeth of right valve two, oblique, the upper compressed, elongate; of left valve triangular, oblique, bifid. Lateral teeth none. Cartilage external, short, in a slightly sunken groove. Siphonal inflection very large, rounded; anterior scar oblong, hinder very large, roundish.

These shells have nearly the external appearance and hinge of *Coralliophaga*, but are easily known by the large siphonal inflection. They are generally covered with a calcareous secretion, which hides the rugosities on the surface, and live in stony corals.

1. *N. costata*. Surface covered with zigzag grooves and costated in front. From the West Indies.

2. *N. radiata*. Surface covered with radiating grooves. Japan.

Fam. 5. CORBICULADÆ, Gray, P. Z. Soc. 1847, 184.

Cardinal teeth 3·3 or 2·2, diverging; lateral teeth compressed. Siphonal inflection none. Periostraca olive, hard, brittle, often polished. Siphons contractile.

A. *Cardinal teeth* 3·3, *front of right and hinder of left valve smallest. Shell solid.*

1. *Corbicula*, Megerle, Gray, P. Z. S. 1847, n. 552. Shell subcordate; lateral teeth compressed, subequal, finely striated. *C. fluminea*.

2. *Batissa*. Shell subcordate; lateral teeth compressed, striated, front very short, hinder elongate. *B. tenebrosa*. *B. obesa*, Hinds.

3. *Velorita*, Gray, Syn. B.M. 1842, 75; P. Z. S. 1847, n. 554. Shell cordate, triangular, thick; teeth large, lateral, very finely

striated, anterior very large, angular, hinder elongate, compressed. *V. Cyprinoides.*

4. *Cyrena,* Lamk., Gray, P. Z. S. 1847, n. 553. Shell subcordate; lateral teeth smooth, front roundish, hinder rather compressed. *C. Zeylanica.*

B. *Cardinal teeth* 2 · 2, *moderately diverging, front of right valve and hinder of left valve smaller; lateral teeth elongate, compressed, smooth; of right valve double, of left valve simple. Shell thin.*

5. *Sphærium,* Scopoli, Gray, P. Z. S. 1847, n. 555. Shell oblong, cordate, equilateral; siphon of animal separate, diverging at the tip. *S. corneum.*

6. *Pisum,* Megerle, Gray, P. Z. S. 1847, n. 556. Shell ovate, wedgeshaped, inequilateral, truncated behind; siphons of animal short, united to the end. *P. amnicum.*

Fam. 6. Cyrenelladæ.

Shell oblong, roundish, ventricose, thin, covered with a hard olive periostraca. Cardinal teeth 3 · 2, the front and hinder of the right valve thin, laminar, united above under the umbo and enclosing the small triangular central one; the two teeth of the left valve united above under the umbo, and fitting into the very narrow slit between the central and two united teeth in the other valve; the front tooth the longest, large and high, especially in the middle of its length, and oblique; the hinder small, thin, and diverging from the umbo; front lateral teeth none, hinder rudimentary, elongate, the one of the left valve being separated from the dorsal margin by a slightly impressed groove. Siphonal inflection none.

Animal:—mantle lobes free beneath, united at each end, and furnished with two elongated, united, contractile (not retractile) siphons; lips elongate; foot subcylindrical, clubshaped. Gills two on each side (in *Lucinidæ* only one) (Mag. Zool. 1835, t. 70).

Genus 1. *Cyrenoida,* Gray, Proc. Zool. Soc. 1847.

Cyrenoida, *Joannis, Mag. Zool.* 1835, t. 64 (shell).

Cyrenella, *Deshayes, Mag. Zool.* 1836, t. 70 (animal); *Wiegmann's Archiv,* 1836; *Desh. Elem. Conch.* t. 14*.

Cyrenodonta, *Auct.?*

Cyrenoides, *Sow. Manual,* ed. 2. 135. 1842, misprint.

This genus was established by Joannis (Mag. Zool. 1835, t. 64), who very inaccurately observes,—"Le charnier qui est pour les dents cardinales à-peu-près celle des *Cyrènes,* mais qui manque complètement des dents latérales si caractéristiques dans ces dernières, nous a décidé à établir le sousgenre *Cyrenoide.*" The figure is more accurate than this description.

M. Deshayes shortly afterwards (Mag. Zool. 1835, t. 70) described the animal, and observed that he had previously suggested for the genus the name *Cyrenella,* and proposed to place it between the genera *Lucina* and *Venus,* which M. Joannis combats in the same paper.

1. *Cyrenoida Dupontia,* Joannis, Mag. Zool. 1835, t. 6.

Hab. River of Senegal.

Is the only species known; the new species referred to this genus by Mr. Adams (Proc. Zool. Soc. 1849) and M. Deshayes being species of *Sphærella* of Conrad belonging to the family *Lucinidæ.*

Fam. 7. CARDIADÆ, Gray, Syn. B.M. 1840, 137; 1842, 75.

Cardinal teeth 2·2, placed so as to form a cross when the valves are closed; lateral teeth lamellar, elongate. Shell costate. Periostraca thin, rarely distinct. Siphonal inflection none. Siphons very short, separate.

A. *Shell gaping and furnished with a serrated posterior margin.*

1. *Cardium,* Gray, P. Z. S. 1847, n. 557. Shell subglobose, hinder gape distinct.

* Gape very large. *C. indicum.* ** Gape moderate. *C. costatum.*

2. *Bucardium.* Shell subglobose, costated, hinder gape narrow and strongly toothed on the hinder edge.

* Shell as long as high, costated. *B. ringens.* ** Shell higher than long. *B. procerum.* *** Shell, hinder slope subcarinated. *B. unedo.*

3. *Papyridea,* Swainson, Gray, P. Z. S. 1847, n. 560. Shell oblong, elongate; hinder gape moderate, toothed. *P. soleniforme.*

4. *Fulvia.* Shell subglobose, rather produced behind; hinder gape moderate, slightly toothed. *F. aperta.*

B. *Shell closed and smooth, or nearly smooth behind.*

5. *Cerastes,* Poli. Cardium, part., *Gray, l. c.* n. 557. Shell subcordate, convex behind; lunule simple; cardinal teeth well developed.

* Rounded, ribbed. *C. aculeatum.* ** Rounded, smooth. *C. norvegicum.* *** Rounded, anterior half obliquely ribbed. *C. æolicum.* **** Subcarinate. *C. medium.* ***** Costate, hinder slope keeled. *C. hemicardium.* ****** Smooth, hinder slope keeled (*Didacna*). *C. lineatum.*

6. *Aphrodita,* Lea, Gray, P. Z. S. 1847, n. 557. Shell subcordate; lunule simple; cardinal teeth rudimentary. *A. edentula.*

7. *Cardissa*, Megerle, Gray, P. Z. S. 1847, n. 558. Shell cordate, keeled, very short, hinder side shortest or impressed; lunule simple; cardinal teeth distinct, more or less distorted. *C. Cardissa.*

8. *Lunulicardia.* Shell cordate, keeled; lunule deeply impressed; cardinal teeth more or less distorted. *L. retusa.*

Cardium avicularia and *C. cymbulare* are more allied to *Hippopus* than to *Cardium*; like *Hippopus* the front side is short, with the gaping edges, and not the hinder as in *Cardium*, and the teeth are oblique and not placed in a cross. If distinct from *Hippopus*, it may form a genus of *Tridacnidæ*, named *Avicularium*, characterized by the height of the shell (see Gray, P. Z. S. 1847, 561).

Adacna (*læviuscula*) has a long and *Didacna* a small siphonal inflection and distinct siphons; they are evidently more allied to the genera *Panopea* and *Cyrtodaria* than to *Cardiadæ*, with which they have generally been placed, apparently on account of their costated shells.

Fam. 8. MACTRADÆ, Gray, Syn. B. M. 1840, 137; 1842, 75.

Shell equivalve. Cardinal teeth two in each valve, the hinder one small, compressed, often rudimentary, the front one triangular, more or less deeply nicked; lateral teeth of left valve simple, of right double. Cartilage in an internal pit. Siphonal inflection distinct. Mantle lobes more or less free beneath, united before and behind, and extended into two retractile siphons. Foot lanceolate, subanterior.

A. *Shell subtriangular, ovate, nearly closed behind; lateral teeth distinct, well developed, laminar; mantle lobes free.* Mactrina.

a. *Ligament in a groove above the cartilage-pit.*

1. *Schizodesma*, Gray, Mag. N. H. i. 370; P. Z. S. 1847, n. 563. Shell triangular; lateral teeth simple, compressed. *S. Spengleri.*

b. *Ligament marginal, triangular, separated from the cartilage-pit by a shelly ridge.*

2. *Mactra.* Mactra A., *Gray, Mag. N. H.* i. 370. Shell trigonal; lateral teeth elongate, linear, subequal. *M. stultorum.*

3. *Mactrinula.* Mactra C., *Gray, Mag. N. H.* i. 371. Shell trigonal, thin; hinge-margin double; lateral teeth short, very close to the cardinal ones. *M. plicaria.*

4. *Mactrella.* Mactra B. & E., *Gray, Mag. N. H.* i. 371. Shell cordate, triangular, thin; hinder lateral teeth very short, rudimentary, and near the cardinal. *M. striatula.*

5. *Harvella.* Mactra E., *Gray, l. c.* Shell cordate, thin, hinder slope keeled, narrow; hinge-margin double; lateral teeth very small, close up to the cardinal. *H. elegans.*

c. *Ligament submarginal, triangular, near the cartilage-pit.*

6. *Spisula.* Shell trigonal, hinder slope more or less keeled; lateral teeth elongate, cross-ribbed. *S. solida.*

d. *Ligament internal, in the same closed pit as the cartilage.*

7. *Mulinia,* Gray, Mag. N. H. i. 372. f. 33; P. Z. S. 1847, n. 568. Shell triangular; lateral teeth short, simple. *M. typica.*

8. *Gnathodon,* Gray, Mag. N. H. i. 373. f. 34; P. Z. S. 1847, n. 569. Shell ovate, triangular, thick, rather produced behind; lateral teeth elongate, front dilated and angular above. *G. cuneata.*

B. *Shell oblong or elongate, gaping behind; lateral teeth very small, rudimentary, often obsolete, especially in adult shell; mantle lobes (generally?) united.* Lutrariana.

a. *Ligament external, marginal, separated from the cartilage-pit by a shelly plate.*

9. *Tresus.* Lutraria sp., *Middend.* Shell ovate oblong, ventricose, hinder gape roundish; cardinal teeth small; lateral teeth very small, close to the cardinal; siphonal inflection large, oblong. *T. maximus.*

10. *Darina.* Erycina sp., *King.* Shell oblong, compressed, rounded, and slightly gaping at each end; umbo subposterior; cartilage-pit large; lateral teeth very small, close to cardinal. *D. solenoides.*

b. *Ligament subexternal, marginal, not separated from the cartilage.*

11. *Standella,* n. g. Spisula A., *Gray, Mag. N. H.* i. 271. Shell ovate, hinder slope more or less keeled; lateral teeth short, smooth, anterior oblique.

* Oblong, smooth. *S. fragilis.* ** Oblong, radiately ribbed. *S. ægyptiaca.*

12. *Eastonia.* Lutraria C., *Gray, Mag. N. H.* i. 174. Shell oblong, rather ventricose, thick, equilateral, radiately ribbed, hinder slope rugose, hinder gape small; cardinal teeth of left valve compressed, nicked; anterior lateral tooth nearly perpendicular. *E. rugosa.*

13. *Lutraria,* Lamk., Gray, P. Z. S. 1847, n. 566. Shell oblong, elongate, rather compressed, subequilateral; umbo subanterior; hinder gape moderate or large; cardinal teeth distinct;

anterior lateral teeth erect, hinder very small, often obliterated in adult shells. *L. elliptica.*

14. *Zenatia.* Lutraria sp., *Quoy.* Shell oblong, elongate, compressed; umbo anterior, submarginal, hinder gape large; cardinal teeth distinct, lateral teeth none. *Z. zelandica.*

15. *Resania.* Shell oblong, rounded in front, tapering behind, strengthened by two broad raised diverging ribs within; umbo central, hinder gape moderate; cardinal teeth distinct; anterior lateral tooth very small, close to the cartilage-pit, posterior none.

R. lanceolata. Shell oblong, lanceolate, compressed, tapering behind, white. N. Zealand. 565

16. *Cypricea,* Gray, P. Z. S. 1847, n. ~~185~~. Lutraria **, *Gray,*
375 *Mag. N. H.* i. ~~176~~. Shell oblong, marked with an oblique posterior ridge, largely gaping and reflexed behind; lateral teeth distinct; anterior oblique, near the small cartilage-pit. *C. recurva.*

17. *Raeta.* Lutraria ***, *Gray, Mag. N. H.* i. 37~~6~~. Shell 5
cordate, ventricose, thin, slightly produced and rather gaping behind, hinder slope keeled, narrow; cardinal teeth strong; hinder lateral tooth small, distinct. *R. campechensis.*

c. *Abnormal; ligament marginal near cartilage; cardinal tooth of left valve broad, triangular, nicked.*

18. *Cœcella.* Shell oblong, subequilateral; lateral teeth very small, close to the cardinal tooth; cartilage-pit produced into the cavity of the shell.

C. Horsfieldii. Madras and China. Perhaps the type of a new family.

The genus *Pythina* of Hinds (Zool. Sulphur, 71. t. 19. f. 8, 9), which that author has referred to *Mactradæ,* evidently belongs to *Lasiadæ,* and is very nearly allied to *Kellia.*

Fam. 9. Anatinelladæ.

Shell oblong, rather gaping behind, equivalve, equilateral; umbo central, white; covered with a thin smooth periostraca. Ligament thin; cartilage internal, in an oblong narrow pit, projecting into the cavity of the shell, nearly at right angles with the cardinal edge. Cardinal teeth in the right valve two, diverging, slightly raised; of the left valve single, triangular, rather bifid; lateral teeth none. Siphonal inflection none; anterior scar elongate, slender, marginal, hinder oblong, triangular.

The *Anatinelladæ* are like a roundish *Lutraria* without any lateral teeth, but the cardinal teeth are less developed, and there are no lateral teeth nor siphonal inflection, and the inner surface of the valves is opake white.

1. *Anatinella*, Sow., Gray, P. Z. S. 1847, n. 570. *A. Sieboldii.*

Fam. 10. PAPHIADÆ, Gray, P. Z. S. 1847, 186.

Chiefly distinguished from *Mactradæ* by the imperfect development of the cardinal tooth, which is simple, compressed, and with a small process on the upper edge in the place of the second tooth.

A. *Siphonal inflection distinct.*

1. *Mesodesma*, Deshayes. Shell ovate, subequilateral; lateral teeth short, smooth, subequal. *M. novæzelandiæ.*
2. *Taria.* Shell oblong, subequilateral, attenuated behind, hinder slope keeled; lateral teeth very small. *T. Stokesii*, n. s.
3. *Donacilla*, Lamk. 1818. Shell elongate, wedge-shaped, hinder slope truncated; anterior lateral teeth elongate, hinder short. *D. cornea.*
4. *Paphia*, Lamk. 1801; Gray, P. Z. S. 1847, n. 572. Shell ovate, cuneate, truncated and slightly keeled behind; lateral teeth small, subequal, smooth. * Siphonal inflection short. *P. glabrata.* ** Siphonal inflection elongate. *P. ventricosa.*
5. *Ceronia.* Shell ovate, cuneate, truncated behind; lateral teeth subequal, compressed, strongly cross-grooved. *C. denticulata.*

B. *Siphonal inflection none.*

6. *Anapa*, Gray, Syn. B. M. 1842; P. Z. S. 1847, 573. Shell subtrigonal, ventricose, truncated behind; lateral teeth subequal, compressed, smooth. *A. Smithii*, V. D. Land.
7. *Davila.* Shell ovate, cuneate, truncated behind; lateral teeth unequal, anterior small, perpendicular. *D. polita*, n. s.

[To be continued.]

VI.—*On the* Ianthinæ, Scalariæ, Naticæ, Lamellariæ, *and* Velutinæ. By WILLIAM CLARK, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN, Norfolk Crescent, Bath, Nov. 25, 1852.

HAVING, agreeably to my method of the classification of the British Mollusca, published in the 'Annals,' N.S. vol. vii. p. 469, constituted the family of the *Peloridæ*,—forming, as I think, one of the approaches to the *Murices*, also described in the 'Annals,' vol. vii. p. 108,—I have thought that it would be a proper attention to naturalists, and justice to myself, to assign the reasons for the steps I have taken, by giving some account of the singularly anomalous genera and species that compose the new family, which, though often mentioned,—and some of them have even fallen on good ground with respect to natural order,—have not received the attention they deserve. My object is to give these aberrant animals a more collective form, and improved arrangement with respect to their connexion with the Muricidal tribes, until better are proposed; for in the present age we see that the highest intelligences in every science are scarcely more than ephemeral,—"summisque negatum stare diu." I have also supplied fuller descriptions of the British species, and hope I have interspersed some observations that hitherto have escaped the attention of naturalists.

Several of the species were known to Linnæus and his followers, but the older zoologists being comparatively ignorant of the animals have transferred them from genera to genera, and the moderns have scarcely succeeded in bringing all of them to a safe anchorage. I believe that the examination of many of our species will enable me perhaps to carry out some of these views. I have felt a difficulty in uniting these wanderers, almost without a home, as aberrant sections of the strict *Muricidæ*, though the animals have some of the essential organs of that family, and it would be still more inconvenient to locate them in any of the existing families of the *Holostomata*. I have considered that the best plan would be, to form for the *Ianthinæ*, *Scalariæ*, *Naticæ*, *Lamellariæ*, and *Velutinæ*, a family, combining the respective characters of the holostomatous and canaliferous divisions of the Gasteropoda, as by their entire apertures they have, conchologically, a large affinity with the former tribe, and by the retractile proboscis, malacologically, the closest alliance with the *Canaliferæ*. Naturalists must therefore either raise each of the above genera to the rank of families, which at best can only have conchological variations, and scarcely any very essential malacological distinction, or deposit them for conciseness sake in a neutral one, under an indifferent term, embracing the principal attributes of the five genera. If the latter view is thought convenient and acquiesced in, I propose the appellation of the *Peloridæ*, from the *Peloris* of the ancients, probably a testaceous animal, but whether of the holostomatous or muricidal race is doubtful, and on that account more appropriate for a family of hybrid and transitive pretensions. The position of the new family would be intermediate with the *Pyramidellidæ* and *Muricidæ*; its genera, the *Chemnitziæ* and *Eulimæ*, which have also an entire aperture and retractile proboscis, may be said to occupy a sort of debateable ground between two of the great divisions of the gasteropodan domain.

These anomalous genera must not be looked on as freaks of nature; they are her avenues from one division of a class to another. Under the respective genera will be pointed out the curious characters that connect them with particular groups, and also the various differential points with each other, which though conchologically great in appearance, when malacologically examined will exhibit striking similarities : for instance, *Ianthina* and *Scalaria* are inseparable, as are *Natica, Lamellaria,* and *Velutina*; but notwithstanding their respective discrepancies, they all have various connecting links, decidedly showing that they form a single family about to blend with the strict *Muricidæ*. Many considerations have induced me to propose the *Peloridæ*. Abstractedly, I would rather have preferred the transfer of its proposed genera as sections of the *Muricidæ*, with which group they appear to have the greater approximation; nevertheless for the present I abandon this view, on the plea that one intermediate family would be less repugnant to the feelings of conchologists, and even to some malacologists, than the adoption of five families or the creation of five sections of essentially the same malacological structure. However great may be the disapprobation of naturalists at these changes, we feel it to be our duty to see that nature is satisfied before conchological hypothesis, and we fearlessly invite malacologists to point out a more natural site for these creatures, than as a united anomalous group, immediately abutting on the Muricidal tribes.

This family will conspicuously illustrate the great advantage, nay even the triumph, of malacological facts over conchological considerations, and point out the little reliance to be placed on the *form* of the hard parts as distinctive characters. What conchologist would have ventured to associate these anomalous genera in the same circle? Conchology could never have given to these singular objects an appropriate constitution : without the assistance of malacology they would for ever have remained a nomadic tribe, and indefinitely the sport of hypothesis.

Fam. Peloridæ, nobis.

Animalia, quoad testam, formæ variabilis, nunc, *Naticam, Sigaretum,* nunc, *Bullam,* aut *Scalariam* simulantia; apertura integra vel canali obsoleto; quoad organa essentialia, summæ consensionis; semper proboscide retractili plus minusve longa prædita; pallio ad latus columnari, canalem brevem efformante.

Ianthina, Lamarck.

This singular genus appears not to be indigenous to any of the coasts of our globe; it has a truly oceanic habitat amidst the mighty waters of the Atlantic and Pacific; the various species are occasionally wafted to the different shores of the world. More than twenty years ago, many of the *Ianthina communis* were brought to us alive, though collapsed, collected on the South Devon coasts; I believe none have appeared since in those localities.

This genus has long caused embarrassment to naturalists, and is still a source of difficulty in regard to the structure of the animal and its natural position; but I think the obstacles to a true determination will disappear on attentive consideration. The great stumbling-block is the float, as it is called, or vesicular mass attached to the foot, which has been considered an hydrostatic apparatus. This idea is erroneous: the organ is the membranous vehicle of the contents of the ovarium and matrix, that has descended from under the mantle, and fixed itself to the foot, for a very obvious purpose of the animal œconomy in reference to the pulli in the genial season. It is probable, that as the animal, from its peculiar habitat, cannot, like the tribes of the coasts, deposit the germs of reproduction on marine substances, it makes use of the foot as a substitute, until its young emerge from the agglomerated mass of capsules to shift for themselves; then the temporary vesicular deposit is cast off. I have seen a similar appendage to the foot of the *Pileopsis hungaricus* and several other Gasteropoda.

That this organ is not necessary for the floatation of the animal is strongly supported by the fact, as the sexes are distinct, that many may be presumed the males, and such often occur without the so-called float. Many of the *Littorinæ* with a shell ten times more ponderous in proportion than the globular delicate *Ianthina*, float with the shell beneath, and foot uppermost, in every direction for days, without descending from the surface of the waters.

It will be seen that the other parts of the animal scarcely differ from the more regular gasteropod. The double branchial plumes, one of them with two ranges of strands; the small head, and the retractile, though short, inflated proboscis; and the rudimentary mucous fillets, which latter are only seen in the *Canalifera*, show that *Ianthina* is in the vicinity of *Murex*. It has been thought to approach *Trochus*; I am not of this opinion: the above characters, with its oceanic habitat, food and habitudes, and absence of operculum, seem entirely to remove it from that genus, to which it would be difficult to find a colourable approach; and above all, we may observe, that the illustrious Cuvier, by his dissection, places it in the category of the *Muricidæ*.

I therefore deposit *Ianthina* as the first member of the new family, forming, with the *Eulimæ* and *Chemnitziæ*, the passage from the tribes with entire apertures to the *Canaliferæ*: the aperture in *Ianthina*, by its columellar elongation and canaliferous tendency, shows that it is in a state of transition, and the short neck and head, with the retractile rostrum, point out that in the soft parts there are also the elements of transition.

Ianthina communis, Lamarck.

Animal inhabiting a spiral, subglobose, bluish-white or lilac-coloured shell of four tumid volutions and a minute reflexed apex. Mantle lax, swelling beyond the margin of the aperture and forming an incipient canal. The neck and head are very short, but capable of evolving an inflated retractile proboscis, which has been mistaken for the head itself; it is armed, as in the *Murices*, with corneous plates and the usual short spiny tongue. Tentacula short, conical, pointed, with deeply cloven offsets of half their length; but the eyes are obsolete, probably being useless, as the animal floats with the shell downwards and the foot to the skies. Foot truncate anteally; auricled at the external angles, moderately long, gradually tapering to a point: on the under part, the animal in the genial season deposits the vesicular mass containing the ova and pulli, ejected from the matrix; it exudes from the collar and surface of the body a purple liquid. There are two branchial plumes, one with a double row of strands, and there are the rudiments of mucous fillets; in fact, all the organs resemble those of *Murex*. I should rejoice to review this species, as my examples, though alive, were torpid from the effect of the agitation of the tides on the shores, consequently there was no adequate exertion of their organs.

I beg malacologists to lose no opportunity of rigorously examining these animals, as there are still points in their structure on which it would be desirable to have further information; amongst them the constitution of the proboscis, whether it be strictly the *proboscis retractilis* of the *Muricidæ*. M. Cuvier insists again and again that it is retractile, assimilating it to that organ in the *Buccinum undatum*, which he has so elaborately described, and stating that when he treats of that muricidal animal, the mechanism of *Ianthina* by comparison will be better appreciated. Therefore, after M. Cuvier's particular and minute account, that the proboscis in this species is a great and inflated, though short muzzle, that can be retracted *within* the buccal sheath, we must bow to such high authority; but independent of this fact, there are other characters which sufficiently declare that this extraordinary animal can have no other allocation than in the vicinity of the *Muricidæ*.

This is the only species I have seen alive; one or two other rarer ones are sometimes found in company with it, as the *Ianthina exigua* and *I. pallida*, which last I think is only a variety of the present species. These animals have no operculum.

Scalaria, Lamarck.

This genus contains several British species. Authors and Lamarck's commentators say, that it is allied to *Turritella*, but I think that it has much greater affinity with the *Canalifera*. *Turritella* and *Scalaria*, in addition to the single branchial plume, appear to have the mucous strands of the *Muricidæ*, the animals of which are always provided with that appendage, besides the gland of viscosity; in other points, *Turritella*, by its short produced muzzle, circular operculum, and absence of a proboscis, is nearer to the *Littorinæ* and *Trochi*, whilst *Scalaria* also, with the mucous fillets, has the decided proboscis of the *Canalifera*; consequently it must be assigned, as a muricidal anomaly, to the new family of the *Peloridæ*. However, whatever may be the affinities of the two genera, they will not be far apart; the one claiming, by its subcanal, both of shell and mantle, to take position on the last confines of the *Holostomata*, the other on the first lines of the *Canalifera*. An attentive perusal of the account of the undermentioned species will show that the *Scalariæ* are truly strange animals; the spiral operculum, single branchial plume, and almost entire aperture, indicate their relation with the *Littorinæ* and *Cerithiadæ*, whilst the mucous fillets and prominent retractile proboscis, a character of the highest value, fix them amongst the immediate points of transition to the *Muricidæ*.

Scalaria clathratula, Montagu.

Animal occupying a densely plicated milk-white spiral shell of 9–11 volutions. The animal nearly throughout is bluish white, aspersed at the points of the tentacula, on the head and neck, and margins of the foot, with blotches and spots of snow-white matter. Mantle fleshy, reflexed on the peripheral rib of the aperture, and forming also a short lax branchial fold to correspond with the incipient canal of the shell. The head, though very short, is distinct, compressed and crescent-shaped as in *Murex*, beneath slightly emarginate in the centre, at which point is the mouth that is partially transversely and vertically cloven, from which a long strong fleshy proboscis is exserted, which I have repeatedly seen evolved, several times in a minute. The tentacula are moderately long, divergent, subcompressed, with blunt terminations; the eyes are very black, not fixed on offsets, but on scarcely raised eminences or decidedly external semicircular inflations that are integral parts of their bases. The foot can be extended beyond the tentacula; it is nevertheless short, narrow, and bevelled on both sides, arcuated gently in front when on the march, and slightly auricled; at rest subtruncate; it is also grooved transversely in front, dividing the sole from the upper part, and forming a distinct labium, the sole being somewhat the longest; it tapers to a slender rounded termination, carrying at some distance from the extremity, on a simple lobe, a white spiral operculum of three turns; the two first are very small and eccentric, the third rapidly increases and occupies $\frac{9}{10}$ths of the area, and is marked with elliptical striæ of increment; the posterior half of the foot is deeply grooved longitudinally and medially in the sole, with a central depression exactly as in *Murex tubercularis*, but not quite so decided:—it is probable that this groove, and apparent, if not real, solution of continuity, is not solely to convey water to the foot, but also to assist the folding of that organ on its anterior portion, and the central pit is to aid another doubling at right angles. I witnessed the operation both in retraction and when the animal deployed the foot, which confirmed that part of M. Bivona's description,—"Pes, plica triplici in testam retractus." On retraction, each posterior longitudinal half, bounded by the groove, is folded on its counterpart, forming two plications; then these halves are at the central depression doubled on the anterior portion, and the whole is withdrawn and covered by the operculum. Of course the routine of exsertion is exactly the converse, but it appears to me that these manœuvres are pretty much the same in all the Gasteropoda. *Scalaria*, in these and other points, is closely allied to *Murex tubercularis*, as far as external organs are considered; it only differs in having a spiral operculum instead of a muricidal one.

This creature is very free in showing its points. It inhabits the three zones. The one described was captured by myself in the middle of the littoral district, at the roots of the *Corallina officinalis*, at Exmouth, where it is of rare occurrence. I have not taken more than five or six live specimens of this species and the *S. communis* in thirty years; most of them were from the coral zone. I observed that when the animal was *in extremis*, it emitted, like the *Ianthinæ*, a brilliant purple fluid. I am not prepared to speak, at present, of the reproductive organs and the internal mechanism of the proboscis, but we may safely conclude that it does not greatly differ from the *Buccinum undatum*,—*Murex* with me. I have examined the *S. communis*, which does not vary in the organs from this species; its colours and disposition of the markings exhibit some differences.

I believe the only other British species are the *S. Trevilliana*, *S. Grœnlandica*, and *S. Turtoni*. The two first I have not seen alive; the latter has been examined, but I unfortunately lost the notes. I have omitted to state one of the proofs of the intimate connexion between *Ianthina* and *Scalaria*, that they are the only two spiral animals which copiously, spontaneously and immediately emit the purple fluid. Many of the *Murices* produce the purple dye, but not until the gland is punctured, when a greenish white fluid is obtained, which becomes purple, on exposure to heat, light, air, and the sun.

Natica, Bruguière.

This genus has several British species, and is one of the anomalies that occasionally are met with in every department of zoology, and which cannot enter into natural order in regular progression, but must be intercalated as an excrescence in line with the object to which it has the greatest affinity. The present animal has alliances throughout the scale of its class:—by the position of the eyes in the species that have them, and the peculiar character of the flat tentacula coalescing with the membrane of the head, it exhibits a connexion with the *Eulimæ* and *Chemnitziæ*; it shows only slight connexion by the operculum with the *Littorinæ*; it has also by the foot a certain affinity with the *Bullæ*; but the important organ which fixes its true position is the retractile proboscis, the invariable concomitant of the Muricidal tribes, by which this apparently ambiguous animal becomes one of the points of transition from the *Holostomata* to the *Canalifera*, and I think that it ought to enter the natural order as a member of the new family.

Authors state that *Natica* has affinity with *Sigaretus*, an exotic genus of which there is no true British species; we cannot concur in this view until the anatomy of the latter is more fully examined; if it is found to have the retractile proboscis, it will be in the same category as *Natica*, and must be withdrawn from the *Haliotidæ*.

Natica monilifera, Lamarck.

Natica glaucina, Anglorum.

Animal inhabiting a spiral, globosely conical, smooth shell of 6–8 tumid volutions. The mantle, neck, and body are of the palest or lightest mouse-colour; it is thin, rather lax, but does not extend beyond the shell;—Lamarck's commentator, M. Deshayes, says, "Le manteau se développe particulièrement sur les parties antérieures de la coquille;" this is quite incorrect; he has mistaken the upper skin of the anterior portion of the foot, which some call the mentum, for the mantle. There is no distinct head; the only vestige of one is a compressed arcuated veil which is fixed by the centre of its membrane on the anterior part of the fleshy tunic of the proboscidal sheath, and on each side by a small white muscle to the base of the groove formed by the neck and skin of the foot, at the centre of which, and under the veil between it and the inside of the front skin of the foot, the yellowish-white proboscis and the end of its inner cylinder may be seen retracted; the head veil is shallow, sinuous, or lunated, breaking at the right and left sides, very far apart, into two moderately long, flat, triangular pointed tentacula, red-brown on the upper and outside half, and white on the lower and inside portion, forming at the extreme angles small subcircular auricles. The eyes in this species are so excessively minute as scarcely to be detected; however, if they really exist, we know their precise position by those of *N. nitida*, in which they are very visible and immersed in the skin at the centre of the anterior base of the tentacula, on the white concealed portion, but being always covered they appear to be of little use as organs of vision. The foot is an enormous subcircular disk, much larger in proportion than that of any other pectinibranchous Gasteropod I am acquainted with: though of one plate, it has the aspect of being formed of four lobes; the anterior portion, by having its upper skin posteriorly and laterally disunited to form what is called the mentum, appears a distinct upper and lower lobe, so much so, that the upper one has been mistaken for and described as a large broad head, "une tête très large et très aplatie," but its central anterior connexion with the sole shows that it is an integral part thereof. The disk, which is the third portion, is not, when the animal is in full action, greatly extended at the sides; it is posteriorly rounded, anteally somewhat constricted and more truncate, and at rest forms nearly a flat, oval, sharp-edged plateau; on this springs the operculigerous or fourth lobe, supporting on the posterior portion a demi-semicircular yellow corneous paucispiral operculum, which is situated just as far from the posterior extremity as to allow the unoccupied part of that end of the lobe to reflect on and conceal it altogether from view when the foot is deployed; the operculigerous lobe is then continued on each side the cone of the shell, almost to the mentum or front skin, and forms what M. Deshayes calls "un bourrelet circulaire plus ou moins épais, dans laquelle la coquille est presque entièrement cachée." This is really the case in this species, but by no means to such an extent in the *N. nitida*.

Authors say that the upper flap of the foot is reflexed on, and keeps the tentacula glued as it were to, the front of the shell; this is not so; it is never thus reflexed, but often on itself, forming a rounded white rouleau. The fact is, that when the animal is on the march, the upper or coloured skin of the anterior part of the foot spreads itself on the shell, but is not reflexed, supporting the tentacula nearly to their tips, but never otherwise, as when at rest it is always folded on itself, causing the white tumid part of the rouleau to press the bases of the tentacula against the shell, and thus they obscure the eyes in those species in which they are not obsolete. The upper part of the anterior division of the foot is marked with fine dark longitudinal rather close lines or streaks, behind it is of a pale brown or drab, the reflexed operculigerous lobe is white, and the entire disk of the sole pale yellowish white. The animal has the power of stowing entirely out of sight the enormous mass of foot; it does so very deliberately, and closes the aperture effectually by placing the strong corneous operculum well within the margin; it has nothing of the rapid retraction of the foot, as in *Rissoa*.

These animals abound of large size in the Warren Sands, opposite Exmouth. When they are just taken, in vigour, and immersed in sea-water, it is scarcely possible to contemplate a more beautiful and interesting object, with its shell rising as a globular pyramid from an immense circular disk, elegantly marked with fine dark lines on a clear drab ground. I recommend this species for examination; its large size affords a good view of the external organs, and the anatomy is comparatively facile.

Natica nitida, Brit. Moll.

Natica Alderi, nonnull.

This species, as regards the external organs, is so similar to the *N. monilifera*, that a notice of the variations will suffice. It has, like its congener, the extended anatomy of which has been omitted to save space, two branchial plumes, and the mucous fillets are nearly as evident as in the *Muricidæ*. In the male, the organ of reproduction is in every respect more developed. The eyes are distinctly visible, immersed in the centre of the anterior bases of the tentacula. The colour of the upper front surface of the foot and tentacula is a deepish dull red-brown, which is deposited on the first-named organ in close irregular longitudinal streaks, but on the posterior portion they are less close and paler coloured, and still less so laterally; the sole is a uniform pale yellow: these animals vary much in the general colour, but whatever the ground colour may be, it is thus modified on the particular parts as above stated.

The animal is active and not uncommon in the coralline zone at Exmouth, where, though very rarely, the pure snow-white variety occurs, as well as the plain chestnut-coloured *N. sordida*, which is probably not distinct from the present animal. The other British species we have not met with alive are the *N. Montagui*, *N. Grœnlandica*, which is the *N. pusilla* of Gould, and the *N. helicoïdes*; this latter is quite unknown to us, as is the *N. Kingii*.

Lamellaria, Montagu.

This genus has not more than one or two British species; the excellent Montagu, the discoverer of one of them, constituted the genus *Lamellaria* to receive it; we are bound to adopt this generic term, though *Coriocella* would have been more significant, and place in it the *L. tentaculata* of Montagu and the *L. haliotoidea* of authors, which latter has been continually shifted from one genus to another. Both these species have, at times, been deposited by mistake in the exotic genus *Sigaretus*, after Lamarck, who had been misled by M. Cuvier having erroneously described the *Helix haliotoidea* of Linnæus for Adanson's *Sigaretus*, that has an external shell, which fact—see *Natica*—has been noticed. M. Blainville expressly formed the genus *Coriocella* to receive M. Cuvier's animal, which is undoubtedly identical with the *L. perspicua*, but Montagu's appellation claims the priority as to time. As to the natural position of this genus, we must have recourse to that unerring magnet, the malacology of the animal, which consigns it to the vicinity of *Murex*. This situation, which has already been alluded to by authors, has been looked on by the older zoologists as unnatural, but, like the preceding genera, it can only be brought into the line of natural order by being deposited as an anomalous muricidal excrescence.

Lamellaria perspicua, Montagu.

Sigaretus perspicua, Cuvier et auct.
Coriocella perspicua, Blainville.
Helix haliotoidea, Linnæus.
Bulla haliotoidea, Mont. et aliorum.

Animal suboval, covered by a strong coriaceous mantle extending on all sides beyond the foot and body, with the margins plain and united, except in front, where there is a short but decided branchial fold or canal to admit the water; the inner surface is marked with radiating white lines and flaky spots; the outer one in different individuals is variable, being often studded with bright orange or citron papillose spots, and in others with brown or red-brown ones. Under the skin, about the centre of the upper surface, is imbedded a white subopake semispiral ear-shaped shell that protects the branchial plume and some of the viscera. The head is a flat, smooth, very inconspicuous projection with a subrotund orifice beneath, from whence the short retractile proboscis is exserted, and at a little distance within it are two fleshy lobes supporting very thin pale corneous plates, between which a long flat spiny tongue springs, and on leaving the palate forms on the top of the back of the head three coils, and is then continued to the stomach. These remarks, the result of various dissections, lead me to observe, that this short proboscis, though retractile, is not the strict and usually formed muricidal one, as in that tribe the tongue is rarely coiled; it is, however, thus contorted in our *Murex lapillus, Purpura auctorum*, an indisputable muricidal animal; but in this creature, the most anomalous of our five genera, there are a host of characters to prove its close connexion with the Canaliferous tribes;—it is as far from *Bulla*, the usual conchologist's depositary for animals of this sort of aspect, as the poles. Its entire coriaceous unreflected mantle has the decided branchial canal of many of the *Murices*, and M. Cuvier considers it the equivalent of the muricidal shell; that great naturalist in the anatomy of this animal thus sums up: "En un mot, pour faire du Sigaret un Buccin, il suffirait que les tours de sa coquille moins inégaux, se prolongeassent en une spirale plus aigue." The tentacula arise from the short membranous awning of the head; they are long, flattened, pointed, pale yellowish white, with large black eyes, a very small distance from the bases on extremely short offsets at the external angles, which gives them the appearance of being nearly on the bases of the tentacula. The foot is rather large and long, very little rounded in front, but deeply labiated, forming short auricles, and gradually becomes acuminated behind; it is above and below of a pale yellow. The branchial apparatus is, we believe, a single plume, crescent-shaped, which gives it the aspect of being double; it consists of about twelve vascular filaments lying on the centre of the back part of the head, under the protection of the front portion of the shield, whilst the liver and the ovarium, and in the male the testis, occupy the spiral portion. The anus opens between the mantle and the body, rather posteriorly on the left side. The verge is a spatulate organ on the right side of the neck, and is connected with the testis by a very long convoluted thread or epididymis.

These animals are sparingly taken in the summer, in the coralline zone at Exmouth; but in winter after a gale they are often washed up in great numbers on the Warren Sands, near the same place.

Having just received live examples, I am enabled to state that the branchial apparatus is a single arcuated light brown plume of coarse strands, transversely placed, with the point reaching to the canal between the foot and the mantle. What Montagu calls an appendage or protruded arm from a sinus of the mantle is what has now been described; he also mentions and figures the tentacula as very short; this is not so, unless his specimen was mutilated, a very common occurrence. I have seen hundreds of live animals of all colours, but the tentacula were what would be called moderately long, and at least twice the length of those in Montagu's vignette, fig. 6.

Lamellaria tentaculata, Montagu.

Though the 'British Mollusca' quotes me for this species, I now believe that it and the preceding are identical. In the great numbers I have examined during the last forty years, I have never seen one of them with such decided long, filiform, sharp-pointed tentacula as to distinguish it as a species; I think we may safely conclude that Montagu's animal is the *L. perspicua.*

Velutina, Gray.

Velutina has a single British species; it has been thought to have close connexion with *Sigaretus,* on which point see the remarks under the title of *Natica*: in addition it may be stated, that *Velutina* has eyes, but no operculum; *Sigaretus* is the reverse, and whatever it may prove when more investigated, we will for the present consider *Velutina* a good genus of the muricidal type, and I consign it to the *Peloridæ.*

Velutina lævigata, auct.

Helix lævigata, Mont.

Animal suborbicular, inhabiting a brown auriform shell with a coarsely striated thick epidermis. The mantle is extremely large, fleshy, with two emarginations, one branchial on the left side of the centre of the shell, the other is an anal conduit; it is marked in all directions with fine intense flake-white anastomosing lines; the inflations and thick lobules of the margin can scarcely be maintained within the periphery of the aperture. The head is of muricidal stamp, being a small, flat, almost united membrane, under which is the mouth, a mere subvertical fissure, from which the animal can exsert a long cylindrical proboscis annulated by fine flake-white lines, and has within the orifice a small white palate, supported by two oval yellowish-brown striated corneous plates, between which is a very short white spiny tongue, which is quite anterior, not $\frac{2}{10}$ths of an inch long. The tentacula are short, white, not very pointed, and spring from the head-veil, with eyes on slightly raised eminences at the external bases. The foot is rather long and wide, and when extended truncate anteriorly, with inconsiderable auricles, and these in full action disappear; it then tapers to a blunt terminus. The branchial apparatus consists of two plumes, lying on the left side of the neck; the one a pale brown riband of numerous strong striæ or vessels, the other is a small dark striated leaf with an apparent division in the centre caused by the arterial vein; it is placed close under the larger mass. The heart and auricle are at the base of the larger leaf; perhaps the greater range may be the mucous fillets common to most or all the *Muricidæ,* but from the position of the heart I think both leaves are branchial. The œsophagus is extremely short; it almost immediately opens into a large oval stomach that is always filled with pulp. The œsophageal cordon consists of two oval yellow ganglia on each side, and one smaller a little posterior to the others. The verge is yellow, not long, and is a miniature of that organ in *Murex undatus*, except that it is rather more pointed, and has the orifice at the point instead of a little below it as in that species.

This animal inhabits, at Exmouth, the deepest waters of the coralline zone. This is the last genus which in respect of the shell and animal cannot be placed in a simple natural series, but must fall therein by a branch; it is not so aberrant as *Lamellaria*, as here the coriaceous mantle has vanished, and the auriform shell protecting the viscera and branchiæ has become external; nevertheless, by its thick epidermal coat it appears to supply the place of the thick external mantle of *Laminaria*. Its place in the natural order is conspicuously marked out by the retractile proboscis as a sequence to the last genus, and it is assigned to the present family as a striking point of transition to the *Canalifera*.

Velutina flexilis, Montagu.

This is a Scottish and Hebridean species: it appears to belong to this genus. For some account of the animal I refer to the 'British Mollusca,' vol. iii. p. 350.

The *Velutina otis* of authors, now *Otina otis*, has been deposited in this genus, but from observations published in one of my papers, I believe its relations are in the neighbourhood of the *Bullæ* and *Conovuli*; at the same time I admit that it requires further examination.

I now conclude, and if it be considered, 'Et genus insolitum concordi lege coëgit,' or in other words, that I have applied a law, that of union, to a strange or anomalous race, and brought its members more prominently into view, the design of this paper will not have entirely failed.

I am, Gentlemen, your most obedient servant,

William Clark.

P.S.—I have just received from Mr. Damon, of Weymouth, some minute shells collected in Zetland; I have met with them occasionally on the South Devon coast. They are partly dwarf, or an immature variety of that singularly variable species the *Rissoa inconspicua*, and are marked in the direction of the axis with about seven brownish red lines that are tolerably regular and equidistant.

I believe they are the long-lost species of Adams, "lineis rubris notata. Apertura margine patentissima." (Linn. Trans. vol. iii. p. 67.) With respect to the thickened or broad margin, it is rarely seen but in the completed shell, whether it be dwarf, or of a larger growth; and in the variety styled *pulcherrima* it is mostly wanting, probably in consequence of a depauperation from littoral causes, as the *R. inconspicua* is usually a deep water or coralline zone species.

BIBLIOGRAPHICAL NOTICES.

A Popular History of British Zoophytes. By the Rev. D. LANDSBOROUGH, D.D., A.L.S. &c. London: Reeve and Co.

WE suspect there may be some, even among the lovers of natural history, who on reading the title of this book will exclaim, "*But what are Zoophytes?*"

If this be so, we would implore all such good folks not to stop at the mere inquiry, but to open the pages of Dr. Landsborough's very interesting and attractive little volume, and judge for themselves what zoophytes are. The admirable illustrations will enable them at once to perceive the exquisite beauty of form which is to be met with even in this remote corner of the kingdom of nature—exemplifying for the thousandth time the truth of Lord Bacon's Commentary on Scripture: "God beheld all things which his hands had made, and lo they were all passing good. But when man turned him about and took a view of the works which his hands had made, he found all to be vanity and vexation of spirit."

Dr. Landsborough has dedicated his volume to two friends, one of whom is Dr. Johnston of Berwick-upon-Tweed, whose work on Zoophytes has long been the standard in the scientific world both at home and abroad. And to those "admirable volumes," as Dr. Landsborough calls them, he intends his own more popularized and briefer work to form "a stepping-stone." We have every hope that this may be the case. The study of zoophytes has not hitherto been so popular as it richly deserves to be from their interesting and wonderful nature, and we hail with delight the stepping-stones which are to shorten and facilitate the path of the young student across the many difficulties by which he must at first be surrounded.

To the idle wanderer or invalid by the sea-shore, the volume before us will be invaluable. He will find the "ugly brown sea-weeds" which he has kicked so recklessly from before his feet as he sauntered listlessly along the beach, assume a new shape and character in his eyes. He will discover that they are neither "ugly brown sea-weeds," nor bits of dirty branches either, but the marvellously constructed homes of thousands of living creatures, united in households, as it were, by their respective similarities of growth, formation and habits. The very broken shells he meets with, and on which the conchologist could not deign to cast an eye, are to him precious morsels, for here and there upon them are to be seen clusters of other families of the strange zoophytic race, their cell-like habitations constructed with an art and adorned with a variety of pattern and beauty which leave the mind bewildered at the loveliness with which it has pleased God to embellish every nook of the habitable world.

The spirit of "ennui" can never come near those to whom Nature unfolds her wonders, and when such a subject is rendered so attractive as it is now done by being offered in a popular and yet comprehensive form, we cannot doubt its gaining daily more and more hold on general attention.

This volume is published uniform with Dr. Landsborough's previous one on British Sea-weeds, and no thoughtful visitor to our watering-places ought to be without both the one and the other.

There are two new species of *Lepralia* described and figured in the volume, viz. *L. melolontha* and *Gattyæ*. For the characters we must refer to Mr. Busk's Catalogue. The descriptions in Dr. Landsborough's 'Popular History' are from the pen of Mrs. Gatty, who has well merited the compliment of having her name associated with one of them by the acuteness of observation which led her first to discriminate them, and the accuracy of observation which prompted her to maintain the opinion she had justly formed, in opposition to what might have been deemed authority. The *L. Gattyæ* is beautifully figured from a drawing by Dr. Greville. Mrs. Gatty is also the first to have ascertained that the *Hippothoæ* have ovarian capsules similar to those of the true *Lepraliæ*,—another fact which vindicates the justice of the compliment she has received from the hand of the ablest of our present zoophytologists.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

February 11, 1851.—William Yarrell, Esq., V.P., in the Chair.

Descriptions of some New Birds in the Museum of the Earl of Derby. By Dr. Kaup.

[Concluded from p. 455. vol. x. Ser. 2.]

Some remarks on the genus Psaris, Cuv.

The genus *Psaris*, which is synonymous with *Tityra*, Vieill., is a true genus, which cannot be considered as the only type of a subfamily, and which cannot be divided into several genera. It is an indivisible genus, which I have separated into some little subgenera only. I prefer, from well-known reasons, the name *Psaris*.

The characters of this genus are:—Thick, strong, slightly compressed bill, without strong bristle-feathers on the mouth gape; tarsi moderately high, with broad scales on the front; on the sides and behind with small scales. *The old males have the second hand wing-feather abnormously short and of an unusual formation.* The females and young birds have the wings regular.

The species of this large genus are limited to the southern parts of America.

a. Subgenus Chloropsaris.

They have the bill and the feathered lorum of the *Pachyrhamphus*, but the wings are shorter and the tail more graduated. Size of a Sparrow, colouring more variegated and greenish on the back.

1. Psaris Cuvieri, Swains. Spix, tab. 45. 2.

2. Ps. atricapillus. *Muscicapa*, Gmel. Enl. C. 871 ♂. 831 ♀.

3. Ps. versicolor. *Vireo*, Hartlaub.

b. Subgenus Pachyrhamphus, G. Gray.

The bill unicolor black, shorter than the head, not compressed on the sides; the bristle-feathers moderately long; the abnormous hand-feather like *Chloropsaris*, with broader inner webs and emarginated only on the tip; tail unicolor, very little graduated. Size of a *Lanius colurio*. The colouring is dark and not so variegated.

We can give by the diagnosis the colouring of the abnormous hand-feather of the males.

4. Ps. validus. *Lanius validus*, Licht.

The second hand wing-feather with a long white spot on the inner web, which reaches to the third part of its length.

5. Ps. nigrescens. *Pach. nigrescens*, Cab.

The second hand wing-feather black, with white margin on the exterior web.

6. Ps. pectoralis. *Pach. pectoralis*, Swains.

The second hand wing-feather black, with white spot near the root, and fine white exterior margin.

7. Ps. Aglaiæ. *Pach. Aglaiæ*, Lafr.

The second hand wing-feather with an oval white spot near the root, and without white exterior margin.

c. Subgenus Psaris.

The red and black bill on the anterior part more compressed, and like *Cassicus*, with broad root, surrounded by the frontal feathers; lorum and eye region naked; the bristle-feathers over the gape very indistinct; the second hand wing-feather extremely narrow, formed like a sword, without an emargination on the tip. The colouring is silver-grey, like *Lanius excubitor*, with more or less black head, face, wings and tail. Size of *Lanius excubitor*.

8. Ps. cayanus, Cuv.

The black colour covers the whole head, and extends to the tip of the ear-feathers; the bill two-thirds red-coloured; tail black, on the root only white or silver-grey; the wings 116–122, and the abnormous second hand-feather 40 mm. long.

9. Ps. brasiliensis, Swains.

The black of the ear-feathers extends further than the black of the head; the bill one-third red-coloured; the inner webs of the wings white-bordered; the wings 129, and the abnormous second hand-feather 41 mm. long.

This species is probably a subspecies of *cayanus*.

10. Ps. semifasciatus. *Pach. semifasciatus*, Spix, t. 442.

The black on the head covers only the front to the eye, and descends to the anterior ear-feathers round the eye to the chin; tail black, with a silver-grey or white band under the tail-covers, and a white band on the tip; the wings 127–134, and the abnormous second hand-feather 46 mm. long; it is on the exterior web black, and on the interior white.

The female with dirty brown head and a greyish brown back, with a tinge of red.

11. Ps. maximus, Kp.

In the collection of Lord Derby I found a young bird of very large dimensions, which does not belong to any of the preceding species. The bill is reddish on the root; the under parts are lighter than on the young *cayanus*; the stripes are more obsolete, and are reduced on the side as black shaft-stripes; shafts of the tail reddish brown; under tail and interior wing-covers white, without spots.

	Ps. cayanus.	*Ps. maximus.*
Dimen.—Head	52	56
Gape	35	35
Wing	129	129
Tail	70	73
Height of the bill	11	13
Breadth	12	13½

It would be very interesting to discover the old bird of this species.

d. Subgenus Erator.

It unites the size, colouring and formation of the second hand-feather of the true *Psaris* with the bill and feathered lorum and eye region of the other subgenera.

This little subgenus, with its mixed characters, gives the clearest proof that *Psaris, Pachyrhamphus* and *Bathmidurus* cannot be considered as true genera.

12. Ps. inquisitor, Orb. *Lanius inquisitor*, Olf.

Diag.—Tail black.

Descr.—The male with black head and white ear-covers, connected with a white collar, which divides the black head from the silver-grey body; tail black, at the root white, which extends to the margins of the inner webs; end of the tail without white band; the second hand-feather on the inner web white.

The female (*Jardinii, erythrogenys, Selbyi*, and *Nattereri*, Sw.) with white front and rufous ear-covers.

13. Ps. Fraserii, Kaup.

Diag.—Tail two-thirds white, with black white-bordered end.

Descr.—The head to the ear-covers black; ear-covers and under the posterior part of the eye white; the second hand wing-feather light ash-grey, with white root.

The dimensions of these two species are nearly the same:—head, 52; gape, 32; height of the bill, 10; breadth, 14–15; wing, 105–113; tail, 63–70.

I give to this very distinct species the name of a very able zoologist, who is going a second time to Western Africa. From this journey we may anticipate the greatest benefit to our science, and we wish Mr. Fraser the best success. For all his kind assistance in the collection of Lord Derby I give him my best thanks.

e. Subgenus BATHMIDURUS, Cab.

They have the bill like *Chloropsaris, Pachyrhamphus* and *Erator,* but the tail in most of the species is more graduated. The colouring of it is black, with white or yellow end spots. Size of a Finch. The predominating colour of the males is black, white and grey.

In this little subgenus we have different type-species, about which the different subspecies arrange themselves. One of these is

PS. MARGINATUS.

Head-feathers black, on the tip with steel-blue; wings black; shoulder-covers, wing-covers and arm-wings white marginated; tail graduated, black with broad white tip.

The female has all the margins and the under parts rufous yellow, the back greenish, and the head darker coloured.

a. PS. MARGINATUS MINOR.

Lorum and a small line on the front whitish; ear-covers, back part of the neck, lower part of the back light grey; upper part of the back black; all the under parts white with grey tint; the abnormous second hand-feather white, on the exterior web on the root with a black spot, and from this spot till the end; along the shaft on the interior web a small long black stripe.

b. PS. MARGINATUS MAJOR. *Bathmidurus major,* Cab.

Lorum and a small line on the front whitish; before the eye a black spot of bristle-feathers; the shoulder-covers all white; overback black; the abnormous second hand-feather longer, white, with a small stripe along the shafts on both sides.

c. PS. MARGINATUS TRISTIS, Kp.

Without a small white line on the front; lorum and the whole head black; the feathers on this part are more massive on the tip, and have more lustre; the shoulder-covers only on the tip white; the whole neck and upper part of the back black; lower part of the back, ear-covers and all the under parts dark grey, mixed with black; the tail has not so much white on the tip; the under side of the wings with smaller white margins; the second abnormous hand wing-feather on the inner web whitish with grey spots, on the outside black, with a grey margin on two-thirds of the upper part; the emargination on the tip very distinct.

Mus. Derb.

Comparison.—	*Ps. marg. minor.*		*Ps. marg. major.* ♀	♂		*Ps. marg. tristis.*
Head	35	..	38	36	..	37
From the gape to the tip of the bill	18	..	19	19	..	20
Wing	65	..	84	73	..	75
Tail	50	..	64	56	..	62

A new species in the collection of Lord Derby and in the British Museum, forming a second type-species, I have called

Ps. PARINUS, Kaup.

Size of *Parus major*; head-feathers black, with a soft violet lustre, and not imitating the form of scales; lorum, ear-covers and all the under parts dirty white; the whole back and shoulder-covers grey; the little plumage of the wings black or grey, with whitish margins; hand-wings black, arm-wings dark grey, marginated with whitish yellow; the inner webs of the wings broadly marginated with whitish yellow; tail-feathers grey, along the shafts black and on the margin narrowly bordered with yellowish white; the second abnormous hand-feather with broader inner web black, with white margin from the emargination to the end, and with a large long white spot from the root to two-thirds of the feather.

The female rufous with darker head; wings black-brown, with predominating rufous yellow margins; belly and under tail-covers lighter-coloured.

This species comes from Para.

Very near to this species must be placed the *Psaris surinamus* (*Muscicapa*, Gmel.), which is characterized with the following diagnosis:—*Caudâ rotundatâ, apice albâ; corpore nigro, subtus albo.*

I have not hitherto seen this species, nor *Ps. niger variegatus* and *melanoleucus*.

Dimensions of *Ps. parinus*:—head, 34; gape, 17; wing, 68; tail, 49.

Genus SETOPHAGA, Swains.

This genus is one of the finest of the whole family of *Muscicapidæ*. It is found only in America. Only one species inhabits the northern part, namely the very distinct species, *Set. ruticilla*, with its yellow or red-banded wings and tail. The tail-feathers are pointed.

The greater part inhabit the southern parts. They form various little subgenera, distinguished by their very different colouring. One of these, and I think the most beautiful, is the little section to which the following species belong. They have much yellow on the head and under side; on the over parts dark cinereous.

SETOPHAGA RUFICORONATA, Kp.

Diag.—With red head-spot; the first tail-feather all white.

Descr.—The hind ear-feathers black; front, lorum and eye-region yellow; the first tail-feather all white; the second white, with black spot on the outer web, and black margin on the inner web; under tail-covers black-spotted.

Mus. Derbyanum.

Very near to this species is

SET. RUFICAPILLA, Cab.,

of which Bonaparte gives the following diagnosis:—
Fusco-plumbea, subtus omnino flava, lateribus fuscis; *pileo castaneo, rectricibus extimis* apice *albis.* Guiana.

SET. LEUCOMPHOMMA, Kp.

Diag.—Lorum, eye-region and chin white.

Descr.—Ear-covers black, the yellow colour reaching only to the after part of the eye; tail and under tail-covers like *ruficoronata.*

Hab. Bogota. Mus. Derb.

SET. ORNATA, Boss.

Diag.—The whole head beautiful yellow.

Descr.—The head-feathers longer (10 mm.); the face and chin white; the anterior ear-feathers on the tip black, the hind ear-feathers all white; the first tail-feather all white, the second only on the basal inner web black; under tail-covers black-spotted.

Hab. Andes. Mus. Derb.

SET. FLAVEOLA, Lafr.

Diag.—The hind ear-feathers with black stripes.

Descr.—The face orange; the anterior ear-feathers black, the hind ear-feathers yellow, black-striped; under tail-covers white; the first to the third tail-feather with white shaft and shaft-spot, which is enlarged on the tip.

Hab. Columbia. Mus. Derb.

A third type-species is VULNERATA, Wagl.

The species belonging to this type-species have the breast and belly beautiful red.

They are natives of Mexico.

SET. VULNERATA, Wagl.

Above cinereous, with black front, throat and rufous spot on the head; first to third tail-feather with white spots on the tip.

SET. PICTA, Swains. Zool. Ill. t. 3. *tricolor,* Licht.

Above, throat and sides of the lower parts black; margins of the first hand-wing and the three least arm-wings white, like the cover-feathers of the wings; the first and second tail-feather nearly all white, the third white, with broad black margin on the inner web.

SET. MULTICOLOR, Bonap.

Black; front, small band over the wing-covers, belly and the tips of the tail-feathers white.

A fourth type-species is

SET. VERTICALIS, Lafr.

Cinereous, head rufous; breast and belly yellow; the first tail-feather three-fourths, the second half, and the third only on the tip white.

Hab. Bogota. Mus. Derb.

SET. FLAMMEA, Kp.

Breast and belly orange; the first to the third tail-feathers only on the tips white.

Hab. Guatimala. Mus. Derb.

SET. MELANOCEPHALA, Tchudi, p. 192. t. 12. 1.

A small line of the front, lorum, eye-region, like all the lower parts, yellow; the four exterior tail-feathers white.

Hab. Peru. Mus. Derb.

Genus TYRANNULA, Swains.

The genus *Tyrannula*, as Prince Ch. Bonaparte has apprehended it, is too large, and the forty species must be divided into some natural genera and different subgenera.

The manner of arranging these species in geographical sections is very simple, but very often the wrongest way, although so very clear that it can be understood by everybody. It is true that some genera are limited to a certain part of the world; but there are also many genera which are composed of species from all parts of the world, or from different zones of the same part of the earth.

A very natural section is formed by the species which Bonaparte called "Ultimi Tyrannorum sive Tyrannularum primæ."

The bill of the length of the head; over the nostrils as high as broad; the back rounded off; the gape bristle-feathers of moderate length; the wings moderately long, reaching to the tail-cover feathers; the tip of the wing short; the first wing-feather as long as the eighth, third and fourth the longest; the long tail of the length of the body; the head unicolor, without yellow crest, but the feathers can be erected; above dirty olive, with darker-coloured head; gorge and over breast ash-grey; the belly yellowish; the margins of the wings and tail rufous.

1. TYR. COOPERI. *Muscicapa*, Nuttall.

With shorter wings than *mexicanus*, but with longer bill, like *crinita*; throat and over breast light grey, not so dark as *crinita*; the black stripe along the inner webs of the tail-feathers is broader, like *stolida*.

Hab. Northern America and Chili. Brit. Mus.

2. TYR. CRINITA. *Muscicapa*, Linn.; *irritabilis*, Vieill.

With longer wings; throat and over breast darker grey; all the wing-feathers, except the first, black-brown with rufous margins.

Hab. North America. In every museum.

3. TYR. GOSSII, Bonap.

With longer wings; the anterior part of the outer webs of the first and second hand-wing whole rufous; the head darker, and the ash-grey dark, like *crinita*.

Hab. Jamaica. Brit. Mus.

4. TYR. MEXICANA, Kaup.

With short wings; all the wing-feathers, except the first, with rufous margins; breast light ash-grey; above lighter.

Mr. Wollweber sent me this species, which I found also in the British Museum.

5. Tyr. stolida. *Myobius,* Gosse.

With short wings; the rufous margins on the wing-feathers very fine; the black stripe along the shafts of the inner webs of the tail-feathers reaching only to the middle of the feathers; the inner webs of the exterior tail-feathers with extinguished bands.

Hab. Jamaica. Brit. Mus.

Comparison of the dimensions.—

	Tyr. Cooperi.	*Tyr. crinita.*	*Tyr. Gossii.*	*Tyr. mexicana.*	*Tyr. stolida.*
Head	46	45	48	43	43
Bill from the gape	28	28	31	24	24
Wing	94	100–105	104	93	86
Tail	88	89–94	95	86–90	82
Tarsus	22	19	24	22	19

It is possible that all these species are subspecies of one or two type-species. This point, however, can only be determined by future researches.

Genus Todirhamphus.

I found in the collection of Lord Derby two new species belonging to this genus.

Tod. pectoralis.

Green, with a white spot before the eye; throat and chin dark ash-grey; next this with white on the crop; breast light ash-grey; the inner margins of the wing-feathers and the inner wing-covers yellow; outer margins of the wing-feathers and tail olive; belly and sides white.

Head, 28; gape, 14; wing, 45; tail, 42; tarsus, 15 mm. long.

Hab. ? Mexico.

Tod. ruficeps.

With red head and dark ash-grey occipital feathers; next this an ash-grey collar; over part of the wings black, with two light yellow bands; wing- and tail-feathers with olive margins, which on the arm-wings are more white; lorum black; ear-covers brownish; chin and throat white, with brownish tint, and divided from the yellow under parts with a black striped band; the tibial feathers black.

Head, 26; gape, 13; wing, 46; tail, 36; tarsus, 17 mm. long.

Hab. ? Mexico.

Phrynorhamphus, Kaup. *Smithornis,* Ch. Bonap.

The bill very broad, half as high as broad, with sharp culmen; the wings short; the first wing-feather long, nearly as long as the seventh, the second as long as the third and fourth; outer toe at the base connected with the middle toe.

I am strongly inclined to believe that this section does not possess the song-muscles.

Phrynorhamphus capensis. *Platyrhynchus capensis,* A. Sm.

Descr.—Upper mandible black, lower mandible yellow; front and lorum rufous yellow; head black; the bristle-feathers with white roots; ear-covers ash-grey, with whitish shafts and shaft-spots; back olive-grey, with black spots; the roots of all the feathers on the back pure white; wing-covers with rufous yellow margins, which form two small bands; lower parts white, on the sides tinted with brownish rufous, and with broad black shaft-spots; the middle of the throat, belly and under tail-covers white; tail black-brown, with olive margins.

Head, 40; gape, 22; height of the bill, 7; breadth, 12; wing, 72; tail, 55; tarsus, 18; middle toe, 15 mm. long.

Lord Derby's collection. Brit. Mus.

February 25, 1851.— R. H. Solly, Esq., F.R.S., in the Chair.

An Enumeration of species of recent Shells, from Borneo, with Descriptions of the new Species. By W. Metcalfe.

1. Helix Brookei, Adams and Reeve, Zoology of the Voyage of the Samarang, Mollusca, p. 60. pl. 15. fig. 4 *a, b*.

2. Helix vittata, Adams and Reeve, Zool. of the Samarang, Mollusca, p. 60. pl. 15. fig. 7 *a, b, c*.

This species, having been previously described by Mr. Benson, in the 'Magazine of Natural History,' under the name of *H. reglis*, ought to retain that name.

In addition to the variety figured in the Mollusca of the Samarang, Mr. Hamilton received two other varieties, in which the pale green bands are wanting, the brown colour more or less predominating, with bands of yellowish brown, and a brown circle surrounding the umbilicus.

3. Helix Schumacheriana, Pfeiffer.

4. Helix resplendens, Philippi in Zeitschr. f. Malak. 1846, p. 192.

5. Helix nasuta, nobis. *H. testâ subdiscoideâ, sinistrorsâ, carinatâ, angustè perforatâ, tenuissimâ, lineis incrementi et spiralibus confertis subtilissimè decussatâ, pellucidâ, hyalinâ; lineâ angustâ pallidè brunneâ ad carinam ornatâ; spirâ subconicâ; anfractibus* $5\frac{1}{2}$ *planulatis, ultimo acutissimè carinato, subtus nitescente; aperturâ subrhomboideâ, ad angulum exteriorem valdè productâ et coarctatâ; peristomate simplici, tenui, margine superiore vix reflexo, basali anticè reflexiore, umbilicum subtegente.*

Long. $1\frac{4}{10}$; lat. $1\frac{1}{10}$; alt. $\frac{5}{10}$ unc.

This elegant species is covered with a thin epidermis, of a pale straw colour, under which the shell is milky white. It bears some analogy to *H. Tayloriana* (Adams and Reeve, Zool. of the Samarang, Mollusca, pl. 15. fig. 2 *a, b*), but the projection at the extremity of the aperture is much more acute, and the shell is of a more gelatinous texture: it differs also in being sinistral.

6. Helix glutinosa, nobis. *H. testâ orbiculato-convexâ, angustè perforatâ, tenui, nitidissimâ, diaphanâ, pallidè brunneâ, carinatâ; supra carinam fuscâ, infraque lineâ angustâ flavescente, ornatâ; spirâ conoideâ, obtusâ; anfractibus 5 parum convexis; ad carinam supra infraque lineâ impressâ circulari,*

striisque numerosissimis transversis notatâ; peristomate simplici, acuto, margine columellari vix reflexo.

Long. $1\frac{1}{10}$; lat. 1; alt. $\frac{6}{10}$ unc.

A bright shell, resembling a thin film of glue, with a keel of a darker shade; slightly indented above and below the keel, the indentation elegantly crossed with slight striæ, the effect of which, as well as the darker line, is partially visible throughout the sutures.

7. Helix conicoides, nobis. *H. testâ imperforatâ, trochiformi, acutè carinatâ, tenui, pellucidâ, luteo-corneâ; spiraliter leviter striatâ, striis ad suturam majoribus, confertioribus; apice mamillari; anfractibus 7, superioribus subconvexis, duobus ultimis planulatis, ultimo subtus convexo, nitido, ad carinam et in medio depresso; aperturâ trapeziformi, subtus arcuatâ; peristomate simplici, acuto, subtus flexuoso, marginibus callo tenui junctis.*

Long. $\frac{7}{10}$; lat. $\frac{6}{10}$; alt. $\frac{4}{10}$ unc.

8. Bulimus citrinus, Bruguière; Reeve, Conch. Icon. Bul. pl. 31. fig. 187 *a*.

9. Bulimus chloris, Reeve, Conch. Icon. Bul. pl. 37. fig. 223.

10. Cyclostoma Borneensis, nobis. *C. testâ suborbiculari, depresso-conoideâ, acuminatâ, albidâ, fusco-variegatâ, maculis ad suturam, cinguloque infra medium fusco ornatâ; striis obliquis minutis, aliisque circularibus minutissimis impressâ; anfractibus quinque planiusculis, carinatis; ultimo magno, margine acutè carinato, circa umbilicum obtusè angulato; aperturâ subcirculari; peritremate albo, reflexo; supra productiore, subtus reflexo, ad columellam subsinuato; umbilico magno, profundo; operculo corneo, tenui.*

Long. $1\frac{6}{10}$; lat. $1\frac{3}{10}$; alt. $\frac{9}{10}$ unc.

Varietas minor, magnitudine solum diversa.

Shell bearing some characters in common with both *C. aquilum*, Sow., and *C. acutimarginatum*, Sow.; but having a more depressed spire, and flatter whorls than either of those species.

11. Cyclostoma, apparently *C. parvum*, Sow. Thes. Conch. Cycl. fig. 254, 255.

12. Cyclostoma undatum, nobis. *C. testâ globoso-pyramidali, tenui, pellucidâ, albâ, lineis hyalinis undatis decurrentibus ornatâ, tenuiter striatâ; anfractibus 6, parum rotundatis, primis conicis regulariter crescentibus; ultimo magno, obtusè carinato; aperturâ circulari, supernè angulatâ; peritremate lato, expanso, vix nisi ad columellam reflexo; suturis mediocribus; umbilico parvo.*

Long. $\frac{6}{10}$; lat. $\frac{5}{10}$; alt. $\frac{6}{10}$ unc.

This species belongs to the division of the genus of which *C. læve*, Gray, may be considered the type.

13. Cyclostoma tenuilabiatum, nobis. *C. testâ discoideâ, spirâ depressâ, planâ, colore pallido, supernè castaneo-maculatâ et undulatâ; epidermide luteo-castaneâ, indutâ; anfractibus 5 rotundatis, 4 primis lævibus, ultimo lineis impressis*

irregularibus ruguloso; suturâ impressâ; aperturâ circulari; peritremate duplici; interno simplici, supernè emarginato; externo tenui, lato, planiusculo, supra ascendente, fornicato, dein compresso; umbilico patulo; anfractibus intus distinctis.

Long. $1\frac{1}{10}$; lat. $\frac{8}{10}$; alt. $\frac{3}{10}$ unc.

Belonging to the genus *Pterocyclos* of Benson.

14. Cyclostoma biciliatum. *Pterocyclos biciliatum*, Mousson, Land- und Süss. Moll. von Java, p. 49. t. 20. fig. 9.

Several individuals of this species having been received, its locality is thus fixed. It is observable that the complete shell, which was not known to Mousson, exhibits a tubular spiracle near the aperture, similar to that apparent in *C. spiraculum*, Sow.; also, that the aperture is circular, depressed, with the peritreme white, expanded, slightly reflected, and at the upper part faintly undulated.

15. Scarabus plicatus, Fer. *var. major*.

This variety, in place of the usual purple colour of the shell, exhibits a deep yellow ground, with four broad bands of dark brown colour.

16. Scarabus Borneensis, A. Adams.

17. Auricula subnodosa, nobis. *A. testâ ovato-oblongâ, crassâ, albâ, epidermide castaneo-fuscâ, infra suturas decussatim granosâ, medio lævi, ad basim striis decussatâ; anfractibus convexiusculis, suturis distinctis, subcrenulatis; anfractu ultimo supernè longitudinaliter plicato-subnodoso; aperturâ medio paululum angustatâ; columellâ biplicatâ.*

Long. $2\frac{4}{10}$; lat. $1\frac{3}{10}$ unc.

A species distinguishable from *A. Midæ* by the convexity of the upper whorls and the smoothness of their lower halves, the depth of the sutures, and the longitudinal nodulous folds which surround the upper part of the final whorl: the aperture is also proportionally wider than in *A. Midæ*. In the single specimen received, the columellar lip has an interior protuberance above the upper fold.

18. Auricula polita, nobis. *A. testâ ovato-oblongâ, basi angustiore, spirâ brevi; epidermide castaneo-fuscâ, nitidâ; striis numerosis minutissimè granulosis circumdatâ, granis superius distinctioribus; aperturâ medio coarctatâ; columellâ triplicatâ, plicâ infimâ lineari.*

Long. $1\frac{6}{10}$; lat. $\frac{8}{10}$ unc.

Although the characters of the aperture resemble those of *A. Judæ*, the form of the shell differs entirely in its greater breadth, and in the shortness of the spire.

19. Auricula felis, Lam.

20. Auricula mustelina, Desh.

21. Neritina crepidularia, Lam. Conch. Ill. fig. 25.

22. Neritina Beckii, Reclus, Thes. Conch. fig. 13.

23. Neritina piperina, Chemn. Thes. Conch. fig. 166, 167.

24. Neritina dubia, Chemn. Thes. Conch. fig. 81–88.

25. Melania circumstriata, nobis. *M. testâ elongatâ, turritâ, solidâ, fusco-viridi; anfractibus convexiusculis, infra suturam paululum constrictis; superioribus striis 6 transversis elevatis, plicisque 8 majoribus longitudinalibus ornatis; ultimo striis 13; aperturâ ovali-oblongâ, basi dilatatâ, superius acutè angulatâ, et ferè rimatâ, intus albidâ; peritremate sinuato, columellâ callosâ.*

Long. $2\frac{6}{10}$; lat. $\frac{8}{10}$ unc.

26. Melania subsuturalis, nobis. *M. testâ turritâ, fusco-viridi, lineis castaneis longitudinalibus obliquis variegatâ; anfractibus ferè planis, quorum superiores striis elevatis perpaucis validis, inferiores pluribus minoribus inæqualibus ornati; ultimo ad basim crebristriato; suturâ distinctâ, excavatâ; aperturâ ovali, supernè angulatâ, intus albido-cærulescente; peritremate acutō, sinuato, extus effuso.*

Long. $1\frac{4}{10}$; lat. $\frac{5}{10}$ unc.

27. Paludina Hamiltoni, nobis. *P. testâ ovato-conicâ, tenui, perforatâ, viridi, concolore; striis transversis undulatis, aliisque longitudinalibus tenuissimè decussatâ; anfractibus 5 rotundatis, superioribus ætate erosis; suturâ impressâ; aperturâ ovali, supra angulatâ, intus cærulescente, margine paululum incrassato, albido; peristomate acuto, lineâ tenui nigrâ circumdato.*

Long. $\frac{9}{10}$; lat. $\frac{6}{10}$ unc.

The Bornean specimens being scarcely adult, the description is drawn up from individuals in my cabinet, which have long been there without any locality assigned.—W. M.

28. Littorina scabra. *Helix sc.*, Linn.

29. Littorina melanostoma, Gray, Zool. of Beechey's Voy.

30. Littorina albicans, nobis. *L. testâ ovato-oblongâ, acuminatâ, tenui, albidâ, apice lævi, nitente; anfractibus 7 vel 8, quorum 5 ultimi striis numerosis paulatim crescentibus ornati; ultimus rotundatus, ætate varicosus, striâ unicâ majore, quasi carinatus, striis ad basim minoribus circumdatus; aperturâ rotundato-lunari, lacteâ; peristomate subreflexo.*

Long. $\frac{7}{10}$; lat. $\frac{4}{10}$ unc.

A delicate species, of a milk-white hue, the older specimens having many varices produced by the previous reflexions of the outer lip.

31. Cerithium obtusum, Lam.; Zool. of the Samarang, Moll. pl. 13. fig. 3.

32. Cerithium unicarinatum, nobis. *C. testâ turritâ, tenui, apice truncato, hinc inde varicosâ, cinereâ, longitudinaliter plicatâ, interstitiis longitudinaliter striato-rugosis; suturâ parum impressâ; anfractibus vix rotundatis, regulariter crescentibus; ultimo acutè carinato, infra carinam crebristriato; aperturâ mediocri subfuscâ; columellâ rectâ; peritremate modicè reflexo, albescente.*

Long. $1\frac{6}{10}$; lat. $\frac{5}{10}$ unc.

33. Ampullaria, probably *A. Celebensis*, Quoy, Voy. de l'Astr. pl. 57. fig. 1–4.

34. Natica maculosa, Lam. *pellis-tigrina*, Chem.

35. Novaculina olivacea, nobis. *N. testâ oblongâ, valdè inæquilaterali, epidermide olivaceâ, ad extremitates fuscescente, indutâ; natibus erosis; anterius rotundatâ, posterius angulato-rotundatâ; margine superiore ferè recto, posticè paululum descendente, ventrali medio subcompresso; intus albâ, dentibus lamellatis duobus recurvatis in utrâque valvâ, posteriore bifido.*

Long. $\frac{9}{10}$; lat. $3\frac{3}{10}$ unc.

A large example of this species, in the Collection of H. Cuming, Esq., exhibits a character which will probably be found generic; namely, a shelly protuberance in each valve, attached to the interior ligament at nearly its hinder extremity. These shelly substances have not, that I am aware, hitherto been noticed. It is probable that they become detached in most specimens by the removal of the animal.

36. Cyrena triangularis, nobis. *C. testâ trigonâ, solidiusculâ, epidermide fusco-virescente, transversim striatâ, striis marginalibus lateralibusque eminentioribus, sulco ab umbone ad marginem posteriorem leviter impressâ; margine antico descendente, vix excavato, angulo anteriore rotundato; margine superiore subrotundato, posticè ferè biangulato, propter sulcum dorsalem subsinuato; intus lacteâ, margine continuo nitentiore; dentibus cardinalibus in utrâque valvâ tribus, duobus bifidis; dentibus lateralibus brevibus, tenuissimè rugosis, haud striatis.*

Long. 3; lat. $3\frac{1}{10}$; alt. $1\frac{8}{10}$ unc.

The characters of this shell bear some resemblance to *C. Sumatrensis*, Sow. Gen.; but on comparison with the type of that species, now in the Cabinet of Sylvanus Hanley, Esq., the present is found to differ materially, in its triangular outline, as well as in the characteristic furrow from the umbo to the posterior margin, affecting the curvature of the posterior angle, and producing a slight sinuosity in the margin.

37. Unio. 38. Unio.

I am unwilling to describe as new these two species of the genus *Unio*, from want of acquaintance with the great American collections of the genus.

Although no letter accompanied this box of shells, Mr. Hamilton presumes that they have been sent to him by his friend Sir J. Brooke, Rajah of Sarawak. The remittance is undoubtedly from Borneo.

BOTANICAL SOCIETY OF EDINBURGH.

November 11, 1852.—Dr. Seller, President, in the Chair.

Various donations were announced to the Society's Library and Herbarium.

Professor Balfour exhibited a beautiful map, by James Lynam, Esq., titled "The Climates of the Earth, their characteristic vegetation, and the zones of the cultivation of useful plants, as limited by altitude and latitude, shown in the elevation of the principal mountains of Europe, Asia, and America, accurately laid down by scale from the writings of Humboldt, Meyen, Boissier, Hooker, Watson, &c."

Professor Balfour exhibited specimens of *Lastrea cristata,* and var. *uliginosa, Lastrea spinulosa* and *Polystichum angulare,* and made some observations regarding them.

The following papers were read:—

1. "On the Development of Tubular Structure in Plants," by R. Hobson, M.D. Cantab. Communicated by Dr. Balfour.

The object of this paper was to show the mode in which tubular structure is formed by the aggregation of cells in a linear series and the subsequent absorption of the partition-walls. The structure selected for observation was the moniliform hair found on the claw of the spurred petal of *Viola tricolor.* The author stated, that "If the structure of the tube is traced under the microscope from the root or base upwards, the lower part will be found fully formed (tubular), having gradually substituted a tubular for its previously cellular formation. A little higher up, absorption of the partition-walls (the united portion of the cells) is yet incomplete, being *in transitu* from cell into tube, whilst the remaining part is entirely cellular to the extreme point, which point is, in fact, a simple cell.

"There may be distinctly seen in a portion of this multicellular tube, near to its base, marks sufficient to prove that those points of the cells which have been primarily in union to form the tube have now been absorbed, or in some other way removed, and that this absorption or removal has taken place precisely in an equal degree from the centre of the different septa, or united portions of the cells, towards the periphery of the tube to the extent required to perfect nature's 'handiwork.' The marks to which I allude are triflingly apparent annular contractions."

The author made some observations, also, as to the time occupied in the formation of the tubes. He remarked:—

"In order to ascertain whether the mutation of cell into tube occupied much time, I instituted a comparison between the tubular portion of the hair on the full-blown flower, and that on the flower just opening, and found that the lower portion of the tube on the former (the full-blown flower) had generally become tubular to the amount of from eight to ten cells in each hair, which usually consisted of from twenty-five to thirty cells, whilst that of the latter (the opening flower) had become tubular only to the extent of about two or three cells. It therefore seems that the time occupied between the first opening of the flower and its fading period is sufficient to convert six or eight cells into tube, and it is probable that in the earlier part of the season during more genial weather, the fading stage would be delayed, and consequently that in proportion as the blooming period is prolonged, the length of the tubular formation would be increased; but it seems doubtful whether these tubes ever became tubular throughout their *entire* length.

"On the two contiguous petals on the inner and inferior part of each, on a prominence where the claw takes its origin, there is a ridge of hair of a totally different character from that on the claw of the spurred petal, being at all ages pervious *throughout*, dilating gradually from its base to within a trifle of its extremity, when it again gradually lessens in diameter, until it terminates almost spherically. There is not any second cell to be detected in any portion of *these* tubes, even before the flower opens; *their* origin and termination seem to be a simple cell, lengthening and dilating, and therefore they are clearly unicellular. In the multicellular tube, it is evident that in order to secure a *tubular* structure, nature clearly manifests her intention by generating a single linear series of cells, and that this multicellular tube shall be a *cone*, she as clearly manifests her determination by generating cells gradually decreasing in transverse diameter from the base to its apex; and it would seem that where she has completed her cellular arrangement as regards their position and formation, her subsequent care is, by some peculiar and amalgamating process, to unite the adjoining cell-walls into one compact septum, denominated a partition-wall.

"As regards this septum, it is not unreasonable to hope that repeated and minute microscopical investigations of the progressive growth and formation of the multicellular tube, at different periods of its age, may furnish material data on which to found a knowledge of the probable mode of its absorption or removal.

"To discover whether the comparative *increase* of growth of the opening and fading flower kept pace with cellular conversion into tube, I measured the transverse diameter of the tubular portions of the two stages of growth of a *cultivated* plant, and found that the average transverse tubular diameter of the hair of the *multicellular* tube of an ordinary full-blown flower in September was 1-1540th, whilst the tubular diameter of the opening flower was 1-2320th, giving an increase during the blooming period of 1-774th.

"The average of the tubular diameter of the unicellular tubes which had been exposed to light and air in the full-blown flower of the cultivated plant was 1-928th, whilst the tubular diameter in the opening flower was 1-1546th, giving an increase during the blooming period of 1-618th. On measuring the transverse diameter of the *multicellular* tube of the full-blown flower in its native state, I found it to be 1-3437th, whilst that in the opening flower was 1-2566th, giving an increase, during that portion of the blooming period, of 1-871th.

"The diameter of the unicellular tube of the wild flower, which was full blown, measured 1-182th, whilst that of the opening flower was 1-1370th, giving an increase of 1-688th."

2. "On the Cumberland forms of *Myosotis*," by Mr. James B. Davies. In this paper, the author, after describing various forms of *Myosotis*, of which specimens and drawings were exhibited, called attention to the *Myosotis palustris* var. *strigulosa* (Reich.).

3. "On the Plants found in Cumberland in June 1852," by Mr. James B. Davies. The author gave an account of the species which he had found in the Lake district of Cumberland during the month of June.

December 9, 1852.—Professor Balfour, V.P., in the Chair.

The following gentlemen were elected office-bearers for the ensuing year:—

President.—Professor Balfour.

Secretary.—Dr. Greville.

Treasurer.—Mr. Evans.

Numerous donations were announced to the Society's Library and Herbarium.

Dr. Balfour exhibited a series of alpine specimens transmitted by Mr. Backhouse, including a collection of Clova and Braemar *Hieracia*, which contained nearly every alpine form found among the mountains of that district. Mr. Backhouse hopes ere long to be able to write a paper minutely describing these, and in such a manner as to enable persons to identify each form or species. In mentioning forms he alludes of course to the apparently permanent forms which may prove true species. Of the whole *Hieracia* (50 or 60) Mr. Backhouse has growing specimens carefully named and numbered, and he means to record the results of cultivation.

The following communications were made to the meeting:—

1. Dr. Balfour made some observations on the *Polypodium rhæticum*, Vill. Voyage Botan. p. 12, the *Polypodium alpestre*, Hoppe, and *Pseudathyrium alpestre*, Newm.

A good specimen of the plant is found in Mougeot and Nestler's 'Stirpes Cryptogamæ Vogeso-Rhenanæ,' no. 602. The plant is said to grow "in summis Vogesorum præruptis herbidis." It is stated by Mr. H. C. Watson to have been gathered by him in the great corrie of Ben Aulder on the west side of Loch Ericht, Inverness-shire; also in 1844 in Caenlochen Glen. The plant resembles *Athyrium Filix-fœmina* so much as to have been passed over by many botanists, and it had been put by Mr. Watson among his specimens of that species. It has been found of late by several botanists in the Highlands of Scotland, especially in the Clova and Braemar district. On looking over the plants in his herbarium, Dr. Balfour found that it had been gathered on several occasions by himself and others and put along with specimens of *Athyrium Filix-fœmina*. Dr. Balfour exhibited from his herbarium the following specimens of the plant, which had also been carefully examined by Dr. Greville:—

1. From Ben Hope, Sutherlandshire, August 1827, Dr. Balfour; and 2. August 1833, Dr. Graham. 3. Glen Callater, August 1836, Dr. Gilbert M'Nab. 4. Caenlochen, Glen Isla, August 6, 1840, Dr. Balfour.

The following papers were read:—

2. "Remarks on the Distribution of Plants in Madeira," by John M'Laren, Esq.

Mr. M'Laren made some observations on the distribution of plants in Madeira, as compared with the flora of neighbouring countries. He remarked that the vegetation of Madeira might be said to consist of two distinct floras. One of these had a great analogy to the flora of Algiers and the south of Spain, and contained many species common to those countries and to the shores of the Canaries and Western Isles. This might be described as the flora of the cultivated region. It included the naturalized trees and shrubs of the south of Europe; and most of the agricultural and littoral weeds, which, from their identity with European and North African species, were supposed to have been introduced by the agency of man, or by other natural means. A few lowland species not yet known as habitants of the Mediterranean shores, but which belong to Mediterranean genera, and do not claim affinity with the native flora of the Atlantic islands, he also includes in the flora of the cultivated region. He next adverted to the native flora of the island, which he said was identical in character with that of the interior of the Canary Islands and the Azores. It was well marked by the predominance of ferns, both in respect of the number of species and the fertility of individual life. Laurels and evergreen trees, with the arborescent heath, characterize the mountain scenery and give their name to the island, Madeira signifying 'the land of woods.' *Compositæ*, *Ericaceæ*, *Labiatæ* and *Cruciferæ* are represented by more than the usual proportion of species; *Gramineæ* and *Leguminosæ* hold an average place; and there is a remarkable deficiency in species of *Rosaceæ* and *Cyperaceæ*.

Mr. M'Laren gave a table showing the proportion of species in the different natural orders for the two Phyto-Geographic regions here indicated, and entered into some details to show the relations of these regions to the flora of the Mediterranean and the Atlantic islands respectively.

3. "On certain Structures observed in *Pentas carnea*, Benth.," by Daniel Oliver, Esq. jun., of Newcastle.

This plant furnishes an interesting form of cellular tissue; it also presents singular interpetiolary processes, which seem to be of a glandular nature.

Those persons who are interested in cell-multiplication, the relation of the primordial utricle to the secondary deposits of the outer cell-membrane, and the nature of such deposits, will find this plant a useful addition to their means of prosecuting such inquiries.

The regular gamopetalous tubular corolla of *Pentas carnea* is about 1 inch in length at the time of flowering.

Surrounding the throat of the tube, and to about one-fourth the distance down it, to the base of the attachment of the short free filaments with the tissue of the corolla, is a dense collection of unicellular hairs directed upwards. These hairs are slightly broader about the middle of their length, tapering, with sometimes a rather undulating outline, to the distal extremity, and a little narrowed towards the base.

Scattered in the lower portion of the corolline tube are hairs of a different structure, consisting of a single series of several cells; these narrow from the base to the apex, and are similar in form and structure to the hairs of the petioles of the leaves and interpetiolary processes.

The corolline hairs are remarkable from their fibro-cellular character; the nature of the spiral fibrous deposit is, however, difficult to determine. A first glance, with a magnifying power of perhaps 200 or 300 diameters, discovers the appearance of a narrow fibre winding, in a spiral direction, up the inner wall of the cell, ascending to the right (as seen from its axis), and closely applied to the apparent outer cell-membrane, which has become in part absorbed. Numerous elongated and narrow slits or line-like markings occur throughout the spiral, but whether they are openings between the edges of an individual thread, or series of fibres, or analogous to the dots and slits of broken vascular tissue, it is not very easy to pronounce.

When examined in fluid, this fibrous deposit has the appearance either of a coil of irregular breadth, or of a plexus or branching arrangement of fibre, between the threads of which a line of division is perceptible: if a dried hair be placed under the microscope, we only see slits, narrow and rounded at the extremities, in the direction of the spiral ascent; these are probably an altered condition of the exceedingly fine separating lines, discovered in the fresh state. The portions of fibrous matter intervening between these openings are of very irregular breadth. The threads of the fibre vary from the 1-6000th to 1-9000th of an inch in breadth. After observation with my highest magnifying power, one of Powell and Lealand's excellent $\frac{1}{4}$-inch objectives, I am not prepared certainly to describe the true condition and arrangement of this secondary spiral deposit.

In a hair of the young corolla (the latter about the 1-6th of an inch in length), I observed the spiral arrangement pretty distinctly; in the younger stages the cuticle does not appear to have become absorbed to such an extent as in the matured cell, a double wall being perceptible towards the extremity of the hair.

The primordial utricle is readily separated from the cell-wall by the application of reagents. A solution of chloride of calcium produces this effect after a brief interval, the utricle becoming either almost destroyed, or a mere thread lying in the cell.

I have thought that I may have observed an alteration in the fibrous deposit, connected with the irregularly distributed convexities of the cell-wall, and which gives rise to the frequently somewhat sinuous outline of the hair, but I cannot certainly mention an instance. The spiral fibre, if such it be, is quite incapable of unrolling, at least in the cases which I have examined, and the wall of the hair tears in a manner almost totally irrespective of its direction.

Series of spiral vessels, sometimes branching, are met with in the corolla, but I do not discover any direct communication between these vessels and the spiral cells.

I have not detected any movement of the cell-sap in this tissue; merely at times a slight molecular motion.

With regard to the multicellular hairs, these are readily obtained from any portion of the young exposed plant, but the curious filiform processes from the petiolary sheath furnish them without trouble in a condition easily prepared for examination.

The hairs consist of a variable number of cells, sometimes as many as nineteen, applied by their extremities. They almost invariably present more or less the appearance of dots, or rather slits, generally in a direction somewhat parallel with the axis of the hair, but sometimes also slightly inclined in a spiral (as in the unicellular hairs of the corolla), ascending to the right, as viewed from the centre. The edge of the lower portion of these hairs sometimes presents an almost even outline, but frequently (and perhaps nearly always towards the extremity of the hair) a slight irregular beading occurs, exactly as we might expect, were the dots or markings occasioned by external matter; but I am not sure that this appearance is incompatible with the idea that they may be openings or slits in a secondary deposit on the common wall of the hair, which, from an examination, solely of the markings in the central portions, we might conclude they were. I have not detected in these hairs actual motion of the cell-sap, but mucilaginous threads may be easily seen radiating irregularly from the nuclear vesicle, indicating such a circulation. With regard to the contents of the nucleus I cannot certainly speak. Sulphuric acid diluted, causes the primordial utricle to contract and lie in the interior as a loose sac; in some small cells the separation is not apparent after twenty-four hours' action.

A solution of chloride of calcium causes a partial dissolution of the primordial utricle, certain bodies, perhaps including the true nucleus, remaining visible.

The epidermis of the intervenal spaces of the under side of the leaf consists of cells with a sinuous boundary, numerous stomata formed by two crescentic cells applied by their extremities being scattered about.

Acicular raphides are of frequent occurrence; they abound also in the glandular stipules found between the petioles of the opposite leaves.

The application of pressure causes the escape of very numerous raphides, together with a peculiar thick fluid. In some instances this substance has a vermiform appearance when forced out of the enclosing sac, owing to its having been exuded, I suppose, through a small orifice.

MISCELLANEOUS.

On the Coccidæ *of the Olive, Orange, Lemon, and Rose-bay, and on the Maladies produced by them on those trees in the Province of Nice and in the Department of the Var.* By M. Robineau-Desvoidy.

The author proceeded to the South of France with the view of ascertaining the cause of a malady which had long been prevalent on the above trees in that part of the country, and which it was supposed had made its appearance in the central and northern departments.

This disease, called *morfée* by the Italians, *fumagine* in the North of France, consists in a thick, black crust which covers the trunks, branches, &c. of trees, sometimes over a considerable extent of country. The trees become arrested in their growth, languid and barren.

According to historical accounts, this disease has not appeared more than a century. It is said to have first occurred near Rome, and thence to have spread through the whole of Italy, and lastly into France. It every year makes fresh progress, and no means have yet been found to arrest it.

The Italians are not agreed as to whether this disease be a special malady, or merely the result of the attacks of *Coccidæ*. The author supports the latter opinion, stating that the disease never occurs except upon trees attacked by those insects.

Of these he says that the *Coccus adonidum*, a native of Senegal, attacks especially the citron and lemon trees; the *Coccus hesperidum*, a native of America and Africa, prefers the orange, rose-bay and peach trees; the *Coccus aonidum*, native of the Indian Archipelago, attacks the Lauraceous trees; the *Coccus oleæ* commits the greatest ravages upon the olive-trees, but also attacks the oranges and a number of other trees; it is the most destructive of all.

Rich, moist, well-cultivated localities are most favourable to the development of these insects, and it is in these that they commit the greatest ravages.—*Comptes Rendus*, 2 Août, 1852, p. 183.

OBITUARY.—JAMES FRANCIS STEPHENS.

James Francis Stephens, F.L.S., late President of the Entomological Society, &c., died on the 22nd of December, at his house in Foxley Road, Kennington, of inflammation of the lungs.

Mr. Stephens was in his 61st year, having been born at Shoreham on the 16th of September, 1792; he was the son of a naval officer. He has left a widow to deplore her loss, his only child, a son, having died some years ago.

Mr. Stephens was the author of the 'Systematic Catalogue of British Insects,' the 'Illustrations of British Entomology,' 'Manual of British Coleoptera,' of a 'Catalogue of the British Lepidoptera in the Collection of the British Museum,' and editor of the latter volumes of 'Shaw's General Zoology' containing the Birds.

Mr. Stephens was a clerk in the Admiralty, but lately retired on a superannuation. Early in life he paid considerable attention to electricity and meteorology; but for the greater part of the last half-century he devoted the whole of his leisure to the study of the natural history of the British Islands, and had formed the most complete and best arranged collection of the insects of this country that had ever been brought together. This collection and his extensive library of entomological works he, in the most liberal manner, opened to the inspection of any students who wished to consult it for scientific purposes, on every Wednesday in the year; hence most of the cabinets in the country are named in conformity with it. In 1839 his Collection of British Insects consisted of 12,449 species and 88,132 specimens contained in 193 drawers, and it has been very much increased since that period.

In 1818 he assisted Dr. Leach to form and arrange the Collection of Insects in the British Museum, permission having been obtained from the Lords of the Treasury that he might be temporarily absent from his office for the purpose.

Mr. Stephens was a most active and successful collector to a late period, taking long excursions for the purpose; and he combined in a very unusual degree the practical experience of a field naturalist with the bibliographical and scientific knowledge of a profound entomologist.

J. E. Gray.

METEOROLOGICAL OBSERVATIONS FOR NOV. 1852.

Chiswick.—November 1. Uniformly overcast: drizzly: slight rain. 2. Heavy rain: clear. 3. Clear: heavy rain: clear. 4. Foggy: large white clouds: slight rain. 5. Overcast: exceedingly fine: rain at night. 6. Rain: very fine: boisterous. 7. Cloudy and boisterous: rain: clear and windy. 8. Overcast. 9. Uniform haze: overcast: clear. 10. Overcast. 11. Drizzly: rain: excessively heavy rain at night. 12. Rain and boisterous throughout. 13. Uniformly overcast: foggy: drizzly. 14. Rain: very fine: extraordinary heavy rain. 16. Barometer very low: fine: rain at night. 17. Fine. 18. Densely clouded: fine: clear. 19. Foggy: overcast. 20. Dense fog: constant rain. 21. Rain. 22. Densely overcast. 23. Fine: rain at night. 24. Overcast. 25. Foggy: fine: rain. 26. Boisterous, with heavy rain. 27. Clear and fine. 28. Showery. 29, 30. Overcast.

Mean temperature of the month	47°·38
Mean temperature of Nov. 1851	35 ·86
Mean temperature of Nov. for the last twenty-six years ...	43 ·08
Average amount of rain in Nov.	2·30 inches.

Boston.—Nov. 1. Fine. 2. Cloudy: rain A.M. and P.M. 3. Fine: rain A.M. and P.M. 4. Fine. 5. Fine: rain A.M. 6. Fine: rain A.M. and P.M. 7. Cloudy: rain A.M. 8. Fine: rain A.M. 9. Cloudy. 10. Fine. 11. Rain A.M. and P.M. 12. Cloudy: rain A.M. 13. Cloudy: rain P.M. 14, 15. Rain A.M. and P.M. 16. Rain A.M. and P.M., with thunder and lightning 1 P.M. 17. Fine. 18. Fine: rain A.M. 19, 20. Fine: rain P.M. 21. Rain A.M. and P.M. 22. Cloudy. 23. Fine. 24. Cloudy. 25. Fine: rain P.M. 26. Cloudy: rain A.M. and P.M. 27. Fine. 28. Cloudy: rain P.M. 29. Fine: rain P.M. 30. Fine.

Sandwick Manse, Orkney.—Nov. 1. Rain A.M.: clear, aurora P.M. 2. Bright A.M.: drops P.M. 3. Cloudy A.M.: clear, aurora P.M. 4. Clear A.M.: clear, aurora P.M. 5. Damp A.M.: rain P.M. 6. Bright A.M.: clear, aurora P.M. 7. Damp A.M.: showers P.M. 8—10. Showers A.M. and P.M. 11. Sleet-showers A.M.: clear, aurora P.M. 12. Clear, frost A.M.: clear, aurora P.M. 13. Clear, frost A.M.: showers, aurora P.M. 14. Clear, snow A.M.: clear P.M. 15. Snow-showers A.M.: rain P.M. 16. Rain A.M.: drizzle P.M. 17, 18. Cloudy A.M.: showers P.M. 19. Clear A.M.: fine P.M. 20. Cloudy A.M.: fine, fog P.M. 21. Fine, frost A.M.: showers P.M. 22. Bright A.M.: showers P.M. 23. Showers A.M. and P.M. 24. Bright A.M.: cloudy P.M. 25. Clear A.M. and P.M. 26. Drizzle A.M.: cloudy P.M. 27. Sleet-showers A.M. and P.M. 28. Clear, frost A.M.: snow-showers P.M. 29. Snow-showers A.M. and P.M. 30. Damp A.M.: rain P.M.

Mean temperature of Nov. for twenty-five years	42°·60
Mean temperature of this month	41 ·52
Average quantity of rain in Nov. for six years	4·83 inches.

On the 11th from 6·50 till 7·10 P.M. very red aurora. A bow in the southern hemisphere, from which it proceeded to the zenith, particularly from the ends towards the east and west.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston.	Orkney, Sandwick.		Chiswick.		Boston.	Orkney, Sandwick.		Chiswick.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1852. Nov.	Max.	Min.	8¾ a.m.	9¼ a.m.	8½ p.m.	Max.	Min.	8¾ a.m.	9¼ a.m.	8½ p.m.	1 p.m.					
1.	29·773	29·675	29·30	29·28	29·22	62	57	50	51	50	s.	se.	s.	·02	....	·05
2.	29·620	29·538	29·55	29·26	29·25	60	48	55	50	49	sw.	sse.	s.	·61	·14	·34
3.	29·748	29·658	29·20	29·27	29·47	56	32	58·5	48	42	sw.	wsw.	ssw.	·16	·26	·06
4.	29·840	29·689	29·40	29·53	29·65	60	44	42	47	44	s.	sw.	s.	·01	·05	....
☾ 5.	29·391	29·306	28·97	29·60	29·14	63	40	53	49	51½	s.	cse.	se.	·05	·10	·01
6.	29·843	29·737	29·32	29·22	29·39	58	52	43·5	46	44	sw.	ssw.	ssc.	·05	·04	·66
7.	29·979	29·862	29·33	29·25	29·21	60	54	58	47	50½	sw.	s.	sw.	·15	·04	....
8.	30·146	30·048	29·46	29·47	29·79	62	56	55	47½	44	sw.	wsw.	nw.	....	·09	·14
9.	30·164	30·045	29·70	30·00	30·06	59	48	53	45	42	sw.	calm	nw.	....	·06	·15
10.	30·032	29·937	29·60	30·09	30·09	50	42	43	41½	37	nw.	nw.	nne.	·06	....	·20
● 11.	29·706	29·408	29·37	29·94	29·90	54	48	41	39	36	s.	e.	nne.	1·02	·29	....
12.	29·558	29·487	29·25	29·97	29·97	49	44	46	37	34	e.	e.	......	·13	·93	·05
13.	29·496	29·412	29·20	29·79	29·74	48	44	43	39	34	e.	se.	nne.	·22	·04	·08
14.	29·362	29·225	29·05	29·66	29·60	54	46	42	32	33	e.	s.	n.	1·24	·11	·08
15.	29·071	28·989	28·70	29·43	29·28	58	49	48	34	37½	sw.	cse.	e.	·34	·43	·08
16.	29·057	28·848	28·50	29·11	28·88	60	49	52	41	44½	s.	ssw.	nne.	·12	·25	·62
17.	29·189	29·070	28·67	29·00	29·02	56	42	48	46	45	sw.	s.	se.	·11	·10	·11
☽ 18.	29·713	29·279	28·83	29·00	29·16	40	27	42	45	43	sw.	w.	wnw.	....	·04	·11
19.	29·763	29·548	29·40	29·39	29·40	53	36	35·5	43	42	se.	ssc.	s.	·24	....	·56
20.	29·550	29·304	29·10	29·40	29·38	53	43	42·5	43	39	s.	sse.	e.	·35	·03	....
21.	29·096	29·034	28·73	29·31	29·26	54	45	47	34	39	se.	e.	......	·10	·22	....
22.	29·299	29·042	28·76	29·12	29·15	47	29	42	42	40½	e.	nw.	w.	·04	·48	·08
23.	29·512	28·965	29·13	29·15	29·27	44	38	32·5	43	40½	sw.	nw.	nw.	·18	....	·22
24.	29·872	29·266	29·04	29·53	29·81	47	27	43	41	38	n.	n.	n.	....	....	·04
25.	29·947	29·689	29·60	29·96	29·83	54	41	32	34	38½	s.	s.	se.	·22	....	....
○ 26.	29·483	29·426	29·00	29·16	28·73	56	38	52	42	44	sw.	s.	ssw.	·70	·47	·13
27.	29·832	29·692	29·26	29·16	29·23	49	39	42	42	42	w.	wsw.	ssw.	....	·05	·30
28.	29·670	29·450	29·10	29·21	29·38	51	28	42	34½	37	nw.	ssw.	nnw.	·08	....	·12
29.	29·680	29·507	29·20	29·64	29·83	39	34	32	34½	34	n.	n.	nw.	....	·05	·94
30.	29·954	29·783	29·54	29·78	29·47	42	25	32	37	41	n.	n.	s.	....	·05	·05
Mean.	29·644	29·463	29·17	29·456	29·452	53·26	41·50	44·9	41·83	41·21				6·20	4·32	5·18

TABLE I.—OF THE POSITION OF THE CARPEL WHEN SINGLE AND OF THE RAPHE.

ENDOGENS,

(OR § 1. OF THE RACE OF THE RHIZANTHS.)

All. 1.	All. 4. / All. 5. / All. 6. / All. 7.	§ Dictyogenæ. / All. 8
All. 1. **Pontederaceæ.** [Fertile carpel always anterior.] 1 pendulous, r. lateral. **Liliaceæ.** Numerous, horizontal, r. lateral. **Melanthaceæ.** When ascending r. next pl. **Gilliesiaceæ.** **All. 2** **Philydraceæ.** **Xyrideæ.** **Commelynaceæ.** **Mayaceæ.** **All. 3** **Juncaceæ.** Erect r. next pl. **Cyperaceæ.** R. lateral ? **Desvauxiaceæ.** **Restiaceæ.** **Eriocaulaceæ.** **Graminaceæ.** R. next pl. **Zosteraceæ.**	**All. 4.** **Orchideæ.** **Apostasiaceæ.** **Burmanniaceæ.** **All. 5.** **Musaceæ.** **Amomaceæ.** **Marantaceæ*.** 1 erect cotyledon next pl. **All. 6.** **Irideæ.** **Amyrillideæ.** Numerous, horizontal, r. lateral. **Hypoxideæ.** **Hæmodoraceæ.** **Taccaceæ.** **Bromeliaceæ.** **All. 7** **Palmaceæ.** 1 if pendulous r. averse pl. being next the dorsum of the cell. 1 erect r. lateral. **Pandanaceæ.** **Typhaceæ*.** Pendulous r. averse pl. **Orontiaceæ.** **Araceæ.** Numerous, horizontal, r. frequently on the upper surface **Lemnaceæ.**	**§ Dictyogenæ.** **Roxburghiaceæ** **Trilliaceæ** **Philesiaceæ** **Smilaceæ** **Dioscoreaceæ.** *2 pendulous r. next pl.* (in the early stage lateral.) **All. 8** **Hydrocharideæ** **Butomaceæ** *Ascending r. generally averse pl.* **Alismaceæ.** Cotyledon next pl. **Juncagineæ.** When pendulous cotyledon averse pl. When erect r. next pl. **Naiadeæ.** 1 pendulous convexity of cotyledon averse pl.

RHIZANTHÆ.

HETEROCARPOUS EXOGENS,

(OR § 2. OF THE RACE OF THE RHIZANTHS.)

Alliances (as far as is at present known) wholly Heterocarpous;—Carpels never all anterior.

Subdivs.	PIPERAL.	LAURO-ELÆAGNAL.	POLYGONAL.	DAPHNAL.	GARRYAL.
MONOPETALOUS	**All. 1** **Orobanchaceæ.** **Gentianaceæ.** Numerous horizontal r. lateral.	**All. 1.** **Ebenaceæ.** 2 r. averse pl **Aquifoliaceæ*.** R. lateral. **Styraceæ.** 2 erect or pendulous r. lateral, also 2 erect r. next pl. **Oleaceæ.** 2 r. lateral.	**All. 1.** **Diapensiaceæ.** **Myoporaceæ.** 1 or 2 r. lateral. **Stilbaceæ**.** R. lateral. **Empetraceæ.** ? **Batideæ.** **All. 2.** **Salvadoraceæ*.** **Myrsinaceæ.** **Primulaceæ.** Erect r. next pl **Plumbagineæ**.** R. averse pl. **Brunoniaceæ*.** **Plantagineæ*.** When erect r. next pl.	**All. 1.** **Monotropaceæ.** **Pyrolaceæ.** **Vacciniaceæ.** **Epacrideæ*.** 1 pendulous r. lateral. **Ericaceæ.**	**All. 1.** **Stellatæ.** **Cinchonaceæ*.** 1 erect r. next pl. or 1 pendulous r. averse pl. **Caprifoliaceæ*.** 1 pendulous r. latera.
POLYPETALOUS	**All. 2** **Nymphæaceæ.** Numerous pendulous r. averse pl *occasionally next pl. in the same ovary.* **Hydropeltideæ.** 2 or 3 r. averse pl **Nelumbiaceæ** ?** R. averse pl **Ceratophyllaceæ**** **All. 3** **Ranunculaceæ*.** When pendulous r. averse pl **Cephaloteæ.** ? **Triurideæ.** Erect r. (apparently) next pl. **Sarraceniaceæ.** **All. 4.** **Nepenthaceæ.** **Aristolochiaceæ.** **All. 5.** **Dilleniaceæ*.** R. next pl. **Magnoliaceæ*.** When erect r. next pl. When horizontal r. lateral. **Anonaceæ.** **Schizandraceæ.** Pendulous r. lateral. **Lardizabaleæ.** **Monimiaceæ.** Pendulous r. averse pl. **Atherospermeæ.**	**All. 2** **Ternstrœmiaceæ.** 2 r. averse pl. **Hypericaceæ.** **Clusiaceæ.** When erect r. next pl **Canellaceæ.** **Brexiaceæ.** **Marcgraviaceæ.** **All. 3** **Stackhousiaceæ.** R. next pl. **Hippocrateaceæ.** **Celastraceæ.** When pendulous r. averse pl. **Malpighiaceæ.** R. averse pl or lateral. **Coriarieæ.** R. averse pl **Anacardiaceæ*.** R. averse p. **Ochnaceæ.** When pendulous r. averse pl. ? **All. 4.** **Staphyleaceæ.** Ascending (in two rows) r. lateral. **Rhamnaceæ.** 1 or 2 r. lateral. **All. 5.** **Icacineæ*.** R. averse pl. **Olacaceæ.** **Santalaceæ*.** R. lateral. **Loranthaceæ*.** Nucleus pendulous, inverted, funiculus attached to it on the averse side from the central placenta.	**All. 3.** **Elatineæ.** **Lythraceæ**.** When erect r. next pl. **Podostemaceæ.** Ascending r. next pl. ? **All. 4** **Crassulaceæ.** 1 erect r. next pl. or 2 the lower erect r. next pl. *the upper horizontal r. on the under surface.* **Reaumuriaceæ.** Several r. next pl. **Tamaricaceæ.** **Frankeniaceæ.** Ascending r. lateral. **All. 5.** **Portulaceæ.** When erect cotyledons lateral. **Caryophyllaceæ.** When ascending cotyledons next pl. or lateral. **Illecebraceæ**.** 1 pendulous, cotyledons averse pl. or lateral. **Chenopodiaceæ**.** 1 erect, cotyledons next pl., or horizontal and cotyledons lateral, or pendulous and cotyledons averse pl. **Amaranthaceæ**.** 1 pendulous cotyledons averse pl.	**All. 2.** **Francoaceæ.** **Droseraceæ.** **All. 3.** **Humiriaceæ.** **Cyrillaceæ.** 1 pendulous r. averse pl. **All. 4.** **Pittosporaceæ.** **Grossulariaceæ.** **Escalloniaceæ.** **All. 5.** **Granateæ.** **Combretaceæ*.** **Pomaceæ*.** R. next pl. **All. 6.** **Calycanthaceæ.** R. next pl. **Amygdaleæ*.** *2 r. next pl.* **Rosaceæ.** 1 erect r. next pl., *or 1 pendulous and r. next pl.* **Saxifragaceæ.**	**All. 2.** **Cornaceæ*.** R. averse pl., or lateral **Alangiaceæ*.** R. lateral. **Begoniaceæ.** **Datiscaceæ.** — **Belvisiaceæ.** Cotyledons averse pl. **Rhizophoraceæ.** **Barringtoniaceæ.** **Columelliaceæ.** **Philadelphaceæ.** **Hydrangeaceæ.** **Cunoniaceæ.**
APETALOUS	**All. 6** **Chloranthaceæ**.** **Piperaceæ**.** **Saururaceæ**.** **All. 7.** **Myristicaceæ*.** R. next pl. **Menispermaceæ*.** *1 or 2 pendulous, cotyledons or short raphe next pl.* (In the early stage ovule horizontal, r. lateral ?)	**All. 6** **Lauraceæ*.** R. averse pl. **Cassytheæ** **Elæagnaceæ*.** R. lateral.	**All. 6.** **Nyctagineæ*.** Cotyledons next pl. **Polygonaceæ.** **Basellaceæ** ?** Cotyledons next pl ?	**All. 7.** **Penæaceæ.** Geissolomia 2 pendulous r. averse pl. *Penæa 2 erect r. averse pl.* *Sarcocolla 4 erect r. averse pl.* **Aquilariaceæ.** **Daphnaceæ**.** *R. next pl.* **Sanguisorbaceæ*.** *1 pendulous r. next pl.*	**All. 3** **Garryaceæ.** Pendulous r. averse pl **Helwingiaceæ.** R. averse pl.

RHIZANTHÆ.

PRIMORDIAL PHANEROGAMS.

Those Orders to which an asterisk is affixed have the Carpel when single, variable and frequently posterior, and those with two asterisks all or nearly all posterior;—the others are placed according to their affinities. *Pontedera* is an exception, and is noticed in the first column of Endogens.

The Numbers refer to the Ovules, whether one or more in each cell; r. is an abbreviation of Raphe, and pl. of Placenta.

The ovule pendulous with the raphe next the placenta is (for perspicuity) always printed in *italics*, as are also those which are considered as having an equivalent character, viz. ovule erect with the raphe turned away from the placenta, and pendulous campylotropal ovules in which the embryo subsequently formed has the cotyledons next the placenta.

[To face p. 81 of Ann. Nat. Hist. 2nd Ser. vol. xi.]

Table II.—OF THE POSITION OF THE CARPEL WHEN SINGLE AND OF THE RAPHE.

PROTEROCARPOUS EXOGENS,

Alliances either in part or wholly Proterocarpous;—where exceptions (which are few) occur, the Carpel very rarely posterior.

§ 1. Subdivisions derived from the Heterocarpous division.

	PAPAVERAL.	PHYTOLACCAL.	PETIVERIAL.	PROTEAL.	CRASSULOIDAL.	TETRAGONIAL.	ONAGRARIAL.	MYRTAL.	BRUNIAL.
MONOPETALOUS.	All. 1. **Cuscutaceæ.** **Convolvulaceæ.** [illegible] pl. **Solanaceæ.** Numerous, horizontal, r. lateral.	All. 1. **Polemoniaceæ.** When single, erect r. next pl.	All. 1. **Sapotaceæ*.** Erect r. next pl.	All. 1. **Pedaliaceæ.** **Bignoniaceæ.** **Gesneraceæ.** **Acanthaceæ**.** 1 erect r. next pl., 2 erect r. lateral. **Scrophulariaceæ.** Diplacus — *numerous pendulous r. next pl.* **Utriculariaceæ.** All. 2. **Jasminaceæ.** Ascending—*r.* lateral or next pl. **Verbenaceæ*.** R. lateral. **Labiatæ**?** R. lateral.	All. 1. **Hydrophyllaceæ.** *When pendulous r. next pl.* **Ehretiaceæ.** *R. next pl.* **Nolanaceæ.** *Erect r. averse pl.* **Cordiaceæ.** **Boragineæ.** *R. very short next pl.* All. 2. **Selagineæ.** *R. next pl.* **Callitrichaceæ.** *R. next pl.*	All. 1. **Valerianaceæ*.** R. lateral. **Dipsaceæ**.** R. lateral or averse pl. **Globulariaceæ**.** R. lateral. **Calyceraceæ**.** R. averse pl.	All. 1. **Campanulaceæ.** **Lobeliaceæ.** **Stylidiaceæ**.** **Goodeniaceæ**.** 1 erect r. next pl. or (when several) lateral.	All. 1. **Cichoraceæ.** **Compositæ**.** *R. averse pl.*	
POLYPETALOUS.	All. 2. **Papaveraceæ.** Macleaya sp. horizontal r. on the upper surface. [illegible] [illegible] zontal, foramen on [illegible] **Berberideæ.** *2 erect r. averse pl.* **Vitaceæ.** 2 erect r. next pl.	All. 2. **Sterculiaceæ.** **Malvaceæ.** *Cotyledons next pl.* **Byttneriaceæ.** 1 erect r. next pl. **Surianeæ.** [illegible] pl. **Tiliaceæ.** 1 erect r. next pl.	All. 2. **Cruciferæ.** *Cotyledons next pl.* **Capparideæ.** All. 3. **Vivianaceæ.** **Geraniaceæ.** *Ascending r. averse pl.* **Oxalideæ.** *R. next pl.* **Linaceæ.** *R. next pl.* **Chlænaceæ.** *2 pendulous r. next pl.* **Zygophyllaceæ.** **Balsaminaceæ.** **Resedaceæ.** *Cotyledons next pl.* **Tropæolaceæ**?** *R. next pl.* **Limnantheæ.** Erect r. next pl. All. 4. **Cedrelaceæ.** **Meliaceæ.** *R. next pl.* **Amyrideæ.** **Aurantiaceæ.** *R. next pl.* **Simarubaceæ.** **Rutaceæ.** 2 *r. next pl.* **Xanthoxylaceæ.** *R. next pl.* **Connaraceæ*.** All. 5. **Rhizobolaceæ.** *Cotyledons next pl.* **Sapindaceæ.** *R. next pl. in the lower ovule* and also in the upper. **Erythroxyleæ*?** *R. next pl.* **Aceraceæ.** Convexity of the cotyledons averse pl.	All. 3. **Vochysiaceæ.** **Polygalaceæ**.** *R. next pl.* **Tremandraceæ.** *R. next pl.* All. 4. **Moringaceæ.** **Papilionaceæ**.** *Numerous pendulous cotyledons next pl.*, or horizontal and cotyledons lateral. **Cæsalpinieæ**.** **Mimoseæ.** *Cotyledons next pl.* **Mimosa**.** **Chrysobalaneæ**.** 2 *erect r. averse pl.*		All. 2. **Cactaceæ.** **Mesembryanthemeæ.** All. 3. **Tetragoniaceæ**.** 1 pendulous cotyledons averse pl. or 2 erect cotyledons lateral. **Scleranthaceæ**.** *Pendulous cotyledons next the funiculus.*	All. 2. **Onagrariæ**.** Erect r. next pl. or pendulous and r. averse pl. **Hippurideæ.** 1 pendulous r. lateral.	All. 2. **Chamælauciaceæ**.** 2 *erect r. obliquely averse pl.* **Myrtaceæ*.** When ascending r. next pl. **Lecythideæ.** **Melastomaceæ.**	All. 1. **Umbelliferæ*?** *R. next pl.* **Araliaceæ.** *R. next pl.* All. 2. **Bruniaceæ**.** R. lateral inclining to averse. **Hamamelideæ.** R. lateral.
APETALOUS.		All. 3. **Gyrostemoneæ.** Pendulous cotyledons averse pl.? **Phytolaccaceæ**.** Erect cotyledons next pl.	All. 6. **Petiveriaceæ**.** 1 erect cotyledons next pl.	All. 5. **Proteaceæ**.** 2 r. next pl. (or several horizontal r. lateral?)					
	Derived from Anonaceæ.	Derived from Nyctagineæ.	Derived from Phytolaccaceæ.	Derived from Petiveriaceæ.	Derived from Crassulaceæ. / Derived from Elatineæ.	Derived from Illecebraceæ.	Derived from Podostemaceæ.	Derived from Lythraceæ.	Derived from Helwingiaceæ. All. 1. from Cornaceæ?

§ 2. Race of the Gymnosperms.

(Raphe in pendulous Ovules never turned away from the Placenta.)

		All. 1. **Loganiaceæ.** Numerous, horizontal, r. lateral. **Asclepiadeæ.** *Numerous, horizontal, r. on the under surface.*	All. 1. (continued) **Apocynaceæ.** *Numerous, horizontal, r. on the under surface, or 2 pendulous r. next pl.*		
All. 2. **Paypayaceæ.** **Pangiaceæ.**	All. 3. **Euphorbiaceæ*.** *R. next pl.* **Scepaceæ.** *R. next pl.*	All. 4. **Cistaceæ.** **Samydaceæ.** *R. very short next pl.* **Flacourtiaceæ.** *R. next pl. or somewhat oblique.* **Passifloraceæ.** Numerous, horizontal, r. lateral. **Malesherbiaceæ.** **Sauvagesiaceæ.** **Turneraceæ.** **Violaceæ**?** 2 *r. next pl.* All. 5. **Lacistemaceæ.** **Stilagineæ.** *R. next pl.* **Juglandeæ.**		All. 6. **Chailletiaceæ.** [illegible] *pl.* **Dipterocarpeæ.** 2 [illegible] *next pl.*	All. 7. **Homaliaceæ.** [illegible] Numerous [illegible]
All. 8. **Artocarpeæ.** *When pendulous r. next pl.* **Moreæ*.** *Cotyledons next pl.*	All. 9. **Urticaceæ**.** Elatostemma*. *Cotyledons next pl.* **Cannabineæ**.** *Cotyledons next pl.* **Ulmaceæ*.** *R. next pl.* **Celtideæ*.** *Cotyledons next pl.* **Casuarineæ**.** *R. next pl.*	All. 10. **Myricaceæ.** **Cupuliferæ.** *R. next pl.* **Betulaceæ.** *R. next pl.*		All. 11. **Altingiaceæ*.** *Cotyledons next pl.?* **Plataneæ.**	All. 12. **Salicaceæ.**

PRIMORDIAL PHANEROGAMS. — GYMNOSPERMÆ.

Those Orders to which an asterisk is affixed have the Carpel when single anterior or lateral,—those with two asterisks all anterior, and the others are placed according to their affinities. The ovule pendulous with the raphe next the placenta is (for perspicuity) always printed in *italics*, as are also those which are considered as having an equivalent character, viz. ovule erect with the raphe turned away from the placenta; ovule horizontal with the raphe inferior, i. e. on the under surface; and pendulous campylotropal ovules in which the embryo subsequently formed has the cotyledons next the placenta.

The Numbers refer to the Ovules, whether one or more in each cell; r. is an abbreviation of raphe, and pl. of placenta.

Table III.—Showing the Lateral Relations of the Divisions of Exogens.

Proterocarpous.

§ 2. Race of the Gymnosperms.

- All. 1
  - Loganiaceæ, Asclepiadeæ.
  - Apocynaceæ.

§ 1. Derived from the Heterocarpous Division.

- *Papaveral.* All. 1. Solanaceæ.
- *Phytolaccal.* All. 1. Cuscutaceæ. Convolvulaceæ. Polemoniaceæ.
- *Petiverial.* / *Proteal.* All. 1.
  - Pedaliaceæ. Gesneraceæ. Bignoniaceæ.
  - Acanthaceæ. Scrophulariaceæ. Utriculariaceæ.
- *Proteal.* All. 2. Jasminaceæ. Verbenaceæ. Labiatæ.
- *Sapotal.* All. 1. Sapotaceæ.
- *Crassuloidal.* All. 1. Hydrophyllaceæ. Ehretiaceæ. Nolanaceæ. Cordiaceæ. Boragineæ.
- *Crassuloidal.* All. 2. Selagineæ. Callitrichaceæ.
- *Tetragonial.* All. 1. Valerianaceæ. Dipsaceæ. Globulariaceæ. Calyceraceæ.
- *Onagrarial.* All. 1. Campanulaceæ. Lobeliaceæ. Stylidiaceæ. Goodeniaceæ.
- *Myrtal.* All. 1. Cichoraceæ. Compositæ.

Heterocarpous.

§ 2. Derived from the Lauro-Elæagnal Subdivision.

- *Polygonal.*
  - All. 1. Diapensiaceæ. Myoporaceæ. Stilbaceæ. Empetraceæ. ? Batideæ.
  - All. 2. Salvadoraceæ. Myrsinaceæ. Primulaceæ. Plumbagineæ. Brunoniaceæ. Plantagineæ.

§ 1. Continued from Polypetalous forms.

- *Piperal.* All. 1. Orobanchaceæ. Gentianaceæ.
- *Lauro-Elæagnal.* All. 1.
  - Ebenaceæ.
  - Aquifoliaceæ. Styraceæ. Oleaceæ.
- *Daphnal.* All. 1.
  - Monotropaceæ. Pyrolaceæ.
  - Vacciniaceæ. Epacrideæ. Ericaceæ.
- *Garryal.* All. 1. Stellatæ. Cinchonaceæ. Caprifoliaceæ.

Proterocarpous.

§ 2. Race of the Gymnosperms.

- All. 2. Papayaceæ. Pangiaceæ.
- All. 3. Euphorbiaceæ. Scepaceæ.
- All. 4. Cistaceæ. Samydaceæ. Flacourtiaceæ. Passifloraceæ. Malesherbiaceæ. Sauvagesiaceæ. Turneraceæ. Violaceæ.
- All. 5. Lacistemaceæ. Stilagineæ. Juglandeæ.
- All. 6. Chailletiaceæ. Dipterocarpeæ.
- All. 7. Homaliaceæ. Loasaceæ. Cucurbitaceæ.

§ 1. Derived from the Heterocarpous Division.

- *Papaveral.* All. 2. Papaveraceæ. Fumariaceæ. Berberideæ. Vitaceæ.
- *Phytolaccal.* All. 2. Sterculiaceæ. Malvaceæ. Byttneriaceæ. Surianeæ. Tiliaceæ.
- *Petiverial.*
  - All. 2. Cruciferæ. Capparideæ.
  - All. 3. Viviannaceæ. Geraniaceæ. Oxalideæ. Linaceæ. Chlænaceæ. Zygophyllaceæ. Balsaminaceæ. Resedaceæ. Tropæolaceæ. Limnantheæ.
  - All. 4. Cedrelaceæ. Meliaceæ. Amyrideæ. Aurantiaceæ. Simarubaceæ. Rutaceæ. Xanthoxylaceæ. Connaraceæ.
  - All. 5. Rhizobolaceæ. Sapindaceæ. Erythroxyleæ. Aceraceæ.
- *Proteal.*
  - All. 3. Vochysiaceæ. Polygalaceæ. Tremandraceæ.
  - All. 4. Moringaceæ. Papilionaceæ. Cæsalpinieæ. Mimoseæ. Chrysobalaneæ.
- *Tetragonial.*
  - All. 2. Cactaceæ. Mesembryanthemeæ.
  - All. 3. Tetragoniaceæ. Scleranthaceæ.
- *Onagrarial.* All. 2. Onagrariæ. Hippurideæ.
- *Myrtal.* All. 2. Chamælauciaceæ. Myrtaceæ. Lecythideæ. Melastomaceæ.
- *Brunial.*
  - All. 1. Umbelliferæ. Araliaceæ.
  - All. 2. Bruniaceæ. Hamamelideæ.

Heterocarpous.

§ 2. Derived from the Lauro-Elæagnal Subdivision.

- *Polygonal.*
  - All. 3. Elatineæ. Lythraceæ. Podostemaceæ.
  - All. 4. Crassulaceæ. Reaumuriaceæ. Tamaricaceæ. Frankeniaceæ.
  - All. 5. Portulaceæ. Caryophyllaceæ. Illecebraceæ. Chenopodiaceæ. Amaranthaceæ.

§ 1. Continued from Apetalous forms.

- *Piperal.*
  - All. 2. Nymphæaceæ. Hydropeltideæ. Nelumbiaceæ. Ceratophyllaceæ.
  - All. 3. Ranunculaceæ. Cephaloteæ. ? Triurideæ. Sarraceniaceæ.
  - All. 4. Nepenthaceæ. Aristolochiaceæ.
  - All. 5. Dilleniaceæ. Magnoliaceæ. Anonaceæ. Schizandraceæ. Lardizabaleæ. Monimiaceæ. Atherospermeæ.
- *Lauro-Elæagnal.*
  - All. 2. Ternstrœmiaceæ. Hypericaceæ. Clusiaceæ. Canellaceæ. Brexiaceæ. Marcgraviaceæ.
  - All. 3. Stackhousiaceæ. Hippocrateaceæ. Celastraceæ. Malpighiaceæ. Coriarieæ. Anacardiaceæ. Ochnaceæ?
  - All. 4. Staphyleaceæ. Rhamnaceæ.
  - All. 5. Icacineæ. Olacaceæ. Santalaceæ. Loranthaceæ.
- *Daphnal.*
  - All. 2. Francoaceæ. Droseraceæ.
  - All. 3. Humiriaceæ. Cyrillaceæ.
  - All. 4. Pittosporaceæ. Grossulariaceæ. Escalloniaceæ.
  - All. 5. Granateæ. Combretaceæ. Pomaceæ.
  - All. 6. Calycanthaceæ. Amygdaleæ. Rosaceæ. Saxifragaceæ.
- *Garryal.*
  - All. 2. Cornaceæ. Alangiaceæ. Begoniaceæ. Datiscaceæ.
  - Belvisiaceæ. Rhizophoraceæ. Barringtoniaceæ. Columelliaceæ. Philadelphaceæ. Hydrangeaceæ. Cunoniaceæ.

Proterocarpous.

§ 2. Race of the Gymnosperms.

- All. 8. Artocarpeæ. Moreæ.
- All. 9.
  - Urticaceæ. Cannabineæ.
  - Ulmaceæ. Celtideæ. Casuarineæ.
- All. 10. Myricaceæ. Cupuliferæ. Betulaceæ.
- All. 11. Altingiaceæ. Platanaceæ.
- All. 12. Salicaceæ.

§ 1. Derived from the Heterocarpous Division.

- *Phytolaccal.* All. 3. Gyrostemoneæ. Phytolaccaceæ.
- *Petiverial.* All. 6. Petiveriaceæ.
- *Proteal.* All. 5. Proteaceæ.

Heterocarpous.

§ 2. Derived from the Lauro-Elæagnal? Subdivision.

- *Polygonal.* All. 6. Nyctagineæ. Polygonaceæ. Basellaceæ.

§ 1. Continued progressively from the Piperal Subdivision.

- *Piperal.*
  - All. 6. Chloranthaceæ. Piperaceæ. Saururaceæ.
  - All. 7. Myristicaceæ. Menispermaceæ.
- *Lauro-Elæagnal.* All. 6.
  - Lauraceæ. Cassytheæ.
  - Elæagnaceæ.
- *Daphnal.* All. 7. Penæaceæ. Aquilariaceæ. Daphnaceæ. Sanguisorbaceæ.
- *Garryal.* All. 3. Garryaceæ. Helwingiaceæ.

[Face p. 461 of *Ann. Nat. Hist.* 2nd Ser. vol. xi.]

SHOWING THE POSITION OF THE CARPE S IN DICARPOUS OVARIES, AND ALSO THE EXTE… | ABLE IV … O WH…

MENISPERMO-PIPERAL.

HETEROCARPOUS.

§ 1. *Piperal.*

All. 1.
…robanchaceæ (*).
…entianaceæ (*);
…r ⊛; or ⌒;
…r ( ) ⌒.

All. 2.
…ymphæaceæ.
…ydropeltideæ.
…elumbiaceæ
…eratophyllaceæ.

All. 3.
Ranunculaceæ.
Cephaloteæ.
? Triurideæ.
Sarraceniaceæ.

All. 4.
Nepenthaceæ.
Aristolochiaceæ.

All. 5.
Dilleniaceæ.
Magnoliaceæ.
Anonaceæ.
Schizandraceæ.
Lardizabaleæ.
Monimiaceæ.
Atherospermeæ.

All. 6.
…loranthaceæ.
…peraceæ.
…aururaceæ ⌒.

All. 7.
Menispermaceæ ( ).
Myristicaceæ.

Derived from Araceæ and Cytinaceæ. (All. 1–6) — Derived from Smilaceæ and Piperaceæ. (All. 5, 7)

PROTEROCARPOUS.

§ 2. *Papaveral.*

All. 1.
Solanaceæ ⊛; or ⌒.
Cestrum ( ).
Habrothamnus (*).

All. 2.
Papaveraceæ (*); (or (,?).
Fumariaceæ (*).
Berberideæ.
Vitaceæ ( ); or ( ) ( ) ⌒.

Derived from Anonaceæ; (All. 1. from Gentianaceæ?)

LAURO-GARRYAL.

HETEROCARPOUS.

§ 1. *Lauro-Elæagnal.*

All. 1.
Ebenaceæ ( ); or ⌒. — Aquifoliaceæ. Styraceæ. Oleaceæ ⌒.

All. 2.
Ternstrœmiaceæ ⌒.
Hypericaceæ.
Clusiaceæ ⌒.
Canellaceæ.
Brexiaceæ.
Marcgraviaceæ.

All. 3.
Stackhousiaceæ.
Hippocrateaceæ.
Celastraceæ.
Malpighiaceæ ( ).
Coriarieæ.
Anacardiaceæ.
Ochnaceæ.

All. 4.
Staphyleaceæ.
Rhamnaceæ ( ) ( ) ⌒.

All. 5.
Icacineæ.
Olacaceæ.
Santalaceæ.
Loranthaceæ.
Viscum ⊛ ?

All. 6.
Lauraceæ.
Cassytheæ. — Elæagnaceæ.

Derived from Myristicaceæ and Piperaceæ.

§ 2. *Daphnal.*

All. 1.
Monotropaceæ. Pyrolaceæ. — Vacciniaceæ. Epacrideæ ⌒ ⌒ ( ). Ericaceæ ⌒.

All. 2.
Francoaceæ.
Droseraceæ.

All. 3.
Humiriaceæ.
Cyrillaceæ.

All. 4.
Pittosporaceæ ( ); or ⌒.
Grossulariaceæ ⌒; or ( ); or ⌒ ( ).
Escalloniaceæ ⌒.

All. 5.
Granateæ.
Combretaceæ.
Pomaceæ ⌒; or ⌒ ( ).

All. 6.
Calycanthaceæ.
Amygdaleæ.
Rosaceæ ⌒.
Saxifragaceæ ⌒ ( ); or (*).

All. 7.
Penæaceæ. Aquilariaceæ. — Daphnaceæ. — Sanguisorbaceæ.

Derived from Lauraceæ.

§ 3. *Garryal.*

All. 1.
Stellatæ ⌒.
Cinchonaceæ ⌒; or ( ) ( ) ⌒.
Caprifoliaceæ (*); or ( ); or ⌒.

All. 2.
Cornaceæ ⌒.
Alangiaceæ ⌒ ⌒ ( ).
Begoniaceæ ( ) ( ) ⌒.
Datiscaceæ.

Belvisiaceæ.
Rhizophoraceæ.
Barringtoniaceæ.
Columelliaceæ.
Philadelphaceæ.
Hydrangeaceæ ⌒ ⌒ ( ).
Cunoniaceæ ( ).

All. 3.
Garryaceæ ⊛ (Douglas).
Fadyenia (*).
Helwingiaceæ.

Derived from Lauraceæ; or Santalaceæ.

PROTEROCARPOUS.

§ 4. *Brunial.*

All. 1.
Umbelliferæ ⊛; or ⌒ ⌒ ( ).
Araliaceæ ⌒ ⌒ ( ).

All. 2.
Bruniaceæ.
Hamamelideæ ⌒.

Derived from Helwingiaceæ, All. 1. from Cornaceæ.

HETE…

§ 1.

Dia… My… Stil… ⌒ Em… Eat…

All. 3.
Elatineæ.
Lythraceæ ⊛; or ⌒ ( ).
Podostemaceæ.

Cra… Re… Ta… Fr…

Nyctagineæ. — Po…

ENDOGENS.—Zosteraceæ (*)? Graminaceæ (*). Cyperaceæ (*). Araceæ ⊛; or (*). Typhaceæ ⌒ ( ) when dicarpous. Palmaceæ ⌒.

CASUARINAL EXOGENS.—Loganiaceæ ⌒; or ⌒ ( ). Apocynaceæ ⊛; or ⌒. Asclepiadeæ ⌒. Euphorbiaceæ ⊛; or (*). Stilagineæ ⌒ ( ). Juglandeæ ⊛; or (*). …reæ ⌒. U…

In this Table ⊛ indicates that the Carpels are all anterior and posterior; ⌒ with few exceptions anterior and posterior; (*) all right and left; ( ) with few exceptions right and le…; ⌒ (… va…

TABLE IV.

O WHICH (ON THE FOREGOING PRINCIPLES) NATURAL COMBINATIONS CAN BE EFFECTED.

POLYGONO-LYTHRAL.

HETEROCARPOUS.		PROTEROCARPOUS.					
§ 1. *Polygonal.*		§ 2. *Sapotal.*	§ 3. *Crassuloidal.*		§ 4. *Tetragonial.*	§ 5. *Onagrarial.*	§ 6. *Myrtal.*
ALL. 1. Diapensiaceæ. Myoporaceæ ⊛. Stilbaceæ ⊛; (or ⌒?). Empetraceæ. Batideæ.	ALL. 2. Salvadoraceæ. Myrsinaceæ. Primulaceæ. Plumbagineæ. Brunoniaceæ. Plantagineæ ⌒.	ALL. 1. Sapotaceæ ⌒.	ALL. 1. Hydrophyllaceæ (*). Ehretiaceæ ( ); (or ⊛). Nolanaceæ ⌒? Cordiaceæ. Boragineæ ⌒.	ALL. 2. Selagineæ ⊛; (or ⌒?). Callitrichaceæ (*).	ALL. 1. Valerianaceæ. Dipsaceæ. Globulariaceæ. Calyceraceæ.	ALL. 1. Campanulaceæ ( ) ( ) ⌒; or ( ) ⌒. Lobeliaceæ ⊛. Stylidiaceæ ⊛. Goodeniaceæ ⊛.	ALL. 1. Cichoraceæ (*). Compositæ ⊛; or ⌒.
ALL. 4. Crassulaceæ. Reaumuriaceæ. Tamaricaceæ. Frankeniaceæ.	ALL. 5. Portulaceæ. Caryophyllaceæ ⌒. Illecebraceæ ⊛. Chenopodiaceæ, Stigmas ⊛; or ⌒. Amaranthaceæ, Stigmas (*); or ⌒.				ALL. 2. Cactaceæ. Ficoideæ. ALL. 3. Tetragoniaceæ ⌒. Scleranthaceæ.	ALL. 2. Onagrariæ ⊛. Hippurideæ.	ALL. 2. Chamælauciaceæ. Myrtaceæ ⊛; or ⌒. Lecythideæ. Melastomaceæ ⊛?
ALL. 6. Polygonaceæ (*).	Basellaceæ.						
Derived from Lauraceæ and Cassytheæ.		Derived from Salvadoraceæ?	Derived from Crassulaceæ and Elatineæ.		Derived from Illecebraceæ.	Derived from Podostemaceæ.	Derived from Lythraceæ.

PROTEOIDAL.

ALL PROTEROCARPOUS.					
§ 1. *Phytolaccal.*	§ 2. *Petiverial.*		§ 3. *Proteal.*		
ALL. 1. Cuscutaceæ. Convolvulaceæ ⊛. Polemoniaceæ.		ALL. 1. Pedaliaceæ ⊛. Gesneraceæ ⊛. Bignoniaceæ ⊛.	ALL. 1. Acanthaceæ ⊛. Scrophulariaceæ ⊛. Utriculariaceæ ⊛.	ALL. 2. Jasminaceæ ⊛; or ⌒. Verbenaceæ ⊛. Labiatæ ⊛.	
ALL. 2. Sterculiaceæ. Malvaceæ. Byttneriaceæ. Surianeæ. Tiliaceæ ( ) ( ) ⌒.	ALL. 2. Cruciferæ (*). Capparideæ (*). ALL. 3. Vivianaceæ. Geraniaceæ. Oxalideæ. Linaceæ. Chlænaceæ. Zygophyllaceæ. Balsaminaceæ. Resedaceæ ⊛. Tropæolaceæ ⊛? Limnantheæ.	ALL. 4. Cedrelaceæ. Meliaceæ. Amyrideæ. Aurantiaceæ. Simarubaceæ. Rutaceæ. Xanthoxylaceæ ( ) ( ) ⌒. Connaraceæ. ALL. 5. Rhizobolaceæ. Sapindaceæ ( ) ( ) ⌒. Erythroxyleæ. Aceraceæ ( ).	ALL. 3. Vochysiaceæ. Polygalaceæ ⊛. Tremandraceæ ⊛.	ALL. 4. Moringaceæ. Papilionaceæ. Cæsalpinieæ. Mimoseæ. Chrysobalaneæ.	
ALL. 3. Gyrostemoneæ. Phytolaccaceæ.	ALL. 6. Petiveriaceæ.		ALL. 5. Proteaceæ.		
Derived from Nyctagineæ.	Derived from Phytolaccaceæ.		Derived from Petiveriaceæ.		

…e ⌒. **Urticaceæ** (Elatostemma)( ). **Ulmaceæ** ⌒. **Myricaceæ** ( ). **Cupuliferæ** ⊛; or ( ). **Betulaceæ** ⊛; (or ⌒ ⌒ ( )?). **Altingiaceæ** ⌒. **Salicaceæ** (*); (or ( )).

⌒ ( ) variable; and ⌒ ⌒ ( ) and ( ) ( ) ⌒ show the degree of variation.

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VII.—*On Relative Position; including a new Arrangement of Phanerogamous Plants.* By B. Clarke, F.L.S. &c.

[With a Plate.]

Part I.

On the Position of the Raphe.

The position of the raphe in anatropal ovules is a character which has hitherto attracted but partial attention, yet is, as will be seen, one of much constancy, being rarely variable in the same natural order, and the exceptions also, in most if not in all instances, being readily explained.

For the purpose of giving to this physiological character a more definite form, I will endeavour in the first place to show what is the most usual position of the raphe, where each margin of the carpel bears a single row of ovules, as in *Pæonia*, and afterwards notice the variations of its position, more especially where the ovule is single.

The most usual position of the raphe where the ovules form two rows—one row to each margin of the carpel—is the same throughout the families of phanerogamous plants, viz. the raphes of the two opposite rows lie in apposition with each other in the mesial line of the carpel, or, in other words, are turned towards each other, and the ovule bends downwards so as to be in contact with the parietes. And hence it may be a question whether this is not the normal position, as it is common to Endogens and Exogens, of which Amaryllideæ, Liliaceæ, Ranunculaceæ, and Passifloraceæ contain well-marked examples.

But when anatropal ovules are very numerous in consequence of each placenta bearing more than a single row, this regularity of position is not always observable, further than that the raphe usually retains its lateral position as in Cucurbitaceæ; and campylotropal ovules also not unfrequently have an equivalent character in the direction of their curvature.

It is chiefly therefore when the ovule is reduced to one, that characters of much importance can be derived from the relative position of the raphe to the placenta; and for the purposes of arrangement, the positions of the anatropal ovule may be described under the following variations, each of them including also some instances in which the ovules are two, or three, or more numerous.

1. Ovule pendulous with the raphe turned away from the placenta.
2. Ovule pendulous with the raphe lateral, so that it appears as if it were turned sideways in the cell.
3. Ovule pendulous with the raphe next the placenta.
4. Ovule horizontal with the raphe on the upper surface.
5. Ovule horizontal with the raphe lateral.
6. Ovule horizontal with the raphe on the under surface.
7. Ovule erect with the raphe next the placenta.
8. Ovule erect with the raphe on one side, that is, neither in apposition with the placenta, nor yet turned directly away from it.
9. Ovule erect with the raphe turned away from the placenta.

1. *Ovule pendulous with the raphe turned away from the placenta.* This character was first observed by Mr. Brown in *Euonymus*, and subsequently by Dr. Schleiden in Ranunculaceæ (Annals of Natural History, vol. v. p. 164), who, referring to Mr. Brown's researches, remarks: "As far as I am aware, no one has profited by his inquiries in order to solve similar anomalies which obscure the clear principles of affinity," and adds some further observations, describing it as "ovulum spurie pendulum anatropum raphe aversa."

The researches of Dr. Schleiden have already shown that in the Typhaceæ the raphe is averse, and as the Ranunculaceæ so nearly approach Endogens, it might be supposed that it would be of frequent if not constant occurrence in this class; and I am able to add that in *Chamædorea elegans*, although the ovule is not completely pendulous, the raphe is next the dorsum of the cell; that in *Potamogeton* the ovule shows a decided tendency to it in the direction of its curvature; and that the numerous ovules of Araceæ also show a tendency to it by the raphe being frequently on the upper surface. There are, however, apparent exceptions afterwards particularly alluded to.

In Exogens it occurs more frequently as Endogens are approached, which the following enumeration will show:—1. *Ne-*

lumbium. 2. Hydropeltideæ (ovules two, one above the other). 3. Ranunculaceæ. 4. Monimiaceæ. 5. Lauraceæ. 6. Anacardiaceæ. 7. *Coriaria* (Pl. II. figs. 1 & 2). 8. Malpighiaceæ (in those genera in which the funiculus is next the dorsum of the cell). 9. Celastraceæ. 10. Ternströmiaceæ (ovules two, collateral). 11. Ebenaceæ (ovules two, collateral). 12. Icacineæ. 13. Loranthaceæ (Pl. II. fig. 3, and see also Part III.). 14. Plumbagineæ. 15. Illecebraceæ. 16. Chenopodiaceæ. 17. Amaranthaceæ. 18. *Geissoloma* (ovules two, collateral). 19. Cyrillaceæ. 20. *Helwingia*. 21. *Aucuba*. 22. Cinchonaceæ (Pl. II. fig. 4). 23. Tetragoniaceæ. 24. Calyceraceæ. 25. *Dipsacus*. 26. Onagrariæ (ovules three or four).

The campylotropal ovule in which the radicle of the embryo subsequently formed is turned towards the placenta, as in Amaranthaceæ, is a character which deserves especial attention, if it is equivalent to that of the raphe averse in the pendulous anatropal ovule, and that it is so, *Statice* and *Plumbago* seem to prove. That *Plumbago* is a genuine instance of the raphe averse there appears no reason to doubt, because it is constantly so,—the raphe being always on the side of the ovule which is directly away from the funiculus, the latter coiling round the edge of the foramen to join it. And if its occurrence in the ovule of *Plumbago* is admitted, then there can scarcely remain a doubt of the correctness of the inference in question, because in *Gomphrena* and *Philoxerus*, where the ovule is equally suspended as in *Plumbago*, the foramen and subsequently the radicle are always next the funiculus. It may be added also, that in *Scleranthus annuus* the ovule as regularly curves away from the funiculus, as in *Gomphrena* it curves towards it (see also Part III. and the accompanying figures); and this question is almost set at rest, when it is considered that no distinction which is absolute exists between anatropal and campylotropal ovules, as in *Trianthema* the ovules are simply campylotropal, but in the nearly allied genera *Galenia* and *Tetragonia* a short raphe is present, although the ovule is curved as in the former case*.

2. *Ovule pendulous with the raphe lateral.* This has been

* Since the above was written, I have ascertained that in *Atriplex* the same inversion of the ovule takes place as in *Euonymus* and Ranunculaceæ when it is single and pendulous; thus in *A. angustifolia* the seed is erect and the cotyledons next the placenta, being on that side of the ovary to which the short funiculus is adherent; in *A. laciniata* the seed is attached above the middle of the wall, so that being vertical, the cotyledons are on the upper surface, and the radicle underneath curving up so that its extremity reaches to the hilum; and in *Halimus pedunculatus* (olim *A. pedunculata*) the inversion is complete, the seed being pendulous and the cotyledons turned away from the funiculus.

already noticed as occurring in *Cornus* and *Marlea,* and the following enumeration will show that it is one of the more frequent variations of the position of the raphe.

1. *Pontedera lanceolata.* 2. Aquifoliaceæ (*Ilex*). 3. Styraceæ (*Halesia*—ovules two). 4. Oleaceæ (ovules two). 5. *Malpighia* and other genera of Malpighiaceæ in which the funiculus (representing the raphe) is constantly lateral (Pl. II. fig. 5). 6. *Nitraria* as figured by Prof. Lindley. 7. Santalaceæ. 8. Myoporaceæ (ovule single or two). 9. Illecebraceæ. 10. Chenopodiaceæ. 11. Epacrideæ (*Acrotriche*). 12. Caprifoliaceæ. 13. *Globularia.* 14. Dipsaceæ. 15. Valerianaceæ. 16. Hippurideæ (*Goniocarpus*). 17. Hamamelideæ. 18. Bruniaceæ. 19. *Schizandra.*

In *Corrigiola* the cotyledons are lateral, that is, neither next the funiculus nor yet directly removed from it, and therefore if the ovule were completely inverted the raphe would be lateral. In *Paronychia,* however, the cotyledons are turned away from the funiculus and the radicle in relation with it; but as the raphe averse, and the raphe lateral, occur in the same family, as in *Aucuba* and *Cornus,* and equivalent characters also in Malpighiaceæ, this offers an explanation of the variable relation of the cotyledons to the funiculus in Illecebraceæ, and also tends to show that the raphe averse the placenta and the cotyledons averse it (*i. e.* next the dorsum of the cell) are characters of equivalent value.

3. *Ovule pendulous with the raphe next the placenta.* This, as is well known, is the ordinary position of the raphe in pendulous anatropal ovules; but although it is the more common, it is of rare occurrence in the Heterocarpous families, as will be seen from the Tables.

4. *Ovule horizontal with the raphe on the upper surface.* Of this position I have hitherto observed only three instances. 1. A species of *Macleya* in which the ovules are six, three on each placenta, having the raphe constantly on the upper surface. 2. Araceæ. Where they are numerous, many of the ovules have this character, but in others the raphe is lateral. 3. *Fumaria officinalis.* The ovule, although not anatropal, has the equivalent character of the foramen, being always directly below its attachment to the wall of the ovary. To these perhaps should be added *Paris quadrifolia* as the ovules are scarcely ascending, the raphe being frequently on the upper surface but sometimes lateral, thus agreeing with Araceæ; and also the ovules on the upper portion of the placenta in *Swietiana,* where in the early stages they are horizontal.

5. *Ovule horizontal with the raphe lateral.* Of this no instance has been observed where the ovule is single, except in Chenopo-

diaceæ, the ovules of which have an equivalent character in those genera in which the seed subsequently produced is horizontal; and even when they are two it is very rare, having been only observed in *Talauma* among Magnoliaceæ and *Trianthema*, the latter of which is afterwards more particularly noticed.

6. *Ovule horizontal with the raphe on the under surface.* Of this no instance has been observed where the ovule is single, nor yet where they are two, unless it is that in *Geranium Robertianum* they are in their early stages nearly horizontal; and Asclepiadeæ and Apocynaceæ are the only ascertained instances where the ovules are numerous.

7. *Ovule erect with the raphe next the placenta.* This, as is well known, is the ordinary position of the raphe in erect anatropal ovules, and occurs I believe not unfrequently where they are numerous, as in *Cuphea* and *Reaumuria*.

8. *Ovule erect with the raphe lateral.* This character, which was first observed by Mr. Bennett in Rhamnaceæ, and by that gentleman attributed to torsion of the funiculus, obtains to a considerable extent among Exogenous families, but is very rare in the Endogenous, *Calamus viminalis* being the only instance hitherto observed.

1. Elæagnaceæ. 2. Rhamnaceæ. 3. Staphyleaceæ (ovules in two rows). 4. Stilbaceæ. 5. Portulaceæ (ovules campylotropal). 6. *Justicia* (ovules two, one above the other). 7. Labiatæ and Verbenaceæ?*. 8. Jasminaceæ (ovules two). 9. *Trianthema decandra* (ovules campylotropal). 10. Goodeniaceæ (ovules two or more, numerous).

9. *Ovule erect with the raphe turned away from the placenta.* Since my first Dissertation on the Position of the Raphe was read at the Linnæan Society, several additions have been made to the instances of the raphe having this position then particularly adverted to, and it is not improbable that others remain as yet unobserved. 1. *Limnocharis Humboldtii* (ovules numerous). 2. *Penæa fruticulosa* (ovules two, Pl. II. fig. 8). 3. *Geissoloma* (ovules four, Pl. II. figs. 6 & 7). 4. *Berberis vulgaris* (ovules two). 5. *Geranium* (ovules two). 6. *Nolana*. 7. *Calytrix virgata* (ovules two). 8. Compositæ (Pl. II. fig. 9). 9. *Chrysobalanus* (ovules two).

In Compositæ the raphe in several genera examined proved to be always on the anterior side of the ovule, and consequently in relation with the anterior angle of the ovary, and hence it is averse from the placenta, supposing the anterior to be the fertile

* In such species of Labiatæ as I have examined, the raphe is not in relation with the inner angle of the achenium, but inclines more or less away from it as it ascends.

carpel (see Part III. Compositæ). It may be interesting, however, here to add, that in *Aster* and *Centaurea* the ovule arises from the base towards the posterior side of the ovary always more or less distinctly.

In such Cichoraceæ as I have examined, the raphe is for the most part or always lateral (that is, towards one side of the ovary), in no instance posterior; but as the carpels in this section of Compositæ are right and left the axis, the position of the raphe might be expected to be different. In *Calytrix virgata* the raphe is not so completely averse as in the other instances, being intermediate between lateral and averse; but in *Berberis vulgaris* I have since ascertained it is always next the dorsum of the carpel.

Causes of the Variations.

The cause of the first of these variations has already been demonstrated by Dr. Schleiden (*loc. cit.*), and each of the others being also especially deserving of attention as influencing the value of the characters derived from the position of the raphe, I would suggest the following as the most frequent, if not unexceptionable.

1. That a single ovule pendulous with the raphe averse, being, as first observed by Mr. Brown, an erect ovule pressed or growing downwards, may result from the cavity of the ovary elongating in that direction, while its upper part remains stationary. As tending to show that it may be produced by pressure, I have met in *Sassafras officinale* with an instance in which the ovule had apparently forced its way through the upper part of the ovary as it was growing from its external surface,—the ovary having again closed and the cavity still remaining, but empty. It may be further suggested, however, that it is only when an erect ovule has the raphe next the placenta, that it has the raphe averse when it thus becomes pendulous.

2. That a single pendulous ovule with the raphe lateral is an ovule originally extending horizontally from the placenta with the raphe lateral (as in Ranunculaceæ, where the ovules are numerous, and in Cucurbitaceæ), and subsequently becoming pressed downwards in consequence of the ovary elongating in that direction more than upwards. By the raphe lateral in horizontal ovules, it is to be understood that it is not on the upper surface towards the stigma, nor beneath it towards the base of the ovary.

3. That a single pendulous ovule with the raphe next the placenta may possibly be an ovule originally extending in a horizontal direction from the placenta, having the raphe on the under surface, and should perhaps be regarded as the only truly

pendulous ovule, including however those pendulous campylotropal and amphitropal ovules with the foramen and (in the seed) the radicle of the embryo turned away from the placenta, while the cotyledons are in relation with it.

4, 5 & 6. That these three positions may perhaps be equally regarded as normal, although the 4th and 6th are comparatively so rare. It may here be observed that an ovule horizontal with the raphe on its upper surface is doubtless equivalent with an ovule pendulous with the raphe averse, and the same observation may apply to those having the raphe on their under surface, as compared with those which are pendulous with the raphe next the placenta.

7. That an erect ovule with the raphe next the placenta is usually an ovule raised into that position without any torsion taking place in the funiculus, but that torsion may, in this instance, sometimes have taken place, its normal position in such a case being lateral. It here becomes an interesting question as to whether or to what extent twisting of the funiculus may take place; two positions there are at least in which in all probability it does take place,—in some of those instances where the ovule is longer than its raphe, and the funiculus so short that the ovule appears as it were sessile; thus in *Geum urbanum*, the ovule in growing erect must have the raphe next the placenta, as its apex or foramen projects much below its point of attachment to the ovary, and the ovule of *Cliffortia ilicifolia* must for the same reason in being pendulous have its raphe next the placenta; and as far as my own observations have gone, I believe a very slight degree of pressure will occasion twisting of the funiculus, so that the form of the ovary or winged seeds might give rise to an alteration of position. But whether it ever takes place spontaneously, as in the filament of *Lopezia*, remains a question, as the funiculus has very rarely any appearance of being twisted; *Dodonæa* and other Sapindaceæ, and part of Rhamnaceæ, as referred to by Mr. Bennett, being the only instances particularly noticed where it seems likely that the position of the ovule is to be attributed to that cause.

8. That a single ovule erect with the raphe lateral is a horizontal ovule spontaneously becoming erect or pressed upwards by the ovary remaining contracted below while its upper part expands; this is distinctly shown to take place in Tetragoniaceæ (in an equivalent character), where *Trianthema micrantha* has two seeds horizontal, one above the other, the cotyledons being lateral, and *T. decandra* two erect seeds, one completely above the other, the cotyledons also in each of them being lateral.

9. Ovule erect with the raphe turned away from the placenta. This position is to be accounted for on the same principles as the

foregoing, *i. e.* either from the peculiar form of the ovary or by the spontaneous growth of the ovule; and in the case of *Limnocharis* it appears rather to arise from the latter, as the ovary makes no pressure on the greater part of the ovules. The position of the raphe in the seed of *Geranium Robertianum* is however rather produced by pressure, as it is forced to become ascending in consequence of being attached near the base of the cavity, and in *Nolana* the external side of the ovule (on which the raphe is situated) curves forward, giving it somewhat the appearance of having been forced upwards in its growth.

Value as a Differential Character.

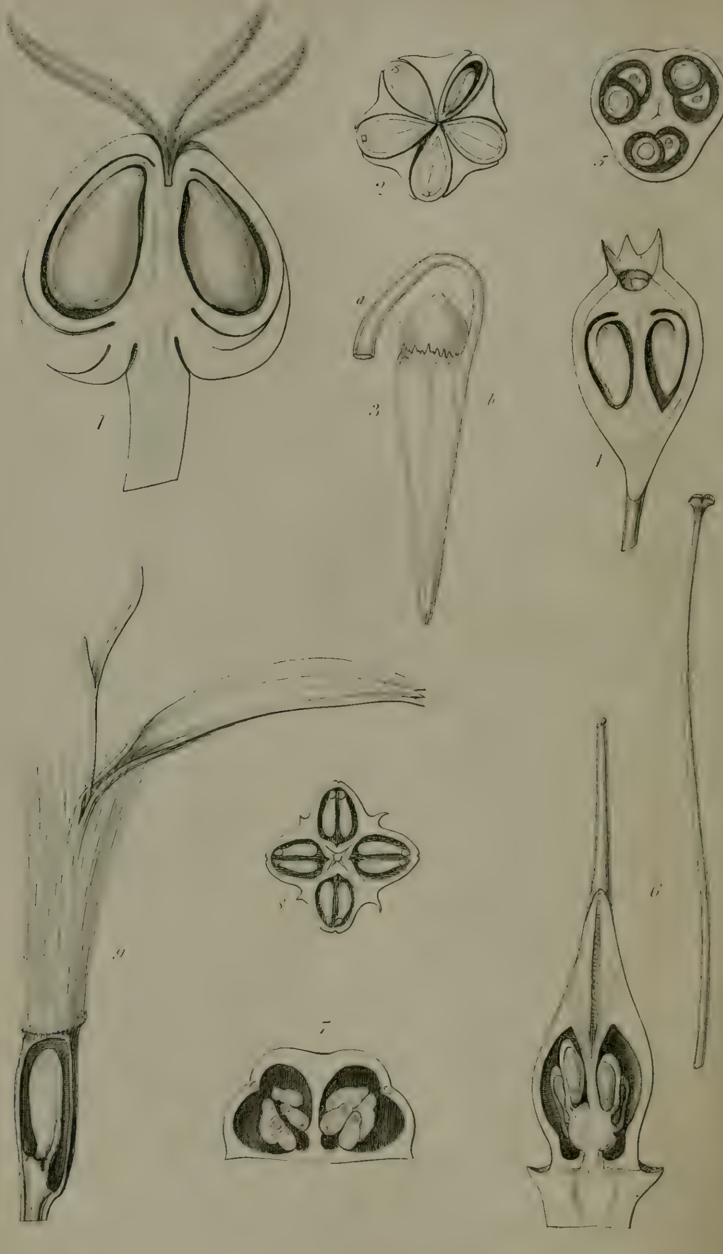
Should further observation show the position of the raphe when differing from its ordinary relation to the placenta to be a character without exception in the families in which it occurs, it will form an important distinction between many of them which otherwise nearly approach each other; thus Lauraceæ and Daphnaceæ have usually been considered as almost conterminous, and the Urtical Orders have by most botanists been compared with Chenopodiaceæ and its allies. It may also tend to a more definite distribution of the Orders in Alliances, as for instance of those related to Rutaceæ, Sapindaceæ, Rhamnaceæ, and Clusiaceæ, as showing *Erythroxylon* to differ from Malpighiaceæ, *Spondias* from Aurantiaceæ, &c.

Berberis differs from Ranunculaceæ in having the raphe away from the placenta, and *Hedera* from *Cornus* in its being next the placenta as in Umbelliferæ.

It may also show a distinction between *Nolana* and Convolvulaceæ, and its near approach to Boragineæ, as the short raphe in the latter family is next the placenta.

The raphe next the placenta also separates some minor families from others in or with which they have been included, as Selagineæ from Myoporaceæ, Scleranthaceæ (the position of the cotyledons being equivalent) from Illecebraceæ; and differences in this character between many others usually regarded as in near affinity will be seen by the Tables.

As to whether a single pendulous ovule having the raphe next the placenta ever occurs among Endogens is not fully ascertained, as in *Tamus* the ovule is longer than the raphe, which also in a very early stage has more or less the appearance of being lateral; and in *Dioscorea* and *Rajania*, where the raphe is also next the placenta, the seeds are winged. These may be compared with *Menispermum* where the raphe is very short, so that the ovule in having its foramen superior must have it next the placenta, or if the raphe is wanting, have an equivalent character; so that it



B. Clarke del.

J. De C. Sowerby sc.

is possible that in all these genera the raphe may be lateral, as in *Schizandra* and Magnoliaceæ; and to this may be added, that in a *Menispermum* having two ovules, the lower one is oblique or almost horizontal. *Limnocharis Humboldtii* has the ovules ascending with the raphe averse, and a part of the ovules in *Nymphæa* are pendulous with the raphe next it, which seems to show that it may occur in Endogens; but in the latter instance many of them have the raphe averse, and some of the ovules of the former have the raphe variable, if not next the placenta or dorsal surface of the carpel to which they are attached *.

But supposing the position of the raphe next the placenta in Endogens to be the consequence of torsion of the funiculus, another question would then arise, viz. as to whether many of the instances in which the raphe has this relation to the placenta are not also the consequence of torsion; to which the only reply that at present offers, is that the cases before alluded to, in which the ovules are horizontal and the raphe on the under surface, show beyond doubt that this position of the raphe is not to be ordinarily referred to that cause.

In conclusion it may be observed, as a remarkable circumstance, that while pendulous ovules with the raphe averse and the raphe lateral occur in several instances in the same family, and it seems not unlikely may exist in the same genus, as the vertical and horizontal positions of the seed in *Chenopodium* and *Atriplex* appear to be equivalent characters, yet pendulous ovules with the raphe turned away from the placenta and the raphe next it are not known in the same family, nor yet even the raphe lateral and the raphe next the placenta. And although the raphe lateral in the case of ovules numerous is a character of but little value, yet, looking at the affinities of those families in which a single ovule erect or pendulous has the raphe lateral, these two positions may be regarded as being of equivalent value to ovule pendulous with the raphe averse, and even more decidedly so than ovule erect with the raphe next it.

EXPLANATION OF PLATE II.

Fig. 1. *Coriaria nepalensis,*—an ovary in longitudinal section.

Fig. 2. *Coriaria myrtifolia,*—a transverse section of a fruit.

Fig. 3. *Mysodendron* sp.; an immature seed, showing the relation the funiculus has to the hilum or point of attachment; *a*, the embryonal

* I find also that *Butomus umbellatus* agrees with *Limnocharis* in the position of the raphe, but I have reasons for believing that these cases should not be regarded as exceptions, and I would suggest that the ovules are here attached to the inner surface of the placenta, not to the external as in axile and other modes of placentation.

sac protruding; *b*, a thickened rib of tissue (analogous to the raphe?).

Fig. 4. *Chiococca anguifuga*,—an ovary in longitudinal section.

Fig. 5. *Bannisteria* sp.,—a transverse section of an ovary.

Fig. 6. An ovary of a *Sarcocolla* in longitudinal section, two of the ovules being removed from each cell.

Fig. 7. A transverse section of half the ovary.

Fig. 8. A transverse section of the ovary of *Penæa fruticulosa*.

Fig. 9. *Aster sibiricum*; a floret of the ray as seen laterally, a part of the wall of the ovary being removed.

VIII.—*Observations on the* Solanaceæ. By John Miers, Esq., F.R.S., F.L.S.

[Concluded from p. 14.]

Having animadverted upon M. Dunal's general arrangement of the *Solanaceæ*, I now proceed to offer a few comments on some of the genera. In p. 449 we find *Cacabus* included in *Physalis*: it is nearly four years since (*huj. op.* iv. 252) I pointed out the characters by which the former differs from the latter, one of the most striking features being, that in *Cacabus* the inflorescence is fasciculated, while in *Physalis* the axillary flowers are invariably solitary. In this last-mentioned genus the calyx is at first more urceolate, 5-toothed, afterwards it becomes greatly enlarged, inflated, pentagonously globular and subreticulated: in *Cacabus* at an early stage it is tubular, inflated below by five salient saccate lobes, and narrowed towards the mouth, where it is divided into five acute segments; it is then delicately thin in texture, finely and elegantly reticulated, and afterwards increases in size, but less in proportion, when it always retains its delicate texture, form, and almost araneoid appearance. In *Physalis* the corolla is broadly and roundly campanular, generally of a yellow colour, and is either immaculate, or more usually marked with five large purple spots in its lower moiety; it is seldom more than twice the length of the calyx: in *Cacabus* the corolla is large and conspicuous, tubular, and slender at base, suddenly expanding into a funnel-shaped campanular form, with a nearly entire limb, like the flower of a *Nolana* or *Convolvulus*, being like them of a delicately pale blue, marked with five long linear rays, each ray formed of three nearly parallel nervures; it is at least three times the length of the calyx. M. Dunal states that *Cacabus* has the habit and the corolla of *Atropa*. On this point he appears to me clearly under a mistake, for its habit is certainly more that of a *Nolana*, being a prostrate herbaceous plant, with a fleshy angular stem, and its corolla, as above shown, bears no resemblance to that of *Atropa*. One of the peculiar features which I have pointed out in this genus, is the remarkable fleshy epigynous gland, seen on the summit of the ovarium, like the same feature seen in *Thinogeton*, to which genus it closely approaches in its general habit, and in the form and colour of its flowers: there is indubitably much analogy in this peculiar feature, observable in both these genera, with the still more conspicuous fleshy enlargement of the summit of the ovarium in *Hyoscyamus*: there is nothing approaching to this structure in *Physalis*. It is for these reasons that I preferred placing *Cacabus* among the *Hyoscyameæ* next to *Thinogeton*, although I have not discovered that its fruit possesses an opercular dehiscence, nor been able to ascertain the æstivation of its corolla. M. Dunal does not appear to have been aware of these facts, but Prof. A. DeCandolle in a note of the Appendix to the 'Prodromus' (p. 690) adheres to the views of that botanist on this subject, and reverses the conclusions to which I arrived, without attempting to subvert the facts above-mentioned, or annul the reasonings founded on them: he quotes the character I published of *Cacabus nolanoides* under the name of *Physalis nolanoides*. These facts remain submitted to the judgement of botanists, and it appears to me that any one who will carefully compare the analysis given of that plant in plate 49 of my 'Illustrations' with any species of *Physalis*, will admit that it cannot possibly belong to the latter genus, and that *Cacabus* is justly entitled to claim a generic distinction. *Physalis*, indeed, possesses such well-marked features, that it seems a pity to mar its simple and prominent characteristics by combining it with a group so essentially distinct as *Cacabus*.

The ample generic character of *Witheringia*, as defined by M. Dunal (p. 402), and the details he has given from an examination of good specimens of L'Héritier's typical species, *W. solanacea*, confirm the opinion I long ago expressed in regard to this genus: these details, if carefully compared, will be seen to differ in no respect from the characters presented by most species of *Saracha* of the 'Flora Peruviana.' The reasons for this conviction were given nearly four years since (*huj. op.* iii. p. 142 et 451), when I considered the typical plant above-mentioned as a species of *Saracha*: to this inference I was led by its striking resemblance to another species closely allied to it, which I figured in my 'Illustr. South Am. Plants' in plate 39 A, under the name of *Saracha glandulosa*, the only structural difference between these species being that L'Héritier's plant is tetramerous, while all other species of *Saracha* are pentamerous. As M. Dunal considers this difference to be of no generic value, it is clear that under such circumstances the *Witheringia*, L'Hérit. (non aliorum), and *Saracha*, R. and P. (with a single species excepted), must merge into one genus, and according to the rule of priority the former will claim the precedence: in such case the species of this genus will be as follows:—

1.	Witheringia solanacea, L'Hérit.		....	DC. Prodr.	xiii.	402
2.	—— villosa, *nob.*	=	Saracha villosa, *Don*	,,	,,	430
3.	—— contorta, *nob.*	=	—— contorta, *R. & P.*	,,	,,	,,
4.	—— Zuccagniana, *nob.*	=	—— Zuccagniana, *Don*	,,	,,	,,
5.	—— biflora, *nob.*	=	—— biflora, *R. & P.*	,,	,,	431
6.	—— procumbens, *nob.*	=	—— procumbens, *R. & P.*	,,	,,	,,
7.	—— umbellata, *nob.*	=	—— umbellata, *G. Don*	,,	,,	,,
8.	—— alata, *nob.*	=	—— alata, *Dun.*	,,	,,	,,
9.	—— jaltomata, *nob.*	=	—— jaltomata, *Schl.*	,,	,,	432
10.	—— allogona, *nob.*	=	—— allogona, *Schl.*	,,	,,	,,
11.	—— dentata, *nob.*	=	—— dentata, *R. & P.*	,,	,,	,,
12.	—— viscosa, *nob.*	=	—— viscosa, *Schr.*	,,	,,	433
13.	—— ciliata, *nob.*	=	—— ciliata, *nob.*	,,	,,	683
14.	—— propinqua, *nob.*	=	—— propinqua, *nob.*	,,	,,	,,
15.	—— diffusa, *nob.*	=	—— diffusa, *nob.*	,,	,,	,,
16.	—— laxa, *nob.*	=	—— laxa, *nob.*	,,	,,	,,
17.	—— auriculata, *nob.*	=	—— auriculata, *nob.*	,,	,,	,,
18.	—— conspersa, *nob.*	=	—— conspersa, *nob.*	,,	,,	684
19.	—— glabrata, *nob.*	=	—— glabrata, *nob.*	,,	,,	,,
20.	—— acutifolia, *nob.*	=	—— acutifolia, *nob.*	,,	,,	,,
21.	—— vestita, *nob.*	=	—— vestita, *nob.*	,,	,,	,,
22.	—— glandulosa, *nob.*	=	—— glandulosa, *nob.*	,,	,,	,,
23.	—— Candollei, *nob.*	=	—— Miersii, *A. DC.*	,,	,,	,,

The *Saracha geniculata*, Mart. Gall. (Prodr. xiii. 430), should be removed from this genus and placed in *Physalis* (*P. geniculata*): this is evident from the description of its inflorescence and other characters, among which is that the berry is edible as in *P. Peruviana*.

In order to explain the ground on which my conviction of the identity of *Witheringia* and *Saracha* is founded, looking at this latter genus in the sense in which it has been hitherto understood, it may be well to observe, that a difference in the description of generic characters often results from an investigation of the flowers in a living or a dried state: thus in *Saracha* (as hitherto limited), the corolla when dried scarcely shows the fornicated origin of the filaments, the dilated bases of which in that state appear flattened, as if simply adnate to the bottom of the tube; but when these are seen in a living state, the filaments will be found to spring out of as many dilated salient glands, the margins of which often extend upward for some short distance along the tube and form conspicuous hollow cups that secrete a nectariferous juice, a corresponding furrow being often seen externally at the bottom of the tube opposite these glands; the hairy filaments spring at an angle from and are in fact an extension of the front margin of these cups, which, with the dense clothing of long cottony hairs generally seen about the base of the tube, form altogether a kind of fornix or annulus around the ovarium: the anthers are seen in a somewhat connivent group surrounding the stigma. These are precisely the distinguishing features that characterize *Witheringia,* but described in other words by M. Dunal in p. 402: this structure is indistinctly shown in L'Héritier's figure, though better explained in his description. The other features of M. Dunal's diagnosis, as respects the form of the calyx, corolla, pistillum and fruit, will be found to agree completely with those of *Saracha,* the species of which correspond in habit with L'Héritier's typical plant. It would have been better for the sake of convenience to have retained the genus *Saracha,* now so long established, for the group of plants just enumerated: this was maintained as long as a doubt hung over the real nature of L'Héritier's plant; but now that this doubt is removed, we have no alternative but to follow the course demanded by the rules of science.

Having thus removed from *Saracha* all its species, except *S. punctata,* R. & P., which in reality is the original type of this genus as instituted and figured in the Prodromus of the genera of the 'Flora Peruviana' (p. 31. tab. 34), and which I formerly separated from it in order to form the basis of a new genus (*Pœcilochroma*) (Lond. Journ. Bot. vii. 353), we are now compelled to retrace our steps, and re-establish *Saracha* for that group of plants, so that the name of *Pœcilochroma* must consequently be suppressed: the several species enumerated will now stand as follows:—

1. Saracha punctata, *R. & P.*,	instead of	Pœcilochroma punctatum, *nob.*	(*l. c.*)
2. —— frondosa, *nob.*	=	—— frondosum, *nob.*	,,
3. —— guttata, *nob.*	=	—— guttatum, *nob.*	,,
4. —— maculata, *nob.*	=	—— maculatum, *nob.*	,,
5. —— Lobbiana, *nob.*	=	—— Lobbianum, *nob.*	,,
6. —— Lindeniana, *nob.*	=	—— Lindenianum, *nob.*	,,
7. —— Quitoensis, *nob.*	=	—— Quitoense, *nob.*	,,
8. —— Boissieri, *nob.*	=	—— Boissieri, *Dun.* = Lycioplesium Boissieri, *Dun.*	
9. —— Funkiana, *nob.*	=	—— Funkianum, *Dun.*	
10. —— Sellowiana, *nob.*	=	Witheringia Sellowiana, *Sendtn.*	

Considering for the reasons before stated, that among the several individuals included by M. Dunal in *Witheringia,* the typical species only belongs really to that genus, it becomes necessary to indicate the proper position of the remaining species in the manner following:—

2. Witheringia macrophylla, *H. B. K.*	est	Brachistus macrophyllus, *nob.* (*huj. op.* iii. 263).
3. —— Sellowiana, *Sendt.*	=	Saracha Sellowiana, *nob.*
4. —— acuminata, *Dun.*	=	Brachistus acuminatus, *nob.*
5. —— stramonifolia, *H. B. K.*	=	—— stramonifolius, *nob.* (*huj. op.* iii. 263).
6. —— lanceolata, *Dun.*	=	verisimiliter *Solani* species.
7. —— aspera, *Spr.*	=	potius *Borraginea* ut suspicat cl. Dunal.

Witheringia ciliata, H. B. K.; *W. dumetorum*, H. B. K.; *W. mollis*, H. B. K.; *W. rhomboidea*, H. B. K.; *W. riparia*, H. B. K., and *W. diversifolia*, Klotsch, referred by M. Dunal to his genus *Fregirardia*, had been long before placed by me in *Brachistus* (*huj. op.* iii. 263–268).

The *Witheringia* of Von Martius, which I had proposed to restore for a group of plants of which the type is *W. picta*, Mart., must consequently be suppressed, and we shall presently see to what genus these must now be referred. This last-mentioned plant has been oddly arranged by M. Dunal in *Withania*, for what reason it is difficult to conjecture, as it offers no analogy whatever with that genus: it is associated with other kindred species, placed by Dr. Sendtner in his genus *Athenæa*, which is made to form a distinct section of *Withania* under that name (Prodr. p. 458–459). The *Witheringia hirsuta*, Gardn. (No. 239), from Tejuca, a plant that I collected in company with that active botanist, was long ago shown by me (*huj. op.* iii. 145) to be identical with the *Witheringia picta*, Mart. (*Withania picta*, Dun. Prodr. p. 458). This same plant however is *again* referred by M. Dunal to *Bassovia* under the name of *B. Gardneri* (Prodr. p. 409). I was always struck by the strong analogy between the *Witheringia picta*, Mart., and the drawing of *Bassovia sylvestris* (Aubl. tab. 85), but in the absence of more precise evidence in regard to the latter plant the reflection was passed over, as I found this species had been referred by M. Dunal to the genus *Solanum* (Dun. Syn. 22). Now, however, that *Bassovia* has been restored by this distinguished botanist, and its characters displayed at some length, this reflection returns with additional force, especially as the genus *Aureliana* of Dr. Sendtner is at the same time made to be identical with it. If we compare the *Aureliana velutina*, Sendtn. (Flor. Bras. tab. 19) with the figure of *Athenæa anonacea*, Sendtn. (tab. 18 of the same work), and these again with the *Witheringia picta*, Mart. (Nov. Gen. et Sp. tab. 227), and my details of Gardner's plant (in Illust. S. Am. Plants, ii. pl. 35), and keep in recollection that the same species has been referred by M. Dunal, at the same time, both to his section *Athenæa* of *Withania* and to the genus *Bassovia* of Aublet, we must come to the conclusion that the genera *Witheringia*, Mart., *Athenæa*, Sendtn., *Aureliana*, Sendtn., and *Bassovia*, Aubl., are identically one genus, and of these the latter must claim the priority, on account of its long previous existence. To the species of *Bassovia* enumerated by M. Dunal (Prodr. 405–411) we must therefore add *B. picta* (of which *B. Gardneri*, Dun., must be regarded as a synonym), *B. pogogena*, *B. mollis*, *B. micrantha*, *B. pyrifolia*, *B. Pohliana*, *B. Schottiana*, *B.*? *Novo-Friburgensis*, *B. Martiana*, *B. oocarpa*, *B. hirsuta*, and *B. anonacea*, nob.

I have hitherto only spoken of the section *Athenæa*, and it now remains to consider the other species included in the same genus by M. Dunal: of these it is evident that only two really belong to *Withania*—the original *W. aristata*, Pauq., and *W. frutescens*, Pauq., which form a genus marked by distinct characters, the limits and differential features of which have been defined in 'Hook. Journ.' i. 225 (Illust. S. Am. Plants, ii. App. p. 7); the remaining nine species are referable to *Hypnoticum*, *Larnax* and *Puneera*, genera confounded by M. Dunal in the genus *Withania*. This last-mentioned genus differs from *Hypnoticum* in its urceolate calyx with five long setiform teeth, the tube expanding with the growth of the fruit into a large bell-shaped cup, with a still broader open mouth, in the bottom of which the berry is seated; this cup is of somewhat thickened texture, glabrous, and very reticulated by numerous strong transverse veins between its ten longitudinal nervures; the margin is almost entire, with five long setiform processes, which are extensions of the principal nerves: in *Hypnoticum* the calyx is tubular, very tomentose, with five broad short teeth; this increases in size, becomes inflated in the middle, contracted in the mouth, with five erect short teeth, finely reticulated in texture, and enclosing the berry as in *Physalis*. In *Withania* the corolla has the form of a very short tube below, with a limb of equal length, divided into five elongated narrow lobes obtuse at the apex; the stamens are shorter than the tubular portion; the filaments, much dilated at base, form a disjointed annular ring adnate to the base of the corolla; they are compressed, gradually narrowing toward their summit; the anthers, equal to them in length, are erect, pointed at the apex, and cordate at base, by the divarication of the two parallel cells: in *Hypnoticum* the corolla is smaller than in *Withania*, and more tubular; the tubular part, not exceeding the length of the calyx, is marked below the mouth with five coloured spots; it has a small border of five short angular reflexed teeth; the filaments are filiform, arising out of as many expanded processes adnate to the base of the corolla, and the anthers are formed of two parallel cells, without intervening connective. In *Withania* the stigma is formed of two lips with a large intermediate globular stigmatic gland: in *Hypnoticum* the stigma is clavate, obsoletely 2-lobed. In *Withania* the berry is small, seated in the broadly campanular expanded calyx, containing few seeds, which are proportionally large, somewhat conchoid, the embryo of more than a circle, being spirally helical: in *Hypnoticum* the berry is larger, generally of a bright scarlet colour, 2-celled, filled with very numerous small seeds, which are reniform and compressed, with a spiral and nearly annular embryo; the cotyledons, equal in length to the terete radicle, are subdilated and accumbent. These differences are sufficiently evident and numerous enough to constitute a wide generic distinction—the affinity of *Hypnoticum* being much closer to *Physalis*, from which it differs in its much smaller corolla and the adnate placentation of its seeds.

M. Dunal has formed another section of *Withania* out of the *Puneeria coagulans* (Stocks), a plant extremely different from the former genus; in habit and structure it more nearly approaches *Hypnoticum*, resembling it greatly in the form of its flowers: the calyx, however, instead of becoming inflated to a larger diameter than the berry, and reticulated and vesicular, in *Puneeria* invests it closely, remaining opake and tomentous, destitute of visible nervures, brittle, and of the texture of tender paper. Its flowers are diœcious, a rare occurrence among the *Solanaceæ*; the corolla is tubular, scarcely funnel-shaped, with a narrow border of five short reflexed teeth: the whole plant is covered with dense tomentum consisting of stellated brachiate hairs, as in *Physalis* and *Hypnoticum*: in these features there is little in common with *Withania*.

Larnax differs from *Withania* in its herbaceous stems and fasciculated axillary flowers, in its minute urceolate calyx with five short blunt teeth, which increases in size with the growth of the fruit; it is of thin texture, becomes inflated and globular, closely investing and concealing the berry, its mouth being much contracted and tubular, as in *Margaranthus*. The corolla is somewhat bell-shaped, with a border equal in length to the tubular portion, divided into five expanded oblong segments: its stamens have capillary filaments. One species is made to form a section of *Withania* by M. Dunal (*Pseudowithania*), but it will be seen to hold little resemblance to that genus.

The remaining species before alluded to, included by M. Dunal in *Withania*, may therefore be thus disposed of; viz.—

1. *Withania somnifera*, Dun. is *Hypnoticum somniferum*, Rodr.
2. ——— *Morrisoni*, Dun. = *Larnax Morrisoni*, nob. Agreeing with this genus in its numerous fasciculated flowers, its small urceolate calyx and red berries enclosed in an inflated calyx, and in the country of its origin: its characters are quite at variance with *Withania*.
3. ——— *Orinocensis*, Dun. = *Larnax Orinocensis*, nob. (*huj. op.* iv. p. 38).
4. ——— *Xalapensis*, Dun. = *Larnax Xalapensis*, nob. (*ibid.*).
5. ——— *subtriflora*, Dun. = *Larnax subtriflora*, nob. (*ibid.*).
6. ——— *arborescens*, Dun. = of doubtful affinity, not only in regard to the genus, but to the family to which it belongs: its berry is said to be 10-celled, each cell being 1-seeded: it cannot therefore belong to *Solanaceæ*.

7. *Withania ramosa*, Dun.	is *Larnax ramosa*, nob. Agreeing with this genus in the similarity of its inflorescence and structure of its flowers and its red berries enclosed in an inflated calyx, and the country of its origin.
8. ——— *sordida*, Dun.	= *Larnax sordida*, nob. Referrible to this genus for the same reasons.
11. ——— *pulvinata*, Dun.	= *Salpichroma pulvinatum*, nob. From the details given of it evidently belonging to this genus.
12. ——— *coagulans*, Dun.	= *Puneeria coagulans*, Stokes.

The genus *Lycium* differs from all true *Solanaceæ* in the very imbricated æstivation of its corolla, as frequently pointed out, but this character has not been considered by M. Dunal as of any value, for he constitutes a section of this genus (*Schistocalyx*) out of two species where the corolla has apparently a valvate æstivation. The first species is the *Lycium ciliatum*, Schl., a plant referred by me on this very account to *Salpichroma* (Lond. Journ. Bot. iv. 329). As this reference has not been confirmed either by Dr. Sendtner or M. Dunal, it is necessary that I should repeat my reasons for the above conclusion. The habit of the plant, as described by Prof. Schlechtendal, is quite as much that of *Salpichroma* as that of *Lycium*; in both cases the axils of its branches, after the fall of its leaves, become nodose; the stems are angular, from the salient lines decurrent from the points of insertion of the petioles; the exserted stamens are in like manner often densely villous at the points of their origin. It differs however from *Lycium* in its calyx being divided nearly to the base into five very long linear segments, densely ciliated with glandular hairs, and which increases in size with the fruit; the corolla, nearly twice the length of the calyx, is funnel-shaped, with five reflexed subtriangular segments, which are glandularly ciliated on their margins, indicating a valvate or a plicato-valvate æstivation as in *Cestrum*: these segments in *Lycium* are invariably broad and rounded in their form, overlapping one another by their margins, of thin texture, which are almost always glabrous, except in a few cases where they are fringed with simple ciliate hairs: the berry is red, supported by its erect persistent calyx, the lobes of which exceed it in length, while in *Lycium* the berry is supported on its small unchanged cupshaped 5-toothed calyx, not one-fourth or one-sixth the length of the fruit. These are all characters of *Salpichroma* and not of *Lycium*, and although certainly we have not positive evidence, we have every fair indication that the plant in question belongs to the former rather than to the latter genus. This subject will be again considered in a review I have prepared of the genus *Lycium*.

Another singular medley of incompatible genera, resulting from the rejection of the character of æstivation, occurs in the genus *Juanulloa*, which M. Dunal divides into three sections: 1. *Eujuanulloa*; 2. *Physalina*; 3. *Sarcophysa*. In *Juanulloa* proper we see a small group of plants, distinguished by their scandent habit, large thick coriacous leaves and conspicuous pendent flowers; the calyx, covered with dense yellow stellate tomentum, is formed of five distinct sepals, which are connivent by their tomentous margins into a pentagonous tube, with undulating prominent angles; this is persistent, increasing but little with the growth of the berry, which it partially encloses, being generally slit into its original segments by the separation of the adherent edges of the sepals; the corolla, covered also with orange-coloured tomentum, is twice or three times the length of the calyx, and in the form of an elongated narrow tube, somewhat ventricose in the middle, and contracted in the mouth, with a small border of five almost orbicular lobes, quincuncially imbricated in æstivation, being, as well as the tube, of a thick fleshy consistence; the berry is filled with seeds, having a nearly straight terete embryo: these characters are fully delineated in plate 46 of my 'Illustrations.' In *Sarcophysa* we find a corolla very similar in texture and structure, but larger and more ventricose; the calyx, of half its length, is fleshy in substance, roundly tubular, ventricose, decreasing in diameter towards the mouth, where it is terminated by five short erect teeth; this scarcely increases in size, but becomes still thicker, more coriaceous in texture, and is at length irregularly ruptured on one side, nearly to the base, by the growth of its enclosed large berry. This genus has been shown to be generically distinct from *Juanulloa* (*huj. op.* vii. 349), both being closely allied to *Solandra*; its characters are delineated in plate 47 of the same work. The place in the system of *Juanulloa* and *Sarcophysa*, as I have shown, is not among the true *Solanaceæ*, but in the tribe *Solandreæ* of the *Atropaceæ*.

The section *Physalina* of M. Dunal belongs to a very different group, which I have described under the name of *Cleochroma*, a genus closely allied to *Iochroma*, and therefore belonging to the family of the true *Solanaceæ*. The *Juanulloa* (*Physalina*) *umbellata*, Dun. (Prodr. 530) is again recorded (Prodr. 491) as the *Iochroma calycina*, Benth., figured in 'Bot. Reg.' (1831) tab. 20, both being an identical plant of Hartweg's collection (No. 1312), and described by me as *Cleochroma calycina* (*huj. op.* vii. 350). This and two other species of his section *Physalina* are frutescent shrubs, with leaves of more membranaceous texture, with conspicuous purple fasciculated flowers; the calyx is much larger than in *Iochroma*, tubular, thin in texture, 5-toothed, increasing considerably in size during the development of the flower, becoming ventricose in the middle, and finally enclosing the fruit;

the corolla, of more membranaceous texture, is tubular, and of small diameter at its base, soon expanding above into a broad funnel-shape, with a wide conspicuous border of five large acute lobes, which are plicately valvate in æstivation; the fruit is a berry, concealed by the membranaceous calyx, which is sometimes, but not always, split on one side; the seeds contain a slender, filiform, almost annular embryo; the yellowish down that invests the flowers of this species consists of simply articulated hairs: in *Juanulloa* the hairs of its dense tomentum are stellately brachiate. The second species of *Physalina*, the *Juanulloa grandiflora*, Dun., appears to me to agree well, in all essential respects, with my *Cleochroma grandiflora*, figured in plate 32 of my 'Illustrations'; it is the *Iochroma grandiflora*, Benth., and again described by M. Dunal (Prodr. 491) under that name; it seems to differ only in the blade of the leaves being somewhat shorter; and if the dimensions of the calyx, which always increases rapidly with the age of the flower, be taken as that of its ultimate growth (as shown in fig. 4 of the plate referred to), all the proportions and floral details will be found to accord completely with those of M. Dunal's description: should it be found, however, to be a distinct species, it may be called *Cleochroma Dunalii*. Upon the same evidence, *Juanulloa microphylla*, Dun., will become *Cleochroma microphylla*, nob. M. Dunal includes *Cleochroma* as a section of *Iochroma*: it is undoubtedly much allied to that genus, but I have offered strong reasons (Illust. South Am. Plants, i. p. 147) to prove why it should be considered generically distinct. We have only to compare the details given in plates 46, 47, 32, 31 and 30 of the work last quoted, to be convinced of the great generic differences between *Juanulloa*, *Sarcophysa*, and *Cleochroma*, and of this last from *Iochroma*.

Codochonia of M. Dunal (Prodr. p. 482), if it be not identical with, is evidently allied most closely to *Hebecladus*, and not to *Atropa*, agreeing with the former in habit, and the æstivation and general structure of its floral parts, differing only in being 6-merous, and in having shorter stamens and style, which in other genera (as in *Solanum*, *Capsicum*, and his *Witheringia* for instance) are not allowed to constitute generic distinctions.

With the *Sicklera* of Dr. Sendtner (Prodr. p. 501) I am not in the least degree acquainted, but from the description there given, it cannot be, as M. Dunal states, allied to *Lycium*, on account of its herbaceous habit and the valvate æstivation of its flowers: judging from the characters there described it appears to be very near *Capsicum*, and indeed to differ little from that genus: it accords in the form of its unchanged persistent calyx, in the shape and size of its corolla, the insertion of its short stamens, and its apiculated cordate subexserted anthers: there does not appear anything in the description of its other characters at variance with that genus.

Upon a few other genera described in the 'Prodromus' I shall at another time treat at more length, and in now closing these strictures upon the last volume of the 'Prodromus,' I beg to disclaim the slightest intention of reflecting either on M. Dunal or M. DeCandolle, who must ever demand our homage and highest esteem. I will here only allude slightly to the circumstance, that although M. Dunal in his important monograph has naturally availed himself to a large extent of the materials I have contributed towards a history of this family, he has, without the slightest reference to them, passed over altogether the several reasonings, and the numerous essential and differential characters I had given, with the view of distinguishing the several genera, and upon which I proposed to group the different tribes and sections of the order. In offering these remarks I am bound to say, that my principal motive has been to establish and ascertain the relative value of the facts so applied, and also to show that the illustrious author of that monograph in his arrangement of the *Solanaceæ* has not selected and employed those characters best suited to establish the affinities of the several natural divisions, that he has been incautiously drawn into many errors by neglecting to attend to certain fixed rules and valid characters already suggested by others, and that consequently his whole arrangement of the order is incomplete and unsatisfactory: it almost bears the semblance of having been compiled nearly twenty years ago under the imperfect state of our knowledge of the family at that time, and upon the defective system of arrangement then employed, the genera since established appearing as if now interpolated at random, without regard to their affinities, or placed as sections of old genera to which they bear no relation, and to which the characters there given are ill adapted: similar defects are apparent in the distribution of species in several genera, as I shall shortly have occasion to show in regard to the genus *Lycium*: at the same time all must agree that the whole forms a collection of materials of much value and importance. I do not presume to say that the distribution and characters I have proposed are the best that can be offered, but as they seem to bring together the several well-marked groups, and with all their defects to offer to a great extent a consistency of arrangement, they are at least entitled to the indulgent consideration of botanists.

I cannot dismiss this review without adverting to the admirable work of Dr. Sendtner on the *Solanaceæ* of Brazil (Vienna, 1846), which is more especially deserving of attention because the classification there employed in the distribution of the very extensive and difficult genus *Solanum* has been fully adopted by M. Dunal in the 'Prodromus,' in preference to the unscientific arrangement in Don's 'Dictionary,' previously in use among botanists. The system of Dr. Sendtner is founded in great measure on the structure of the stamens, which afford valid characters, as I had long before observed and adopted for my own purposes. Dr. Sendtner has therefore rendered much service to science by this work, which everywhere displays originality of observation, his materials being classically and ably elaborated. His ordinal diagnosis of the *Solanaceæ* is infinitely preferable to that of M. Dunal, but notwithstanding this admission it is not free from some defects, among which may be mentioned the assertion that in the position of the embryo the extremity of the radicle points to the hilum. His synopsis of the distribution of the few genera indigenous in Brazil answers the purpose there intended, but is one quite unfitted for a classification of the whole family. The *Nolanaceæ* are here very properly excluded, although *Grabowskya* is placed in the *Solanaceæ* upon an erroneous principle, as explained in a former page (*ante*, p. 3). The *Cestrineæ* are likewise excluded from the *Solanaceæ* on account of their straight embryo, and, as suggested by Schlechtendal, placed in a separate family, while *Nicotiana, Petunia* and *Nierembergia,* also with a nearly straight embryo, are retained in the latter order; this is inconsistent, at the same time that the peculiar mode of æstivation in these genera, so different from *Solanaceæ,* is unnoticed. The Brazilian *Cestrineæ,* according to these views, are confined to *Cestrum* and *Metternichia*; the embryo in the former is said to be hemianatropous, in the latter anatropous, but I can perceive little difference in this respect, as in both cases the hilum is somewhat ventral and removed from the radicle, which points to the base of the seed as in *Nicotiana*: the only real distinction that I can perceive in the ordinal characters of Dr. Sendtner is that in *Solanaceæ* the calyx is "opisthodromicus , *i. e.* sepalo secundo postice verso, atque locum in mediana inter axin secundarium et primarium obtinente," and in the *Cestrineæ* the calyx is "emprosthodromicus , *i. e.* laciniis 3 anticis et 2 posticis." These are hard words that might be better expressed by the more simple terms of 'posticeps' and 'anticeps': this character, if it be general, has certainly escaped my observation, and we might almost infer that it is not constant, since M. Dunal, who has evidently studied Dr. Sendtner's work, nowhere alludes to this feature. I have searched in vain for its constancy in dried specimens, and it must be confessed that it does not appear to be likely, from its very nature, to prove a character available for practical purposes, because by the mere torsion of the pedicel, in so small a quantity as one-tenth part of a revolution, an opisthodromical calyx becomes at once emprosthodromical. Besides, at all times it must be a doubtful test among the *Solanaceæ* and *Atropaceæ*, where the insertion of the peduncle is always more or less extra-axillary and lateral, forming a kind of inflorescence termed centrifugal; for here the point of the calyx, that under ordinary development would be directed towards the axis of its parent branchlet, is actually twisted away from it, so that in the more bilabiate genera of the *Atropaceæ* the two lips cease to be superior and inferior as in the true *Scrophulariaceæ*: this is very clearly manifest in *Nierembergia* and several other genera when examined in a living state. We should be guided by facts rather than by hypothesis in these cases.

Dr. Sendtner in his work (p. 225) has made some rather ill-natured remarks for my want of attention to what he conceived to be essential characters, quoting in addition that I had not observed the structure of the stamens in *Cyphomandra*, and had not noticed the articulation of the pedicel in *Cestrum*. My details of *Pionandra*, as illustrated in plate 8, were made, and the drawings taken from the living plants, ten years previously, though only published about the same time as *Cyphomandra*; these naturally differ in some respects from the dissections of Dr. Sendtner, made from dried specimens, and it is from this cause that this excellent botanist failed to observe the fleshy annular ring that I have depicted. It is true that I omitted to mention the articulation of the pedicels in *Cestrum*, as well as many other ordinary characters which it was not thought necessary to notice, but it is evident that this feature, which is common to other species, did not escape my observation, for in plate 16 of the same work, every flower of *Cestrum organense* there delineated will be seen to be distinctly articulated on its pedicel. If an omission of this kind has crept into the descriptions of the desultory nature I had adopted, it is evident that the more learned and systematic work of Dr. Sendtner is not less free from error; for instance, among many others, we may quote his generic character of *Hyoscyamus*, where the lobes of the corolla are said to be plicated in æstivation when they are really imbricated—the placentation is stated to be free, whereas it was certainly adnate in the species I examined in a living state: he makes no mention whatever of the conspicuous epigynous gland that crowns the summit of the ovarium, which tends subsequently to the singular mode of dehiscence of its capsular fruit. In like manner this learned botanist failed to observe the gynobasic origin of the style in *Grabowskya*, which led to his error in placing that genus among the *Solanaceæ*, and he does not notice the erect position and basal insertion of its ovules, so contrary to all that is met with in that family. I merely quote these instances, out of a number of others, to show that the most accurate observers and the most learned men are as liable to errors and omissions as those of less pretensions, and they ought consequently to look charitably on the faults of others. The necessity of groping, as it were, in the dark in search of tangible facts, and treading the path firmly at every step, giving thus a desultory character to these communications, added to the rigour of detail, originating in my professional habit of proving everything by rule and by positive demonstration, may justify the charge made by Dr. Sendtner, who says of me, regarding these contributions, "rei botanicæ parum profuit: veras disciplinæ botanicæ notiones vilipendens," &c. (*loc. cit.* p. 225); and this dullness may account for my utter inability to comprehend the more refined and transcendental definitions of the German school. This accomplished botanist, describing in his elaborate work the nature of the inflorescence of the *Solanaceæ* (p. 181), has employed an extent of definition that would occupy ten close octavo pages, in order to describe that which appears to me might be made far more intelligible in almost as many lines. After giving my best attention to this elaborate diagnosis, I am yet unable to comprehend the finer distinctions of "recaulescent, concaulescent, estalechic, antidromical or homodromical" developments and their various combinations; nor can I perceive the utility of employing other new terms, such as "dichasia, concinna, cormanthæ, metapodia, hypopodia," and a number of others, in order to explain what we commonly understand by a simple or compound cyme or corymb, expressions long in use and comprehensible to everybody, without the necessity of employing words, involving ideas of development founded wholly on hypothesis. Besides, after all, the fact is known to all horticulturists that in the same species its habit and the development of its inflorescence are subject to much variation if grown in different soils, in a hot or cold temperature, in a moist or dry atmosphere, in exposed or open situations; hence the characters derivable from such sources are always variable, while those features observed in the development of the flowers and fruit are far more constant and always to be relied upon for scientific purposes. This consideration leads us naturally to inquire how many out of the 900 kinds of *Solanum* enumerated by M. Dunal ought not to be considered as genuine species? There are many individuals of this genus that are perfect weeds and have become quite cosmopolitan, such for instance as *Solanum nigrum*, *S. dulcamara*, *S. pseudocapsicum*, *S. torvum*, &c.; these under different circumstances assume many varieties of development, and consequently figure in herbaria as numerous and distinct species.

In concluding these observations tending to justify the conclusions I have formed after a long and careful examination of the whole family of the *Solanaceæ*, it is necessary to offer a few words of apology, especially after the reproachful remarks of Dr. Sendtner before quoted. It will be seen that the different subjects there treated upon were published at frequent intervals during a space of seven years, in detached portions, without regard to any system of arrangement. At the commencement I had not the most distant thought of extending these investigations to the length they have been carried, step by step: sufficient proof of this is seen in the preface to the first memoir in 1845 (Lond. Journ. Bot.) and in the first number of my 'Illustrations' in 1846, my object, as there shown, being merely to publish the drawings and details of the plants I had collected abroad; but in attempting to define in succession the particular genus to which these plants belonged, I found myself continually at fault: hence arose the necessity of comparing them with those of other collections, among which may be mentioned the rich herbarium of Sir W. Hooker, who most liberally opened everything to my inspection, and those of the British Museum and Linnæan Society: these distant journeys, necessarily frequent, much increased the difficulties of my progress, for my only plan of procedure was to make sketches of each plant for comparison with others at a distance and with my own notes at home. The results were published in desultory succession as the subjects presented themselves to my notice: had the whole of these inquiries been completed before the publication of any portion, and each analysis compared carefully with others, aided by a knowledge of the real structure of the rest, there would have been more consecutiveness and uniformity in the general definitions. Some indulgence may therefore be claimed and allowance made for the many faults that have necessarily resulted from this mode of procedure, the only one at my command. Notwithstanding the manner in which the materials are thus scattered throughout those pages, much that is useful may indubitably be gleaned, both from the text and the drawings, towards our knowledge of the members of this family and their respective affinities: a great many new facts have been added, and others previously known have been corrected; some progress has also been made towards a record of the essential as well as differential characters, and towards defining the more exact limits of each genus, and this has been throughout the full extent of my aim.

From what has been shown in the preceding remarks, it will be seen that much yet remains to be done before we obtain a proper arrangement of the *Solanaceæ* and the genera more immediately allied to them, and it certainly affords cause for regret that at a period of excellent opportunity, with such abundant materials, with every facility at command, and with a considerable amount of assistance from others, so imperfect a digest of the family should have appeared in the highest standard work of our time, the 'Prodromus' of M. DeCandolle.

IX.—*Descriptions of species belonging to the genera* Pterocyclos *and* Cyclostoma, *from Ceylon and West Australia.* By W. H. Benson, Esq.

1. *Pterocyclos Cingalensis*, nobis, n. s.

Testa late umbilicata, orbiculato-depressa, solidula, radiato-striata, albida, superne strigis subundatis, medio fascia castanea picta; spira planiuscula, apice vix prominulo, sutura profunde impressa; anfractibus 5, convexis, ultimo lente descendente, superne alato, breviter soluto; ala prominentiam elongatam angustam ascendentem formante, postice carina obtusa desinente; apertura obliqua, subcirculari; peristomate duplice, interno porrecto, superne profunde inciso, externo incrassato, superne dilatato, leviter deflexo; umbilico profundiusculo. Operculo (teste E. L. Layard) pyramidali.

Diam. major $19\frac{1}{2}$, minor 16, alt. 6 mill.

Hab. ad vicum montanum Monahagalla, Insulæ Ceylon. Teste Dom. Edgar Leopold Layard.

Distinguished from *Pt. rupestris* by the length and narrowness of the alar prominence, which ascends slightly on the penultimate whorl, and runs parallel with it, instead of spreading semicircularly as in that shell. From *Pt. Albersi* it differs not only in size, but in the absence of the incurvated beak which is such a prominent feature in that species. The umbilicus, equally broad with that of *Pt. rupestris*, is somewhat deeper in proportion.

This very interesting addition to a genus, which, though still limited in number, receives yearly additions from our Eastern possessions, was found by Mr. Layard in the central mountain region of the island, the fauna of which he is so successfully investigating. A monograph of the genus *Pterocyclos*, including all the species hitherto published, will be found in Dr. Pfeiffer's 'Monographia Pneumonopomorum' recently issued, including, in a compact volume, excellent descriptions of all the known Cyclostomacea and Helicinacea, with references to the figures given in the 'Conchylien Cabinet,' Sowerby's 'Thesaurus,' &c.

2. *Cyclostoma orophilum*, nobis, n. s.

Testa anguste umbilicata, globoso-conica, sub epidermide non nitente olivacea, albida, versus apicem acuminatum nigrescente; spira elevata, conica, attenuata, sutura distincta; anfractibus 5, convexis, ultimo rotundato, lineis 9 elevatiusculis, subtus remotioribus munito; apertura parum obliqua, circulari; peristomate tenui, recto, anfractui penultimo breviter adnato, labio expansiusculo; umbilico non pervio.
Diam. major 9, minor 7, alt. $7\frac{1}{2}$ mill.
Hab. ad Monahagalla vicum montanum interiorem Insulæ Ceylon. Teste Edgar L. Layard.

Allied to the Point de Galle *C. halophilum*, nobis, but differing in sculpture and in the acuminated spire. It belongs to *Leptopoma* of Pfeiffer.

3. *Cyclostoma liricinctum*, nobis, n. s.

Testa depressa, orbiculata, albida, liricincta, ad intervalla radiato-striata; spira vix elevata, apice obtuso, suturis excavatis; anfractibus $3\frac{1}{2}$ convexiusculis, ultimo rotundato, liris 8 cincto; apertura subcirculari, oblique superne angulata; peristomate recto, acuto; umbilico lato, perspectivo. Operculo corneo, tenui, multispirato.
Diam. major 4, minor $3\frac{1}{2}$, alt. 2 mill.
Hab. ad oras Australiæ Occidentalis. Dr. J. F. Bacon.

The penultimate whorl shows three elevated lines which are diminished to two in the upper whorl. Its place seems to be in Pfeiffer's 10th section of *Cyclophorus*.

4. *Cyclostoma orbiculatum*, nobis, n. s.

Testa depressa, orbiculata, albida, oblique striata, liris nonnullis, præcipue subtus, munita; spira elevatiuscula, sutura excavata, marginata, exiliter striata; anfractibus 4, convexis, ultimo rotundato; apertura subcirculari, obliqua, superne angulata, subcanaliculata; peristomate simplici; umbilico aperto, perspectivo. Operc.?
Diam. major $3\frac{1}{2}$, minor 3, axis 2 mill.
Hab. cum præcedente.

Malvern, January 4, 1853.

X.—*On the Animal of* Chamostrea albida. By Albany Hancock, Esq.

[With Two Plates.]

Having been favoured by John Whichham Flower, Esq. of Croydon, with a specimen in spirits of *Chamostrea albida*,—the

Cleidothærus chamoides of Stutchbury, and believing that a description of the animal would be acceptable to malacologists, I have drawn up the following account of it; which, though imperfect, I trust will assist in determining the position that this anomalous genus ought to have in the classification.

It will be seen that this animal differs too much from the *Anatinidæ* to be placed with them; but that it seems to accord pretty well with the *Chamaceæ*; nevertheless I am unable to say whether or not it is a true member of this latter family, for I can find no sufficiently detailed account of the animal of *Chama* to allow of a critical comparison. Such comparison, however, can very easily be made by any one who may happen to possess the requisite knowledge of that genus.

It is unnecessary to give any description of the shell, that being already well known; although it is proper to state that the convex or attached valve is the right,—the flat or free valve the left.

On removing the animal from the shell the mantle is found to be rather thick, less transparent than usual, and of a pretty regular, pale brownish colour; the two lobes, of course, being unequal, corresponding with the irregular development of the valves, are united throughout, the pedal and siphonal apertures being the only openings, except a minute orifice to be afterwards described. The borders (Pl. III. fig. 1 *a*) of the anterior margin are, however, free so far back as the anterior adductor muscle (*d*); and a little below this they become closely united for a short distance, the border of the right lobe projecting a little beyond that of the left. This point (*b*) corresponds to the angle of the shell produced by its adhesion to its support. Just above this point and close to the lower extremity of the adductor is the pedal opening (*c*), which is small and circular. The muscle forms the upper margin of the orifice, its fibres being exposed between the borders of the mantle, for more than half its length; in fact it here becomes the wall of the branchial chamber, closing up, as it were, a large portion of the pedal aperture, and reducing it to its present limited dimensions. Behind the point where the borders of the mantle are united, they (*e*) again separate, forming a sort of recess external to the union of the lobes, and from which the siphonal tubes (*f*, *g*) issue; this recess extends as far as the posterior adductor (*h*). From thence up to the dorsal region the mantle-borders are again united, forming in these parts a sharp edge. Immediately below the beak the ossicle (*j*) passes diagonally through both lobes of the mantle, and is surrounded at either end with a membranous expansion (*k*); these expansions are developments of the lobes, and are undoubtedly for the purpose of providing for the growth of the ossicle. Close by and a little anterior to the beak, the margin of the conjoined mantle is deeply sinuated or notched (*l*) to permit of the passage of the tooth. The margins of the lobes are smooth, a little thickened and grooved throughout, and for some short distance within are well supplied with radiating muscles which are attached along the pallial line, and are for the purpose of drawing in the free borders.

The siphonal tubes (Pl. III. fig. 1 *f*, *g*, & Pl. IV. fig. 2) are quite distinct, and are placed a little apart; they are situated lower down than usual, being almost ventral, are short and wide with the walls rather thin, and with both orifices encircled by minute simple papillæ. Besides the siphonal apertures there are other two,—one, the pedal (Pl. III. fig. 1 *c*), has already been described; the other (*m*) is comparatively minute, and is situated a little in front of the lower or inhalant tube, and in the angle of the recess formed by the opening of the mantle-borders. A similar fourth aperture exists in several,—perhaps in most of the *Lamellibranchiata* with closed mantles. I have observed it in *Lutraria*, *Cochlodesma*, *Panopæa*, and *Myochama*, and Professor Owen has described a fourth orifice in *Pholadomya*. It would seem probable that this fourth aperture is to allow the escape of the contained water when the tubes are suddenly withdrawn and the valves contracted, as always happens when the animal is startled. It might be supposed that the pedal orifice would be sufficient for this purpose; but it must be recollected that in all these animals it is comparatively minute, and is placed towards the anterior extremity. The contraction being instantaneous, this fourth aperture, which is situated at the posterior end of the chamber, would seem necessary to prevent undue pressure in this region, while the pedal orifice will sufficiently relieve the parts in front.

The anterior adductor muscle (Pl. III. fig. 1 *d*) is long, narrow, and slightly arched outwards, and has the upper extremity pointed, and rather suddenly curved inwards; the lower extremity is rounded. The posterior adductor (*h*) is much shorter and thicker in proportion to its length than the anterior, is somewhat arched outwards and has both extremities rounded.

On laying open the mantle, the body (fig. 2 *a*) is seen suspended from the dorsal and posterior walls of the chamber, the anterior adductor (*b*) forming the boundary in front; immediately below this muscle is the pedal orifice (*c*), and in the ventral wall, towards the posterior margin, project the two large, partially retracted siphonal tubes (*d*, *e*), and a little in advance of them is the fourth minute aperture (*f*) with slightly projecting margin. The gills (*g*, *g'*) lie near the centre of the chamber suspended from above and behind; they are large, of an irregularly rounded or oval form, and are united at a point below; at first sight they appear to be composed of a single plate on each side of the body; but we shall presently see that this is not the fact. The body, stretching downwards from between the gills, is of an oval form, and gradually subsides into a small, compressed linguiform foot (*i*) which projects forwards. The mouth (Pl. III. fig. 2 & Pl. IV. fig. 1 *j*) is placed above, exactly in front of the body, and is a rather large transverse slit, furnished with the usual four appendages or palps (*k*, *k'*), which are well developed, and are divided into a superior and an inferior pair, between which the upper anterior margin of the gill-plate of each side is inserted. They are flat, leaf-like, slightly tapering, and rather obtusely pointed; the external surface is smooth, as well as the margin of the external border of the inner or opposing surfaces. This surface, however, is for the greater part laminated, each palp being furnished with thirty transverse laminæ, inclined towards the free extremity. The palps are united above and below the mouth by widish membranes; that above forming a sort of hood which overhangs the oral orifice.

To return to the gills;—The apparent single plate lying on each side of the body is found, on close examination, to be divided longitudinally by an obscure line (Pl. III. fig. 2 *h*) into two portions, the anterior (*g*) being much the larger; this portion is formed of two laminæ in the usual manner. These laminæ are united internally at several points, forming the interbranchial space into a transverse series of tubes (*l*) as in most of the *Lamellibranchiata*. This portion, then, is a complete gill-plate, and is attached to the body of the animal above, from the side of the mouth as far as the line defining its boundary behind; and is suspended from behind by a membrane (*m*), which extends the entire length of the gill, its junction with the membrane being indicated externally by the longitudinal line already alluded to. Thus on each side of the body, along the posterior or dorsal margin, there is formed a large channel (*n*) into which the interbranchial tubes open, and likewise the oviducts. The posterior portion (*g'*) of the supposed single gill-plate is narrow, and is found to be composed of only a single lamina; it is therefore a rudimentary gill, and forms a sort of flap attached by its whole length to the external lamina of the gill-plate; its under surface, dorsal and posterior margins being free. *Chamostrea* has consequently only a single gill, and a rudimentary gill on each side of the body.

The branchial organ of *Cochlodesma* is arranged much in the same manner; but in it the rudimentary portion is attached throughout, there being no free margin. In *Chamostrea* we have just seen that the rudimentary gill is a flap-like appendage, though I would not positively assert that this is its natural condition, for the animal had been removed from the shell before it came into my possession, and these parts are so delicate that very little violence is sufficient to rupture them. I could not, however, perceive the least appearance of laceration, and there is therefore little doubt that the above description is correct.

It is difficult to say whether the gill-plate represents the outer or the inner plate of other Lamellibranchs. In *Mytilus*, which has two perfect gill-plates, there is also an external rudimentary gill formed, as in this instance, of a single lamina. It would seem probable, therefore, that the breathing organ of *Chamostrea* represents the outer plate together with the rudimentary gill of that genus.

The branchia of *Chamostrea* being reduced to little more than a single gill-plate on each side of the body, some complication of the apparatus might be expected as a compensation for the deficiency; and such is found to be the fact. If the laminæ composing the plate are divided, their inner surface is found to be formed of a reticulation of blood-vessels running at right angles to each other; those (Pl. IV. fig. 4 *a*) extending across the lamina, predominating considerably in size, give to the surface a corded appearance in a transverse direction, the cords being separated by a series of apertures (*c*). On turning the lamina over, the outer surface is ascertained to be covered with numerous delicate transverse plaits or folds (fig. 3 *a*), so crowded together as to conceal the true surface. When a transverse section of the lamina is made, these plicæ (fig. 5 *a, a*) are seen to coincide with the spaces between the large transverse vessels seen on the under surface of the lamina, and are consequently placed over the series of apertures (*d, d*) between these vessels. The plicæ themselves are formed of double walls, enclosing a wedge-shaped space with its base towards the lamina. These walls are made up entirely of a very minute network of vessels (fig. 6 *a, b*) which cross each other at right angles, the meshes being open, and elongated in the direction of the plicæ. This structure is perfectly similar to that of the gill-laminæ of *Mya, Pholas*, &c.; and the nutritive particles will be strained from the surrounding element by the surface of the plicæ, just in the same way as the gill-lamina itself strains the water in other Lamellibranchs; that is to say, the water by ciliary action will be made to pass through the apertures or meshes, leaving behind all sedimentary matters, and, escaping into the wedge-shaped spaces between the walls of the plicæ, will find its way at once, by the series of apertures between the large, transverse, cord-like vessels of the gill-laminæ, into the interbranchial spaces or tubes; and as these latter open freely into the great dorsal or posterior channel which communicates with the exhalant siphon, the stream will pass readily out of the animal.

The minute structure of the rudimentary gill is precisely similar to that of the laminæ forming the gill-plate; and the plicæ of the former are continuous with those of the latter. The sedimentary matters will therefore, in all probability, pass from one to the other, and be collected, as usual, along the free anterior margin (fig. 1 *l, l*) of the gill, which margin is provided with an ample groove (fig. 7 *a*) for the purpose, formed by the projection of the plicæ (*b, b*) of both sides; and in this manner the nutriment will be conducted to the mouth.

The water strained through the rudimentary gill will pass along the dorsal or posterior margin external to the membrane which defines the great channel at the root of the gill-plate, and thus reach the exhalant siphon, which is provided at its internal orifice with two lateral membranous processes (Pl. III. fig. 2 *o*); these are united below, partially separating the two tubes; above each forms an angulated lobe which projects forward as far as the lower extremity of the rudimentary gill, and is undoubtedly for the purpose of guiding the excurrent branchial streams to the siphonal outlet. This membranous process is apparently the rudiment of the septum which completes the separation of the tubes in the *Pholades*, and in several other Lamellibranchs.

The alimentary system presents nothing very peculiar. The œsophagus is well defined, moderately long, and ascends a little as it passes backwards to reach the upper portion of the stomach, which is irregularly rounded; below it becomes suddenly constricted, and is prolonged almost to the lower extremity of the body, where it terminates in a blind sac. In this elongated portion there is a narrow plait of the lining membrane extending near its whole length, and giving off on either side short, alternate branches. The biliary ducts are seven or eight in number; five or six of these enter the superior portion of the stomach,—two the inferior prolongation; but these latter were not very distinct. I did not succeed in tracing the whole of the intestine; but it appears to me to leave the upper portion of the gastric organ behind, just above the commencement of the inferior prolongation; and passing a little upwards and backwards, curves round the upper extremity of the posterior adductor, and then coursing along its external margin, terminates below it in a short, free, tubular anus within the base of the exhalant siphon: the margin of the anus is entire. Thus it would appear that the intestine is shorter than usual. It is possible, however, that the above description may, on further examination, require modification;

for in dissecting the tube upwards from the anus, I lost it just before it reached the stomach; I may have been deceived, therefore, as to its path on leaving this organ. And perhaps the inferior prolongation of the gastric cavity is what in other Lamellibranchs has been called the duodenum.

I saw no "crystalline style," neither did I detect the "tricuspid body"; the former most likely does not exist, the latter has probably escaped me.

EXPLANATION OF THE PLATES.

PLATE III.

Fig. 1. View of right side of *Chamostrea albida* enclosed in the mantle:—*a*, anterior borders of the two lobes of the mantle turned back; *b*, the point at which the borders are united; *c*, pedal orifice; *d*, anterior adductor muscle; *e*, borders of the ventral margin separated a little to show siphonal tubes; *f*, exhalant tube; *g*, inhalant tube; *h*, posterior adductor; *i*, posterior margin; *j*, extremity of ossicle; *k*, membranous process surrounding same; *l*, notch for the passage of tooth; *m*, fourth minute aperture leading into branchial chamber.

Fig. 2. View of left side of animal, the mantle laid open:—*a*, body; *b*, anterior adductor; *c*, pedal aperture; *d*, inhalant siphon; *e*, exhalant siphon; *f*, fourth aperture leading into branchial chamber; *g*, gill-plate; *g'*, rudimentary gill; *h*, line dividing the two portions of branchial organ; *i*, foot; *j*, mouth; *k*, oral palps; *l*, orifices of interbranchial tubes; *m*, membrane suspending gill; *n*, the two great posterior channels; *o*, two membranous flaps in connexion with exhalant siphon; *p*, the two extremities of ossicle; *q*, processes for secreting ossicle; *r*, notch in mantle for passage of tooth.

PLATE IV.

Fig. 1. Front view of mouth:—*a*, body; *j*, oral orifice; *k*, *k*, superior pair of palps; *k'*, inferior ditto ditto; *l*, anterior border of gill-plate, exhibiting groove.

Fig. 2. Siphonal tubes as they would appear when in action.

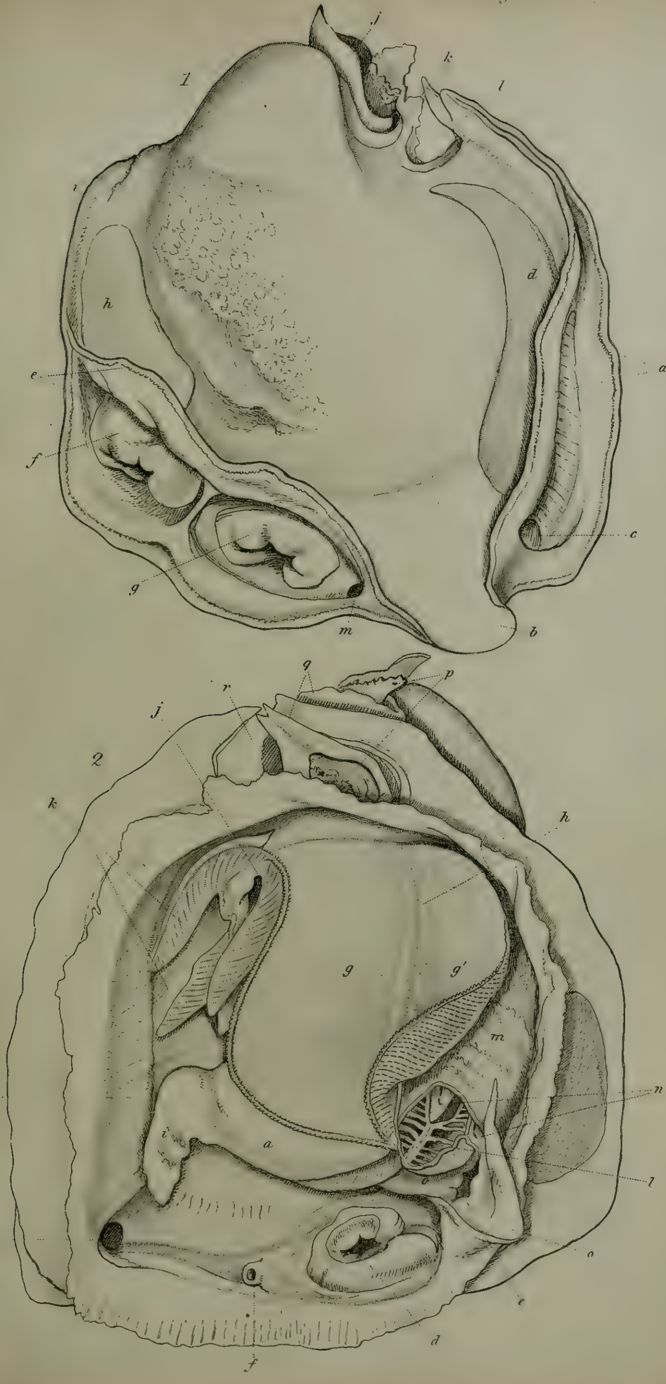
Fig. 3. A portion of external surface of gill-lamina:—*a*, transverse plicæ; *b*, extremities of plicæ extending beyond lamina.

Fig. 4. A portion of under surface of gill-lamina:—*a*, large transverse vessels; *b*, small vessels; *c*, series of apertures.

Fig. 5. Transverse section of lamina of gill-plate:—*a*, *a*, plicæ on external surface; *b*, *b*, large transverse vessels seen on under surface of lamina; *c*, *c*, small vessels of ditto; *d*, *d*, series of apertures.

Fig. 6. A portion of the wall of plicæ highly magnified:—*a*, vessels running in the direction of plicæ; *b*, vessels running in the opposite direction; *c*, apertures.

Fig. 7. Margin of gill-plate much enlarged, exhibiting groove:—*a*, groove; *b*, *b*, extremities of plicæ of the opposite sides.



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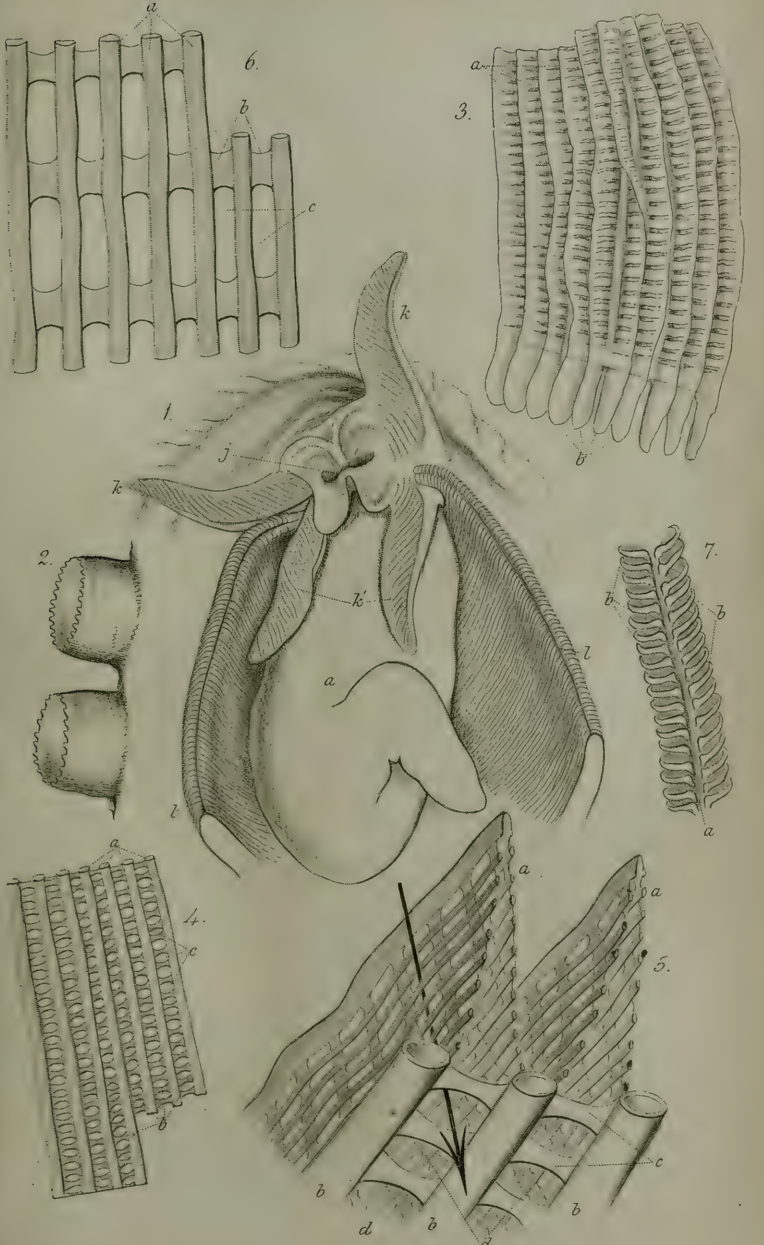
J. Basire, sc.



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XI.—*Supplement to a Catalogue of British Spiders, including remarks on their Structure, Functions, Œconomy and Systematic Arrangement.* By JOHN BLACKWALL, F.L.S.

SUCH additions and corrections as may tend to render more complete my catalogue of British spiders, published in the 'Annals and Magazine of Natural History,' Second Series, volumes vii. viii. ix. and x., will be given in this supplement as occasions present themselves.

Tribe OCTONOCULINA.

Family LYCOSIDÆ.

Genus *Lycosa*, Latr.

Lycosa campestris.

To the notice of this species given in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. vii. pp. 257, 258), the following fact may be added. In the spring of 1851 I captured an adult female *Lycosa campestris* which had only six eyes; not the slightest rudiment of the lateral eyes of the anterior row was perceptible, even with the aid of a powerful magnifier.

The tyro in arachnology may learn from this example, should a similar instance of anomalous structure happen to come under his observation, not to conclude too hastily that, because the organs of vision are arranged symmetrically, he has discovered a true *Lycosa* whose normal number of eyes is six.

Lycosa cambrica.

The following particulars in connexion with this species have been ascertained since that part of the catalogue was published in which it is introduced (Annals and Mag. of Nat. Hist. Second Series, vol. vii. pp. 396, 397). In July and August the female deposits between 60 and 70 spherical eggs of a yellow colour in a globular cocoon of compact white silk, which is encircled by a narrow zone of a slighter texture and measures $\frac{1}{5}$th of an inch in diameter.

On the 23rd of August 1851 I detected the apodous larva of an insect in a cocoon of *Lycosa cambrica*, which had fed on the young spiders as they were disengaged from the eggs; its abdomen of thirteen segments was short, broad, and of a pale brown colour mottled with white. On the 28th of the same month it spun an oviform cocoon of yellowish white silk of a slightish texture, in which it died in the pupa state.

Family Salticidæ.

Genus *Salticus*, Latr.

After *Salticus cupreus* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. vii. p. 447) add the following species.

Salticus notatus.

Salticus notatus, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. x. p. 94.

An adult female of this species was found among herbage in a wood at Southgate, in Middlesex, in June 1850, and is in Mr. Walker's cabinet.

Salticus reticulatus.

Salticus reticulatus, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 14.

Specimens of this minute *Salticus* were discovered among moss growing in woods on the slopes of Gallt y Rhyg, a mountain near Oakland, in Denbighshire. The female is adult in autumn.

Family Thomisidæ.

Genus *Thomisus*, Walck.

After *Thomisus pallidus* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. vii. pp. 450, 451) add

Thomisus versutus.

Thomisus versutus, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 15.

Adult and immature individuals of this *Thomisus* were met with among grass growing in and near woods at Oakland in August 1852.

Thomisus incertus.

Add the following fact to the remarks on this species in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. vii. p. 451). In June 1852 a female *Thomisus incertus*, confined in a phial, fabricated a lenticular cocoon of white silk of a compact texture, which she attached to the glass. This cocoon measured $\frac{1}{4}$th of an inch in diameter, and contained 20 whitish eggs of a spherical form, not adherent among themselves.

Family Drassidæ.

Genus *Drassus*, Walck.

After *Drassus sericeus* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 40) add

Drassus reticulatus.

Drassus reticulatus, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. x. p. 97.

This spider was captured by Mr. Walker near Lancaster in August 1850.

Genus *Clubiona,* Latr.

After *Clubiona accentuata* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 96) add

Clubiona domestica.

Clubiona domestica, Wider, Museum Senckenb. B. i. p. 214. taf. 14. fig. 9.
Philoica notata, Koch, Die Arachn. B. viii. p. 55. tab. 268. fig. 631, 632.

An immature female *Clubiona domestica,* captured in Gloucestershire in 1852, was received from Mr. R. H. Meade in the summer of the same year.

M. Walckenaer is certainly mistaken in supposing this species to be identical with *Clubiona corticalis* (Hist. Nat. des Insect. Apt. t. iv. p. 439), from which it differs in organization and colour. The males are very dissimilar, not only differing remarkably in the relative length of their legs, but also in the structure of the palpi and palpal organs. The genus *Philoica* of M. Koch, like some of the other genera which he has proposed for adoption, comprises spiders belonging to different families.

Clubiona nutrix.

Under this head in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 96) the *Clubiona nutrix* of M. Hahn is introduced; but it must be admitted that the identity of this spider with the species whose name it bears is not so clearly ascertained as might be wished, for M. Walckenaer has included it among the synonyma of *Clubiona erratica,* and M. Koch entertains the opinion that Hahn has described the former species and delineated the latter; his words are, "der Beschreibung nach hatte Hahn unbezweifelt *Club. Nutrix* Walck. vor sich, dagegen deutet freilich dessen Abbildung auf *Club. erratica*" (Die Arachn. B. vi. p. 15).

Clubiona erratica.

The *Bolyphantes equestris* of M. Koch should be added to the synonyma of *Clubiona erratica* given in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 96). This will be rendered apparent on a perusal of the following passage extracted from M. Koch's account of *Cheiracanthium carnifex* (*Clubiona erratica*):—"Meine *Bolyphantes equestris* Uebers. d. Arachn. Syst. bezeichnet eine olivenbräunliche oder rostbraune Abart" (Die Arachn. B. vi. p. 15).

I avail myself of this opportunity to correct an orthographical error which occurs under the heads of *Clubiona nutrix* and *Clubiona erratica* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 96). For *Chieracanthium* read *Cheiracanthium*.

Family Cinifloniðæ.

Genus *Ciniflo*, Blackw.

Ciniflo atrox.

Annex to the particulars of this species recorded in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. pp. 98, 99) the following remark. The subjoined dimensions of *Clubiona* (*Ciniflo*) *atrox* given by M. Hahn (Die Arachn. B. i. p. 115) have, most probably, been taken from *Ciniflo ferox*.

"Länge eines ausgewachsenen Weibchens 7 Linien. Breite des Hinterleibes $2\frac{1}{2}$ Linien."

Family Agelenidæ.

Genus *Agelena*, Walck.

Agelena elegans.

To the particulars in connexion with *Agelena elegans* given in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 101) the following facts relative to its œconomy may be appended. It spins a minute, horizontal sheet of web in depressions produced by the trampling of cattle, and by other causes, in damp soil; and in August the female constructs a plano-convex cocoon of compact white silk, measuring $\frac{5}{24}$ths of an inch in diameter, which comprises 5 or 6 spherical eggs of a yellow colour, not cemented together, and is usually attached by its plane surface to the leaves of plants.

Family Theridiidæ.

Genus *Theridion*, Walck.

Theridion sisyphum.

As the remarks under this head in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 338) appertain to *Theridion tepidariorum*, they should be transferred to that species, merely substituting the trivial name *tepidariorum* for that of *sisyphum,* and their place should be supplied by the following statement.

Theridion sisyphum occurs in the South of England, and was observed by Lister in Cambridgeshire, Lincolnshire, and Yorkshire. He remarks that it fabricates an extensive snare on the trunks of large oaks, and between the greater branches of trees; and that towards the end of June the female usually constructs in this snare a dome-shaped cell, whose concavity is directed downwards, in which she deposits one or more lenticular cocoons of a red-brown colour, containing her eggs.

After *Theridion sisyphum* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 338) add

Theridion tepidariorum.

Theridion tepidariorum, Koch, Die Arachn. B. viii. p. 75. tab. 273. fig. 646, tab. 274. fig. 647, 648.

This spider I had regarded as a variety of *Theridion sisyphum,* but by comparing numerous individuals with specimens of the latter species, for which I am indebted to Mr. R. H. Meade, I have satisfied myself that they are distinct; as, though nearly allied, they present differences in size, structure and colour; it will be seen also that there is a want of coincidence in their habits and œconomy.

In Germany, as in Britain, *Theridion tepidariorum* has only been met with in conservatories, a circumstance which has induced M. Koch to conjecture, with great probability, that it is not indigenous to that country, but that it has been introduced with exotic plants; and this conjecture applies with equal force to our own country. His words are, "fast möchte ich diese Art als eine ursprünglich deutsche in Zweifel ziehen, indem sie, wie es scheint, nur in warmen Glashäusern vorkommt; vielleicht ist ihre Brut mit aussereuropäischen Pflanzen nach Deutschland gebracht worden" (Die Arachn. B. viii. p. 78).

Theridion varians.

Since the remarks under this head appeared in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 443), I have captured an adult female *Theridion varians* which had only six eyes; the two posterior intermediate ones were entirely wanting, and the posterior eye of each lateral pair had not half of the usual size. An inexperienced observer might be induced by the symmetrical arrangement of the organs of vision in this individual not only to give it a place in the tribe *Senoculina,* but also to propose a new genus for its reception.

After *Theridion albens* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. viii. p. 445) add

Theridion flavo-maculatum.

Micryphantes flavo-maculatus, Koch, Die Arachn. B. iii. p. 67. tab. 95. fig. 220.

An adult male *Theridion flavo-maculatum,* which hitherto appears to have escaped the observation of arachnologists, was found running on a foot-path in a wood near Oakland in May 1852. The female of this species, previously described and figured by M. Koch under the name of *Micryphantes flavo-maculatus,* judging from the smallness of its size, was probably an immature individual; its colours, though not so intense, bear a close resemblance to those of the male in their distribution. A minute examination of the essential characters of this spider has induced me to remove it from the genus *Micryphantes* to that of *Theridion.*

Family Linyphiidæ.

Genus *Linyphia,* Latr.

Linyphia crypticolens.

To the synonyma of this species, which is misspelled *cripticolens* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. ix. p. 16), add the *Meta cellulana* of M. Koch (Die Arachn. B. viii. p. 123. tab. 287. fig. 691, 692).

After *Linyphia tenuis* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. ix. p. 18) add the following species.

Linyphia terricola.

Linyphia terricola, Koch, Die Arachn. B. xii. p. 125. tab. 425. fig. 1047, 1048.

This spider, which varies considerably in colour, bears a striking resemblance to *Linyphia tenuis*; but the more slender form of the latter, the larger size of the anterior eyes of the trapezoid, which are somewhat wider apart, and are seated on a less prominent protuberance of the cephalo-thorax, together with slight modifications in the structure and development of the palpal organs of the male, serve, independently of colour, to distinguish it from the former. *Linyphia terricola* is common among moss growing in woods in many parts of England and Wales, and the sexes arrive at maturity in July and August.

The length of the male of this species given by M. Koch in the text is incorrect, but the line representing it in the plate rectifies the error.

M. Walckenaer has added *Linyphia terricola* to the synonyma of his *Linyphia bucculenta* (Hist. Nat. des Insect. Apt. t. iv. p. 485), which is a very different species, and is identical with the *Linyphia socialis* of Professor Sundevall, the name *Linyphia bucculenta* having been conferred by the Swedish naturalist on the species denominated *Linyphia reticulata* by M. Walckenaer.

Linyphia Meadii.

Linyphia Meadii, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 17.

Early in May 1852, adult individuals of both sexes of *Linyphia Meadii* were taken by Mr. R. H. Meade under a stone in a pasture at Low Moor, near Bradford.

Linyphia anthracina.

Linyphia anthracina, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 18.

This species, which appears to be nearly allied to *Linyphia nigella*, was received in July 1852 from Mr. R. H. Meade, who captured it near Bradford. In November, in the same year, Mr. Meade transmitted to me an adult female *Linyphia anthracina* which had been sent to him from Southgate, in Middlesex.

Linyphia pulla.

Linyphia pulla, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 19.

Both sexes of this spider, in a state of maturity, were discovered in Nab Wood, near Bingley, in Yorkshire, in 1852, by Mr. R. H. Meade, who forwarded specimens of them to me, and also an adult female which had been taken at Southgate.

Linyphia alacris.

Linyphia alacris, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 20.

Mr. R. H. Meade found specimens of this *Linyphia* in May 1852, in a wood near Bingley, and in the neighbourhood of Bradford, in Yorkshire.

Linyphia ericæa.

Linyphia ericæa, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 22.

Specimens of this small species of *Linyphia* have been found in moss growing among heath in woods about Oakland, and at the roots of heath on Bingley Moor in Yorkshire. Two adult males and an immature female, captured in the latter locality, were received from Mr. R. H. Meade in October 1852.

Linyphia pernix.

Linyphia pernix, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. x. p. 98.

Mr. F. Walker captured this species in May 1850, among juniper bushes at Southgate.

Genus *Neriëne*, Blackw.

After *Neriëne fusca* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. ix. p. 270) add the following species.

Neriëne agrestis.

Neriëne agrestis, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 23.

This species, which is closely allied to *Neriëne fusca*, occurs among herbage and under stones in pastures near woods at Oakland. The sexes are adult in autumn.

Neriëne vigilax.

Neriëne vigilax, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 24.

An adult male of this species was found running on a gravel-walk at Oakland in July 1852.

Genus *Walckenaëra*, Blackw.

After *Walckenaëra parva* in the catalogue (Annals and Mag. of Nat. Hist. Second Series, vol. ix. p. 465) add

Walckenaëra exilis.

Walckenaëra exilis, Blackw. Annals and Mag. of Nat. Hist. Second Series, vol. xi. p. 24.

A specimen of this minute *Walckenaëra*, in a state of maturity, was discovered among moss growing at the root of an oak on the northern slope of Gallt y Rhyg in October 1852.

XII.—*Observations on the Anatomy of* Actinia. By T. Spencer Cobbold, M.D., Vice-President of the Physiological Society, Edinburgh*.

No apology we trust is needed as introductory to the following remarks, which have for their object the elucidation of a point upon which much discrepancy of opinion exists. It is distinctly stated in the last edition of Dr. Carpenter's valuable work on the Principles of General and Comparative Physiology (p. 271), that "the stomach is closed at the bottom, alike in the solitary and in the compound *Helianthoida*," and it is further added (p. 272), "the manner in which they (the young) pass from the ovarial chambers into the stomach, is yet an unsolved mystery;" the accompanying figure from Dr. Sharpey's article "Cilia," in the 'Cyclopædia of Anat. and Physiol.,' likewise representing that organ as closed inferiorly.

Dr. Johnston, in his well-known Treatise on Zoophytes, says (p. 197), "The mouth leads by a very short and wide passage into a large stomach, which is a membranous bag; there is no intestine, nor any other visible exit from the stomach than the mouth;" and he has also had the politeness to inform me by note, that his private dissections, which were made simply with the view of understanding the descriptions of others, do not permit him to answer the question as to whether there be any aperture of communication between the digestive cavity and that of the body generally.

In Prof. Rymer Jones's 'Outline of the Animal Kingdom,' the stomach is described (p. 41) as "a simple bag, closed inferiorly," and in the figure there given it is thus represented. In the article Polypifera (Cyclop. Anat. and Physiol.), also by Prof. Jones, an illustration of *Actinia*, taken from Quoy and Gaimard (Voyage de l'Uranie), also conveys the same impression.

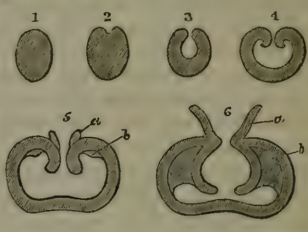
Two only of the several authors which we have consulted in reference to this point show the views just alluded to to be incorrect, viz. Professors Owen and Grant; the former states (Lectures on Invertebrate Animals, p. 87), "The impregnated ova (of *Actinia*) make their way by the small inferior aperture of the stomach into that cavity, and escape by the mouth of the parent." The latter author says, speaking of *Lobularia* (see his Lectures on Comp. Anat. No. XL., Lancet, 1833–34, vol. ii. p. 645), "The stomach here, as in many allied zoophytes, forms a distinct membranous tube within the body of the polypus, and quite open at its posterior extremity, like the stomach of an *Actinia*, and each polypus has its distinct ovaries at its

* Verbally introduced to the Society, Dec. 17th, 1852. See reports, wherein other particulars will be mentioned, and which are purposely omitted in the present communication.

base, the ova or gemmules coming out through this open tubular stomach*."

That this viscus is assuredly not simply a membranous sac or bag closed at the base, our own inquiries have fairly demonstrated. We were led to this investigation by the following circumstance. Two species of *A. mesembryanthemum* were taken one afternoon last October from the north shore of the Firth of Forth, and on arriving at Edinburgh the same evening, the number (in the vessel) had increased to *thirty-five*. The animals were therefore carefully watched that night, but not until next day were we gratified by witnessing what has been shown by numerous observers to occur, viz. the evolution of the young (of all shapes and sizes) by the mouth. On dissecting one of the adult Actinias, it was found, as we were thus led to anticipate, that a considerable opening obtained to the base of the stomach, admitting the tip of the little finger, and freely communicating with the interseptal spaces and general abdominal reservoir. This, to our mind, fully cleared up the difficulty so often expressed concerning the passage by which the young polyps gain access to the digestive cavity and are ultimately set free.

The existence of this opening (which if not functionally may morphologically be regarded as the *pylorus*) was further rendered evident by a careful examination, aided with low magnifying powers, of the embryo polyps. In the present instance none of the individuals, although extremely small and of various forms, presented the vibratile or ciliated character which the late Sir John Graham Dalyell has shown them to possess in their earliest condition. The smallest were semi-opaque spherical bodies, while the remainder presented every gradation of form, from the simple sphere up to the complete tentaculated polyp. The largest were about the size of peas. On section they presented appearances similar to those exhibited in the accompanying diagrams, which are intended to illustrate the manner in which the morphological changes are brought about, and the several special organs unfolded. The figures may be thus explained:—1. Outline of mature embryonic corpuscle after the disappearance of the cilia. 2, 3, 4. Primary involution of integumentary membrane. 5, 6. Re-induplication of external mem-



* Prof. Goodsir informs me that he has repeatedly pointed out, in his Lectures, " the occurrence of this opening," and has referred to it as typical of the entire group of *helianthoid* polyps.

brane and formation of stomachal cavity,—commencement of tentacula (*a*), and ovarian septa (*b*), by the same process of involution. These observations on the development are corroborated by the following remarks of Sir J. G. Dalyell; speaking of the corpuscula (Rare and Remarkable Animals of Scotland, p. 209), he says, "The motion subsisted eight days, but the shape of some was changing, and elongating prominences were rising on others. Their form improved, when I concluded that they would certainly become *Actiniæ*. The rudiments of tentacula became visible in the largest in ten days more, and in two days they proved six in number."

In reference to the behaviour of the young of *Actinia* immediately on their quitting the parent, it was noticed in those under our observation, that they slowly sank to the bottom of the basin, lighting and resting upon their outspread tentacula, with the base or convex portion corresponding to the sucking disk, uppermost; they then elongated and moved this part of the body laterally, after the manner of *Hydræ*; and if the mother *Actinia* or any projecting body lay in the vicinity, they immediately attached themselves to it and there remained. Some of the young thus adhering to the adult polyp gave the idea of a gemmiferous mode of reproduction, which circumstance may, we think, explain the notion of increase by gemmation, hitherto ascribed to the whole group of these animals, but only actually demonstrated (so far as we are aware) by that careful naturalist Sir J. G. Dalyell, to have taken place in one species, viz. *Actinia lacerata**.

In those species (*A. gemmacea*) that we exhibited to the Physiological Society, the fissiparous mode of propagation was well seen, the serrated line of demarcation indicating that reunion of the halves was effected by a similar process to that which takes place in the cranial bones of the higher animals. An interesting analogy to the phænomena above described, we are informed by Mr. J. R. Mummery, obtains in the young of *Tubularia indivisa*†: "Slowly it emerges, withdrawing its tentacles in succession, until it has set itself free, when it crawls slowly upon the bottom of the vessel containing it, elevating itself *on the extremity of its tentacles*. After a period of time, varying from one to four days, the animal having selected a suitable stone, *or the surface of the old polypidom, reverses its position*, and with the mouth upwards, now attaches itself by the opposite extremity and remains rooted fast for life."

* Illustrations of this are given in his work, vol. ii. pl. 47.

† See an excellent paper in the Microscopical Society's Transactions, new series, p. 29.

XIII.—*On the Division of Ctenobranchous Gasteropodous Mollusca into larger Groups and Families.* By J. E. Gray, Ph.D., F.R.S., V.P.Z.S. &c.

Cuvier, Dumeril, and Lamarck separated the Gasteropodous Mollusca, which have pectinated or comb-like gills, into two divisions, according as they possessed or were without a siphon to facilitate the admission of water to their gills, probably being influenced by preceding conchologists, who had in a similar manner divided the spiral shells into those which had an entire, or an emarginated, or a channelled mouth. Lamarck called those with a siphon *Zoophaga*, and those without it *Phytophaga*, believing the food of the molluscs to be indicated by the form of the mantle. As we have become more acquainted with the habits of the Mollusca, it has been observed that many of the animals without any siphon to the mantle, as *Natica*, *Scalaria*, *Ianthina*, &c., are quite as carnivorous as those which have the siphon most perfectly developed; on the other hand, Lamarck found it requisite to arrange many genera, as *Cerithium*, *Melanopsis*, *Planaxis*, &c., with the *Phytophaga* with entire mouths, though the animals have as well-developed siphons and the shells as distinct canal or siphonal notch, as any of the genera of Zoophagous Mollusca. These divisions, however, have been almost universally adopted. Dr. Lovén in his paper on the Scandinavian Mollusca and on the Tongues of these animals, divided the Gasteropoda into natural families independent of these divisions, and Dr. Troschel in his arrangement of Mollusca has followed the same course, separating the families into groups according to the structure of their tongues. The observations which Dr. Troschel made on the arrangement which I published in Mrs. Gray's work, 'Figures of Molluscous Animals,' have induced me to reconsider the subject, consult again all the authorities, and examine the tongues of the molluscous animals which have been lately received at the Museum collections.

Being impressed with the importance which Dr. Lovén attached to the form of the mouth, I was induced to pay attention to this character, and I believe that it affords a much more natural one to separate families into two great groups, than the presence or the absence of the siphon of the mantle, and one which appears to be more consistent with the habits of the animal and much less liable to exceptions. I may observe in passing that some of the French zoologists do not appear to have been impressed with its importance, for MM. Quoy and Gaimard in some few instances erroneously represent some of the species of a genus, as a *Murex* and *Terebra*, for example, as having a rostrum, while the greater part of the species are properly represented without it, and as having a proboscis, and the same may be remarked of some of the more modern figures of these animals.

I fully expect that many naturalists, especially those who have chiefly confined their studies to the external form of shell or to the fossil species, will consider that the system here proposed is very artificial, as it separates many genera and families from one another which they have regarded as being very nearly allied, or as belonging to the same family or even genus. But it must be recollected that this was the case when first the study of the animal was undertaken, yet no one now objects to the terrestrial *Helices* and *Bulimi* being separated from the sea shells which were formerly arranged with them, or the *Bullæ* from the other marine families, and we must expect that as the structure of the animal becomes more known, the more the genera founded only on the shells will become separated and dispersed.

In drawing up the characters of the suborders and families, I have attempted to select those which appeared most permanent, or least subject to variation. In all animals, as a general rule, those organs by which they obtain their food belong to the first class; hence the characters of the suborder and its divisions have been taken from the form of the mouth and the disposition and form of the teeth on the lingual membrane, as I have no doubt these parts have a most important bearing on the œconomy of the animal; while the characters of the families have been taken from the modifications of the mantle and differences in the structure and form of the operculum and shell; for though I consider that the characters of the order, suborder, and families should be chiefly taken from modifications of the animal, I always consider that the shell and operculum are quite as important as regards the genus, as the animal which forms it.

Suborder I. Proboscidifera. Head small, with an elongated, retractile, longly exsertile proboscis, when retracted hidden within the body; tentacles close together at the base or united by a veil over the base of the proboscis; eyes sessile, on the outer base of the tentacles; operculum annular (except in *Natica*). Carnivorous, eating living mollusca and other animals.

The trunk or proboscis is of a very complicated structure and furnished with a number of muscles, well described by Cuvier in his anatomy of *Buccinum*, which enable it to be withdrawn into itself like the tentacles of a snail. These animals are said to form the round holes so commonly found on other shells, and the lingual membrane is placed near the apex of the exserted trunk.

Suborder II. Rostrifera. Head moderate, with a more or less elongated, produced, contractile, transversely annulated rostrum; tentacles subulate, far apart on the side of the rostrum. Essentially phytophagous; the rostrum is only furnished with contractile muscles, and varies in length and shape; in *Struthiolaria* it is very long and conical subulate, but it is not retractile like those of the former suborder; the rostrum of *Strombi* is also elongated, while in some other families it is short and truncated; but it is always easily known from the retractile proboscis of the former group; the lingual membrane is often very long, extending far into the body of the animal.

The families are the same as those characterized in the 'Figures of Molluscous Animals,' vol. iv. 1850, only placed in different order, to show the characters afforded by the teeth, with some new ones rendered necessary by the examination of the teeth of some genera which had not before been described.

Suborder I. Proboscidifera.

A. Hamiglossa. *Teeth on lingual membrane in three series* (1 · 1 · 1), *the central broad, the lateral versatile* (fig. 1).

Fam. 1. Muricidæ. Lateral teeth flat, with a bent-up process at the end more or less at right angles with the base; siphon of mantle and canal of shell straight; foot simple in front; mantle enclosed.

a. *Muricina*. Operculum ovate; nucleus subapical within the apex; varices of shell developed. *Murex, Trophon*.

b. *Fusina*. Operculum ovate, acute; nucleus apical; varices of shell rudimentary or none. *Pisania, Colus, Cassidulus, Chrysodomus*.

? c. *Pusionellina*. Operculum semiovate; nucleus in middle of the straight inner edge. *Pusionella*. Teeth —— ?

d. *Rapananina*. Operculum ovate, blunt; nucleus elongate, forming the outer or hinder edge. *Rapana*, ? *Chorus* and ? *Cuma*.

Fam. 2. Buccinidæ. Lateral teeth flat, with a bent-up process at the end more or less at right angles with the base; siphon of mantle and canal of shell recurved; foot simple; mantle enclosed.

a. *Buccinina*. Operculum ovate; nucleus small, near outer front edge. *Buccinum*.

b. *Nassina*. Operculum ovate, acute, nucleus apical.
* Operculum entire. *Latrunculus, Cominella, Phos*.
** Operculum serrated. *Bullia, Nassa*, ? *Northia*.

c. *Purpurina.* Operculum oblong; nucleus elongate, forming the long outer edge. *Purpura, Concholepas, Sistrum, ? Magillus.*

It is to be observed that the operculum of these two families offers exactly the same modifications.

Planaxina, which have been arranged in this family, have a distinct rostrum and operculum like *Littorina.*

Fam. 3. Olividæ. Siphon of mantle recurved; foot with a cross groove on each side in front; often enclosing part of the shell; mantle enclosed; operculum small or none.

a. *Olivina.* Pillar of shell plaited in front.

* Lateral teeth broad ovate. *Strephona, Olivella, Scaphula, Agaronia.*

** Lateral teeth hook-like, narrow. *Ancilla.*

? b. *Harpina.* Pillar of shell smooth. *Harpa.* Teeth —— ?

Fam. 4. Lamellariadæ. Lateral teeth simple, curved; mantle very large, covering the shell, with a notch in place of the siphon in front; operculum none. *Lamellaria, Coriocella.* The genus *Marsenina* (*prodita*) appears more allied to *Velutinidæ.*

B. Odontoglossa. *Teeth on lingual membrane in three series* (1 · 1 · 1), *the central recurved, toothed at the tip, the lateral not versatile* (figs. 2, 3).

Fam. 5. Fasciolariadæ. Mantle enclosed; siphon and canal of shell straight; shell with plaits on the front of the pillar; central tooth narrow, small; lateral teeth very broad, linear, with many equal teeth (fig. 2). *Fasciolaria, Lagena.*

Fam. 6. Turbinellidæ. Mantle enclosed; siphon and canal of shell straight; shell with plaits on the middle of the pillar; central teeth broad, few-toothed; lateral teeth narrowed, strong, with a single large tooth (fig. 3). *Turbinellus, Cynodonta.*

C. Rachiglossa. *Teeth on lingual membrane in a single central series, often toothed* (figs. 4, 5).

Fam. 7. Volutidæ. Shell with plaits on columella; siphon recurved, and canal very short.

a. *Volutina.* Siphon with auricles on side of base; tentacles far apart, united by a broad veil over the head.

* *Teeth lunate, apex 3-toothed* (fig. 4). Yetus, Cymbium, ? Voluta.

** *Teeth linear, base angularly diverging, with a single conical apex* (fig. 5). Cymbiola.

b. *Mitrina.* Siphon simple at the base; tentacles close together at the base; mantle enclosed; "teeth broad, many-toothed"? very small at the tip of the proboscis. *Mitra, Turris, Imbricaria.*

c. *Porcellanina.* Siphon simple at the base; tentacles close together at the base; mantle lobes expanded, covering the shell; teeth ——? very small? not to be seen in the only specimen (in bad state) I have been able to examine. *Porcellana, Persicula.*

The specimen of *P. glabella* in spirits showed no appearance of the dilatation of the mantle.

D. Toxoglossa. *Teeth on lingual membrane in two lateral series* (1 · 0 · 1), *elongate, subulate* (fig. 6).

Fam. 8. PLEUROTOMIDÆ. Siphon of mantle and canal of shell straight; mantle and shell often with a slit in hinder part of right side.

a. *Pleurotomina.* Operculum ovate, acute; nucleus apical. *Pleurotoma, Drillia.*

b. *Clavatulina.* Operculum semiovate; nucleus in the centre of the straight front edge. *Clavatula, Tomella.*

c. *Defrancianina.* Operculum none. *Mangelia, Defrancia.*

E. Tænioglossa. *Teeth on lingual membrane in seven rows* (3 · 1 · 3), *central generally toothed, lateral in three series, converging, the inner often broad, two outer subulate, versatile* (fig. 7).

Fam. 9. DOLIIDÆ. Foot small; siphon of mantle recurved; mantle enclosed; operculum none. *Dolium, ?Malea.* Tongue—?

Fam. 10. TRITONIADÆ. Foot small; siphon of mantle and canal of shell straight; shell variced; mantle enclosed; operculum ovate, annular; nucleus subapical. *Apollon, Triton, Persona.* The teeth of this family have been verified in a dozen species of the three genera.

Fam. 11. SCYTOTYPIDÆ. Foot small; siphon of mantle produced; operculum none. *Scytotypus**.

Fam. 12. VELUTINIDÆ. Foot moderate, rounded; mantle edge inflated, folded on the edge into two canals; eyes on outer side of tentacles. Operculum none. *Velutina, Otina, ?Marsenina.*

Fam. 13. NATICIDÆ. Foot very large, much produced; shell

* In Ann. and Mag. Nat. Hist. x. 415. 1852, by a slip of the pen, I erroneously stated that this animal had no proboscis.

sunk into the foot; eyes none; operculum distinct, spiral, few-whorled (fig. 7).

a. Operculum, outer layer shelly. *Natica.*

b. Operculum simple, horny. *Neverita, Polinices, Mammilla, Stomatia.*

From Dr. Lovén's description of the animal of *Trichotropis borealis,* it should be referred to this suborder, and equally so by Messrs. Forbes and Hanley's figures, t. II. f. 1; but in examining the animals of *Trichotropis bicarinatus,* the original type of the genus, I find the animal to have a rostrum and no proboscis. I should have been inclined to have regarded the animal of these two species as probably forming two genera, but Messrs. Forbes and Hanley's description of the animal (Brit. Moll. 361) agrees pretty well with the animal of *T. bicarinatus.*

F. Ptenoglossa. *Teeth on lingual membrane in many series, numerous, similar* (fig. 8).

Fam. 14. Cassididæ. Mantle enclosed, with a recurved siphon; shell ventricose, subglobose, with a recurved canal, often variced; outer lip thickened; lingual membrane short, broad, triangular, with many rows of similar lancet-shaped teeth, and a single small dentated tooth in the central series; operculum annular; nucleus in the middle of the straight inner side. *Bezoardica, ? Cassis, ? Levenia, ? Morio.* The teeth bear no resemblance to those figured by Quoy and Gaimard as those of *Bezoardica.*

Fam. 15. Scalariadæ. Foot moderate, mantle enclosed; shell turrited, variced, without any canal; eyes on outer side of the subulate tentacles; operculum horny, spiral. *Scalaria.*

Fam. 16. Acteonidæ. Foot moderate; mantle enclosed; eyes on the inner side of the base of the expanded tentacles; operculum horny, subspiral. *Acteon.*

G. Gymnoglossa. *Teeth and lingual membrane rudimentary or none.*

Fam. 17. Acusidæ. Foot small; mantle enclosed, with an elongated siphon; shell turrited; lip thin, not variced; eyes on tip of tentacles or wanting; tentacles very small or wanting; operculum annular; nucleus apical. *Acus* (tentacles small). *Subula* (tentacles and eyes none). *Leiodomus* (suture callous; operculum ovate; tentacles small; has been confounded with *Bullia*).

Fam. 18. Pyramidellidæ. Foot moderate; mantle enclosed; eyes on the inner side of the broad folded tentacles; operculum horny, spiral; shell spiral, pillar plaited.

a. *Pyramidellina.* Shell turrited. *Obeliscus, Odostomia, Eulima, Aclis, ? Stylina.*

b. *Tylodinina.* Shell subspiral. *Tylodina.*

Cerithiopsis of Forbes and Hanley, tab. OO, if accurately described, must form a new family in this section.

Fam. 19. ARCHITECTOMIDÆ. Tentacles folded, with the suture below; eyes sessile on upper surface of their base (*Eydoux*). Gill-cavities divided by a longitudinal fold; foot moderate, truncated in front, rounded behind (*Quoy*). I have not been able to examine the animal of this family, nor has the proboscis been figured, but the position of the tentacles as given by Quoy, and with more detail by Eydoux, lead me to believe that it is furnished with one.

a. Operculum ovate. *Architectoma.*

b. Operculum circular. *Torinia.*

Suborder II. ROSTRIFERA.

Section 1. Gymnoglossa. *Lingual membrane and teeth none; operculum none.*

Fam. 20. CANCELLARIADÆ. Mantle enclosed; pillar of shell folded; operculum none. *Admete, ? Cancellaria.*

Section 2. Toxoglossa. *Lingual membrane with two series of subulate elongate, often barbed, lateral teeth* (fig. 9).

Fam. 21. CONIDÆ. Teeth barbed; mantle enclosed; operculum ovate, nucleus apical. *Conus.*

Section 3. Digitiglossa. *Teeth on lingual membrane in seven rows,* 3 · 1 · 3 (*or perhaps five rows,* 2 · 1 · 2 ?), *the central teeth triangular, recurved, 3-toothed; lateral teeth converging, inner conical, recurved; the outer large, broad, ovate, with numerous long, linear, equal, curved digitations on the upper edge* (fig. 10).

Fam. 22. AMPHIPERASIDÆ. Operculum none; mantle lobes expanded, covering the shell, bearded externally; shell, edge of outer lip inflexed. *Amphiperas.*

The black colour on *A. ovum* washes off when in spirits.

Section 4. Tæniglossa. *Lingual membrane with seven series of teeth* (3 · 1 · 3), *the central broad, the lateral converging, the inner often broader; outer lateral conical, except in* Viviparidæ (fig. 7).

A. *Operculum subannular or none; mantle furnished with a siphon, and shell with a canal in front.*

* *Eyes sessile, on the outer side of the base of the tentacles.*

Fam. 23. CYPRÆADÆ. Operculum none; mantle lobes expanded, covering the shell; outer lateral teeth conical, entire or toothed. *Cypræa, Trivia, ? Erato.*

Fam. 24. Pediculariadæ. Operculum none; mantle enclosed. *Pedicularia.*

Fam. 25. Aporrhaidæ. Operculum annular, ovate, nucleus apical, small; mantle, outer edge expanded, lobed, or rarely reflexed; siphon and canal of shell bent to the right. *Aporrhais; Trichotropis,* lingual membrane short, broad; ? *Struthiolaria.* (See observations on *Trichotropis* at p. 129.)

** *Eyes on elongated peduncles.*

Fam. 26. Strombidæ. Foot compressed, used for jumping, not walking; mantle, outer side generally expanded and often lobed; muzzle longly conical.

a. *Strombina.* Tentacles on middle of eye-pedicel; operculum claw-like. *Strombus, Pterocera, Fusus.*

b. *Seraphina.* Tentacles none ?, operculum none. *Seraphys.*

B. *Operculum subannular; mantle and shell simple in front; eyes sessile.*

Fam. 27. Phoridæ. Foot compressed, used for jumping, not walking; eyes sessile, on the outer side of the subulate tentacles; operculum large, horny, subannular; muzzle conical, produced; tongue —— ?; teeth —— ? *Phorus, Onustus.*

C. *Operculum annular, regular; mantle with a siphon in front; shell simple in front; eyes produced near the outer side of the base of the subulate tentacles.*

Fam. 28. Ampullariadæ. Central teeth acute, lateral, subulate. *Ampullaria, Marissa, Pomus, Pomella, Lanistes, Asolene.*

D. *Operculum annular, regular; mantle and shell simple in front; eyes sessile, on the outer side of the base of the subulate tentacles.*

Fam. 29. Viviparidæ. Teeth abnormal, laminar, longitudinal, ovate; apex recurved, toothed on each side the tip; inner lateral tooth broad. *Viviparus, Paludomus, Bithinia.*

E. *Operculum annular, regular, with an internal process; mantle and shell simple in front; eyes sessile, far back behind the tentacles.*

Fam. 30. Rissoellidæ. Rostrum divided into two tentacular lobes in front; "teeth in five series," *Alder*. *Rissoella = Jeffreysia,* Alder; *Rissoina.*

F. *Operculum spiral* (*rarely wanting*) ; *mantle and shell generally simple, sometimes with a rudimentary siphon and a canal in front of shell; eyes sessile; outer lateral teeth conical, curved.*

a. *Eyes sessile, on outer side of tentacles.*

* *Gill enclosed, in one or three lines on inner side of mantle-cavity.*

Fam. 31. LITTORINIDÆ. Mantle edge simple or with only a slight fold in front; gills in two series; shell free; foot flat. *Assiminia, Littorina,* &c.

Fam. 32. PLANAXIDÆ. Mantle edge with a siphon and shell with a notch in front. *Planaxis, Quoyia,* ? *Litiopa.*

Fam. 33. MELANIADÆ. Mantle edge torn, with a more or less distinct siphon in front; gill of a single series of plates. *Rissoa, Skenea, Melania, Vibex, Faunus, Melanatria, Rhinoclavis, Cerithium, Telescopium, Triphoris, Terebellum.*

Fam. 34. VERMETIDÆ. Shell attached, irregular; foot scarcely fit for walking, dilated, clavate at the end. *Vermetus, Serpuloides, Siliquaria,* &c.

Fam. 35. ? VANICOROIDÆ. Shell free; foot small, circular, produced in front with a dilated membranous expansion on each side; operculum horny, ovate; teeth —— ? *Vanicoro.*

** *Gills plumose, exposed; lamina pinnate, spirally twisted.*

Fam. 36. VALVATIDÆ. Operculum orbicular, spiral, many-whorled. *Valvata.*

b. *Eyes sessile, on the head between or rather behind the base of the tentacles.*

Fam. 37. CÆCIDÆ. Shell subcylindrical, arched; apex deciduous, subspiral; operculum circular, horny; foot short; teeth —— ? *Cæcum.*

Fam. 38. TRUNCATELLIDÆ. Body and shell spiral; foot very short, roundish; muzzle broadly 2-lobed: walks with its foot and lips; teeth —— ? *Truncatella.*

G. *Operculum none; mantle and shell simple in front; gills in an oblique line across the mantle-cavity; lamina elongate, linear, partly exposed; eyes small, on the outer side of the base of the tentacles.*

Fam. 39. CAPULIDÆ. Foot folded on itself. *Capulus, Hipponix, Amalthia.*

Fam. 40. CALYPTRÆIDÆ. Foot expanded. *Crypta, Galerus, Crucibulum, Calyptra, Trochita.*

Fig. 2. *Fasciolaria filamentosa.*

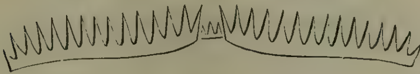


Fig. 8. *Scalaria Turtoni.*

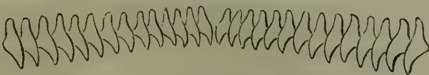


Fig. 4. *Yetus olla.*

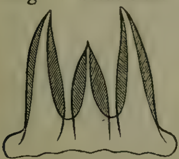


Fig. 5. *Cymbiola Turneri.*

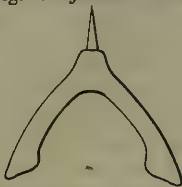


Fig. 6. *Mangelia costata.*

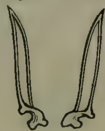


Fig. 9. *Conus* sp.

Fig. 1. *Chrysodomus antiquus.*

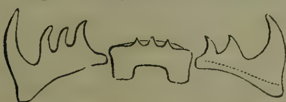


Fig. 3. *Turbinellus cornigera.*

Fig. 7. *Natica pulchella.*

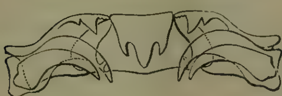
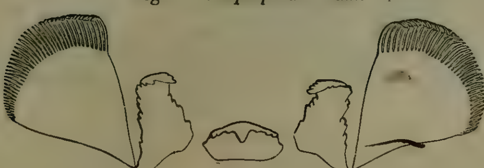


Fig. 10. *Amphiperas Ovum.*



BIBLIOGRAPHICAL NOTICES.

On the Growth of Plants in Closely Glazed Cases. By N. B. Ward, F.R.S., F.L.S. Second edition. Pp. 143. London: Van Voorst, 1852.

Mr. Ward's cases for the growth of plants in situations naturally unfavourable for their development are too well known to require description. They take the place of the old mignionette-box on the window-sill, enabling their owner to grow plants which under other circumstances he could never have dreamt of. They serve as elegant ornaments in the drawing-room; they furnish the suburban horticulturist with a ready means of striking cuttings and protecting tender plants during the winter; in fact, to a certain extent they render those luxuries of the rich—the greenhouse and conservatory—accessible to every one who can afford to lay out a few shillings with that object. But there is another class to whom these cases are of still more value—we allude to those numerous botanists whose avocations necessitate their constant residence in one or other of our great cities, and who, though no way behind their country brothers in their admiration for nature and zeal for science, have yet but few opportunities of observing growing plants, except perhaps during their annual holiday, or on an occasional hebdomadal excursion. To such these cases are invaluable,—enabling them to have constantly under their eyes, during the whole course of its development, almost any plant that they may wish to study. They are especially useful in growing ferns, many species which are perfectly intractable under other treatment flourishing in them luxuriantly. Nor is it in many cases necessary for botanical purposes to go to any great expense—a wide-mouthed bottle furnished with a cover will serve to grow many plants as well as the most elegant case.

Another purpose for which these cases are employed, and by no means the least important of their applications, is the transport of living plants to and from distant regions. By their means a long sea voyage becomes a much less serious matter than formerly, and many plants will now no doubt reach our hothouses which have hitherto baffled the ingenuity of collectors.

In the elegant little book, whose title stands at the head of this notice, Mr. Ward lays before the public a statement of what has been and may be done by the development of the principles on which his cases are constructed. His work is divided into six chapters, of which the first is devoted to the consideration of the conditions necessary to the growth of plants in a state of nature—the second treats of the influences which produce a prejudicial effect upon vegetable life in large towns—the third contains an account of the mode in which the author was led to the discovery of the principle on which his closed cases are constructed, with many interesting details connected with the practical working of the principle—the fourth chapter points out the utility of the closed cases for the conveyance of plants on shipboard—the fifth the enjoyment offered by the closed cases to the working man—and the sixth the probable future applications of the facts detailed in the preceding chapters, in scientific investigations and in the treatment of disease. The work closes with an appendix containing letters relative to Mr. Ward's cases which have passed between that gentleman and several of our leading scientific men. It is ornamented with a series of very nicely executed woodcuts representing some of the principal forms in which the cases may be constructed, in order that those of its readers who may be desirous of commencing the cultivation of plants in closed cases may "choose for themselves." We think that few will rise from the perusal of this attractive little volume without feeling some such desire.

PROCEEDINGS OF LEARNED SOCIETIES.

LINNÆAN SOCIETY.

June 1, 1852.—R. Brown, Esq., President, in the Chair.

Read a paper "On two new genera of *Fungi*." By the Rev. M. J. Berkeley, F.L.S.

After some preliminary observations on the gratification attendant on the satisfactory determination of the synonyms of the earlier writers, and on the advantages to be derived from an attentive study of their works, particularly (as regards *Fungi*) those of Micheli, Schmidel, Müller and Battarra, Mr. Berkeley proceeded to call the attention of the Society to two subjects, the one figured by Battarra and the other by Bulliard. The figure of Battarra is contained in his "Fungorum Agri Ariminensis Historia," t. 40, and represents a *Phallus* which some later writers have referred to *Phallus caninus*, Huds., although at first sight it bears but a remote resemblance to that species. Several specimens of it were found, according to Battarra, in the neighbourhood of Rome, and he describes them as having the volva dirty white, coriaceous, and filled with a mucilaginous substance, as in the other species of *Phallus*. From this arose a club-shaped cellular receptacle, hollow within, the upper part being even and solid within (meaning probably that it was imperforate), and covered with a crust which was red when the fungus was young, but when it had arrived at maturity the top was green with a zone of red beneath it, the lower portion of the stem being dirty white sprinkled with reddish brown superficial specks: when the fungus was past maturity, the upper portion passed into a fœtid fluid. It would seem that Battarra did not see the fungus when fresh, and that his figure was taken from a dried specimen; but it is very difficult to conceive how a fungus tapering to a point, as exhibited in Sowerby's figure of *P. caninus*, could by any mode of drying assume the broadly clavate form exhibited by Battarra's figure. A fungus, however, has been recently found in S. Carolina by H. W. Ravenel, Esq., which exhibits the peculiar form of that of Battarra, and when forwarded to Mr. Berkeley by the Rev. M. A. Curtis was noticed as differing greatly in structure from the other species of *Phallus* in its not showing the slightest distinction between the stem and hymenium. At a later period specimens of the same species were found by Mr. Ravenel exhibiting the same form as that of *P. caninus*, but with the ample hymenium more clearly confluent with the stem, which differs but slightly from it in appearance and structure, and always perforated at the apex, while the loose cellular pale stem of *P. caninus* is at the first glance distinct from the short and more minutely cellular head. No doubt whatever rests in the mind of Mr. Ravenel as to the identity of the clavate and fusiform individuals of his plant; and as these two forms occur in a species analogous to *P. caninus*, though not identical with it, Mr. Berkeley is of opinion that we may conclude, with tolerable certainty, that the figure of Battarra does indeed represent a peculiar state of the well-known species. With regard to the plant of S. Carolina, Mr. Berkeley points out the distinctions between it and *P. caninus*, and thinks that they completely justify the formation of a new genus for its reception, unless such genera as *Dictyophora*, *Mutinus*, *Dictyophallus*, &c. are to be rejected, as mere members of the genus *Phallus*. He therefore proposes to characterize it as follows:—

Corynites, *Berkel. & Curt.*

Uterus rotundatus, e membranâ duplici gelatinâ distentâ compositus, lobato-rumpens *Receptaculum* cum stipite elongato celluloso-cribroso omninò continuum, obtusum, perforatum, massâ sporiferâ primùm sinuato-cellulosâ tenaci mox verò diffluente tectum. *Sporæ* minutæ. —Fungi *terrestres, oblongi, subfusiformes, autumnales. Genus a* Mutino, *Fries, differt receptaculo minùs discreto, apice perforato.*

C. Ravenelii, n. sp.

Hab. in sabulosis graminosis, juxta fl. Santee Carolinæ Australis, autumno.—*Curtis*, no. 2573, 3037. *Ravenel*, no. 844.

Mr. Berkeley describes the egg as globose, $\frac{3}{4}$ of an inch in diameter, the volva bursting in two or three lobes applied to the stem; the stem $1\frac{1}{2}$–2 inches high, 4–5 lines thick, bright red, coarsely cribrose, below attenuated, above confluent with the receptacle, which is sometimes broadly clavate, sometimes conical, but always more or less obtuse, pervious at the apex, sometimes half as long as the stem; the mass of spores dark olive, soon washed off; the odour heavy and nauseous, but only perceptible when the hymenium is brought near to the nose.

The second subject of Mr. Berkeley's paper relates to a group of Fungi of which *Sphærocarpus capsulifer*, Bulliard, is the type, and which appear to have been for the most part neglected by authors, the accounts of them by French botanists (by whom alone they have been noticed) being more or less complete compilations from Bulliard. Externally the fungi in question, with one exception, have the appearance of species of the genus *Physarum*, the peridium being single and smooth, and the spores mixed with flocci; the latter are broad and lamellæform in parts, but vary greatly in breadth, and intermixed with spores as in other *Myxogasteres*, but these spores grow in little aciniform masses instead of being single as in other allied *Fungi*, with the exception of *Enerthema, Reticularia* and *Ptychogaster*, in the former of which (figured by Mr. Bowman in the 'Linnean Transactions') as well as in the present instance, Mr. Berkeley has ascertained that they are produced within a vesicle, as in *Hymenogaster vulgaris*, Tul., thus confirming at once Mr. Bowman's curious genus, and M. Tulasne's observation of a similar anomaly in a different group of fungi; while in the two other genera they form little radiating fascicles. Mr. Berkeley states that the credit of calling attention to Bulliard's figure, and ascertaining the structure, is entirely due to Dr. Badham, and he therefore dedicates the genus to him, in the hope that its characters are so well founded as to ensure permanence.

BADHAMIA, *Berkeley*.

Peridium simplex, extùs nudum, v. rarissimè subtomentosum, apice demùm lacerato-apertum; *flocci* laxè reticulati, parietibus affixi, hic illic expansi in laminam sæpè triangularem peridio similem; *sporæ* globosæ, v. subangulares, primùm sacco communi inclusæ, demùm liberatæ, conglobato-adnatæ.—Fungi *minores, fragilissimi, muscos v. corticem colentes*, Physarum *utplurimùm referentes*.

1. *B. hyalina*=Physarum hyalinum, *Auct.*

2. *B. utricularis*=Physarum utriculare, *Auct.*

3. *B. capsulifer*, peridiis sessilibus v. breviter membranaceo-pedicellatis obovatis congestis e nigro-cæsiis albidis, floccis candidis.
Sphærocarpus capsulifer, *Bull.* t. 470. f. 2.
Trichia capsulifera, *Dec. Fl. Franç.* vol. ii. p. 254 (1815).
Physarum capsuliferum, *Chev. Par.* vol. i. p. 339 (1826)?; *Duby, Bot. Gall.* p. 861 (1830).
Hab. ad muscos, in Galliâ.
A sequentibus differt stipite spurio, peridiis magis obovatis, floccisque albidis. *B. utriculari* verosimiliter propior.

4. BADHAMIA NITENS, peridiis sessilibus depressis congestis nitidè flavis, floccis flavis, sporis extùs fortiter echinulatis.
Hab. ad ramos quercinos emortuos; apud East Bergholt, in Com. Suffolk, Febr. 21, 1851, *Rev. Dr. Badham.*

5. BADHAMIA PALLIDA, peridiis sessilibus depressis sublentiformibus hic illic congestis sparsisque pallido-luteis, floccis flavis, sporis majoribus granulatis; vesiculâ centrali magnâ.
Hab. ad ramos quercinos emortuos; apud East Bergholt, in Com. Suffolk, Mart. 1, 1851, *Rev. Dr. Badham.*

6. BADHAMIA FULVELLA, peridiis gregariis sessilibus globosis nigris tomento subtili fulvo vestitis, floccis albidis.
Hab. ad lignum emortuum; apud East Bergholt, in Com. Suffolk, *Rev. Dr. Badham.*
Habitus *Didymii* potiùs quàm *Physari.*

The paper was accompanied by coloured drawings, and magnified representations of the details.

ZOOLOGICAL SOCIETY.

February 11, 1851.—William Yarrell, Esq., V.P., in the Chair.

Notes on the Raptorial Birds of British Guiana. By Dr. G. R. Bonyan.

There are, I believe, only three species of Vulture in British Guiana. The first is the well-known

King of the Vultures.

Sarcorhamphus Papa of Dumeril.—*Irubicha*, Azara.—*Vultur Papa*, Linn.—*Le Roi des Vautours*, Cuv.—*Carrion Crow Governor* of negroes.

There is a very good drawing of this bird in Latham's 'General History of Birds.' It is by no means common in Demerara, but young birds are occasionally brought from the upper rivers, particularly the upper parts of the Mahaica and Mahaicony creeks, where they abound, to the town. They are easily tamed and eat any sort of meat, not showing a particular predilection to putrid meat. Although I have seen this bird in its wild state, I have never witnessed it alighting upon a carcase; the common Carrion Crows, it is said, cede place until the king has fed. Mr. Waterton witnessed this singular fact, and I have heard it corroborated by more than one person of veracity. I know nothing of its habits or nidification. The colours about the head and neck are remarkably beautiful and varied, and have a downy bloom as it were, which it is impossible to imitate by painting the preserved specimen.

The Common Carrion Crow. *Cathartes iota.*

If this bird be the same as "*Vultur iota*" of Charles Bonaparte, it is imperfectly described by Cuvier as having only the head naked; whereas it has the head and the neck more than half way down, naked, warty and black; nor is its plumage of a shining black, but dull and inky. The Carrion Crow is seen over the whole surface of the country, either soaring on dry sunny days at an immense height in the air, or swooping down in wide gyrations towards the ground. If a carcase be thrown out on a dam, no Carrion Crow being within the range of vision, after a short time one will be seen in a distant part of the horizon; presently another will appear; then another and another, until they will be observed coming from all quarters; not, however, in a direct line towards the object, but in more or less extensive gyrations. There can be no doubt that the first Carrion Crow that sees the object, by an increased energetic quickness of its flight, gives notice to those which are within its sphere of vision that there is game in view, which accounts satisfactorily enough for the vast number of these birds which are collected from every quarter of the horizon in so short a time after a dead body is exposed. Indeed, to the eye of the common observer, the difference of motion of a *Vultur iota* on the look-out, and after it has sighted its quarry, is very remarkable. The former is a slow, steady and gentle soar, in small gyrations, at an equal height; the head of the bird, if it be examined with a glass, being seen turning from side to side. The latter is a rapid and energetic advance, every hundred yards or so the speed being increased by several vigorous flaps of the wings. It appears to me to be quite unnecessary to enter into the discussion, as to whether this bird hunts by sight or scent, as it is quite sufficiently established that it is assisted by both senses. The instant a snake is killed, the Carrion Crow will, if in the neighbourhood, sight the object, and speedily descend and commence his attacks upon the dead animal. Or if a negro lets fall a calabash with eggs, and they are broken, the Carrion Crow will soon be seen feasting on the unwonted luxury. If, on the other hand, a body be imperfectly interred, this bird will, so soon as putrefaction has commenced, be seen in the neighbourhood perched upon a tree or tombstone, and apparently much puzzled to know where the piece of mortality can lie concealed which evolves the, to him, delicious fragrancy. If the body be that of a tough-skinned animal, such as an ox or horse, the Crows will wait, perched on trees in the neighbourbood, until putrefaction has softened it sufficiently for them to feed on it. Their bills and feet are remarkably weak. They build in very high trees nests of broken sticks. The eggs when broken have a semi-putrid odour. It is worthy of remark that the Carrion Crow is common about the streets of New Amsterdam, scarcely getting out of the way of the passengers; while in Georgetown, not more than sixty miles distance, this bird is never seen in the streets. The former town is said to be much more cleanly and well-kept than the latter.

The Yellow-necked Carrion Crow.

This bird is smaller and more slender than the common Carrion Crow. It is found principally about the creeks of Mahaica and Mahaicony. It is less numerous than the Black-headed Carrion Crow. It is not either so gregarious a feeder, and appears to search for smaller carcases, such as the putrid fish on the dried savannahs bordering the creeks. There is certainly, with the exception of the colour of the head and neck, the absence of warts, and the slender form of the body, but a very slight specific difference between this bird and the former. The colour is black, with blue and greenish iridescence.

The Fishing-Hawk. *Pandion.*

A very handsome little fishing Eagle. I do not think this is the same species as *Le Balbusard* of Cuvier. It enlivens very much the scene about the flat swampy lands of the sea-coast, when the trenches are full with the mixed tide and bush water. It hovers for a length of time in one spot at a considerable height, and then suddenly descends vertically on its finny prey, or it alters its position to another part of the trench. When it makes a capture it flies off to a neighbouring tree to devour it.

The Large Blue Hawk of the Cataracts.

This bird I shot with a single bullet while descending the long and swift rapid of Twansinki, lat. 5°, on the Essequibo. It is very rarely seen on the lower parts of the rivers. The manner of its death was as follows, as I find on referring to my journal of the trip:—10th November. An exciting day's journey in the descent of the rapids between Twansinki and Waraputa. Some of these we did not venture to *shoot*, as it is called, but had to let the boat down, by means of the tow-line, most ignominiously, stern foremost. We had, however, the satisfaction of being very nearly swamped in descending a long rapid in the lower Twansinki range, which made up somewhat for the slight we considered had been put upon our courage by our coxswain, Hermanus, refusing to shoot down those rapids he considered to be dangerous. Our indignation against the noble captain was considerably cooled. The great danger in the descent of these long rapids is from the boat being carried down by the rush of the torrent, and the bow being at the same time more or less submerged by the curling back of the water, when it meets the resistance of the rocks in its passage. Thus the descent, although very swift, is in a succession of violent plunges, at each of which the boat, if not built with a sufficient *spring* in the bow, which was unfortunately the case with us, takes in a large quantity of water, and is in great danger of being swamped before it reaches the foot of the rapid. Everything depends of course on the *way* the boat has on it, and our crew, on this occasion, urged by the frantic gestures and shouting of the steersman and bowman, pulled with amazing vigour and energy. In the very midst of the hurly-burly of this descent, a Large Blue Hawk flew rapidly across our bow and alighted on a high dry tree. My soul had long yearned after a "Blue Hawk" of the Cataracts. Before I could fairly cover it, the bird was eighty yards behind us. The report of the gun was scarcely audible in the tremendous noise, and the Hawk for a second remained immoveable and apparently unhurt, when his head sunk, his body swung forward, and the powerful grasp of his talons relaxing in death, he fell plumb down.

There are three species of *Ibycter*, or "Carracarra Hawks," as they are called by the creoles. These are very numerous on the banks of the rivers and creeks, and appear to be continually on the alert, flying from tree to tree, alighting and scratching on the sands, and indeed being the only specimens of the bird kind on the higher rivers which are always to be met with during the whole day. The first is

The Laughing Hawk.

A well-known bird, which has been described by Waterton, Schomburgk and others. It is remarkably noisy, and is generally seen in company with three or four others of the same species flying about and perching on the high trees on the borders of creeks, uttering almost constantly a discordant loud gabbling, from whence it has got the name of the "Laughing Hawk." This bird feeds on eggs, young birds, insects, and does not despise certain sorts of fruit. It is, in fact, omnivorous.

The Yellow-headed Carracarra Hawk.

Smaller than the preceding. Three or four are generally seen together. They frequent chiefly in the months of September, October, and November, when the guana and river turtle lay their eggs, the extensive sand-banks on the river Essequibo, beyond the first rapids in latitude 6° 10′. I have seen them in companies of from three to five, assiduously scratching up the sand in which the guana or turtle had laid; and as these reptiles deposit their eggs at least eight inches beneath the surface, their rasorial powers are very considerable. The sands on this part of the Essequibo extend in every direction, lying on the beautiful bosom of the placid river, among finely wooded islands of all sizes, with most inviting sand beaches, enticing you to land at every turn. If you do land, you will probably see on the hard fine sand the scrambling track of a guana, which, if petrified, would set a palæontologist frantic with delight. Close by, the steadier and more decided footstep of the cayman, clearly showing that he is made of somewhat sterner stuff than his herbivorous friend, and still further off, a camoude has dragged his slow length along. There are tracks of turtle, ducks, snipes, lizards, and all sorts of *Copriæ*; in fact, a first-rate piece of interesting geology, only not baked or compressed yet. Edging the bank is the eternal forest.

The Red-headed Carracarra.

This bird is of the same size as the preceding, but its habits are somewhat different, as its food appears to be principally confined to insects and small reptiles. I found the stomach of one I dissected full of fragments of beetles. Mr. Swainson places these birds at the head of the Kites, where they are certainly more naturally situated than among the Eagles, where they are placed by Cuvier.

The next birds are the Awl-beaked Fish-Hawks. I only know two, and they are very near one another.

The Larger Awl-beaked Fish-Hawk

Is remarkable for the great length of the curve of the upper mandible, and is somewhat larger than the next. Both are savannah birds, feeding on freshwater fish. They are often seen in large flocks, particularly on an extensive savannah, through a part of which is dug the freshwater canal called the "Lamaha," which was intended to supply the city of Georgetown with water. They prey particularly on the Hassar (*Callichthys*, Schomb.). This curious fish, which builds a nest in or under which it lays its eggs, is found in abundance in the small pools and water-holes of the savannahs. It is a very domestic fish. The female, when the time for spawning arrives, collects a number of small pieces of stick, and places them together, across one another; it then, descending beneath this structure, which is about a foot in diameter, exspumates a quantity of viscid matter, which, being mingled with air, causes the nest to float. In this viscid exspumation the eggs are laid, and both the male and female remain near the nest, making furious strokes at any intruder; and as they are provided with a very sharp bony first ray to the dorsal fin, if a wound be inflicted it is generally a severe one. The form of the beak of the Fish-Hawk is admirably adapted for separating the plates of mail in which the Hassar is enveloped. It is when the water in the pools and water-holes is reduced in the first part of the dry season to soft mud, that flocks of these birds are seen on the savannahs, feasting on Hassar.

The Smaller Awl-beaked Fish-Hawk.

Habits the same as the former. From the habits of this group of birds of scouring the savannahs in search of prey, the length of their wings, and the strength of their claws, they approach near to the Harriers.

The Scissors-tailed Kite. *Nauclerus furcatus.*

This is a very graceful bird, and is generally seen soaring, with widely-forked tail, above the lower parts of creeks, or over rivers when the water is fresh. They are, when perched, generally in companies of from five to six. They strike at small birds, creepers and such like, when feeding. I do not think that they strike at birds on the wing, and I never saw the *Nauclerus* pounce on a fish, although they appear to prefer to soar over the broad parts of creeks and fresh rivers. In fact, they are scarcely ever seen elsewhere. The Camouni creek, a few hours' sail up the Demerary river, is a favourite haunt of the Scissors-tail. Here they may be seen by the now rare traveller in this once thickly populated and very beautiful creek, either soaring high up in the brilliant sunshine, with a gentle undulatory motion, moving the head from side to side, and alternately opening and shutting the fork of the tail, whence their name of "Scissors-tail"; or perched in a small company upon some high creek-side tree, attracted probably by a flock of creepers or manakins. In coming down the Camouni one morning with a pleasant company of sportsmen—we had bivouacked near the source of the river the night before—I was much struck with the remarkable gracefulness and beauty of the *Nauclerus*. A company of six had selected a high tree close to the water's edge, at a wide and graceful bend. The approach of our boat alarmed them, and they flew up and around the tree as if inclined to settle again after we had passed on; but on one of our party firing, the birds, finding the danger impending, sought for safety in the higher regions of the atmosphere, and it was in their gyrations to obtain a suitable elevation that their gracefulness and beauty were particularly remarkable. I am not acquainted with any Hawk which soars to such a height as the *Nauclerus*. I have seen them over the river Pomeroon, at an elevation so great as to be scarcely visible.

The whole of the next group, nine in number, with the exception of three, are birds which frequent the extensive abandoned fields near the sea and the courida trees (*Avicenna nitida et tomentosa*), which form a narrow belt of vegetation along the coast, between the sea and the high roads. These fields, which were for the most part formerly in cotton, are often inundated, either from imperfect drainage of bush-water, or the incursion of the sea, which, since the British people commenced to make us pay the penalty of having had slaves, is fast resuming its ancient dominion, from whence it was dammed out by our Dutch predecessors. Over these fields may be seen hunting with indefatigable industry the first two of the group; viz.

The Brown-backed Harrier, and

The Long and Slender-legged Buzzard.

They search every bush, destroying old and young alike, snatch up the little grass-finches, and in fact are a most dreadful scourge to the feathered inhabitants of these woe-begone and miserable looking swamps, remembrances of our former glory and shame. The next is

The Chestnut Harrier.

A very rare bird, which was shot while flying over the Mahaica creek. Nothing whatever is known of its habits, but from its structure they must be similar to those of the two former.

The Large Sea-fishing Hawk.

The coasts of Demerara, it may not be unnecessary to inform the English reader, are bound by vast mud-flats, which at high tide are covered by the sea. At dead low tide the water-mark is, at many parts of the coast, not visible. It is on the courida trees which border the coast landward that the Large Sea-fisher may be seen waiting patiently for the influx of the tide, which brings with it his food. At about half-tide he begins to bestir himself, and as there is always an abundance of fish brought up by the water, he soon captures as much mullet and other such-like coast-fish as gratifies his hunger. The Sea-fisher fishes on the hover from a considerable height, pouncing down vertically on its prey. The next is

The Bird Hawk,

With striated chestnut belly, which does not hunt on the wing, but sights its prey, small birds, from the perch, generally a courida tree. It builds a nest of dry sticks upon these trees. The next is

The Parrot-beaked Buzzard.

A rare bird, and was shot in a cocoa-nut tree in the Mahaicony. It sights its prey, small birds, from the perch. Another species,

The Long-legged Snake-eater,

Leads us back to the abandoned fields. This bird, a large, brown, dirty and ruffianly-looking animal, is very often seen, particularly on the east sea-coast, undergoing the punishment peculiarly appropriated to bullies, namely, being severely thrashed by fellows much smaller than himself. The Kiskadee, a tyrant shrike, is the little champion who thrashes the Snake-eater. Sometimes two or three of these birds will be seen, always keeping above it, pecking the Hawk most unmercifully, and they seldom fail in bringing it to the ground, when the sight of its powerful talons I presume, reminding them that the better part of valour is discretion, causes them to fly off to some neighbouring tree and set up a glorious "Io Pæan" of Kiskadee, Kis-kis-kiskadee over their victory. I have seen this Hawk capture snakes more than once and fly off to its perch to devour the prey. Another species,

The Crab-eater,

Frequents the courida trees, from whence it sights its prey on the mud-flat, namely crabs. It pounces upon any unwary crab that quits its hole, and, unlike the Snake-eater, consumes it on the spot where it takes it, and then returns to its look-out. They build a nest of sticks in the courida bush. Another species,

The Insect-eater,

Is the most ignoble of all our Hawks. Its feet and claws are singularly weak, and it feeds almost exclusively on beetles and other insects, which it captures on the courida bush, which it frequents. I have opened them and taken a large quantity of the fragments of insects out of the stomach.

The Crested and Booted Eagle.

A live specimen of this beautiful bird was brought to me as a present by an old servant who had left me a long time, and had been living far up the Demerary river. He unfortunately knew nothing of its habits, and told me that it was the only one he had seen. I have never seen one in the wild state. This bird lived for some days, but would not eat. Apparently, the beautiful semicircular crest of black feathers with a white central star was only elevated when the bird was excited. This however was almost constantly the case, from extreme wildness. The cry was a loud, plaintive, diminishing ha-ha-ha-ha-ha-ha. This bird certainly has most of the characters of a true Eagle. It is heavy and robust, with a beak somewhat straight at base; tarsi plumed to the toes; wings moderately long, with the fourth feather the longest; and the general air is that of an Eagle.

There are only three Falcons that I have seen here; the first two true Falcons, with the typical characters and habits marked, and the third with all the typical characters (excepting the two-toothed beak) and the habits wanting. The first two are little Falcons, namely,

The Chestnut-bellied Falcon, and

The White mottle-bellied Falcon.

They are both birds that strike their prey on the wing, and are capable of killing birds nearly as large as themselves. The yellow-bellied species may be seen very busy at dusk, hunting bats with amazing swiftness. I have never been able to find either of their nests.

The Two-toothed Baridi.

A bird with precisely similar habits to the next three birds. Like them, the Baridi never strikes, but confines himself to pillaging nests and destroying young birds. He is a sneaking marauder and burglar, and not audacious enough to commit highway robbery and murder, like the true Falcons. His wings are very short, and the characteristic formula of the quill-feathers is wanting. Consequently, I have placed this bird at the head of the succeeding group.

The Plaid-chested Short-winged Hawk.

The Brown-backed Short-winged Hawk.

The Yellow-cered Short-winged Hawk.

They are characterized by the same habits as the Baridi, stealing eggs and murdering unfledged birds.

The two next Hawks are large and powerful. The first is a large Black Hawk. It is a very fierce and destructive bird. It will kill rats and other small quadrupeds, as the Adouri (*Cavia agouti*), &c., and will strike at and kill so large a bird as a Currycurry (*Ibis rubra*). My huntsman Benjamin tells me that some time ago he shot a Currycurry, and before the bird fell to the ground, a large Black Hawk seized it and bore it away. It is very destructive to hen-roosts. The next species is found far up the river Demerary, and is by no means common. Mr. John King, a very respectable bird-stuffer and an observant naturalist, tells me that in a period of many years, constantly occupied in procuring species of birds and animals, he has only seen a few specimens of this bird. I have ascertained from the same authority, that its habits are very similar to the Large Black Hawk of the coasts.

I only know of five Owls in this country; of four I have procured specimens. The first two, Booted Owls without ears, are common enough, and I have not been able to ascertain anything in their habits differing from the well-known and frequently described habits of their European congeners.

The Small-booted Brown Owl.

This is seen frequently at dusk in company with the Little Bat-falcon, hunting bats. The larger one, or Large-booted Black and White Owl, is strictly a night bird, and found principally in the forests. The next two are likewise strictly night birds.

The Large Long-legged Strix, or Jumbi Bird,

Inhabits hollow cabbage-trees or old and dilapidated houses, unfortunately that style of habitation in Georgetown, and over the whole country, being at this time the rule, and not the exception. They make a great noise at night, a sort of clack, clack, clack, &c., terminating with a harsh, disagreeable and ominous scream. They are held here, as elsewhere, to be birds of ill omen, portending death, wherefore they are called "Jumbi," or Ghost Birds, by the negroes.

The Little Long-legged Strix

Is a very handsome little mouse-coloured Owl, which preys upon moths and other night insects as well as small bats. They are mostly seen on the savannahs and in the courida bushes, and are strictly nocturnal.

It will be perceived that I have not described the *Harpya destructor*. This is in consequence of my not having had an opportunity of examining a dead specimen; a living specimen which I have access to, in the possession of Governor Barkly, being altogether too fierce to take liberties with. It has a very owlish appearance, both in its facial disk and soft plumage. I have seen another imperfect skin of a very large Eagle feathered to the toes, with tremendous talons; both this and the Harpy I hope to be able to describe in a subsequent communication.

March 11, 1851.—J. E. Gray, Esq., F.R.S., in the Chair.

Description of new species of Emarginula in the Collection of H. Cuming, Esq. By Arthur Adams, R.N., F.L.S. etc.

Genus Emarginula, Lamarck.

Head proboscidiform; tentacles subulate, with the eyes on tubercles at their external bases; foot with a range of cirrhi round the sides; mantle-margin simple; branchial plumes two; anal siphon with its angulated membranous sides projecting from the edges of the fissure; tongue with a central laminar subquadrate tooth and numerous lateral teeth.

Shell conical, with an elevated slightly recurved entire vertex turned towards the posterior end; surface cancellated; aperture emarginated in front by a slit, which runs for some distance up the shell; interior without a partition; muscular impression crescentic, interrupted in front.

Emarginulus, Montf.—*Patella*, sp. Linn.

1. Emarginula clypeus, A. Adams. *E. testâ elongato-ellipticâ, valdè depressâ, testaceâ, maculâ luteolâ in medio dorsi, vertice subcentrali, posticè inclinato; costis confertis, æqualibus, radiantibus, imbricato-asperis, ornatâ; basi arcuato; aperturæ margine crenulato, anticè valdè fissurato; fissurâ magnâ; aperturâ intus bimaculosâ.*

Hab. Isle of Burias, Philippines, on dead shells, 7 fathoms, sandy mud. Mus. Cuming.

2. Emarginula scabriuscula, A. Adams. *E. testâ elongato-ellipticâ, depresso-conicâ, testaceâ, vertice subpostico, retrorsum inclinato; costis inæqualibus, radiantibus, imbricato-subaculeatis, asperis, et lineis elevatis, concentricis, cancellatâ; aperturâ anticè angustatâ, basi arcuatâ, margine creno-denticulato.*

Hab. ——? Mus. Cuming.

3. Emarginula obovata, A. Adams. *E. testâ elongatâ, obovatâ, depresso-conicâ, testaceâ, vertice subcentrali, retrorsum inclinato, costellis radiantibus, imbricato-asperis, et liris ele-*

vatis, concentricis, cancellatâ; aperturâ posticè rotundatâ, anticè angustatâ, margine creno-denticulato, anticè profundè inciso.

Hab. Catbalonga, isle of Samaar, on stones, 4 fathoms. Mus. Cuming.

4. Emarginula incisura, A. Adams. *E. testâ elongato-ovali, planulatâ, pallide fulvâ, vertice antico retrorsum inclinato, costellis inæqualibus, radiantibus, longitudinalibus, imbricato-asperis, et lineis elevatis, concentricis, decussatâ, basi arcuato, aperturæ margine crenulato, anticè declinato, valdè fissurato, incisurâ magnâ, longâ, haud usque ad verticem productâ, marginibus intus callosis.*

Hab. ——? Mus. Cuming.

5. Emarginula micans, A. Adams. *E. testâ elongato-ovali, pallide fuscâ, nitidâ, vertice posticè declinato, costellis radiantibus et lineis elevatis transversis, regulariter cancellatâ, cancelli quadrati; aperturæ margine denticulato, incisurâ magnâ et longâ.*

Hab. Rains Island, North Australia (*Lieut. Ince*). Mus. Cuming.

6. Emarginula punctata, A. Adams. *E. testâ ovato-conicâ, albido-griseâ, pulcherrimè viridi punctatâ, vertice subcentrali, posticè inclinato; costis longitudinalibus (majoribus cum minoribus alternatis) concinnè granulatis; aperturæ margine crenulato, excurvato, anticè valdè fissurato.*

Hab. San Nicholas, island of Zebu, under stones, low water. Mus. Cuming.

7. Emarginula variegata, A. Adams. *E. testâ ovato-conicâ, albidâ, rufo-fusco variegatâ, vertice acuto, subcentrali, posticè inclinato, costellis radiantibus, æqualibus, imbricato-asperis, ornatâ; aperturæ margine denticulato, anticè fissurato, fissurâ brevi subquadratâ.*

Hab. Isle of Camaguan, Philippines, on exposed rocks, low water. Mus. Cuming.

8. Emarginula puncticulata, A. Adams. *E. testâ elevato-conicâ, capuliformi, albâ, fusco punctulatâ, costellis planulatis, crebris, longitudinalibus, radiantibus, ornatâ; aperturâ ovali, margine crenulato, anticè profundè fissurato; fissurâ magnâ et longâ.*

Hab. Calapan, island of Mindoro, Philippines, on stones, 12 fathoms. Mus. Cuming.

9. Emarginula fuliginea, A. Adams. *E. testâ ellipticâ, valdè depressâ, fuligineâ, apice subcentrali, posticè inclinato, costellis æqualibus, radiantibus, granulosis, confertis, et lineis incrementi concentricis, ornatâ; aperturâ ovali, intus viridi, margine crenulato, anticè fissurato, incisurâ intus in canalem productâ.*

Hab. ——? Mus. Cuming.

10. Emarginula galericulata, A. Adams. *E. testâ obliquè*

conicâ, capuliformi, vertice valdè curvato, ultra marginem posteriorem decumbente, costellis angustis, crenulatis, radiantibus, interstitiis lineis elevatis, transversis, concinnè clathratis; costâ anticâ, supra incisuram, granulato-punctatâ; aperturæ margine crenulato, anticè profundè inciso.

Hab. Calapan, isle of Mindoro, on stones, 12 fathoms. Mus. Cuming.

11. Emarginula pulchra, A. Adams. *E. testâ depresso-conicâ, viridi, albo pulcherrimè radiatim pictâ, vertice subcentrali, posticè inclinato, costis radiantibus, inæqualibus, aculeato-asperis, interstitiis lineis elevatis transversis clathratis; aperturæ margine denticulato, anticè inciso, fissurâ brevi subquadratâ.*

Hab. Isle of Camaguan, Philippines, on exposed rocks, low water. Mus. Cuming.

12. Emarginula concinna, A. Adams. *E. testâ ovato-depressâ, albidâ, vertice postico, ad marginem declinato, costis sulcosis, distantibus, radiantibus (circa 12), interstitiis lineis longitudinalibus, et transversis, concinnè decussatis; aperturæ margine dentato, anticè profundè inciso.*

Hab. ——? Mus. Cuming.

13. Emarginula viminea, A. Adams. *E. testâ ovato-conicâ, albidâ, vertice centrali, retrorsum inclinato, costellis radiantibus, nodulosis, subæqualibus, et lineis crassis, transversis, regulariter cancellatâ; cancelli profundi, punctiformes; aperturæ margine crenato, anticè profundè inciso.*

Hab. Philippine Islands. Mus. Cuming.

14. Emarginula excurvata, A. Adams. *E. testâ elongato-ellipticâ, depresso-conicâ, testaceâ, apice acuto, subpostico, retrorsum inclinato, costis radiantibus, et liris concentricis, elevatis, cancellatâ, liris ad costas nodulosis, basi arcuato; aperturæ margine excurvato, crenulato, anticè profundè inciso.*

Hab. ——? Mus. Cuming.

15. Emarginula dilecta, A. Adams. *E. testâ elongato-ovali, subquadrangulari, albâ, valdè depressâ, vertice subpostico, retrorsum declinato, costis subdistantibus, radiantibus, asperulatis, et liris elevatis, concentricis, pulcherrimè cancellatâ; basi arcuatâ; aperturæ margine denticulato, anticè valdè fissurato.*

Hab. King George's Sound, South Australia. Mus. Cuming.

16. Emarginula scabricostata, A. Adams. *E. testâ ovali, valdè depressâ, albidâ, fasciis tribus, lutescentibus, radiantibus, anticè ornatâ; vertice subcentrali, posticè inclinato, costis radiantibus, distantibus, corrugatis, interstitiis valdè clathratis et corrugatis; aperturæ margine dentato et denticulato, anticè valdè inciso.*

Hab. Isle of Corrigidor, Bay of Manila, on dead shells, sandy mud, 12 fathoms. Mus. Cuming.

17. Emarginula candida, A. Adams. *E. testâ ellipticâ, de-*

presso-conicâ, obliquâ, albâ, vertice subpostico, retrorsum declinato, costis radiantibus, imbricato-asperis (majoribus cum minoribus alternatis), interstitiis clathratis; aperturæ margine denticulato, anticè profundè inciso.

Hab. Port Adelaide, Australia, on the sands. Mus. Cuming.

18. Emarginula bellula, A. Adams. *E. testâ elongato-ellipticâ, subdepressâ, albidâ, vertice subpostico, declinato, costis distantibus prominentibus, lineisque transversis concinnè sculptis; carinâ, supra incisuram, puncturatâ; aperturæ margine denticulato, intus sulcato, anticè profundè inciso.*

Hab. Catanuan, province of Toyabos, island of Luzon, on dead shells, 10 fathoms. Mus. Cuming.

19. Emarginula retecosa, A. Adams. *E. testâ elevato-conicâ, ellipticâ, albidâ, vertice subcentrali, posticè inclinato, costis radiantibus, æqualibus, subnodosis, ornatâ; interstitiis regulariter cancellatis, cancelli in serie unico dispositi; aperturæ margine crenulato, incisurâ profundâ.*

Hab. Bolinao, province of Tambalas, island of Luzon, sandy mud, 10 fathoms. Mus. Cuming.

20. Emarginula eximia, A. Adams. *E. testâ elongato-ovali, valdè depressâ, albâ, subpellucidâ, vertice postico retrorsum inclinato, costis radiantibus, distantibus, prominentibus, imbricato-nodosis, interstitiis liris transversis et longitudinalibus latè cancellatâ; totâ superficie lineolis radiantibus et concentricis pulcherrimè decussatâ; aperturæ margine denticulato, anticè profundè inciso.*

Hab. San Nicholas, island of Zebu, under stones, low water. Mus. Cuming.

21. Emarginula planulata, A. Adams. *E. testâ elongato-ovali, complanatâ, vertice subcentrali, posticè inclinato, albidâ, costellis radiantibus, æqualibus, imbricato-asperis, lineisque concentricis incrementi decussatâ, basi arcuato; aperturæ margine anticè valdè inciso; incisurâ latâ et profundâ.*

Hab. Singapore, coarse sand and shells, 7 fathoms. Mus. Cuming.

22. Emarginula cucullata, A. Adams. *E. testâ obovali, obliquè conicâ, albâ, vertice producto, subpostico, intorto; costis prominentibus, nodulosis, radiantibus, interstitiis cancellatis; aperturæ lateribus anticè angustatis, margine denticulato, posticè rotundato, anticè profundè fissurato, incisurâ longâ et latâ.*

Hab. Singapore, on shells, 7 fathoms. Mus. Cuming.

23. Emarginula aculeata, A. Adams. *E. testâ elongato-ovali, depressâ, rufescente, vertice subpostico, retrorsum inclinato; costis radiantibus, aculeato-asperis, prominentibus, interstitiis valdè clathratis; aperturæ margine denticulato, anticè fissurato, fissurâ profundâ.*

Hab. ——? Mus. Cuming.

24. Emarginula lævicostata, A. Adams. *E. testâ parvâ,*

ellipticâ, valde depressâ, apice subpostico, retrorsum inclinato, costis lævibus, radiantibus (circa 14), interstitiis costellis longitudinalibus, et lineis transversis latè clathratis; aperturæ margine denticulato, lateribus anticè angustatis, anticè valdè inciso.

Hab. ——? Mus. Cuming.

Subgenus Clypidina, Gray.

Shell ovate, conical, surface with radiated ribs; vertex acute, central, not recurved; aperture with the margin crenulated; muscular impression fungiform, anal groove and emargination inclining towards the right anterior margin (in the natural position of shell).

1. Clypidina sulcifera, A. Adams. *C. testâ ovali, depresso-conicâ, viridescenti, vertice obtuso, ad partem posteriorem posito; costellis radiantibus, interstitiis haud æquantibus, et striis incrementi ornatis; basi arcuatâ; aperturæ margine crenulato, incisurâ haud profundâ, sublaterali, intus in canalem productâ.*

Hab. ——? Mus. Cuming.

2. Clypidina rudis, A. Adams. *C. testâ crassâ, rudi, albidâ, depresso-conicâ, costis octo angulatis radiantibus, interstitiis costellis longitudinalibus et lineis concentricis decussatis; apice subcentrali; basi arcuato; aperturæ margine crenato, anticè sinuato, sinu intus in canalem producto.*

Hab. ——? Mus. Cuming.

3. Clypidina stellata, A. Adams. *C. testâ solidulâ, albidâ, ellipticâ, depresso-conicâ, apice subcentrali, costis elevatis, subspinulosis, radiantibus; interstitiis costellis et striis crebris decussantibus, exasperatis; aperturæ margine dentato, sinu sublaterali, intus in canalem apicem versus producto.*

Hab. Australia. Mus. Cuming.

4. Clypidina scabricula, A. Adams. *C. testâ elongato-ovali, obliquè conicâ, costis radiantibus, elevatis, distantibus, asperulatis, interstitiis costellis longitudinalibus et lineis scabriusculis valdè cancellatâ; vertice subcentrali, posticè inclinato; aperturæ margine dentato-crenulato; incisurâ profundâ, intus in canalem productâ.*

Hab. Australia. Mus. Cuming.

5. Clypidina annulata, A. Adams. *C. testâ crassâ, ellipticâ, albidâ, annulo luteo-fusco circumcinctâ; costis elevatis asperis radiantibus distantibus, interstitiis costellis longitudinalibus et lineis transversis elevatis concinnè clathratis; aperturæ margine duplicato, incrassato, pulcherrimè fimbriato, sinu quadrato intus in canalem producto; aperturâ intus annulâ albidâ.*

Hab. Australia. Mus. Cuming.

6. Clypidina acuminata, A. Adams. *C. testâ elevato-conicâ, albidâ, viridi annulatâ, costis longitudinalibus radiantibus, imbricato-asperis, interstitiis tricostulatis, costellis imbricato-asperis; sulcis transversis concentricis, distantibus, impressâ;*

vertice acuminato, acuto, subcentrali; aperturæ margine valdè crenulato, sinu subquadrato, intus in canalem producto.

Hab. Australia. Mus. Cuming.

7. Clypidina candida, A. Adams. *C. testâ ellipticâ, solidulâ, conicâ, candidâ, costellis asperulatis inæqualibus, radiantibus, et striis elevatis transversis, concentricis, decussatâ; vertice subcentrali; aperturæ margine crenulato, sinu brevi, intus in canalem producto.*

Hab. Port Adelaide, Australia. Mus. Cuming.

Subgenus Tugali, Gray.

Shell oblong, narrow anteriorly, back elevated, cancellated; apex posterior and recurved; aperture with the margin crenulated, and deeply sinuated anteriorly.

1. Tugali carinata, A. Adams. *T. testâ elongato-ovali, dorso carinatâ, costis longitudinalibus, radiantibus, confertis, et striis transversis, concentricis, decussatâ; apice posticè declinato; basi arcuatâ; aperturæ margine crenulato, extremitate anteriori sinuato, sinu intus in canalem producto.*

Hab. Philippines. Mus. Cuming.

2. Tugali cicatricosa, A. Adams. *T. testâ elongato-ovali, albâ, dorso valdè depressâ, costellis radiantibus et lineis concentricis elevatis decussatâ, vertice subpostico depresso excavato quasi cicatricoso, subpellucido; basi arcuato; aperturæ margine crenulato, extremitate anteriori sinuato, sinu intus in canalem producto.*

Hab. Philippines. Mus. Cuming.

3. Tugali scutellaris, A. Adams. *T. testâ elongato-ovali, viridi-fuscâ, tenui, dorso planulatâ, vertice postico, acuto, vix elevato, costellis radiantibus subdistantibus, et striis concentricis incrementi, decussatâ; extremitate anteriori vix sinuato; aperturâ intus fuscâ, margine subcrenulato.*

Hab. Bais, Philippines. Mus. Cuming.

4. Tugali radiata, A. Adams. *T. testâ elongato-ovali, luteolâ, valdè depressâ, costis radiantibus, rotundatis, elevatiusculis, distantibus, et striis concentricis, ad incrementum ornatâ; aperturâ intus albidâ, margine crenulato, extremitate anteriori vix sinuato.*

Hab. Catanuan, Philippines. Mus. Cuming.

5. Tugali decussata, A. Adams. *T. testâ elongato-ovali, albidâ, planulatâ, dorso carinatâ, costellis longitudinalibus, radiantibus, et lineis elevatis concentricis eleganter clathratâ; vertice acuto, postico; aperturæ margine crenulato, anticè sinuato, sinu intus in canalem producto.*

Hab. Philippine Islands. Mus. Cuming.

Subgenus Subemarginula, Blainville.

Shell conical, compressed, vertex inclined towards the posterior margin; aperture with the anterior margin folded in the form of a gutter or channel; surface cancellated.

Hemitoma, Swainson.

1. SUBEMARGINULA GALEATA, A. Adams. *S. testâ griseo-rufescente, elevato-conicâ, tenui, vertice subcentrali, posticè inclinato, costis tuberculosis, radiantibus, albidis, et lineis transversis, elevatis, subclathratis, costâ anticâ prominenti; aperturæ margine dentato, anticè valdè sinuato, sinu intus in canalem producto.*

Hab. Philippine Archipelago. Mus. Cuming.

2. SUBEMARGINULA ARABICA, A. Adams. *S. testâ albidâ, crassâ, depresso-conicâ, vertice obtuso subcentrali, posticè inclinato; costis radiantibus tuberculosis et liris elevatis transversis clathratâ; aperturæ margine incrassato, crenato, anticè sinuato, sinu intus in canalem producto.*

Hab. Red Sea. Mus. Cuming.

3. SUBEMARGINULA ALVEOLATA, A. Adams. *S. testâ tenui, albâ, subpellucidâ, depresso-conicâ, vertice subcentrali, posticè inclinato; costis radiantibus lirisque transversis irregulariter alveolatâ; costis ad liras nodulosis; alveolis pellucidis; aperturæ margine dentato, anticè sinuato, sinu intus in canalem producto.*

Hab. Honduras. Mus. Cuming.

4. SUBEMARGINULA IMBRICATA, A. Adams. *S. testâ ovato-oblongâ, subquadrangulari, cinereo-albidâ, vertice parvo, centrali, posticè inclinato; costis radiantibus imbricato-asperis, inæqualibus, et lineis crassis irregularibus incrementi decussatâ; aperturæ margine dentato, anticè valdè sinuato, sinu subquadrato, intus in canalem producto.*

Hab. Mouth of Victoria River, north-east coast of Australia, under stones, low water. Mus. Cuming.

5. SUBEMARGINULA PUMILA, A. Adams. *S. testâ orbiculato-ovali, valdè depressâ, apice subcentrali, posticè inclinato; costis radiantibus, nodosis, inæqualibus, et lineis elevatis concentricis incrementi, decussatâ; aperturæ margine denticulato-crenato, anticè profundè sinuato; sinu subquadrato, intus in canalem producto.*

Hab. ——? Mus. Cuming.

6. SUBEMARGINULA CATILLUS, A. Adams. *S. testâ elongato-ovali, valdè depressâ, vertice vix elevato, posticè inclinato; costis radiantibus nodulosis, crassis, et lineis incrementi transversis, ornatâ; aperturæ margine irregulari, crenulato, intus calloso, anticè valdè sinuato.*

Hab. ——? Mus. Cuming.

7. SUBEMARGINULA DENTICULATA, A. Adams. *S. testâ elongato-ovali, albâ, novem-radiatâ, vertice acuto posticè inclinato, costis novem, crassis, rugulosis, radiantibus; intervallis costellatis, costellis longitudinalibus, asperulatis; aperturæ margine*

dentato, et denticulato, anticè emarginato, incisuræ lateribus incrassatis, anticè in dentes duos productis.

Hab. Mexico. Mus. Cuming.

8. Subemarginula polygonalis, A. Adams. *S. testâ elongato-ovali, depresso-conicâ, albâ, octoradiatâ, vertice subcentrali, posticè inclinato, costis radiantibus subnodulosis, longitudinalibus (octo majoribus), lineis concentricis incrementi asperâ; aperturâ octagonali, margine crenulato, anticè valdè sinuato, sinu intus in canalem producto.*

Hab. Catanuan, Philippines. Mus. Cuming.

9. Subemarginula crassilabrum, A. Adams. *S. testâ ellipticâ, crassâ, rudi, albâ, depresso-conicâ, vertice subcentrali, eroso, costis radiantibus distantibus, inæqualibus, subaculeatis, ornatâ; aperturæ margine crenato-denticulato, posticè recto, anticè rotundato, sinuato, sinu intus in canalem producto.*

Hab. ——? Mus. Cuming.

10. Subemarginula nodulosa, A. Adams. *S. testâ ovatâ, obliquè conicâ, albido-rufescenti, vertice subcentrali, posticè declinato; costis longitudinalibus nodosis, radiantibus, duabus latere anterioribus permagnis, liris irregularibus transversis, decussatâ; aperturæ margine irregulari, posticè acuminato, anticè truncato, sinuato, sinu intus in canalem producto.*

Hab. Sibonga, island of Zebu, on small stones, 10 fathoms. Mus. Cuming.

11. Subemarginula cratitia, A. Adams. *S. testâ ovatâ, conicâ, albidâ, vertice obtuso, centrali, posticè haud inclinato, costis radiantibus distantibus, nodulosis; interstitiis costellis duabus longitudinalibus, et lineis elevatis, transversis, eleganter cancellatis; aperturæ margine crenulato, anticè sinuato, sinu quadrato, intus in canalem producto.*

Hab. ——? Mus. Cuming.

12. Subemarginula sculptilis, A. Adams. *S. testâ ovali, obliquè conicâ, albidâ, viridi radiatim maculatâ; vertice subcentrali, posticè valdè declinato; costis radiantibus, longitudinalibus, corrugatis; interstitiis pulcherrimè punctato-clathratis; costâ anticâ prominenti, crenulatâ; aperturæ margine undulato et crenulato, posticè rotundato, anticè truncato et sinuato, sinu intus in canalem producto.*

Hab. Calapan, island of Mindoro, on small stones, 12 fathoms. Mus. Cuming.

Description of a new species of Bulimus from Callao, collected by Erneste Denicke. Communicated by J. E. Gray, Esq., V.P.Z.S.

M. Erneste Denicke, a sailor on board a Hamburg vessel trading with Chili, called at the British Museum, and informed me that he had a new species of *Bulimus*, which he had discovered on the White-sand Hill at Chala, near Callao. He further stated that he had collected the Chilian shells, and had studied shells in general, and that he was convinced that it was a new species. Having compared the shell with the species in the English collections and the descriptions in Pfeiffer, and being satisfied that M. Denicke was correct in his idea, I propose that it should be named after that conchologist.

Bulimus Denickei.

Shell conical, trochiform, white, the upper whorls small, forming a rather produced tip, the others rapidly enlarging, slightly convex, forming a conical spire, the last angularly keeled; axis perforated; mouth rhombic; outer lip slightly reflexed, acute; throat deep rose-coloured.

Hab. Chala, near Callao, on the Whitesand Hills.

To the preceding communication by Mr. Gray, the following details were added by Mr. Lovell Reeve:—

Bulimus Denickei. *Bul. testâ pyramidali-conicâ, subampliter umbilicatâ, apice papillari, anfractibus supernè convexo-declivibus, medio acutangulis, carinatis, undique peculiariter corrugatis et malleatis, opaco-albis, immaculatis, aperturâ suboblongo-ovatâ, labro tenui, simplici, effuso, aperturæ fauce intensè purpureo-roseâ.*

Hab. Found imbedded in sand at the top of a lofty hill near the Port of Chala, Peru, by M. Erneste Denicke.

This interesting species of *Bulimus* is of about the same size and form, and belongs to the same type, as *B. lemniscatus*, inhabiting Ilo, Peru. Specifically it is very distinct, the entire surface of the shell being peculiarly indented and shrivelled, and of an opake unspotted white. The interior of the aperture is of a deep purple-rose colour.

On a new species of Musophaga.
By John Gould, F.R.S.

Mr. Gould exhibited to the meeting a drawing by Lieut. J. R. Stack, of a new and beautiful species of *Musophaga*, of which a living example had been for the last ten years in the possession of Lady Ross, at St. Helena. Mr. Gould also exhibited some feathers shed from the wings and tail of the bird, an examination of which, and of the drawing, satisfied him that the bird was quite distinct from all previously described members of the genus.

Lady Ross, who is at present in England, had informed Mr. Gould that the bird was about the size of a hen-pheasant, and that it had been brought to St. Helena from the western coast of Africa, but the precise locality in which it had been procured was unknown to her.

For this interesting addition to the *Musophagæ* Mr. Gould proposed the specific appellation of *Rossæ*, in honour of its amiable owner.

Musophaga Rossæ.

Body, wings and tail rich deep blue; primaries and secondaries arterial blood-red, narrowly margined and more broadly tipped with purplish brown, as in the other species of the genus; crown surmounted with a high rounded crest of hair-like blood-red feathers; bill and denuded orbits yellow; irides brown.

CORK CUVIERIAN SOCIETY.

Nov. 3, 1852.—Robert J. Lecky, Esq., President, in the Chair.

Dr. Haines exhibited two species of *Holothuriæ,* one of them new to the British fauna; it is the *Holothuria tubulosa,* and is fully the size of the large cucumber to which those animals have been appropriately compared: the upper surface or back of this animal is studded with tubercles, the outer ones being the largest; the whole under surface is thickly covered with ambulacriform tubes partially retractile; two lateral lines barely mark off two bands of them, leaving the central band much wider; the animal is of a dark brown colour, but nearly black on the upper surface; when contracted both extremities tilt upwards; the short thick tentacula count from fourteen to twenty, and can be retracted within the oral orifice; into that orifice open the œsophagus, seven or eight appendicula cæca, a clear vesicular sac, and the single duct from the numerous ovarian tubuli.

The intestinal tube, which is filled with sand, makes one large flexure in the abdomen before terminating in the cloaca, and is sustained in most of its course by a very delicate mesentery; from a considerable portion of the line of attachment of the mesentery hangs a beautiful open network of vessels resembling an omentum, but not possessing a continuous membrane between them; this network is described as consisting of veins and arteries; the upper portion of it, which has more free intermingling with the respiratory lobules, has fine vessels, but in the lower portion the vessels and lacework look coarser.

The anterior third of the animal is occupied by the red ovarian tubuli hanging loosely in the general cavity, full of ova in one specimen, but all discharged in another. The respiratory apparatus (renal of Hunter) corresponds with the description in other species; it commences by one tube near the termination of the intestine, and ramifies in two branches, one up among the viscera, the other along the wall of the sac. There is further, occupying the lower third of the animal, *a large mass of white tubuli,* their lower extremities hanging into the cloaca, and this mass is bound to the general wall by a single strong band and a few fibres close to the end of the respiratory tube. This mass of white tubes is not described in any British species by our authors; Cuvier probably had this species before him, for he mentions the white tubes, calling them 'vesiculæ seminales,' and describing the order as hermaphrodite;—Owen however says the order is not hermaphrodite, but in his 'Anatomy' there is no mention of these tubes, nor is there in the 'Hunterian Descriptive Catalogue's' account of the details of the *Holothuria tremula.* Possibly therefore this structure is peculiar to this or to some species, and it certainly seems to support the hermaphrodite character of at least this species. Now this species has the property of what is called cotton-spinning, and it is produced by the white tubes being at times protruded from the vent; and they are most singularly extensile—they may be drawn out to almost any length.

At the York meeting of the British Association, Mr. Peach exhibited in 1843 a *Holothuria* from Cornwall with the local name of Nigger or Cotton-spinner, but the species was not then identified; it was probably the same as the above specimens, but he says there were four rows of suckers, a condition which could not be established from any of those specimens of which Dr. Haines has now examined five; the ambulacra are so thickly placed beneath, that although there is some linear arrangement, it requires close observation to see two lines separating the lateral bands, while the central broader band has no line running through it to constitute four rows of suckers. Dr. Haines placed the several organs under the microscope; the ova were of a flattened oval form, approaching the pentangular, with a central clear cell. The white tubes did not seem to possess any discoverable contents; they were found to be closely corrugated transversely, and those corrugations could be drawn out to an *immense extent*, exhibiting only the finest possible membranous structure. The reticulated vessels hanging from the margin of the intestine presented a very curious appearance; they were of a pinkish colour, and on compression it seemed that a transparent pink tube had its *external* surface coated with innumerable transparent minute corpuscles, especially in the lower and coarser vessels: every examination showed that the clear vessel lay on the glass, the corpuscles under compression spreading out evenly on both sides of the vessel.

It may be stated that these creatures were examined after being a few days in Goadby's solution, having been forwarded by Mr. Blackburn from Valencia, county of Kerry. This gentleman had described the cotton-spinning appearance to Dr. Haines.

One of the specimens carefully dissected had a considerable number of the white tubes extruded, and it was in this individual that the ovaria were found empty;—is it not probable then that the male and female organs had been called into operation about the same time, supposing these white tubes to be vesiculæ seminales? The extremities of many of the white tubes were of a dark colour in their protruded state, but possibly this was in some manner due to the action of the solution. Blainville describes this animal as a Mediterranean species.

The peculiarity in this genus is the rudimentary and separate condition in which each of the organs is found, without any parenchyma or connecting cellular membrane, floating in one general cavity; the salivary ducts, the ovarian tubules, the vesiculæ seminales at the opposite extremity, the respiratory lobules, and the lacework or circulating vessels (may not these latter have some hepatic function?), all are here as if in their dissected state to show the parts of compound organs.

The other species exhibited by Dr. Haines was the *Thyone papillosa*; it has ten beautiful ramifying tentacula. One of the specimens presented the remarkable habit of the order, that of *eviscerating* itself; this is not done by turning the bowels *inside out*, but the tubes attached at the vent break off, and part of the *circle round the tentacula* separates *laterally*, when the whole contents with their transparent containing membrane slip out, the margin of the oral orifice still remaining attached at one side to the skin; so that we have the whole animal, tentacula, teeth and all, minus the skin and muscular bands, protruded in their natural and relative position. In fact it is just as if the anatomist ran his knife round the neck and slipped off the skin, without any disturbance of the other parts. Sir J. Dalyell says he has observed the entire visceral apparatus renewed within three or four months.

MISCELLANEOUS.

On the Classification of Serpents. By M. C. Duméril.

In a memoir with this title, read before the Academy of Sciences, M. Duméril proposes an arrangement of the *Ophidia*, of which the following is a tabular view:—

Third Order of Reptiles.—Ophidia.

Char. Body elongate, slender, destitute of feet or lateral fins; mouth furnished with pointed, recurved teeth; branches of the lower jaw disunited, longer than the skull; head with a single rounded condyle, with neither a distinct neck, nor an external ear or auditory conduits; eyes without moveable eyelids; skin extensible, covered with a caducous epidermis.

	Suborders.
I. Teeth in only one of the jaws, either the upper or lower	1. *Opoterodontes.*
II. Teeth in both jaws.	
A. Teeth all smooth, not furrowed	2. *Aglyphodontes.*
B. Some of the teeth furrowed.	
a. Posterior teeth longer and furrowed.........	3. *Opisthoglyphæ.*
b. Anterior teeth furrowed, isolated, perforated	5. *Solenoglyphæ.*
c. ——————————, followed by smooth teeth	4. *Proteroglyphæ.*

The first of these suborders corresponds with that named *Scolecophides* by MM. Duméril and Bibron, in their work on Reptiles in the 'Suites à Buffon'; the second to the *Azémiophides* of the same authors; the third to their *Aphobérophides*; the fourth to their *Apistophides*; and the fifth to their *Thanatophides.*—*Comptes Rendus*, Nov. 2, 1852, p. 621.

On the Influence of Coal Gas upon Vegetation. By G. H. Ulex.

The introduction of lighting by gas upon the promenades of Hamburgh has exhibited the injurious influence of coal-gas upon vegetation in a very vexatious manner. The gas-pipes are placed, at a depth of three feet, in the middle of avenues 30 feet wide, planted principally with elms, but with a few lime-trees. Since its introduction, a great number of trees, previously healthy and vigorous, have quickly perished. The alburnum becomes rotten, the bark detached, and the tree dies in a few days, without any alteration taking place in the wood. Wherever this malady appeared, the roots were found to be decomposed, and the soil impregnated with the odour of coal-gas, showing that the cause of this destruction must be the escape of gas from the pipes.

M. Ulex mentions several other localities where similar facts have occurred, so that there can no longer be any doubt as to the injurious influence of coal-gas upon vegetation. We must not, however, conclude from these circumstances that this is a necessary consequence of the introduction of gas-lights. In Leipzig for instance, the gas-pipes pass through the promenades without any appearance of injury to the trees. This arises from the junction of the pipes being much more carefully effected than at Hamburgh, so that escapes of gas are much more rare.

From these observations it follows, that it is as well to allow gas-pipes to pass as far as possible from plantations of trees, and that when this cannot be managed, great care must be taken to render the junctions of the tubes as perfect as possible.—*Journ. für prakt. Chemie*, lvi. p. 257.

On the Habits of the Wigeon. By Matthew Moggridge.

To the Editors of the Annals of Natural History.

The Willows, Swansea, Jan. 8, 1853.

Gentlemen,—Last summer a pair of wigeons were observed on the lower lake at Penllergare, long after their brethren had migrated. At last I saw them swimming about with five young ones, and watched them with a good pocket-glass for some time at the distance of about 100 yards. The keepers and some others saw them also, so that there is no doubt of the fact.

Your obedient servant,

Matthew Moggridge.

On the Relations between the Oxygen consumed by the Spadix of Arum italicum *and the Heat produced by it.* By M. Garreau.

The observations of M. Garreau confirm the well-known facts of the augmentation of the heat of the spadix of *Arum italicum* at the moment of flowering, and with redoubled intensity at certain hours, during several consecutive days. As might be expected, the oxygen taken from the air to form carbonic acid gas, and the development of heat are correlative phænomena. M. Garreau has measured the oxygen consumed at different hours; the difference is considerable. Thus, an *Arum* on the 7th of June indicated an increase of heat of $4^{\circ}\cdot 5$ Fahr. at half-past three in the morning; about half-past six the temperature had risen to 16° Fahr. above that of the surrounding atmosphere, and then diminished again to half-past nine. During this period of six hours the spadix consumed say 341 volumes of oxygen, whilst in the ensuing eighteen hours it only consumed 184. The same phænomena took place during several days.

"It was interesting to ascertain," says M. Garreau, "whether there existed any organic cause, by means of which the ready action of atmospheric air upon the spadix of this *Arum* could be explained. Microscopic examination shows, in fact, that it presents a much larger absorbing surface than could have been supposed, as the cells forming the surface are so many cones projecting outwards; it is these elongated cells that give the organ its velvet-like appearance. But these cells, although presenting the disposition of the epidermal cells of some velvet-like flowers, and offering stomata here and there, do not form a true epidermis; they form, if I may so express myself, an epidermis in a rudimentary state, for there is no cuticle, unless close to the base of the inflated portion, or certainly from the basal third to the apex. From this fact, it is easy to understand how, as was remarked by M. Ad. Brongniart, the heat is greater in this part than anywhere else, since the air acts upon an almost naked tissue, which can absorb it without any obstacle."—*Ann. des Sciences Naturelles,* 3rd Ser. xvi. p. 250.

METEOROLOGICAL OBSERVATIONS FOR DEC. 1852.

Chiswick.—December 1. Overcast: rain. 2. Overcast. 3. Fine. 4, 5. Densely clouded. 6. Overcast. 7. Rain. 8. Foggy: rain: clear at night. 9. Clear and fine. 10. Low clouds: rain: densely overcast. 11. Exceedingly fine. 12. Fine: overcast: rain. 13. Rain: uniformly overcast. 14. Cloudy: clear at night: rain. 15. Rain: cloudy: clear. 16. Clear: fine, with sun: thunder, lightning and heavy rain at night. 17. Partially overcast: fine: boisterous, with lightning at night. 18. Clear and fine: extensive and sudden rise of barometer. 19. Slight rain: overcast. 20. Fine: densely clouded: clear at night. 21. Exceedingly fine. 22. Overcast: rain. 23. Overcast. 24. Rain: drizzly: overcast. 25. Very fine: overcast. 26. Fine: very fine: boisterous, at times quite a hurricane at night. 27. Very boisterous: large white clouds: clear at night. 28. Clear and fine. 29. Fine: overcast. 30. Overcast: fine: clear. 31. Very fine.

Mean temperature of the month .... 46°·54
Mean temperature of Dec. 1851 .... 38 ·88
Mean temperature of Dec. for the last twenty-six years ... 39 ·69
Average amount of rain in Dec. .... 1·52 inches.

Boston.—Dec. 1. Fine: rain P.M. 2. Fine. 3. Fine: rain P.M. 4. Cloudy: rain A.M. 5. Cloudy. 6, 7. Cloudy: rain A.M. 8. Cloudy: rain A.M. and P.M. 9. Fine: rain P.M. 10. Cloudy: rain A.M. 11. Fine. 12. Cloudy. 13. Cloudy: rain A.M. and P.M. 14. Fine. 15. Cloudy: rain A.M. 16. Fine: rain P.M. 17, 18. Fine. 19. Cloudy: rain A.M. 20, 21. Cloudy. 22. Cloudy: rain A.M. and P.M. 23. Fine. 24. Cloudy. 25. Fine: rain A.M. 26. Fine. 27. Fine: rain and stormy A.M. 28. Fine. 29. Cloudy. 30. Cloudy: rain A.M. 31. Fine.

Sandwick Manse, Orkney.—Dec. 1. Showers A.M. and P.M. 2. Showers A.M.: showers, aurora P.M. 3. Bright A.M.: cloudy, aurora P.M. 4. Damp A.M.: cloudy P.M. 5. Showers A.M.: showers, aurora P.M. 6. Rain A.M.: showers, aurora P.M. 7. Bright A.M.: clear, aurora P.M. 8. Cloudy A.M. and P.M. 9. Cloudy A.M.: clear P.M. 10. Rain A.M.: showers, aurora P.M. 11. Showers A.M.: rain P.M. 12. Drizzle A.M.: cloudy P.M. 13. Clear, frost A.M.: clear, aurora P.M. 14. Bright, frost A.M.: drizzle P.M. 15. Damp A.M.: clear P.M. 16. Clear, frost A.M.: drizzle P.M. 17. Sleet-showers A.M. and P.M. 18. Cloudy, frost A.M. and P.M. 19. Lightning, rain A.M.: cloudy P.M. 20. Cloudy A.M. and P.M. 21. Cloudy A.M.: snow-showers P.M. 22. Clear, frost A.M.: cloudy P.M. 23. Clear A.M. and P.M. 24. Cloudy A.M.: showers P.M. 25. Cloudy A.M.: sleet-showers P.M. 26. Bright A.M.: hazy P.M. 27. Cloudy A.M.: drizzle P.M. 28. Showers A.M.: fine P.M. 29. Cloudy A.M.: shower P.M. 30. Drops A.M.: shower P.M. 31. Showers A.M.: showers, thunder and lightning P.M.

Mean temperature of Dec. for twenty-five years .... 41°·20
Mean temperature of this month .... 40 ·74
Average quantity of rain in Dec. for six previous years ...... 3·86 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* CHISWICK, *near London; by* Mr. Veall, *at* BOSTON; *and by the* Rev. C. Clouston, *at Sandwick Manse,* ORKNEY.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1852. Dec.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	29·960	29·897	29·58	29·32	29·43	48	39	32	46	43	sw.	ssw.	ssw.	·05	....	·44
2.	29·936	29·838	29·44	29·40	29·48	48	35	38	42	42½	sw.	sw.	w.	....	·06	·43
3.	30·028	29·992	29·60	29·75	29·82	51	38	37	39	37	sw.	w.	sw.	....	....	·33
☾ 4.	29·904	29·884	29·40	29·48	29·42	55	52	49	40½	45	sw.	ssw.	ssw.	....	·04	·02
5.	29·897	29·827	29·37	29·51	29·56	55	49	52	45	46	sw.	wsw.	w.	·25	....	·16
6.	29·778	29·771	29·30	29·34	29·35	52	41	48	42½	44	sw.	w.	ssw.	....	·25	·25
7.	29·691	29·435	29·28	29·43	29·45	50	44	44	42⅓	41	s.	s.	se.	·19	....	·21
8.	29·298	29·241	28·94	29·48	29·35	49	37	45·5	43	44	sw.	s.	e.	·08	·20	....
9.	29·613	29·525	29·10	29·42	29·48	53	45	40·5	41	40	sw.	w.	e.	·01	·05	·10
10.	29·583	29·537	29·10	28·98	28·96	54	49	48	46	45½	s.	s.	sw.	·03	·07	·30
● 11.	29·595	29·519	29·18	29·00	29·06	57	48	47	45	41	sw.	s.	ne.	....	....	·01
12.	29·505	29·429	29·05	29·28	29·33	54	40	47	39	37	s.	s.	n.	·20	....	·21
13.	29·473	29·383	29·12	29·52	29·51	54	43	44	39	34	s.	s.	calm	·12	·08	·01
14.	29·364	29·335	28·93	29·27	29·15	55	42	46	36	39	sw.	s.	nne.	·25	....	·07
15.	29·106	28·983	28·58	29·07	29·14	52	37	47	39	38	sw.	s.	nne.	·03	·16	·19
16.	29·412	29·151	28·98	29·24	29·17	52	45	39·5	36	36½	sw.	w.	nne.	·27	....	·10
17.	29·259	29·146	28·63	29·11	29·58	51	34	45	36½	37	sw.	w.	n.	·01	·12	·04
☽ 18.	30·208	30·026	29·68	30·07	30·08	49	31	36	35½	36	ne.	nnw.	ese.	....	....	·05
19.	30·119	30·007	29·61	29·44	29·36	52	43	46	42	46½	s.	ssw.	w.	·01	·05	·47
20.	29·999	29·771	29·35	29·36	29·68	56	37	49	43	41½	sw.	ssw.	nw.	....	....	....
21.	30·053	29·925	29·58	29·85	29·90	51	34	46	36	34½	sw.	wsw.	nw.	....	....	....
22.	29·794	29·738	29·42	29·85	29·80	49	38	42	36	35	sw.	ese.	sse.	·04	·07	·03
23.	29·788	29·724	29·42	29·64	29·50	50	37	36·5	38	40	se.	se.	sse.	·03	·08	....
24.	29·788	29·735	29·30	29·06	29·16	56	48	40	42	42	sw.	sw.	sw.	·09	....	·04
25.	29·733	29·659	29·25	29·00	29·16	52	41	46	41½	40	w.	sw.	wsw.	....	·04	·20
○ 26.	29·703	29·351	29·30	29·14	29·06	55	45	41	34	38	sw.	wsw.	sse.	·29	....	·12
27.	29·729	29·032	28·50	28·00	28·38	54	36	52	44	44	sw.	wsw.	w.	....	....	·43
28.	29·789	29·525	29·16	28·78	29·15	54	26	35·5	43	41	sw.	sw.	nw.	....	·16	·41
29.	29·700	29·654	29·43	29·46	28·92	54	47	35	37	45	sw.	s.	se.	·02	....	·04
30.	30·046	29·784	29·38	28·87	29·29	52	38	47	46½	45½	sw.	sw.	w.	....	·02	·28
31.	30·040	30·003	29·70	29·40	29·24	50	44	37	44	46	s.	sw.	ssw.	....	....	·10
Mean.	29·738	29·607	29·24	29·307	29·361	52·38	40·71	43·1	40·66	40·82				1·97	1·45	5·04

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XIV.—*Descriptions of some of the larger Forms of Fossilized Foraminifera in Scinde; with Observations on their Internal Structure.* By H. J. Carter, Esq., Assistant Surgeon, Bombay Establishment.

[With a Plate.]

Through the kindness of several officers of the Bombay Army, access to the Museum of the Bombay Branch of the Royal Asiatic Society, and my own experience in Scinde, I have become acquainted with many, if not most, of the larger forms of fossilized Foraminifera of that country; and as descriptions of them may prove acceptable to those engaged in the study of geology in Scinde and elsewhere, I have much pleasure in offering them to the public through the medium of this valuable Journal.

I wish it had been in my power to point out the particular parts of the Nummulitic Series in which they are found, but as we are perfectly ignorant of all detail of this kind respecting Scinde, it must be left for future opportunity to develope.

In the description of these Foraminifera, I shall not confine myself to their external characters alone, for generally speaking this would be useless, but having studied them by sections, shall also allude to their internal structure, which, though already given most faithfully by Dr. Carpenter (Quart. Journ. Geol. Soc. vol. vi. p. 21), yet there are some parts still incomplete which I shall endeavour to supply, and some observations which can only be made intelligible when the forms of *Operculina, Assilina, Nummulina, Alveolina, Orbitoides,* and *Orbitolites* are considered together and described successively.

The distinguishing characters of these genera, familiar, at least in name, to all who are acquainted with the classification of Foraminifera in D'Orbigny's 'Foraminifères fossiles du Bassin Tertiaire de Vienne,' and in his 'Cours élémentaire de Paléontologie et de Géologie Stratigraphiques,' I shall here premise; that the reader, if inclined to study them, may have no trouble in immediately referring to the same sources from which I have derived my guide.

Order III. HELICOSTEGUES.

Fam. 1. Nautiloidæ.

Genus Nummulina, D'Orbigny.

"*Shell* free, equilateral, orbicular or discoidal, thick, encrusted, without appendices at the border, formed of a *spire* embracing, with whorls very near together and numerous; the last always marked in the young animal, but often impossible to be found in the adult. *Chambers* small, short, near together, very numerous, the last projecting in the young animal, but indistinct in old individuals; pierced by an opening, transverse, linear, against the turn of the spire, often concealed in the adult."

Assilina, D'Orbigny.

"*Shell* free, equilateral, orbicular or discoidal, very compressed, formed of a *spire* embracing only in the young animal. Afterwards whorls apparent and without appendices at the border. *Chambers* small, short, very numerous, the last projecting in the young animal, but not so in the adult, each pierced by an *opening* against the turn of the spire."

"*Relations and differences.*—The *Assilina* like the Nummulines have a projecting mouth when young; but they are distinguished by all the turns of the spire being apparent in the adults instead of being embracing."

Operculina, D'Orbigny.

"*Shell* free, equilateral, oval or discoidal, very compressed, formed of a *spire* not embracing, regular, equally apparent on both sides, turns contiguous and increasing very rapidly. *Chambers* numerous, narrow, the largest projecting beyond all the rest, pierced at all ages by an opening which is visible, triangular, against the turn of the spire."

"*Relations and differences.*—It is evident, that by the situation of its opening, this genus comes near to the Assilines; but it is distinguished from them by its opening being triangular instead of a transverse slit, and by its chambers increasing regularly without becoming narrow towards the opening."

Alveolina, D'Orbigny.

"*Shell* free, regular, equilateral, round, oblong or elongated in the direction of its axis, not variable in its enlargement, composed of a very regular *spire,* embracing at all ages; whorls often very near together, not formed of many chambers, elongated transversely, divided into a great number of capillary cavities by partitions longitudinal to the whorl, the openings round, numerous, and in lines transverse to the whorl*."

CYCLOSTEGUES, D'Orbigny.

"Animal composed of numerous segments placed in circular lines. Shell discoidal, composed of concentric chambers, simple or multiple; no spire."

"*Cyclolina,* D'Orb. 1839. Shell discoidal, each chamber pierced by a number of pores making an entire circle round the rest."

"*Orbitolites,* Lamarck, 1801. (*Orbulites,* 1816, non *Orbulites cephalopodes.*) *Marginopora,* Quoy et Gaimard, 1836. Shell discoidal, plane, equal, and encrusted on both sides, presenting concentric lines. Chambers numerous in irregular transverse lines only visible at the border."

"*Orbitolina,* D'Orb. These are *Orbitolites* with unequal sides; the one convex, encrusted, presenting concentric lines; the other concave, not encrusted; presenting numerous chambers, in oblique lines upon the side at the circumference."

"*Orbitoides,* D'Orb. Shell discoidal, convex on both sides, formed of a single range of chambers, round the disk, very thickly encrusted about the middle, and presenting either radiating lines or granulations†."

To these characters I shall add the following observations before proceeding further:—

First as regards the distinction between the genera *Assilina* and *Nummulina.* This is said to consist chiefly in the spire not being embracing in the former, and which appears to be the case to the naked eye. But if we make a vertical section of *Operculina,* which, from its extreme thinness, is still further removed from *Nummulina* than *Assilina,* it will be seen, under a magnifying power, to be formed of several layers, which may be traced from the centre to the circumference, showing, that as the turn of the spire is progressing, the deposition of new material not only takes place at the margin but on both sides of the shell generally, in a line from the last chamber in process of development up to the central or first-formed one. If then this can be seen in a shell so thin as that of *Operculina,* how much more evident must it be under the same circumstances in *Assilina*!

* Foram. Foss. du Bassin Tert. de Vienne, par M. Alcide d'Orbigny.

† Cours élément. de Paléontologie et de Géologie Stratigraphique, par M. Alcide d'Orbigny.

which is the case. D'Orbigny's grand distinction, therefore, of the spire not being embracing in *Assilina,* would seem to be more apparent than real, and although sufficient for common purposes, yet, if we add to it the *absence* of chambers above and below the central plane, we shall not only have a real, but a more evident distinguishing sign for *Assilina* than the one just mentioned.

Second, as regards the division of *Nummulina* into subgenera. It appears to me that this may be advantageously done by separating those in which the septa extend from the circumference to the centre in more or less continued sinuous lines (Plate VII. figs. 11 & 15), from those in which these lines are so branched and inosculate as to present a densely reticulated structure (fig. 21).

These differences have already been alluded to by Dr. Carpenter (*loc. cit.*).

In the latter subgenus would then come *Nummularia acuta* ?, Sowerby, which borders close upon *Orbitoides,* from possessing this reticulated structure on the surface, a comparatively less development of the spire and chambers, a tendency to an abrupt prominence in the centre, and an expanded thin margin.

From *N. acuta* we should then pass on to *Lycophris dispansus,* Sowerby, where the spire is still more incomplete, and then to *Orbitoides Mantelli,* or *Orbitolites Mantelli* (for we shall see hereafter that we must make this an Orbitolite), where the spire is entirely lost.

In the last two genera I have been at much pains to ascertain if the rows of chambers in the central plane are arranged spirally or concentrically, and I think that I have been as successful, as, under the circumstances, we can expect to be.

For some time I was unwillingly obliged to yield to the opinion of D'Orbigny, that the rows of chambers commenced concentrically, for having taken adult specimens of *Lycophris dispansus* and *Orbitoides Mantelli* for sections, I found the centre in each species invariably filled with calc-spar, which apparently was surrounded by circles of chambers at its circumference, that is, where the latter began to appear. Hence I had given up almost all hope of being able to determine this satisfactorily, when I conceived that the origin of this structureless centre might be owing to a decay of the central chambers only in the adult animals and its subsequent filling with calc-spar during fossilization ; and, that if I took very young individuals, I might obtain what I wanted. Accordingly I made sections of specimens not larger than the 24th part of an inch in diameter, and found just what I had expected, viz. the centre in its natural state, that is, filled with chambers to the central point.

I will now shortly describe the central planes in both these species, reserving a more particular description of them until we come to the descriptions of the species themselves.

In *Lycophris dispansus* the central plane is extremely, though uniformly, thin throughout, and only one chamber deep. The chambers commence in an imperfect spire, round a central spheroidal or oval cell, not much larger than the chambers themselves generally. Around this cell are a few chambers which have—one a semilunar, and two or three the pear-shaped forms of the chambers commencing the spire in the nautiloid forms of Foraminifera (compare fig. 26. Pl. VII. with fig. 7. Pl. IV. vol. x.); the rest are more or less polygonal. From these chambers (about seven in number), as many rows of others fly off from the centre in whorls similar to the sparks of a rotatory fire-work, but these rows soon diminish in breadth, and end more or less abruptly upon the back of each other; when another set rises from their circumference, which takes a larger latitude; and so on successively, a series of whorls or wreaths follow upon the back of each other, until the rows appear to form concentric circles, still every here and there dipping inwards, or suddenly terminating on the preceding ones, even to the circumference. This is the appearance presented by the central plane; but the real spire must be traced across the rows in the position that it would be in Foraminifera wherein it is more perfectly developed, if it be traceable at all.

In *Orbitoides Mantelli**, however, the central plane is very different; here it is not uniformly thin throughout, but thin in the centre and thick at the circumference, from the cells being only half the size in the former that they are in the latter; they are also all spheroidal, or elongated vertically, and not quadrangular. When they are elongated vertically, this seems to depend on two or more running into each other in this direction; hence the central plane, instead of being composed of only one layer of quadrangular chambers as in *O. Mantelli*, is composed of a plurality of layers of spheroidal ones; this, together with the smallness of the central cells, their great similarity, and the whole plane which they compose being more or less wavy, renders it almost impossible in the section to detect the central cell itself, or to determine whether the others are arranged around it in concentric circles; while it seems almost equally impossible to trace them in circles towards the circumference, to determine this, where their arrangement even is most distinct.

Hence it would appear, that D'Orbigny is not warranted in giving the distinguishing character of concentricity to the rows of chambers in his order *Cyclostègues*, for in his three first genera, which are all alike in this respect, we have seen that it is almost impossible to determine this; and in the last genus, viz.

* Quart. Journ. Geol. Soc. vol. vi. p. 30.

Orbitoides, of which *Lycophris dispansus* is a type, it is evident that it is not the case, but that the chambers are arranged subspirally.

That *Orbitoides Mantelli* should be included among the *Orbitolites* and not among the *Orbitoides,* must also now be evident, from the striking differences that exist between it and *Lycophris dispansus,* and its identity in structure with *Orbitolites* generally; while the intervening link between it and *Nummulina* is naturally supplied by *Orbitoides* bearing the characters above mentioned. It may be observed, that the cells of the central plane in *O. Mantelli* are elongated and not spheroidal, but the one seems to be as constant as the other, and the elongation vertically only to depend, as before stated, on the thinness above and below of the walls of the cells forming the central plane, which renders those parts imperfect or imperceptible in the vertical section, and makes the cells appear to run into one another; while the opake material or intercellular substance showing out at their sides, gives them that septal and at the same time quadrangular form, which approximates the whole central plane in appearance to that seen in the vertical section of *Orbitoides* and *Nummulina.*

There are several other observations which I have to make on the structure of these two genera, but they will be better understood in connection with their species when respectively described.

As the list of synonyms of the discoidal Foraminifera already described is very great, for the short time they have become interesting*, at the same time that their descriptions are very few and not within my reach, I shall avoid as much as possible introducing new names here, in hope that others who are more favourably situated may be able to do this from my descriptions and figures, if required, or that I may be able to do it myself at some future period, when I have better means of comparing the specimens of different localities than I at present possess. Meanwhile, as so little has been done in the subject, I am not without hope that that which I have now to offer may be found useful.

In order of description I shall not exactly follow D'Orbigny's arrangement, that I may be the better able to show the transition from the simple to the more complicated forms of discoidal Foraminifera. Thus, I shall place *Operculina* before *Nummulina,* &c.; *Alveolina* after *N. obtusa,* Sowerby, and before *N. acuta,* id.; and then pass on to *Orbitoides* and *Orbitolites.*

The figures in the Plate are intended to represent the largest

* See Murchison on the Structure of the Alps (Quart. Journ. Geol. Soc. vol. v. p. 309).

specimens of the species I have met with respectively, and where the characteristic structure externally has been too minute to be seen by the naked eye, a small portion has been magnified in the centre. Indeed in almost all, the lines and markings are larger than they are naturally, and are therefore represented as seen under a magnifying glass of low power, for in no other way could these characters be given.

As a typical description of *Operculina* and the structure of foraminiferous shells generally, I must refer the reader to my observations on *O. Arabica*, published in vol. x. No. 57 of this Magazine, by a perusal of which an understanding of what follows will be much facilitated.

Operculina, D'Orbigny.

1. *Operculina inæquilateralis* (H. J. C.). Inequilateral, oval or discoidal, thin, horizontal or wavy; centre prominent, margin thickened, rounded, cord-like. Spire more or less irregular, more apparent on one side than the other, consisting of three whorls concave on one side, flat on the other, increasing rapidly from a central cell. Chambers numerous, narrow, slightly reflected. Septa reflected, more apparent on one side than the other. Diameter of largest specimens 5–24ths of an inch (Plate VII. figs. 1, 2).

Loc. Muskat in Arabia.

Obs. This species differs a little from D'Orbigny's characters in being inequilateral, but the difference between the two sides is so slight, that it cannot be referred to any other genus. The intercameral communication I have not been able to make out, and although D'Orbigny almost invariably gives its shape and position in the nautiloid Foraminifera as a distinguishing character, yet I have hardly ever been able to see it satisfactorily in any of the species that I have examined.

O. inæquilateralis is a characteristic fossil of a thick, pink-coloured, silico-calcareous, sandy stratum at Ras Ghissa, the first little cape south of Muskat, which is a port on the north-eastern coast of Arabia opposite Scinde. I have inserted its description here chiefly for the purpose of commencing with the simplest form of nautiloid Foraminifera, and also from its proximity in locality to Scinde.

2. *O.* ——? Equilateral, discoidal, plane or slightly wavy, thin. Centre prominent and presenting granulations or small tubercles, projecting more in the young than in the adult state; tubercles situated over the septa, one to each; margin slightly thickened, rounded, cord-like. Spire more or less regular, equally evident on both sides; consisting of six whorls, gradually increa-

sing to the last, which is 1–24th inch broad; each whorl overlapping or embracing, with its internal border, the external margin of the preceding one, which is rounded and cord-like. Chambers numerous, reflected; septa reflected, apparent on both sides. Diameter of largest specimens 5–12ths of an inch; thickest part, which is the margin, 1–36th of an inch (figs. 3, 4).

Loc. Scinde; in company with *Alveolina*, near the town of Tatta.

Obs. In this species, which is twice the diameter of the last and generally more horizontal, the whorls are more numerous and the spire increases more gradually. I could not discover the intercameral communication.

Assilina, D'Orbigny.

1. *A. irregularis* (H. J. C.). Equilateral, discoidal, more or less wavy, compressed, thin. Centre depressed, margin thickened, rounded, cord-like. Spire more or less irregular, projecting on both sides, excepting in the centre, where it is nearly obscured; consisting of nine whorls increasing gradually towards the penultimate, which is 1–12th inch wide; each whorl overlapping or embracing, with its internal border, the external margin of the preceding one, which is thickened, rounded, and cord-like throughout the spire. Chambers subquadrangular, oblong, irregular in size, presenting a number of minute granulations over their surface externally. Septa straight, radiating, and a little reflected, evident on both sides except in the centre. Diameter of largest specimens 11–12ths of an inch; thickest part, which is the margin, 1–24th of an inch (figs. 5, 6).

Loc. Scinde.

Obs. This, although somewhat resembling the last-described species of *Operculina*, differs from it in being much larger and coarser in form, in the extreme irregularity of its spire and development generally, the depression in the centre, the obscurity of the three first whorls, and in the penultimate whorl being the broadest. I could not discover the intercameral communication.

2. *A.* —— ? Equilateral, discoidal, slightly wavy, thick, smooth, depressed in the centre, angular at the margin, presenting broken curvilinear lines on the surface with minute granulations between them, arranged in a spiral form, radiating from the centre, indicating the position of the spire and septa. Internally whorls more or less wavy, more or less irregular in breadth, the largest between the centre and the circumference (2–48ths of an inch broad); about nineteen whorls may be counted within half an inch of the centre. No chambers above or below the cenral plane. Diameter of largest specimens 1½ inch; thickest

part, which is between the centre and the margin, 3–12ths of an inch (figs. 7, 8).

Loc. Scinde.

Obs. This closely approaches *Nummulina* from its size and thickness; the spire and septa however are still more or less visible externally, but the increased thickness of the shell obscures their prominence, and gives the surface more smoothness and uniformity. The edge is thick and angular instead of being round and cord-like as in the foregoing species, and the whole now closely approaches a Nummulite.

NUMMULINA, D'Orbigny.

1. *N.* —— ? Equilateral, discoidal, more or less wavy, thin, gradually diminishing in thickness from the centre towards the margin, presenting on the surface numerous small papillæ or granulations, between sinuous lines running more or less irregularly from the centre to the circumference, the latter being the most evident of the two in the young shell. Internally whorls more or less wavy, more or less irregular in breadth; the widest between the centre and the circumference (2–48ths inch broad); about twenty whorls may be counted within half an inch of the centre. Compressed chambers above and below the central plane. Diameter of the largest specimens $2\frac{4}{12}$ inch; thickness in the centre 2–12ths of an inch (figs. 9, 10).

Loc. Scinde.

Obs. The great point of difference between this and the last-described species of *Assilina* is the presence of the compressed chambers above and below the central plane in the former. The whorls here therefore are evidently what are termed embracing, and the centre is prominent on both sides instead of being depressed. This Nummulite attains the largest size of any species that has come under my observation.

2. *N. millecaput*? Equilateral, discoidal, more or less wavy, thick, angular at the margin, presenting sinuous lines on the surface in close approximation, which extend from the circumference to the central prominence on each side, presenting a series of superficial whorls in the adult animal. Internally turns of the spire very numerous, more or less wavy and irregular in breadth, the widest between the centre and the circumference 1–48th of an inch broad; about forty-eight whorls may be counted within half an inch of the centre; compressed chambers above and below the central plane. Diameter of the largest specimens $1\frac{6}{12}$ inch; thickness in the centre 3–12ths of an inch (figs. 11, 12).

Loc. Egypt.

Obs. This differs from the foregoing species in its general thickness; the number and approximation of its sinuous lines; the absence of the small granulations or papillæ between them, and the greater number and narrowness of its whorls. The sinuous lines, although confused and in whorls all over the surface in the adult animal, are nevertheless distinctly sigmoid in the young one, running from the circumference to the central prominence of the shell on both sides.

This specimen was brought from Egypt. It appears to be *N. millecaput.* That figured by MM. Joly and Leymerie is $1\frac{1}{12}$ inch in diameter. Generally the *Nummulites* of this kind from Egypt which I have seen (those of the Pyramids to wit) have been about an inch in diameter and about 2–12ths inch thick. I have inserted its description here and figure in the Plate for the sake of comparison, not having met with one of the same kind in Scinde.

3. *N. obtusa,* Sowerby. Equilateral, more or less globular, compressed in the centre, obtuse at the margin. Surface presenting sinuous lines in close approximation, and in confused whorls in the adult animal, but simple and sigmoid in the young shell; extending from the septa at the circumference to the central prominence on each side. Internally whorls numerous, the broadest between the centre and the circumference; lines of the spire nearly as widely separated above and below the central plane as they are in the central plane itself. Chambers numerous, reflected; septa reflected. Diameter of the largest specimens 11–12ths of an inch; thickness 2–10ths; number of whorls thirty-three (figs. 13, 14).

Alveolina, D'Orbigny.

1. *Alveolina melo,* D'Orb. (*Melonites spherica,* Lamarck.) Spherical, equilateral, presenting longitudinal lines which extend in a sigmoid form from apex to apex; and minute transverse parallel ridges between them, marking corresponding internal divisions of the chambers. Internally chambers fusiform, sigmoid, divided into hair-like spaces by transverse septa which are the continuations of the ridges mentioned; the whole arranged in a spiral form. Diameter 5–24ths of an inch (fig. 15).
Loc. Scinde, Arabia.

2. *Melonites spheroidea,* Lamarck (fig. 16).
Loc. Scinde, Arabia.

Obs. This has the same characters as the last, with the exception of being larger and a little elongated. Longest diameter 7–24ths of an inch; transverse diameter 6–24ths. Abounds about Yolta in Scinde, where it is well known by the name of "tomra," and is made into strings of beads for Hindu pilgrims and others of the Hindu faith. They are said to be prepared for this purpose by being repeatedly struck with a hammer, until the external layers peeling off leave a smooth surface.

3. *Fascicolites elliptica,* Parkinson (fig. 17).
Loc. Scinde.

Obs. This also has the same characters as the foregoing species, but is much elongated, almost cylindrical. Length 7–24ths of an inch; breadth 3–24ths. It abounds about Hydrabad, and near the Buran river, in company with a discal Orbitolite to be hereafter described.

There is nothing to distinguish these species one from another but their spherical, spheroidal and elliptical forms respectively. The two latter appear to have their peculiar localities in Scinde, and to be sparingly mixed together. On the south-east coast of Arabia, where they are also found in company with discal *Orbitolites,* the spheroidal form is most common. D'Orbigny has made this the last genus of his second section of nautiloid Foraminifera, but I have inserted their description here, to show the transition from the flat to the elongated forms of his *Helicostègues.*

Let us now return to the descriptions of the other *Nummulites*; which will be found to differ from the foregoing in the absence of the sinuous lines on the surface and in the presence of the reticulated structure mentioned.

4. *Nummularia acuta*?, Sowerby. Equilateral, discoidal, wavy; centre rather abruptly prominent, margin thin, acute; surface presenting a subgranular, reticulated structure, the interstices of which tend to a spiral arrangement towards the circumference. Internally consisting of a thin central plane of chambers arranged in a spiral form, with layers of compressed ones above and below it. Whorls numerous. Chambers three times as long as the whorl is broad. Septa straight or but slightly reflected; each chamber divided into three or more reticulate divisions by subsepta, which structure, extending from the circumference to the central prominence, gives the surface the reticulated appearance mentioned; each interstice corresponding to a compressed cell, which is the external extremity of a columnar pile extending down, more or less regularly, to the central plane. Diameter of largest specimens 7–12ths of an inch; thickness in the centre 3–10ths (figs. 21, 22).
Loc. Scinde.

Obs. This appears to be *N. acuta,* Sowerby (Grant's Geol. Cutch, *loc. cit.*), from its subgranular surface, size and shape. I do not know any other species like it in Scinde, if this be not the one. There is another species (figs. 19, 20) of this character which abounds in the nummulitic rocks at the island of Masira, on the south-east coast of Arabia, but this appears to be *N. Garausiana* (Joly et Leymerie, Mém. sur les Nummulites, pl. 1. figs. 9–12). It is also subgranular on the surface and presents the reticulated structure of the species just described, but with a tendency to radiation in its lines, which approximates it to the *Nummulites* of the first subgenus, and therefore its place in this should precede *N. acuta*. Its diameter is 9–24ths of an inch, and its thickness 3–24ths of an inch.

The reticulated structure on the surface, while it characterizes this subgenus of *Nummulina*, also allies it strongly to *Orbitoides*. Another character which distinguishes *N. acuta* from the foregoing species, is the greater length of the chamber being in the direction of the spire instead of across it, and its subdivision into reticulate ones, which, with the thinness of the central plane, implies a commencing disappearance, or imperfect state, of the latter generally; it is also more abruptly prominent in the centre and thinner and more expanded in the margin. All this, while it separates *N. acuta* from the *Nummulites* of the first subgenus, tends towards the structure of *Orbitoides*, in which the chambers of the central plane are arranged subspirally. The lines too, which are seen descending in this as well as in other discoidal Foraminifera, to the central plane, are but the opake matter filling up the interstices between the reticulate chambers; and in the midst of which are situated the interseptal vessels, which pass down to the central plane and ramify throughout the shell.

CYCLOSTEGUES, D'Orbigny.

Orbitoides, D'Orb.

1. *Lycophris dispansus*, Sowerby (Grant's Geol. Cutch, *loc. cit.*). Discoidal, wavy, more or less equilateral, centre abruptly prominent, margin expanded and excessively thin and fragile at the edge; surface subgranular or tuberculated, especially over the central prominences; tubercles round, irregular in size and shape, united together by stellate lines. Internally presenting an extremely thin plane of quadrangular chambers, compressed vertically; oblong, and arranged subspirally, with their long axis in the direction of the horizontal diameter of the shell. Compressed chambers above and below the central plane, arranged in successive layers, like those of *Nummulites*, and more or less over each other, so as to form columns, which radiate more or less regularly from the central plane to the periphery, and end in the tubercles before mentioned. Diameter of largest specimens half an inch (figs. 23–29).

Loc. Scinde, Cutch, and Arabia.

Obs. I have already stated that the chambers of the central plane (fig. 24) of this genus commence from a central cell. This cell is spheroidal or elliptical, and perhaps a little larger than the generality of those which succeed it; the next formed is semilunar, and then comes a pear-shaped chamber or two; after which, the rest, that are in contact with the central cell, are more or less polygonal. From each of these chambers comes off a line of others in a spiral form, which, diminishing abruptly in breadth, terminates upon the back of the preceding one, the first being the shortest; to this succeeds another series of lines or rows terminating in like manner, but of wider extension; and so on successively, until the plane, as before stated, appears to be formed of concentric circles. Sowerby's account and figures of the external and internal structure of this fossil (*loc. cit.*) accord with my own observations; but Dr. Carpenter (Quart. Journ. Geol. Soc. *loc. cit.*) I think has been misled in considering the pillars of Sowerby "nothing more than the opake matter filling the perforations;" since by a proper section, these columns are seen, as before stated, to be the piles of compressed cells (fig. 29), as they ascend from the central plane, surrounded by the "opake matter" to the periphery. It is in this "opake matter" that Dr. Carpenter's "perforations" are situated, that is, in the interseptal or intercellular spaces, which it partially fills; his perforations being the orifices of the interseptal vessels described in the structure of the shell of *Operculina Arabica* (*loc. cit.*).

In this species of *Orbitoides* we have the "stellate lines" uniting or as it were supporting the columns of the cells. They consist of bars or vertical septa of opake matter extending from one column to another, in straight lines, but diminishing in thickness towards the central plane, where they become faint and at last disappear altogether. They form the only distinguishing character between this species and *Orbitoides Prattii* (see illustrations to Dr. Carpenter's paper, *loc. cit.*); yet I am pretty sure that I have seen them in a section of the latter, near the central plane (where of course they were not present on the surface), just as they are represented in fig. 14 *b* of Dr. Carpenter's illustrations, which this author regards as a feature of an undescribed species. Hence I am inclined to the opinion that *Lycophris dispansus* and *Orbitoides Prattii* are but varieties of the same fossil.

I should also here mention, that when the central plane of *Lycophris dispansus* is ground down to an extreme thinness, an interseptal space appears between the septa and an opake line in the centre of it indicative of the former existence of an interseptal vessel there, as in *Operculina* and *Nummularia*: this is also seen in Dr. Carpenter's illustrations (fig. 34).

2. *Lycophris ephippium,* Sowerby (*loc. cit.*).
Loc. Cutch.

Obs. Of this fossil Mr. Sowerby states: "These two fossils [*Lycophris dispansus* and *L. ephippium*] may possibly be different stages of growth of the same species," which seems to me very probable.

3. *Orbitoides Prattii.*
Loc. Scinde, Cutch, Arabia.

Obs. I have just stated the reasons which induce me to think that this is merely a variety of *Lycophris dispansus.*

ORBITOLITES, D'Orbigny.

1. *Orbitolites Mantelli* (H. J. C.). *Nummulites Mantelli,* Morton (Quart. Journ. Geol. Soc. vol. iv. p. 12). *Orbitoides Mantelli,* D'Orbigny (*ib.*). Discoidal, wavy, equilateral or inequilateral; centre abruptly prominent on one or both sides, margin more or less expanded, very thin, plane or wavy, more or less obtuse at the edge; surface smooth, subgranular or tuberculated, especially over the prominent portions of the centre; tubercles minute, round, irregular in size and shape. Internally presenting a central plane, thin at the centre, thick at the circumference, composed of spheroidal or elongated cells, small in the centre, large at the circumference, placed in rows which appear to have a concentric arrangement, but this is indeterminable; cells alternate in adjoining rows. Compressed chambers above and below the central plane, arranged in successive layers like those of *Orbitoides* and *Nummulites*; more or less over each other, so as to form columns which radiate from the central plane to the periphery, where they end in the granulations or tubercles mentioned. Diameter of largest specimens half an inch (figs. 30–31).

Figs. 32, 33, 34, appear to be merely varieties in form of the same species.

Loc. Scinde, Arabia.

Obs. This fossil, though at first sight almost identical with *Orbitoides,* is nevertheless on minute examination strikingly different. 1st. It is for the most part inequilateral, which at least is the opposite with *Lycophris dispansus*; its surface also is smoother from the granulations being more minute. 2nd. The central plane is thin in the centre and thick at the circumference; in *Orbitoides* it is extremely and uniformly thin throughout. 3rd. It is composed of a plurality of layers of spheroidal or elongated cells (figs. 36, 37); in *Orbitoides* it consists of a single layer of quadrangular cells (fig. 27). 4th. The cells are very minute and confusedly arranged in the centre; in *Orbitoides* they are as large in the centre as at any other part and distinctly arranged. All this, while it tends to separate *Orbitoides Mantelli*, D'Orb., from *Lycophris dispansus*, which is a type of the genus *Orbitoides*, approximates it just as much more to *Orbitolites*; hence my reasons for changing its name.

The subgranular or tuberculated form which this species, as well as *Lycophris dispansus*, presents externally, arises from the extremities of the columns of compressed cells projecting above the surface, increased sometimes, probably, by the intercellular substance having been worn or dissolved away; but this is not the case towards the circumference, on account of the columns being shorter, more vertical, and therefore nearer together, which of course renders the intercellular space smaller.

The septa seen in a vertical section of the central plane consist of opake matter which surrounds the columns, and as the latter end more or less in pointed extremities upon an imaginary central plane, we often see those of the opposite side interknitting with them, and the chambers of the centre of the plane assuming a triangular shape (fig. 39); sometimes they are quadrangular, and the septa continuous across the plane (fig. 38); at others they are oblong vertically and curved a little outwards, like the septa seen in a vertical section of the central plane of *Nummulites*, which is their common form towards the circumference (fig. 37); while, just as often, the central plane is composed of two or three layers of spheroidal cells entire (fig. 36); from which I am inclined to infer, that where the other forms appear, it is merely from the cells running into each other vertically, and their parietes in this direction disappearing partially or altogether. In examining a vertical section of this plane, we frequently observe that every other space is a septum and not a cell; this is owing to the cells being arranged alternately in adjoining rows.

2. *Orbitolites* —— ? Equilateral or inequilateral, discoidal, patulous, more or less wavy, gradually diminishing in thickness from the centre, which projects a little above the general surface, to the margin, which is thin, though more or less obtuse at the edge. In other respects the structure of this is the same as that of the last species described. Diameter of largest specimens 2 inches; thickness 3–24ths of an inch (figs. 40, 41).

Loc. Scinde.

Obs. The great points of difference between this and the last species are, that it is not abruptly prominent in the centre, and diminishes gradually to the margin. It also attains a far larger size; and, as Dr. Carpenter has remarked, *loc. cit.*, sometimes "seems, instead of being a circumscribed disk," to have spread itself irregularly in every direction. The latter character is not more peculiar to it, however, than to the foregoing species.

From its frequent deep, patulous and wavy form too, the sections of this Orbitolite often indicate a stellate or other complex figure, which however is not the case when freed from the matrix in which it may be imbedded; for with the exception of the foliaceous extension mentioned, it seems almost always to be discoidal. It is sometimes thicker on one side than the other, like the last species, but tends more to a horizontal than a vertical development, and therefore more nearly approaches the species about to be described, which is altogether discal, and without any incrustation on either side, being representative only of the central plane of this and the last species.

D'Orbigny's genus *Orbitolina*, in which there is an incrustation on one side only, I have not yet seen, unless that be considered it, where one side is plane and the other convex, as in fig. 33, which I think may be a variety in form of either of the foregoing species, and which, after all, has an incrustation of compressed cells on the plane side, although not prominent. That species I consider to have no incrustation where the central plane comes to the surface.

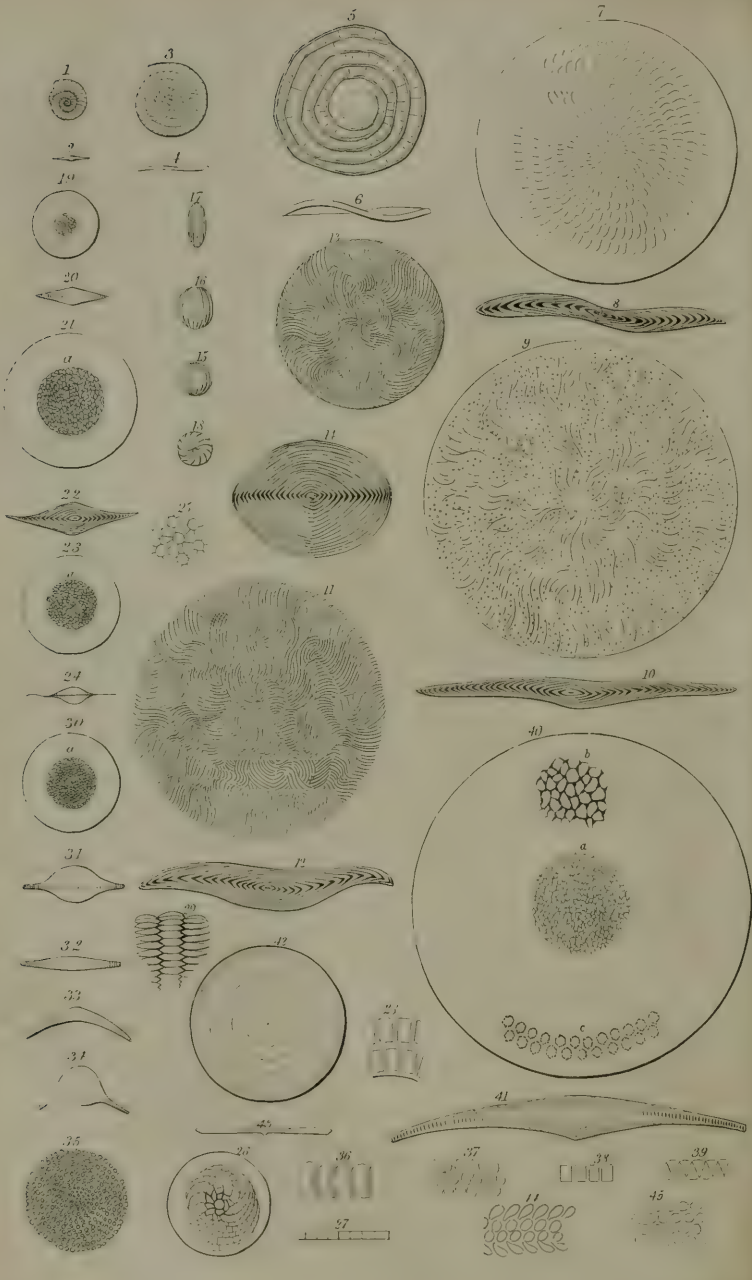
Cyclolina, D'Orbigny.

1. *Cyclolina pedunculata* (H. J. C.). Inequilateral, discoidal, smooth, thin in the centre, with a small papillary eminence on one side; thick at the margin; presenting concentric circles on the surface, alternately raised and depressed, with cells arranged circularly, which are hardly visible to the naked eye (fig. 25). Cells small in the centre, enlarging towards the circumference, spheroidal interiorly, elongated at the surface (fig. 44), arranged in circular rows, alternate in each row. Diameter of largest specimens 10–12ths of an inch; thickness at the margin 1–48th of an inch (Pl. VII. figs. 42, 43).

Loc. Scinde.

Obs. This is, as it were, nothing but the central plane of the foregoing species; that is, its development rests here, there being no incrustation on either side, and no compressed cells above or below the disc. I have called it *pedunculata* from the little papillary eminence in the centre on one side, this being constant in the few specimens I possess. By a typographical mistake, this species has been called "Indian" instead of Scindian, vol. x. No. 57, p. 175, of this Magazine.

Thus we have passed, in description, from the simple nautiloid form of *Operculina*, in which the spire and septa are all visible exteriorly, to *Assilina*, where they are more or less obscured in



H. I. C. del.

J. De C. Sowerby sc.

the centre; thence to *Nummulina,* where there is an addition of compressed chambers on each side the central plane, expanding above and below into the globular form of *N. obtusa*; and elongating in *Alveolina.* Returning to the subgenus of *Nummulina,* which presents the "reticulated structure" externally, we have passed on to *Orbitoides,* where the characteristic spiro-central plane of the nautiloid forms of Foraminifera is beginning to disappear, and then to *Orbitolites,* where it is entirely lost; ending with *Cyclolina,* which bears the same relation, in the simplicity of its structure, to *Orbitolites,* that *Operculina* bears to *Nummulina.*

EXPLANATION OF PLATE VII.

Fig. 1. *Operculina inæquilateralis* (No. 1). 2. Vertical section of ditto.
Fig. 3. *O.* ——? (No. 2). 4. Vertical section of ditto.
Fig. 5. *Assilina irregularis* (No. 1). 6. Vertical section of ditto.
Fig. 7. *A.* ——? (No. 2). 8. Vertical section of ditto.
Fig. 9. *Nummulina* ——? (No. 1). 10. Vertical section of ditto.
Fig. 11. *N. millecaput*? (No. 2). 12. Vertical section of ditto.
Fig. 13. *N. obtusa,* Sowerby (No. 3). 14. Vertical section of ditto.
Fig. 15. *Melonites spherica,* Lamarck (No. 1). 16. *M. spheroidea,* id. (No. 2). 17. *Fascicolites elliptica,* Parkinson (No. 3). 18. Arrangement of the septal lines at the apex in the last three species.
Fig. 19. *Nummulites Garausiana*? 20. Vertical section of ditto.
Fig. 21. *Nummularia acuta,* Sowerby (No. 4): *a,* magnified view of reticulated structure on the surface. 22. Vertical section of ditto.
Fig. 23. *Lycophris dispansus,* Sowerby (No. 1): *a,* magnified view of reticulated structure on the surface. 24. Vertical section of ditto. 25. Stellate arrangement of tubercles, magnified. 26. Central part of central plane of chambers, magnified. 27. Portion of vertical section of ditto ditto. 28. Magnified view of septa, showing interseptal spaces and remains of interseptal vessel? 29. Vertical columns of cells ending in tubercles, magnified.
Fig. 30. *Orbitolites Mantelli* (No. 1): *a,* magnified view of reticulated structure of the surface. 31. Vertical section of ditto. 32, 33, 34. Vertical sections of varieties.
Fig. 35. Central plane of *Orbitolites Mantelli,* magnified. 36. Vertical section of elongated cells of ditto. 37. Vertical section where the cells are entire and have not run into each other. 38. Vertical section of central part of central plane where the chambers are quadrangular. 39. Ditto where the internal ends of the columns interlace with each other.
Fig. 40. *Orbitolites* ——? (No. 2): *a,* magnified view of surface, showing reticulated structure; *b,* the same still more magnified; *c,* arrangement of the cells of the central plane towards the circumference. 41. Vertical section of ditto.
Fig. 42. *Orbitolites pedunculata* (No. 3). 43. Vertical section of ditto. 44. Arrangement and form of cells in vertical section of ditto. 45. Ditto on the surface.

XV.—*Further Notes on British Zoophytes, with descriptions of new Species.* By the Rev. Thomas Hincks, B.A.

[With two Plates.]

It is with peculiar pleasure that I have to record the discovery of two new species of the beautiful genus *Campanularia* in the British Seas. The first which I shall describe is allied to the *Campanularia Syringa* and the *C. dumosa,* and belongs to the section of the genus which is distinguished by the "dense corneous texture" of the cells and the shortness of the pedicle. The only specimen which I have yet seen occurs on a fragment of *Nitophyllum* from the north of Ireland, and was sent me for description by my father, Professor Hincks of the Queen's College, Cork.

Genus Campanularia.

i. *C. parvula* (Hincks).

Stem creeping; cells very minute, on short ringed stalks, campanulate, the aperture entire.

The creeping stem is of great delicacy, and forms a rude kind of network over the surface of the weed. The cells are exceedingly minute, campanulate, of equal width throughout till within a short distance of the base, when they are abruptly rounded off; of a somewhat dense, corneous structure, and mounted on very short stalks, composed of about four rings. The aperture is truncate and the margin plain.

This pigmy species is, I believe, the smallest of the 'Bell-corallines,' and there is no other British form with which it can be confounded. The shape of the cell is very distinctive, and is well preserved in dried specimens.

Hab. Weed from the north of Ireland (Plate V. A.).

ii. *C. caliculata* (Hincks).

Stem creeping, filiform; cells on rather thick crenated stalks, campanulate, having an interior cup which contains the body of the polype, and is prolonged below into a tubular case, which pervades the pedicle and envelopes the medullary pulp; rim entire.

This very beautiful and interesting species was first obtained by Mr. R. S. Boswell, lately of Ramsgate, from Pegwell Bay. In the course of the past summer this gentleman showed me a specimen of it, amongst some other zoophytes, exquisitely mounted according to a peculiar method of his own, and expressed an opinion that it was new, an opinion in which I was much inclined to agree with him. Within the last few weeks my friend Richard

Allman, Esq. of Bandon has supplied me with abundant specimens of a *Campanularia* from the coast of Ireland, which, to my no small delight, has proved to be identical with Mr. Boswell's species. A careful examination of these has fully convinced me that this elegant form can be referred to none of the species hitherto described as British.

The remarkable peculiarities of internal structure are in themselves sufficiently distinctive. The double cup and the inner casing of the medullary pulp are, so far as I know, unique. But there are also other important characters which separate it from *C. integra*, its nearest ally.

From the creeping stem of *C. caliculata*, which spreads, in the specimens I possess, over one of the red sea-weeds, rise at intervals crenated pedicles, bearing campanulate cells, which, instead of being wide and basin-shaped like those of *C. integra*, are rather in the form of a wine-glass. They are perfectly transparent and have the rim entire. Within is a second cup of most graceful form, resembling an inverted hand-bell, in which the body of the polype is lodged. This inner cup, the walls of which are continuous *above* with those of the cell itself, is produced below into a tubular sheath, which encases the medullary pulp throughout its entire length, and is crenated like the stalk. I have likened the inner cup to an inverted hand-bell, and the resemblance is very striking; for one segment of the crenated sheath, mentioned before, is always included within the *outer* cup, so as to represent the *handle* of the bell.

The stalks which support the cells are very constant in their characters. Amongst a great number examined, I have met with scarcely any variation. They are somewhat thick in proportion to their length, and are composed for the most part of about nine or ten crenations, of which the one immediately below the cell is always the smallest. Like the cells they are double throughout, as is also the creeping stem. Throughout the entire structure there is an inner envelope which immediately surrounds the animal substance, and which is very distinctly visible when the polype and the pulp have perished.

Mr. Boswell, who had the pleasure of examining the polypes when alive, informs me that they are "exceedingly opaque and the tentacles rather small."

A mere description, however faithfully it may give the characters, can hardly do justice to the beauty of this interesting species. This want however is supplied by Mr. Tuffen West's expressive drawing, than which nothing could be more true to the original (Plate V. B.).

Hab. Discovered by Mr. R. S. Boswell in Pegwell Bay. Near the Old Head of Kinsale, County Cork, R. Allman, Esq.

I may here mention a marked variety of *Campanularia volubilis,* of which I have seen specimens from the west of England, obtained by Mr. W. Templer. This species, in its ordinary state, has the rim of the cells cut into sharply-pointed and deep segments. The crenations terminate acutely. In the variety to which I refer, the margin is cut in a somewhat castellated fashion, the crenations being shallow and square-topped. So they are represented in the figure of *C. volubilis* in Van Beneden's 'Mémoire sur les Campanulaires,' a figure which differs widely from that of the same species in Dr. Johnston's work. In other respects the English variety agrees with neither of the figures. The cells are wide, and lined at regular intervals, longitudinally; the stalks of great length, of a greyish colour, semi-opaque, and of much coarser texture than those of the normal *volubilis.* There are one or two *annuli* just below the cell, but otherwise the pedicle is generally destitute of rings.

Cordylophora lacustris.

The discovery of this zoophyte in some of the London docks has removed the apprehensions of collectors consequent on the destruction of the old canal-boat from which it was first obtained by Professor Allman, and has afforded opportunities of studying more thoroughly its structure and physiology. The following notes are offered as a contribution to its history.

In September last I procured fine specimens of the *Cordylophora,* some of which are still living in my possession, and have produced several crops of polypes within the time. The polypes soon perish and are soon reproduced. They do not drop off, like the heads of *Tubularia,* but would seem to be destroyed by a process of *absorption.* On one occasion a fine polype in full health and vigour, which I had been watching for some time, was observed suddenly to contract all its *tentacula,* which became perfectly rigid and motionless. Meanwhile a strange ferment was perceptible within the cavity of the stomach. A dense fluid filled it, which was constantly flowing round the interior, and in this granules of various sizes and in great number were to be seen in restless motion, hurrying here and there, some just entering the stomach, and others hastening towards the entrance of the canal which traverses the polypidom. Within the latter a like activity prevailed. While this unusual ferment was proceeding the arms were gradually shortening, until at length they appeared as trifling inequalities on the surface of the body. The latter also lost its characteristic shape and became contracted in its dimensions, and was finally represented by a slight enlargement at the extremity of the medullary pulp, which had receded some way within the horny tube. The polype in short had been absorbed. Many similar cases have occurred to me.

The newly-formed polypes are of a most delicate whiteness, and are beautiful objects, especially when they appear on an old and worn polypidom, reminding one of frail blossoms bursting forth from a bare and rugged stem. They are developed at the ends of the branches and are non-retractile. The body is more or less ovoid, and is produced above into a kind of snout which bears the mouth. This portion is capable of much elongation and contraction, and possesses great mobility. From the peculiar *lined* appearance which it presents in certain lights, I am inclined to believe that it is furnished with an apparatus of muscles. The mouth is connected by a short passage with the stomach. This organ is a well-defined cavity, elongate-oval in form, which tapers off below, and is prolonged into a canal which passes down the centre of the pulp. This canal like the stomach itself is very clearly defined. The polype-head is supported on a fleshy neck, to the base of which the horny polypidom extends.

The walls of the stomachal cavity and the central canal are covered with a complicated web of anastomosing vessels, from which simple vessels seem to pass off to the sides. This vascular structure is, so far as I know, unique amongst the Hydroid Zoophytes, and it gives a very marked and peculiar appearance to the polypes of the *Cordylophora*.

The arms are scattered over the body, filiform, and roughened with granules, which are arranged in regular nodules. They present a very interesting structure. They are distinctly tubular and prettily encircled at intervals by rings, which are no doubt muscular bands, and which are all connected together by longitudinal fibres, running the entire length of the arm, and prolonged at the base into the body. Upon this structure is dependent, in great part, the remarkable power which the polype possesses of elongating and shortening its tentacles. At times they are so much extended as considerably to exceed the entire body in length, and in this state are attenuated into most delicate filaments. When contracted they appear corrugated and comparatively thick, and the muscular rings are pressed together. I have seen the arms, when extended, fully six times as long as in their contracted condition.

The polype of the *Cordylophora* is a singularly beautiful object when its tentacula (some twelve or fourteen in number) are all elongated, floating like slender threads through the water, and waving to and fro with its every slightest movement.

Reproduction of Cordylophora.

The *Cordylophora* is propagated, like the *Sertularian* zoophytes, by means of *planulæ* (motive buds), which are matured in deciduous vesicles. These are oval and are produced on the polype-bearing branches. They consist of a thin corneous envelope with a soft mucous lining of some thickness, enclosing a central cavity in which the reproductive bodies are contained. In an earlier stage of development, the interior is occupied by a mass of granular matter surrounded by a delicate membrane. At first the vesicle appears as a small transparent oval case, budding from the branch, into which an offshoot from the fleshy axis of the polypidom has penetrated. Gradually it increases in size, and after a while the contained mass is resolved into a number of round bodies, which lie clustered together within the membranous sac, a stump of the offshoot remaining at the bottom of the vesicle. I have counted as many as twelve of these bodies in a single capsule, but more commonly they amounted to six or eight in number. For some time they undergo apparently but little change, merely increasing in size. At length however a marked alteration in form takes place. They become first oval, then elongate, and are now prepared to issue from the capsule as *planulæ*. This change occupies two or three days. When on the point of escaping they are found clustering together at the upper part of the vesicle.

I was fortunate enough to witness the exodus of a whole company of these embryo *Cordylophoræ*. As there is no natural opening to the vesicle, as amongst the Sertularians, a passage has to be made through the soft external covering. This was effected by one of the *planulæ*, which acted as a pioneer, and slowly, and with some difficulty, as it seemed, worked its way into the surrounding water. As soon as the leader had escaped the others followed in succession, and with great ease and rapidity,—with the exception of one, which happening to have the portion of its body representing a head turned in the wrong direction, moved towards the bottom of the vesicle instead of towards the water, and was some time in finding the right road and following its companions.

On reaching the water the *planula* remains inactive for a few seconds, undergoing remarkable changes of shape; the body then acquires a rotatory motion, and it sails off with considerable rapidity. It is elongate, and leech-like in form, somewhat broader at one extremity than the other, white, opaque in the centre, and semitransparent towards the edge of the body.

The *planulæ* made their escape late in the evening, and on the following morning some of them had become attached. They fix themselves by one extremity, which expands into a roundish disc, the body itself standing erect in the centre of it. This gradually assumes the form of the polype, the upper portion becoming somewhat ovoid and pointed above. Three or four tentacles also sprout from it, while the horny polypidom forms round the lower part, crenated or ringed, as it always is towards the base of the polype-bearing branches. When the stem has reached a certain height, it swells out into small protuberances here and there, which soon develope themselves into fresh polypes.

I have seen a *planula* apply one end of its body to the bottom of the watch-glass in which it was kept, and then revolve on its axis for a minute or two; and no doubt it is in this way that attachment is effected.

Besides the vesicles in which the *planulæ* are produced, other bodies occur at times on the *Cordylophora* in considerable numbers, which call for some notice. These are elongate, and often pointed at the apex, opaque white and of varying figure (Plate VI. fig. 2). They spring from the branches and are supported on short stalks. They consist of an opaque mass of granular matter, surrounded by a delicate and perfectly transparent corneous envelope, and are developed into polypes. I have seen rudimentary tentacles sprouting from them, but have not watched the course of development. These buds were present in great numbers along with the vesicles, but disappeared as the season advanced.

Though much attenuated, there can be little doubt that the corneous skin encloses the body of the fully-developed polype.

It will be at once evident that *Cordylophora* presents us with a somewhat strange assemblage of characters. Its embryology, as now determined, separates it from the *Tubularina* with which it has hitherto been associated. It has no tentacular ovisacs, and its *planula* resembles that of the *Sertulariadæ*.

Its extensible, muscular and roughened arm is that of a *Hydra* rather than a *Tubularian*. Its naked polype and the arrangement of its tentacula are points of difference between it and the *Sertulariadæ*, while its vascular system (whatever be its precise nature) is perhaps unique. Nor must we omit to note its well-defined digestive cavity. In external character it is for the most part a Tubularian zoophyte; in embryology it is rather a Sertularian, and there would seem to be points in which it differs from both (Plate VI. figs. 1, 2).

Additional Note on Cordylophora.—On one occasion, in removing a piece of the *Cordylophora* from one glass to another, a polype-head was accidentally detached. In a short time the wound caused in it by the separation had healed, and the base had assumed somewhat of a bulbous form. In this free condition the detached head continued for (I think) a day or two. At the end of that time I found that it had attached itself to the watch-glass, and soon after a new branch began to shoot from its *base*. As the latter increased, the polype exhibited the appearance which precedes *absorption*; the arms became contracted and rigid, and at length almost disappeared. At the same time a dense fluid filled the interior, in which an extraordinary ferment was perceptible. Numbers of spherical bodies, most of them opake, as if laden with matter, might be seen bustling to and fro, and hurrying down the central channel, which communicated with the new offshoots, into which they penetrated. The process of absorption proceeded until the original polype-head had altogether vanished, its substance having gone to build up the new stem, which had now attained a considerable length. The destruction of the specimen put an end to my observations, but there can be no doubt that a polype would soon have been produced at the extremity of the shoot.

A polype, then, artificially detached from the *Cordylophora* is capable of originating a new organism. It may be likened to a precocious *planula*. It is in fact a bud which has been developed into the polype form while in connection with the parent structure, while the *planula* is a bud which has become free, before assuming that form.

Mimosella gracilis.

Since I first described this beautiful production in the 'Annals,' I have had the satisfaction of dredging it in some abundance in Torbay. It occurred here, as in Salcombe Bay, where it was originally obtained, on rocky ground at a short distance from the shore, and was always, I think, parasitical on the same weed. Mr. W. Templer has also procured a specimen which was cast on the Plymouth Breakwater after a gale of wind. The species therefore would seem to be pretty generally distributed along the western coast.

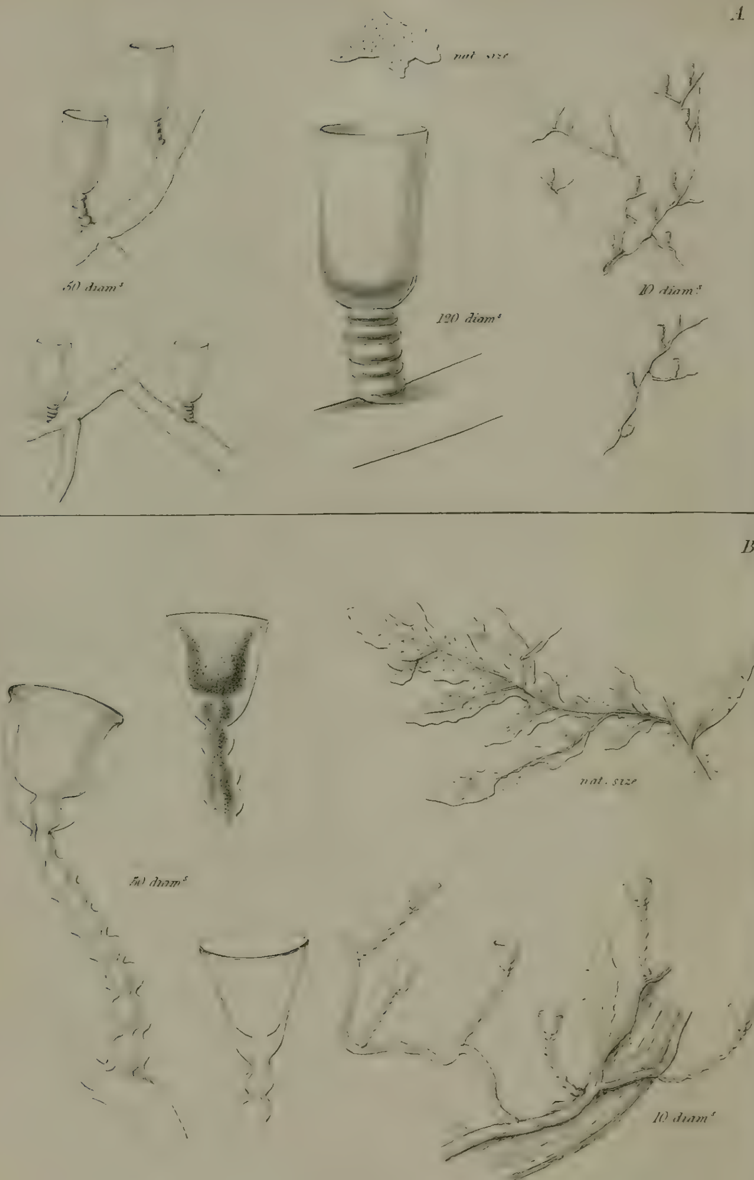
A renewed examination of the *Mimosella* in its living state enables me to add a few words on its peculiar habits.

The movement of the cells always accompanies either the retraction or expansion of the polype. When the polypes on both sides of a pinna are withdrawn, the cells are all folded together, like the leaflets of the *Mimosa* when touched. But each one of them when about to issue throws back its cell, and then immediately darts forth. When it retreats, the cell returns to its former position.

Great numbers of pinnæ were met with covered with budding polype-cells in various stages of development. They appear at first as small, roundish excrescences on the branch.

Eucratea chelata.

One of the leading characters of the family of *Eucratiadæ*, as constituted by Dr. Johnston, is the absence of "external ovarian



Tuffin West del.

J. De C. Sowerby sc.

Rev^d T. Hincks del. J. De C. Sowerby sc.

capsules." We learn however from Dr. Landsborough's 'Popular History of British Zoophytes,' recently published, that two of its members are furnished with these bodies, Mrs. Gatty having detected them on *Hippothoa divaricata*, and Mr. Peach on *Hip. catenularia*. I have now to record their occurrence on *Eucratea chelata*. Some time since Mr. W. Templer informed me that he had procured this species with ovaries, and upon my expressing some doubts on the point, he kindly supplied me with the specimens from which the following description is taken. The ovaries of the *Eucratea* spring from the fore part of the cells, immediately below the opening, occupying the place of the "spinous process" mentioned in Dr. Johnston's description. They are evidently metamorphosed cells. The lower portion resembles the corresponding part of an ordinary cell; but this is surmounted by a pouch, which contains three or four somewhat circular, opaque, white gemmules (Plate VI. fig. 3).

The reproductive bodies are enclosed in an inner sac, and there is generally a quantity of granular substance in the lower portion of the ovary.

EXPLANATION OF PLATES.

Plate V.

A. *Campanularia parvula*, natural size and magnified.
B. *Campanularia caliculata*, natural size and magnified.

Plate VI.

Fig. 1. *Cordylophora lacustris*, with vesicle.
Fig. 2. Bud of *Cordylophora*.
Fig. 3. Two cells of *Eucratea chelata*, with ovary.

XVI.—*Observations on the Genus* Schwenkia. By John Miers, Esq., F.R.S., F.L.S.

Schwenkia.

This is a genus of considerable interest, on account of the singular structure of its corolla, which for a long while offered a question difficult of solution. It was considered by Jussieu as nearly allied to *Browallia*, the two genera being placed by him among the *Labiatæ*. Linnæus, with much penetration, suggested its affinity to the *Solanaceæ*, an opinion quite disregarded by succeeding botanists. By Kunth it was classed, together with *Browallia*, in the *Scrophulariaceæ*. Dr. Lindley, in his 'Introd. to Bot.' p. 224, arranged it among the *Primulaceæ*, because the stamens are opposite to the expanded segments of the border of the corolla. Mr. Bentham subsequently pointed out what he considered to be the true nature of those gland-like processes, always seen between the divisions of the border, and which he showed to be the true segments, while the others were mere appendiciform expansions, and under this ingenious point of view, he was enabled to reconcile its structure with the opinions of Jussieu: following the example of Kunth, he therefore arranged both *Schwenkia* and *Browallia* in the *Scrophulariaceæ*, among his tribe of the *Salpiglossideæ* (De Cand. Prodr. x. p. 122). Martius suggested its affinity with the *Acanthaceæ*, a view not confirmed by other botanists, and quite unsupported by facts. It is now four years since I first explained in what respects this genus differs from *Browallia* and other genera of the *Salpiglossideæ* (*huj. op.* iii. 177), and I indicated the circumstances that, in my opinion, point to its nearer affinity to *Fabiana*, in the *Solanaceæ*. This genus forms one of those instances, in which it is difficult to determine, under the ordinary interpretation of the respective ordinal characters, whether it belongs to *Solanaceæ* or *Scrophulariaceæ*. In order to obviate uncertainty in similar cases, I endeavoured to show (*loc. cit.* p. 163), and again lately (*huj. vol.* p. 6), how by separating certain anomalous genera of these two orders, marked by peculiar characters, into a separate family, a prominent and unerring line of demarcation may be established between the former,—a difficulty that has hitherto puzzled every botanist. Under this test, *Schwenkia* must be referred to the *Solanaceæ*, on account of the decidedly valvate æstivation of the corolla, as I shall presently endeavour to show.

It may be urged, that in *Schwenkia* the total number of lobes in the border being generally more than five, and the suppression or diminution of some of these and of the stamens being of frequent occurrence, are features quite foreign to the *Solanaceæ*. But in *Hebecladus* and *Dunalia* we meet with five intermediate teeth between the lobes of the border, and in *Nectouxia*, an annular 10-toothed ring is placed in the mouth of the corolla, within the line of origin of the five segments, forming thus a corona, closely analogous in its nature to those more expanded petaloid segments which Mr. Bentham describes as appendiciform processes in *Schwenkia*. In this genus the stamens are always five in number, and are situated below the middle or near the base of the tube of the corolla; of these, two, or sometimes four, are antheriferous and reach the mouth of the tube, while three, two, or one, are occasionally sterile or anantherous, the filaments in such case being sometimes short and rudimentary. In many Solanaceous plants there is often a difference in the size of the stamens, and this becomes a constant feature of the section *Nycterium* of the genus *Solanum*, where three of them are always considerably larger than the two others, which are sometimes almost sterile. The suppression of some of the anthers, and of a portion of the glandular-looking lobes (true segments) of its border in *Schwenkia,* must be considered one of those exceptional cases which are occasionally met with in a great many orders; it serves as a point of osculation between the *Solanaceæ* and *Scrophulariaceæ,* in which latter family, the want of symmetry in its parts, and a total or partial suppression of one of its stamens, form almost universal characters. On the other hand, we meet in the same family several cases where the corolla is pentamerous, and as regularly symmetrical in its parts as in *Solanaceæ*; thus in *Capraria* (*Xuaresia,* R. & P.), we find a corolla with a border of five equal lobes and five equal stamens; so also in some species of *Verbascum,* and in *Sibthorpia,* where likewise the stamens are generally five, and equal in number to the regular segments of the border, although rarely four or eight occur. In my definition of *Schwenkia,* as given below, I have modified somewhat Mr. Bentham's view of the structure of the corolla, considering the expanded segments of the border to be analogous in their nature to the corona of *Nectouxia.*

Referring to the question of æstivation, it will be seen that in the sections *Chætochilus, Euschwenkia,* and *Brachyhelus,* where the segments of the corona are small, they are valvately conjoined in bud by their floccose margins into a short cone, that closes the mouth of the tube, the lobes lying over them, and pointed toward the axis: in *Brachyhelus,* these lobes, which are several times longer than the toothed segments, soon become approximated in the axis, where they are connately disposed in an erect central column, so that both lobes and segments may be said to have a valvate æstivation: in *Cestranthus* the lobes are reduced to short teeth, but the segments of the corona are of considerable length, linear and acute, and also valvately disposed in bud, into a lengthened pentangular cone, exhibiting at its basal angles the five short lobes, as so many salient erect points. In *Cardiomeria* the lobes are equally short and similarly situated, but the very broad emarginated segments have their margins valvately disposed, and they are replicated lengthways down the middle, as in *Datura,* so that the corolla appears in bud like a slender tube swollen into a pentapterous form above, and terminated by five semilunate wings, depressed at the point of their union in the axis, and furnished on the external angles with the five salient short erect lobes, like so many uncinate teeth.

Besides the considerations above described, we have the evidence in the structure of the seed, that this genus must be referred to *Solanaceæ,* and not to *Scrophulariaceæ,* because the embryo, which is slightly curved, has its radicle pointed to the basal angle of the seed, and turned away from the ventral hilum, as shown by Gaërtner (De Fruct. tab. 214), while in the latter family the radicle always points to the true point of origin of the hilum. *Schwenkia*, like *Vestia*, has a stipitate ovarium, the support being enclosed in its hypogynous disk, and the corolla also falls away by a circumscissile line above its base, forming a small cup that invests the base of the ovarium: the mode of its placentation likewise resembles that of *Fabiana*, the points of attachment of the ovules being placed in several prominent longitudinal lines; the seed in a similar manner is slightly curved and hollow on its ventral face, the hilum being seen in this hollow.

Schwenkia, Linn.—D.C. Prodr. x. 192.—Chætochilus, *Vahl. Enum.* i. 102.—Mathea, *Vell. Fl. Flum.* i. tab. 51—(Charact. emend.).—*Calyx* tubulosus, 5-dentatus, vel semi-5-fidus, laciniis sublinearibus, præfloratione valvatis, persistens. *Corolla* monopetala, tubo elongato cylindrico, rarius supra medium infundibuliformi, sæpissime gibbosim subinflato, ore contracto, et hinc in lobos 5 glanduliformes producto, lobis erectis, lineari-teretibus setiformibus subæqualibus, aut inæqualibus et clavatis, vel ad dentes minutos mucroniformes redactis, fauce corona limbiformi rotata 5-partita instructo, segmentis seu brevibus et dentiformibus, vel oblongis, integris, acutis, expansis, lobis multo longioribus, aut truncato-oblongis, emarginatis, bifidisve, et tunc sæpe sese longitudinaliter retroplicatis, lobis segmentisque æstivatione valvatis. *Stamina* 5 inclusa, imo vel medio tubi orta, lobis alterna, et segmentis coronæ opposita, nunc 2 superiora fertilia et faucem attingentia, quinto summo duobusque anticis brevibus, vel his tantum (summo deficiente) anantheris sterilibusve, nunc 4 fertilia, summo quinto ananthero: *antheræ* conniventes, ovatæ, cordatæ, 2-lobæ, lobis ad connectivum tenuem dorso adnatis, rima longitudinali antice dehiscentibus. *Ovarium* oblongum, disco hypogyno cupuliformi suffultum, rarius disco obsoleto stipitatum, et hinc casu corollæ circumscissæ cyatho membranaceo imo cinctum, 2-loculare, placentis crassis, carnosis, dissepimento utrinque adnatis; *ovula* plurima, in lineas longitudinaliter digesta: *stylus* filiformis, inclusus; *stigma* claviforme, pulvinatum, obsolete 2-lobum, apice umbilicatum. *Capsula* septicide 2-valvis, valvulis integris, dissepimento demum libero medio seminifero parallelis. *Semina* plurima, tetragono-oblonga, paullo curvata, *testa* scrobiculata: *embryo* intra albumen carnosum subincurvus, cotyledonibus oblongis, compressis, radicula infera tereti hilo umbilicato ventrali distante, vix latioribus et subæqualibus.—Herbæ suffruticesve *Americani* (*una specie etiam in Africa tropicali crescente*): folia *ovata, aut lanceolata, integra,* floralia *decrescentia vel minuta;* pedunculi

1-flori, aut simpliciter pauciflori, breves, in paniculam foliosam vel subnudam dispositi.

I have nothing to add to the excellent description and arrangement of the species, as determined by Mr. Bentham*, in D.C. Prodr. x. 193.

XVII.—*Observations on Relative Position; including a new Arrangement of Phanerogamous Plants.* By B. Clarke, F.L.S. &c.

[Continued from p. 90.]

Part II.

On the Position of Carpels.

As the progress of discovery shows that Jussieu's system in its primary divisions, viz. Monopetalous, Polypetalous, and Apetalous, leaves unassociated plants between which there is the closest resemblance in both structure and habit, and that in numerous instances,—it has become desirable to form primary divisions depending on different characters, but retaining as far as possible those of Jussieu as of subordinate value. How far the present attempt is successful the Tables will show, and the researches connected with the relative position of carpels to the axis will I trust prove of interest, and may also assist in determining questions of affinity which at present remain unsettled.

It being so common for the ovary to consist of two or only one carpel, in either case having a variable relation to the axis, it becomes interesting to trace the cause of this reduction, and more especially the causes of the variations in their position; and of these inquiries, the varying position of the two carpels of dicarpous ovaries affords the most satisfactory explanation. Thus, the cause of the difference of the position of the carpels when reduced to two, is explained by the mode in which the changes of position occur when a tricarpous ovary becomes dicarpous.

Differences in the Position of the Carpels when Two.

1. *When the two carpels are right and left with respect to the axis.* In the genus *Carex* the three carpels are ordinarily two of them right and left and one posterior, and when reduced to two, they are (in the species examined) uniformly right and left; in *Malpighia coccifera* the three carpels have also the same relation to the axis, the posterior one being smaller; and in *Banisteria* of the same family, the carpels when only two are right and left.

* Analytical details of the æstivation and structure of the five different sections of this genus will be given in plate 63 of the Ill. So. Amer. Plants.

In *Omalanthus* among Euphorbiaceæ, the tricarpous and dicarpous ovaries are to be seen on the same plant, and as tricarpous ovaries have generally one carpel posterior, its disappearance sufficiently accounts for such ovaries when reduced to two carpels having them placed laterally. Two carpels right and left sometimes, however, arise from the suppression of two carpels of an ovary consisting of four, of which Caprifoliaceæ and Cruciferæ contain examples.

2. *When the two carpels are anterior and posterior.* In *Houttuynia cordata* the ovary is tricarpous, one carpel being posterior and two lateral; but frequently it becomes dicarpous; in these instances a lateral carpel generally disappears, first leaving the other two anterior and posterior, as afterwards more particularly adverted to.

In *Agrimonia*, although the ovary is apocarpous, the three carpels are almost uniformly two of them lateral and one posterior, and in abortion a lateral carpel first becomes rudimentary or ceases to be developed, the remaining two being left (with but very few exceptions) anterior and posterior; thus corresponding in position with *Spiræa* when dicarpous.

In *Reseda luteola*, which frequently has dicarpous ovaries, the two carpels are anterior and posterior, or less frequently oblique from the absence of a lateral carpel, as the three carpels of *Reseda* have the same relation to the axis as in *Houttuynia* and *Agrimonia*.

These and other analogous examples make it evident that an ovary consisting of two carpels anterior and posterior generally results from a tricarpous ovary, one of the lateral carpels of which is not developed, the other lateral carpel having become in consequence anterior, having been removed from its position to be opposite the posterior carpel. Another instance as occurring in *Heracleum* is mentioned by Mr. Ralph (vide Proceedings of Linn. Soc. vol. i. p. 284).

3. *When the two carpels have an oblique relation to the axis.* Although perhaps in no instance are the carpels when two always oblique, yet the oblique position frequently occurs, both in plants in which the carpels are generally anterior and posterior, and in those in which they are as predominantly right and left. This oblique position probably arises from the lateral carpel of a tricarpous ovary not becoming anterior when the other lateral carpel has disappeared, but remaining nearly in its original position, in consequence of which the posterior carpel is somewhat displaced, becoming obliquely posterior; and thus anterior and posterior and oblique may be regarded as one and the same character, and as a general rule this may prove available, but two lateral carpels do undoubtedly sometimes become oblique.

Differences in the Position of the Single Carpel.

Ovaries in which the carpel is single are for the most part the result of the abortion or non-development of one of the carpels of a dicarpous ovary; and the position of the carpel depends consequently upon whether it is an anterior, or a posterior, or one of two lateral carpels which is absent.

1. *When the single carpel is anterior.* When the ovary in Myrtaceæ, Bruniaceæ, Onagraceæ, Polygalaceæ and Acanthaceæ is one-celled, it is the posterior cell which has disappeared, and to these may be added Tetragoniaceæ and Ulmaceæ among apetalous plants*.

2. *When posterior.* A single carpel posterior may be explained in an analogous manner. In *Houttuynia* for example, the carpels when reduced to two are for the most part anterior and posterior, and in the instances of single carpels they are all directly posterior. This offers an explanation for the unusual position of the carpel in Piperaceæ, where when single it is constantly posterior.

3. *When lateral or oblique.* The position of the single carpel on one side of the flower, either directly lateral or more or less oblique, is frequently owing to the same circumstance, as in *Elatostemma* and *Morus*, where the carpels are frequently lateral. The stigmas here being two, one of them is continuous with the dorsal rib of the fertile carpel, and the other corresponds with the placenta, being a part of the rudimentary carpel.

From the causes particularly noticed as occasioning the differences of the position of the two carpels in dicarpous ovaries, it necessarily follows that in such cases a single carpel anterior and a single carpel lateral would be the same carpel in different positions†; and consistently with this inference, those Orders which have the carpel always lateral are also very nearly allied to those in which it is always anterior, with the exception of Nyctagineæ (and some others in which the carpel is lateral only in part) as afterwards explained. Such Orders are therefore placed in the Proterocarpous Division.

Position of the Carpels when Three.

From the foregoing and other analogous examples it seems to follow as a theoretical inference, that the regular number of carpels in all ovaries where they are definite is three, or a multiple

* The term anterior is used as synonymous with inferior, and posterior with superior.

† Those cases must be excepted where two carpels right and left occur in an ovary in which the third carpel is anterior, as in *Menispermum laurifolium* and *Maranta dichotoma*.

of that number, the additional series being frequently reduced by abortion or non-development in the same manner as the first, thus giving rise to the formation of ovaries with five or four carpels. And as tricarpous ovaries in Exogens have generally two carpels lateral and one posterior, it might be supposed that ovaries having a greater or a less number of carpels would, if they became tricarpous, have the three carpels so placed. There are, however, exceptions to this rule, of which *Viola, Fagus* and *Menispermum* are instances, where the carpels are two of them lateral and one anterior; and in other instances the three carpels vary in their position in the same plant, as in *Clethra, Pittosporum* and *Delphinium.* In Endogens the position of the three carpels is perhaps less regular, as *Dioscorea, Maranta, Phœnix,* and others have them placed as in *Viola* or irregularly, the irregularity being apparently the consequence of the ovary being turned on its axis so that a lateral carpel becomes anterior.

Value of the Characters.

From the Tables as they now stand, the following inferences are deducible*:—

1. That the position of carpels when two, right and left of the axis, is common to all subdivisions, but predominates in the Heterocarpous Division, where the position of the single carpel is for the most part different from flower to flower, and generally variable to the greatest degree.
2. That species with carpels anterior and posterior also occur in all subdivisions, but that this arrangement obtains more generally in the division designated as Proterocarpous, from the single carpel being usually anterior, and from the ovaries when dicarpous not unfrequently exhibiting a tendency to suppression of the posterior cell.
3. But that in plants with irregular flowers or didynamous stamens, the position of the carpels when two is constant, and with very few exceptions anterior and posterior.
4. That a certain portion of the class Exogens never has the single carpel posterior.
5. That a single carpel lateral may possibly occur in all subdivisions, but that this character does not, among Heterocarpous plants, extend through an entire family, unless Nyctagineæ should prove to be an exception.

As however the position of the single carpel in many families remains to be ascertained, some changes will doubtless have to

* Since the formation of the Tables, it has been found that part of the details are obliged to be omitted in the printing, but those most deserving notice are contained in Part III.

be made, and transition-classes, not strictly referable to either of the two primary divisions, must be expected, such as Berberideæ, Moreæ, and Mimoseæ. The latter remark however applies principally to the Proterocarpous Division, as in the Heterocarpous Division the position of the single carpel is in all probability variable and nearly in the same degree throughout the Orders: thus its position in the Orders of the Anonal Alliance must be expected to be variable, as in *Tasmannia*, in those of the Clusial and Anacardial Alliances, as in Anacardiaceæ, &c. And the remaining inquiry therefore appears to be more especially as to whether the Orders included in the Proterocarpous Division have the single carpel always anterior or lateral, or with so few exceptions as that they might be associated with them.

It is worthy of remark, that although the position of the carpels when two may be variable to the greatest degree in a single genus, as in *Ribes*, yet, on the other hand, it does not separate genera, which Jussieu's and other systems would, if strictly adhered to; thus, the position of the two carpels is the same in monopetalous, polypetalous and apetalous Oleaceæ, as also in the perigynous *Eschscholtzia* and hypogynous *Glaucium*.

But the position of the carpel when single does not appear liable to such exceptions, and may assist in determining affinities which at present remain much obscured; thus, its position in *Ceratophyllum* corresponds with that of the Piperal Alliance, and differs, as far as is at present known, from that of any other Orders with which it could be associated, unless it is compared with *Nelumbium*.

It constitutes a differential character between families otherwise scarcely distinct, as does also in some cases the position of the fertile cell of compound ovaries; thus, *Viburnum* differs from *Centranthus*, *Valeriana*, *Valerianella* and *Fedia*, whether the axis or (in the latter genera) the irregularity of the corolla is regarded, or the position of the stamens in *Fedia* (see also Part III. and the accompanying figures).

Two-celled Ovaries with Unequal Cells.

When the two cells of an ovary are equal in size, each containing an ovule, and the fruit becomes one-seeded, the position of the fertile cell cannot be relied on as an indication of the position the single carpel would occupy. Thus, in *Galenia africana* the ovary consists of a single carpel anterior, but in a two-celled one-seeded species (the carpels being anterior and posterior) either cell indifferently is fertile; and this deserves more attention, because in the nearly allied genus *Trianthema*, a one-celled species (*T. micrantha*) occurs having the carpel anterior or less frequently lateral. The position of the fertile cell therefore (in such cases) is subsequently noticed only to show how far the inquiry has extended.

But there is a circumstance occurring not unfrequently in compound ovaries, by which the position the single carpel would occupy may be with confidence assumed, viz. the diminished size of one of the carpels. Thus, in *Circæa alpina,* when the ovary is two-celled the posterior cell is both shorter and less in its diameter, and when one-celled the cell is always anterior, and analogous examples occur in *Stylidium* and *Dampiera.* In Valerianaceæ the barren cells are sometimes so reduced as to be scarcely apparent, but occasionally they are larger than the fertile; and although this is an exception as to the size of the carpel, yet like the smaller cells they are destitute of ovules.

One of the stigmas of a dicarpous ovary being larger than the other is a character which is likely to prove of the same value, as in Labiatæ and Verbenaceæ the anterior portion of the stigma is sometimes enlarged, and in *Lantana* and *Lippia* the two-celled ovary is formed by a single carpel anterior. In Acanthaceæ, also, stigmas occur with the anterior lobe elongated, and in the one-seeded *Mendozia* it is the anterior carpel which is fertile*.

To the inequality of the stigmas there are however exceptions (which may be compared to the barren cells of *Valerianella* having become inflated, or to sterile stamens having become petaloid), as in Lentibularieæ the posterior portion of the stigma is constantly larger, and also in *Polygala speciosa.* But as it is always the posterior lobe which becomes enlarged, while in Polygalaceæ it is the posterior cell which is suppressed in one-celled ovaries, these two exceptions are unimportant; and the larger lobe of the stigma being variable in its position should alone perhaps be taken as an evidence of variation in the position of the single carpel. *Schweiggeria* also supplies another instance (though less marked), in which the two larger stigmas are lateral or obliquely posterior, while the larger-ribbed carpel of the tricarpous ovary is anterior.

Free Central Placentæ.

It would not perhaps be expected, that in compound ovaries having a free central placenta, the position of the ovule when solitary would supply any evidence from which the position the

* In *M. puberula* the fertile carpel is always anterior, and from the similarity of the species there seems no reason to doubt but that it is so in all. The two-celled fruit described by Martius as having its cells placed one above the other, is produced by an extension of the placenta across the anterior cell, as the remains of the posterior cell are behind the upper fertile cell.

single carpel would occupy might be inferred; yet from the constancy of its position in certain families, this may be considered as no longer a question, as in Chenopodiaceæ, Amaranthaceæ* and Plumbagineæ the ovule is with rare exceptions posterior or lateral; but in *Scleranthus annuus* and *Calytrix virgata* always anterior, in the latter instance two ovules being present. *Scleranthus* therefore agrees with Tetragoniaceæ, and *Calytrix* with Myrtaceæ, &c.; and its variable position in *Thesium* tends rather to confirm the evidence, as showing a correspondence with *Aucuba*, &c. in the variable position of the fertile carpel.

The Position of the Raphe.

From the remarkable regularity of the position of the raphe, both in erect and pendulous anatropal ovules, and also of the cotyledons and radicle in seeds produced from campylotropal ovules, these characters may, there appears no reason to doubt, be relied on as furnishing indications of the position of the carpel; and also (the ovule being erect) of the fertile carpel, when two or more being equally developed are united by their margins and form a one-celled ovary. Thus, in *Illecebrum* and *Atriplex*, where the ovary is dicarpous, the radicle of the embryo curves down posteriorly, showing, in the latter instance at least, that the placentation is anterior to the seed, as is the funiculus in *Beta* and *Rhagodia*; while in *Opercularia* the position of the raphe is variable, showing the position of the fertile carpel to be variable, as in Cornaceæ and Caprifoliaceæ, and more frequently posterior than in the latter†.

General Characters of the Divisions.

The division thus separated as Proterocarpous is natural, in having no direct affinity either with Endogens or Rhizanths, with both of which the second or Heterocarpous Division is so inti-

* *Gomphrena globosa*, in which the funiculus is lateral, is further remarkable for having the ovule almost always on its right side: may this be owing to the direction of the spires of bracts? In *Cliffortia ilicifolia*, where the carpels are all lateral, more than two-thirds of them have their bracts toward the ascending portion of the spire, whether the spire is from right to left, or from left to right; but so slight a variation is perhaps scarcely deserving attention, and such instances should rather be referred to their nearest affinities.

† The relation of the raphe to the placenta in any given family must be ascertained before such an inference can be made, except it is in those cases where the position of the raphe (in relation to the axis of the inflorescence) is variable, as then the position of the fertile carpel must be variable, of which *Brunonia* is an example; and the same rule applies to the position of campylotropal ovules.

mately connected, and hence it may be regarded as the more highly developed; and the three subdivisions, Phytolaccal, Petiverial, and Proteal, being alone Proterocarpous in their apetalous form (excluding the Urtical), may especially on that account be so regarded; and of these again the Proteal is the first, in the flowers being irregular and the carpel more constantly anterior. This subdivision, it will be seen, contains in its polypetalous form Leguminosæ, which Endlicher on other grounds came to the conclusion were the most complicated or highest developed form of Exogens.

It differs from the Heterocarpous Division also in the frequent occurrence of irregularity of the corolla, which is comparatively rare in that division and confined to sections of the Orders. It is also very rarely apocarpous, less frequently polycarpous (and then seldom with more than one whorl of carpels), and more frequently exalbuminous.

And lastly, there is some difference in the medical properties, the Proterocarpous Division being remarkable for the absence of febrifuge alkaloids, the bitter tonics also being less stimulant; while, on the other hand, narcotics strictly so called are almost exclusively to be found here.

The Subdivisions.

The principal object in arranging the Alliances in Subdivisions is to endeavour to show the mutual relation borne to each other by the monopetalous, polypetalous, and apetalous divisions of Exogens, an affinity so close, that most of the subdivisions form natural assemblages*. In the formation of these and of the Alliances, I am much indebted to Dr. Lindley's valuable work the 'Vegetable Kingdom.'

Rhizanths.

From the affinities of Rhizanths it might be expected that the position of the carpels would correspond with that of the Aral

* The following remarks of Schleiden on the development of the corolla and other parts of the flower also show the monopetalous corolla to be a character of minor value:—"All foliar organs of the flower, though they may subsequently unite in growth, first arise entirely free parts; and if they belong to one circle, they are at their earliest rudiments, and for some longer or shorter time after, exactly like each other; so that the coherence of these several members and their symmetrical development is a later process. I have been able readily to trace the most irregular flowers up to the condition of bud in reference to this; as, for instance, the flowers of the Leguminosæ, of the Labiatæ, the Scrophulariaceæ, and the species of *Aconitum*, and these fully established the laws laid down here." (Dr. Lankester's Translation of Schleiden's Principles of Scientific Botany, p. 330.)

and Piperal Alliances, especially in such Balanophoreæ as have but one carpel, in which the inflorescence resembles that of Araceæ. This opinion perhaps may derive some support from the figures of the species of *Balanophora* by Mr. Griffith in 'Trans. Linn. Soc.' vol. xx., where the carpels are apparently irregular in their position; and should this prove to be the fact, it will be an additional reason for regarding Rhizanths as the common basis of Endogens and a part of Exogens, which seems to be indicated by his proposed distribution of them.

Endogens.

That all the great sections of Exogens in their higher developed forms may become Proterocarpous is evident from the Tables (vide Table II. Derivations), and hence it might almost be anticipated that Endogens would also; but as it is very rare in those sections of Exogens which approach Endogens, so it may be very rare in Endogens themselves, and hitherto I have only observed it in *Pontedera*. It seems however not unlikely to occur in the greater part of Orchideæ, but as in the lower forms of Endogens the position of the carpels when two is variable, the exceptions may be confined to petaloid forms with irregular flowers, such as Pontederaceæ.

Gymnosperms.

In *Pinus* the flattened expanded ovary is always anterior, as is also the succulent carpel of *Podocarpus*; and as far as the other genera of this section of Phanerogams show any traces of a carpel, or an envelope which possibly may be a rudimentary carpel, it is always anterior, as the external tunic of *Saxe-Gothæa* and *Gnetum*.

Didynamous Stamens.

From the fact that as far as the didynamous monopetalous families show any tendency to suppression in the carpels of their dicarpous ovaries, it is for the most part or always in the posterior one, it might be supposed that the stamens and carpels follow the same order in this character, as it is the posterior stamen which is deficient, and thus the cause of didynamous stamens might be explained. And possibly this may be Mr. Ralph's reason for considering the anterior as the odd carpel in Scrophulariaceæ (vide Proceedings of Linn. Soc. vol. i. p. 284). But this correspondence in position between the fertile carpel and stamens is perhaps confined to the Proterocarpous Division, as in repeated instances in which the stamens of *Pimelea decussata* were reduced to one, it proved to be always on the opposite side of the flower to the carpel, the stamen being anterior and the carpel posterior, and *Lachnæa* shows the same tendency in the anterior stamens being longer. In *Stilbe* also the posterior stamen is rudimentary or absent, yet the larger cell of the ovary which becomes the fertile is for the most part posterior, the anterior cell in *S. ericoides* being frequently obliterated. And *Pleurophora* has the same structure when the posterior stamens are deficient. Possibly the truth may be, that when the single carpel is anterior or lateral, the fertile stamens are also anterior, rarely lateral; but that when the position of the carpel is variable there is no longer any constant relation between them, although the posterior stamens continue to be far more frequently suppressed.

Characters therefore derived from the position of fertile stamens are of less value than those derived from the position of the single carpel, and the same remark may apply to the relative position of floral envelopes, it being a question if Mimoseæ always agree with Leguminosæ in this character. The number five however in Exogens may prove to be the consequence of the non-development of a sepal or petal, as in the instance of the calyx of a *Phyllanthus* consisting of six sepals becoming occasionally reduced to five by the suppression of one of the external three, and this would also account for the alternation of petals and stamens in Exogens; thus, supposing six stamens to be opposite six petals, and the anterior petal and the posterior stamen to be removed, an ordinary pentamerous flower with the stamens alternate to the petals would be produced.

The Axis.

In ascertaining the position of carpels, an uncertainty sometimes arises as to their position in consequence of a doubt existing as to which is the axis, there being two or more branches, either of which might be regarded as the axis to a flower growing in connection with them; but an attentive examination of the mode of growth and of the position of the bracts, in specimens more than usually developed, generally obviates this difficulty; it is necessary however to observe, that in the construction of the Tables, whenever any irregularity exists in the flower, that irregularity is taken as a guide, as for example in *Grevillea*; and some allusions to modes of growth are subsequently added in connection with the structure of ovaries.

Conclusion.

By arranging the Natural Orders in two divisions, it is not intended so much to draw any exactly definite line by which to separate them, as to show that there exists in Exogens two facies of organization, one of them conterminous with or passing into Endogens, and the other the most remote from them, differing from each other more in the position of the carpel when single than in any other character. And as placentæ are prolongations from one common pith, and as ovules are analogous to buds, in connection with which the wood is formed, it becomes a question whether there is not an analogy between the formation of wood externally on the stem, and the development of ovules and carpel on the external or anterior side of the flower, especially in such forms of inflorescence as spikes, racemes, &c. If so, it would be a reason for regarding those Orders in which the single carpel is anterior, as having a more perfectly exogenous character, the first ovules and carpel being constantly formed on the external or anterior side, showing more tendency to exogenous structure than where they are produced irregularly or posteriorly.

Consistently with such an analogy, stems imperfectly exogenous are confined to the Heterocarpous Division; and it may be observed also, that in Endogens the first leaf of an axillary bud is for the most part lateral or posterior, and that the succulent leaf forming the clove of *Allium*, although not the first leaf, is posterior or occasionally lateral, while among Exogens the first leaf is commonly lateral or anterior, of which latter *Xylophylla* and *Phyllanthus* are remarkable instances*. And finally, this anterior or external development sometimes extends to the floral envelopes, as in *Acanthus spinosa* the calyx and corolla are deficient posteriorly in common with the stamens and (in *Mendozia*) the ovary of Acanthaceæ, and a comparison may be made with the modes of growth and branching of the axis.

Note on Table III.

The main purpose of this Table is to show that the arrangement adopted in Tables I. and II. is not inconsistent with well-established affinities. The Subdivisions therefore stand in the same succession to each other as in Tables I. and II., by which the epigynous Alliances are now brought into relation with each other, and most of the Natural Orders become so placed as to be within the range of their more immediate affinities; and, indeed, by contracting or widening the separated portions of the Subdivisions *ad libitum*, but few of them would remain unassociated with their nearest allies. To this, the Leguminous

* The leaves of *Xylophylla* are regarded as true leaves, because—1. The woody circle in the petiole is incomplete in its upper part, a character common in petioles, and which has been termed "the horse-shoe mark." 2. The venation, viz. the branches terminating in the depressions of the serratures, is frequent in *Mercurialis annua*. 3. The scales at the bases of the leaflets occur also in *Schottia*.

Alliance among Polypetalæ, and Phytolaccaceæ, Petiveriaceæ, and Proteaceæ among Apetalæ, are the more remarkable exceptions; but this apparent inconsistency might be obviated by extending the Leguminous Alliance along the vacant space so as nearly to approach Rosaceæ, and by placing Phytolaccaceæ, Petiveriaceæ and Proteaceæ opposite Nyctagineæ and Daphnaceæ; but as this would obscure the design of the Table, it is thought better to leave them so far misplaced.

It should be observed also, that this Table partially differs from Table II. in the distribution of the families of the Proterocarpous section of Monopetalæ, as the true station of Sapotaceæ, from a more recent analysis, appears rather to be between Ebenaceæ and Salvadoraceæ, and nearer the latter; and Convolvulaceæ are placed in the Phytolaccal Subdivision. The Lauro-Elæagnal and Daphnal subdivisions are also folded over the Polygonal, by which separations between some near allies are avoided.

XVIII.—*Note on the* Gryphæa *of the Bed called Gryphite Grit in the Cotteswolds.* By John Lycett, Esq.

The lower bed of the upper ragstones in the Cotteswold Inferior Oolite exhibits an immense profusion of a well-known Gryphæa, and this circumstance, together with the very limited stratigraphical range of the shell, combines to render it of much importance to the geologist, as it affords a certain guide to that portion of the Inferior Oolite. This Gryphæa has been universally accepted as the *G. cymbium* of Lamarck, but the position of that species upon the continent is known to be the Middle Lias, of which it is considered to be one of the characteristic forms, and a reference to the figures and descriptions of Lamarck's shell proves that it is perfectly distinct from the Cotteswold species. In the first edition of the 'Geology of Cheltenham,' by Sir R. Murchison, the Gryphæa is tabulated *G. cymbium*, and this name was copied into the second edition, in which however, fortunately, an illustration was given of it at pl. 7. fig. 3. Subsequent lists of Inferior Oolite fossils have included *Gryphæa cymbium*. It does not appear that Lamarck's species has been recognised in the lias of England; it possesses a general resemblance to *G. incurva* and *G. obliquata*, except that the larger valve has much less convexity, the beak is much less incurved, and has a small area by which it was attached to other bodies; the upper valve is also much larger; the margins of the valves are regular and not sinuous; the height of the shell always much exceeds the lateral diameter, sometimes in the proportion of 6 inches by 3; it is nearly, and in some instances perhaps altogether, destitute of the deep sulcation and large lateral lobe which distinguish the dorsal surface of the convex valve in the Cotteswold species. *G. cymbium*, Lam., is well exemplified in the figures of Goldfuss* and Buvignier†, the larger figure of Goldfuss representing the shell in an advanced stage of growth, in which it acquired a greater degree of elongation, the general outline constituting a tolerable resemblance to the object which the name indicates.

Another Gryphæa, associated in the same beds with *G. cymbium*, and of which it may possibly be only a variety, presents a more near approximation to the Cotteswold species; it has a great degree of flatness and some irregularity which reminds us somewhat of the true oysters; it has also a lateral lobe and sulcus, but much less prominent than in the Cotteswold shell, the general elongated form resembling *G. cymbium*. M. Buvignier considers it to be distinct from *G. cymbium*, and has named it *G. Broliensis*‡.

The conspicuous sulcation and lobe which serves prominently to distinguish the Cotteswold shell, is a feature which in a more modified form is present in nearly the whole of the species of this subgenus, of which it constitutes one of the characteristic attributes; for although the species of Gryphæa are more easily distinguished than those of the true oysters, there exists nevertheless a large amount of variation. The adherent species will be found to exhibit greater variability than the others; it may consequently be inferred, that the variation of form is connected with the position which was accidentally retained by the attached shell. The Cotteswold Gryphæa, which exhibits a considerable difference of aspect, was frequently attached to another of the same species, the shells being clustered together in masses.

In conformity with precedents in similar instances, I dedicate our Cotteswold Gryphæa to the author who first figured it in the 'Geology of Cheltenham,' and whose labours have contributed so much to enlarge our knowledge of the fauna of the Oolite.

Gryphæa Buckmanni.

Syn. *Gryphæa cymbium*, Murch. Geol. Chelt. 1834, p. 10.
——— *columba*, Lonsdale, in Geol. Proceedings, 1835.
——— *cymbium*, Morris, Catal. Brit. Foss. p. 109, 1843.
——— *cymbium*, Geol. Chelt. 2nd edit. 1845, p. 75, pl. 7. fig. 3.

Sp. char. Shell transversely ovate, very convex, irregularly and

* Petref. Germaniæ, tab. 7. fig. 3; tab. 85. fig. 1.
† Géol. et Paléont. Dép. de la Meuse, Atlas, pl. 5. figs. 5, 6, 7.
‡ Ibid. pl. 5. figs. 7, 8, 9.

concentrically laminated; beak acute, incurved, with a small adherent area; larger valve extended laterally, inflated and bilobed, having a wide and deep sulcation which extends from the beak to the lower border; upper valve concave; margins of the valves sinuated.

The deep sulcation in the dorsal surface separates a posterior lateral lobe, which in the mature form has a diameter equal to a third part of the entire valve: in the young state the posterior lobe is but slightly developed, and the valves at that part are thin, but the groove is always conspicuous.

The species which most nearly approach *G. Buckmanni* are *G. dilatata,* Sow., and *G. controversa,* Roemer; but these latter are much larger species, they are less inflated, and have the dorsal sulcation much more superficial.

XIX.—*On two new Subgenera of* Calanidæ. By John Lubbock, Esq., F.Z.S.

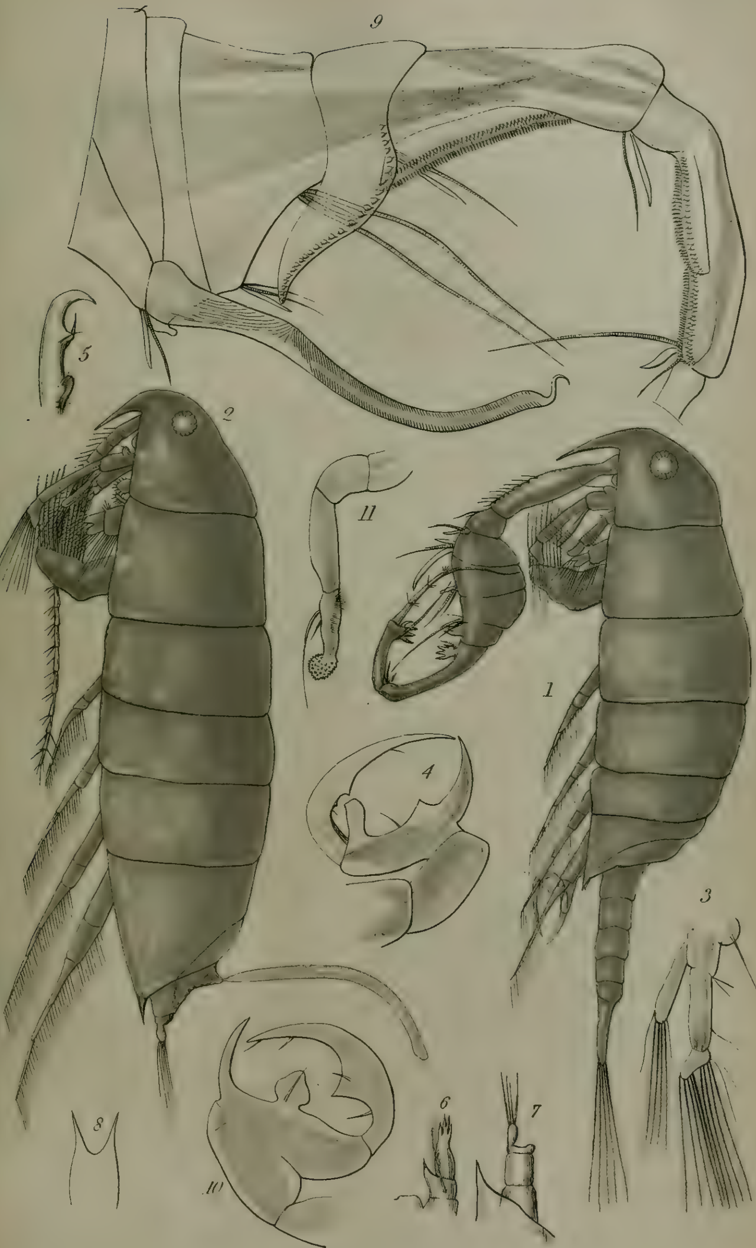
[With a Plate.]

Among Mr. Darwin's Crustacea, I discovered a few specimens of a remarkable Entomostracan nearly allied to *Labidocera Darwinii,* but differing considerably from it in the structure of the right antenna of the male, of the fifth pair of legs, and of the abdomen of the female; and lately, in the collection of the College of Surgeons, through the kindness of Prof. Owen and Prof. Quekett, I found a single male specimen of a third very distinct species belonging to the same group, in which the right antenna of the male is more anomalous than in any form yet described. These two new species will, I believe, eventually form the type of two new genera; for the present, however, it will perhaps be more convenient to consider them subgenera of *Labidocera.* For this purpose it will be necessary slightly to alter its generic character, which will stand as follows:—

Labidocera.

Rostrum furcatum; *antenna antica* maris dextra geniculans tumida, lamellis lobulisve dentatis instructa. *Oculi superiores* duo. *Oculi inferiores* nulli? *Cephalothorax* 7-articulatus. *Pes posticus* maris dexter, prehensilis. *Abdomen* maris 4-articulatum, fœminæ 2-articulatum.

And will contain three subgenera:—



J. Lubbock del.

J. De C. Sowerby sct.

1. Labidocera.

Antenna antica maris dextra duabus serratis lamellis instructa. *Spina prehensilis,* parva, rigido crini similis. *Pes thoracicus quintus sinister,* parvus, ramum internum 2-articulatum, ad apicem annulatum gerens.

Contains one species, *Labidocera Darwinii,* which was described at length in the 'Annals and Magazine of Natural History' for Jan. 1853.

2. Labidocera (Ivella).

Antenna antica maris dextra tribus dentatis lobulis instructa. *Spina prehensilis,* magna. *Pes thoracicus quintus sinister,* magnus, fortis, ad apicem acutus et corneus, ramum internum non gerens.

Also contains one species, *L. Patagoniensis,* which will be described presently.

3. Labidocera (Iva).

Antenna antica maris dextra quatuor dentatis lamellis instructa, tumidissima. *Spina prehensilis,* maxima, annulata. *Pes thoracicus quintus sinister,* magnus, ad apicem tumidus, papillosus.

This subgenus also contains as yet but one species, *L. magna,* which comes from the South Pacific Ocean.

I now proceed to describe *Labidocera* (*Ivella*) *Patagoniensis,* only noticing those points in which it differs from the description of the genus given in the 'Annals and Magazine' for January last.

Pl. X. fig. 1 represents the male, and fig. 2 the female.

First pair of antennæ. These organs will be described in detail, and compared with those of the other members of this group in an appendix.

Right male. Length $\frac{1}{18}$ inch. The basal portion consists of a number of obsolete joints, and is clothed with plumose hair; the next few joints are swollen, the apical one the smallest, and provided with a two- or three-toothed lobe; the next two joints long and slender, each with a toothed lobe, of which the basal is four-toothed, the apical three-toothed; and the three last joints small and simple. Attached to the swollen portion is a prehensile spine like that of *Pontella.*

The second pair of antennæ (fig. 3) is provided at the base anteriorly with a hemispherical lobe which bears one hair. The basal joint was imperfect in the specimen which I represented in my former paper, and the lobe had been torn off.

Inferior eyes. From the fact of spirits of wine removing all the colour of the eyes in this family, it is very difficult to ascertain whether specimens which have been long preserved in spirits, have or have not the inferior eyes, and I have not been able to determine this point with certainty. This species, as well as *L. Darwinii* and *magna*, presents a round projection between the anterior antennæ, similar to that which in *Pontella*, &c., bears the inferior eye; but I have not been able to find any lens belonging to it, and as Mr. Darwin, who, as I before said, must have seen it in recent specimens, had it been present, especially as he examined the mouth, did not notice it, I feel sure that in *L. Darwinii* it is not present; and as the projection is not so well developed in *L. Patagoniensis* or *magna* as in that species, I think myself justified in saying that they also have no inferior eyes.

Mandibles $\frac{1}{66}$ inch in length. They have, like *L. Darwinii*, two large outer teeth, then three small ones, and then a spine serrated externally. Between each of the small teeth is a little lobe; if we count these, we shall have seven teeth and a spine. There are also several rows of strong hairs, which run parallel to the longer axis of the organ on its flat surface; they are all on the inner half.

First pair of maxillipeds $\frac{1}{37}$ inch.

Second pair of maxillipeds—consist of a subquadrate lobe bearing a six-jointed palpus, larger in proportion than that of *L. Darwinii*, and more resembling that of *L. magna*. The hairs on this organ and on the following, are throughout the whole of this family, I believe, for the most part only plumose on the under side. On the palpus there are two unequal hairs at the apex of the two basal segments, one at that of the three following, and three at that of the apical segment. The hairs on the apex of the last two segments have below spines so small, that I could only just see them with a $\frac{1}{8}$-inch object-glass; the others, besides the setæ below, have above very small spines, which are rather larger near the apex, and do not appear to reach more than half-way down the hairs. On the organ itself are five large and two small hairs. The two small ones which are at the apex and the last are setose only above, and the central one also has a few setæ on the upper edge, though neither so large nor so numerous as those below. Length $\frac{1}{80}$ inch; of the palpus $\frac{1}{66}$.

Third pair of maxillipeds. Length $\frac{1}{40}$. The larger hairs on this organ, which appear to have only one row of secondary hairs, have in reality two, one above the other, and both turned in the same direction. The crenature at the tip is caused by a double row of short spines or scales; in the smaller hairs which appear verticillate, these spines are longer, and extend from the apex more than half-way towards the base. Besides these large hairs, there are others smaller. Along the inner margin of the third hair is a row of finer hairs placed close together, besides the usual spines which are larger and much further apart.

Fifth pair of thoracic legs. Female (fig. 6). Very small, $\frac{1}{82}$ inch. The basal part consists of two joints, the apical produced externally into a lobe which represents the inner branch of the preceding legs, and bearing externally a simple segment, analogous to the external branch, which bears at the apex three spines closely applied to the organ. Attached to the second segment is a large plumose hair which extends to the apex of the terminal segment.

Male (figs. 4 & 5). The left leg is simple, four-jointed, as large as the right, curved towards it, and larger and stronger than the corresponding leg of *L. Darwinii*. The terminal segment bears on its internal margin two lobes; close to the apical lobe is a simple hair and a delicate pointed appendage. At the basal lobe there is a short hair and two very delicate tufts. Length $\frac{1}{27}$ inch. I could find nothing similar to the penis ? of *L. Darwinii*.

The right leg is prehensile, and also consists of four joints. The first is short, the second longer, the third large, muscular, and the external basal angle produced into a large claw; the fourth segment is long, slender, and curved, and forms with the preceding joint a powerful prehensile apparatus. This finger bears on the internal margin two slight protuberances and a small hair, and near where it rises, there is on the third segment a rounded knob. When the prehensile apparatus closes, this knob is received into a corresponding depression at the base of the apical segment, by which contrivance the points of the fixed and of the moveable claw would be forced into opposition, and the strength of the organ greatly increased.

Abdomen. Male. Four-jointed, the terminal joint bearing two lamellæ which rise from a common base, and are terminated by five long setose hairs.

It is exactly like that of *Pontella, Labidocera*, &c.

Female (fig. 7). Small, two-jointed; the two joints are of equal size, and the second bears two small round lobes, each with five setose hairs, which represent the lamellæ in the male.

The abdomen of some females differs slightly from the above description; the joint is not apparent; on the left side is an unsymmetrical projection, of a horny appearance, and the whole base has an irregular outline and a reddish chestnut colour, almost as if a glutinous matter had been poured over it and had hardened there. On this there is a cylindrical appendage, the nature of which is as yet doubtful. It is large, elongated, of nearly equal thickness throughout, but slightly swollen at the apex, and terminated by a short narrow neck, attached to the middle of the dorsal surface of the first abdominal joint. It is hollow and empty with soft elastic sides, and $\frac{1}{15}$th of an inch long.

In all the specimens I have seen, this organ has formed a right angle with the longer axis of the body, as I have drawn it; but this position would be such an obstacle to rapid motion, that I consider it owing only to spasmodic contraction of the animal when put in spirits of wine. It would probably during life be extended in the axis of the body, as in *Caligidæ*, and would partly supply the place of the abdomen, and act as a rudder.

This organ might be considered either as the external ovary, or as a spermatic tube similar to that which Siebold has described in *Diaptomus Castor**. In support of the latter hypothesis it may be adduced, that the organ in question differs from all other known external ovaries belonging to this family, in being attached to the back instead of the under surface of the body, and in being long and cylindrical instead of pear-shaped. In shape it agrees exactly with Siebold's drawing of the spermatic tube in *Diaptomus*, and at its base is a quantity of hard, reddish, irregular matter, which forms a small lump on the left side, and is firmly attached to the body of the animal. This strongly reminds one of the glutinous substance by means of which the spermatic tube is attached to *Diaptomus*, and which is driven out by the expulsive matter. If we consider it as a true external ovary, how can we account for this deposit?

It is also worthy of notice, that in Templeton's paper on *Anomalocera* there is figured (fig. 22) and described a "biarticulate spatulate appendage, which is confined to the left side of the female, and attached to the first joint beneath; it is probably a collapsed ovary."

Might not this be a spermatic tube? In Gaimard's 'Voyage en Scandinavie,' a female *Calanus hyperboreus* is represented with an appendage, evidently a spermatophore, attached below to the penultimate thoracic joint. It is true that this organ is ringed, and differs very considerably both from Siebold's figures of the spermatic tube in *Diaptomus*,—from the above-mentioned doubtful appendage of *Anomalocera*,—and from that of the present species; still it establishes the fact, that this mode of fecundation is very generally pursued in this curious family. In all these cases, however, it is attached below.

On the other hand, we may observe, that its position, though curious, is not entirely anomalous, for *Notodelphys Ascidicola*,

* Annales des Sciences Naturelles, 2nd series, tom. xiv.; and Baird's British Entomostraca, p. 223.

Allman, has its external ovary on the back, and in the *Daphnidæ* the receptacle for the eggs, which corresponds in function, is always situated dorsally, whereas the spermatic tube is attached on the under surface close to the vulva, as would appear evident; for if it was not so, how could the spermatozoa reach the eggs? It may perhaps be said, that the glutinous matter forms a tube down the side of the body, and in that way opens close to the vulva; but this does not appear to me probable, for in that case the animal would lose its equilibrium; and besides, I could see no excrescence of that sort; and if it were present, I could hardly have overlooked it. Unless then we suppose that the vulva is situated on the back, its position seems rather in favour of its being an external ovary. From the function of the spermatic tube, we should expect to find it only when the eggs were well developed, but I could not see them in any one of the three females provided with this organ which I have examined; it is true, however, that in the figure of the female *C. hyperboreus* above referred to, which is provided with a spermatophore, no external ovary is represented. Its size also seems almost too large to admit of its having been developed in the generative organs of the male.

The shape of the organ in question, though certainly very different from that of the external ovary in the rest of the family, is however the same as that which prevails in all the *Caligidæ*. In *Caligus* the ovaries are attached to the body by their internal angles, and in *Iva* by the centre; but if we consider that of the latter genus as homologous with the two of the former coalesced, this difference will be removed.

The chief obstacle to this view is the absence of eggs; but Dr. Baird, in his volume on the 'British Entomostraca,' p. 49, describing the process of laying in *Chirocephalus*, says, "When the proper time arrives, the mother deposits these eggs loose in the water, the ovary opening at the point and the eggs being thrown out by a sudden jerk;" and it seems to me possible, that, either in the violent struggles which follow when any Entomostracan is placed in spirits of wine, the eggs may have been expelled, or that they may have been so in the course of nature shortly before they were captured.

I have endeavoured impartially to state both sides of the question, but the paucity of specimens unfortunately makes it impossible to prove either, so that it must be left to some future observer to decide the question*.

* Mr. Darwin and Dr. Baird, who have both examined my specimens very carefully, agree with what I have said above. If it had not been for their assistance my task would have been much more difficult.

Labidocera (*Ivella*) *Patagoniensis*.

There being only one species as yet in the subgenus, no specific description need be given.

Colour ?

Length, from the rostrum to the end of the abdomen, in both male and female, $\frac{1}{5}$ inch.

Taken by Mr. Darwin with *Labidocera Darwinii* in the open sea, lat. 38° south, off the coast of Patagonia.

This species appears rare; at least there were only a few specimens, amongst a great number of *L. Darwinii* and other small Crustaceans, caught in the towing-net.

Labidocera (*Iva*) *magna*.

Rostrum short (Pl. X. fig. 8).

First pair of antennæ. *Male*.

The left is about $\frac{3}{10}$ inch in length, simple, 24-jointed, and clothed with hair, which is all on the external side, except some fine down on the basal joints, and one simple hair at the apex of the penultimate and antepenultimate segments. On the apex of the eleventh segment is a strong spine.

The right antenna (fig. 9) is very different; it consists of a basal portion composed of many almost coalesced segments; then a part very much swollen, and bearing a very large prehensile spine, which is transversely ringed; the two segments which succeed this swollen part are longer, and each bears a plate, one with about twenty, the other about sixty teeth; the following segment (which probably consists normally of three) has two plates, each with about forty teeth. These two plates rise one on each side of the flat external surface of the segment, the one occupying two-thirds at the middle, the other two-thirds at the apex of the segment. There are in the three last plates two unequal rows, each provided with the above-mentioned number of teeth, and the smaller row situated at the base of the larger.

Second pair of antennæ. Have been described above.

Eyes. What has been said of the eyes of *L. Patagoniensis* applies equally well to those of the present species.

Mandibles $\frac{1}{33}$ of an inch in length; bearing, like *L. Patagoniensis*, seven teeth, and a spine serrated externally. The first six teeth are strong, large and subequal, decreasing in size from the outside; the first is $\frac{1}{200}$ inch in length, the seventh is smaller. There are rows of hairs as in the preceding species.

First pair of maxillipeds $\frac{1}{37}$ inch.

Second pair of maxillipeds. Length $\frac{1}{80}$ inch; of the palpus $\frac{1}{48}$.

Third pair of maxillipeds. Length $\frac{1}{30}$ inch. The hairs of this organ have been described above.

Fifth pair of legs (figs. 10 & 11).

Male. The left leg consists of four joints. The first two short, the third longer, and the fourth again shorter; the apex is swollen and covered with delicate papillæ. Externally near the base the terminal segment bears a strong hair, and near the middle a small one. Internally it has a row of hairs near the base, and a large very delicate tuft. This tuft appears to be very constant; it exists in all three species of *Labidocera,* and a similar one is figured in Templeton's paper on *Anomalocera.* Length $\frac{1}{20}$ inch.

The right leg also consists of four segments, and is very similar to that of *L. Patagoniensis* and *Darwinii.* The third joint has the basal spine rather more curved, and bears also a triangular membranous lobe with the angles rounded off and contracted at the base into a sort of neck; at its base is a small hair. The apical joint also has a triangular projection with a broad base, and bears four small hairs.

This fine species being the only one in the subgenus, no specific description need be given.

Its length is $\frac{1}{4}$ inch.

Colour ?

It comes from the South Pacific Ocean, and seems to be rare; at least I have only one specimen, which is a male; the female is therefore as yet unknown.

My single specimen of *L. magna* (as well as more than one of *L. Patagoniensis*) is attacked by a disease, showing itself as white spots which spread over the back. This appears to be similar to that which so commonly destroys *Chirocephalus diaphanus.* The back of the common *Daphnia Pulex* also is often rendered quite white by a substance formed under the shell, and which consists of innumerable very minute, triangular or pear-shaped bodies, each about $\frac{1}{6000}$ inch long, and $\frac{1}{8000}$ broad at the thicker end.

EXPLANATION OF PLATE X.

Fig. 1. *Labidocera (Ivella) Patagoniensis.* Male.
Fig. 2. Ditto ditto. Female.
Fig. 3. Ditto Second pair of antennæ.
Fig. 4. Fifth pair of legs. Male. Right.
Fig. 5. Ditto ditto. Terminal joint of the left.
Fig. 6. Fifth pair of legs. Female.
Fig. 7. Abdomen. Female. Without the appendage.
Fig. 8. *Labidocera (Iva) magna.* Rostrum.
Fig. 9. Prehensile apparatus of the right anterior antenna of the male, much magnified.
Fig. 10. The right leg of the fifth pair in the male.
Fig. 11. The left ditto ditto.

The drawings were done with a camera lucida.

XX.—*On the Germination of the Resting Spores, and on a form of Moving Spores in* Spirogyra. By Dr. W. Pringsheim*.

[With two Plates.]

While the observations on the conjugation of *Spirogyræ*, first made by O. F. Müller†, have since been frequently repeated and are now universally known, the germination of the spores produced through the conjugation, first seen by Vaucher‡ in 1803, has been confirmed only by very few subsequent observations. Considering the active interest which has recently prevailed in regard to the development of the Algæ, and has existed respecting the formation of the spores of *Spirogyra* itself, in a wider circle than that which merely includes algologists, the above fact is the more remarkable, since it is by no means difficult to procure the material required for the investigation; for although conjugation takes place most frequently in spring, I have found *Spirogyræ* both in a state of conjugation and preparing for it throughout the summer and until late in autumn. Nevertheless, so far as I know, there exist only three publications on the germination of the *Spirogyræ*, exclusive of course of all those which do not rest on original observations §.

The first, as already mentioned, was furnished by Vaucher, to whom we must always go back, when we are studying the development of the freshwater Algæ. He gave a representation of the germinating spores correct in all essential points, but not adequately good and accurate for the demands of our own day. These figures ‖ are all botanical literature possesses. The essential part of his description of the germination is as follows: "The spores open at one end, like the cotyledons of a seed when its embryo is beginning to unfold, and the young plant emerges as a small, rapidly-growing green sac, in the interior of which the spiral bands, with thin shining granules (the starch-granules) and septa, soon present themselves. Finally the young plant leaves the envelope in which it originated, grows up in the water and then resembles the parent plant, excepting that its two ends are attenuated to points, and that it is of smaller size."

Meyen confirmed these observations. In one essay, indeed, which he wrote on the genus *Spirogyra* in 1827, he held Vaucher's observations on the germination of *Spirogyra* to be false.

* From the 'Flora,' Aug. 14th and 21st, 1852: translated by Arthur Henfrey, F.R.S., F.L.S.

† Flora Danica, tab. 883.

‡ Histoire des Conferves d'Eau douce; Genève, 1803.

§ See Rev. W. Smith, 'On the Germination of the Spores of *Conjugatæ*,' Annals of Nat. Hist. ser. 2. viii. 480.—A.H.

‖ *L. c.* tab. 4, 5, 6.

"Nevertheless"—he says there*—"it is more than probable that the observations made by Vaucher were not characterized by that great accuracy which is needful here, since, as the figures given show, the growth of these young Confervæ is in contradiction to all analogy, and it is therefore very necessary to repeat these investigations." But he must have been subsequently convinced by his own observations of the correctness of Vaucher's statements, for in his 'Manual of Physiology†,' he gave a description of the germination, which, while devoid indeed, as the limits of a manual compel, of that requisite detail which constitutes the value of a monograph, represents all the essential points of the phænomena so truly, that I have only to confirm all that he states of it in *this* place.

The third confirmation comes from Alex. Braun, in his recent work, 'Observations on the Phænomena of Rejuvenescence in Nature‡.' He mentions here, in several places§, not only the changes of the contents of the spores preceding germination, but the phænomena of the commencement of germination, the dehiscence and the stripping off of the spore coats.

Opposed in appearance to these exact observations on the germination of the bodies originating in the conjugated cells of *Spirogyra*, stands the statement of Agardh‖, that these bodies are broken up into moving spores after a certain time; on which account Hassall¶, who participates in this view, considers these bodies, not as spores, but, as the sporangia of the *Spirogyræ*. Unfortunately, the short account of Agardh, which, although the subject well deserved it, was not accompanied by drawings, does not allow of satisfactory conclusions as to the phænomena observed by him. Meyen** had already noticed that secondary —*but not moving*—cells were often formed inside the spores of *Spirogyra*, and he conjectured that there were likewise propagative cells. I have also found these secondary cells, in which

* Linnæa, 1827, p. 421. † Pflanzen-Physiologie, iii. 422–424.

‡ Beobachtung üb. die Erscheinungen der Verjüngung in der Natur.

§ *Loc. cit.* pp. 144, 192, 215, 216.

‖ The passage runs (Ann. des Sc. Nat. 2nd Ser. vi. 197): "After many vain attempts to see the elliptical body developed into a new filament, as described by Vaucher, *I saw it, on the contrary, broken up definitively into numerous sporules endowed with a rapid motion.*"

¶ History of British Freshwater Algæ, p. 130.

** "In fig. 13. pl. 10. are represented similar seeds (*Samen*) of *Spirogyra princeps*, which *have been formed without conjugation*, and this is very general in *Spirogyra quinina*; they also exhibit double coats; but the mass in their interior has been transformed into small vesicles, which probably may likewise be spores, the further behaviour of which, however, I have not seen. But the formation of these little vesicles in the true seed is not always to be met with in these *unconjugated* Confervas, and usually the green mass is spirally arranged here also."—*Meyen, loc. cit.*

the contents are frequently transformed into *spores not directly germinating*, in spores which had originated through copulation (Pl. VIII. fig. 7). They were always however motionless, and I was equally unsuccessful in observing a further development of these cells, and confirming the very natural conjecture of Meyen by direct observation. But I also frequently found the contents of the filament-cells—*when no large spore had been previously formed in them*—transformed into peculiar cells (Pls. VIII. and IX. figs. 4 & 8), which appear as the mother-cells of smaller *moving cells*; and the latter appear to stand in close relation to the development of the *Spirogyræ*. How far the phænomenon observed by Agardh agrees with one of these phænomena, will be seen from the subsequent description of my observations. At the same time, the import of the well-known large isolated bodies originating from the entire contents of one or two conjugated filament-cells (fig. 1 *a*, *b*, *c*), as true spores of the *Spirogyræ*, is not affected by the possibility of a propagation of the *Spirogyræ* by means of the secondary cells originating in the elliptical spores, since in the regular course of vegetation, the former, exactly as Vaucher observed, exclusively effect the propagation by their direct germination. The dissolution of the contents of a spore *capable of direct germination*, into daughter-cells equally *capable of germination*—for which Agardh's observation would speak—as well as the occurrence generally of *several different* forms of spore in the same plant, appear to me only a result of the independence of the individual cell prevailing in the Algæ, and a very general property of these, physiologically speaking, simply unicellular plants. I shall return to this point in speaking of the rare forms of spore of the *Spirogyræ* at the conclusion of this memoir.

I observed the germination of the ordinary form of *Spirogyra*-spores, those well-known large, elliptical bodies, in *Spirogyra jugalis**. Conjugated specimens of this *Spirogyra*, collected in August, maintained themselves in this condition through the winter, in my room, in a little glass vessel full of water, to the bottom of which they gradually sank. Some spores germinated as early as February, but most of them did not open until April, so that some eight months elapsed between their formation and their germination. We observe in the spores of *Spirogyra*, as in all motionless spores of Algæ, a long period of rest between for-

* The determination of the name was made with Kützing's 'Species Algarum.'—The plant I examined had several, mostly 4, spiral bands; the septa of its cells were not thrown back in folds (see, in regard to such folds in *Spirogyræ*, Cohn's Essay in Nova Acta Acad. N. C. xxii. pars ii. 250 *et seq.*). The diameter of the filaments was 0·1 millimetre; the length of the joints, fertile and barren, varied between 0·12 and 0·2 mm.; some attained a size of 0·3–0·4 mm.

mation and unfolding*; yet during this time of *apparent* rest, processes are unceasingly active in the interior of that germ, not immediately manifesting themselves to the eye, but resulting in effects, which may be detected in the spores of *Spirogyra* in demonstrable alterations of the contents and of the membranes of old spores. Immediately after formation, the spore possesses only one single, perfectly colourless, thin membrane, which, as is shown by the acquisition of a blue colour with iodine and sulphuric acid†, is composed of pure cellulose. In many spores, this membrane is still so thin for a short time after the formation of the spore, that it is yet incapable of withstanding the strong endosmose excited by the addition of sulphuric acid, and bursts at some point, allowing the escape of the contents. The contents of the new-formed spores consist of the almost unchanged spiral bands of the cells concerned in the formation of the spore. The spiral bands are, indeed, contracted far more closely together than in the filament-cells, but retain even their form scarcely changed. As in the spiral bands of the *Spirogyra*-cell, so also the spores contain numerous large and small starch-granules, lying in a layer of the so-called amorphous chlorophyll (extractable by absolute alcohol), which appears to be deposited upon the finely granular protoplasm (a mixture of oil and proteine-substance, albumen?), visible after the removal of the chlorophyll. The older the spores grow, the more does the form of the spiral bands in their interior disappear, and their contents become uniformly diffused over the entire inner surface of the spore-membrane. Finally, just before the germination, the original spiral arrangement of the contents is still indistinctly indicated by several close spiral streaks in the coating, spread uniformly over the wall (fig. 1 *a*, *b*, Pl. VIII.). It is a peculiar circumstance, that during this time the spiral arrangement of the contents of the spore presents itself, sometimes distinctly and sometimes indistinctly, and almost wholly vanishes at the moment of germination, but always appears with surprising clearness when the spores are left for some time in glycerine, or are allowed to become perfectly dried up (Pl. VIII.

* This long repose between formation and development is perhaps the only character which the spores of the Cryptogamia have in common with the seeds of the Phanerogamia. But the true analogue also of the Cryptogamic spore in the Phanerogamia, the pollen, is well known to be capable of maintaining its germinative form through long periods of rest.

† I prefer the application of iodine and sulphuric acid to the apparently more convenient use of the so-called chloride of zinc solution (chloride of zinc, iodine and iodide of potassium), since the former is a much *stronger* and more certain reagent for cellulose, and produces the blue colour without previous application of an acid or an alkali, even in cases where the chloride of zinc solution is ineffective.

fig. 5). Chemically speaking, the contents of the spore appear to be more changed in the relative proportions of quantity of the particular constituents, than in their quality, before germination. The principal constituent consists of large drops of oil, becoming confluent under pressure, with amorphous chlorophyll and albumen, as in the newly formed spore. The *large* starch-granules have disappeared and are replaced by very small irregular corpuscles devoid of any distinguishable structure, but which become blue when iodine is applied, and, therefore, are likewise starch. Lastly, as an entirely new constituent of the spore, appear certain reddish-brown corpuscles, *never absent*, which are also found in the young plant after the germination (Pl. VIII. fig. 1 *d*, fig. 5, fig. 2 *d*).

The differences between the membranes of old and young spores are more important than the changes perceptible in the contents.

Instead of the *one* colourless cellulose membrane of the young spore, this latter exhibits, shortly before germination, three distinct membranes, not blended together. The inmost encloses the entire contents, which are already surrounded by the primordial utricle; the outermost (*e*, fig. 1 *a*, *b*, and fig. 5), thin and colourless, is composed of pure cellulose, as may readily be demonstrated by iodine and sulphuric acid; it is the same membrane which the spore possessed at the time of its formation, only it has become thicker, without, however, perceptible lamellation. Within this lies, without touching it at all points, but closely applied to it, the second coat, a membrane of yellowish-brown colour (*f*, fig. 1 *a*, *b*, and fig. 5), which retains its colouring matter with great obstinacy, and *is not coloured blue by sulphuric acid and iodine.* This, finally, encloses the third, inmost and last-formed membrane, which is colourless like the first, and is also coloured blue with iodine and sulphuric acid. This third membrane is not always visible in the unopened spore, and hence, perhaps, has remained unnoticed by previous observers; perhaps, however, from its only appearing shortly before the germination, as the last deposit of membrane within the spore. It constitutes, really, with the contents it encloses, the essential part of the spore-cell, since in the germination of the spore it grows out directly into the young plant, after the dehiscence and casting off of both the outer membranes. Its existence may always be ascertained by bursting oldish spores by slight pressure, and allowing their contents to escape gradually. If the spore thus burst by pressure is afterwards treated with iodine and sulphuric acid, the third inmost membrane assumes a blue colour, and in this way only can it be certainly made out that the blue colour belongs really to it, and does not depend on the outer coat of the spore or the membranes of the cell in which the spore perhaps still lies. The detection of the three membranes of the spore is very readily effected by the application of concentrated potash. The spore does not burst when left in concentrated solution of potash, but after a few days, the three membranes appear clearly separated from each other (fig. 6 *a* & *b*). Under these circumstances, the inner cellulose membrane (*g*, fig. 6 *a* & *b*) exhibits the remarkable property, otherwise found only in the primordial utricle, of contracting by shrivelling together, It surrounds the primordial utricle (*h*, fig. 6 *b*) with its contents contracted into the middle of the cavity of the cell. The shrivelling together of this cellulose membrane is often so strong, that it is no longer capable of holding the contents, and these, dissolved by the potash, escape in large drops, of indefinite form, into the interspace between the inmost and the middle yellow membrane (*i*, fig. 6 *b*). And in the spores treated with potash, after the latter has been washed out, the application of iodine and sulphuric acid turns this third inmost membrane (*g*, fig. 6 *a* & *b*) bright blue, so that there can be no doubt of its chemical constitution.

The *production* of the two inner membranes in the spores takes place in exact analogy to the universal formation of secondary layers of thickening in vegetable cells; the middle, yellow coat follows the outer primary coat, not only in position but in structure, as a secondary deposit, and the deposition of the inmost, in regard to its productive *tertiary* cellulose membrane, occurs long after the formation of the yellow coat. Since Mohl's* researches have demonstrated that cellulose is the basis of the thickening layers of all vegetable cell-membranes, its reaction, frequently hidden by infiltrated matters, reappearing clearly after the removal of them by potash or nitric acid; it was natural to conjecture that the yellow, middle membrane of the spore would exhibit the cellulose reaction if properly treated. But I only succeeded in demonstrating the cellulose in this membrane after much trouble, for all the means I applied to extract or destroy the colouring matter of this membrane were at first ineffectual. Only after a longish digestion in *aqua regia* was the yellow spore-membrane bleached, without being destroyed. When the *bleached* spores, well washed with water to remove the *aqua regia*, were treated with *iodine* and *sulphuric acid*, the thick, middle, previously yellow membrane became blue. The more perfectly the membrane was bleached by *aqua regia*, the purer the blue colour acquired with iodine and sulphuric acid; the less perfect the bleaching was, the more the blue inclined to green. This membrane certainly is one of those vegetable membranes in which it is most difficult to demonstrate the well-

* Botanische Zeitung, 1847; Trans. in Scientific Memoirs, vol. i. 2nd ser.

known cellulose reaction,and therefore offers a strong support to the opinion that the cellulose reaction is only prevented in membranes which do not exhibit it, by a matter infiltrated in them. In one case the infiltrated matter may be detected even by its colour, and after the removal of this substance the membrane reacquires, with the ordinary colourlessness of vegetable membrane, the chemical characters of cellulose.

After the transformation of the contents is terminated and the formation of the inner two membranes completed, the germination of the spore commences by a growth of the internal cell formed by the inmost membrane. The increasing size of the internal cell first causes the yellow membrane to break across in an irregular crack (Pl. VIII. fig. 1 *a*), and after a further growth of the germinating cell, the outer colourless membrane tears in a similar manner. *This* succession of the bursting of the outer coats of the spore is caused by the structure of the spore and the unyielding rigidity of the middle coloured coat. The internal cell, bursting forth from the coats, grows in the course of a few days into a longish cell, which soon presents septa and becomes a many-celled filament, which resembles the parent, both in the number of spiral bands and in dimensions (Pl. VIII. fig. 1 *c*)*. Even in the unicellular condition, one end of the cell is elongated in a tubular form (fig. 3). The green spiral bands do not extend into this, always unbranched, radical extremity, and its further growth being restricted, it remains fixed from an early epoch, at *that* stage of development which it has attained in the young, few-celled plant, while the opposite end of the spore is capable of unlimited elongation by uninterrupted growth and repeated formation of septa.

This *differencing* of the two ends of the spore, expressed in different directions of growth, and the limited growth of one and the unlimited growth of the other, occur indeed—with the *very rare* exceptions when both ends are characterized by unlimited growth—in all spores; but a difference is found in them, that while, in most, that end of the spore-cell which emerges first out of the coats (figs. 1, 2, 3, 10), is converted into the cellular *Spirogyra*-filament, and the end remaining in the coats grows out into the radical tube, in other (less numerous) spores, their two ends behave in exactly the opposite way, the cell-forming end remaining behind in the coats (Pl. IX. fig. 11 *a, b, c*), and the radical extremity making its way out of

* Hence the characters derived from the number of the spiral bands, and the dimensions of the filament-cells appear to have a specific value; at all events these characters are propagated by germination. Compare also Vaucher's figures of the germinating *Spirogyræ* with those of the parent plants.

them. In spite of this difference, however, the young plants produced exhibit exactly the same behaviour in both cases.

I had conjectured at first that the opposition between the anterior and posterior extremities of the spore would be already indicated by its position in the filament-cell. All spores of the same filament open ordinarily on the same side, so that if we call *that* end of the spore through which the young plant emerges, the anterior extremity, all the spores of one filament have their anterior ends turned in the same direction (Pl. VIII. fig. 1 *a, b, c*). But I afterwards remarked that no constancy prevailed in this, for I met with filaments, rarely it is true, in the cells of which the anterior ends of spores were turned to opposite sides (Pl. IX. fig. 9), so that it could not be certainly determined in the unopened spores, which was the front and which the back. It need scarcely be mentioned, that accidental twisting of a filament was taken into account here. The end of the young plant, no matter whether it was the radical extremity or the growing summit, remained sticking in the burst coats (fig. 1 *c*, 11 *c*) long after the emergence of the other end, and the envelopes were not thrown completely off until a late period, and then either accidentally, or, as mostly occurred, by the young plant rising from the bottom of the water, where the germination took place. I never saw the liberated young plant become attached to anything by its radical extremity, and this corresponds to the ordinary floating condition of the *Spirogyræ*. But I cannot decide whether or not the *Spirogyræ* become fixed to anything by their root-cell, at a later stage than that to which I was able to trace the young plants*. It is probable, however, that those *Spirogyræ* which are found adherent in their natural stations, use their root-cell as the organ of attachment. At the same time, the somewhat elongated basal cell, enlarged below into a shield-shaped root, described by Nägeli as occurring in the Zygnemaceæ†, is certainly not the root-cell produced in the germination, but one of the ordinary filament-cells, enlarged into a short colourless expansion at one extremity. Whether the filament-cell thus altered is incapable of propagation, as Nägeli asserts, I am inclined to doubt, since it is in any case certain that the true root-cell produced in germination is capable of transforming its contents into propagative cells in the shape of moving spores.

* One of the largest of the young plants which I obtained in a perfectly healthy condition was 2·6 mm. long. It was composed of thirteen cells of tolerably equal length, excepting that the root-cell was longer; so that the length of these (subsequently dividing) cells of the young plant equalled that of the larger, undivided (?) cells of older plants.

† Gattungen einzellige Algen, p. 4.

The germination of the spores also gives some insight into the origin of the spiral bands.

When the spore breaks out, the contents form a coat uniformly spread over the wall, with only a slight indication of spiral arrangement (*a, b*, fig. 1. Pl. VIII.). As the young cell grows, this becomes broken up, and the originally irregular and imperfect slits thus produced, subsequently cut in a continuous course through the originally uniform coat, which is now slit up into regularly arranged bands (Pl. VIII. figs. 2, 3). The cause why the coating of the wall tears up into spiral and not rectilinear bands, remains unknown here, just as in the origin of all other spiral forms in the vegetable cell. Germinating plants of *Spirogyræ* with only one spiral band, might, perhaps, give an opportunity of discovering more accurate particulars of this process. That the cytoblast—Meyen's 'central-organ'—notwithstanding the mucilaginous filaments running out from it to the borders of the spiral bands—plays no part here, seems to me so much the more probable, that I doubt its actual existence in the spore and in the young unicellular plant. I never found the cytoblasts in the spores, *even when the contents were gently pressed out, which would make it clearly visible*, and just as little could I detect it in the much more transparent young, unicellular plant (figs. 2, 3). It is first found in the *two-celled* plants, and many-celled specimens have one in *each* cell, even the *radical cell*; it is not oval, but round (fig. 1 *c, m, m, m*). Alex. Braun has shown the part it plays in the formation of new cells in the *Spirogyra**. It appears, therefore, *that it originates* in the unicellular plant *immediately before the formation of the septum*, and then quickly causes the formation of two new cytoblasts, either through solution or subdivision, and thus we should bring its presence in *all* cells of old plants into agreement with its absence from the spores and unicellular plants.

[To be continued.]

XXI.—*Revision of the Families of Nudibranch Mollusks, with the description of a new Genus of* Phyllidiadæ. By J. E. Gray, Ph.D., F.R.S., V.P.Z.S. &c.

The very important results which were obtained by the examination of the tongues and teeth of the *Ctenobranchous* Mollusca, which were partly published in the last Number, have induced me to continue my researches on these organs in the *Nudibranchiate* Mollusca. They have resulted in two important facts:

* *Loc. cit.* p. 257 *et seq.*

first, the necessity of dividing the family *Doridæ* into three families, neatly characterized by the disposition and form of the teeth, as well as by the position of the respiratory organs,—characters showing very great differences in their habits and œconomy; secondly, proving that the genera *Phyllirrhoë* and *Limapontia,* though they have no external gills, or indeed any appearance of gills of any kind, are properly placed in this order, as the structure of the buccal mass, tongue, and teeth exactly agrees with that of the families next to which they were placed in my previous arrangement.

I may observe, that I find the disposition and form of the teeth to afford a very good guide in cases which have been considered doubtful from some modification of the respiratory organs. The genera *Ancylus, Siphonaria,* and *Amphibola* have been placed in different parts of the system, even in the most recent work of Philippi—often with marine families. From the structure of their respiratory organs, I had long satisfied myself that they are all true *Pulmonobranchia,* and the examination of the tongue and teeth strengthens this opinion, for it is almost impossible to distinguish their teeth from those of the *Auriculadæ* and other land Mollusca.

In the following table, the teeth of the genera placed under each family have been actually examined, or their teeth have been described or figured by some other author.

1. *Gills surrounding the vent, on the middle of the hinder part of the back.*

Fam. 1. Onchidoridæ. Teeth two in each cross series; gills in separate cavities; mantle edging the foot and simple. *Acanthodoris, Onchidoris.*

Fam. 2. Dorididæ=Doridina and Polycerina, *Gray.* Teeth many in each cross series, subsimilar, inner often smaller; gill in a common cavity; mantle edge simple. α. *Doris*; β. *Goniodoris, Ceratosoma*; γ. *Ægires.*

Fam. 3. Triopidæ = Triopina, *Gray.* Teeth many (rarely only four) in each cross series, the inner lateral ones large, irregular-shaped; gills in a common cavity; mantle small, edged with tentacles. *Triopa, Idalia.*

2. *Gills superficial, generally in the form of fusiform processes, plaits, or branching vessels.*

a. *Tongue broad; teeth many in each cross series.*

Fam. 4. Tritoniadæ. Tentacula sheathed; gills fusiform or branched on each side of the back; vent lateral; jaws horny. *Tritonia, Dendronotus, Scyllæa, Eumenis.*

Fam. 5. PROCTONOTIDÆ. Tentacula simple, linear, not sheathed; gills fusiform, on the sides of the back; vent dorsal; jaws horny, strong. *Proctonotus, Antiopa.*

Fam. 6. DIPHYLLIDIADÆ. Tentacula simple, united, expanded?; gills in folds on the under side of the edge of the mantle, which is bent up; jaws horny. *Diphyllidia.*

b. *Tongue narrow; teeth in a single central series.*

Fam. 7. DOTONIDÆ. Tentacula sheathed at the base, retractile; gills fusiform, on the sides of the back. *Doto.*

Fam. 8. GLAUCIDÆ. Tentacula subulate, simple, rarely ringed, contractile; gills fusiform or branched, on the sides of the back; jaws often horny. α. *Glaucus*; β. *Eolidia, Montagua, Favorinus*; γ. *Embletonia*; δ. *Hermæa*; ε. *Alderia.*

Fam. 9. PLACOBRANCHIDÆ. Tentacula subulate or linear, folded; gills in the form of plaits or vessels radiating on the surface of the back. *Placobranchus, Elysia.*

Fam. 10. LIMAPONTIADÆ. Tentacula none or simple, contractile; body depressed; gills none external. *Limapontia.*

Fam. 11. PHYLLIRRHOIDÆ. Tentacula elongate-subulate; body compressed vertically; gills none external. *Phyllirrhoë.*

c. *Tongue and jaws none.*

Fam. 12. PHYLLIDIADÆ. Tentacula dorsal, anterior, retractile; labial palpi close, conical, small; gills in form of radiating folds on the under side within the edges of the mantle; vent medial, posterior.

The examination of the specimens of this family has caused me to divide them into two genera, and to add a species which does not appear to have been before noticed.

PHYLLIDIA. Vent dorsal, in the middle of the hinder part of the back.

1. *Phyllidia trilineata*, Cuvier, Ann. Mus. v. t. 18. f. 1–6.

2. *Phyllidia ocellata*, Cuvier, Ann. Mus. v. t. 18. f. 7.

3. *Phyllidia annulata*. Black, with three series of large, unequal-sized white rings, and with a row of minute white warts near the margin; aperture of tentacles with small white warts on each side. *Var.* 1. Central series of four rings. *Var.* 2. Central series of five rings, the last behind the vent.

Hab. Lord Hood's Islands. Brit. Mus. Two specimens.

The *Phyll. ocellata* of Cuvier has only five white rings, one in front and two on each side.

Fryeria. Vent in the middle of the hinder part, in the groove between the mantle and the foot.

1. *Fryeria pustulosa.* Black, with three series of large, unequal, white tubercles on the middle of the back, and with large square white spots containing a tubercle, surrounded by smaller ones, on the edge of the mantle. *Phyllidia pustulosa,* Rüppell, Atlas, Moll. t. 11. f. 1, 1 *a*. *Inhab.* Cosseir. Brit. Mus.

Phyllidia pustulosa, Cuvier, Ann. Mus. v. 266. t. 18. f. 8, may be a bad figure of this species. Cuvier represents the dorsal anus in the other two species, but it is not marked in this, and the colouring somewhat resembles the Museum specimens.

There is a considerable difference in the internal anatomy of this genus, when compared with Cuvier's description of *Phyllidia trilineata.*

This genus is named after my excellent friend Mr. J. H. Fryer of Newcastle, who first sent to England the beautiful Chitons, *Fissurellæ, Purpuræ, Murices,* and other shells of the coast of Peru; and hence attracted the attention of naturalists and collectors to the rich harvest to be made in that country.

XXII.—*Additional Notice of the genus* Tancredia (*Lycett*), Hettangia (*Turquem*). By John Lycett, Esq..

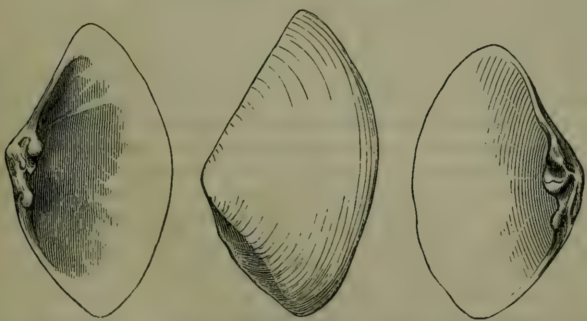
At a meeting of the Cotteswold Naturalists' Club, held July 30, 1850, I had the honour to submit a memoir on the Testacea of the middle division of the Inferior Oolite, accompanied by a separate description of a group of small bivalve shells which occur both in that rock and in the Great Oolite. This group I proposed to erect into a genus, to be called *Tancredia,* a name intended to commemorate a gentleman no longer, unfortunately, a participator in our reunions. The fragility of the small shells which exemplified the genus, together with the coarseness of the investing stone, prevented my exposing the hinge of the left valve so clearly as could be wished; it was not therefore figured, and the description of the hinge in that valve was defective; but the hinge of the right valve, together with the external forms of three species, were faithfully rendered by Mr. Sowerby in the plate which accompanied the memoir. The 'Annals and Magazine of Natural History' for December 1850 contained the paper in question, and it was incorporated with the Transactions of the Cotteswold Naturalists' Club. The description of the hinge in the right valve was substantially correct, but owing to an imperfect knowledge of the form, arising from the valves being always found disunited, the term anterior was employed for posterior, and *vice versâ.*

It is necessary to revert to these facts with precision, as during the past year (1852) a French author of eminence, both as a geologist and palæontologist, M. A. Buvignier of Verdun, has, in a new and splendid work on the geology of the department of the Meuse, figured and described certain species of *Tancredia* under the new generic name *Hettangia,* a name which he states to have been chosen by M. Turquem, the discoverer of the genus. The very superior manner in which the figures of that work are executed leaves no doubt of the identity of the two genera; the five species which M. Buvignier has illustrated are from the Lias, and bear the specific names *Broliensis, Deshayesea, Turquemea, longiscata,* and *Raulinea*? They are all distinct from the oolitic species of the Cotteswolds. From this statement it is evident, that in the absence of any other notice of the genus, my memoir on *Tancredia* has a claim to priority, and the generic name which I have chosen should be retained. More recently three additional species have been ascertained in our Great Oolite, and the hinge-characters of a fine Inferior Oolite species have been developed: as the latter shell, from its superior size and the prominence of its dentition, constitutes a remarkable example of the genus, I propose to describe it in detail, premising that the same species, in a greatly diminished form, was figured in the plate which accompanied the memoir of 1850, under the name of *T. donaciformis.* The small figure there given represents the usual size of specimens obtained in the shelly freestone of Leckhampton Hill; the larger examples now to be described occur not unfrequently in the bed called Gryphite grit, at Rodborough Hill, near Stroud, a locality which has produced so many novel and finely-preserved testacea. Upon comparing the hinge of the new shell with that of *T. extensa,* which was figured in my memoir, the difference between them is found to be considerable, and it requires a close scrutiny to perceive that the parts and their arrangement are alike in both, modified by the more advanced growth of the larger shell, and still more so by the peculiarities of the species.

The dental characters of *T. extensa* have much less prominence; they project but little vertically, and are more extended longitudinally. A similar difference is observable between the species which M. Buvignier has figured: his *T. Broliensis* in its hinge approaches to that of our large shell; but the hinge of his smaller and more elongated species, *Deshayesea,* presents a near resemblance to that of our *T. extensa*; the greater obliquity of the cardinal tooth in the elongated species is strongly marked, more especially in the left valve. The Rodborough examples of *T. donaciformis* may be regarded as representing the hinge-features in an exaggerated form, the result in some degree of greater age, inasmuch as smaller shells from the same locality lose much of this prominence of character. There would seem to exist much variability in the margins of the valves: all the specimens figured by M. Buvignier have a considerable aperture at the truncated posterior border; our Cotteswold examples present this character much modified; it is however very evident in *T. donaciformis*; but, strictly speaking, the borders of the valves are not close-fitting along their extent.

The fact that four, and perhaps five, species of *Tancredia* have been obtained in the Lias of France, will, it is trusted, induce collectors to examine the same formation in Gloucestershire with increased attention. M. Buvignier does not record the genus in the Oolites. In England it has hitherto been recognised only in the lower oolitic system, which would appear, from the work of M. Buvignier, to be very partially and inadequately represented in the Department of the Meuse.

Tancredia donaciformis.



Sp. char. Shell subtrigonal, transverse, rather depressed, pointed at the extremities; umbones mesial or antero-mesial, small, depressed; anterior side attenuated, its superior margin rather concave; posterior side truncated and gaping, its margin straight, posterior to the ligament, and sloping obliquely downwards; an angle extends obliquely from the umbo to the infero-posterior extremity; ligament short, external, horizontal; margins of the valves not close-fitting and rather irregular.

Upon the principle that our choice of the typical example of a genus should comprise the several peculiarities of the form in a conspicuous manner, I prefer to select the present species to illustrate *Tancredia*, and will adopt its hinge-characters in the following amended description:—

Hinge with an obtuse cardinal tooth in each valve, which is received into a corresponding cavity in the opposite valve; there is also occasionally in the right valve a small anterior, and in the left a small posterior, accessory tooth upon the elevated margin of the cavity; lateral teeth, one large posterior and approximate in each valve, that of the left valve projecting, and received into a depression formed by the tooth or callosity of the other valve. Muscular impressions oval; pallial impression simple, faintly marked. There is no lunule: the margin of the right valve anterior to the umbo forms a thickened projecting fold which covers the tooth of the other valve, and is received into a corresponding receding portion of the margin of that valve, so that the junctions of the valves anterior to the umbones have a sinuous flexure. The lateral teeth are remarkably large in our typical species; they are never altogether absent, but are much depressed in some other species; and when this variation occurs in connexion with a depressed, oblique, and elongated cardinal tooth in the left valve, the hinge is much altered in its aspect: the variation is exemplified by several species which occur in our Great Oolite and in the Lias of the Meuse.

The small accessory cardinal teeth are very uncertain in their distinctness, and constitute only a minor and variable feature.

The figure of *Tancredia* varies according as the anterior or posterior sides are the most produced; several species have the posterior side very short and convex, the figure then nearly resembles that of the recent *Donaces*: all the species hitherto discovered are destitute of ornament, they are remarkably smooth, and exhibit but indistinctly the lines of growth.

The number of species now known afford sufficient data for comparison with other genera, and to determine its position in the malacological system. To existing genera it would appear to be only remotely connected; but there are certain fossil forms, as yet insufficiently known, which seem to approach to it in several particulars; but whether these latter forms, which are associated with *Tancredia* in the same beds, are entitled to a position distinct from existing genera, remains to be determined. M. Buvignier has only indicated the position of *Hettangia* by placing it with the Cardiaceæ.

XXIII.—*Rambles in Ceylon.* By Edgar Leopold Layard, Esq.

To Richard Taylor, Esq.

[Continued from vol. ix. p. 339.]

My dear Sir,—I left off on the point of starting for our return to the great central road, by a native path, through a line of country as yet unopened by any government road, but which our energetic government agent was now about to connect with Mulletivoe on the one side, and the central road on the other. If you place a map on the table and trace my course, you will find this makes a pretty large triangle to travel over, one end of it falling about half-way between Jaffna and Anarajahpoora, and this is the point to which we made.

On the 7th, therefore, at 3 P.M., we started for Mulliavilly, Mr. F.'s tents and our baggage preceding us. At first our road lay over the open country by the side of the lake, which we doubled, and crossing a small stream that fell into it, and in which, basking near the ford, lay two huge alligators, we entered into the Ebony and Satin-wood Jungle which we had seen throughout our journey on our right. I cannot describe the beauty of parts of the jungles through which we threaded our way in Indian file; I suppose to *my* eyes they presented peculiar charms, as I constantly detected some new plant, or some bird that I should have delighted to have got; we however had to push on, and my companions cared little for collecting. During our ride we passed through the village of Tanyuttu, where F. pointed out a lovely spring of water, which bubbled up by the side of the road, and furnished a luxuriant coppice in which a botanist would have delighted; from this spring are brought most, if not all, of the medicinal leeches used in the northern province. Templeton used to say there were several species in the island, and had them figured; but I have never paid much attention to them; my hands are too full already of other matters. I can speak by painful experience of the land-leech, and I have seen another curious species at Pt. Pedro, which is of a light brown colour above, white underneath; very broad and thin, and has a peculiarly-shaped tail, half-moon shaped, in fact like a grocer's cheese-knife; I have seen but two of these, and found them both on the bark of trees, after some heavy rain. A little beyond Tanyuttu we came to a boggy piece of ground, and Q. detected a snipe: down he must get to have a shot at it, as he had not killed one this year. Up went the snipe before old Ponto. Q. fired and killed him, and up got fifty or sixty more from every quarter of the field: this was too much to bear; so I dismounted and shot also, and as they lay well we soon bagged six brace of them, and remounting trotted on to our destination, where F.'s tents, prettily placed under some fine jack-trees, laden with their ponderous fruit, looked very inviting, particularly as a savoury smell came from one of them, which we soon made out to be roast duck, Man Friday having bagged a brace while crossing the lake in the morning. After our dinner we sat and chatted till a late hour, when we lay down; sleep however we found to be out of the question—mosquitoes swarmed on us and on the dogs, who kept up a fearful howling. Q. got up and lit a cigar, and we made a fire of green leaves and sticks to drive out the tormentors, but we nearly smoked out our eyes as well; so creeping entirely under a blanket, and half suffocated with the heat, I managed to get an hour's sleep, but before daylight was awakened by the village headman who came for orders. After speaking with him, F. returned home, and Q. and I pursued our way along the native path towards Coddallycallu.

From a branch by the road-side I picked a specimen of the lovely little *Bulimus Mavortius*, which apparently frequents trees and bushes. Our indigenous *Bulimi* are as follows :—

Bulimus punctatus, Anton, common at Jaffna, Trincomalee, and Hambantotte. It feeds on the *Mimosa* common in the jungles, and in Jaffna is found in vast quantities about the walls of the old fort, under stones, in company with the larger form *B. pallens*. This species also is abundant about the forts of Colombo and Caltura, at the roots of grasses. *Bulimus ceylanicus*, Pfr., is found about the mountain zone in company with *Bulimus albizonatus*, and is, I feel nearly sure, but a variety of it; the mollusc is of a beautiful green colour, and when alive shines through the shell; I am told they feed much on the coffee-bushes. *Bulimus Mavortius* has, as yet, been received only from the jungles; it feeds on the *Mimosa* and other trees. I have not observed it in the mountains, but have received it from the western coast about Puttam. *Bulimus trifasciatus* I should also term a *low-country* species; I have taken it about Galle and Matura, and it lies dead in abundance along this road. These, with the exception of *Bulimus pallens*, are essentially *tree* species. *Bulimus pallens* is a ground species; so also is *Bulimus indicus*, which is seldom found but under stones and decaying logs of wood, in very moist situations. The stones about wells are favourite resorts, sometimes also the roots of grasses about old buildings; it is local and singularly abundant. The animal is of a brilliant yellow colour. The epiphragm of all these species is white.—The large wood-pigeon, *Carpophaga pusilla* of Blyth, abounds, its plaintive notes being heard from the summit of the highest trees. While journeying on I was startled by a curious barking that reverberated through the woods: a low "hiss" from Q. brought me to a stand, and he pronounced the word "*Pullettymaan*." Now this was an animal I much desired to see, being one of the two deer, of which, though I had certain information, I had not yet been able to procure for identification. Slipping noiselessly from my saddle, I crept towards where the sound, which seemed however to come from all quarters, was now most frequent; but an unlucky twig made a slight snap, and away bounded the timid animal from a point where I least expected it. Q. laughed at my discomfiture, but consoled me by vouching to its powers of ventriloquism, and promised me a skin, should he fall in with one, adding that I should most likely see them at early dawn on the great centre road feeding in the open places. We reached our destination early; but before doing so, Q.'s warning against riding along the raised baulks in the paddy fields was shown to be a correct one. We were crossing the last field leading into the village, I, as usual, riding along the ridges, when suddenly a weak spot gave way, my horse fell heavily on his head and rolled completely over, flinging me and my gun several feet before him; luckily I was the foremost of the party, or the contents of my gun would have lodged in somebody's legs; as it chanced, it was expended harmlessly on the air, and as no hurt happened, either to horse or man, we enjoyed a hearty laugh at my mishap, and then galloped into the village. After examining the spare guns and baggage, which had been sent round by another route (this being Q.'s head-quarters for some time), we took our rifles and went out to look for our dinners: this was soon procured in the shape of a fine young pea-hen, which fell before Q.'s gun. Committing this to the care of the cook, we sallied out again and wandered along the bank to look for footsteps, so as to judge of the game we were likely to meet: this we soon found was large; elephant tracks of all sizes being abundant, and mingled with them, deer, elks, pigs, and bears. Vast numbers of the shells of *Unio marginalis,* some of very large dimensions, mingled with *Ampullaria glauca, Paludina**, and *Planorbis**, scattered along the borders of the tank, testified to the good dinners eaten by the *Anastomus oscitans,* Bonn., which, from this circumstance, is called *Gombellu cocku* by the Cingalese, *Gombellu* being the name for shells in general. The *Anastomus* is not a shy bird, not being eaten by the natives, and many of them were stalking about the swampy margins in company with egrets and the small black-headed ibis, *Theskiornis melanocephalus.* Winding round the tank, we beat over all the Chenas†, making occasional entries into the surrounding forest. Returning from one of these inroads, Q. dropt on his knees, uttering the well-known native warning note (which Europeans make use of when vexed as a sign of impatience): the whole party were instantly flat on the ground, hidden in bushes or tufts of grass, and looking forward, I made out through the bushes a large herd of spotted deer (*Axis maculata*) drinking at a water-hole; before however we could form any plan of operations they were off again, being evidently very wild, and after a fruitless chase of an hour or two, we emerged again on the open field near the tank. One of our men pointed to a hare in its form, and fixing his eyes on it, walked quietly up and secured it; it proved to be a very young one. At what time of year do these creatures bring forth? I have had them of the tenderest age during *every* month in the year. Birds also seem to lay in the same unseasonable manner: I have obtained nests with eggs in every month. The small change of temperature, and the unmarked character of the summer and winter, so to speak, of the tropics, are also carried out in animated nature within the same limit. I cannot at this moment remember any marked instance of migration, except that of the common swallow, which appears in September, and of *Spias Glaucippe* and all the species of the genus *Callydrias* among butterflies; these, in the months of April and May, may be seen in thousands, generally flying from west to east: the native will tell you that they all go to Adam's Peak, there to die at the shrine of Buddhu. I have not been stationed long enough in any locality to make a very correct list of migrations, but the following contains a few notes which I have jotted down at various times:—

* Vide Supplementary notes.

† Lands periodically cultivated with grain crops and then suffered to lie waste for a certain number of years, during which time low jungle grows up, affording the finest cover and feeding ground for deer, &c.

**Hirundo rustica*, L.	September 12.
**Merops Philippinus*, L.	Ditto.
**Pitta triostegus*, Sparr.......	Ditto.
Gallinago stenura, L.........	September 20.
Macropteryx coronatus, Tickell	March.
Pastor roseus, L.	August (late in).
Ploceus Philippinus, L. .. .	July.
Budytes viridis, Scop.	September (early in).
Calliope cyanea, Hodg.......	October 13.
Cyornis rubeculoides, Vig.....	October 14.
†*Hirundo daurica*, L.........	December.

It is difficult to draw the line between those birds which actually leave the island, and those that only change their residence to breed or procure abundance of food. All the *ducks* I believe are migratory (except perhaps the little *Nettapus coromandelianus*, Gmel.); they arrive at Pt. Pedro about October or November, but much depends on the lateness of the season, and some species are not found *at any time* in the southern portions of the island. Again, the *Laridæ* and *Sternidæ* are undoubtedly migratory, some partially, some totally; but *where* to draw the line? I have often entered a species on my list as "*totally*," when, going on government service to another part of the island, out of the influence of the monsoon, lo and behold my "*totally migratory species*" was quietly fishing away, unconscious of all the perplexity it was giving me!! However, I never found the nests of these families in the island. They may breed in the rocks round Trincomalee, but Kelaart will look them up if they do. But how birds do evade one's notice! I had entered *Rhynchæa bengalensis* as coming and going with the snipe, when one morning in May I find the birds and nest within gunshot of my house, breeding under my nose in fact, while I thought I knew all about them! Vexed as I was, I rejoiced in the acquisition of a bit of information, and now record it for your benefit:—Nest, a slight depression in the soil, lined with a few bents of grass; eggs, four in number, of a brownish yellow, marked all over with dark blotches, rather more frequent at the obtuse end, apparently at times taking an annular form.

While crossing the head of the tank we fell in with a large herd of wild hog; Q. got a long shot, and the "*thud*" of ball came dull back to our ears: away rushed the scared brutes, one poor wretch leaving the pack and making to the nearest jungle: slipping the dog away, we dashed on, and soon came up with old Ponto worrying poor piggy by the throat. I had a favourable opportunity today of observing the habits of the snipe. Strolling into a little garden at the back of the hut in which we had put up, I detected a snipe busily engaged in thrusting its bill into the mud of a water-course among the plantain trees. On first seeing me, down it squatted, and but for its brilliant large black eye, I should have lost it: seeing that I stood still, it

* These three species always precede and foretell the arrival of the snipe.

† This was probably an accident: only one specimen was procured, that at Pt. Pedro—perhaps driven over from the coast by stress of weather.

again commenced its dibbling, sifting the mud somewhat like a duck: it walked with the spring motion of the *Hiaticulæ*, dropping on its belly on the least alarm, and settling itself either backwards or sideways under the least declivity or tuft of grass, the better to evade observation, its fine eye all the while roaming anxiously about: so fearless were the snipes here, that I saw several feeding up the same drain. While drinking our coffee, Q. related one of his adventures with elephants:—"It is now," he said, "some three years ago that I came to reside in this very hut, while tracing a road in the vicinity. I found the villagers in great distress and fear, from the nightly visits of a large elephant, which pulled down their stockades and entered their little enclosures, destroying their crops or stacks, and pulling the thatch off their houses. While talking with them as to his probable haunts, we heard a loud trumpet from the tank; taking my big two-ouncer and the little 'Joe,' I ran down as quick as I could, and on the other side of the tank, which was then very dry, I saw a fine elephant standing up to his belly in the water. I let fly at his head, and down he thundered, making the water surge again; as he lay quite still, we all crossed over and were clustered round him, when up he arose. I luckily had taken the little double 'Joe' from the natives, for they all fled right and left, leaving me standing in the water, and the huge brute eyeing me and making ready for a charge: another shot brought him to his knees, but again recovering himself he made at me, and the last barrel rolled him over on his side. We all made sure he was dead this time, and the cowardly natives returned. But now a fresh evil, worse than the former, presented itself: 'Oh! the water! the water!' exclaimed one of the men; 'it will all be poisoned by the putrifying carcase.' Here indeed was a difficulty no one had dreamt of, or knew how to overcome. Some proposed cutting it up; this was objected to, as the blood would have spoilt the water. Move it we could not, with all the strength of the village. By this time all the women and children had assembled, and rent the air with their lamentations; water could not be procured for miles; suddenly, to relieve our dilemma, up rose the elephant, and without looking to the right or left, walked straight out of the tank to the middle of the field, hesitated, stopt, tottered and fell, with a groan that made us all start,—a lifeless mountain of flesh. You should have heard the noise for many a night after, of all the beasts of the forest, which came for a meal off the carcase: sleeping was out of the question.—By the way, do you know that pigs are carnivorous?" Now, as we had just been eating wild pork-chops, that was not a nice question. "Not *wild* pigs, I should think," was my answer, "seeing they can get such abundance of food in the jungle; tame pigs I know will eat flesh, fresh or putrid." "And so will wild ones," was his rejoinder; "and Captain G., who was very fond of pork, shot one *inside* an elephant: fact, I assure you," said Q., at my roar of laughter. "He and a party had killed an elephant near a rest house, and returning thither some few days after, they were disturbed at night by the squealing and grunting of the pigs. G. stole down to the hedge of the field, and seeing something dark and, as he thought in the dim moonlight, moving, he fired a couple of barrels at it and returned home. Next morning, on going to see what damage his bullets had done, he found he had fired at the dead elephant, the bullet holes being plainly visible on his flanks; one of the party detected a movement under the skin, and on its being lifted a full-grown pig was found, shot through the body: G. never eat pork afterwards." Since Q. told me this, I have made inquiries, and hear that pigs always attack carcases, and biting a hole in the soft part of the belly, they get inside and tear away the flesh, leaving only a thin layer of skin over the bones. I have this on undoubted authority. While we were chatting we heard the drumming of elephants in the tank, and directly sallied out in our paijamehs and shirts; mine being very light and conspicuous in the moonlight, Q. left me in ambush, while he and the guide crept down the back water. I could not help musing on the strange scene, and thinking how our friends in England would have wondered to have seen us. There I stood, on a March night, in the thinnest possible garments, with my shirt-sleeves cut off about the elbow for coolness, and my bare feet thrust into a pair of slippers, a rifle in my hand, and a double gun propped against a tree, waiting for an animal whose gigantic power was unrivalled, and plainly exhibited by the crashing of the boughs all around me. At some little distance lay Q. and the guide, taking advantage of any tuft of grass and the passage of clouds over the moon to creep up the back water, where we heard most of the elephants. Huge masses of clouds steadily rising to the eastward, with frequent flashes of lightning, foretold the approach of an eastern storm; occasionally an alligator would rear up his head within a few feet of me, and blowing sink again to his muddy lair; from the marshy field before me sounded the croaking of frogs and "creeping things innumerable"; the bleat of the elk or deer fell occasionally on the ear, mingled with the wail of the jackal and the "*wagh*" of the little owl (*Scops Lempiji*). Ensconced in my ambush and every sense on the alert, I detected a slight rustle, and then the well-known "chick, chick" of the natives; looking in the direction of the sound, I saw a hand held out from a bush, with three fingers elevated; another, and another, told of five elephants on the tank. How impatiently did I listen for Q.'s gun! but presently he himself stood before me, with the unwelcome news that the elephants had gone over the bund into the village. Tired with my last night's vigil, and having to start by 4 A.M., it being now past 12, I retraced my steps home, leaving Q., who said he would go up the tank and round by the back of the village after the track. Half asleep, I threaded my way through the jungle, and gained the open space in front of the village, where, as is usual, all the cattle were tethered; the prowling jackal sneaked away at my approach and I gained the entrance of my tent, when, forgetting the lowness of the roof, I struck my temple against a roof-stick, and staggering fell senseless on the couch; how long I lay I cannot tell, but I was roused by the reports of Q.'s guns in quick succession, and when Q. came in I was sitting up, staring wildly about. It appeared that the moment I had left the tank, a dark object that Q.

had taken for the stump of a tree, came slowly out into the tank, showing Q. a huge elephant; Q. waited till it had got clear of the trees, and then walking up fired both barrels into its head; unluckily, as he aimed, a cloud obscured the moon, and he could not see clearly; the animal however dropt on its knees, but regaining its feet, ran across the swamp and disappeared. Talking over the adventure, we fell asleep, but about 2 o'clock were roused by the rushing of the storm through the branches of the trees; the rain streamed in torrents through our roof and into our beds, so we got up and sat cowering under the table. At 4 A.M. I started for Irambacolom, and Q. rode with me to put me in the way. Breakfasting at a village called Parandan, on cold peacock, I reached the great central road about 4 o'clock, having seven miles still to go to where I expected to meet Mr. B. of the Madras Service, my baggage, and my buggy. On the open road animal life abounded: puddles left by the night's rain were surrounded by large flights of *Euplœa corus* and *E. prothoe* in some instances, and by *Cal. alcmeone* and *C. Hillaria* in others. Jungle-fowl with their broods scratched upon the lumps of elephants' dung. The little red monkey gambolled among the branches (this being apparently their farthest northern limit). *Pericrocotus flammeus* had replaced *P. peregrinus*. The common horn-bill, *Buceros pica*, was associated with the smaller species, *B. gingalensis*; and I saw for the first time a pair of *rocket-tailed shrikes*, but could not procure them. I halted for a moment to observe a fine *Papilio Erythronius* drinking; it had thrust its trunk in the muddy water and was sucking it up eagerly, its wings quivering and antennæ moving to and fro; on looking closely, I saw that as fast as it sucked in the liquid, it ejected it *ab ano*, in clear filtered drops. I stood and watched this for some minutes, during which the insect, though usually very wary, never took the slightest notice of me; so I rode on and left it, and reached my destination near night-fall, and found, instead of my friend and a comfortable dinner, a rest-house full of noisy Tamul coolies; I had nothing to lie on or to eat off, or wherewith to make a light. A jungle-fowl, meant to be stuffed, was converted into a curry by the horsekeeper; a plantain-leaf, pinned at the corners with thorns, served as a plate; one old preserved-meat tin, often used to boil snails in, made a first-rate cup for some coffee (procured from the coolies and drank without milk and sugar); and a bundle of straw, taken from some bullocks, served as table, chair, and bed, on which I threw my limbs, weary with a walk of some twenty miles. I slept soundly from 7 that evening (at which time I turned in for want of light to do anything else) till 5 next morning, when I shouldered my collecting gun and went to look out for specimens. Rounding the corner of a paddy field, I espied a herd of pigs; so ramming down a little 120 ball on the top of my dust shot, I singled out the largest boar of the herd and sent the ball into his spine; on this he turned and charged me furiously, and I had to fall back on fowling-piece loaded with No. 6, when just as piggy reached me, his spine gave way and he sat on his hind-quarter, frantically tearing up the ground all round him, till another 120 in the brain rolled him over lifeless. About 8 o'clock B. came up; at 11 the bullock bandy, with my buggy in tow, joined us; and at 3 A.M. we started in the buggy for Vavonia Vlancolom, with our guns between our knees, and got in before dark, killing a jungle-fowl *en route.* These jungle-fowl (*Gallus lineatus*) are singularly abundant all along this road: the female lays from six to twelve eggs, of a pinkish colour, finely mottled with reddish-brown spots, choosing often a decaying stump as her nest; the young when just hatched resemble young chickens; the hen leads them to old fallen trees and scratches for white ants, which the young birds eagerly pick up. I have frequently seen three or four broods mingled together, with but one cock among them, who keeps his seraglio very much to himself, often I understand defending his ladies at the expense of his life. He is generally victorious when the tame cock is the aggressor, for his spurs are fearfully sharp, as I can testify by painful experience. I once saw a fight between a tame and a wild cock which terminated most ludicrously; the owner of the tame bird ran in and requested the loan of my gun to shoot the stranger. I asked him if he could shoot, when he drew himself up with "Sare, I one soldier before:" of course he had the gun directly, and taking a murderous aim from the window, he fired, knocked over his own bird and missed the jungle-fowl. His mortified face I never shall forget, and his soliloquy over the body was *almost* as fine as Hamlet's. *We* had however no friendships to regret, so eat the bird for our dinner.

Our game birds in this country consist of the common jungle-fowl, *Gallus lineatus* vel *Stanleyi*, Gray, abundant throughout the country; *Galloperdix ceylonensis* vel *Tetrao bicalcaratus*, Pennant, confined to the southern and central portions of the island, and a most shy and wary bird. I have never seen the eggs of this species, and the natives can give no account of them. *Perdix ponticerianus*, Gmel., confined to the north of the island, breeding in August and laying from eight to sixteen olive-green eggs, obtuse at one end and sharp at the other; they make little or no nest, generally selecting a hollow in the bottom of a bush, or a tuft of grass. *Perdicula argoondah*, Sykes, very rare, the only pair which ever fell under my notice being procured near Cottah, six miles from Colombo. *Coturnix chinensis*, L., are found abundantly in the grass lands about Galle, Matura, and the Pasdoom Corle.

Turnix ocellatus, Scop. The rufous variety of this species (*Hemipodius taigoor* of Sykes) is abundant about the southern parts of the island; the small pale variety common in Bengal, and called *T. bengalensis* by Blyth, replacing it in the northern province. It lays three or four roundish eggs of a yellow green colour, mottled with black spots, which grow larger towards the obtuse end, in some instances running into each other; the nest, if nest it can be called, is composed of a few bents of grass dropt into a depression on the ground—often only the foot-print of a bullock. I have found the eggs from February till August, and equally fresh.

At Vavonia Vlancolom I captured two very minute, and, to me, new bats, certainly not measuring two inches across the wing; unfortunately I put them into one of my carriage lamps and forgot them, and they decayed. I think the native village there is one of the prettiest I ever saw. It is embowered in fruit-bearing trees and palms, and very clean, the whole surrounded by a stockade fence as a protection against the wild beasts. It has a lovely tank well-stored with water-fowl, fish, and alligators; here, with a small boat, the naturalist might procure a number of birds which he could not get elsewhere. *Plotus melanogaster*, Gmel., and *Hydrophasianus Chirurgus*, Scop., abounded; the whistling teal (*Dendrocygna arcuata*, Cuvier), also in large flights; while on the trees along the bund, *Buceros pica*, Scop., and *Hæmatornis Bido*, Horsf., not to mention hosts of smaller species, could have been procured.

Next morning, Friday the 11th, we started early for Maddewatchy, crossing two rivers *en route*, the Sitt-aar and the Pic-aar; we had to dig our way down the banks of the former, and make a bottom for the latter with branches of trees laid on the mud. Over the Sitt-aar is the first hill met with between Jaffna and Kandy; near Maddewatchy is another, called *Issam-bassa-galla*, literally the *Rock* of the *tortoise* and *owl*,—a fine mass of rock, up one side of which we walked, as it is a huge inclined plain—and what a view burst upon us! To the northward the eye wandered on a vast sea of jungle, bounded only by the horizon, the sole break being the hill near the Sitt-aar rising out of the dense impenetrable forest. To the eastward, a few isolated hills in the Bintenne country arose like islands from a leafy ocean. To the southward, the Dambool rock and Kandian hills. On the south-west, a faint glimmering, awakened by the setting sun, pointed out the site of the far-famed tanks, while the mighty dagobas of Anarajahpoora, relics of by-gone years and a debasing superstition, reared their heads among the trees of the forest. We too stood on the mouldering remains of a temple, a shapeless mass of brickwork, while at our feet lay a half-sunken pillar, on which was carved the image of the five-headed snake. The idolater had chosen well, when he fixed his temple on this mass of solid rock; man did indeed seem like an atom in the scale of creation, when viewed from this height. Far down below us we discerned a paddy field, on which grazed a herd of buffaloes tended by a herdsman—they looked like specks; we tried in vain to make him hear our voices, so firing our guns in the air, we descended from our high pinnacle. Among the brickwork I found several specimens of *Helix bistrialis*, a huge gray scorpion, and vast numbers of elephant ticks. Twenty minutes' drive brought us to Maddewatchy, where we found comfortable shelter in the house of a native, and B. having shot one duck on our road, and another on the tank, we feasted well; and while I skinned some birds, B. fell asleep on his bed—a mass of cow-dung hardened and smoothened!! Taking the gun I strolled into the tank, and saw, for the first time in this country, the small pouchless adjutant, *Leptoptilos javanica*, Horsf., but could not shoot it. The large kingfisher (*Halcyon Ghurial*) chattered his harsh notes exultingly as he pounced on the frogs that swarm in the shallows. I hunted in vain for some live specimens of *Cyclostoma ceylanicum* and *C. indicum**, that lay scattered dead in all directions, and then threaded my way home again.

We are well off for kingfishers here; we have *H. Ghurial*, P.,

* Vide Supplementary note.

common in the jungles or tanks and up the large rivers; *H. Smyrnensis*, L., affecting paddy fields throughout the island, and *H. atricapillus*, Lath., one solitary specimen procured near Jaffna. *Ceryle rudis*, L., not uncommon and generally distributed. *Alcedo bengalensis*, Gmel., *passim*; and the lovely little three-toed *Ceyx*, *C. erythaca*, Pallas, rarely seen and more rarely shot, and delighting equally in the wildest mountain-torrent and the placid tank. I have seen *Halcyon Smyrnensis* feeding much upon butterflies and coleoptera, hawking after them in the manner of the *Meropidæ*; their principal food is small crustacea, frogs and fishes; they breed in hollow trees, laying two round white eggs. *A. bengalensis* breeds on banks, and lays four round white eggs; I have procured them in May and June.

Starting very early on the morning of the 12th for Mehintally, our next stage, I bagged two specimens of *Buceros pica* and two of *B. gingalensis*, Shaw, the only two species of the genus I have yet procured, though I am confident I once saw another (probably *B. albirostris*, Shaw) in the Ambegamoa district.

The habits of *B. pica* are very peculiar; I have seen them much on the ground in grass land, but never could detect what they sought—probably some small mammal. In flying they strike the air several heavy strokes with their wings, and then stretching them out, sail for several yards, when another flap is required, the head and monstrous casque thrown as much forward as their long necks will permit. They always fly in flocks, generally in line, uttering their harsh discordant cries, which may be heard for upwards of a mile. The natives assure me that in plucking fruit from the trees, they seize hold of it, and then throw themselves off, turning and twisting in the air till they wrench the fruit from its hold, when they recover their wings and alight again, toss up the fruit, catch it, and swallow it whole. *B. gingalensis* approaches somewhat to the long-tailed cuckoos (*Phœnicophainæ*) in its method of travelling through the leafy tree-tops, and is therefore most difficult to shoot. It flies into a tree and creeps upwards to the top on the opposite side, and then darts into the next. This is a habit with all our cuckoos; less visible in the true genus *Cuculus* than in the other genera of the same family. As far as I can ascertain, the range of *B. pica* is from Pt. Pedro, the most northerly point, to Nallande or Matelle. *B. gingalensis* does not, that I am aware of, attain a greater altitude, but it is found alone in plenty a few miles up the Caltura River, among the isolated hills which mark the first approach to the mountain zone. I have heard of it at Galle and Matura, and saw it at Ragama, twelve miles from Colombo, on the western coast; neither of the species is seen again till Chilaw is past, when *B. pica* becomes abundant, and continues so to Jaffna. The natives assert that *B. pica* builds in holes in trees; that when incubation is fairly commenced, the female takes her seat on the eggs, and the male fastens up the hole by which she entered, leaving only a small aperture, through which he feeds his partner, while she successfully guards their treasures from the monkey tribes, her formidable bill nearly filling the entire entrance.

This day's journey brought us fairly among the mountains. We had one river to cross, and the usual allowance of mud-holes and fallen trees, which had to be cut through, rounded, or jumped over! The drive had been delightful hitherto, but the country being flat, we obtained no views. Now, a sudden rise in the ground would give us glimpses of the hills, sometimes clothed with wood to their summits, at others bare and frowning with solid rock. Villages became more frequent along the road-side; and we skirted many lovely green paddy fields, each with its scaffold, in which the owner sits at night watching his crop, and hurling down lighted firebrands when herds of elephants approach his fence. The cries of man and beast often awoke us out of our sleep at nights. We arrived at Mehintally about midday, and were soon joined by my old friend and fellow-labourer in the Ceylon fauna, B. of Anarajahpoora. Not having met for more than two years, we had much to say and talk over, and he took us up to the Wihare on the top of the mountain, to induce the priests to allow us to sleep there, as it threatened rain. I need not describe to you this celebrated temple; others have done that before me, and I was too much taken up with the abundance of fine butterflies and birds which I everywhere saw, to observe the place very closely. B. was in his element, and pointed out in one place an inscription that he had cleaned, in another a pillar or slab that he had erected again. He descanted, very learnedly no doubt, on its antiquity, &c.; but I had found a pretty little *Streptaxis,* a genus I had not hitherto seen, and I could see nothing else in the old stones but famous places for those shells, of which I secured some half-dozen. An *Achatina,* which I take to be *orophila,* lay dead in abundance; so also *Helix bistrialis* and *Cyclostoma cornu venatorium**. We had a magnificent view of the surrounding country from the top of the hill, the effect heightened by several thunderstorms, which we could see expending their fury on the low country, causing grand changes of light and shade. From one of them which came rushing up, we had to beat a hasty retreat, and after drinking a glass of cherry brandy round to the health of absent friends, B. galloped away to clear the river before it became too swollen to pass; for such is the effect of these storms in the hills, that a friend of mine was detained on the banks of the Sittaar for *eighteen hours,* during which time the river fell *seventeen feet.* The priests in their yellow robes crouched around us, as we squatted on the ground eating our dinner, and looked with amazement at one or two little things we had with us. My compass, for instance, underwent a most strict scrutiny, and mystified them by its resolute determination to point northward: it was no use twisting and turning it—the little gold bar would keep *its* head one way, and turned *their* heads every way.

All this while the lightning flashed and the thunder roared around us in awful grandeur. I more than once wished myself and my long gun-barrel on the low ground, instead of perched up there almost on the summit of the highest hill in the neighbourhood; but wishing could not mend weather, and habit is second nature; the canary-bird priests dropped off one by one; the pilgrims in the sheds outside ceased chatting; my companion's heavy breathing proclaimed he was off to the land of Nod; so wrapping my blanket round me, I lay down

* *Vide* Supplementary note.

on the floor, and by the flickering light gazed at the fantastic carving of the heathen temple. Nineveh and my brother stole over the scene,—what a contrast! our own simple religion, another contrast! and thanking God for the purer light vouchsafed to me than to these poor creatures, I fell asleep on my hard bed, the sleep that only the tired man knows. This morning we were off before daylight, scrambling down the scores of stone steps that lead to the temple. An old pilgrim, whom we had heard loud in his devotions last night, accompanied us, to enjoy the benefit of our light. While on the rough uneven steps he was silent enough, but as soon as we cleared them and came into the jungle-path, he set up his pipes and chanted hymns in honour of Buddhoo, till our ears rang again. I advised him to keep his breath for his journey, as calculated to be of more use to him than Buddhoo; but on this he sang the louder, and only came to a halt, when, having by his melody raised himself up to the seventh heaven, he forgot mundane affairs, and tripping up over a stone, lay sprawling on the ground. The morning dawned as we emerged from the jungle into the open road, and I then had a fair view of the devout pilgrim; he was an elderly man, but still vigorous; on his head he wore a red pilgrim's hat, which only wanted the cockle-shell to render it fit for Peter the Hermit himself; he had two or three coats on, one over the other, and the same number of trousers, all of different lengths, and B. declared he saw a pair made of *matting* under all. He carried a staff, a bundle, and a gourd. When he began his prayers, which he did if ever we halted, he rang a little bell to call attention, and when he came near us he knelt down and bowed to the ground. I observed, among the relics he had on, a Romish medal of the Virgin, doubtless blest by the pope; a sure protection against falling, as I have often been told by the priests when a boy in Florence.

Today, though Sunday, we were forced to make two long stages, and B. rode the last one. We breakfasted at Peria Colom and slept at Allagamo, before reaching which we got a severe drenching, and B. having no change with him, I have wrapped him in a blanket; and while he is sleeping I close my letter, and shall despatch it by the tappat, which we shall meet tomorrow morning. As we are pushing on to save the Bombay steamer, I shall not be able to write again till I get to Kandy. Till then believe me yours very truly,

E. L. Layard.

BIBLIOGRAPHICAL NOTICES.

A History of British Birds, Indigenous and Migratory; Illustrated by numerous Engravings. By William MacGillivray, A.M., LL.D., Professor of Natural History, and Lecturer on Botany in Marischal College and University, Aberdeen. Vols. iv. & v. London: W. S. Orr & Co., Amen Corner, 1852.

We believe it is now admitted, that whoever would worthily attempt to arrange Birds according to the natural system, must not only attend to those external characters which were the sole guides of the early systematists, but also to those anatomical and physiological facts which constitute the framework of philosophic zoology; the scalpel and the needle have long since done their work, and of late years the microscope has revealed some valuable characters in the arrangement of the bone-cells, and the relative measurement of the blood-corpuscles. The relative size of the sexes, the food, the habits, whether ordinary or under parental emotions, the mode of nidification, the number of eggs, the appearance presented by the new-born young, their comparative powers of vision, and of terrestrial or aquatic locomotion, are all more or less valuable accessories* to successful enterprise in a field of research so varied and extensive as to tax all the mental and bodily powers of "the close-pent thinker and the busy worker."

An interval of nearly twelve years having elapsed since the publication of the first volume and the appearance of those placed at the head of this article, it may be useful to remind our readers, that in the introduction, the author ably enforces the claims of comparative anatomy to be considered, not as a mere adjunct to, but an integral part of, scientific zoology. In the three first volumes will be found, besides an explanation of the terms employed in describing the external characters, a series of compendious remarks on the skeleton, the trachea or windpipe, and the interior parts, especially the gullet, stomach, intestinal canal and its appendages, which bear undeniable traces of deep research and thoughtful elaboration. Educated for the medical profession, called to the Conservatorship of the College of Surgeons in Edinburgh for many years, the friend chosen by the lamented Audubon to dissect, describe, and illustrate the anatomy of many hundreds of specimens of American birds preserved in spirits for that purpose, the author has brought to the due cultivation of such rare opportunities an active and inquiring mind, unwearied diligence, great perseverance, a delicate pencil and a ready pen. To these high qualifications for the closet and the field must be added, the rare opportunities he enjoyed and improved of visiting many of the choicest localities for the study of the habits of his feathered favourites, more especially the Water-birds, popularly so called, to the elucidation of whose history these volumes are devoted.

True to his early belief in the importance of anatomic structure, the author neglects no opportunity of illustrating its worth and enforcing its practical application. The position of the Cranes (*Gruinæ*) is disputed by many: "although they bear some considerable resemblance to the Herons and Storks, they are clearly not of that family, but more allied to the Bustards and Plovers, their very muscular stomach and double cæca being sufficient to separate them

* So also are Mr. Denny's researches on the parasitical *Anoplura*, and our author gives the value of the Entozoa in his remarks on British Swans. The Guillemot deposits her egg on the bare rocky shelf, the Woodpigeon on an open platform of sticks, the Wren in a dome-shaped nest: a microscopic examination of the egg-shell, as well as the down of young birds, would lead to much curious, if not useful, information.

from the former birds:" and although it is obvious that the Bustards (*Otinæ*) resemble both the Rasores and Grallatores, "their internal structure," which the author had no means of investigating, "alone can settle the question:" for the same reason, the position of that interesting bird, the Pratincole, cannot be accurately determined: the value of such evidence is pleasingly illustrated in treating of the affinities of the Spoonbill and other birds. The trachea in many of the Ducks (*Fuligulinæ*) and Mergansers is generally characterized by an enlargement, and "the voice of the male is more hoarse and less loud than that of the female;" still, the physiologist will be puzzled to account for the use of the great enlargement of the trachea in the male of the Golden Eye (*Clangula chrysophthalmcus*). The trachea in the male of the Black Scoter (*Oidemia nigra*) differs from the simple apparatus of the female only in having the bronchi larger, and resembles that of the female Ducks in general, whereas the tracheæ of the males of *O. perspicillata* and *O. fusca*, its close allies, have a decided enlargement. The differences in the structure of the trachea which occur in some genera are carefully noted in the description of the eight species of Swans which have been found in Britain: in some species it follows the usual course, whilst in others it first enters the sternum, forming a loop in the same manner as in the Crane. The American and European Spoonbills present equally striking differences, and yet the author admits that it would be "injudicious to subdivide these into distinct genera, as the species otherwise agree in all essential respects;" and in many instances points out the danger of taking some artificial, isolated, and often insignificant character in the construction of genera.

The orders into which the Water-birds have been grouped are mainly constructed with reference to their natural habits: we have *Cursores* or Runners, Cranes and Bustards; *Tentatores* or Probers, Plovers, Sandpipers, Snipes; *Aucupatores* or Stalkers, Herons, Egrets; *Latitores* or Skulkers, Rails, Crakes, Gallinules; *Cribratores* or Shifters, Geese, Swans, Ducks; *Urinatores* or Divers, Grebes, Loons, Auks, and Cormorants; *Mersatores* or Plungers, Petrels, Gulls, Terns. Perhaps we cannot do better than transcribe the account of the habits of the typical species belonging to the last-mentioned order:—

"The *Mersatores* are birds of less compact form, lightness and even buoyancy, as well as strength, being essential to their nature. Their plumage is of looser texture and more bulky. Their long wings are fitted for a light, gliding, bounding flight, very unlike the straightforward, laboured, though quick aërial progression of the *Urinatores*. They sit lightly on the water, swim, though not rapidly, but are incapable of diving, and never enter into the deep otherwise than momentarily by plunging or dipping. The larger species are in a measure omnivorous, in so far as regards animal food; the smaller feed chiefly on small fishes and crustacea. They usually nestle on the ground, laying from three to five spotted eggs; but some which lay in holes or crevices have white eggs. The young, at first densely covered with down, can walk and run, as well as swim, from the first; but usually remain for some time in or about the nest, or conceal themselves in suitable places. Most of the birds of this order walk very expertly. The males are little larger than the females, and generally the sexes are coloured alike; but the young have more mottled and duller colours than the adult. Their flesh is not esteemed, and none of them have been domesticated." (Vol. v. p. 7.)

As a happy illustration of our author's manner of describing the habits of the typical genera, as far as British species are concerned, we quote the following passage on the *Tringinæ,* as remarkable both for its truthfulness and its beautiful imagery:—

"Who, that has often visited the shores of the ocean, wandered along the extended sand-beaches on the margin of which the waves terminate their career in foam and uproar, or visited the muddy estuaries alternately filled and emptied by the periodical floods, has not stood to gaze upon the flocks of tiny birds that were busily picking up their food from the moist gronnd, or wheeling, as if in sport, their devious flight, now skimming the surface of the water, now rising high above the breakers and then shooting far off to sea, to visit a distant part of the coast? How often, in visiting a sedgy pool surrounded with marshes, have we been saluted, but in no friendly wise, by the shrill clamour of the long-billed and sharp-winged birds which had placed their nests on tufts too remote to be reached! Again, on the long range of heathery hills that we had traversed for many a weary mile, we have come, very unexpectedly to us, and with no welcome from its occupant, upon the nest of the lonely Curlew, which fluttered from among our feet in silence and terror, until reaching a safe distance she began to entice us away from her treasure, by displaying a broken wing and shattered leg—taught, in fact by instinct, to act a palpable untruth. Many pleasant sights have we seen on these solitary rambles—here the four spotted eggs of the Dunlin, so like in colour to the surrounding ground, that you wonder how the eye has distinguished them—here the timid young of the same bird squatted among the short heath—there a flock of Godwits thrusting their bills into the mud; and, again, the gliding and low flight of the beautiful White-breasted Tatler, as skimming by the margin of the quiet lake, it emits its shrill and reiterated cries." (Vol. iv. p. 161.)

To enter into a critical examination of the value of the orders, families and genera would demand greater space than we can command, and a far more extensive acquaintance with the subject than we possess; it could only be superficially treated, whilst common justice demands that it should be done with respectful attention: the changes introduced into the scientific nomenclature are much to be regretted, whilst we believe his legislation in vernacular names is worse than useless. Perhaps few naturalists will agree in accepting the views of our author either in nomenclature or in classification, but such has been the labour and research employed in the work, that in wisely admitting or in wisely attacking them, an extensive and varied acquaintance with the subject is required.

Under these circumstances, in dealing with an original work like this, which has been boldly planned and ably executed, we gladly turn from the consideration of the ever-vacillating quantities of families and genera, concerning which there is so much diversity of opinion amongst able men, to that of species, which, if their chief characters are accurately described and their habits ably illustrated, constitute a monument of merit far more enduring than any system that ever has been promulgated; for without such imperishable materials the temple of the natural system cannot be built; and it is for the sake of storing up these materials, some smoothed and ready to fit into their proper place, others rough-dressed and requiring the finisher's touch, that we would respectfully invite the student to lay aside all unworthy prejudices against these innovations.

The specific descriptions are in every instance where practicable taken from fresh specimens, they are most carefully elaborated, and often illustrated in part by excellent woodcuts; there is also a short diagnosis of each species acceptable to the general reader, and obviating any inconvenience in going over those minute descriptions, which can only be justly appreciated for purposes of comparing identical or nearly allied species from different quarters of the globe. The descriptions of the habits are given with much care, beauty, and accuracy; many of them must have been written in the field, and in default of personal observation extracts are given from the works of other naturalists; but it is much to be regretted that the title of the work is occasionally omitted, and in almost no instance is there any reference to the page whence the extract has been derived.

In the remarks on the general habits of the order of Tentatores or Probers, most of which are remarkable for the solicitude with which they guard their nests and young, some remarks possessing much interest are made on this habit, as displayed in birds belonging to different orders; but unfortunately the chapter is concluded by strictures on social morality which are foreign to the subject, injudicious in the choice of examples, and unwise in their general application. Neither can we agree with a general law stated in treating of the *Pluvialinæ*, that "No bird that eats entire and live animals has a crop;" whereas *Bulimus acutus* and *Helix ericetorum* are largely eaten by the Rock Pigeons in the Hebrides, whilst the Kestrel, Honey Buzzard, Pheasant, Partridge, and Quail, devour insects with little or no dismemberment. In the pleasing biographies of the Golden Plover and the Green and White Sandpiper (*Totanus hypoleucos*), no mention is made of their peculiar habits during the pairing season,—how the males lower their heads, elevate their wings, and pirouette around each other in presence of the females, with shrill, menacing, and rolling cries; nay more, the latter are very frequently observed to perch on trees and run along the branches with ease: in America, Audubon notes this arboreal habit in the Spotted Sandpiper (*T. macularius*). Several of our native birds which do not usually swim, do so readily when winged and chased into the water, or when they fall into it severely wounded: amongst those which voluntarily take short swimming excursions in tidal pools, we may enumerate the Oyster-catcher and the Redshank; the latter, we are told, casts up the indigestible cases of the larva of the caddice-fly upon which it feeds, as the Owl ejects the fur of the mouse, and the Rook the husk of the oat. No mention is made of the curious sexual note of the male Lapwing in the breeding season, which resembles the alarm-note of the Missel Thrush, but is uttered in a more abrupt and broken manner. The breeding of the Woodcock in Britain no longer excites great interest: in the excellent communications quoted by our author from the field notes of the Rev. Mr. Smith of Monquhitter and Mr. Burnet of Kembay, many interesting points in its history are pleasingly illustrated. The identity of the beautiful White Egret, shot at Tyningham, East Lothian, in 1840, with *Egretta nigrirostris* of C. L. Bonaparte, is still undetermined, and unfortunately no British localities are given for *Egretta alba*.

The fact that a female Shoveller, *Rhynchaspis clypeata*, was killed in Gullane Loch in July 1828, as recorded in vol. iv. of Sir W. Jardine's 'British Birds,' has been overlooked; else the author would not have stated, that "in Scotland no authentic instance of its occurring at any season has come to my knowledge." It would appear that a very large proportion of the Divers, Mergansers, Golden-eyed Garrots, and Wigeons, killed in winter, in the south of Scotland and in England, are females and young birds. The claims of the Bridled Guillemot, *Uria lacrymans*, to rank as a species are still matter of dispute; but we have here a description of a young bird, and it would appear that the white ring encircling the eye is not peculiar to the old bird as was supposed. The young of the Solan Goose, and all our larger Gulls require three years to attain their perfect plumage, and yet immature birds do not frequent our shores in numbers proportional to their annual increase; they are still more rare in the breeding localities, and in no instance has an immature bird been found paired with an adult. The habits of our larger Gulls—the cries of both adults and young—and the comparative scarcity of the latter, are pleasingly given in the account of the Black-headed Gull, as an important member of the vast congregation of sea birds which assembled to feed on young herrings in the Firth of Forth above Queensferry in December 1837. We are aware that Audubon found, that the young of many species of both land and water birds, in America, migrated during the cold season to a much lower latitude than their parents, and we have seen, that as respects some of our water-birds whose summer haunts are in the Arctic regions, the same fact is observable with us. A more intimate acquaintance with the fauna of the Iberian peninsula and the north of Africa may lead to the discovery of analogous facts in European ornithology; and the question as to the residence of the immature Solan Geese and larger Gulls, can be settled by voyagers in the Mediterranean and adjacent sea.

Our limited space compels us to give only few extracts illustrative of our author's style in describing the habits of his favourites:—

"Beautiful are those green woods that hang upon the craggy sides of the fern-clad hills, where the Heath-fowl threads its way among the tufts of brown heath, and the Cuckoo sings his ever-pleasing notes as he balances himself on the gray stone, vibrating his fan-like tail.

Now I listen to the simple song of the mountain Blackbird, warbled by the quiet lake that spreads its glittering bosom to the sun, winding far away among the mountains, amid whose rocky glens wander the wild deer, tossing their antlered heads on high as they snuff the breeze tainted with the odour of the slow-paced shepherd and his faithful dog. In that recess formed by two moss-clad slabs of mica-slate, the lively Wren jerks up its little tail and chits its merry note, as it recalls its straggling young ones that have wandered among the bushes. From the sedgy slope, sprinkled with white cotton-grass, comes the shrill cry of the solitary Curlew; and there, high over the heath, wings his meandering way the joyous Snipe, giddy with excess of unalloyed happiness.

"There, another has sprung from among the yellow-flowered marigolds that profusely cover the marsh; upwards, slantingly, on rapidly vibrating wings, he shoots, uttering the while his two-noted cry. Tissick, tissick, quoth the Snipe as he leaves the bog. Now in silence he wends his way, until at length, having reached the height of perhaps a thousand feet, he zigzags along, emitting a louder and shriller cry of zoo-zec, zoo-zec, zoo-zec; which over, varying his action, he descends on quivering pinions, curving towards the earth, with surprising speed, while from the rapid beats of his wing, the tremulous air gives to the ear what at first seems the voice of distant thunder."

And again—

"Many a time and oft, in the days of my youth, when the cares of life were few and the spirits expansile, and often too in later years, when I have made a temporary escape to the wilderness to breathe an atmosphere untainted by the effluvia of cities, and ponder in silence on the wonders of creative power, have I stood on the high moor and listened to the mellow notes of the Plover, that seemed to come from the gray slopes of the distant hills. Except the soft note of the Ring-plover, I know none so pleasing from the Grallatorial tribes. Amid the wild scenery of the rugged hills and sedgy valleys, it comes gently and soothingly on the ear, and you feel, without being altogether conscious of its power, that it soothes the troubled mind, as water cools the burning brow. How unlike the shriek of the Heron! But why should we think of it? for it reminds us of the cracked and creaking voice of some village beldame of the Saxon race. The clear tones of the Celtic maiden could not be more pleasant to any one, or perhaps much more welcome to her lover, than the summer note of the Golden Plover to the lover of birds and of nature. As you listen to it, now distant, now nearer and near, and see the birds with short flights approaching as if to greet you, though in reality with more fear than confidence, with anxiety and apprehension, the bright sunshine that glances on their jetty breasts is faintly obscured by the white vapours that have crept up from the western valley, and presently all around us is suffused with an opaline light, into the confines of which a bird is dimly seen to advance, then another, and a third. Who could represent the scene on canvas or card? a hollow hemisphere of white shining mist, on which are depicted two dark human figures, their heads surrounded with a radiant halo, and these black-breasted Golden Plovers magnified to twice their natural size, and gazing upon us each from its mossy tuft. It is as if two mortals had a conference on the heath with three celestial messengers—and so they have. Presently a breeze rolls away the mist, and discloses a number of those watchful sentinels, each on his mound of faded moss, and all emitting their mellow cries the moment we offer to advance. They are males, whose mates are brooding over their eggs, or leading their down-clad and toddling chicks among the to them pleasant peat-bogs that intervene between the high banks clad with luxuriant heath, not yet recovered from the effects of the winter frost, and little meadows of cotton-grass, white as the snow-wreaths that lie on the distant hill. How prettily they run over the gray moss and lichens, their little feet twinkling, and their full, bright and soft eyes gleaming, as they commence their attempts to entice us from their chosen retreats! In the midst of them alight some tiny things, black-breasted too, with reddish backs and black nebs, and neat pointed wings, which they stretch right up and then fold by their sides. These are Plovers' Pages, which also have their nests on the moor; the mist rolls slowly away, and is ascending in downy flakes the steep side of the corry, whence comes suddenly on the ear the scream of the Curlew,—pleasing too, but to the deer startling."

How delightful must the perusal of these volumes prove to the pure-minded man, who devotes his leisure hours to intellectual enjoyment in connexion with the wonderful works of nature! Here, he may live his boyhood over again; he may give reins to his imagination and revel in a little world of his own creation, feeling assured it has a true existence to the senses when these are awakened and cultivated for the highest and noblest end of all perception.

Perhaps better selections might have been made; but such as they are, they possess this advantage, that in these days of cheap travelling, their beauty and truthfulness can be easily tested by all who feel interested in the subject, and to whom even a day's release from the carking cares of the mart and the desk, to breathe the free mountain air, is profitable both for body and mind. We believe, that after due consideration, most of the readers of these volumes will agree, that in the valuable descriptions of the habits of many birds, there is a nice perception and striking expression of that mysterious analogy which exists between the physical and the moral world, which leads man to clothe with life and sentiment everything which attracts the attention in the aspect of external nature, bringing all that strikes the senses into unison with all that touches the soul.

We believe, such is the author's essentially truthful nature, that a more extensive acquaintance with the British and Continental Museums, with the literature of the subject, and with other men of like pursuits, would have materially influenced those peculiar views in classification and nomenclature, which have been developed by research and patient study under the comparatively limited advantages which he enjoyed.

The student may perhaps object to the detailed account of the habits, but if he would attentively investigate the interesting subjects of migration, nidification, singing, local and geographical distribution, he will gratefully acknowledge all that has been written. Stript of those lengthened descriptions which the student can alone appreciate, yet ornamented with the striking diagnosis already provided, and enriched with foot-notes illustrating the progress of the subject, a second, cheaper, and condensed edition of the work would, we believe, attain to an extensive and well-deserved popularity. Wilson, Audubon, Waterton and others have enriched our literature with contributions which are read and welcomed by every class in the community, and we believe that in due time the name of MacGillivray will stand in the foremost rank.

The mournful story of their gifted author will serve to heighten their interest in every feeling heart. The publication of the first three volumes proved a bad speculation, involving the author in pecuniary liabilities, and compelling him to severe labour in support of a large family; death entered his home; his health sunk under accumulated distress and labour; struck by a mortal disease which the milder climate of Devonshire failed to alleviate, last summer the once sturdy wanderer of the wild hills of Scotland returned home to die. As a controversialist, we would cover his faults with the mantle of charity; perhaps he has often been more sinned against than sinning: as a valuable writer in geology, botany, and some departments, especially the mollusca, of zoology, he is very favourably known, but it is as the author of 'British Birds' that his name will go down to posterity. His dying effort was to finish it for the press, to put the keystone to a long career of zealous devotion to science, bequeathing to the naturalist a legacy of which his country may well be proud,—to all men the precious example of an earnest life.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

February 25, 1851.—R. H. Solly, Esq., F.R.S., in the Chair.

Mr. Gould directed the attention of the Meeting to two Hybrid Birds, concerning which he read the following letter, which had been addressed to Mr. B. Leadbeater, F.Z.S.

"Cottimore, Walton-on-Thames, December 17, 1850.

"Sir,—With reference to the bird which you now have of mine to preserve, I will tell you all which I have ascertained concerning it. It was shot at Henley Park, in the county of Surrey, by the keeper of H. Halsey, Esq., on a part of his property called the Peat Moor, and not far from the Frimley ridges; a wild tract of country, with a good many black-game upon it. The keeper was shooting pheasants for the supply of the house, and this bird rose on the opposite side of the hedge to that on which he was, on the outside of a large covert:

he did not see it distinctly; but as in rising it made the sort of cry or crowing which a cock-pheasant is apt to do when disturbed, he shot it. I found it hung up in the larder, but was just in time to rescue it from the cook, and Mr. Halsey allowed me to take possession of it to be preserved. There is no doubt of its being a hybrid between the black-cock and hen-pheasant, as it appears that a black-cock has for the last two years frequented this particular covert and fed with the pheasants. The keeper, after feeding his pheasants, has frequently hid himself, to count his stock of those beautiful birds, and always saw this black-cock come to feed with them; and so it lasted for two years or more. I have no doubt that this bird is the produce of his intimacy with a hen-pheasant. The old black-cock used to play like a cock-turkey, the keeper tells me, dragging his wings, and could drive all the cock-pheasants, being completely master over them; which I wonder at, as the pheasant has spurs and he has none. The hybrid was shot on the 26th of October, and had he lived another month, would have been a beautiful bird. You will observe that he crowed on rising as a cock-pheasant does, which I believe a black-cock does not do. As far as I can ascertain in the number of instances of hybrids mentioned in Yarrell's 'British Birds,' they seem all to be the produce of cock-pheasants and grey-hens, whereas there is no doubt this is the reverse.

"I may mention while on this subject, that in another wood on Mr. Halsey's property two Hybrids were produced between the cock-pheasant and hen golden pheasant; this took place about thirteen years ago. A hen golden pheasant had escaped from confinement, and it was known that she was alive in the coverts; and in one particular wood it was remarked that the pheasants were always disturbed and driven out of it, and it was not known for some time by what; till at last, by watching at the feeding-places, it was discovered that this golden hen-pheasant and two other curious-looking birds were so pugnacious, that they drove every thing from the place. They were all three shot, when the other two proved to be cock-birds, and there is no doubt whatever of their parentage, both from their shape and plumage. They are small birds and not handsome, partaking of the plumage of both sorts of pheasants, without any of the beauty of either. I believe this to be the first instance on record of their ever breeding in a wild state; and you must remember that they were not in a Norfolk covert, full of half-tame pheasants, but in one of the wildest parts of England, as the presence of black-game will tell you. They were shot in the month of November, and therefore had probably got as good plumage as they ever would have. They are now in my possession through the kindness of Mr. Halsey.

"I think it a very curious circumstance that these birds should have been produced in a wild state, as I find in the 'Gardens and Menagerie of the Zoological Society,' vol. ii. Birds, under the head of Golden Pheasant, that in China, where the two sorts are wild, they have never been known to produce a mixed breed, and that in confinement it is sometimes obtained, but with the greatest difficulty. Also, in the 'Natural History of Ireland,' vol. ii. Birds, by W. Thompson, it is stated, as a reason for the Golden Pheasant not doing well in a wild state in this country if introduced where the common pheasant is now abundant, that they are such a shy, timid bird, and would be easily driven off by the other species. This fear is evidently groundless, as not only the half-bred birds, but the golden hen drove all the other pheasants, as was seen frequently by the keeper; and they were so cunning, and so well able to take care of themselves, that after it was known they were there, and the mischief they did, the covert was beat in the usual way for pheasants, in the hopes of being able to destroy these birds, but without meeting with them, and the keeper was obliged to watch for them and shoot them at feed.

"I remain, your obedient servant,

"JOHN W. G. SPICER."

The following paper was also read:—

1. ON THE ANATOMY OF THE WART-HOG (*PHACOCHŒRUS PALLASII*, VAN DER HOEVEN). BY PROF. OWEN, F.R.S., F.Z.S. ETC.

The female *Phacochœrus* died, without previous symptoms of ailment, on Wednesday, February 5th, having lived in the Menagerie of the Society ten months, during which it throve, like the male, and grew rapidly; its weight at the time of its death was 105 lbs.

The length of the body from the extremity of the jaws to the root of the tail was 3 feet 6 inches; the length of the head 1 foot; that of the tail 1 foot: this part is naked, very slender, tapering towards the end, which is subcompressed, a little dilated, and ornamented with a tuft of long and slender black bristles, growing chiefly from the opposite margins, as in the Elephant. A layer of lard or fat adhered to the under surface of the corium, as in the Common Hog, preventing the movement of the skin by a panniculus carnosus.

The hair is of one kind, coarse, scanty, and moderately long; the bulb of each is imbedded in a flattened whitish body, about 3 lines broad. The cuticle is impressed by curved lines, giving it the appearance of being composed of imbricated scales from 3 to 4 lines in breadth. There is a strong callosity in front of each carpus, formed by, or connected with, the frequent habit of this animal of walking on its fore-knees. The suborbital wart-like appendage, situated $1\frac{1}{2}$ inch below the eye, is composed of a mass of fibrous and adipose tissue. A double row of strong cilia project from the upper eyelid; but there are none on the lower lid. There is a broad 'membrana nictitans.' An arch of long black hairs forms an eyebrow. The upper lip is bent upwards, or folded over the base of the upper tusk, and many short hairs grow from the thickened margin of this fold. There is a slightly curved callous ridge of the integument, 5 inches in length, parallel with the middle of the lower border of the lower jaw. There are but four nipples, one pair abdominal, about an inch behind the umbilicus; the other pair inguinal.

The anus is situated about an inch below the base of the tail, is a transverse crescentic aperture, with a thick upper border. The vulva is situated about 10 lines below the anus; it is a little peaked below, and the clitoris, like a small caruncle, projects 4 lines within the margin.

There was no appearance of incisors in either jaw; but in the substance of the alveolar border of the lower jaw were four rudimental incisors, 9 lines long by 2 lines wide, which probably were never destined to come through, and are smaller than those in the Caffrarian Phacochœre, called 'Harruja,' in the British Museum. The present specimen also differed from that species in having no incisor in the upper jaw; not even the rudiment of one could be found in the substance of the premaxillary. Hence I conclude the species to be that which Van der Hoeven has characterized by the absence of incisors in both jaws, and has called *Phacochœrus Pallasii*. The exserted crown of the canine tusks was $2\frac{1}{2}$ inches long in the upper, and 2 inches long in the lower jaw. Five molars were apparent on each side the upper jaw, and four molars on each side the lower jaw. The first in each jaw was a small, obtusely rounded premolar, with three long diverging fangs above and two below, answering to p 3; the second molar in the upper jaw was a much-worn milk-tooth, m 4; the third grinder above and the second below were the first true molar, m 1, with the crown worn down nearly to the roots. The fourth grinder above and the third below were the second true molar, m 2, with a body or crown $1\frac{1}{3}$ of an inch in length before the giving off of the short bent fangs. The last tooth in both jaws was the anterior point of the third true molar just beginning to cut the gum*.

The absence of any incisors above the gum in this young animal, and the presence of four rudimental ones hidden in the lower jaw, just where they are occasionally found in old individuals of the *Phacochœrus Pallasii*, show that this hidden condition and small size are not due to age, but are specific characters.

The roof of the mouth presented about twenty-two pairs of transverse, arched, palatal ridges, with their convexities turned forwards; gradually decreasing as they were placed more backwards, and terminating opposite the end of the molar series; beyond this part the membrane of the palate was smooth and soft. The tongue is long and narrow, with small, obtuse, well-defined papillæ below its margins, with a smooth dorsum, beset with very fine gustatory papillæ for two-thirds of its extent. At the base of the tongue, 6 inches from the tip, are two large fossulate papillæ, on the same transverse line, and behind these the dorsum of the tongue is beset with numerous soft, moderately large, pointed and retroverted papillæ.

* The grinding surface of the teeth in place closely corresponded with those of the *Phacochœrus Pallasii* figured in my Memoir on the Teeth of the Wart-Hogs (Philosophical Transactions, 1840, pl. 34. fig. 8, m 1, m 2 and m 3). The present specimen shows a stage anterior to the one there figured, the last milk-tooth intervening between the first molar and the small premolar in the upper jaw. There was no trace of the germ of a p 4 above the crown of d 4 in place, whence it may be concluded that, at corresponding phases of dentition, the *Phac. Pallasii* has fewer grinders than the *Phac. Æliani*.

Two mucous sacculi, about 1 inch in diameter and $1\frac{1}{2}$ inch in depth, are produced from the upper and back part of the pharynx into the pterygoid fossæ, on each side the basisphenoid. Between the mouths of these sacculi there projects from the back part of the pharynx a glandular prominence or caruncle, about 7 lines long by 5 lines broad. At the lower and back part of the pharynx a third median sacculus is developed, just below the '*constrictores pharyngis*'; in this remarkable structure the Wart-Hog resembles the Babyrussa*. The œsophagus commences between this sacculus behind and two large post-arytenoid sacculi in front, and is divided from both by a transverse membranous ridge or wall. The long ligamentous crura of the epiglottis are continued from the sides and back part of the post-arytenoid sacculi to that cartilage, which is unusually distant from the larynx. The convex border of the broad epiglottis projects into the posterior nostril. The œsophagus descends behind the trachea to the thorax, and in the posterior mediastinum it is suspended by a fold of the pleura, about $1\frac{1}{2}$ inch broad, which attaches the tube to the descending aorta, after it has passed through the arch.

The stomach is of small size and simple shape; its length in a straight line is 9 inches; following its greater curvature 1 foot 7 inches; the lesser curvature, or the distance from the cardia to the pylorus, being only 3 inches. The left end extends about $3\frac{1}{2}$ inches beyond the cardia, and the right end projects about 2 inches to the right of the pylorus. It presents the usual form of the simple stomach, but the cardiac blind end is marked off by a slight constriction, hardly, however, to the same degree as in the Common Hog; and far from presenting the complexity of the stomach in the Babyrussa. The great omentum is continued from behind the great curvature, and was folded or crumpled up behind and beneath the stomach, enclosing the spleen, which was to the left and a little behind the great end of the stomach. No part of the omentum was visible when the abdominal cavity was exposed, and but little of the stomach could be seen. Almost the only viscera that presented themselves were the large spiral coils of the colon, closely united together by mesocolic bands laden with fat, about an inch in breadth. The cæcum was in the left lumbar region. The stomach extended from the left hypochondrium across the epigastric to the right hypochondriac regions. The liver extended from the right hypochondrium to the left, but did not cover all the great end of the stomach. The small intestines lay concealed behind the colon.

The œsophagus, which is 2 inches in circumference at its termination in the stomach, opens nearer the posterior than the anterior surface of the lesser curvature, $3\frac{1}{2}$ inches from the left end, which forms a prominence above the concavity leading to it from the gullet.

The œsophageal epithelium is continued a little way on the inner surface of the stomach, forming a thin, narrow, oval patch, extending $1\frac{1}{2}$ inch to the left of the cardia, $\frac{2}{3}$rds of an inch to the right and

* See Prof. Vrolik's excellent memoir on that animal, 'Recherches d'Anatomie comparée sur le Babyrussa,' 4to, p. 30, pl. 3.

back part of the cardia, and $\frac{1}{3}$rd of an inch to the front of the cardia. The rest of the stomach is lined by the usual gastric vascular membrane, which in the distended state shows one or two short and very narrow, straight rugæ, and is smooth in the rest of its extent, except near the commencement of the short and narrow canal leading to the pylorus, where a number of longitudinal rugæ converge. The muscular coat of the stomach is 2 lines in thickness at the cardia, where its texture is unusually firm; it diminishes in thickness to 1 line after a course of 2 inches from the cardia, and is less than half a line thick over the great dilated portion of the stomach. It resumes its thickness of 2 lines at the narrow pyloric portion. A few longitudinal rugæ radiate from the cardia a little way upon the epithelial part, but there is no valvular apparatus there.

The form of the pylorus is crescentic, bounded below by an arched protuberance, receiving in its concavity a single longitudinal protuberance from the upper side.

The bile-tube (*ductus choledochus*) opens on a mammillary eminence half an inch from the pylorus.

The duodenum, which is about 1 inch in diameter at its commencement, where it receives the ductus choledochus and pancreatic duct, contracts to a diameter of $\frac{2}{3}$rds of an inch as it bends down in front of the right kidney, suspended by a narrow mesentery; it then crosses the first lumbar vertebra, and becomes attached to the back of the ascending colon; there it ascends a little way, bending obliquely round the colon, and becomes suspended, as jejunum, upon the proper mesentery. The jejunum and ilium lie in close coils suspended by the narrow mesentery, which is loaded with fat, terminating next the intestine in lobes which project as a free border on each side the junction of the mesentery to the gut. The mesenteric vessels pass straight through this fat, without forming anastomotic arches. The mesenteric glands are arranged in a semicircle about the root of the mesentery. The small intestines preserve a pretty uniform diameter until near the end of the ilium, which gradually contracts to a diameter of about half an inch. The length of the small intestine is from 18 to 20 feet, or about five times the length of the body; which is proportionally one-half the length of the small intestines of the domestic Hog. The ilium passes near its termination from the right to the left lumbar region, and ascends to terminate in the cæcum, to which it is attached by a duplicature of the peritoneum. The cæcum was situated in the advanced part of the left lumbar region. It was $3\frac{1}{2}$ inches in length, and about $2\frac{1}{2}$ in diameter, with an obtuse rounded end; its parietes were slightly puckered or sacculated on two longitudinal bands, about 4 lines in breadth, a third band commencing near the entry of the ilium; its circumference is 7 inches. It is divided by a constricted neck, $3\frac{1}{2}$ inches in circumference and $1\frac{1}{2}$ inch in length, from the colon, and this contracted part was sacculated only on one side, the other side being smooth, with a strong coat of longitudinal fibres external to the circular ones. At this part the ilium, cæcum and beginning of the colon are attached by a strong mesentery to the spine: the colon ascends in front of the left kidney to the great curvature of the stomach, and bends over to the right side in front of the epiploon, and descending describes a large spiral curve, then a second, third and fourth, progressively diminishing in extent; the last and innermost is folded upon itself, and repeats two spiral coils in the opposite direction, the extent of these increasing; and the gut, quitting the mass of closely connected coils, passes backwards, and bends round the root of the mesentery, adhering to that part and to the pancreas above, then descends in front of the duodenum, much diminished in size, and getting to the back of the lumbar region becomes the rectum, and is continued, tightly bound to the sacrum, behind the genital organs and bladder to the vent. The coils of the colon, which are the first viscera that present themselves, and conceal almost all the others in the abdomen, are attached to one another by bands of mesocolon of about an inch in breadth; and these were laden with lobes of fat. There were many small, dark-coloured glands at the root of the mesocolon, from which straight blood-vessels radiated in groups of from four to eight or ten. The colon, where it forms the first series of coils, is 10 inches in circumference, and is slightly sacculated on two longitudinal bands. The sacculi subside with a slight diminution of diameter in the returning coils.

The length of the 'large intestines' was 13 feet 6 inches, or nearly four times the length of the entire animal.

The mucous membrane of the small intestines is produced in the duodenum into four or five narrow longitudinal folds, which in the jejunum are six or seven in number, and are here or there connected together by oblique folds. Towards the middle of the jejunum these folds disappear, and then reappear at intervals progressively increasing; and in the ilium the mucous lining is even and simply villous. In the partial or interrupted extents of the plicated structure, the rugæ are more reticulate in their arrangement. The lining membrane of the colon was smooth and even, but gorged with blood, and varied in many parts from a deep vinous to an almost black colour. The lining membrane of the rectum was disposed in numerous fine longitudinal rugæ. The small intestines contained only mucus; the large intestines a dark fluid matter of the usual fæcal odour, with one or two masses of hard fæces, about the size and shape of a pullet's egg.

The liver weighed 2 lbs. 4 oz.; it consisted of three principal lobes, viz. a right, middle and left; the right is the largest, and is partially subdivided at its free extremity, which is closely connected with the right supra-renal body and the summit of the right kidney. The middle lobe is bifid, a gall-bladder 4 inches long by $1\frac{1}{2}$ inch broad being lodged in the cleft; a small 'lobulus Spigelii' projects near the neck of the gall-bladder. The left lobe of the liver terminates on the left side, about 3 inches from the cardiac end of the stomach. The hepatic duct joins the cystic after a course of an inch; the 'ductus communis' is about the same length, and has a width of 3 lines at its termination, which is at the upper part of the beginning of the duodenum.

The pancreas is a long flattened band, from an inch to an inch and a half in breadth, extending in two directions from the beginning of the duodenum, where its duct terminates. One portion follows the first part of the curvature of the duodenum to the extent of 6 inches; the other and chief part of the gland passes from the pylorus behind the stomach to the spleen, and is 7 inches in length.

The spleen is a long, flattened, ellipsoid body, about 11 inches in length and $2\frac{1}{2}$ inches across its broadest part at the middle. It weighed 3 oz.

The kidneys together weighed $6\frac{1}{2}$ oz.; they are not cleft or lobulated, and are situated symmetrically at the back of the hypochondria. The supra-renal bodies are of an elongate, subcylindrical shape.

The heart is a somewhat flattened cone, with a produced pointed apex formed by the left ventricle. The pericardium adheres to the sternum; it was covered with much fat. There is a large pleural sac between the pericardium and the diaphragm, which contains the azygous lobe of the lung, the long intra-thoracic inferior cava, the œsophagus and descending aorta.

The right lung is divided into three lobes and the 'lobulus azygos'; the left lung into two lobes, the upper and smaller lobe being slightly subdivided. The tracheal rings overlap each other behind. The thymus gland extended from the fore-part of the pericardium into the neck. The thyroid gland consists of one elongate, narrow lobe, concave where it is applied to the fore-part of the trachea, convex where it is covered by the 'sterno-thyroidei'; it is about 2 inches in length and 8 lines wide. The thyroid cartilage is of unusual length, shaped like the side or section of a vase, convex outwards at its lower half, and concave above, by the bending outwards of its broad upper margin; its length is $2\frac{1}{2}$ inches, its breadth $1\frac{1}{2}$ inch. The arytenoid cartilages are still more unusual in their conformation; they are very long, curved backwards, and confluent at their apices; on each side of this prolonged confluent point they are deeply cleft, so as to form two lateral pointed processes or appendages. A fold of membrane is continued from each lateral appendix outwards to the ligamentous crura of the epiglottis; these folds form the outer walls of two large post-arytenoid sacculi, which intervene between the larynx and pharynx. A median fold of membrane is continued backwards from the middle line and confluent apices of the arytenoids, and forms the septum between the post-arytenoid sacculi. The mucous membrane of the larynx is continued from the anterior and upper border of the thyroid forwards and upwards into the concavity of the basihyal, forming a wide but not very deep anterior sacculus.

The brain weighed $3\frac{1}{2}$ oz.

Female Organs.—The ovarium, 9 lines long, 6 broad and 4 thick, is kidney-shaped, and is suspended by the middle of the concave border by a short, thick peduncle, to which is attached the commencement of the ostium abdominale of the oviduct; this orifice is not fimbriated, but has some delicate wrinkled processes on its inner surface. The peritoneal fold continued from this part to the end of the cornu uteri, and which approximates it thereto, forms one side of the opening of a wide ovarian pouch, upon the outer and fore-part of which the oviduct describes its convolutions in its course towards the uterus. The stroma ovarii contained at its periphery a few advancing ovisacs about a line in diameter.

Each cornu uteri is about 1 foot 4 inches in length, and of a nearly uniform circumference of 2 inches. It is beset with narrow, wrinkled, oblique, irregular rugæ, forming longitudinal elevations as they approach the body of the uterus, and again becoming oblique—patches of the rugous surfaces alternating with smooth patches.

The common uterus presents large, longitudinal, wrinkled rugæ for the first inch of its extent, and then a spiral valve begins to be formed, about 2 lines in thickness, which describes thirteen close coils before subsiding in the common vagina; the length of the spiral portion, which may be compared to the 'cervix uteri,' is $3\frac{1}{2}$ inches; the length of the vagina is 4 inches. The rugæ of the vagina are longitudinal, and longer at its beginning and end, where they terminate on a well-defined circular fold, dividing the vagina from the urogenital canal, and constricting the orifice; the free borders of the spiral valve are beset by free, fine, longitudinal folds of the lining membrane of the uterus.

The urethra is about 3 inches in length, and becomes closely connected with the vagina 2 inches before it terminates. Its orifice is defended by two longitudinal folds.

In comparison with the Common Hog, the Wart-Hog, as regards its internal anatomy, differs in the more simple form of the stomach, the relatively shorter small intestines, and the relatively longer large ones; but, like the Common Hog, the cæcum is small, and the colon disposed in spiral coils, in both which characters they resemble the Ruminants; the cæcum is broader in proportion to its length than in the Common Hog. In both the Common Hog and Wart-Hog the intestinal canal is more tied down by the fat-laden processes of peritoneum, and appears to have less motion allowed it, than in other quadrupeds. The liver and gall-bladder, the kidneys and the thoracic viscera, much resemble those of the Common Hog. The inner surface of the jejunum shows a reticulate disposition of rugæ in the Common Hog, but not the regular longitudinal folds in the duodenum and beginning of the jejunum, as in the Wart-Hog.

The epiglottis passes into the posterior nares in both the Wart-Hog and Common Hog, and has the hyo-epiglottidei muscles; but the pharynx in the Common Hog does not present the superadded sacculi, nor the larynx those peculiarities which distinguish the Wart-Hogs. These resemble the Babyrussa in the sacculated structure of the pharynx, but differ in the more simple stomach. The Wart-Hog differs from the Common Hog in the smaller size and more simple form of the ovaria, and the fewer mammæ. The most marked difference from all other *Suidæ*, and that which best justifies the generic separation, is presented by the dentition of the *Phacochœrus*; the modifications of the alimentary canal are not of the same degree.

March 11, 1851.—J. E. Gray, Esq., F.R.S., in the Chair.

The following paper was read:—

A FEW WORDS ON THE SYNONYMY OF DISTICHOCERA, A GENUS OF LONGICORN COLEOPTERA FROM NEW HOLLAND, WITH CHARACTERS OF THREE SPECIES SUPPOSED TO BE UNDESCRIBED. BY EDWARD NEWMAN, F.L.S. ETC.

Among the invaluable labours of the late Mr. Kirby, none are more useful to the general entomologist than his lucid and masterly descriptions of new and remarkable forms of exotic Coleoptera; and of these, none afford to myself so much instruction and pleasure as that entitled "A Description of several New Insects collected in New Holland by Robert Brown, Esq.," and published in the twelfth volume of the 'Linnæan Transactions.' In this admirable paper is the first description I can find of the extraordinary genus *Distichocera*, although, as Mr. Kirby himself informs us, it was known long previously under the same name, and although he himself gives it as "*Distichocera* of MacLeay," a name which I am inclined to conclude existed in manuscript only. Concerning the genus in question I lay no claim to any additional knowledge of the structure, habits or affinities of the insect described by Mr. Kirby; but the labours of collectors, amid the seemingly inexhaustible riches of our Australian colonies, have placed within my reach a greater number and greater variety of specimens. Mr. Kirby has only made us acquainted with a single species, and a single sex of that species. Mr. MacLeay has added a second, which has also been described by Guérin, Boisduval and myself under a variety of names. Three other forms of the genus have occurred to me, making the number five in all. Of these, three are certainly females, and two as certainly males. The object of this communication is to express my views as to associating the sexes, and to make known two supposed species which were previously uncharacterized.

Genus DISTICHOCERA, MacLeay (MSS.?).

Distichocera, Kirby, Trans. Linn. Soc. xii. 471.

"Labrum transversum, tetragonum. Labium membranaceum apice bilobum: lobis divaricatis. Mandibulæ trigonæ, edentulæ apice incurvæ acutæ. Maxillæ basi trigonæ, apertæ. Palpi filiformes. Mentum transversum, trapeziforme. Antennæ sensim crassiores, disticho-ramosæ."—*Kirby, l. c.*

1. DISTICHOCERA MACULICOLLIS.

Mas. *Distichocera maculicollis*, Kirby, l. c.
Distichocera maculicollis, Audinet Serville, Ann. Ent. Soc. Fr. iii. 59.
Distichocera maculicollis, Boisduval, Faune de l'Océanie.

"Corpus fere cuneiforme, subtus pilis argenteis nitidum, supra nigrum, obscurum. Caput subcordatum, pilosum, canaliculatum utrinque ante antennas carinatum. Oculi brunnei. Antennæ breviores, nigræ: articulis omnibus apice biramosis (duobus primis brevissime); ramis oppositis compressis vertice rotundatis sinistris paulo longioribus, articulo extimo simplici clavato. Thorax subcylindricus: maculis quatuor dorsalibus quadratim ordinatis. Elytra cuneiformia: lineis tribus longitudinalibus elevatis: striga apud scutellum et alia majori in medio apud suturam piloso-argenteis, apice truncata. Femora brunnea. Tibiæ bicalcaratæ. Alæ elytris longiores."—*Kirby, l. c.*

Fem. *Distichocera rubripennis*, MacLeay, App. King's Voyage.

"Rufo-testacea subtomentosa, capitis lateribus oreque nigris, vertice canaliculato, antennis nigris, articulis vix biramosis, ramis sinistris brevissimis; thorace atro, vittâ utrinque rufo-testaceâ, scutello nigro, elytris rufo-testaceis tomentosis apice obtusis dehiscentibus; corpore cuneiformi subtus villo argenteo micante, abdomine utrinque nigro maculato, pedibus nigris."—*MacLeay, l. c.*

Distichocera ferruginea, Guérin, Voyage de la Coquille.

Distichocera ferruginea, Boisduval, Faune de l'Océanie, 467.

"Nigra; capite maculâ frontali, thorace vittis duabus elytrisque dense villoso-fulvis."—*Boisduval, l. c.*

Distichocera fulvipennis, Newman, Ent. Mag. v. 492.

"Antennæ nigræ; caput nigrum, fronte fulvo: prothorax niger, lineis 2 dorsalibus, longitudinalibus, latis, fulvis: scutellum nigrum: elytra fulva: abdomen piceum, lanugine argentea vestitum: pedes picei. (Corp. long. 9 unc.; lat. 3 unc.)"—*Newman, l. c.*

I have cited entire the original specific characters in every instance, in order to save the reader the trouble of making the references. I will now proceed to give more detailed characters.

Male.—Head somewhat cordate, black, velvety, having a slight epicranial sulcus, which is prolonged anteriorly between the bases of the antennæ: face slightly inclined, rather long: eyes arcuate, reniform, pitchy brown, large, approaching on the epicranium, somewhat dilated on the cheeks: antennæ as long as the body, 12-jointed, black; the first joint short, stout, somewhat obconical; the second very short; the following, to the eleventh inclusive, moderately short, still much longer than the second, somewhat cyathiform as regards the shaft, and emitting from its apex two long branches; these increase in length from the first pair, and those on one side of each antenna are uniformly longer than those on the other; this discrepancy is particularly observable in the third (or first branched) joint; the twelfth joint is club-shaped and undivided; it is longer than either of the others, yet scarcely exceeds in length the branches of the eleventh. Prothorax subquadrate, its anterior and posterior margins nearly equal, its lateral margins somewhat uneven, but not produced into a central tooth; pronotum somewhat uneven, black, with four greyish spots, which are due to a grey velvety pilosity; the two smaller of these touch the anterior, the two larger the posterior margin, and appear as though forming parts of two vittæ, each of which is interrupted in the middle; prosternum produced between the procoxæ and there deeply notched, pitchy red, and clothed with a grey pilosity. Scutellum rounded, black, and glabrous. Elytra black, broad at the base, gradually tapering to the apex, where they are slightly divaricate, truncate, and furnished with a small obtuse and obscure tooth in the middle as well as at each angle of the truncature: each elytron has three carinæ; the first is prominent, originates near the base, and curves towards the suture but without reaching it, terminating in the apical area; the second originates on the disk considerably below the humeral angle, and running parallel with the first, unites therewith in the apical area; the third is nearly obsolete; it is situate on the apical half of the elytron, between the second carina and the costal margin; the costal margin is pitchy red, and clothed with a grey pubescence: the wings are fuliginous, slightly longer than the elytra, and unfolded: the legs are rather long; the metatibiæ slightly incurved, and furnished with two apical spines: the under surface of the thoracic and abdominal segments is of a pitchy red colour, clothed with a sparse grey pubescence; the legs are of a similar colour, but the pubescence is scarcely observable.

Fem.—Head somewhat cordate, black, velvety, with a large fulvous spot occupying the face and extending to the epicranium between the eyes, but not reaching the anterior margin of the prothorax; a deep longitudinal epicranial sulcus extends forwards to between the bases of the antennæ: eyes arcuate, reniform, pitchy black: antennæ more than half the length of the body, 11-jointed; the first joint rather short, somewhat obconical; the second very short; the third the longest, but still not disproportionately so, dilated at the apex; the fourth and fifth of the same form, but shorter; the remainder, to the eleventh, slender at the base, but dilated and somewhat cupshaped at the apex, receiving into the cup the base of the next succeeding joint, and being produced into a strong obtuse lobe, tooth, or serrature on one side; this is very conspicuous, and gives the antenna a subserrated appearance; on the opposite side is a very slight, scarcely perceptible indication of a like lobe; the eleventh joint is sesquialterous. Prothorax nearly equal in length and breadth, the anterior narrower than the posterior margin, the lateral margins uneven and slightly lobed in the middle; pronotum uneven, with a slightly impressed anterior and posterior submarginal transverse sulcus, velvety black, with two broad irregular longitudinal vittæ of a bright fulvous orange colour; prosternum produced between the procoxæ, and the process notched. Scutellum short, rounded, black, shining. Elytra at the base much wider than the prothorax, gradually narrowing to the apex, where they are slightly dehiscent, truncated, and the truncature produced in the middle into an obtuse, scarcely perceptible tooth; each elytron has three carinæ; the first is prominent, originating near the base, and curves very gradually towards the suture without reaching it, terminating in the apical area; the second is indistinct, originates near the humeral angle, and running parallel with the first, ceases in the apical area; the third is still less distinct, and its limits are obscure; at both extremities a junction between the first and second carinæ may be made out, but is not very manifest: the wings are fuliginous, slightly longer than the elytra, but scarcely so long as the abdomen; the entire under-surface is pitchy red clothed with a silvery grey pubescence, but there is an ovoid denuded space on each side of each abdominal segment. Legs pitchy red; tarsi pitchy black; metatibiæ with two apical spines.

Obs.—I believe that no author has hinted at the union of these very dissimilar insects under one specific name, but I think such a proceeding will be borne out by the evidence. In the first place I would observe that both forms are equally abundant; that they occur in the same situations and at the same season; that collectors have several times reported them as only sexually different; and finally, that all the individuals of *maculicollis* are males, and all the individuals of *fulvipennis* females. Then, as regards structure, the cibarian organs of the two forms closely approximate; so also does the direction and general figure of the head; the antennæ indeed are remarkably different, but this discrepancy obtains equally in several genera of longicorns and in many other groups of Coleoptera, the males invariably possessing in such instances the longer, more compound and more ornate antennæ. The discrepancy in the prothorax, which at first is very striking, will be found more in appearance than in fact, and more in colour than in figure; and even in colour an analogy exists that would be likely to escape the superficial observer; the two fulvous vittæ so conspicuous in *fulvipennis* appear divided, paler, and semi-obsolete in *maculicollis,* and the difference in the figure of this part is in simple accordance with the more robust habit in the supposed female: the discrepancy in the elytra again is considerable as regards width, and particularly striking as regards colour; but their structure is normally the same; the number, direction and comparative length of the carinæ being identical: the legs are precisely alike in the two forms in structure, proportions, size and colouring. So that the reasons for uniting the forms under one specific name are stronger than any that can be urged for keeping them distinct; and their not having been united by Kirby, MacLeay, Guérin, or Boisduval, merely implies that the idea did not occur to those distinguished entomologists: there is no evidence that they maturely weighed and then rejected the conclusion.

2. Distichocera par. *Sexuum amborum color par: testaceo-fusca, maris capite prothoracisque disco saturatioribus; omninò pilis cinereis obsita.*

Maris long. corp. ·525 unc.; elytrorum lat. max. ·2 unc.

Feminæ long. corp. ·7 unc.; elytrorum lat. max. ·225 unc.

Male.—Antennæ, anterior margin of prothorax, elytra, legs, and entire under-surface testaceous brown, the head and disk of the prothorax being darker; a longitudinal, narrow, silvery spot, due to the presence of a velvety pilosity, is observable in the centre of each elytron; every part of the body is more or less thickly beset with a grey pilosity.

Female.—Almost exactly resembling the male, but the prothoracic disk is not darker than the elytra, and there is no silvery mark in their centre.

In both sexes the carination of the elytra follows that of *D. maculicollis*, but is less pronounced.

Compared with *D. maculicollis* both sexes of this species are of smaller size, and the discrepancy in breadth is rather more obvious than in length; the antennæ of the males are very similar, but the apical joint is more clavate in *par*; their colour is decidedly different, in *maculicollis* being black, in *par* testaceous, with the apices of the ramuli slightly darker; the prothorax is more rounded at the sides in *par* than in the older species; but the plainness and purity of colour in *par* are sufficient at once to distinguish it.

Male and female in the cabinet of Mr. Scott, to whom I am indebted for the opportunity of describing it.

3. Distichocera Kirbyi.

Mas. *Caput nigrum, longitudinaliter sulcatum, antennæ dimidio corporis longiores,* 11-*articulatæ, articulis* 3–10 *biramosis,* 11*o sesquialtero : prothorax niger vittis* 2 *latis fulvis, dorso inæqualis lateribus medio* 1-*dentatus : scutellum nigrum : elytra fulva,* 5-*carinata, apice dehiscentia, singulo truncato, truncaturâ bisinuatâ : pedes nigri.*

Corp. long. 1·15 unc.; elytrorum lat. max. ·3 unc.

Fem. *Caput nigrum, longitudinaliter sulcatum, antennæ dimidio corporis vix longiores,* 11-*articulatæ articulis* 4–8 *apice emarginatis : prothorax niger vittis* 2 *latis fulvis, lateribus medio* 1-*dentatus : scutellum nigrum lateribus fulvum : elytra fulva* 5-*carinata apice dehiscentia, singulo truncato, truncaturâ bisinuatâ, pedes nigri.*

Corp. long. 1·25 unc.; elytrorum lat. max. ·375 unc.

Male.—Head black, with the exception of a scarcely perceptible fulvescent tinge on the short velvety down of the epicranium; a deep epicranial longitudinal sulcus extends forwards between the antennæ: eyes arcuate, reniform, pitchy black, large, approaching on the epicranium, dilated and gibbose on the cheeks: antennæ more than half the length of the body, 11-jointed; the first joint rather short, stout, somewhat in the common shape of a reversed cone; the second joint very short; the following, to the tenth inclusive, short, somewhat cup-shaped towards the base, and emitting at the apex two long branches, which are slightly incrassated externally; the eleventh joint is much longer than either, slender towards the base, somewhat club-shaped and very decidedly sesquialterous: prothorax uneven on the back, somewhat restricted just behind the anterior margin; lateral margins produced in the middle into a decided strong but obtuse tooth; the posterior half of each lateral margin concave, yet the anterior and posterior margins are straight and nearly equal in breadth; the colour of the prothorax is black, with the exception of two broad fulvous irregular vittæ extending from the anterior to the posterior margin: prosternum black, shining, projecting between the anterior coxæ, and the projection deeply emarginate: scutellum rather long, blunt at the apex, perfectly black: elytra fulvous, slightly divaricating, conspicuously carinated, truncate at the apex, and the truncature sinuate carinated; the carinæ five discoidal, one costal and one sutural; the first discoidal originates at the base, and nearly runs into the sutural at about one-third of its length; the second unites with the first at the base and runs into the apical area of the wing; the third originates at the base and runs into the apical area; the fourth originates in the humeral angle, dividing at one-third of its length, and the two branches counting as two carinæ, there uniting with the two previously described in a confused manner in the apical area: the wings are fuliginous, slightly longer than the elytra, and scarcely folded at the tip: the abdomen and legs are black, the latter of moderate size and proportion: the metatibiæ are armed with two spurs.

Fem.—Head black, with the exception of a fulvescent tinge on the short velvety down of the epicranium: eyes reniform, or almost arcuate, ferruginous (probably by accident): antennæ rather more than half as long as the body and moderately stout, 11-jointed; the first joint moderately long; the second very short; the third about equal in length to the first, and together with the fourth, fifth, sixth, seventh and eighth inclusive, deeply notched at the apex, and receiving the base of the next preceding joint in the notch: prothorax uneven on the back, somewhat curved anteriorly, and the anterior half of each lateral margin uniting therewith in producing a somewhat semicircular outline; the posterior half of each lateral margin is concave, and a strong but obtuse central tooth is produced on each side at the point of union of the convex and concave portions of the margin; the posterior margin is nearly straight; the colour is velvety black, with two broad fulvous vittæ, extending from the anterior to the posterior margin: prosternum black, thickly sprinkled with a grey pilosity, projecting somewhat between the procoxæ, and the projection emarginate: scutellum rather long, rounded at the apex, velvety black with fulvous margins: elytra bright fulvous, conspicuously carinated, slightly divaricating, truncate at the apex, and the truncatures sinuate: the carinæ on each elytron are five in number, and are thus disposed; the first is near the suture and parallel therewith for rather more than a third of its length; it unites with the second at the base, and this runs into the apical area and there joins the third; the third originates at the base, exceeds the second slightly in length, and joins the fourth in the apical area; the fourth originates near the humeral angle and divides at about a third of its length; both branches proceed to the apical area, and there unite with the second and third: wings fuliginous, exceeding the elytra in length, and scarcely folded at the tip: legs black.

Hab. Australia. I have seen but a single specimen of the male, which is in the Cabinet of the Zoological Society, and one of the female, in the Cabinet of the British Museum.

4. Distichocera MacLeayii.

Fem. *Caput nigrum, fronte ferrugineâ, longitudinaliter sulcatum: antennæ desunt: prothorax ferrugineo-lanuginosus, lateribus bi-*

tuberculatus, haud dentatus: scutellum ferrugineo-lanuginosum lateribus nigrum, glabrum: elytra ferruginea 5-carinata apice vix dehiscentia vix truncata: pedes nigri.

Corp. long. 1·35 unc.; elytrorum lat. max. 5 unc.

Fem.—Head, including the eyes, black; the face clothed with ferruginous down; epicranium impressed with a longitudinal sulcus, which is very deep between the eyes; the eyes are moderately large and reniform, the lower or cheek lobe being the largest; the face has a large and deep depression occupying the basal or upper portion of the clypeus; the first and second joints of the antennæ alone are present: prothorax black, clothed with ferruginous down, without any trace of that central black velvety vitta which obtains in the females of other described species; the anterior portion of the prothorax is smooth and somewhat ring-like; the rest of the dorsal surface uneven and tuberculated on each side; it has two obtuse tubercles: prosternum produced between the procoxæ into two short incurved, backward-directed processes which approximate at their apices, leaving an aperture through which the point of a needle may be passed: scutellum semicircular, clothed with ferruginous, with the exception of the margin, which is glabrous: elytra ferruginous and clothed with ferruginous down, wide at the base, narrowing to the apex and then truncate, the angles of the truncature being obtuse; the elytra are carinated, each having five carinæ; the first is very short and nearly obtuse; it commences near the scutellum and ceases before it has reached a third of the length of the elytron; the second and third commence near the base of the wing and unite in the apical area; the third and fourth commence almost together just below the humeral angle, and unite in the apical area; the two pairs are also united, and below their union several other raised anastomosing lines form a kind of network: the abdomen and legs are black, with a short hairy pubescence; metatibiæ with two distinct apical spines.

Hab. Australia. A single specimen of the female, taken by Mr. Ince, R.N., in that gentleman's cabinet.

MISCELLANEOUS.

Notice of a Binocular Microscope. By J. L. Riddell.

I devised last year, and have lately constructed and used, a combination of glass prisms, to render both eyes simultaneously serviceable in microscopic observation.

Behind the objective, and as near thereto as practicable, the light is equally divided and bent at right angles, and made to travel in opposite directions, by means of two rectangular prisms, which are in contact by their edges somewhat ground away. The reflected rays are received at a proper distance for binocular vision, upon two other rectangular prisms, and again bent at right angles; being thus either completely inverted, for an inverted microscope; or restored to their first direction, for the direct microscope. These outer prisms may be cemented to the inner, by Canada balsam; or left free, to admit of adjustment to suit different observers. Prisms of other form, with due arrangement, may be substituted.

I find the method is applicable with equal advantage to every grade of good lens, from Spencer's best sixteenth, to a common three-inch magnifier; with or without oculars or erecting eye-pieces; and with a great enhancement of penetrating and defining power. It gives the observer perfectly correct views, in length, breadth and *depth*, whatever power he may employ. Objects are seen holding their true relative positions and wearing their real shapes. A curious exception must be made. In viewing opake solid bodies, with one eye-piece to each eye, depression appears as elevation, and elevation as depression, forming a singular illusion. For instance, a metal spherule appears as a glass ball silvered on the under side; and a crystal of galena, like an empty box. By the additional use of erecting eye-pieces, the images all become normal and natural. Match drawings of any solid object, made from each eye-piece, by the aid of the camera lucida, when properly placed in the common stereoscope, appear to stand out in natural relief. These, if engraved and printed in the proper position with respect to each other, might find an appropriate place in books on the arts and sciences.

In constructing binocular eye-glasses, I use, for lightness and economy, four pieces of common looking-glass, instead of prisms.

With these instruments, the microscopic dissecting knife can be exactly guided. The watch-maker and artist can work under the binocular eye-glass, with certainty and satisfaction. In looking at microscopic animal tissues, the single eye may perhaps behold a confused amorphous or nebulous mass, which the pair of eyes instantly shapes into delicate superimposed membranes, with intervening spaces, the thickness of which can be correctly estimated. Blood-corpuscles, usually seen as flat disks, loom out as oblate spheroids. In brief, the whole microscopic world, as thus displayed, acquires a tenfold greater interest, in every phase exhibiting, in a new light, beauty and symmetry indescribable.—*Silliman's American Journal, January* 1853.

University of La., New Orleans, Oct. 1, 1852.

ON THE GENUS BIFRONTIA.

Mr. MacAndrew has lately discovered *Bifrontia Zanclæa* of Philippi, in a recent state, off the coast of Madeira, and has presented specimens of it to the British Museum. It has a high conical operculum, with a spiral ridge like the genus *Torinia* (*Solarium variegatum*, Lamk.), which supports Dr. Philippi's opinion that this genus is probably allied to *Solarium*, Moll. Sicil. ii. 225.

In the older specimens the outer whorls are separated from the others, like the fossil species of *Bifrontia* found in the Paris formation.

The animal is pellucid: and when it crawled up the glass, the shell laid on one side, so that its flat side nearly touched the glass.—J. E. Gray.

On a new Method of Illuminating Opake Objects, for the high powers of the Microscope; and on a new Achromatic Condenser. By J. L. Riddell.

The front or terminal combination of the objective is made to condense light upon the opake object, by sending rays of light from behind, through the marginal border of the lens.

To accomplish this, a circular disk of fine plate glass, say near a fourth or fifth part as thick as the diameter of the lens, is bevelled on its outer margin, by grinding and polishing to an angle of 45°. A hole is drilled through the centre of the disk, of a diameter, say two-thirds, three-fourths or four-fifths (dependent upon the angle of aperture), as great as that of the lens. The margin of this hole is also bevelled at an angle of 45°, down to a clean sharp edge. Both rings of bevels are on the same side of the glass, so that if considered as projected, the lines would cross each other at right angles.

I find no insurmountable difficulty in giving an exquisite form and finish to these disks. I mount and revolve the disk on a good rose lathe; at the same time the grinding or polishing tool is revolved by an overhead motion, the spindle carrying the tool being mounted upon a slide-rest, and admitting of a protrusive movement at an angle of 45° to the axis of the lathe.

The disk, being finished, is to be placed centrally behind the lens, the bevelled margins looking backward, and the sharp inner edge almost or quite touching the lens. Parallel rays of light being thrown upon the disk, in the direction of the axis of the objective, from below in the direct, from above in the inverted microscope, a ring of parallel rays is sent, by two successive internal reflections from the bevelled surfaces, so that, with direction reversed, the light traverses the outer margin of the objective, and by it is condensed upon the object in focus.

I tested this method of illumination in March last, sufficiently to be satisfied of its great value; more especially where the objective is of very short focal distance, and where consequently other means of illuminating opake objects cannot, on account of the nearness of the objective to the object, be resorted to.

New kind of Achromatic Condenser suggested.

A larger, thicker, similarly bevelled disk, with the bevels on opposite sides of the plate glass, and their lines of inclination coincident, would probably serve as an efficient achromatic condenser of parallel rays. By attaching centrally, on the side opposite the bevel, achromatic lenses of proper size, or a good doublet combination, a most valuable form of achromatic condenser would I think be produced, useful for general microscopic illumination. I have not yet put the plan in practice.—*Silliman's American Journal, January* 1853.

University of La., New Orleans, Oct. 4, 1852.

STRUCTURE OF THE CELLS OF PLANTS.

Physiologists are at the present day almost unanimous in their notions of the normal structure of the cells of plants. An outer membranous sac consisting at first of pure cellulose, and distinguished by no particular organic structure, lined with one or more coats, involving proteine constituents, and indicating more or less perfectly a spiral arrangement or order of growth, may be considered as conveying a tolerably clear notion of the organisms of which vegetables are in great measure composed. Some botanists have, however, doubted the simplicity of structure of the outer membrane, and instances more or less adverse to the view occur in works on botanical physiology, and in introductions to the study of vegetables; but none perhaps of greater weight than the instance so beautifully represented by Kützing, in *Schizosiphon gypsophilus*, and which has been verified by many observers of the more minute freshwater Algæ. In all such cases, however, it is doubtful whether the external membrane is not ruptured, and whether its supposed constituent threads do not really belong to a second membrane, and unfortunately chemical tests have not at present been sufficiently applied to the elucidation of the point.

The question has again very recently been mooted by the younger Agardh, who has published a small tract in quarto, printed at Lund, entitled "De Cellula Vegetabili Fibrillis tenuissimis contexta." His observations do not at all satisfy us as to the compound structure of the external membrane, and are at present too confined and imperfect to warrant the assumption of any general law; they are however so curious, and propose such an interesting field for further inquiry, that we think it almost imperative to call our readers' attention to the subject. The plants which came under his observation were principally *Conferva Melagonium*, remarkable amongst British species for the size of its articulations, though surpassed in this respect by such exotic species as *C. clavata*, together with *Griffithsia equisetifolia* and *Polysiphonia complanata*. In the first more especially he found fascicles of fibres, more or less felted with each other, passing from cell to cell, and by means of the diaphragm from the internal membrane of one cell to that of the cells in immediate contact or continuance with it, and leaving spaces between the fascicles threaded and traversed by finer fibres, with very faint and obscure traces of a connecting gelatinous or submembranous substance. These fibres were especially evident when the walls were ruptured, and appeared to be solid, without any canal. In the *Polysiphonia* he found the fibres separating from the main wall of the cells, and forming little swollen prominences, which he considered to be the commencement of new cells, and the rudiments of the cells external to the well-known radiating vesicles of the main stem.

We are unable to verify the structure represented by Agardh; but as the *Conferva* and *Griffithsia* are by no means rare, it cannot be difficult to procure fresh specimens to enable us to do so. Meanwhile, though we cannot doubt the accuracy of M. Agardh, and are ready to acknowledge our obligations to him for pointing out so curious a matter, many considerations prevent us from entertaining a notion that the structure is at all general. It is quite impossible, for instance, that in such cases as *Zygnema*, the constituent fibres of the diaphragm of continuous cells, if such exist, can pass from one into the other in the manner represented in *C. Melagonium*. A glance at Schleiden's figure, in his collected memoirs, which is very correct, will convince any one that it is almost impossible. M. Agardh, indeed, professes that he is not quite certain whether an external membrane really exists or not; and his figures and observations seem to indicate that it is really present. But even supposing his observations to have reference to a lining membrane only, they differ greatly from those of preceding observers, except in cases where an evident and easy explanation as to the apparent crossing of the constituent fibres exists, in the circumstance that he finds these fibres not simply taking a uniform spiral direction, but felted with one another in distinct fascicles, and passing from one cell to those in immediate contact with it.—M. J. B. —*Gardeners' Chronicle*, Feb. 12, 1853.

METEOROLOGICAL OBSERVATIONS FOR JAN. 1853.

Chiswick.—January 1. Densely overcast. 2. Rain. 3. Fine. 4. Boisterous, with rain. 5. Fine: exceedingly fine in forenoon: clear at night. 6. Fine: cloudy and boisterous. 7. Rain: boisterous, with constant heavy rain. 8. Fine. 9. Fine, with bright sun. 10. Rain. 11. Clear: overcast. 12. Boisterous, with heavy showers. 13. Densely clouded: very fine: clear. 14. Clear: fine: overcast. 15. Rain: clear at night. 16. Fine: rain: hazy. 17. Cloudy: clear at night. 18. Fine: clear: frosty at night. 19. Uniformly overcast: drizzly: very boisterous at night. 20. Densely clouded and boisterous: rain. 21. Hazy: cloudy: showery. 22. Cloudy: clear and cold: hurricane, without rain at night. 23. Overcast and cold: clear. 24. Overcast throughout. 25. Foggy. 26. Foggy: fine: cloudy. 27. Fine: densely clouded: rain at night. 28. Overcast: cloudy. 29. Overcast throughout. 30. Overcast: rain at night. 31. Clear and frosty: very fine, with bright sun: foggy at night.

Mean temperature of the month	40°·85
Mean temperature of Jan. 1852	39 ·66
Mean temperature of Jan. for the last twenty-seven years	36 ·90
Average amount of rain in Jan.	1·68 inch.

Boston.—Jan. 1. Cloudy. 2. Fine. 3—5. Cloudy. 6. Cloudy: rain P.M. 7. Cloudy. 8. Fine. 9. Cloudy. 10. Cloudy: rain A.M. 11, 12. Fine: rain P.M. 13, 14. Fine. 15. Rain A.M. 16. Fog: rain P.M. 17. Cloudy. 18. Fine. 19, 20. Fine: rain A.M. 21. Cloudy. 22. Fine: rain P.M. 23. Fine. 24. Cloudy: rain P.M. 25, 26. Cloudy. 27. Cloudy: rain P.M. 28, 29. Cloudy. 30, 31. Fine.

Sandwick Manse, Orkney.—Jan. 1. Clear A.M.: cloudy, lightning P.M. 2. Clear A.M.: clear, aurora, lightning P.M. 3. Cloudy A.M.: clear, aurora P.M. 4. Rain, cloudy A.M.: showers P.M. 5. Clear A.M.: sleet-showers P.M. 6. Cloudy A.M.: snowing, aurora P.M. 7. Cloudy A.M.: rainy, aurora P.M. 8. Showers A.M.: showers, aurora P.M. 9. Sleet-showers A.M.: hail, aurora P.M. 10. Showers A.M.: fine, aurora P.M. 11. Rain A.M.: rain, cloudy P.M. 12. Bright A.M.: clear, aurora P.M. 13. Bright A.M.: showers P.M. 14. Hail-showers A.M.: clear, aurora P.M. 15. Bright, frost A.M.: clear, frost P.M. 16. Frost A.M.: cloudy, frost P.M. 17. Bright, frost A.M.: clear, frost P.M. 18. Cloudy, frost A.M.: showers P.M. 19. Cloudy A.M.: showers P.M. 20. Rain A.M.: clear, large halo P.M. 21. Cloudy A.M.: showers P.M. 22. Showers A.M.: hail-showers P.M. 23. Clear, frost A.M.: fine, clear P.M. 24. Clear, frost A.M.: frost, clear P.M. 25. Bright A.M.: clear P.M. 26. Showers A.M.: frost, clear P.M. 27. Bright A.M.: clear P.M. 28. Clear A.M. and P.M. 29. Bright A.M.: rain P.M. 30. Rain A.M.: showers, aurora P.M. 31. Bright A.M.: fine P.M.

Mean temperature of Jan. for twenty-six previous years	38°·60
Mean temperature of this month	38 ·55
Average quantity of rain in Jan. for seven years previous	4·21 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse*, Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston.	Orkney, Sandwick.		Chiswick.		Boston.	Orkney, Sandwick.		Chiswick.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1853. Jan.	Max.	Min.	8½ a.m.	9¼ a.m.	8½ p.m.	Max.	Min.	8½ a.m.	9¼ a.m.	8½ p.m.	1 p.m.					
1.	30.039	29.898	29.60	29.44	29.37	52	47	46	40½	42½	sw.	sw.	sw.	.03	....	.11
☾ 2.	29.863	29.703	29.36	29.29	29.46	51	44	44	41	36½	sw.	s.	se.	.18	....	....
3.	29.798	29.663	29.28	29.09	29.26	49	30	45	41	39	w.	wsw.	ssw.	....	....	.11
4.	29.657	29.463	29.24	28.77	28.98	52	38	45	50½	44	sw.	wsw.	w.	.12	....	.43
5.	29.716	29.629	29.18	28.98	29.18	52	30	46	39	39½	sw.	ssw.	ssw.	.01	....	....
6.	29.656	29.481	29.22	29.27	29.02	49	32	39	37	37	sw.	ssw.	w.	.16	....	.06
7.	29.456	29.136	28.92	28.87	28.77	53	30	40	38½	39	sw.	s.	w.	.34	.20	.30
8.	29.527	29.404	29.09	28.82	28.86	49	32	35	36	38	se.	ssw.	ssw.	....	....	.40
● 9.	29.740	29.680	29.30	28.89	29.24	50	35	34	40	41	w.	ssw.	w.	.01	....	.31
10.	29.664	29.300	29.28	29.36	29.22	51	42	41	40	35	s.	s.	e.	.06	....	.37
11.	29.662	29.473	29.00	28.75	28.82	51	42	42.5	42	42	sw.	ssw.	ssw.	.02	.15	.28
12.	29.568	29.412	29.10	29.10	29.11	53	38	45	42	37	sw.	ssw.	sw.	.24	.13	.37
13.	29.454	29.382	29.94	29.13	29.33	48	35	38	35	38	sw.	wsw.	calm	....	.12	....
14.	29.776	29.672	29.33	29.63	29.73	47	34	35	38	31	w.	wsw.	calm	.04	....	.38
15.	29.406	29.393	28.97	29.48	29.49	47	31	40	35	33	sw.	s.	e.	.12	....	.04
16.	29.392	28.996	29.03	29.42	29.43	45	33	33	35½	34	s.	calm	se.	.28	.12	....
☽ 17.	29.540	29.157	28.90	29.52	29.66	42	34	36	32	31	nw.	nw.	s.	....	.40	....
18.	29.943	29.762	29.52	29.63	29.44	44	26	32.5	37	40	n.	nw.	sse.	.08	....	....
19.	29.957	29.799	29.60	29.48	28.87	54	47	37	39	49	sw.	ssw.	s.	.05	.05	.10
20.	29.714	29.569	29.12	28.74	29.39	55	37	50	44	34½	sw.	sw.	s.	.17	.05	.60
21.	29.463	29.360	29.06	29.00	29.12	50	33	42	40½	38	sw.	sw.	w.	.06	....	.12
22.	29.764	29.523	29.17	29.58	30.00	42	35	32	38½	35	nw.	w.	n.	....	....	.14
23.	30.122	29.970	29.77	30.18	30.22	43	31	39	34	35	n.	n.	sse.	....	.05	.01
24.	30.157	29.964	29.87	30.13	29.90	42	34	34.5	36	34	n.	nw.	sse.	....	.05	....
○ 25.	29.803	29.647	29.50	29.77	29.83	42	32	35	39½	38½	e.	sse.	ese.	....	....	....
26.	29.737	29.651	29.36	29.91	30.05	40	26	36	38½	33½	e.	ne.	e.	....	....	.08
27.	29.791	29.739	29.50	29.98	29.87	40	36	36	36½	35	e.	ne.	calm	.04	....	.09
28.	29.833	29.741	29.50	29.85	29.87	42	37	40	37	39	ne.	ne.	se.	....	.09	.06
29.	29.845	29.827	29.53	29.63	29.44	43	35	39	48	42	n.	calm	s.	....	....	....
30.	29.795	29.716	29.36	29.26	29.46	43	25	31	42	40	sw.	ssw.	wsw.	.13	....	.62
31.	30.204	30.086	29.76	29.77	29.98	47	24	31	44	42	n.	sw.	s.	....	....	.14
Mean.	29.743	29.583	29.33	29.381	29.431	47.35	34.35	38.7	39.27	37.83				2.14	1.41	5.12

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XXIV.—*Remarks upon British Plants.*

By Charles C. Babington, M.A., F.R.S., F.L.S. &c.*

Since the publication of the third edition of my 'Manual of British Botany,' my attention has been directed to several groups of plants, either by the discovery of new native species, or by finding that I have taken an erroneous view of them in that work. In this paper the results of the study which I have devoted to the plants included in it are presented to the Botanical Society.

1. Thalictrum majus and T. minus.

The *Thalictra*, which usually pass under the names of *T. majus* and *T. minus* in Britain, seem to be very imperfectly understood, and probably constitute three distinct species. In my 'Manual' (ed. 3) I have given *T. minus*, *T. flexuosum*, *T. saxatile*, and *T. majus* as native species, but now think that that is one too many, and that the so-called *T. majus* is formed out of larger states of each of the others, but especially of *T. saxatile* and *T. flexuosum*. I must however protest against the extreme measure of joining all these *Thalictra* under the name of *T. minus*, as is done in the 'British Flora' (ed. 6), and can only account for it by supposing that the justly celebrated botanists who are the authors of that work were unacquainted with some of the plants.

In drawing up the following revised characters for our plants I have been greatly assisted by my friend Mr. F. J. A. Hort, who has paid much attention to these species, and freely communicated to me the results at which he has arrived.

Attention should be especially directed to the presence or not of leaves from the lower joinings of the stem, as it appears to be

* Read before the Botanical Society of Edinburgh, Feb. 10, 1853.

quite certain that some species are when young always furnished with leaves quite down to the ground, whilst others have only scales in their place. The former at the flowering season present a deceitful appearance, for then the lower leaves have usually faded and often quite disappeared. A careful examination is therefore requisite before deciding upon their presence or absence; also, those joinings that are covered with soil are usually, even in the leaf-based species, devoid of leaves and furnished with scales alone. Dried specimens of the leaf-based species are therefore very liable to be mistaken for leafless-based plants.

My observations do not lead me to place much dependence upon the hollowness or otherwise of the stem, as it often, I think, seems to be hollow, owing to the vigour of its growth having distended and broken the pith. I am not prepared to say that none of the species are normally hollow-stemmed.

The auricles of the larger stipules, especially the lower ones, are well deserving of attention, as they seem to furnish valuable characters.

The direction of the subdivisions of the petioles is deserving of attention, but the form of the leaflets and their size appear to be very inconstant.

The direction of the branches of the panicle should be noticed.

The form of the carpels is probably of little value, but before this can be stated with confidence, they must be subjected to careful study when fresh. The process of drying appears to alter their form considerably.

1. *T. minus* (Linn.); stem zigzag striated branched solid *leafless at the base, stipules with inflexed auricles,* leaves 2–3-pinnate, leaflets ternate 3-cleft glaucous, petioles with angular ascending branches, panicle leafless with divaricate branches, flowers drooping, carpels fusiform 8-ribbed subcompressed ventricose below externally.

T. minus, *Koch, Syn.* ed. 2. 4; *Fries, Summa,* 135; *Reich. Icon. Fl. Germ.* iii. t. 27!

T. majus, *Reich. l. c.* t. 30.

This plant varies very much in size, but is usually about 18 inches in height. Its leaves are rather small, with short intervals between the leaflets; but this is not constantly the case, as in specimens gathered in Cambridgeshire the leaflets are distant, and thus cause the plant to present a different appearance. There is usually a very marked interval between the root and the lowest leaf, the lower joinings of the stem being furnished with sheathing rather lax scales, but no leaves. The main branches of the panicle usually spring from the axils of very small leaves, at the secondary divisions there are rarely more than scales, therefore the upper part of the stem looks naked and the panicle may be described as leafless. The panicle is usually small relatively to the size of the plant, but in a specimen from the Great Ormes Head it is very large and very much more branched than is usual. In this last-mentioned instance, and in some from other parts of Caernarvonshire, the stem is much softer and almost might be called hollow when the plant is in fruit.

The *T. majus* of Reichenbach (*l. c.*) seems to be a large form of this species; that of Gren. and Godr. (Fl. de France) is rendered doubtful by the statement that it is "sans stolons." When this plant is clothed with minute stalked glands, it is the *T. pubescens* of Schleicher and DeCandolle.

T. minus appears to be pretty generally distributed, but seems to prefer the neighbourhood of the sea. It is found upon sandhills adjoining the coast, and also in hilly or even mountainous situations.

In the 'Botanical Gazette' Mr. J. Ball informs us that M. [809. i. 312]
Jordan of Lyons considered that a plant gathered upon Ben Bulben, in the county of Sligo, is his *T. calcareum* (Obs. sur Pl. de la France, v. 9). Not having seen either the Irish plant or that of M. Jordan, I am unable to form a clear idea of it, but suspect that it is very nearly allied to *T. minus*.

2. *T. flexuosum* (Reichenb.); stem zigzag striated branched *leafy to the base, stipules with reflexed auricles,* leaves 2–3-pinnate, leaflets 3–5-cleft paler beneath, *petioles with patent divaricate branches,* panicle leafy elongated with patent often reclinate branches, flowers drooping, carpels narrowly oblong subcompressed sub-10-ribbed gibbous within upwards.

T. flexuosum, "*Bernh. Cat.*" ex *Reich. Fl. excurs.* 728, et *Ic. Fl. Germ.* iii. 14. t. 28; *Fries, Summa,* 136, et *Herb. Norm.* vii. 24!
T. collinum, *Wallr. Sched.* 259. teste *Reich.*
T. capillare, *Reich. Fl. excurs.* 729, et *Ic. Fl. Germ.* iii. 15. t. 36.
T. majus, *Sm. Eng. Bot.* t. 611, et *Eng. Fl.* iii. 42.

Varying greatly in size, but usually a taller plant than *T. minus,* often 3 feet in height. In the lesser forms the leaves are rather small, and the leaflets placed rather closely; but in the larger plants the latter are often very distant. The leaflets are very inconstant in size, they are usually roundish, and on the same plant vary from subcordate at the base to wedge-shaped; the lobes are very blunt and cuspidate, or in the larger forms, and especially in *T. capillare,* the lobes of the upper leaflets are lanceolate-cuspidate. All the sheaths that are not subterranean are furnished with leaves; but the lower leaves soon decay, and thus it is rendered difficult at an advanced period of the year to ascertain their former existence. The primary and secondary branches of the panicle are usually to a far greater extent furnished with leaves, which are also larger, than is the case in *T. minus,* and small ones, consisting of from one to three small leaflets, are frequently found subtending even the ultimate branchlets. This tendency of the panicle to become leafy distinguishes the present plant from both *T. minus* and *T. saxatile,* in which it always looks naked. The panicle is rather large, usually very much subdivided, and in the larger forms has very long pedicels.

My specimens named *T. majus* from North Queensferry in Scotland (Hook. Fl. Scot. i. 172), and Ulleswater (Sm. Eng. Fl. iii. 42, and Eng. Bot. t. 611), are, I am confident, the *T. capillare,* although I only possess a portion of the upper part of these large plants. I quite agree with Fries in thinking that they are a luxuriant state of *T. flexuosum.*

There is much reason to suppose that what is called *T. minus* in the interior of England chiefly consists of this plant, but I can only state the certain presence of its smaller form in Cambridgeshire and at Cheddar in Somersetshire, and its larger form in Fifeshire and Cumberland. I am informed that Mr. D. Oliver, jun., has observed it upon Ben Bulben in the county of Sligo; and Mr. Shuttleworth found it at Curragh More, Lough Corrib, Co. Galway; Mr. Brand at Grey Mare's Tail, Dumfriesshire; and Dr. Greville (I believe) at Far Out Head, Sutherlandshire.

3. *T. saxatile* (DC.); *stem* rather zigzag *smooth* but striated below the striated sheaths branched hollow *leafy to the base,* "stipules with horizontal auricles" (Fries), leaves 2–3-pinnate, leaflets 3–5-cleft paler beneath, petioles subterete with patent *not divaricate branches, panicle* leafless *erect pyramidal* with patent straight branches, flowers drooping (?), *carpels regularly oval.*

T. saxatile, *DeCand. Fl. Fr.* v. 633; *Reich. Ic. Fl. Germ.* iii. 15. t. 34; *Gren. et Godr. Fl. Fr.* i. 7 (excl. syn.).
T. Kochii, *Fries, Mant.* iii. 46, et *Summa,* 136.
T. collinum, "*Wallr.*" teste *Fries, Herb. Norm.* vii. 25; *Koch, Syn.* ed. 1. 4.

A large plant with stems often 4 feet in height. Leaves very large, with long intervals between the leaflets. Leaflets large, broad, closely resembling those of *T. flexuosum.* None of the sheaths are leafless, they are furrowed, and the furrows descend a short distance upon the stem, which is elsewhere without furrows. The secondary branches are so generally unfurnished with leaves that the panicle may be called leafless, although there are leaves at the origin of the principal branches. It is not quite certain if the flowers are erect or drooping; in a plant gathered by myself in Cumberland they appear to have been erect, but it is difficult to determine from a dried specimen; they are figured and described by Reichenbach as erect; Fries states that they nod, and his specimen seems to confirm him. The fruit of this plant differs from that of *T. minus* and *T. flexuosum* in being scarcely at all compressed and very regularly oval in its outline.

I have only seen this plant from the Lake district of the north of England, where it is found in damp situations, such as Brathay near Ambleside, and St. John's Vale near Keswick. Mr. J. Ball appears (Bot. Gaz. i. 313) to have found it "abundantly on the shores of the lakes . . . . of the limestone districts of the west of Ireland," for I presume that this is the plant which he there calls *T. majus*.

The locality in Somersetshire recorded for this species in my 'Manual' (ed. 3. 4) belongs to *T. flexuosum*.

2. Polygala.

The discovery of *Polygala uliginosa* of Reichenbach, a probable variety of *P. austriaca* of Crantz, upon the elevated mountain limestone of Teesdale by my valued friends Messrs. James Backhouse, sen. and jun., has led me to a more careful examination of the plants referable to that genus that are natives of Britain, and as I have considerably altered the technical characters of *P. vulgaris* and *P. calcarea* from those given in the third edition of my 'Manual' (p. 38 & 39), it seems desirable to give the new specific definitions of them in conjunction with that of *P. austriaca*. Much difficulty attends all the supposed species of *Polygala*, and probably their number will ultimately be much reduced, but we are not as yet in a position to do so satisfactorily.

It will be seen that attention should be especially paid to the mode in which the leaves are arranged, and to the appearances caused by the different lengths to which the stems extend each year. In some cases the leaves are pretty regularly scattered over the stems; in others some are scattered, but the larger ones are collected into a marked tuft arranged in the form of a rose at the end of the growth of the year. When this extension is slight, the rosette appears to be radical and includes all the foliage of the true stem, as is the case in *P. austriaca*; when it is elongated its lower part bears small scattered leaves, and the rosette of larger ones is placed at its extremity, a habit presented by *P. calcarea*. In *P. vulgaris* a third condition is seen, where there is no marked distinction between the persistent part of the stem and the deciduous floral portion. The stems of *P. vulgaris* seem usually to die back nearly to the crown of the root, so as to leave only two or three of the lowest buds to produce the shoots of the succeeding year; but sometimes they retain life to a considerable distance from their origin, and then the new growth is far distant from the root-stock and prostrate stems are produced. In this plant, and others of similar habit, there is no rosette.

1. *P. vulgaris* (Linn.); *leaves scattered, lower leaves smaller* oblong, upper leaves lanceolate, wings of the calyx obovate mucronate their *nerves branched the lateral looping with a branch of the central nerve,* capsule obcordate, lobes of the arillus unequal, lateral bracts shorter than the pedicels.

P. vulgaris *auctorum.*

Stems weak, prostrate or ascending, without any clear separation between the persistent part and the annual flowering shoot; sometimes branching so as to make some of the really terminal racemes appear to be lateral. Leaves all scattered, the lower ones much the smaller. Flowers blue, pink or white, with intermediate shades. The central nerve of the wings of the calyx is very nearly simple, only branching slightly near the top, and ending in a mucro. The lateral nerves are much branched, but only on their outer side, where the branches join in loops, as do the nerves themselves with a branch of the central nerve. The lobes of the arillus are unequal, the two lateral being longer than the central one, and half as long as *the seed,* which *has a kind of stalk* that raises it so as to leave a space between its base and the inside of the arillus.

β. *depressa*; lower leaves crowded and often opposite but small, stems long wiry prostrate, racemes ultimately lateral.
P. vulgaris* depressa, *Fries, Mant.* ii. 41.
P. depressa, "*Wend.*" ex *Koch, Syn.* ed. 2. 99; *Coss. et Germ. Fl. Par.* 56. t. 8; *Bromf. in Phytol.* ii. 966; *Gren. et Godr. Fl. Fr.* i. 196.
P. serpyllacea, "*Weihe*" ex *Sond. Fl. Hamb.* 388.

I have examined this plant with care, but do not find any cause for deviating from the opinion of Fries, confirmed as it is by the accurate observations of my lamented friend Dr. Bromfield. As has been remarked in the preliminary observations, the long wiry character of the stems is caused by some of the buds more distant from the root remaining alive through the winter and producing shoots in the succeeding spring. Similar wiry stems are occasionally, although rarely, found in typical *P. vulgaris.*

γ. *oxyptera*; flowers smaller, fruit broader than the wings of the calyx.
P. oxyptera, *Reich. Iconog.* i. f. 46!
P. multicaulis, *Tausch.*!

This appears to be only a variety of *P. vulgaris,* the proportional width and length of the calyx-wings and capsule not being to be trusted.

In my 'Manual' I have directed attention to a plant that grows on the limestone ledges of Ben Bulben in the county of Sligo, and which I have long suspected might be a distinct species. It is remarkable for having deep blue flowers, upright stems, much larger leaves than the typical *P. vulgaris*, and the lateral nerves of the calyx-wings joining the central nerve itself instead of a lateral branch of it. Although looking very different, and being even more beautiful than the common *P. vulgaris*, I have now arrived at the conclusion that it ought not to be separated from that species. Is its situation upon the ledges of limestone in a damp country a sufficient cause for the above-mentioned differences? I am inclined to answer that it is.

P. vulgaris is found throughout the British Isles, upon every kind of soil, and from near the level of the sea to a high elevation on mountains.

2. *P. calcarea* (Schultz); *leaves chiefly in an irregular terminal tuft large* obovate obtuse, leaves on the flower-shoot smaller lanceolate, wings of the calyx oblong their nerves branched the lateral looping with a branch from near the middle of the central nerve, capsule oblong obcordate, lobes of the arillus unequal, lateral bracts shorter than the pedicels.

P. calcarea, *Schultz in Bot. Zeit.* (1837) 752, et "*Exsic.* ii. 15"; *Koch, Syn.* ed. 2. 100; *Bab. Man.* 39; *Gren. et Godr. Fl. Fr.* i. 196!; *Walp. Rep.* i. 232.
P. amara, *Reich. Fl. exc.* 350, et *Fl. exsic.* 749!; *Eng. Bot.* t. 2764!
P. amarella, *Reich. Iconog.* i. f. 43, 44; *Coss. et Germ. Fl. Par.* 56. t. 7.

Stems weak, prostrate or ascending, *nearly naked below*, producing simple flower-shoots from the terminal rosette which loses its leaves and disappears. Racemes terminal. Flowers blue. The central nerve of the wings of the calyx branching considerably, one of its lower branches joining in a loop with the lateral nerves, which are much branched, but only externally. The lobes of the arillus are unequal, blunt, the two lateral being longer than the central one, and half as long as the seed, which is sessile.

This plant is closely allied to *P. vulgaris*, and is joined to it by some authors of eminence; but it is perhaps as frequently, and by botanists of equal authority, combined with *P. amara*. Fries expresses his opinion strongly that the former is the correct view to take of it (Summa, 154), and similarly Arnott (Brit. Fl. ed. 6. 52). Bertoloni combines it and *P. uliginosa* and *P. austriaca* with the true *P. amara* (Fl. Ital. vii. 321); as is also done by the editors of the 'Compendium Fl. German.' (ed. 2. 157).

In my opinion it is equally distinct from each of them. Its naked elongated true stems, bearing a rosette of leaves at their extremity from the axils of which the simple flower-shoots spring, seem to separate it clearly from the former in which no such rosette is found, and at the flowering season the lowest leaves are very markedly smaller than those above them.

With *P. amara* it agrees in possessing a rosette; but in that species the true stem is very short, and therefore the rosette and flower-shoots seem to be radical. Here also the central nerve of the calyx-wings is branched even as low down as its middle, and these lower branches join with the lateral nerves; in *P. amara* the central nerve is unbranched up almost to its apex, although it usually does there join the lateral nerves.

P. calcarea is found on the chalk hills of Surrey and Berkshire.

3. *P. austriaca* (Crantz); *leaves in a rosette* obovate obtuse *larger* than the oblong-lanceolate ones on the flower-shoot, wings of the calyx oblong or obovate obtuse their *nerves simple or slightly branched free,* capsule wedgeshaped below roundish broader than the wings, *lobes of the arillus nearly equal,* lateral bracts shorter than the pedicels.

[α. *genuina*; leaves of the rosette smaller than those of the branching flower-shoot, flowers smaller, capsule rounded below.
P. austriaca, "*Crantz, Aust.* v. 2"; *Reich. Iconog.* i. 23. t. 21. f. 39, et *Fl. excurs.* 350, et *Fl. exsic.* 1923!]

β. *uliginosa*; leaves of the rosette larger than those of the nearly constantly simple flower-shoot, flowers larger, capsules wedge-shaped.
P. uliginosa, *Reich. Iconog.* i. 23. t. 21. f. 40, 41, et *Fl. excurs.* 350, et *Fl. exsic.* 52!; *Fries, Summa,* 154, et *Herb. Norm.* iii. 14!
P. myrtifolia, *Fries, Nov.* ed. 2. 227; *Wimm. et Grab. Fl. Siles.* iii. 24.
P. amara, *Sven. Bot.* t. 484; *Fl. Dan.* t. 1169.
P. austriaca, *Coss. et Germ. Fl. Par.* 56. t. 7, not *Reich.*

Root slender. Root-stock short. Lower leaves collected into a rosette and seeming to be radical, larger than the others, broadly obovate, narrowed below, rounded at the end, but often with a minute apiculus. Flowering shoots short, springing from the axils of the rosette, straight, unbranched; their leaves oblong-lanceolate, upper ones acute. Flowers small, pale lilac, or at length tinged with green. Wing of the calyx longer than the capsule in our plant, and in that of Scandinavia (Fries, Nov. et Herb. Norm.) shorter than it in southern countries. The valueless character of the proportion between these parts is well pointed out in the 'Flora Silesiæ' (*l. c.*).

Fries considers this to be the plant called *P. myrtifolia pa-*

lustris humilis et ramosior by Dillenius (Raii Syn. *287), and found by Sherard "in the bog beyond the wood going from John Coals to Croydon bogs." It is quite possible that his idea may be correct, as the description accords pretty well with *P. uliginosa.* It may however be doubted if Sherard's plant was not *P. calcarea,* which inhabits the range of chalk hills to the south of Croydon, and agrees even better than *P. austriaca* with the description given in the 'Synopsis.' Smith takes no notice of this Dillenian plant; it is mentioned by Hudson, and in the second edition of Withering's 'Botanical Arrangement,' but neither botanist seems to have known more about it than may be learned from Ray's 'Synopsis.' It is to be feared that the neighbourhood of Croydon is far too much altered to allow of the discovery of the spot visited by Sherard, and unless a specimen is preserved at Oxford, the *P. myrtifolia palustris humilis et ramosior* can never be identified with modern species.

Much doubt exists concerning the propriety of separating *P. uliginosa* from *P. austriaca.* The true *P. austriaca* does not seem to grow in the north of Europe. The recorded differences between them are very slight, and are of a kind that is likely to be variable. In *P. austriaca* the lateral nerves of the wings are usually branched and their points incline towards the central nerve: in *P. uliginosa* these lateral nerves are, I believe, nearly always simple and do not curve inwards, but continue to diverge up to their extremity. The true *P. austriaca* has not been found in this country.

This plant was discovered "at the back of Cronkley Fell, Upper Teesdale, Yorkshire, at an elevation of about 1500 feet above the sea," on May 24, 1852, by Messrs. James Backhouse, sen. and jun.

The presence of this plant; of *Myosotis alpestris,* which was discovered by the same botanists, during the same excursion, at an elevation of 2500 feet upon Micklefell; and their previous detection of *Alsine stricta* upon Widdy-bank Fell in June 1844; all places in the same mountainous district of the north of England; is a subject of much interest in connection with the geographical distribution of our plants. It is the most southern extension in Britain of the three species (indeed the only station known for two of them), each of which appears to have derived its origin from Scandinavia, or perhaps, to use more correct terms, is a remnant of that ancient flora of Britain which inhabited the country when its climate nearly resembled that now found in Norway.

[To be continued.]

XXV.—*On the* Chitonidæ. By William Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, Norfolk Crescent, Bath, Feb. 1, 1853.

Before I enter on matters, I beg to state, that a more extended experience of the Mollusca has compelled me to relieve myself, in part, of the assistance of conchological attributes, as I have found them singularly defective and fallacious in reference to the existing constitutions of divisions, families and genera; in support of this view, I refer to many proofs in the various papers of mine that have appeared in the 'Annals.' I therefore, as regards the past, and henceforth, shall only consider the shell coverings of the Mollusca as good and useful aids, in strict subservience to the malacology of the animal, and as specialties, consequential, and emanating from the vital organs; and that the meaning of whatever appellation may be attached to a division, family or genus, has with me no reference to the testaceology: for instance, speaking of the *Muricidæ*, or its synonym, the *Canalifera*, the shell is not in question, except as a corroborating incident, but the animalia canalifera, whose mantles form canals; and in like manner, in mentioning the *Holostomata*, the entire periphery of the aperture is not primarily intended, but, that the mantle lining it is entire.

The use of the word 'shell,' instead of 'animal,' in the construction of the subordinate divisions of a class, has doubtless arisen from the ignorance of naturalists of the inhabitants; but as this cause is in a great measure removed, it is time to abandon a system founded on fallacious bases, and have recourse to nature's imperishable land-marks.

In these observations, I do not mean to say that conchology is without its use: to palæontologists, collections of shells are the only resources to denote that their fossils present similarities to many existing forms; but how infinitely more valuable is an account of an existing animal, to inform them of the real character of the relics of former epochs! Beyond the restricted points, conchology is totally unworthy to be the succedaneum of the attributes of nature, and the true worshipers of the great book will rejoice at the decadence of a usurpation to its just limits.

The Chitons have long been a source of difference of opinion with naturalists, not only as to their position amongst the Mollusca, but it has been insisted on, that they are apocryphal members of that class. The greatest authorities are in collision: M. De Blainville considers that the motive power and other apparatus of the circulation have a rectilinear dorsal arrangement, similar to that of the Annelida: Cuvier and Lamarck regard them as true Mollusca, ranging with the Patelloid group: Professor Forbes has doubts, and looks on the question as still within the limits of debateable ground, and terms the Chitons malacological "puzzles." Some observers contend, that the reproductive organs, unlike the asymmetrical ones of the Gasteropoda, exhibit a disposition of parities on a medial line, and like M. De Blainville refer them to the Annelida. Milne-Edwards demurs that they are Mollusca, and goes no further than to regard them as an aberrant tribe of Gasteropoda.

Having dissected many examples of three species, I think that my notes may assist zoologists in coming to sound conclusions with respect to natural position. As my investigations have induced a chain of reasoning which has convinced me that the Chitons are true Mollusca of the patelloid type, it may be as well at once to allude to that part of them which bears upon the objections that have just been stated.

Though doubts have lately sprung up as to the natural position of these curious animals, they have, until now, been placed by most authors in close connection with the Conchifera. If this is right, what then is there extraordinary and unusual in the disposition of the organs of the circulation? They have nearly the same dorsal rectilinear position as in the Acephala, from which they have long been considered, and I think it will be shown rightly, the point of transition to the Gasteropoda. Why not, therefore, contrast this peculiar arrangement which is the invariable consequence of the symmetry of the bivalve cone, with that which obtains in the Chitons from the same cause, and also in others of the Patelloid tribe that have the same position and a similar parity of their organs? I admit, that the strict *Patellæ*, though symmetrical in their testaceous cones, are exceptions with regard to the heart, auricle, and branchial plume: *Haliotis*, which with me is a patelloid animal, and also an exception, is the reverse, having the organs of the respiratory circulation symmetrical, but not the cone. These, and two or three other genera, may be regarded as the precursors of the Gasteropoda, and points of transition from the strict parities of the cone of the shell and organs of the Patelloida, to the asymmetrical division of the Gasteropoda.

The only differences, and they are not important, with respect to the position of the circulation in the bivalves and Chitons are, that in the latter the motive power is placed greatly more posteriorly than in the former; and the illustrious Cuvier has taught us to observe, that the auricles of the Chitons have a quadruple connection with the heart, of which he has seen no other example in the animal kingdom: this is not stated in an objective sense, but as a curious fact, though he gives no reason for this aberration of the usual structure. Enough has now been said to demonstrate the little value of the much insisted on dorsal rectilinear position of the motive power of the circulation in *Chiton*, in comparison with the Annelida.

As to the objection to the allocation of these animals with the Mollusca on account of the symmetry of the reproductive organs, we think they are of small importance, even if double: and who can say that the symmetrical Patelloida have not in this respect a similar structure? but these points are doubtful. M. Deshayes says, "Quoique nous ayons fait des anatomies minutieuses d'Oscabrions, il nous a été impossible de trouver la seconde issue des organes de la génération;" and M. Cuvier observes, they became so attenuated that he confessed he could not trace them. Our own researches lead to doubts of these appendages being oviducts; at the same time we admit, they may prove to exercise those functions: they are situate in the immediate vicinity of the heart and auricles, and may be glands to secrete a liquor for those organs, or the fecundating pouches of the peculiar hermaphroditism of this tribe, in which latter case, the true issue for the ova will probably be found between the rectum and the posterior part of the ovarian sac.

It has been said that the body is subannulate: in a hundred dissections we could not see much trace of such configuration, or breaks in it to correspond with the segmental arrangement of the valves; only slight marks, the effect of pressure, were observed. The connection of the Chitons with the Crustacea is, as I think, so very slight and remote as to require no further notice.

Having cursorily disposed of certain objections, we will proceed to state our own views, and in their course, allude to other objections and discrepancies. Though the Chitons are in closer alliance with the Bivalves, anatomically, by the arrangement of the circulatory apparatus, symmetry of the branchiæ, and in the absence of tentacula and eyes, than by the external hard parts, still in them there are points of coherence which are not without their value; for instance, in *Pholas dactylus*, its immediate predecessor, in our method, though the bivalve portion is not broken into regular segments, there are certain testaceous pieces, commonly, though perhaps incorrectly, called accessories, in number six, including the principal valves. We also find in the Chitons a subsymmetrical division into eight segments of what I consider essentially an integral patelloid cone, and as much accessorial as those of *Pholas*; indeed both in one and the other, these component parts are equally necessary and essential. I admit that no great stress ought to be laid on the contrasted points; nevertheless, in conjunction with other decided anatomical analogies, they have their weight in the balance. Our view of the natural position of *Chiton* is after *Dentalium*, with which it has marked affinities, and in immediate contact with the Patelloid group, in which we regard, in almost every respect, *Fissurella* as the point of comparison, as in it is seen the same form of the cone, though entire instead of broken, the same parity of the branchiæ, a similar posterior anal debouchure, and the attenuated mantle, gradually thickening, in both genera, to a tumid coriaceous margin, which in *Fissurella* can scarcely be withdrawn within the shell, studded alike in both with papillæ and rugosities, and the same marginal fringes. The nervous masses in the two accord closely: the only exception is the striking, but really unimportant, division of the cone of the Chitons into segments; but this incident may be accounted for on very simple grounds. We consider the fracture of the shell not a character denoting an affinity with the Annelida, as the body of the animal has no corresponding articulations, but simply an aid to facilitate locomotion. The foot of the strict symmetrical testaceous Gasteropoda is generally nearly concurrent with the length of the body, and forms its base, from which, by a gradually increasing cone, the animal becomes at maturity fixed to the summit of the shell by a powerful muscle: this structure united to an entire cone, and combined, as in the Bivalves, with the depressing effects of a complete hermaphroditism, that of *Venus sine concubitu*, almost extinguishes the locomotive functions; and we see throughout the patelloid tribe, all of which have a foot co-extensive with the body, an almost entire fixation to the same spot; indeed we believe that some of the *Patellæ* pass their existence in the depressions of the rock on which they are cast as embryos, and the same apathy exists in *Pileopsis* and *Calyptræa*. But nature has judged fit to give the Chitons additional motive powers, for when fixed on the area of a smooth pebble, they will travel off it, whilst the *Patellæ* are immoveable: this is owing to the integrity of the cone, and the enormous muscle which fixes the animal to its apex: this structure does not permit the body sufficient flexibility for much progression, and almost confines it to a vertical elevation and depression; but the Chitons, by the segmental condition of their shells, have accorded to them sufficient flexibility to obtain a vermicular motion, and its consequence, a greater facility of march. The Trachelipoda have infinitely superior attributes for motion, by the foot being fixed to a small portion of the body by an elastic cylindrical pedicle that affords a perfect pliability, and the acquisition of the necessary undulatory quality to effect a comparatively facile progression.

The above remarks perhaps furnish us with the proper value of the arguments of malacologists in favour of the Chitons being, by the peculiar disposition of the testaceous covering, allied to the Articulata.

It is scarcely necessary to observe, that the usual single powerful muscle of attachment of the animal to the shell in the patelloid tribe, is in *Chiton*, from a necessity arising from the disunited structure of the cone, converted into a minuter series of coordinate muscles to attach it and each section of the shell in its proper position.

It will now be convenient to look at the anatomy of these animals, of which the most important feature are the medullary masses, and for an account of them we refer to the descriptive notes on *Chiton fascicularis*, in which will be seen the unmistakeable œsophageal collar of the Mollusca, without a trace of the longitudinal knotted, or ganglionic cordon of the Annelida, or any of that division of the Articulata termed Crustacea, including the Cirripoda. This point alone is, perhaps, decisive of the question at issue. The next consideration are the organs of the circulation; these, by being disposed on a mesial line, dorsally, and more externally than in the strict Gasteropoda, have a greater alliance with the conchiferous type, and as they exhibit some unusual variations in their composition, it will be necessary to examine with detail the extraordinary, I believe unique, structure of these organs, and we hope to arrive at such probable conclusions as will account for the rationale of this abnormal disposition.

The posterior position of the motive power of the circulation will, I think, assist in solving this problem, and must always be kept in view.

If we divide the longitudinal area of the animal into eight equal sections, the heart will be found near the hinder extremity, and may be considered as composed of two inflations connected by an intermediate marked strangulation; but between them, there is an isochronal systole and diastole action; the anterior inflation is of an elongated oval shape, and the largest, the posterior, is considerably smaller and more subrotund. The auricles receiving blood from the branchial veins communicate in the usual lateral manner with the greater division of the heart, and at this point present their largest calibre; they then form an attenuated arcuation on each side the constricted portion, and effect a second contact at the sides of the lesser inflation, which may be regarded as an aortic ventricle receiving the blood by a special auricular apparatus. From the anterior axis of the major part of the heart, a long and large aorta or arterial vein ascends medially to the front, distributing by diverging arteries the aërated fluid to the greater portion of the body, whilst the minor and posterior ventricle, after receiving from the arcuated ducts of the auricles its quota of blood, serves the remaining area; but I could not detect a descending arterial vein, which however must exist to convey the blood; unless one of the arteries of the ascending aorta doubles back and supplies the part. But this conjecture is scarcely tenable, as we must then suppose, that the blood conveyed by the arcuation of the auricles to the lower inflation is thrown back again on them and the larger ventricle, thus producing a useless periodic action and counter-action.

We will now endeavour to explain the probable causes and effects of this unusual construction. It has been shown that the principal ventricle of the heart is the propelling power of the blood to the major part of the body, and the smaller one by its separate auricular contact supplies the remainder; we also have observed on the connection of both parts of the heart by the strangulated and without doubt valvular intervening portion, so that no blood can pass between the two; and it is clear that none is intended to pass, as the auricles by distinct ducts supply each with its proportion of the vital fluid; consequently the mitral valves of the ventricles are closed at their axes abutting on the strangulation, at each simultaneous dilatation, and thus this constriction acts as a *point d'appui* and departure, and enables them to exercise a full power of propulsion.

We shall now perceive the reason for these separate inflations. If one only had existed, with an ascending and descending aortic vein of similar calibre, as much blood would be sent to a very small area as to one seven times more extensive, and so great an inconvenience would have resulted, that nature has created this peculiar mode to effect a just distribution. I hope I have almost proved that this anomalous structure is a consequence of the posterior position of the heart.

I have extended these remarks somewhat beyond what is necessary, but I am anxious to show that this curious contrivance to effect a particular object has nothing in it essentially contrary to the molluscan type; in other respects, as in it, the circulation is aortic, venous, and particular, the blood being brought from the body by the venæ cavæ to the great arterial vein of the respiratory organ, from whence it is distributed to its minor arteries, and after aëration reverts by the branchial vein to the auricles and heart, to repeat, as long as life lasts, the same course; consequently it is completely molluscan, and appears more advanced in composition than that of the Annelida, by the presence of a much more effective motive power of the heart and auricles, which in the Articulata are comparatively obsolete, or mere continuous fluctuating cylinders or inflations. A short œsophagus conducts to the stomach, which is an irregular subcylindrical cavity about double the diameter of the pyloric extremity; it traverses the body, forming a sudden curvature like the doubling of a horse-shoe, and returns across the body with the posterior portion parallel to the anterior one, commencing at the pyloric orifice a very long intestine of five or six transverse or oblique folds, supported by the liver, and disemboguing as rectum, at the centre of the posterior extremity between the branchiæ.

For further particulars we refer to the description of the type, as well as for the liver, ovary, and foot, all which present no essential variation from the molluscan type, except the double oviduct, if such be the case.

The Chitons are best illustrated by the patelloid section of the class, from which they are inseparable, but there is scarcely a group of Mollusca to which they are not allied. The posterior termination of the rectum is not without example; it is essentially the same in *Fissurella*, and more or less so in many of the *Bullidæ* and *Pleurobranchidæ*. M. Deshayes observes, that the want of eyes and tentacula has been adduced as denoting affinity with the Annelida; but, as we have already observed, why not compare these deficiencies with the Conchifera, their immediate predecessors? And as regards the Gasteropoda, the absence of eyes and tentacula is not unusual: for instance, *Bulla cylindracea* has not a trace of these organs; the *Velutina otis* of authors, Mr. Gray's *Otina*, has no tentacula; some of the *Bullidæ* are without eyes, and others without tentacula; there are examples of the *Naticæ* without eyes, and in the *Dentalia* both eyes and tentacula are absent. *Dentalium*, in my method, is placed in the van of the Gasteropoda, and *Chiton* follows; both are closely allied, and, we think, appropriately succeed the Conchifera.

I do not say that with the latter, the characters of alliance are very decided; still on examination there will be found analogies: for instance, in *Chiton* and *Dentalium* the branchiæ are placed symmetrically, though varying in particular position. In *Chiton*, though not in *Dentalium*, the anus has the same posterior site as in the Conchifera and in some of the patelloid forms. The strict sexual order of hermaphroditism appears to obtain in both, and throughout the Patelloida to the Pleurobranchidæ and Bullidæ, in which a more influential plan of reproduction commences. These notes, in conjunction with the special typical ones, only call for a very brief summary, and we think a calm review of all the circumstances that are adduced will go far to convince zoologists that there is not a *locus standi* for any one organ in *Chiton* contrary to molluscan essential characters;—all are confirmatory of the *Chitonidæ* belonging to that class, and the only return we can make *per contra* is—*nil*.

It has been suggested by Professor Forbes in the 'British Mollusca,' vol. ii. p. 390, that an examination of the fœtal metamorphoses of the Chitons would throw light on their natural position; I propose, if practicable, to carry out this idea, though the attempt will be attended with difficulties and uncertainties, which need not now be alluded to.

We are not sure that much will be gained by the investigation; it may possibly give us an idea of the affinities of remoter lineages with the present conditions of a particular genus or species; but we think the arrival of the animal, after its embryonic phases, at an adult state, will not only give a knowledge of what it is not, but of what it actually is, and more will be gained by a comparative view of the mature organs with those of its allies.

We apply these remarks to the present case, and think that the œsophageal nervous collar, the buccal mass, the long spinous tongue, the system of the circulation, and the true Gasteropodan foot, will inform us that such an animal cannot be either one of the Annelida or Cirripoda, or belong to any other group of the Articulata, and we believe that the comparative examination of the above-mentioned organs with those of the Conchifera and Patelloida will irresistibly lead us to acknowledge their true molluscan composition.

Chitonidæ.

The British Chitons are a group of about ten species; we have given notes of three, selecting the *C. fascicularis* as the type. They inhabit all the zones according to their respective special habits. As regards British geographical distribution, they appear to arrive at larger growth in the northern latitudes.

Chiton, Linnæus.

C. fascicularis, Linnæus et Auct.

Animal forming an elongated oval, the body being convex on the upper surface, and enveloped in a mantle, thin above, but gradually resolving into a thick, strong, broad, granular margin, clothed with a rigid setose white fringe, and on each side is furnished with eight packets of yellowish white bristles, 12–15 in each, and two of the same number at the anterior end; above these are imbedded, in the margin and longitudinal area of the animal, eight transverse, convex, saddle-shaped, beaked, imbricated, strongly shagreened, dark gray testaceous plates, whereof the anterior one has five emarginations, the six behind in succession one on each side and two on the terminal margin of the eighth. The head is a membranous puckered frill, under which is the rugosely-rayed buccal disk with its round orifice in the centre: there are neither eyes nor tentacula: the buccal apparatus consists of two elliptical white, or pale yellow corneous plates, between which a rather long, black, strap-shaped tongue passes, armed with a double line of tubercles, the inner edges being tricuspid; at the base of the corneous plates is a nervous collar of five minute subrotund yellow ganglions; these are followed by the œsophagus, which leads into a complicated stomach doubled on itself, and is continued as an intestine of four or five folds supported by the liver, which from their complexity can scarcely be described, as they lie in a space of little more than $\frac{1}{8}$th of an inch; the last fold passes into a moderately long rectum that discharges in the centre of the branchial cordon; the convolutions can be easily drawn out, and with the stomach, œsophageal canal and rectum produce an extent of nearly two inches in moderate-sized examples. The pale yellow, minutely granular, sinuated ovarium is immediately under the mantle, nearly coextensive with the length of the body, and under it are the stomach and other organs, including the large liver of many granular dusky greenish brown lobes. The foot is suboval, very little angular in front, slightly tapering to an obtuse termination. The under part of the mantle is of a red-brown colour. Between the foot and mantle is the branchial cordon, composed of fifteen oblique cord-like, short, close-set, pale brown fillets, on each side the body, commencing at the right and left of the immediate posterior extremity, leaving between the series only room for the depuratory duct; the cordon does not quite extend half the length of the body; the fillets gradually diminish in volume from the posterior end, and at the anteal termination are not more than half the length or size of the hindmost ones. There are no traces of male reproductive organs; and of the other sex, we only meet with the doubtful oviducts, and a conspicuous well-filled ovarium in the genial epoch; it may therefore be inferred that these animals depend on their own individual generative influences, on which we shall perhaps, at a future time, make some observations in a paper on the *Patellæ*; indeed the present matter would be incomplete without introducing that group, now omitted, to bring this communication within reasonable limits.

Chiton asellus, Chemnitz.
Chiton cinereus, Auct.

The anatomy of this species is nearly the same as the preceding, which we have considered the type of the genus, and as the external organs do not vary greatly, I shall only mention the deviations; the principal, and I believe the only one of the least consequence, is, that there are only ten branchial fillets, on each side the body, which do not nearly occupy half the extent of its circumference. The inner surface of the mantle in different individuals exhibits the various hues of flesh-colour: the foot is a dull muddy purple. The margin of the mantle is powdered with minute, granular, dark, sand-like points, and fringed with very short, fine, close-set, pale yellow filaments. This species, at Exmouth, is rarely met with in the littoral or laminarian districts; its habitat is within the coralline limits, and it is scarce.

Chiton cinereus, Linnæus.
Chiton marginatus, Auctorum.

The same remarks apply to this as to the preceding species, from which the only decided variation is the greater number of branchial leaflets, being seventeen on each side, of a dull flesh-colour, and occupying considerably more than half the circumference of the mantle, which on its inner surface is also flesh-colour. A fine, setose, short, thick, pale rufous fringe clothes the margin of the mantle, which is minutely granulated, as if aspersed with dark sand-points. This very common species is strictly, at Exmouth, a littoral one, and rarely found beyond its limits.

The other British Chitons are—the *C. discrepans* of Brown, *C. Hanleyi*, *C. ruber*, *C. lævis*, *C. cancellatus*, *C. albus*, *C. marmoreus*, which latter is the *C. lævigatus* of authors, and the '*latus*' of the Rev. R. T. Lowe. The *C. discrepans* of Brown is not strictly one of our indigena, being confined to the Guernsey and Channel Islands: it is not improbable that this and the *C. fascicularis* are identical, and only exhibit the specialty-differences of locality.

I am, Gentlemen,

Your most obedient servant,

William Clark.

XXVI.—*Additional Character of the Shell of the Cyclostomatous genus* Alycæus *of Gray, with descriptions of its Animal Inhabitant,—of a fourth species,—and of other new Indian* Cyclostomata; *also, Remarks on an unrecorded Character in* Diplommatina. By W. H. Benson, Esq.

The existence of a sutural callus in a third species of Gray's genus *Alycæus*, described below as *A. Urnula*, induced a conjecture that the feature might be generic, and that it had been overlooked in the single remaining Cochin Chinese species *A. gibbus*, as well as in *A. strangulatus* and *constrictus*, the first descriptions of which were silent in regard to this character*. The figures in Sowerby's 'Thesaurus' and in the 'Conchylien Cabinet' threw no light on the subject, but as the figure of *A. strangulatus* in the latter work failed to exhibit the callus, it appeared equally possible that the artist had overlooked the peculiarity in the other species.

After an examination of the specimens in the British Museum, at my request, with the view of setting this conjecture at rest, Dr. J. E. Gray has obligingly informed me that the sutural callus is also present in the Museum specimens of *A. gibbus*, but varying in size. Dr. Pfeiffer's description of that shell will therefore require to be modified, and instead of "sutura profunda simplex," we must record "sutura profunda, callum retroversum magnitudinis variabilis gerens;" and to the generic character a similar addition must be made.

The following description of the animal was drawn up by me at Landour in 1842, from specimens of *Cyclostoma strangulatum*, Hutton.

ALYCÆUS, Gray.

Tentacula duo mediocria, cylindracea, apicibus obtusis, oculos ad basin posteriorem ipsa gerentia; oculi integri, circulares, nigri minuti (quasi puncta), vix prominentes. Pes brevis, postice ultra testam non transiens, operculum testaceum concaviusculum multispiratum, sursum ad dextram gerens.

The shell is carried high in the air and clear of the foot, showing a strong muscular power in the neck. A moveable orange spot is apparent in the head and which moves down to the snout.

I once succeeded in passing a hair through the sutural tube or callus into the aperture of the shell.

1. *Alycæus Urnula*, nobis, n. s.

Testa rimata, vix perforata, globoso-conica, lævigata, sordide albida, apice obtusiusculo, rubescente, sutura impressa, callum gerente; anfractibus $3\frac{1}{2}$ convexis, ultimo ventricoso, exilissime radiato-striato, pone aperturam breviter constrictiusculo, proxime tubam retroversam, suturalem, elongatam, emittente; apertura circulari verticali integra, peristomate incrassato, subduplicato, expanso, subreflexo, breviter adnato; operculo aperturam æquante, planato, anfractibus mediocribus, subconspicuis.

Diam. $3\frac{1}{2}$, alt. $4\frac{1}{2}$ mill.

Hab. ad Darjiling Himalayanum. Teste Dom. R. Trotter.

This interesting species inhabits the same locality as *A. con-*

* Vide for *A. strangulatus*, Zeitschr. für Malak. 1846, p. 86, and Conch. Cab. p. 104, amended Zeitschr. 1851, p. 7; and for *A. constrictus*, Annals, vol. viii. p. 188, and for amended description vol. x. p. 272.

strictus, described in the tenth volume of the 'Annals,' but differs in form, sculpture, and in the position of the sutural callus. The strangulation is less conspicuous than in other species of *Alycæus,* and the constriction occurs immediately behind the peristome; hence the sutural callus also commences near the aperture instead of being remote as in the other species. A brown mark, in the single specimen which has come to hand, occurs at the point where the callus is given off. The callus lying in the suture is also longer than in the orbiculate *A. strangulatus,* in which it is moderate, or in *A. constrictus,* where it is short. The number of whorls in the operculum of *A. strangulatus* is much greater, and they are more compactly wound than in either *A. Urnula* or *constrictus;* in *A. Urnula* the sutures are tolerably distinct, and the central whorls are slightly concave; in *A. constrictus* the sutures are inconspicuous, as originally noted.

2. *Cyclostoma tersum,* nobis, n. s.

Testa subperforata, minuta, ovato-conica, albida, longitudinaliter (radiatim) sub lente striis exilissimis eleganter insculpta; sutura impressa, apice obtusiusculo; anfractibus 5 convexis; apertura angulato-ovata, verticali, tertiam partem testæ æquante; peristomate simplici, crassiusculo, marginibus callo tenui junctis.

Diam. 1, long. 2 mill.

Hab. in muscis arborum ad Musmai, prope Cherra-poonjee.

This and the following still more minute species I detected in moss which had been gathered in the mountain range which fills the eastern angle of the Birhampooter river, where it flows from the valley of Assam into the plains of Bengal. In the absence of an operculum it is difficult to decide whether it belongs to the subgenus *Cyclostomus,* to *Tudora,* or to *Leonia,* Gray.

3. *Cyclostoma Milium,* nobis, n. s.

Testa aperte umbilicata, minutissima, trochiformis, lævigata, albida, spira conica, sutura profunda, apice obtuso; anfractibus $4\frac{1}{2}$ convexis, ultimo inflato, rotundato; apertura obliqua, diagonali, subcirculari; peristomate expansiusculo, margine recto acuto, integro, breviter adnato; umbilico margine angulato, compressiusculo.

Long. $1\frac{1}{4}$, diam. vix 1 mill.

Hab. cum præcedente.

Possibly belonging to *Cyclophorus,* near *C. cœloconus,* nobis. It is the smallest known species, being of less size than *C. Cytora,* Gray.

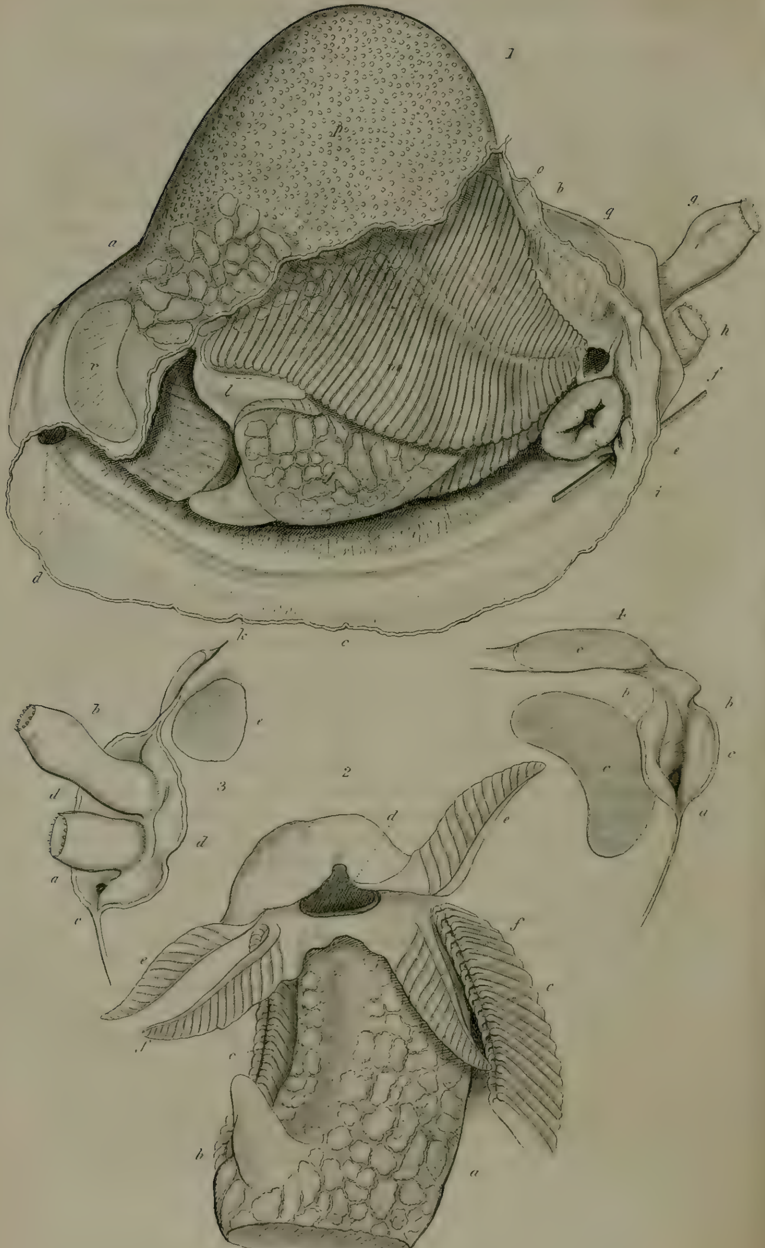
The climate of Cherra is perhaps not exceeded by any other in moisture, 600 inches of rain having been registered as falling within the seven months of a single rainy season. The range has produced some fine and rare shells, but it has not yet been explored thoroughly by a practised conchologist.

An additional character which I have distinctly ascertained in *Diplommatina folliculus* and *D. costulata,* and which appears also in *D. Huttoni,* may probably be found coextensive with the true species, viz. the truncation of the columella far within the aperture, so as to present the appearance of an oblique plait. In some specimens this feature appears to be developed so far back as to be immersed, or imperfectly distinguishable, from the aperture; but a sufficient series will reveal the character; otherwise the outer lip of a specimen may be broken for the purpose of examining the interior.

In the only two specimens which I possess of the Australian species brought by Mr. Strange (vide Annals, vol. x. p. 352), I cannot make out the fold distinctly from the aperture, and I am unwilling to sacrifice either of the specimens by the destruction of the outer lip; a more extensive series is necessary to establish the point, although one example affords an indication of the character very remotely seated. I have some reason to think that this species has been described by Dr. Pfeiffer, for his Supplement to the *Helicidæ,* as *Pupa Strangei*; in which case it will eventually be classed as *D. Strangei*; I therefore still refrain from describing it as a new species. It was, at first, the fate of *D. folliculus* to be classed with *Bulimus* by the same author, thus affording a tolerable proof of the difficulty of reconciling the general characters of the shell, apart from the operculum, with the *Cyclostomidæ.*

In reply to an inquiry regarding another shell, the proper station of which, in the absence of an operculum, is still noted as doubtful, Dr. Gray informs me that *Cyclostoma minus* of Sowerby (*Diplom. minor* of Gray, *D. Sowerbyi* of Pfeiffer) has no plait apparent on the columella in the Museum specimens. In addition to the want of a double peristome, which is characteristic of the three Himalayan and the single Australian species, that shell differs from adult specimens of the other species in the non-continuity of the expanded peristome, and in the imperfect costulation of the whorls; in fact, several characters applicable to the other four species have been set aside from my original description in order to admit this doubtful species, viz. "anfractu ultimo subascendente," "peristomate duplicato," and "marginibus callo parietali appresso junctis."

An urgent exhortation to Capt. Hutton to repeat, on living specimens of the Himalayan species, the examinations which failed to discover the presence of an operculum (found by Dr. J. E. Gray in two or three specimens of *Diplommatina* in the Bri-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tish Museum), has not, as yet, elicited a reply. In October 1849 Capt. Hutton communicated to me his description of the animal of his sinistrorse discovery, *D. Huttoni*, Pfr., from Mussoorie (not Muporee as printed in the Monograph), or rather from a lower elevation at Jerreepanee. In this species also it appears that an operculum was not observed. Can it be possible that the animals of this genus have a general habit of casting off their opercula? I can only account by some such supposition for not seeing it among the hundreds which I have seen or taken alive, and for its escaping several examinations of the animal, made with a view to description, and to fixing its position with reference to the anomaly of the form among the *Carychiadæ*, unless the appendage be concealed in the fleshy part of the foot.

Malvern, February 17, 1853.

XXVII.—*On the Animal of* Myochama anomioides.

By Albany Hancock, Esq.

[With a Plate.]

The animal of *Myochama anomioides* is at present only imperfectly known. I am, therefore, fortunate in possessing an individual well preserved in spirits. I owe this advantage to John Wickham Flower, Esq.,—the same gentleman to whom I am indebted for the specimen of *Chamostrea albida* which was recently described in the 'Annals.'

The mantle-lobes of the animal now before us are very unequal, as might be inferred from the form of the shell, the right or attached valve of which is small and flat, the left large and much inflated, particularly towards the umbo, which is excessively developed. The mantle is delicate and pellucid, revealing to some extent, through its substance, the various organs; it is entirely closed with the exception of the siphonal orifices, the pedal opening, and a fourth minute aperture similar to that described in *Chamostrea*. On looking down upon the large or left lobe, the ovary (Pl. XI. fig. 1 *p*) is seen through the membrane to occupy the umbonal region, and below it the body or visceral mass and gill can be partially observed. On each side the adductor muscles are conspicuous; they are not large, the posterior (*q*) being irregularly rounded, the anterior (*r*) somewhat elongated and arched outwardly. The posterior extremity of the animal is slightly truncated, and here the margins of the mantle separate and form a shallow recess (fig. 3), within which are situated the siphonal tubes. These latter are quite distinct, though placed near together at their origin; they are rather long and narrow, the exhalant or upper tube (*b*) being slightly inflated towards the extremity, and longer than the other (*a*); but this disparity may be owing to the irregular contraction of the parts. The orifice of each is fringed with a circle of simple, minute papillæ; the papillæ of the inhalant tube were very imperfectly observed. I failed to detect the siphonal tentacles described by M. Deshayes. The fourth orifice (fig. 3 *c*, & fig. 1 *i*), which is minute and circular, is situated immediately below the inhalant tube, and within the inferior angle of the recess formed by the margins of the lobes. This orifice leads into the branchial chamber, and is undoubtedly similar to the fourth aperture which I have pointed out in *Chamostrea*, and in some other Lamellibranchs with closed mantles; and here, as in them, it is probably for the purpose of allowing the water to escape on the sudden withdrawal of the tubes and closing of the valves. The pedal orifice (fig. 1 *d*, & fig. 4 *a*) is very small, and is situated far forward directly below the anterior adductor muscle (fig. 4 *c, c, c*) which forms its superior wall, and around the lower extremity of which the foot would seem to play. At this point, which corresponds to the angle of the shell indicating the union of the anterior slope with the ventral margin, the borders of the lobes (*b, b*) separate a little, forming a similar recess to that from which the tubes issue. The pedal orifice is at the lower angle of this recess, all the rest of the space above being closed by the adductor muscle, much in the same manner as in *Chamostrea*. The margins of the lobes, in the vicinity of the pedal orifice and siphonal tubes, are simple and grooved; along the anterior and posterior slopes (fig. 1 *a, b*) they are closely united forming a sharp edge, and following the ventral margin (*c*) they can be traced as two indistinct grooved ridges closely approximating to each other.

When the mantle-lobe is laid open, the body or visceral mass (*j*), partially enveloped in the gills and projecting from above, is found to occupy the greater portion of the branchial chamber; the pedal orifice (*d*) being seen at the anterior extremity, and the two siphonal apertures (*e, f*) at the posterior; the latter having the fourth minute opening (*i*) immediately below them.

The mouth (fig. 2 *d*) is situated above directly in front of the visceral mass; it is rather large, transversely oval, and guarded by two pairs of palps (fig. 1 *l*, & fig. 2 *e, e, f, f*). The membrane uniting the upper is ample, and forms a hood overhanging the oral aperture; the lower pair are also united at the base by a membrane of considerable extent. The palps, which are of moderate size, are wide at the base, and gradually taper to a point; the laminæ on the inner surface are not numerous, there being, on each, only fourteen or fifteen large, transverse plates sloping from the external margin to the point: the border of this margin is smooth.

There is on either side of the visceral mass a single gill-plate, and a rudimentary gill-plate, which, from their arrangement, have much the appearance of forming but one leaflet. This apparent single leaflet is of a triangular form with one of the angles directed backwards, and is attached the whole extent of the dorsal margin, the anterior or ventral border alone being free. This border is grooved and terminates above, at the side of the mouth, between the upper and lower palp; the posterior angle is united below the visceral mass to that of the leaflet of the opposite side. The external surface of the leaflet is divided longitudinally by a line (fig. 1 *o*) into two portions—an anterior or ventral, and a posterior or dorsal; the anterior or ventral (*m*) is much the larger, and is a perfect gill-plate, being composed in the usual way of two laminæ, with the space between them divided into wide, transverse tubes, which open into a dorsal channel. There are two such channels, one on each side of the visceral mass corresponding to the gill-plate of either side, which open into a great central channel,—the anal chamber leading to the exhalant siphonal tube. The gill-plate is suspended from the dorsal margin of the branchial chamber by a membrane, which, passing under the posterior or dorsal portion of the leaflet, is united to the outer lamina, the union being marked by the external longitudinal line.

The posterior or dorsal portion (*n*) of the leaflet is formed of only a single lamina, and must therefore be looked upon as a rudimentary gill-plate. It is attached by the whole length of its ventral margin, which is defined by the external line (*o*) already alluded to, to the outer lamina of the gill-plate, and by its dorsal border to the dorsal margin of the branchial chamber. Thus an additional channel is formed beneath each rudimentary gill, and external to the membrane which suspends the gill-plate; these two channels open likewise into the anal chamber. There are consequently four channels leading from the breathing apparatus towards the exhalant siphonal tube; two being from the origin of the perfect gill-plates, two from below the rudimentary gill-plates.

This arrangement of the branchial organ is precisely similar to that of *Cochlodesma*, only in the latter the gill is more elongated, consequently the channels in connexion with it are greatly increased in length, and the central channel or exhalant chamber becomes more obvious. From Professor Owen's description of these parts in *Pholadomya*, they would also appear to be arranged in a very similar manner, there being perhaps some slight, but unimportant, modifications. In *Myochama*, however, the branchial and anal chambers are not perfectly divided as they are in *Cochlodesma*, and probably in *Pholadomya*. In the former the septum which cuts off the communication does so only partially, there being a considerable aperture in it (fig. 1 *f*) just where it joins the extremity of the gills. It is quite possible that this aperture may be the result of injury, for these parts are so exceedingly delicate that the examination of more than one specimen is necessary to determine this point with certainty.

It is pretty clear too that the gills of this animal resemble very closely those of *Chamostrea*; the most important difference being, that in the latter the dorsal border of the rudimentary gill is free, while we have seen that in *Myochama* it is attached. The minute structure of the organ is the same in both; it is therefore only necessary to refer to my paper on *Chamostrea* recently published in the 'Annals,' where a detailed description of this part of the subject will be found. It may be observed, however, that the surface of the branchial leaflet of the animal under description is transversely plicated; but the plicæ are not so numerous, neither are they so delicate nor so much produced as they are in that genus; and it may be further remarked, that in this respect *Myochama* agrees better with *Cochlodesma*, in which the plicæ are rather coarse and thick. Such slight differences are certainly of very little importance, and can in no way affect the function of the parts. The food will be secured on the surface of the gills in *Myochama* exactly as in *Chamostrea*, and the water will be strained through the organ in a similar manner; in the former as in the latter it will find its way, through the vascular network forming the plicæ, into the spaces or tubes between the gill-laminæ, and from thence into the dorsal channels leading into the anal or exhalant chamber, and so to the siphonal outlet. From the rudimentary gill the water will be strained into the channel situated below it, and thus reaching the anal chamber will pass out with the general current.

In concluding these few remarks on the branchial organ, it may perhaps be worthy of notice that there appear to be three distinct modifications of gill-structure in the *Lamellibranchiata*. In the first the laminæ forming the gill-plate are composed of filaments, either free or only slightly united to each other at distant intervals, as in *Anomia* and *Mytilus*; in the second they are formed of a simple vascular network, as in *Mya*, *Pholas*, &c.; and in the third the laminæ of the gill-plate are complicated by the addition of transverse plicæ composed of a minute reticulation of vessels, as in *Chamostrea*, *Myochama*, *Cochlodesma*, &c.

Other modifications may exist, but these are all that have come under my observation.

The body or visceral mass (*j*) of *Myochama* is largely developed, and projects downwards and forwards from between the branchial plates; it is somewhat compressed and inclined to a triangular form, with a small conical foot (*k*) rising abruptly in front from the inferior extremity. The liver is of a pale brown colour, and is composed of numerous small lobules, irregular in form and size, which appearing all over the surface of the visceral mass give to it a peculiar tessellated appearance. The intestine passes round the external surface of the posterior adductor muscle, and terminates within the anal chamber close to the base of the exhalant tube as a simple tubular anus.

From this description of the animal of *Myochama*, it would seem evident that the proper place in the arrangement of this genus is with the *Anatinidæ*, if we may take *Cochlodesma* as a type of that family. The former agrees in every essential character with this latter genus: the siphonal tubes are long and narrow, the mantle is closed, and there is a single gill-plate and a rudimentary gill-plate on each side arranged exactly in the same manner. *Chamostrea* differs from *Myochama* chiefly in having short, wide tubes, and in the rudimentary gill-plate having its dorsal margin free.

EXPLANATION OF PLATE XI.

Fig. 1. General view of the animal of *Myochama anomioides*, the left mantle-lobe laid open:—*a*, anterior slope; *b*, posterior ditto; *c*, ventral margin; *d*, pedal orifice; *e*, orifice leading to inhalant tube; *f*, orifice in the septum dividing anal and branchial chamber; *g*, exhalant tube; *h*, inhalant ditto; *i*, fourth aperture leading into branchial chamber with a needle passed through it; *j*, body or visceral mass; *k*, foot; *l*, palps, the superior overhanging the mouth; *m*, perfect gill-plate; *n*, rudimentary gill-plate; *o*, line dividing the two portions of the gill-leaflet; *p*, ovary; *q*, posterior adductor muscle; *r*, anterior ditto.

Fig. 2. Front view of visceral mass:—*a*, liver; *b*, foot; *c*, *c*, margins of gill-plates; *d*, mouth; *e*, *e*, superior pair of palps; *f*, *f*, inferior ditto.

Fig. 3. View of siphonal tubes:—*a*, inhalant tube; *b*, exhalant ditto; *c*, fourth or small aperture leading into branchial chamber; *d*, *d*, margins of mantle-lobes forming a recess for the accommodation of the tubes; *e*, posterior adductor muscle.

Fig. 4. External view of pedal orifice:—*a*, pedal orifice; *b*, *b*, margins of mantle-lobes; *c*, *c*, *c*, anterior adductor muscle.

XXVIII.—*On the Germination of the Resting Spores, and on a form of Moving Spores in* Spirogyra. By Dr. W. Pringsheim*.

[Concluded from p. 218.]

[With two Plates.]

I now pass to the account of those structures which I have found in the spores, and certain others met with in the filament-cells of *Spirogyræ*, and of which I presuppose that they likewise serve for the reproduction of the *Spirogyræ*. The same, or some phænomena similar to those I have detected, probably led Agardh to the idea that the large spores became broken up into zoospores†.

I have little to add to what has been stated at page 211 concerning the secondary cells originating in the spores from their contents. The transformation of the contents of the spores into these cells is by no means rare. They present either the appearance shown in fig. 7, of little round cells with granular contents, or, as Meyen‡ represented them, of similar cells, but with contents consisting only of *one single homogeneous* grain, almost entirely filling the cell. I have not been able to detect movement or germination in them.

The structures existing in the filament-cells are more interesting. I frequently found, namely, in conjugated filaments, that the contents of one or more pairs of conjugated cells were not transformed into the well-known large spore. But while in unconjugated cells, in which no spore was produced, the contents became decomposed, exhibiting a disappearance of chlorophyll and simultaneous appearance of a red-brown colouring matter, in perfectly indefinite although here and there granular forms (Pl. VIII. fig. 1 *o*), the contents of *such conjugated* filament-cells as produced no solitary spore, became transformed into a number of little cells of regular, definite and unchangeable form (Pl. VIII. fig. 4). This regular occurrence led me to conjecture that these cells were more than mere pseudo-forms of decaying cell-contents. I first obtained an insight into these structures by observation of their production in the cells of the young *Spirogyræ*, which I had myself seen emerge from large spores. In the cells of *these young Spirogyræ* the existing spiral bands are often broken up, and from their substance are formed, in a manner still unknown to me, little cells in which a membrane can be

* From the 'Flora,' Aug. 14th and 21st, 1852: translated by Arthur Henfrey, F.R.S., F.L.S.

† Vide p. 211, note ‖.

‡ Pflanzenphysiologie, iii. pl. 10. fig. 13 *c, d, e*.

clearly detected surrounding green contents (Pl. IX. fig. 8 *a*). I call these cells spore-mother-cells. They soon increase in size, their membrane separating itself from the contents, and expanding into a largeish hollow vesicle. The contents at the same time acquire a yellowish or yellow-brown colour, and separate into a *central*, denser, yellow-brown nucleus, and a finely granular mucilage, which surrounds the nucleus and does not entirely fill the space between it and the membrane (Pl. IX. fig. 8 *b, c, d, e*). This finely granular mucilage then becomes balled together, in the space between the yellow nucleus and the surrounding membrane, into a single large corpuscle exhibiting a sharply defined outline, and appearing as a transparent vesicle with finely granular contents (fig. 8 *f, f*). The new cell thus formed pushes the brown body, as the figures show, out of its central position, against the wall of the parent-cell or the spore-mother-cell. The pressure of these two bodies causes the rupture of the membrane of the spore-mother-cell; the *transparent* cell emerges and moves about independently and freely in the filament-cell in the manner of the zoospores.

The expelled zoospores are small elliptical cells; seen from the side they appear longish (fig. 8 *g*), from above, round (fig. 8 *h*). Their aspect resembles that of the moving spores of *Achlya prolifera* more than of any others. Their movement is much slower than that of other zoospores, and is further distinguished by the fact, that in advancing they do not make a *complete* revolution round their longitudinal axis, but merely slight oscillations to the right and left. In moving about they traverse the cavity of the filament-cells in all directions, mostly gliding onwards along the wall, as if, as it were, seeking an orifice whereby to escape; but notwithstanding that I observed very many of these moving cells for long-continued periods, I never saw them emerge from the filament-cells in which they had been produced, since no orifice was ever formed in the *everywhere closed* filament-cells. That these cells possess locomotion-threads (cilia) is certain; I could often detect them *in vibration* with the greatest clearness; but as I remained in uncertainty as to the number of vibrating threads, I have omitted them altogether in the drawing. I think it most probable that they have one single thread at the anterior extremity; yet in certain cases it appeared as if they bore a crown of several threads.

After wandering about unceasingly for several hours, they finally fix themselves *by the point*. All, however, that I have observed, after they had come to rest, became decomposed without further organic development, and their contents, *which, so long as they were in motion, were always coloured yellow and never blue with iodine*, became transformed into a number of very small, irregular starch-granules, coloured blue by iodine (Pl. IX. fig. 8 *i, i*), around which could often be detected an enveloping coat, the membrane of the dead spore. The spore-mother-cell from which the moving spore has escaped (fig. 8 *k, k, l*), only changes so far that the yellow-brown nucleus lying in it acquires a regular outline and an indistinct structure. *The orifice through which the moving spore has escaped, may still always be distinguished in the membrane of the mother-cell, if its position is not too unfavourable* (fig. 8 *k, k, l, l*). The spore-mother-cells exactly resemble those structures which I had found in the *conjugated* cells of old filaments (Pl. VIII. fig. 4*).

I have met with the following inessential variations from ordinary course of formation of the moving spores in the spore-mother-cells just described. Frequently several moving spores are formed, instead of one, in a spore-mother-cell, and this is the cause of the variable size of the spores. Moreover, one or more little brown corpuscles—portions of the central brown-yellow nucleus of the spore-mother-cell—are often combined with the finely granular mucilage which collects in the spore-mother-cell for the formation of the spores. In such cases the free spore likewise possesses one or more brown-yellow nuclei. Finally, the finely granular mucilage inside the spore-mother-cell frequently never arrives at the formation of the spore, but is transformed at once into starch-granules (Pl. IX. fig. 8 *m*).

The question now arising, how we are to interpret these moving structures, it appears to me that their *mode of formation* and the *regularity* of their appearance necessarily repel the idea that they are accidental, abnormal productions, without further value in the development of the plant. That they are foreign structures, not belonging to the *Spirogyræ*, would be an altogether inadmissible hypothesis, *since they are formed in the interior of the closed filament-cells of the* Spirogyræ, *directly from their contents*; for how, supposing them to be Infusoria, should an earlier generation of them have come into a closed cell? or is it probable that such Infusoria, produced by a *generatio æquivoca*, would begin and end their life in the interior of a vegetable cell?

In my opinion the most direct and simplest assumption, in the present condition of science, is, that they are propagative cells of the *Spirogyræ*, capable of development, and if set free, under favourable circumstances, from the filament-cell during their motion, they would reproduce the parent plant.

* When I drew fig. 4, I was still unacquainted with the history of development of this cell, and overlooked the orifices in the outer membrane through which the moving spore had emerged. Subsequently, however, *I could in every case see these orifices most distinctly in these cells, also, occurring in the conjugated cells of old filaments.*

According to this hypothesis, the contents of the filament-cells of the *Spirogyræ* might form, sometimes a large immediately-germinating, single spore (fig. 1 *a, b, c,* fig. 5), sometimes several parent-cells of moving spores (figs. 4, 8), and the contents of already formed single spores might, instead of germinating immediately, undergo metamorphosis into a number of propagative cells equally capable of propagation (compare fig. 7. Pl. VIII. and Agardh's statement, page 211; Agardh having probably seen the contents of the *spores* converted into the same moving cellules which I found in the contents of the *filament-cells*). This apparently strange behaviour finds however its explanation, in the fact that the Algæ in general, as may be shown by reference to similar phænomena, are possessed of a greater variety of *forms of spores* than was formerly supposed. And that the form of the propagative cell may vary between wider limits in these simple plants, does not appear remarkable, when we reflect that the independence of the life of the individual cell is, of all plants, greatest among the Algæ, and that the capability of bringing forth the same species is in them alone peculiar to the *contents* of the individual vegetative cell. Why should this preserve only in one, and not in more, persistent or transitory resting forms, the reproductive power dwelling in it? Can nature have here connected the maintenance of the species with one single form, where she yet has committed the power of reproduction profusely to the *mass of contents of each individual* vegetative cell?

The very occurrence simultaneously of moving and motionless spores in the same plant is but an expression of this possibility of *variation of form* of the spores of the same species. For it is untenable to attribute to the moving form a value different from the motionless, and to call the moving germs, say propagative gonidia, and the motionless true spores, since both correspond in the same way to the universal law of formation of seed in true asexual plants, *to form reproductive cells by the immediate metamorphosis of the contents of the vegetative cells.* But the capacity of reproduction in the contents of the vegetative cells is not connected merely with one *single* form of moving and one *single* form of motionless spore, and in this especially is most distinctly shown the great independence of the contents of the individual cells of the lower plants. It is true that the contents of the spore-mother-cells constantly assume a form of moving or motionless spore determinate for each species in the *ordinary* course of the cell's life, and thence we see one propagate almost exclusively by *one* definite form of moving spore, another almost exclusively by *one* definite form of motionless spore; but when the *formation of this ordinary, normal form,* or the *development of their already complete normal form* is prevented, the contents of the spore-mother-cells, or the contents of the already formed spore, give origin to these other, rarer forms, in which the capability of reproduction is likewise either permanently or transitorily secured to the cell-contents.

Examples of manifold forms of spores in the same species have indeed often presented themselves to observers, but hitherto have been mostly regarded as abnormal cell-formations, and no further estimated. In spite of the slight attention directed to these structures, many undoubted phænomena referable here may already be indicated, of which, however, I shall only cite a few.

The contents of the individual cells appear to be capable of producing new individuals in other ways than by the forms of spores already mentioned, in the *Spirogyræ*. Vaucher*, namely, whose observations may be regarded as correct, even when not yet extensively confirmed, saw the contents of isolated cells of his *Conjugata angulata* (*Mougeotia genuflexa*) transformed directly into a young plant, without having first assumed a definite resting form, and emerge from the cell, as it were born alive; and Dillwyn†, on the other hand, observed that *this* plant formed seed in the same way as the rest of the Zygnemaceæ. The observation also on the division into four of the spores of *Mesocarpus scalaris*, made by Thwaites and published by Montagne‡, is to be included here, like so many other observations of the division of spores. But such a division of spores into *many* daughter-spores, does not afford any distinctive character of species or genera; it is possible in all propagative cells of a great number

* *Loc. cit.* p. 80. pl. 8. figs. 7, 8, 9. Here, the cell which grows into a new *Spirogyra*, and which ordinarily, in the normal spores of the Zygnemaceæ, is formed subsequently on the inside of two membranes thrown off in the germination, appears to have been formed directly in the cell of the parent plant, without these coats.

† British Confervæ, London, 1809, p. 18. The passage runs:—"I have since discovered the seeds of *Conferva genuflexa*; they are large and globular, and not found within either filament as in *Conferva jugalis* (*Spirogyra jugalis*), but in the connecting tube, which thereby becomes greatly distended, as it is represented in my supplementary plate. *M. Vaucher could not discover the seeds of this species*, and of the nature of his observations I cannot form any conjecture." The figure of *Conferva genuflexa* cited by Dillwyn, as well as the reference to the passage in Vaucher, leave no room for doubt that it was the *Mougeotia genuflexa* on which Dillwyn made his observations, and that Vaucher and Dillwyn investigated the same plant. I will remark in passing, that, consequently, the seeds of *Mougeotia* are not only known, but also represented by Dillwyn (*op. cit.* Supp. pl. C), and then the distinction between the genera *Mougeotia* and *Mesocarpus* founded on the want of spores in the former falls away.

‡ Duchartre, 'Revue Botanique,' 1846, p. 469, or the Report on this notice in Mohl and Schlechtendahl's 'Botanische Zeitung,' 1846, p. 498. The Report agrees exactly with the text of the notice.

of Algæ and organisms allied to them, the limits of its extension being at present indeterminable.

I have made an observation similar to that on the origin of moving spores in the cells of the young *Spirogyræ* (Pl. IX. fig. 8) in the spores of *Œdogonium tumidulum*, after they had already come to rest and had formed a radical prolongation at one end, as in the commencement of germination. Thuret *, in his splendid illustrations of the moving spores of Algæ, has figured two locomotive, but already resting spores of *Œdogonium vesicatum* (Link, not Kützing), from the summits of which the membrane has separated all round, like a lid, by a transverse slit, and he remarks that the green contents of such spores had always vanished. I had an opportunity of repeating this observation (fig. 12 *e*), but found that the contents of such spores, before vanishing out of the upper orifice, had become metamorphosed into a number of little *moving* spores, exactly resembling those which I had found in *Spirogyra jugalis* (fig. 12 *b*, *c*). I could not trace completely the transformation of the green contents of these spores into the moving cells; but the appearance of similar large cells with brown nuclei and lighter contents separate from the nucleus, before the formation of the moving cells (fig. 12 *d*, *d*), exactly as in *Spirogyra jugalis*, led me to conjecture that their formation takes place in the same way as in that case.

The moving cells exactly resemble those of *Spirogyra jugalis* in shape, size, and motion. I have not, indeed, observed their exit from the spore which comes to rest, myself, but have frequently found the empty spore with the detached lid; the place, also, where the lid is to separate subsequently is very frequently indicated beforehand, and I often saw the lid already *separated all round*, but not yet removed (fig. 12 *a*, *d*), while the transformation of the contents of the spore into moving cells was yet incomplete. If, as is probable, the clear cellules of *Œdogonium* are capable of propagating, these plants also may present, besides the resting form of spore which is produced in the enlarged cells, and whose germination is equally unknown at present, and the ordinary moving form of spore, a third equally mobile form of spore.

Of analogous occurrences in plants of other families, I will further refer to those observations which I have made on *Achlya prolifera* †, standing so nearly allied to the Algæ in its physiological phænomena, because these leave no doubt as to the *power of germination* of the *daughter-spores* produced in the *spores*

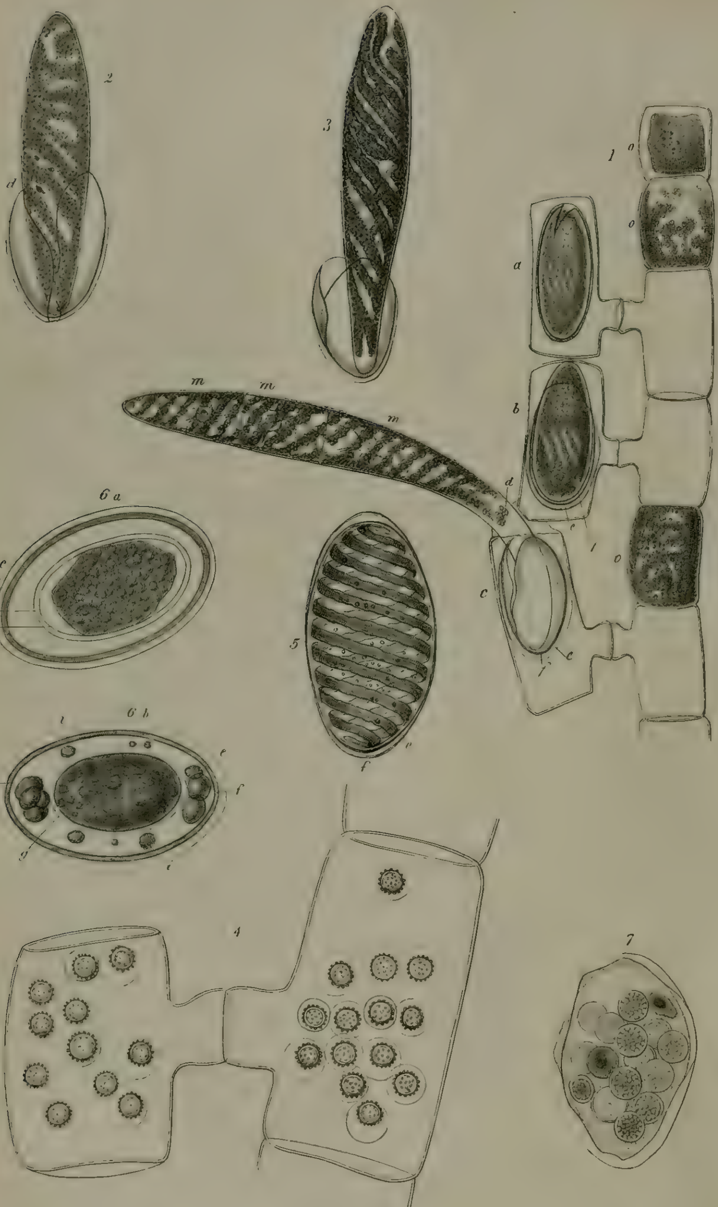
* Ann. des Sc. Nat. 1850, Sér. 3. xiv. 26. tab. 14. fig. 9.

† Die Entwickl. der *Achlya prolifera*, Nov. Acta A. N. C. xxiii. pars 1. 397.

capable of direct germination, while the third form of spore in *Achlya* reminds one in the most striking manner of the above-described moving spores of the *Spirogyræ.* Here again are formed inside the mother-cells of the resting spores, in rare cases, instead of the ordinary large globular spores, smaller (likewise resting?) spores of a form more resembling the well-known moving spores of *Achlya* (Pl. IX. fig. 13); or these same smaller spores are formed, after the complete development of the ordinary resting spores, *in the individual resting spores themselves and from their contents.* I was able to observe directly the germination of these daughter-spores in *Achlya.* Here, therefore, there certainly exist three different forms of spores capable of germination, one of which originates, as in *Spirogyra,* by cell-formation in the contents of a form of spore likewise capable of germination *.

These circumstances lead me to consider as certain the possibility of the formation of various forms of spore in the same plant, and out of the *same contents destined for reproduction.* I have already mentioned, at the outset, that in each species, *one,* as it were normal form, is distinguished, among the various *possible* forms of spore, by the preponderating frequency of its occurrence, from the other rarer and generally exceptionally produced forms. But that those rarer, or if it be wished, abnormal forms, are nevertheless quite as capable of reproducing the parent plant, as the so-called normal form, appears to me quite beyond doubt, and for some, *e.g.* in *Achlya,* directly demonstrable. That the formation of the abnormal forms is subject to as definite morphological laws, as the formation of the normal form, follows from the regularity of the mode of their formation and the constancy of their appearance. It moreover seems to me probable, that the above-described production of moving, colourless spores, in large mother-cells possessing a brown nucleus, is not limited merely to *Spirogyra* and *Œdogonium,* but perhaps represents a very general type of formation of, in my sense abnormal—*i. e.* rare, merely appearing under exceptional conditions of vegetation—forms of spore. I shall only add here, that I have found exactly the same cells with detached coats and a brown nucleus, somewhat as in *e,* fig. 8. Pl. IX., in apparently dead cells in *Cladophora fracta* also, and the exactly similar figured in *f,* fig. 8, in decaying, still closed cells of young plants of *Nitella syncarpa.*

* I also observed in *Achlya* a division of the moving cells (figs. 14 *a, b, c, d, e*); these often become constricted in the middle (fig. 14 *b*) instead of germinating, after they have come to rest, and the two halves separate from each other until perfectly (fig. 14 *c, d, e*) distinct, each then acquiring a locomotive thread (cilia) and moving freely, like the mother-spore.



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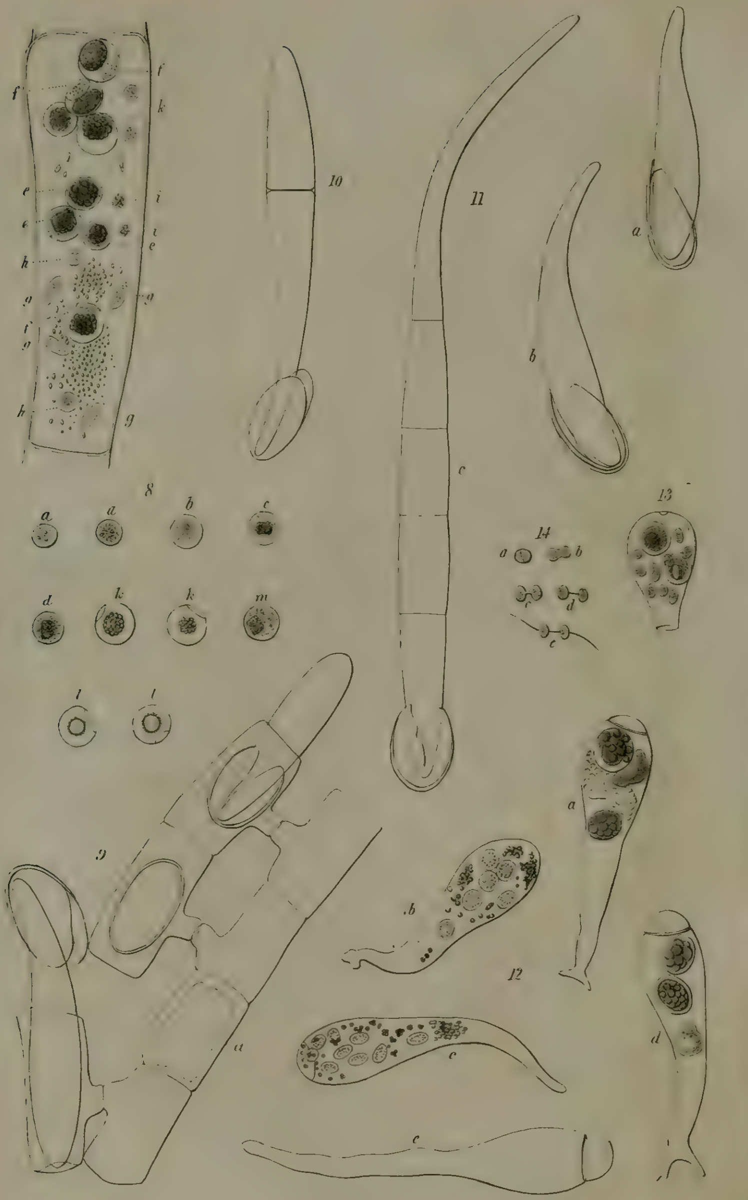
J. De C. Sowerby sc.



Autor del.

J. De C. Sowerby sc.

The assumption, moreover, that these clear moving cells (Pl. IX. fig. 8 *g*) are really true spores of *Spirogyræ*, is not opposed to any of our experience of the propagation of the Algæ. We find an analogy with the production of these moving cells in the formation of the third, probably likewise slowly moving form of spores in *Achlya*, the germination of which I have actually seen. Finally, they agrec perfectly in essential points of form and motion with other moving spores which have long been known to germinate.

EXPLANATION OF PLATES VIII. AND IX.

Figs. 1–3 are magnified 123 times; *figs.* 4–8, 246 times; *figs.* 9–11, 45 times; *fig.* 12, 345 times; and *figs.* 13 & 14, 180 times, and drawn from nature.

Figs. 1–11. *Spirogyra jugalis.*

Fig. 1. Conjugated filaments with germinating spores.

Figs. 2 & 3. Germinating spores; the germ-plants are still unicellular; their ends sticking in the spores are prolonged into a rootlike structure. The green coat upon the walls separates by tearing in several places into spiral bands.

Fig. 4. Conjugated cells with the mother-cells of the moving spores.

Fig. 5. A resting spore which had remained a longish time in glycerine.

Figs. 6 & 6 *b*. Such a spore after long digestion in potash.

Fig. 7. A similar spore with the contents transformed into several small cells.

Fig. 8. Filament-cells of a young *Spirogyra*; its contents have been transformed into the mother-cells of moving spores; part of these have already escaped from the mother-cells, part are still in process of formation, part are perfect, but still contained in the mother-cells. All the filament-cells of these young *Spirogyræ, even the radical cell*, have had their contents metamorphosed in this way; *a, b, c, d, e, f, g*, & *k, l*, exhibit the successive stages of development of the mother-cells and the moving spores.

Fig. 9. Conjugated filaments with germinating spores, in outline.

Fig. 10. Young germinating plants with the radical extremity in the spore.

Fig. 11 *a, b, c*. Young germinating plants with the cell-producing apex in the cell.

Fig. 12. *Œdogonium tumidulum.*

Fig. 12 *a, b, c, d, e*. Moving spores of *Œ. tumidulum* after their attachment.

a & *d*. The lid is already separate all round; the contents are transformed into the supposed mother-cells of the second form of moving spores.

b. The contents are transformed into six moving spores and a number of small brown bodies. *The movement* (*a real locomotion*) *of the clear spores evident, though slow. No indication of a lid yet; the cell still completely closed.*

c. The same as *b*, but the number of moving spores greater, and the places where the lid falls off already indicated.

e. Empty spores with the lid open.

Figs. 13 & 14. *Achlya prolifera.*

Fig. 13. Sporangium of *Achlya prolifera* with resting spores and a number of smaller cellules resembling the moving spores of *Achlya,* and which being likewise capable of germinating are consequently spores also; they have originated either directly from the contents of the sporangium in company with the motionless, larger, *round* spores, or *from* the latter through a metamorphosis of *their contents.*

Fig. 14. Moving spores of *Achlya prolifera* undergoing constriction, whereby two, equally moving, but smaller, daughter-spores are produced, each of these possessing a motile thread (cilia).

Note by the Translator.

While this translation has been passing through the press, I have had an opportunity of observing these active *gonidia,* and ascertaining with certainty the number of cilia in *Spirogyra quinina.* In a detached, unconjugated joint I found *sixteen* bodies moving gently but freely about in the cell-cavity, which had lost all its original protoplasmic structures, and contained only those active bodies and a number of minute granules (which from the action of iodine appeared to be starch). The active bodies consisted entirely of a viscid substance (protoplasm) without an enveloping membrane, or any trace of nucleus, and were in most cases colourless, one or two only having a greenish tinge. The containing filament-joint was $\frac{1}{800}$th of an inch in diameter, the active bodies, oval in side view and circular in front view, $\frac{1}{1200}$th and $\frac{1}{1600}$th of an inch in their respective diameters. I wished to keep these bodies alive in order to follow their escape and probable germination, but the water in the contrivance for supplying fresh water to replace that evaporating from the slides was fatal to the active bodies (perhaps from being rendered impure by some fumes in the room, as it had been exposed to air some days); at all events the movement suddenly stopped, and as I saw that the bodies would soon become decomposed, I added iodine to bring out the cilia more distinctly. When coloured full brown, the active gonidia exhibited *a pair* of long cilia proceeding from one of the ends of the oval. Even while alive and moving, I had convinced myself of the existence of two, and only two, and they were very flexible. The active bodies moved over and around each other by the waving of these cilia, and the motion of these organs caused a rapid flowing of the small (starch) granules by the currents produced in the liquid confined in the cell-cavity.

Since the preceding lines were written, I have observed the production of these ciliated bodies from the disorganized spiral bands, and also some other phænomena connected with them, which I must reserve for a future notice, after I have investigated them more fully.—A. H.

XXIX.—*Description of* Rhopalodina, *a new form of Echinodermata.* By J. E. Gray, Ph.D., F.R.S., V.P.Z.S. &c.

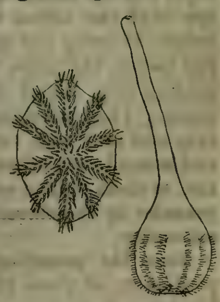
Among the specimens collected by the late Mr. Cranch during Captain Tuckey's Congo Expedition, is the case of a very curious animal which has been erroneously placed among the Worms. By the label on the bottle it was taken on the "22nd of May." After examining the specimen I feel convinced that it is a Radiated animal most nearly allied to *Siphunculus*, and probably forms the type of a new family intermediate between that genus and *Holothuria*. Unfortunately the whole of the internal organs appear to be destroyed, either by the weakness of the spirit, or their expulsion by the contraction of the organs at the time of death; for when the specimen was first examined, the sides of the body were closely compressed against each other, leaving no internal cavity, and giving the specimen the form of a spoon with a roundish bowl and a slender tapering blunt handle; but when carefully examined it showed that its proper form was ovate, rather compressed, with a slight keel on each side.

It may be described thus:—

Rhopalodina.

Animal elongate, clavate, rigid, rather brittle, covered with imbedded hard calcareous plates having the appearance of rugose spinulose scales, the imbricate edge being directed towards the aperture; the scales of the dilated lower part of the body large, and those on the narrow tubular part very small and close, being most distinctly visible round the edge of the oral aperture. When examined under the microscope the surface appears to be formed of very numerous small circular imbedded plates, and scattered with rather distant transparent rugulose spines.

The upper part near the mouth is cylindrical and tubular and more rigid, very gradually and slightly enlarging towards the end, where it rather suddenly dilates into an ovate, somewhat compressed body, with a slight keel on each of the two edges. The parietes of the body are thinner and less rigid than that of the tube. The hinder half of the dilated body is furnished with ten bands or ambulacra, each formed of two series of thin tentacles, supported or defended by transparent rugulose spines, which regularly diverge from the centre of the hinder end of the body. They are more like the ambulacra of the



Rhopalodina lageniformis.

Holothuriæ than those of the Sea Egg or *Echina*, for I cannot discover any regular perforations, such as are found in the ambulacra of the latter animals. They end abruptly, but there is an obscurely marked rather darker line, which extends from their extremity a greater or less distance towards the upper part of the tube. The aperture of the tube is circular, and I cannot find any trace of a second opening to the alimentary canal.

The animal is $1\frac{9}{12}$ long; the dilated body $\frac{8}{12}$ long and $\frac{5}{12}$ wide, $\frac{4}{12}$ thick from side to side.

The only specimen known may be designated *Rhopalodina lageniformis.*

In general external appearance it resembles a *Siphunculus* with a scaly covering like the scaly *Holothuriæ*, and with distinct ambulacra like those animals, but only covering the upper half of the club-shaped part of the body; but, unlike the *Holothuriæ*, which have the ambulacra limited to a part of the body, the part where these are situated is that which is the most convex. For the present I should be inclined to place it as the type of a new family between *Holothuria* and *Siphunculus.*

XXX.—*Rambles in Ceylon.* By Edgar Leopold Layard, Esq.

To Richard Taylor, Esq.

[Continued from p. 236.]

Allawattegodde, Top of Balacadua Pass,
April 23, 1852.

My dear Sir,—I resume my narrative from this place—so much of my way back to Jaffna. I closed my last letter at Allagamo on the night of Sunday the 13th, after which we pushed on vigorously and got into Kandy safe and sound, in spite of all the ill-omened prophecies with which we started; though, absurdly enough, while standing at the farrier's door, giving him instructions about shoeing the horse, the back-band of the harness gave way, and down we came: fortunately neither of us was hurt. B. left the next morning by the mail, and I heard from him by return that he had arrived just in time for the Bombay steamer. I managed to get over my business in Kandy in one day, and loving the jungle more than the town, I left by daylight the next (Saturday) and came on here, intending to halt for my Sunday. Here I have been ever since, for my horse, who has never been among the hills but once before, and is therefore quite unused to them, has been quite lame, and I but little better; however, we are both getting well, and my friend C. (at whose house I am stopping) and I go down the Pass tomorrow to Matelle, the scene of the late rebellion. I ride one of his horses, and poor old Baba takes the buggy down this evening. I have not been idle during my stay here;

I have added largely to my collection, and ascertained many habitats that I did not know before. This morning I found the nest of *Merops erythrocephalus*, Lath., in a steep bank; it was merely a hole dug into the clay, about eighteen inches deep, terminating in a vaulted chamber; the eggs, two in number, of a pure white and rounded form, were laid on the bare ground; several of the adult birds were flying about, every now and then darting into their holes with flies for their young, of which, in other places in the same bank, we found several pairs. The only two other species we have in the island are *Merops viridis*, L., and *Philippinensis*, L.; the former is resident with us throughout the year, the latter is migratory, as I told you in my last. I do not think *erythrocephalus* migrates, but it is a bird so entirely confined to the jungle, that I cannot say much of its habits in this respect; they keep much about the tops of the highest trees, and never descend like the other species; they do not seem gregarious, like *viridis*, which roosts together in flocks of several hundreds, though several may be seen on the same tree, each occupying its separate throne, from which it darts off in quest of insects. *M. viridis* is almost confined to the northern province, where it is singularly abundant, much affecting the *Euphorbia* hedges about the open country. It is the only species I have ever seen actually perch *on the ground, M. Philippinensis* generally selecting a pebble, be it ever so small. All the species utter a pleasing note, particularly *viridis*, when selecting a place for their roosting quarters, generally a low tree or bush, to which they return night after night. I never found them occupying an elevated place.

I see that *Pomatorhinus melanurus*, Blyth, is not uncommon here; it has a curious creeping motion up the branches of trees, not unlike our English wryneck (*Yunx Torquilla*, L.). It is a bird more often heard than seen, delighting in the low dense thickets that clothe the sides of our Ceylon hills, creeping about in search of insects, and continually calling to each other to keep their small parties together. Another bird has fallen under my notice here for the first time, the discovery of which has given me great satisfaction; it is, I am sure, the long-lost *Treron Pompadoura** of Brown's wretched figures, in pl. 19, 20 of his 'Illustrations,' and of which Blyth has sent me facsimiles. It is abundant here, feeding on berries which it swallows whole; its cry is very like that of *T. bicincta*, and I should not have detected it had not C. shot some for the pot (where, by the way, they are superexcellent), and thus revealed to me that they were distinct from those in the low country.

It may not be amiss to tell you somewhat of our pigeons. First then, in the low country about Colombo, we have *Treron bicincta*, Jerd., *Chalcophaps indica*, L., and *Turtur suratensis*, Lath., abundantly; and I shot a young pigeon in the Pasdoom Corle (during a journey I once took thither with the late botanist, Dr. Gardner), which I am sure was *Turtur orientalis*, Lath.

* Since confirmed.

T. bicincta keeps to the high trees, on the berries of which it feeds, the teak being a very favourite one; they fly in large flocks, and I have frequently, when firing into a tree at one, killed half a dozen, which I never saw till they fell. They breed in lofty trees, making a rough nest of sticks, and lay two white eggs. Their note is a modulated plaintive whistle, like that of all our other Trerons.

Chalcophaps indica is a *ground dove*, and is rarely seen on trees; it is abundant about Colombo, and extends into the Kandy or Hill District and as far as Kodally-kallu, northward, but I never saw it at Pt. Pedro or round Jaffna. It is very abundant in the southern province; its plaintive *lowing* cry may be heard morning and evening from almost every thicket.

Turtur suratensis, Lath., is not uncommon about Colombo, but affects open lands and the palmirah topes of the northern province; there its numbers are prodigious, and I have often killed twenty-eight or thirty of a morning between six o'clock and nine, when, utterly tired of the unvarying round of seer-fish and tough chicken (all we could get to eat in our station), my wife has begged for a few pigeons to make a pie. I got to like these pigeon-pies, and was so much benefited by the exercise it gave me, that at length rarely a week passed without my sallying out once or twice to make up a bag, and yet I never saw the number of these birds diminish. They and *Turtur risorius*, L., are the commonest northern pigeons; the latter, however, abides more on the open lands and low jungle, and from its partiality to the *Euphorbia* hedges and jungles, is called by the Tamuls *Cally-praā*, *Cally* being the native name for the *Euphorbia*, and *praā* (the *aā* sounded as the final letter in *papa*) their name for pigeons of all kinds. In one palmirah tope near the village Warrany I discovered the elegant little *T. humilis*, Tem.; this species has not, that I am aware of, been found elsewhere, nor does it extend a mile on each side of its location. All three of these turtles were building their nests in the same tope, similarly constructed of twigs slightly laid together; their eggs the same in colour and shape and only distinguishable by their size. *T. risorius* and *T. suratensis* are also found along the western coast as soon as the traveller comes to the *Euphorbia* jungles, and they extend all round thence northward and eastward to Hambantotte, where *T. risorius* ceases.

Treron bicincta begins about a day's journey to the southward of Anarajahpoora, and extends up to the ford at Elephant Pass, a few straggling over; but in the peninsula it is replaced by *T. chlorigaster*, Blyth; this however never extends elsewhere, and is I believe a migratory *coast* bird, only visiting us when the banian-trees are laden with their scarlet fruit.

Down the central road from Tangutta, as far as Matelle, Blyth's *Carpophaga pusilla* is not uncommon, but is a shy and wary bird. On the western coast I frequently saw a pigeon which I feel sure is *Alsocomus puniceus*, Tick., and Kelaart has procured *Palumbus Elphinstonii*, Sykes, at Newera Ellia; and now this long list is done, and I suppose you are nearly tired of it. Ah, no! I had nearly forgotten the Trincomalee rock-pigeon, *Columba Livia*, Briss., which is *the* pigeon of that place, breeding in thousands in some rocks in the sea, near the shore.

But let me get back to Balcadua Pass. I have got many good shells here. *Helix Waltoni* is abundant in the early morning along the sides of the road; the mollusk is a fine shining black. A large variety of *Hæmastoma* is common on the coffee bushes. I have a minute little *Vitrina*[1], new to me, and a small *Helix*[2] with a multitude of close-set whorls, also new. *H. citrina*[3], or a shell that poor Gardner gave me as such, is not uncommon about the rocks under decaying vegetation; and the curious *H. Rivolii*, Desh., lies in every direction, calcined by the burning of the forest for planting, and yet, curiously enough, I cannot find a single live specimen. *Achatina orophila*[4] and another larger species[5] whose name I do not know are abundant under dead leaves and at the roots of trees, and in the latter place I found a new *Carocolla*, but unfortunately lost it by my collecting-box falling from my pocket while jumping over a chasm, beneath which the river ran foaming and roaring. This little mountain stream has supplied me with *Paludomus nigricans*, Reeve, and two others[6], neither of which I can identify with any figured by Reeve; but the larger bears a striking likeness to *P. conica*, R., which I have received from Sylhet. In the Mahawilla Ganga, on my road from Kandy hither, I procured *P. globulosus*, R.[7], not on the *stones*, but on *sand* only! and there are some others, which I have left at Matelle, gathered hastily on my road down. A little tributary to this stream has furnished me with some strange varieties of *Melania elegans* and *M. pyramis*[8], very stunted in growth and tinged with sulphate of iron, with which the water is strongly impregnated. I must not forget to tell you, I have also procured here *Cyclostoma zeylanicum*, Pfeiffer. There is also a *Pterocyclos*[9], much larger than another species, from a cave at Tondemanäar in my district, which has a curious spiral operculum.

Our *Cyclostomacea* are, as far as I know, very little worked out as yet.

Cycl. cornu venatorium, the largeish dark brown species[10] with a

[The following notes have been supplied by W. H. Benson, Esq.—Ed.]

[1] *Vitrina membranacea*, Bens. MSS.

[2] *Helix Puteolus*, Bens. MSS.

[3] The only shell resembling *H. citrina* in form and size among the specimens received, is a pale *H. Juliana*, Gray, with a narrow brown band.

[4] *Achatina Orophila*, Bens., is *A. Ceylanica*, Pfr.

[5] Probably *A. inornata*, Pfr., which is in the collection.

[6] *Paludomus abbreviatus*, Reeve, P.Z.S. ined. is one of these species; the other appears to be a somewhat smooth variety of *P. sulcatus*, Reeve.

[7] *Paludomus globulosus* has not been received. *P. dilatatus*, Reeve, P.Z.S. ined. may have been intended.

[8] *Melania elegans* is *M. spinulosa*, Lamarck, and *Melania pyramis* is *M. tuberculata*, Müll.

[9] *Pt. Cingalensis*, Bens., Annals, vol. xi. p. 105.

[10] This is *Cycl.* (*Aulopoma*) *Itieri* of Guérin.

reddish zone, is common about Caltura and the Pasdoom Corle, Kandy and Matelle;—the white variety[11] with the dark zone, in the high tree jungle about the central road, crawling on decaying leaves in moist situations;—the little uniform brown variety[12] with the zone very faint, only under one large banian-tree in the Academy Gardens at Colombo. Similar as these varieties are, I should not wonder if they are all distinct, the smaller variety in particular; this never exceeds half an inch in diameter, whereas the others often attain to one inch. [See Note A. at the end of the paper.]

The next we come to is *C. involvulus*; this exists in myriads at Galle, under cocoa-nut and other umbrageous trees, generally buried beneath the soil or dead leaves[13].

We have a distinct species, or else a strongly marked variety of this, near Pt. Pedro, in a curious cave at Tondemanāar[14]. It seldom has the protruding lip of *involvulus*, but in most instances the peritreme is simple: I have examples in which the lip is decidedly reflected, as in some specimens received from Chittagaon, and marked *C. indicum*[15]. [See Note B.]

The cave variety is altogether a lighter-built shell than that from Galle; it is more finely striated, and its colours darker and more blended together. The white band so conspicuous on the underside of *involvulus* is wanting, the black band fading off to a yellowish brown. The aperture is *yellow*, whereas in the Galle specimen it is *pink*. Found under large stones and the crevices of rock, in the Tondemanāar cave. I should not omit to mention, I have a specimen from Galle nearly quite white, aperture pink as usual.

The next species we come to is *C. ceylanicum*[16]. I leave better judges than myself to determine whether this is separable from the last. I can but bear testimony to its being found in widely-different localities, being in fact confined to the hills. There is a nearly white variety of this also.

The opercula of *involvulus* and *ceylanicum* are multispiral, the last layer diminishing so as to form a circle. I have three more of this turbiniform group of *Cyclostoma*: one from Pt. Pedro, found after rain on the trunks of palmirah trees. This, Mr. Cuming writes me word, is a new species[17]. It may be briefly described thus: Diameter 3 lines, axis $4\frac{1}{2}$ lines; umbilicus open; whorls much rounded, minutely striated; spire rather long, subacute; peritreme simple; operculum round, multispiral, corneous, retractile. The colour varies

[11] This appears to be a mere variety of *Itieri*.

[12] This is *Cycl.* (*Aulopoma*) *Helicinum*, Chemnitz, as defined by Pfeiffer.

[13] The Galle species is *C. Menkeanum*, Philippi.

[14] The Tondemanāar species is *C. involvulus*, Müll.

[15] The Chittagaon species is *Cycl. Bensoni*, Pfr., of which the habitat was previously unknown. It comes from the N.E. angle of the Bay of Bengal, near the Mogna mouth of the Ganges and Burhampooter.

[16] *Cycl. ceylanicum*, Pfr., which, with a curious white variety, is in the collection, is perfectly distinct from the Tondemanāar shell.

[17] A large and finely coloured variety of *C.* (*Leptopoma*) *halophilum*, Bens.

from a darkish horn-colour, with one or more lines on the body-whorl, to a deep tortoiseshell, with black lines. The animal is brown, with a livid foot; tentacula short.

Another, allied to the foregoing, but larger, I have received in an imperfect state from Monegahagalla, in the hilly zone[18]. I wait to get living examples to describe it.

Another, nearly allied to *C. Listeri*, from the Mauritius, but a less solid shell: diameter 4½ lines, height 4½ lines; umbilicus closed; whorls five, rounded, smooth; spire rather long, subacute; peritreme white, double, the outer edge reflected; operculum corneous, retractile. The prevailing colour is a lightish ground, with dark brown transverse wavy lines; apex blackish. I have seen numerous examples of a dirty white, immaculate; the apex blackish, as in others. A cousin of mine, Mr. Charles P. Layard, obtained this in great abundance in the Saffragam district, in the Curuwitty Pass. At the same time, he procured four specimens of a very curious species: diameter 5 lines, axis 3 lines; spire exserted, covered with a dark brown epidermis, which is *ribbed*; ground colour of shell light yellowish brown, marked with close-set, dark, wavy lines; peritreme double; operculum retractile[19].

Leaving this division we enter the flattened form, of which Lamarck's *Planorbulum* is an example. This species, as far as I can judge from description, without comparison of actual specimens, I have received from the hilly zone. Unfortunately none that I have are in good preservation[20].

We have also from the same localities a lesser species, but all I have seen are faded.

Of the curious Pupæform group of *Cyclostoma*, of which Benson's *C funiculatum* is an example, we have two species, both found in the same localities in the Saffragam district, which is rich in mollusca.

The smaller species[21] measures: diameter 3½, length 10 lines; it is thick in the middle and tapers off towards the apex; and the mouth, which is circular and furnished with a deep circular sinus, communicating with a canal running along the base of the whorls and visible in all stages of growth; the peritreme is white, broad and reflected; general colour of shell reddish brown; the whole surface is finely striated and granulated, the granulations being more visible as the growth of the shell increases; the operculum is unlike any other I have seen, resembling in fact the thread of a wood-screw, varying from two to three revolutions; it is horny and retractile; shell abundant under moss and stones.

The larger species[22] measures 6 lines in diameter, 14 in length, and tapers gradually to the apex; aperture, canal and peritreme as in the last species; operculum horny, dense, and retractile to a level with

[18] *C. orophilum,* Bens., Annals, vol. xi. p. 106.

[19] Those two species have not been received.

[20] *C. annulatum,* Pfr., which has been received, is probably the form here alluded to.

[21] *Cataulus Thwaitesi,* Pfr.

[22] *Cataulus pyramidatus,* Pfr.

the surface of the mouth; surface of shell finely streaked, between the canal and the umbilicus (which is closed) assuming a coarser character; general colour reddish brown. Found in the same locality and situations as the last.

Friday, April 25.

Here we are at Nalande, thirty-two miles from where I last wrote. C. is taking his cheroot, and I resume my pen.

On our way down the Balcadua Pass I found the nest of *Hirundo hyperythra* (Layard and Blyth). It was built under the arch of a drain, into which I had to creep on my hands and knees. In structure it precisely resembled that of the European swallow, *H. rustica*. There were four half-fledged young ones in it, and I found the remnants of broken eggs on the ground: from these I should say they were of a pale cream-colour speckled with dark spots, as in those of the English species. C. pointed out a nitre cave, which he said was worked by the natives; it appeared to be inhabited by myriads of bats. I procured the curious *Lyriocephalus scutatus*, L., from some low shrubs near it.

At Matelle we rested under the hospitable roof of the assistant-agent, Mr. T. He and his family were absent, but I had seen them on my way down, and left my bullock-cart there. In his garden I shot *Calliope cyana*, Hodg., and *Loriculus philippensis*, Briss., which is very common here; *Palæornis cyanocephalus*, L., *Pal. Calthropæ*, nobis, are also abundant; and I shot *P. Alexandri*, L., about five miles from the town, on my way hither: thus, with the exception of *P. torquatus*, which I did not observe, I obtained all our island parrots at this one place. *P. torquatus* is abundant about Jaffna, breeding in hollow trees and laying three or four white eggs. I saw them as far as Dambool, and doubt not they are sometimes found in Matelle.

We left Matelle this morning at daylight, and reached this about ten o'clock: C. rode and I drove. We got along pretty well, stopping now and then to go after birds, of which *Bucco flavifrons*, C., and *H. hyperythra*, L. & B., were what I principally wanted. *B. flavifrons* is strictly a hill species; the other three, *Bucco zeylanicus*, L., *B. indicus*, Lath., and *B. ruficapillus*, Gmel., being found equally in the high and low country. *B. flavifrons* does not seem to extend farther than this. Our drive was very lovely, and I had more time to admire the beautiful scenery than I had on my way down. We were gradually descending from the Kandian country over a succession of undulating hills clothed with vegetation and abounding in birds and insects. We passed through one magnificent forest of large timber trees, whose branches were laced together and festooned with gigantic flowering creepers and encircled by the broad bright green leaves of the sword-fern, or clothed with the dark tapering leaves of the finger-fern. In this forest I saw some of our most valued indigenous butterflies: *Minetra gambrisius, Papilio Helenus, Charaxes Bernhardus, Pap. Crino*, in abundance; *Thecla Narada*, a beautiful copper-coloured *Myrina, Iphias Glaucippe*, and many others. Unluckily, the bullock-driver had torn my net so much at starting, that I had left it behind with the cart as useless; I therefore could only capture a few specimens of *T. Narada*: these were so busily employed in thrusting their trunks into the buffalos' dung scattered about the road, that I simply had to take them by the wings, one after another, till I caught all I saw. I have captured this insect in Matura Galle and Jaffna; it has therefore a wide distribution.

Between Kandy and this place I found the following *Papilionidæ*:—

Papilio (Ornithopterus) Amphimedon	Abundant.
Pap. Polymnestor	Abundant.
Pap. Erithonius	Abundant.
Pap. Agamemnon	Not uncommon.
Pap. Brathycles	Common.
Pap. Sarpedon [See Note C.]	Rare.
Pap. Pammon	Common.
Pap. Helenus	Rare.
Pap. Hector } *Pap. Diphilus* } [See Note D.]	Very abundant.
Pap. Polytes	Very rare.
Pap. Romulus	Very rare.
Pap. Crino	Abundant.

This last frequents the higher branches of the trees, and is consequently seldom captured: I have however procured a few, by finding them asleep and hanging to the underside of leaves, with their bodies in a line with the stems, so that their closed wings were quite protected from the dews. Some stress has, I believe, been laid on the extension of the green band into the discoidal cell on the upper wing of this species. I myself once thought that this seemed to be a *local* distinction, but since I have captured a large quantity I find it does not hold. I am now decidedly of opinion that it is quite an accidental variety.

After we had seen to our horses, we sallied out to look for snipe and specimens. In the forest over against the Rest House I found a *Carocolla* which I had not hitherto seen (but which I unfortunately lost from my box in some way), and a dead example of a remarkable *Achatina* with a multitude of whorls[23]. I also procured a *Cyclostoma* new to me: diameter 12 lines, depth 3 lines; peritreme double, reflected, spire flat, surface of whorls finely streaked; operculum multispiral, retractile, colour a dark straw. Animal livid. Habitat, vegetable deposits in the clefts of rocks[24].

We found a pair of the large owls, *Retupa ceylonensis*, in a dark place near the river, but they were wide awake and flew away long ere we came within gun-shot of them. The natives all say they feed largely on fish; they certainly relish that food in confinement.

On arriving at the ford I found the river very low, and was amazed to think how I had escaped an upset when I came over it on my way down, when it was swollen. It was full of large boulders, then quite

[23] *Ach. veruina*, Bens. MSS.

[24] Not recognized in the collection.

hidden by the water, which came up to the seat of the gig, but now, high out of the stream, they really look impassable. Tomorrow will decide.

The river furnished me with abundance of *Paludomus spiralis*, a species which I found at several of the rivers as far north as Maddewatchy.

Dambool, April 26.

Safe and sound so far, thank Heaven! over the worst day's journey of the whole road. The old time-worn rock, enfolding in its cavern temple hundreds of Buddhos of all sizes, from forty feet to as many inches, is frowning upon me in the dim moonlight: the night hawks sit churring and gobbling on the tumbledown rails of the Rest House fence: the large white bullocks of my cart lie ruminating at my side: and extended at full length, and covered with a single cloth, tucked under their heads and toes, repose my retainers; they look horribly like a line of corpses, but the nasal *in*voluntaries that they play dispel the illusion. How fresh and beautiful the night is after the rain, and yet I cannot fancy myself in any place but the tropics, cool as it is! In Old England not a sound would break the stillness: in the words of a beautiful evening hymn, there "Night and silence reign," indeed; but here, the words of the Psalmist, "Thou makest darkness that it may be night, wherein all the beasts of the forest do move," strike one with double force. I certainly think the stillest season of the twenty-four hours is from 11 A.M. to 3 P.M. As I sit, there are such a variety of sounds that it is hardly possible to distinguish them one from another: stop, let me try. There's the lesser fern owl (*C. asiaticus*), the larger (*C. Mahrattensis*), the little *Scops Lempiji*, tree frogs, marsh frogs, crickets by scores, and seated on my table is an attenuated green grasshopper, whose pipe is as shrill as any of them despite his leanness. But there's a sound I can't make out; I think it is the cry of the *Brachystoma*. I heard it on my way down, but could not detect what made it, nor could I this evening, though I hunted well for it; it is very like the cry of the cuckoo. Oh! of course there go the jackals; a night in the East would not be perfect without them. "*Dead hindoo-ooooo,*" howls one; "*Where, where, where,*" drawls a famished wretch, impatient for a bit; "*Here, he-re, he-e-er, he-ar*" (a mouthful rendering his articulation imperfect) yells a third; and then comes a general chorus, in which "*Hindoo-ooooo,*" "*where*" and "*he-ar*" are happily blended. But what has checked the noisy wretches in their concert? "*a-a-arch! a-a-arch!*" That's a new note, and not far off either; whose is it I wonder? "Here, Muttu! Muttu! you lazy beast, Muttu!"—a shove, which sends him rolling over and over. "*Eh! d'ara?*" (who is that?) growls the sleeper, awakened. "Here, Muttu! *enna chattam?*" (what is that noise?) "Ah! *Dorray*" (master), and the winding sheet sits upright. "*A-a-arch, wa-a-arch*" again from the jungle. "*Pully*" (leopard), coolly replies Man Friday, and the winding sheet is resumed again. Such is habit! he is sleeping in the verandah of this lonely bungalow, with no protection in the world. Well, that loaded rifle yonder is some little comfort to me; so now for the events of the day.

C. and I parted this morning; he to inspect his work, I to return home: he however saw me safe over the river, which was indeed a difficult matter. How we blundered blindly through it the first time I have no conception. After passing this, near the fifth mile there is a very bad place; in fact, the road passes over a rock, on which the iron shoes of my poor horse were like so many skates, and we had to hold him up by main force. Getting safely over this, we drove down what appeared the half-dry bed of a river rather than a road, full of loose stones and with a stream of water down the centre: at one place was a deep hole filled with mud; luckily, a native passing with a caicatty (a crooked knife like a bill-hook) helped me to clear a space through the jungle a little to one side, and I managed to avoid it. Today's journey was fourteen miles, but owing to the bad state of the road I got in very late. At 4 o'clock, when the sun was not very hot, I sallied out to mount the rock again. I did not care about visiting the temples a second time, because I was disappointed when B. and I went into them on our way down. The priests pointed out the gigantic Buddhos with great satisfaction. I am sure the figures are not solid stone; there is a large amount of plaster about them, which the yellow paint hides. One thing connected with Buddhos always strikes me as ridiculous: however one may be placed, standing or lying, "the flame" issuing from the head is always in a *right line* with the body.

I was pleased to find the *Cypselus affinis* building under the shelter of the high cliff, their nests being placed in patches of fifty or sixty together against the overhanging face of the rock: they were composed of mud, of a hemispherical shape, with a round hole at the side for egress and ingress. While on the top of the rock, being in want of a specimen, I shot two of the birds, and found that the many hundreds I saw hawking all round were procuring food for their young ones; this consisted of minute green tree-hoppers (*Cercopidæ*), which they carried in a ball under the tongue. While I was watching them one uttered a peculiar scream; the cry was taken up and re-echoed from the minute specks in the clear blue ether far above me; all seemed animated with a common purpose—that of uttering piercing cries and chasing each other round and round the rock a dozen times or more. Suddenly, in mid career, the cries ceased, and as each bird neared one spot it darted over the cliff, and I saw no more of them for the night. What could have thus led all of them to follow one common course so suddenly? A large swift (which I take to be *C. Melba*), *C. Balasiensis* and *Macropteryx coronatus* still kept on their airy gyrations, and so continued till my eyes could no longer follow them in the deepening shades of evening. On the summit of the rock, at the roots of some dead clumps of coarse grass that had once flourished in the scanty soil accumulated in the crevices, I found a new *Cyclostoma*[25]: diameter 6 lines, axis $2\frac{1}{2}$; spire slightly exserted; whorls 5, finely striated; umbilicus very open; colour a uniform dark hair-brown; operculum spiral, thin, corneous, totally retractile;

[25] *Cycl. Parapsis,* Bens. MSS.

animal approaching to black. Lower down I detected none of these, but I procured several new *Helices* and the *Pterocyclos*, allied to that before mentioned found in the cave at Tondemanāar in my district, but larger and coarser, with the wing more free, the spire not exserted[26]. The Tondemanāar shell measures: diameter 9 lines, axis 4; whorls 5; umbilicus very open; the ground colour is whitish, marked with transverse wavy reddish brown lines; spire slight, exserted; operculum pyramidal, rough, multispiral, hollow, partially retractile; animal livid brown[27]. It is found in some abundance in a cave in the curious limestone formation of the Jaffna peninsula, which at Tondemanāar crops out in a large mass. The best idea I can give of this remarkable formation is comparing it to a huge wave of liquid mud, which has rolled over the country and been suddenly arrested and hardened in its course. The whole of this muddy stream appears to have been full of bubbles, and this cave merely a large one; I should say, 40 yards long by 10 broad: it is raised above the surrounding country, and the centre, where the crust was thin, has fallen in and lies in crumbled fragments below. A solitary banian-tree, planted doubtless by some passing crow, springs from the bottom of the cave, and among its roots and the crevices of the weather-worn fragments lie the *Pterocycli* I have described. In no other place in the whole of the Northern peninsula could I find a single specimen,—its dry and burning soil affords them no shelter; but down in the cave it is always cool and moist, and ferns (only, otherwise, found down deep wells in this province) abound in the wildest luxuriance. There are several of these caves about Jaffna; the most celebrated is that near Pootoor, called Nurahverri, which assumes the shape of a natural well, said to communicate with the sea. It is of a vast depth, and bottles previously corked have been lowered into it and brought up filled with salt water, though the upper surface is perfectly fresh. Of the *Helices* I defer giving you any information (I have observed about forty species here, many of which are undescribed) until Mr. Benson shall have examined them. I should probably only describe many well-known species, and run my letter to an enormous length: it has already exceeded the limits I had assigned to it, and I shall therefore close, and resume it again if I find anything to amuse you further on.

I do not think I shall be able to write till I reach Anarajahpoora, for there are no Rest-Houses along the road I am going, and I have neither table nor chair, and must trust to chance for accommodation. So, till you hear from me again, believe me yours very truly,

E. L. Layard.

Note A.—Since the above was written, Mr. W. H. Benson writes me word that a *Cyclostoma* in the British Museum (supposed to have been received from me, but sent by a cousin of mine, Mr. Fred. Layard) is not the true *C. cornu venatorium*, as labeled by him, but *C. Heli-*

[26] *P. Cingalensis*, B.

[27] The Tondemanāar *Pterocyclos* is *Pt. rupestris*, Benson, var. *picta*, Troschel.

cinum, Pfr. He also writes: "Pfeiffer informs me that specimens of *C. halophilum* found by Captain Templeman near Colombo are larger than those I got at Galle (described 'Annals,' vol. vii. p. 265)." Mr. F. Layard's *C. cornu venatorium* I never saw; I merely guess, therefore (recollecting that before I took to observing mollusca myself, I brought him many different species from Galle), that these may have been some Galle specimens: in which case my dark *cornu venatorium* may be *C. Helicinum*, and my small variety, the large variety of *halophilum* taken by *Capt. Templeman**. (Quere: Should not this be *Dr. Templeton*, a well-known naturalist here?)[28]

Note B.—Mr. Benson, as before quoted, writes: "With the little turbiniform *halophilum* I took *C. Menkeanum*, Pfr.[29], which is confounded in England with *C. involvulus*." In this case the Galle shell will probably be *C. Menkeanum* (mine were however named by Mr. Cuming); and may not my cave shell be *C. involvulus*, vera, sed?

Note C.—*P. Sarpedon* is a low-country species, and remarkably abundant about Colombo; it feeds principally on cinnamon; and the chrysalis is shaped like that of *Agamemnon*, which feeds on the soursop. *P. Brathycles* represents these two in the hills and is very abundant, while they are *rare*. The larva I do not know.

Note D.—*P. Hector* feeds on the *Aristolochia medica*, which is very abundant about Pt. Pedro: the caterpillar of this and *Diphilus* are extremely similar, and feed on the same plant. I have often thought of obtaining a fine brood of *Hector*, and procured *Diphilus*, and *vice versâ*. They are not however identical, for they appear at different times of the year, *Diphilus* in May and June, *Hector* end of July; and I have taken each species *in coitu* with one of its own family; in fact, copulation has gone on in my own breeding-cage among species reared from the same plant. The males have the upper wings more attenuated than the females.

Pammon and *Romulus* feed on various species of *Citrus*, and have a very differently shaped chrysalis from *Hector* and *Diphilus*.

A curious division might be made by separating the species according to the chrysalis, showing at once how little this can be depended on in the formation of groups. *Pap.* (*O.*) *Amphimedon* stands alone. Then *Hector* and *Diphilus*, in which the knobs on the body are largely developed: the caterpillars also resemble each other, and they feed on creeping plants. A large new species, somewhat resembling *Diphilus*, may be classed with these. Then follow, *Polymnestor*, *Erithonius*, *Pammon*, *Polites*, *Romulus*, and probably *Crino* and *Helenus*: in these the knobs are entirely wanting and the head bifurcate; the caterpillars are green, smooth (not spiny, like *Amphimedon* and *Hector*), and all feed on trees of the genus *Citrus*. Then *Aga-*

* Pfeiffer writes and prints Capt. Templeman.—W.B.

[28] Vide notes 10, 11, 12 and 17 supra.

[29] *Cycl. Menkeanum* is distinguished from *C. involvulus* by sculpture, wider umbilicus, smaller aperture, porrect and rugose interior lip, greater solidity, and further by a character previously overlooked, viz. the gradual descent, above, of the last whorl behind the aperture. Vide notes 13 and 24 supra.

memnon and *Sarpedon* (and probably *Brathycles*), which feed on cinnamon and sour-sop: the chrysalis is smooth, the head bluntly bifurcate, the thorax prolonged into a point and the back nearly straight; whereas all the others are more or less bent into an angle: they differ also in position, being suspended to the undersides of *leaves* with the head *downwards*, whereas all the others are attached to the *stems* of plants with the head *upwards*.

I cannot at this moment call to mind what the larvæ are like; it is several years since I saw and drew them (with many others), and my wife painted them. They are, or were, in the British Museum, placed there by Dr. Templeton; you can refer and see, if you wish to follow this up.

Lastly, *P. dissimilis* carries its name with it into the chrysalis state: it is unlike any other, being indeed *sui generis*: it precisely resembles a piece of burnt stick, very elongated and ending abruptly as it were; head hardly bifurcate; thorax distinctly so.

Papilio Antipathes has only been captured once to my knowledge in the island, I therefore know nothing of its transformations. Besides this one which is in my collection, I saw two specimens only, and those on the road between Ambegammoa and Yatteantotte in the hills.

BIBLIOGRAPHICAL NOTICES.

Principles of the Anatomy and Physiology of the Vegetable Cell. By HUGO VON MOHL. Translated by ARTHUR HENFREY, F.R.S. &c. Van Voorst, 1852.

SOMEWHAT late in the day perhaps, but still we hope not too late, we call the attention of our readers to the above most valuable contribution to the science of vegetable physiology. There are others who have made more noise in the world, but perhaps no continental botanist has contributed so much, by careful, painstaking, and conscientious research to the development of his subject, and there is certainly none whose voice deserves to be more attentively listened to than Hugo von Mohl;—a man of facts, whose theories have been his humble and useful servants, not his masters. It is hardly necessary for us to point out in addition, that Mr. Henfrey's name, as the translator, not only secures the fidelity of interpretation of Von Mohl's ideas, but is sufficient assurance that the doctrine of the vegetable cell is here at the level of the present state of knowledge.

As an admirable exposition of that doctrine, we cordially recommend it to the English reader, and regarding it in that point of view, there are one or two matters on which we shall venture to offer a few words of criticism.

The first of these is the very common notion which prevails, we might say among all botanists (with the exception of Von Mohl), with regard to the respective *activities* of the two great morphological elements of the vegetable cell,—the cellulose membrane, and the nitrogenous primordial utricle.

Alex. Braun, one of the most profound of modern vegetable physiologists, says, "From the contents (*i. e.* the primordial utricle with its contents) all the vital activity of the cell proceeds; the membrane is an externally deposited structure, a product of secretion, which takes only a passive share in the vital actions, as the medium of exchange between the interior and the exterior, at the same time separating and uniting the neighbouring cells, and affording defence and solidity to the separate cell in connexion with the whole tissue .... Thus the life of the plant weaves in the cell-membrane its own shroud, and dies at last in the dwelling it has constructed for itself." (Ueber Verjungung, p. 166.)

Schacht (Die Pflanzen-Zelle) as decidedly advocates the same view, and so far as we know, it is that adopted in all the ordinary text-books; in these we universally find it assumed or stated, that the cellulose membrane of the cell is a passive element excreted and formed by the primordial utricle, and possessing no powers independent of it.

Von Mohl, however, speaks far more cautiously on this head; in his present work, p. 36, we find:—

"In all young cells, whatever their subsequent contents may be, whether they persist in the stage of cells or become changed into vascular utricles, a series of formations are met with, which disappear again more or less perfectly in the subsequent periods of life, and which stand in the closest relation to the origin and growth of the young cell, but only in particular cases in relation to their later functions .... The primordial utricle disappears again with the thickening of the vessels, the cells of the wood of the pith of the inner part of the petiole, and of thick leaves" (p. 36–37). And the fact of the early disappearance of the primordial utricle in many cases was equally pointed out in his earlier work, "Remarks on the Structure of the Vegetable Cell," 1844 (Taylor's Scientific Memoirs, iv. 91). Now a slight consideration must we think render it evident, that if it be true that the primordial utricle disappears with the thickening of the cellulose membrane, the latter continuing to grow subsequently to its disappearance, it cannot be that the primordial utricle is the sole active agent in the growth of the plant; the cellulose membrane must have its power of growth and independent activity also.

That such is indeed the case is we think evidenced in the most clear and striking manner by the development of the peculiar spirally thickened and perforated cells in the leaf of *Sphagnum*, which is so well described by Schacht (*l. c.* 66–67), whose observations (the full bearing of which he does not seem to see) we have taken occasion to verify in every particular. We have no space to enter into details in this place, but we may shortly state that certain cells, at first perfectly resembling the rest of those which constitute the base of the leaf of *Sphagnum*, enlarge disproportionately, and gradually lose every trace of contents and primordial utricle. Iodine, sulphuric acid and sugar, and other reagents which yield abundant evidence of the primordial utricle in the surrounding cells, fail to produce the slightest characteristic reaction in these. But tracing these enlarged cells in their course towards the point of the leaf, we find that, first, a very considerable spiral or annular thickening band is developed from their ovules ; and secondly, that these walls become perforated in particular localities, showing clearly that the cellulose wall is in itself abundantly competent to perform the vital actions of assimilation and absorption, or rather resolution, without the assistance of the primordial utricle.

Nor let it be said, that here the thickenings and resolutions are determined by the primordial utricles of adjacent cells, for the *Sphagnum* leaf, as is well known, consists of only a single layer of cells joined side by side, and the thickening takes place as much on the upper and lower surfaces as on the sides of the spiral cells, while the perforations are formed exclusively upon the upper and lower surfaces. Surely here nature furnishes us with a crucial instance of the independent vitality and powers of action of the cellulose cell-wall, whence important conclusions may be drawn for the whole vegetable kingdom.

There is yet another error which we venture to submit pervades the whole of vegetable no less than animal physiology,—we refer to the notion that animals and plants are formed by the coalescence of their histological elements—the cells. It is said that plants are formed by means of cells which have "*grown together*" (Von Mohl, p. 30), having "arisen separately as development teaches" (Schacht, p. 75) ; and this conception of the individuality of the separate plant-cells, though by giving distinctness to the ideas of investigators it has served a good purpose, seems to us to be at present essentially obstructive.

If in fact we turn from this convenient mode of viewing the facts to the facts themselves as they really are, we find that the cells which compose any vegetable tissue never have been independent, and that therefore it is as absurd to talk of their coalescence, as to say that a man is formed by the coalescence of his head, trunk and limbs.

Indeed, all the knowledge we have hitherto obtained of development, whether morphological or histological, uniformly bears testimony to the truth, that the great law established by Von Bär for the animal world holds good as universally in that of plants. They and all their organs, and all the histological elements of these organs, are produced, *not by the coalescence of the heterogeneous, but by the differentiation of the homogeneous parts*, and it would be more true to say that the plant is formed by the separation of cells than that it arises from their coalescence. This however is a most important subject, and one which we hope to follow out elsewhere.

Handbuch der Conchyliologie und Malacozoologie.
Von Dr. R. A. Philippi. Halle, 1853. 8vo, pp. 548.

By the preface we are informed that this work was written on board the Hamburg brig Bonito, and dated while it was passing Cape Horn, the author having, by the late political disturbances in

Germany, and also on account of his own very bad health, been obliged to make an excusion to the west coast of South America, where there is no doubt he will add much to our knowledge of the molluscous animals, and it is to be hoped give us as good a work on the mollusca of those seas as his very excellent one on those of Sicily.

The present work is divided into three sections. The first contains the general characteristics of Mollusca, with an account of their systematic classification, uses, and terminology.

The second, the systematic arrangement of the 638 genera of *Mollusca* (viz. 403 Univalves, 210 Bivalves, 25 Tunicata), and 35 genera of *Cirripedia*, with their characters, synonyma, a reference to those works in which they were first described, and the derivations* of their generic names.

The third contains an alphabetical list of all the genera of recent and fossil Mollusca which are not referred to in the former part; an index of the Latin and German terms used in the work and of the genera and their synonyma.

The first Part appears to be very carefully executed, and contains a great quantity of very interesting and novel matter.

In the second Part all the classes are arranged nearly in the same manner as in the latest edition of the Systems proposed by Dr. Gray in his various Essays, and as now used in the British Museum, and the greater part of the names of the genera and their synonyma are evidently adopted from the List of Genera of Mollusca published by that author in the Proceedings of the Zoological Society for 1847. The enlargement of the Cuvierian order *Scutibranchia* to contain the *Nerites, Trochi* and *Turbines*, as well as the *Haliotidæ* and *Emarginulidæ*, is adopted, and it is placed next to the *Cyclobranchiæ* and *Cirribranchiata*. The families proposed in the 'Synopsis of the British Museum' for the year 1838 and 1840, gradually modified as the knowledge of the animals increased until the publication of the fourth volume of the 'Figures of Mollusca' by Mrs. Gray, and in the Special Catalogues of Pteropods and Cephalopods, have been almost uniformly adopted; the chief alterations being the separation of the *Olivacea* from *Buccinidæ* proposed by Dr. Troschel, the placing of *Siphonariacea* and *Acmeacea* (= *Tecturidæ*) with *Pectinibranchia*, and the arranging of *Ampullariacea* with *Pulmonata*, —three alterations which must have arisen from Dr. Philippi's not having had the opportunity of examining the animals, which we are convinced he will be the first to alter when he has done so; and fortunately the country he is now engaged in exploring will afford him many materials for the purpose.

Dr. Philippi, when speaking of Dr. Gray's arrangement, observes, that it has been changed from year to year. We consider this is the greatest praise, for the changes have only been made by trying to keep the systematic arrangement of the Mollusca on a level with the rapidly progressive state of the science.

It is an excellent manual, and almost the only work on the sub-

* There are many instances where explanations are given of names which were intended simply as names without any meaning, and some names of this kind are corrected to make them fit the explanations given ! ! !

ject which approaches the present state of the science; and from the same arrangement being used as that adopted in the British Museum, it forms an excellent manual for that collection.

In the Press.

A Naturalist's Rambles on the Devonshire Coast.
By P. H. Gosse, A.L.S.

This work will embody the result of researches and observations made by the author among the rocks, caves and tide-pools of the interesting shores of North and South Devon; and will comprise the most beautiful and interesting forms of sea-side Natural History, many of which are as yet undescribed.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

Jan. 13, 1853.—A paper was read, entitled "Description of some species of the extinct genus *Nesodon*." By Prof. Owen, F.R.S.

The author commences by referring to a genus of extinct herbivorous mammals which he had founded in 1836, on certain fossil remains discovered in Patagonia, and which, from the insular disposition of the enamel folds characteristic of the molar teeth, he had called *Nesodon*. Subsequent transmissions of fossils from the same part of South America, by their discoverer, Capt. Sulivan, R.N., now enabled the author to define four species of the genus. The first which he describes is founded on a considerable portion of the cranium and the lower jaw, with the teeth, and is called *Nesodon ovinus*. After the requisite osteological details and comparisons the author proceeds to describe the three incisors, the canine, and five molar teeth, which are present on each side of both upper and lower jaws, and then enters upon an inquiry as to the nature and homologies of the grinding teeth. The result is to show that the first four molars belong, with the incisors and canines, to the deciduous series, and that the fifth molar is the first true molar of the permanent series; the germ of a second true molar was discovered behind this, in both the upper and the lower jaws, whence the author concludes that the *Nesodon ovinus* had the typical number of teeth when the permanent series was fully developed, viz. $i\,\frac{3-3}{3-3}$, $c\,\frac{1-1}{1-1}$, $p\,\frac{4-4}{4-4}$ $m\,\frac{3-3}{3-3}=44$.

The structure of the grinding teeth proving the extinct animal to have been herbivorous, the number and kinds of teeth in the entire series show that it was ungulate. In this great natural series of mammalia the author next shows that the *Nesodon* had the nearest affinities to the odd-toed or Perissodactyle order amongst the existing species; but certain modifications of structure, hitherto peculiar to the even-toed or Artiodactyle Ungulates, are repeated in the cranium of the *Nesodon*: more important marks of affinity are pointed out in the *Nesodon* to the *Toxodon*; and both these extinct forms of South

American herbivores are shown to agree with each other in characters of greater value, derived from the osseous and dental systems, than any of those by which the *Nesodon* resembles either the Perissodactyle or Artiodactyle divisions of hoofed animals.

The genus *Nesodon* is characterized by the following modifications of the teeth, which in number and kind are according to the typical dental formula above given. *Incisors* trenchant, with long, slightly curved crowns, of limited growth: *canines* small, not exceeding in length the contiguous premolars. *Molars*, in the upper jaw, with long, curved, transversely compressed crowns, which contract as they penetrate the bone and ultimately develope fangs; the outer side of the crown ridged, the inner side penetrated by two more or less complex folds of enamel, leaving insular patches on the worn crown: enamel thin. The *lower molars*, long, straight, and compressed; divided by an external longitudinal indent into two unequal lobes, both penetrated at the inner side by a fold of enamel, which is complex in the hinder lobe. All the teeth have exserted crowns of equal height and arranged in an unbroken series. The bony palate is entire and extends back beyond the molars, the maxillaries and palatines forming the back part in equal proportions. A distinct articular cavity and eminence for the lower jaw; the eminence long and concave transversely, short and convex longitudinally; a protuberant post-glenoid process; a strong and deep zygoma, the orbit and temporal fossa widely intercommunicating; the premaxillaries join the nasals.

Of the genus presenting the above dental and osteal characters the author defines four species:—the first, about the size of a Llama, is the *Nesodon imbricatus*; the second, of the size of a Zebra, is the *Nesodon Sulivani*; the species to which belong the portions of skull, with the teeth, described in the present memoir, did not exceed the size of a large sheep, and is termed the *Nesodon ovinus*; fourthly, a species of the size of a Rhinoceros, *Nesodon magnus*, is satisfactorily indicated by a grinder of the upper jaw. In conclusion, the author remarks, that the osteological characters defining the orders of hoofed quadrupeds, called *Proboscidia*, *Perissodactyla* and *Artiodactyla*, are associated with modifications of the soft parts of such importance, as not only to establish the principle of that ternary division of the great natural group of *Ungulata*, but to indicate that the known modifications of the skeleton of the extinct Toxodons and Nesodons of South America, in the degree in which they differ from the osteology of the already defined orders of *Ungulata*, must have been associated with concomitant modifications of other parts of their structure which would lead to their being placed in a distinct division, equal to the *Proboscidia*; and, like that order, to be more nearly allied to the *Perissodactyla* than the *Artiodactyla*. This new division of the *Ungulata* the author proposes to call *Toxodontia*, and he remarks that its dental and osteal characters, while they illustrate the close mutual affinities between the Nesodons and Toxodons, tend to dissipate much of the obscurity supposed to involve the true affinities of the *Toxodon*, and to reconcile the conflicting opinions as to the proper position of that genus in the mammalian class.

ZOOLOGICAL SOCIETY.

March 25, 1851.—William Yarrell, Esq., Vice-President, in the Chair.

Descriptions of new species of Nassa, in the Collection of Hugh Cuming, Esq. By Arthur Adams, F.L.S. etc.

Subgenus Nassa.

Shell cassiform; spire short; inner lip with the callus greatly developed.

A. Shell ribbed or nodulous.

1. Nassa coronula, A. Adams. *N. testâ ovato-conicâ, cinerescente, fasciâ supra albidâ, infra fusco ornatâ; spirâ brevi; anfractibus ad suturas angulatis, longitudinaliter costatis, costis distantibus rotundis supra nodulosis; labio callo crasso obtecto; columellâ rugosâ; labro extus marginato, intus lirato.*

Hab. Corrigidor, Bay of Manila, under stones, low water (*H. C.*). Mus. Cuming.

2. Nassa dispar, A. Adams. *N. testâ ovato-conicâ, ventricosâ, lævi, lutescente, rufo cinereoque varie pictâ; anfractibus supernè gibbosis; labio callo albo mediocri tecto; columellâ transversim corrugatâ; labro anticè dentato, intus lirato.*

Hab. Philippines, sandy mud (*H. C.*). Mus. Cuming.

3. Nassa stigmaria, A. Adams. *N. testâ ovato-ventricosâ, rufescente, albo fuscoque variegatâ et punctatâ; liris granosis transversis ornatâ, granis planis quadratis; labio lævi, callo albo nitido obtecto, labro margine dentato.*

Hab. Island of Siquijor, Philippines, under stones (*H. C.*). Mus. Cuming.

4. Nassa Siquijorensis, A. Adams. *N. testâ ovatâ, subturritâ, rufescente, fasciâ pallidâ cinctâ, longitudinaliter costellatâ; suturâ tuberculis moniliformibus ornatâ, costellis permultis confertis, interstitiis transversim striatis; columellâ corrugatâ, labro anticè valdè dentato.*

Hab. Island of Siquijor, Philippines (*H. C.*). Mus. Cuming.

5. Nassa retecosa, A. Adams. *N. testâ ovatâ, acuminatâ; spirâ acutâ, rufescente, suturâ canaliculatâ, cingulis albis transversim et longitudinaliter cancellatâ; labro crenato, anticè dilatato et sinuato; labio callo, subexpanso, anticè recto.*

Hab. Albay, Luzon, coarse sand, 6 fathoms (*H. C.*). Mus. Cum.

6. Nassa verrucosa, A. Adams. *N. testâ ovato-acuminatâ, spirâ productâ; suturâ canaliculatâ, rufescente, fusco sparsim punctatâ, liris transversis granosis ornatâ, granis rotundis verruciformibus in seriebus obliquis longitudinalibus dispositis; labio valdè calloso, tuberculato, albo; labro margine serrato.*

Hab. Eastern Seas.

7. Nassa variegata, A. Adams. *N. testâ ovato-ventricosâ, albido-griseâ, fuscoque variegatâ, longitudinaliter striatâ, liris*

transversis granosis subdistantibus ornatâ, granis rotundis in seriebus obliquis longitudinalibus dispositis; labio tuberculato callo tenui expanso tecto, labro margine crenato.

Hab. Dalmaguete, island of Negros, Philippines (*H. C.*). Mus. Cuming.

8. Nassa cælata, A. Adams. *N. testâ ovatâ, acuminatâ, subturritâ, albidâ, fasciâ rufâ cinctâ, suturâ tuberculis moniliformibus ornatâ, longitudinaliter costellatâ; costellis simplicibus, interstitiis concinnè clathratis, labio callo tenui obtecto, labro margine crenulato.*

Hab. Cagayan, Mindanao, sandy mud, 25 fathoms (*H. C.*). Mus. Cuming.

9. Nassa ranida, A. Adams. *N. testâ ovatâ, acuminatâ, subturritâ, rufescente, cingulis transversis granosis sculptâ, granis elongatis subquadratis in seriebus obliquis longitudinalibus dispositis; columellâ rugosâ; labio non calloso, labro valdè dentato.*

Hab. Burias, 6 fathoms, coral sand (*H. C.*). Mus. Cuming.

10. Nassa sordida, A. Adams. *N. testâ ovatâ, albidâ, fusco fasciatâ; suturâ tuberculis moniliformibus ornatâ; longitudinaliter costatâ, transversim valdè liratâ; labio callo albo crasso tecto; columellâ corrugatâ; labro margine calloso reflexo.*

Hab. Siquijor, on the reefs.

11. Nassa Cumingii, A. Adams. *N. testâ ovatâ, ventricosâ albidâ, rufo nebulosâ; suturâ canaliculatâ, liris transversis granosis sculptâ, granis quadratis in seriebus longitudinalibus dispositis; aperturâ ringente; labio corrugato, tuberculifero; labro intus valde sulcato.*

Hab. China. Mus. Cuming. Unique specimen.

12. Nassa crenellifera, A. Adams. *N. testâ ovatâ, acuminatâ, subturritâ, albidâ, fasciâ pallidâ rufâ cinctâ; suturâ canaliculatâ, margine crenellifero, transversim striatâ, longitudinaliter tenuissimè costatâ; columellâ sublævi; labro integro.*

Hab. —— ? Mus. Cuming.

13. Nassa sulcifera, A. Adams. *N. testâ ovato-ventricosâ; spirâ productâ, cinerescente, luteo-fusco variegatâ, longitudinaliter subplicatâ, transversim liratâ; anfractu ultimo infra suturam sulco impresso; labii callo crasso mediocri; collumellâ anticè biplicatâ; labro intus lirato.*

Hab. Algoa Bay.

14. Nassa corticata, A. Adams. *N. testâ ovato-conicâ, spirâ productâ, epidermide viridi-fusco obtectâ; anfractibus supernè nodosis; anfractu ultimo anticè cingulâ subnodosâ ornato, posticè nodulis coronato; labio vix calloso; columellâ anticè biplicatâ; labro extus marginato, intus lirato.*

Hab. New Zealand.

15. Nassa labecula, A. Adams. *N. testâ ovato-conicâ, obliquâ; spirâ subacuminatâ, pallidè fuscâ; anfractu ultimo fasciâ fuscâ*

obsoletâ cincto; anfractibus planulatis supremis costatis, ultimo supernè costato, infernè plano; labii callo expanso, tenui, nitidâ labeculâ fuscâ ornato; labro posticè incrassato, intus dentato.

Hab. Burias, 6 fathoms, coral sand (*H. C.*). Mus. Cuming.

16. Nassa multicostata, A. Adams. *N. testâ ovatâ, acuminatâ, albo rufoque variegatâ, longitudinaliter costatâ; costis planis obliquis confertis permultis; labio cum callo parvo tecto; columellâ lævi, anticè biplicatâ; labro intus sulcato, margine acuto integro.*

Hab. Batangas, island of Luzon, 4 fathoms, coarse sand (*H. C.*). Mus. Cuming.

17. Nassa costata, A. Adams. *N testâ ovato-conicâ, spirâ acutâ, productâ, pallidâ, anfractu ultimo maculâ rufo-fuscâ ornatâ; anfractibus convexiusculis, longitudinaliter costatis, interstitiis planis; anfractu ultimo anticè transversim striato; labio cum callo circumscripto tecto; columellâ transversim rugosâ; labro anticè dentato, intus lirato.*

Hab. Island of Burias, sandy mud, 6 fathoms (*H. C.*). Mus. Cuming.

18. Nassa callosa, A. Adams. *N. testâ parvâ, ovatâ, spirâ acutâ, albâ fusco-maculatâ, longitudinaliter costatâ, transversim sulcatâ; labio cum callo magno albo nitido expanso tecto; columellâ anticè triplicatâ; labro margine incrassato calloso, intus dentato-lirato.*

Hab. Bais, island of Negros, 7 fathoms, sandy mud (*H. C.*). Mus. Cuming.

19. Nassa gemmulifera, A. Adams. *N. testâ ovato-conicâ, spirâ acutâ, productâ, cinerescente rufo variegatâ, longitudinaliter plicatâ, transversim cingulatâ, cingulis ad plicas noduliferis; labio cum callo expanso albo tecto; columellâ transversim corrugatâ; labro intus lirato.*

Hab. Burias, 6 fathoms, coarse sand (*H. C.*). Mus. Cuming.

20. Nassa fissilabris, A. Adams. *N. testâ ovato-conicâ, obliquâ, cinerescente, pallidè fasciatâ, longitudinaliter costatâ, anfractu ultimo anticè transversim sulcato; labio cum callo expanso obtecto; columellâ anticè tuberculis duobus transversis; labro anticè sinuato, posticè valde inciso.*

Hab. Cagayan, Prov. Misamis, island of Mindanao, 25 fathoms, sandy mud (*H. C.*). Mus. Cuming.

21. Nassa nodicostata, A. Adams. *N. testâ ovato-conicâ, albâ, fasciâ pallidâ fulvâ cinctâ; anfractibus planulatis, longitudinaliter costatis, transversim evanide liratis; costis nodis distantibus instructis, supernè nodosis; labio cum callo circumscripto tecto; columellâ rugosâ, anticè acutâ, productâ; labro extus limbato, anticè valde sinuato.*

Hab. Island of Corrigidor, 6 fathoms, coarse sand (*H. C.*). Mus. Cuming.

22. Nassa delicata, A. Adams. *N. testâ ovato-conicâ, subpellucidâ, albidâ, fasciâ angustâ, fuscâ, maculisque fuscis ornatâ, lon-*

gitudinaliter costatâ, costis planulatis supernè nodosis, interstitiis lineis elevatis transversis clathratis; labio calloso; columellâ anticè plicis quatuor; labro margine acuto, intus longitudinaliter sulcato, transversim lirato.

Hab. Sorsogon, Albay, Luzon, coarse sand, 6 fathoms (*H. C.*). Mus. Cuming.

23. Nassa cancellata, A. Adams. *N. testâ ovato-conicâ, spirâ acutâ, fulvescenti, fusco variegatâ, longitudinaliter costatâ, costis planis rotundatis, interstitiis concinnè cancellatis; labio callo magno expanso crasso obtecto; columellâ lævi, simplici; labro margine calloso incrassato, anticè subsinuato.*

Hab. Masbate, under stones (*H. C.*). Mus. Cuming.

24. Nassa clathratula, A. Adams. *N. testâ ovatâ, spirâ acutâ, anfractibus convexis, niveâ, longitudinaliter costatâ; costis nodulosis, interstitiis valde clathratis; labio cum callo mediocri obtecto; columellâ anticè biplicatâ; labro extus varicoso, intus lirato.*

Hab. Island of Siquijor, deep water, sandy mud (*H. C.*). Mus. Cuming.

25. Nassa crenolirata, A. Adams. *N. testâ parvâ, ovatâ, pallidâ, lineis angustis transversis fuscis ornatâ, longitudinaliter costatâ, costis nodulosis, supernè nodosis; aperturâ angustatâ; labio cum callo obtecto; columellâ plicis quatuor transversis instructo; labro extus marginato, intus valde dentato-lirato.*

Hab. ——? Mus. Cuming.

26. Nassa sinusigera, A. Adams. *N. testâ ovato-conicâ, obliquâ; spirâ acuminatâ, pallidâ, fusco variegatâ, longitudinaliter costatâ, costis supernè nodulosis, transversim sulcatâ; labio cum callo mediocri tecto; columellâ transversim corrugato-plicatâ; labro anticè valde sinuato.*

Hab. Catbalonga, island of Samaar, 8 fathoms, coarse sand (*H. C.*). Mus. Cuming.

27. Nassa geniculata, A. Adams. *N. testâ parvâ, ovato-conicâ, fulvâ, albo variegatâ; fasciâ latâ, transversâ, cinereo-fuscâ cinctâ, transversim striatâ, longitudinaliter costatâ; costis geniculatis; labio subcalloso, anticè bituberculato; labro extus incrassato, intus dentato-lirato.*

Hab. Island of Ticao, 4 fathoms, sand (*H. C.*). Mus. Cuming.

28. Nassa speciosa, A. Adams. *N. testâ ovato-conicâ, acuminatâ, lutescente, albo variegatâ, transversim liratâ, liris confertis granulosis, longitudinaliter plicatâ; plicis distantibus obliquis, supernè nodosis, nodulis albis; aperturâ albâ, anticè rufo-fusco maculatâ; columellâ lævi, callo subexpanso tectâ; labro intus evanidè lirato, margine anticè maculâ fuscâ.*

Hab. ——? Mus. Cuming.

29. Nassa obtusata, A. Adams. *N. testâ ovato-conicâ, spirâ obtusâ, pallidâ, rufo-fusco variegatâ, transversim liratâ, longitudinaliter costatâ, costis distantibus supernè nodosis; labio callo*

crasso albo obtecto; labro intus incrassato, sulcato et transversim lirato.

Hab. Island of Ticao, coral sand, 7 fathoms (*H. C.*). Mus. Cuming.

30. Nassa abyssicola, A. Adams. *N. testâ parvâ, ovato-conicâ, sordidè albâ; costellis confertis longitudinalibus permultis, interstitiis concinnè clathratis ornatâ; labio arcuato, mediocriter calloso; labro intus dentato-lirato, extus incrassato.*

Hab. Loay, island of Bohol, clayey ground, 60 fathoms (*H. C.*). Mus. Cuming.

31. Nassa pusio, A. Adams. *N. testâ parvâ, ovato-conicâ, fulvâ, fusco variegatâ et maculosâ; costellis planis, longitudinalibus confertis ornatâ; anfractu ultimo anticè sulcato, labio cum callo nitido subexpanso tecto; labro intus sulcato, margine subreflexo.*

Hab. Sorsogon, Albay, isle of Luzon, 6 fathoms, coarse sand (*H. C.*). Mus. Cuming.

B. Shell spinulose; inner lip with the callus moderate, defined.

32. Nassa hispida, A. Adams. *N. testâ ovato-acutâ, albido-cinereâ, rufo-fusco punctatâ, nodispinosâ, longitudinaliter plicatâ; plicis cum seriebus novem tuberculorum spiniformium armatis.*

Hab. Loon, island of Bohol, on the reefs, low water (*H. C.*). Mus. Cuming.

Plicated, the rows of tubercles rather close together, the upper row distinct from the rest.

33. Nassa echinata, A. Adams. *N. testâ elongato-ovatâ, albidâ, nodispinosâ, longitudinaliter plicatâ, plicis quinque, seriebus tuberculorum spiniformium armatis.*

Hab. Galeo, island of Mindoro, 3 fathoms, sandy mud (*H. C.*).

Plicated, with the upper row of tubercles larger and distinct from the others.

Subgenus Eione, Risso.

Shell with the back gibbous; inner lip with the callus greatly developed, surrounding the circumference of the shell.

1. Nassa circumcincta, A. Adams. *N. testâ ovatâ, cinereâ, nitidâ, dorso gibbosâ; spirâ brevi, acutâ, suturâ fuscâ; labio cum callo crasso albo nitido tecto, marginibus usque ad spiram decurrentibus fusco marginatis; columellâ lævi, anticè uniplicatâ; labro calloso marginato, intus lævi.*

Hab. Red Sea. Mus. Cuming.

2. Nassa dorsuosa, A. Adams. *N. testâ ovatâ, depressâ; spirâ acutâ, dorso in medio nodatâ, olivaceâ, lævi, longitudinaliter subplicatâ; labio cum callo magno crasso lutescente tecto, marginibus incrassatis usque ad spiram decurrentibus; columellâ lævi, labro margine calloso incrassato, intus sublirato.*

Hab. Masbate, on the mud-banks at low water (*H. C.*). Mus. Cuming.

3. Nassa orbiculata, A. Adams. *N. testâ semiorbiculari, con-*

vexo-depressá, lævi, olivaceá, apud dorsum gibbá; spirá brevi, labio cum callo expanso crasso tecto, marginibus usque ad spiram decurrentibus, columellá lævi, labro extus calloso incrassato.

Hab. ——? Mus. Cuming.

4. Nassa callospira, A. Adams. *N. testá ovatá, pallidá, fasciá transversá cineréá ornatá; spirá acutá, transversim liratá, plicis nodosis longitudinalibus instructá; labio cum callo magno albo extenso tecto, marginibus usque ad spiram decurrentibus; columellá anticè biplicatá; labro crasso calloso, marginato, intus valde lirato.*

Hab. Island of Burias, 6 fathoms, coral sand (*H. C.*). Mus. Cuming.

5. Nassa nana, A. Adams. *N. testá ovatá, spirá acutá; anfractibus rotundatis, rufescente, fasciá pallidá luteá ornatá, longitudinaliter plicatá, transversim semistriatá; labio cum callo expanso tenui tecto; columellá rugosulá; labro marginato, intus sulcato.*

Hab. Dumaguete, island of Negros, coarse black sand, 11 fathoms (*H. C.*). Mus. Cuming.

6. Nassa bellula, A. Adams. *N. testá ovatá, spirá acuminatá, acutá; anfractibus angulatis, pallidulá, fasciá luteolá ornatá, longitudinaliter plicatá, transversim liratá; interstitiis concinnè longitudinaliter striatis, labio callo magno tecto; columellá rugosá; labri margine rugoso calloso, intus crenulato.*

Hab. Catbalonga, island of Samaar, under stones, low water. Mus. Cuming.

7. Nassa bimaculosa, A. Adams. *N. testá suborbiculari, apud dorsum valde convexá, nodosá; spirá acutá, longitudinaliter subplicatá, anticè transversim sulcatá, olivaceá, fasciá pallidá transversá cinctá, labio cum callo crasso albo magno suborbiculari cincto; columellá lævi, anticè uniplicatá; labro valde incrassato marginato, anticè sinuato, intus lirato, extus maculis duabus rufofuscis ornato.*

Hab. Island of Siquijor, on mud-banks (*H. C.*). Mus. Cuming.

8. Nassa leptospira, A. Adams. *N. testá ovatá, apud dorsum convexá, nodosá; spirá productá, acutá, lutescente longitudinaliter plicatá, anticè transversim striatá, labio cum callo luteo crasso tecto; columellá corrugatá, labro intus lirato.*

Hab. Ilo Ilo, island of Panay, on mud-banks, low water (*H. C.*). Mus. Cuming.

[To be continued.]

BOTANICAL SOCIETY OF EDINBURGH.

January 13, 1853.—Professor Balfour, President, in the Chair.

The following papers were read:—

1. "On the Lichens used in Dyeing," by W. Lauder Lindsay, M.D.

2. "Remarks on the Flora of the District in the neighbourhood of Peebles," by James Young, Esq. The author gave a brief account of some botanical walks made in the autumn of 1851.

3. "On the Cultivation of *Victoria regia* in Jamaica," by Dr. G.

M'Nab. Seeds sent from the Botanic Gardin, Edinburgh, in September 1851, had been planted by the Hon. Edward Chitty, at Kingston, in a tank prepared for the purpose, and the plant had grown vigorously and had flowered well.

February 10.—Professor Balfour, President, in the Chair.

The following papers were read:—

1. "Remarks on British Plants," by Charles C. Babington, M.A., F.R.S., F.L.S. &c. This paper will be found in the present Number of the 'Annals,' and in the Society's Transactions.

2. "On the Dyeing Properties of the Lichens—Part 2," by W. L. Lindsay, M.D. In this paper and that read at the preceding meeting, the author gave a short but comprehensive view of the present state of the different branches of Lichenology in this country and on the continent, and showed, from the aggregate amount of information which is at present possessed thereupon, the great necessity there still exists for renewed and extended experimental investigation. He then considered—1. The vast importance of this humble tribe of plants in the grand œconomy of nature, as the pioneers and founders of *all* vegetation. 2. Their importance to man and the lower animals, as furnishing various articles of food. 3. Their importance in medicine, and especially in its past history, at home and abroad. 4. Their importance in the useful and fine arts, and especially in the art of dyeing. 5. Their affinities and analogies to other cryptogamic families, and to the Phanerogamia. 6. Their value as an element of the picturesque in nature; and, 7. Their typical significance.

He then adverted more specially to the subject of his communication, under the ten following heads:—

I. The colours of the thallus and apothecia of Lichens—their causes, and the circumstances which modify and alter them.
II. History of the application of their colouring matters to the art of dyeing.
III. Chemical nature and general properties of these colouring matters.
IV. Tests and processes for estimating qualitatively and quantitatively the colorific powers of individual species—with their practical applications.
V. Processes of manufacture of the Lichen-dyes, on the large and small scale, in different countries—with the principles on which they are founded.
VI. Nomenclature of the dye-Lichens, and of the Lichen-dyes.
VII. Botanical and commercial sources of the same.
VIII. Special applications of the Lichen-dyes in the arts.
IX. Commercial value of the dye-Lichens, and their products.
X. Geographical distribution of the dye-Lichens—with the effect of climate, situation, &c., on their colorific materials.

Four of these sections were elaborately treated at these two Meetings, and the others left for notice at a future opportunity.

3. "On the occurrence of *Asplenium germanicum*, *Convallaria Polygonatum*, and other rare plants, at Kyloe, Northumberland," by George R. Tate, Esq. "Kyloe Crags are chiefly composed of rudely columnar basalt. Sandstone comes out from beneath this, and at the western end forms a steep cliff. I had the good fortune to find *Asplenium germanicum* growing sparingly upon the basalt; its pale green fronds at once attracted my attention. The few specimens I observed were remarkably luxuriant; I counted upwards of thirty fronds growing on a single root. *Asplenium septentrionale* still exists in considerable abundance, on the high and exposed portions of the crag, as well as among the debris. I obtained *Convallaria Polygonatum*, which was recorded by Wallis in his History of Northumberland."

4. "List of Plants in Flower in the open air, in the Royal Botanic Garden, on the 1st of February 1853," by Mr. M'Nab.

Eranthis hyemalis.
Galanthus nivalis.
Potentilla Fragariastrum.
Sisyrinchium grandiflorum.
Helleborus odorus.
—— orientalis.
—— niger.
—— viridis.
—— atrorubens.
—— olympicus.
—— —— rubra.
Rhododendron atrovirens.
Hepatica triloba, numerous varieties.
Aubretia grandiflora.
Primula vulgaris.
Lamium album.
Tussilago fragrans.
Daphne Mezerium.
—— Laureola.
Erica herbacea.
Cornus mascula.
Knappia agrostidea.
Tritonia media.
Viola odorata.

5. "On the Effects of the Mildness of the month of January 1853, in the Isle of Wight," by T. Bell Salter, M.D. "On the evening of the 3rd of January I was struck by seeing two or three of the small bat (*Vespertilio Pipistrellus*) flying about just as on a summer's evening. Whenever we are favoured with a little sunshine, the little *Tipulidæ* may be seen enjoying their peculiar up-and-down flights, and the earthworms may be seen every day, lying or crawling on the ground, as in the spring and autumn. Scarcely any wild-fowl have yet resorted to our coasts, as is usual at this season. Our native birds have quite their spring song, and the nest of a song-thrush, with four eggs, was found at Comley. One effect of mildness of season, which I observed a few (three or four) years since, I do not perceive, although on that occasion the mildness was not so great. On that occasion few of the large geometric spiders (*Epëira Diadema*) perished as usual in the autumn or early winter, but very generally remained till spring. When, however, I looked for their increased activity, and their attaining an unusual size as the warmth of their second year increased, they soon disappeared.

"At the present time, the effects of the mildness of the temperature on the vegetable kingdom are yet more remarkable than on the animal. For nearly a month past, Primroses have been blossoming on the banks, and the green swards have been bespangled with Daisies, while the gorse bushes (*Ulex europæus*) are getting quite yellow with the abundance of bloom. I would enumerate the following, which within the last few days I have observed in flower in the fields, woods and hedges, viz.:—

Ranunculus Ficaria, and several other species.
Sinapis arvensis.
Cardamine hirsuta.
Viola sylvatica.
Lychnis diurna.
Stellaria Holostea.
—— media.
Mœhringia trinervis.
Cerastium triviale.
—— glomeratum.
Geranium Robertianum.
Linum angustifolium, nearly in flower.
Fragaria vesca.
Potentilla Fragariastrum.
Alchemilla arvensis.
Æthusa Cynapium.
Heracleum sphondylium.
Torilis Anthriscus.
Anthriscus sylvestris.
Sonchus arvensis.
Lapsana communis.
Senecio—several species.
Pyrethrum inodorum.
Erythræa Centaurium.
Veronica serpyllifolia.
Lamium purpureum.
Anagallis arvensis.
Daphne Laureola.
Mercurialis perennis.

"The Honeysuckle and Elder are in leaf. I saw a few Hawthorn leaves, and there was one bush which had sprouted to the length of 3 inches. The Oaks, Elms and Hazels have already an altered tint, from the swelling of their buds. On the banks the leaves of the wild Arum are fully developed; and in the hedges the *Rubia peregrina* is grown to several inches.

"In the gardens there are in blossom, of Roses several varieties; Arbutus, Laurustinus, Coronilla, an Acacia, Violets, Daffodils, Periwinkles, Anemones, Hepatica, Snowdrop, Stock, Scarlet Pelargonium, *Omphalodes verna*, Mignonette, *Petasites fragrans*, *Sphenogyne speciosa*, Scabious, and others.

"The Virginian-Stock is becoming quite abundant. I have observed in bloom the common Wallflower, the *Cheiranthus mutabilis*, and the *C. scoparius*; and it is a curious instance of the wonderful adaptability to climate in some plants, that the two latter, though natives of warmer regions—Madeira and Teneriffe—are yet more forward in flowering than the British species. To continue:—there are in flower Candytuft, garden Cress, Picotee, Almond, *Cydonia japonica*, *Œnothera rosea*, *Ageratum conyzoides*, *V. teucroides*, Polyanthuses and Primroses, several species of *Daphne*, the *Iris germanica*, and I have no doubt many more might be added.

"The Clematis, in many instances, has grown more than a foot in length. Potatoes are in many places a foot in height. Near Ryde, *Aponogeton distachyon* is blooming to perfection."

March 10.—Professor Balfour, President, in the Chair.

The following papers were read:—

1. "On the occurrence of Palms and Bamboos, with Pines and

other northern forms, at considerable elevations on the Himalaya," by Major Madden, H.E.I.C.S., F.R.S.E. This paper will appear in the 'Annals of Natural History' and the Society's Transactions.

2. "Remarks on British Plants, Part II.," by Charles C. Babington, M.A., F.R.S., F.L.S. This paper will appear in the 'Annals of Natural History' and the Society's Transactions.

Dr. Balfour stated that the *Hypericum* called *H. anglicum* had been observed by him, in large quantity, apparently wild, on the banks of the Glanmire river, near Cork. The plant had also been seen by Mr. Sibbald, at Aghada, and Dr. Balfour exhibited a specimen picked by him, near Culross, in July 1833, which seemed to be the same plant. Another specimen gathered near Galway, in August 1838, resembled the *H. anglicum* in the size of its petals, length of styles, and form of capsule.

Dr. Balfour exhibited a specimen of *Matricaria maritima* from Marseilles, which seemed to differ in its remarkably pale phyllaries, as well as in its leaves, capitulum, and habit, from any British form he had seen.

3. "On a remarkable Formation of a Stem-root in the decayed trunk of a Willow," by John Lowe, Esq. Communicated by Dr. Balfour. A sketch was exhibited of a large willow in which a root had been developed in a peculiar manner so as to form a main stem. Mr. Lowe observed—"The tree (*Salix viminalis*) having become decayed in the centre, a root had evidently been sent down by a portion of the upper extremity of the tree, through the rotten sponge-like substance which filled up the interior. Feeding upon this and the moisture absorbed by it, the root at length reached the ground, where it established a firm hold; the circumference then died away, until the root, now taking on the functions of the stem and becoming entirely denuded, at length became the only support of the living top. The remaining part of the periphery only acts as a mechanical support. The circumference of the root-stem is 18 inches at top and 13 at the bifurcation, about 3 feet above the ground; it has latterly taken on more stem-functions by putting forth several branches. The tree is growing near Sleaford, where I have observed its progress for some years."

PROGRESS OF ZOOLOGY IN IRELAND.

An Association for the promotion of Practical Zoology has been formed amongst the Under Graduates of Trinity College, Dublin, with the approval of the Provost and board of senior Fellows: this Association has for its special object the cultivation of Irish zoology, and presents in its constitution some striking peculiarities. The number of ordinary members, all Under Graduates, is limited to thirty-two, being as it were one for each county; the limit being designed to make the body more suited for working well together than a larger corps would probably be. The desire to draw the members from the different counties is with the view that when they quit college, still remaining as corresponding members, they should be as widely spread as possible, and thus a band of trained observers, after the lapse of a very few years, will become organized over the whole of Ireland, and capable of carrying out any desirable zoological investigation in connection with the centre in Dublin. There are four Secretaries, each taking a department of zoology, so as to ensure a general attention to all parts of the science, combined with that special energy which each may be expected to exert in the promotion of the zoological pursuit he chiefly attends to, and for a proficiency in which he was chosen. There is a limited number of Honorary Members, taken from the Professors and other cultivators of zoological science; from this body the Presidents are to be selected. As corresponding members, many of the most distinguished naturalists have been enrolled, in various parts of the empire, and have expressed their warm desire to aid the progress of the Association. Its working is entrusted to the Secretaries, Librarian and Treasurer as a Council, the President merely presiding at fortnightly meetings, held during college terms.

At these meetings communications are read and zoological subjects discussed, and it is the duty of the respective Secretaries each to note in his special minute-book all the information which may thus be elicited in his special department; thus will come to be accumulated, in a somewhat classified form, much original information, from which future publications may be drawn. On the whole, the Association promises much to promote practical zoology: it meets in the President's rooms in connection with the University Museum, of which he is Director, and in which is a very considerable collection of Irish zoology in all its departments, and an instructive general collection.

We give a short abstract drawn up by the General Secretary, Mr. A. Hogan, of the proceedings of the first meeting for the reading of papers:—

Report of the Proceedings of the Dublin University Zoological Association.

February 26, 1853.—Robert Ball, Esq., LL.D., President, in the Chair.

The following gentlemen were duly proposed and elected:—Corresponding Members: The Earl of Enniskillen; Professor F. M'Coy, Queen's College, Belfast; Rev. W. M'Ilwaine, Belfast; Benj. Clarke, Tuam; Thos. Knox, Lurgan; J. G. Jeffreys, Esq., Swansea; J. M'Adam, Esq., Belfast; R. J. Burkitt, M.D., Waterford; R. Davis, Esq., Clonmel; John Garner, M.D., Haltwhistle; R. Warren, jun., Esq., Sligo; M. J. O'Kelly, Esq., Cabinteely; W. R. Tagart, Esq., Monkstown; and Wm. Ogilby, Esq., Co. Tyrone.

Mr. Grainger read a paper on the Shells found in the alluvial deposits of Belfast; by which it appeared that great numbers of recent shells now found on the coast at no great distance have been imbedded in the formation upon which the town is built.

The President inquired at what height above high water mark the deposits were found?—to which Mr. Grainger replied, that the elevation did not exceed 4 feet.

Dr. Allman drew the attention of the Meeting to the facts described with regard to the retention of colour in some of the shells; and mentioned as an analogous instance of the lasting nature of the colours derived from a similar source, that in certain tombs of Etruria garments have been found with the colours still fresh and unfaded.

The General Secretary read a paper by Capt. Smith, Hon. Member, on *Hirudo Sanguisuga*; in which the author mentions having found one of those leeches devouring a *Helix aspersa*.

The President remarked, that he had many years since observed on Dalkey Common, in a pool of water, a frog apparently very much distressed, and on closer examination found several leeches almost imbedded in its body: the species he did not ascertain.

The following communication from A. Furlong, Esq., Hon. Member, was then read:—

"During my recent excursions I particularly explored the *marine sands* of our coast,—I mean those of an elevated character, such as Portmarnock, and such as are for the most part locally known as *warrens*: they vary considerably in their productions as to insects, although similar as to plants. At Tyrella sands (Dundrum, Co. Down) I found, during the intense sun in July, the surface literally strewn with insects—dead; I could not bear to hold my hand at the time upon the sand; similar insects were gathered in great numbers, alive, on the tufts of sandy grass. I think that spring and autumn answer best for such localities. I found *Cleonus sulcirostris* on those sands rather plentiful, and nowhere else, at both sides of the harbour; *Dasytes viridis* I have only found at Arklow, North Sands, facing the sea; *Phaleria* at Arklow and Tramore, never at Portmarnock; *Timarcha lævigata* (?) was superabundant at Tramore within the sands; I have not met with it elsewhere in Ireland. Near Rostrevor I found for the first time *Mniophila muscorum*, on the banks of the Demesne river, rather high up. I found the sands near Dunfanaghy, Co. Donegal, very extensive, but my visit having occurred at the time that the bay was strewn with whales, I was driven off by the effluvia. The Rossbegh or Glenbetry sands on Dingle Bay, and those at the opposite side, are very remarkable and extensive; the variety of *Creophilus* called *C. ciliaris* attains the highest perfection in that locality, and is very striking when *recent*; both varieties change greatly after death. I took *Cucujus testaceus* at Guidore, Co. Donegal."

Mr. Furlong subsequently stated, that the supply of food afforded by the dead whales (*Delphinus melas*), to which he above refers, had attracted a very large number of carrion crows (*Corvus corone*). This is a rare bird in Ireland.

Mr. Hogan exhibited some specimens of Arachnidæ, preserved in small glass tubes filled with alcohol, by R. H. Meade, Esq., of Bradford.

Mr. Hogan exhibited specimens of *Sphæria entomorrhiza* (?) taken by him at Roebuck near Dublin, in spring 1852; and growing on the body of a Lepidopterous larva, name unknown. They were nine in number, but being all barren, it could not be accurately determined by Dr. Harvey, Hon. Mem., to which of the two British species, *S. militaris* and *S. entomorrhiza* (Hooker's English Flora, vol. v. part 2), they belong.

The President in reference thereto laid before the Meeting a larva of *Hepialus Robertsii,* having a single fungus (*Sphæria*) attached to one of the segments close to the head, about 4 inches in length; the larva itself not being half that length. Subsequently Dr. Harvey exhibited *Sphæriæ* attached to wasps, and made some interesting observations on the subject.

Mr. Hogan also exhibited specimens of the pupæ of *Vanessa Urticæ,* taken by him in the autumn of 1852 at Dalkey, Co. Dublin, from a group of nettles and from a stone wall; the former being beautifully gilded, while the latter were of the usual dark colour; and read the following communication from E. W. Janson, Esq., on the subject:—

"The fact you mention relative to the pupæ of *Vanessa Urticæ* I observed this autumn, and was not a little puzzled to account for it. On a bank at the foot of a wall in my quotidian route to the city (London), the nettles, which grow there luxuriantly, were thickly inhabited by the caterpillars of the small tortoise-shell butterfly, and in passing I daily watched their progress to the pupa state, which many of them assumed on the stalks of the plants, whilst many appeared to prefer the inequalities of the wall; the former I found nearly all possessed the metallic brilliancy of the chrysalis of *V. polychloros,* whilst the latter were invariably quite destitute of lustre. This circumstance, as I have before said, I was at a loss to account for; but on turning to Reaumur's 'Mémoires pour servir à l'Histoire des Insectes,' tome i. Memoir 6, at the conclusion of which he explains very satisfactorily the nature of the beautiful gilded appearance which the pupæ of many butterflies present, I find the following paragraph: 'L'état de l'air, qui fait que la peau de la crisalide se dessèche plus ou moins vite, peut encore contribuer à les rendre plus ou moins dorées. Quelques expériences m'ont paru prouver que celles qui se dessèchent trop promptement ne prennent pas une belle couleur d'or: j'en ai exposé au soleil qui venoient de sortir du fourreau de chenille et je les y ai laissées pendant plusieurs heures; toutes ont été assez mal dorées.' The facts I have related and your observations fully corroborate the views entertained by the great French philosopher; for whilst the external covering of the chrysalides attached to the wall, being exposed to the unchecked action of the air and sun and the absorbent influence of the bricks themselves, would be speedily dried, the cuticle of those attached to the stems of the plants, and in most cases protected from the direct rays of the sun by the foliage, and being nearer the ground, surrounded by a comparatively moist atmosphere, would desiccate very slowly."—A. R. H.

ENTOMOLOGICAL SOCIETY.

March 7, 1853.—Edward Newman, Esq., F.L.S., President, in the Chair.

The following papers were read:—

A note from Mr. Hogan on a specimen of *Hipparchia Janira* having the pollen masses of *Orchis bifolia* attached to its head, which Sir J. E. Smith had thought in the case of bees to be one of the modes employed by nature for the fructification of flowers having a viscid pollen.

M. Morren in a paper in the 'Mémoires de l'Académie de Bruxelles,' has stated that wild bees are frequently found with their heads studded with pollen masses of *Asclepias*.

Mr. F. Smith's 'Monograph of the genus *Cryptocerus* with descriptions of two new genera of *Cryptoceridæ* belonging to the family *Myrmicidæ*.'

The following are the characters of the new genera and species:—

Cryptocerus.

1. *Cryptocerus dubitatus*.

Male. Length 5 lines. Head and thorax black, rugose punctate; stemmata three, placed forwards on the vertex; antennæ ferruginous; thorax, the collar produced at the anterior angles into a short acute tooth; metathorax produced at the posterior angles into a sharp spine; wings ferruginous; legs ferruginous, the coxæ and trochanters black; abdomen, the two nodes black, the rest ferruginous.

Hab. Brazil.

2. *Cryptocerus Æthiops*, n. sp.

Neuter. Length $3\frac{1}{2}$ lines. Black opake, lateral margins of the head dilated and slightly raised, within which is an indistinct longitudinal ferruginous stripe; at the posterior angles of the head are two acute spines, and in front of each eye beneath the dilated margin is a short tooth visible from above; at the vertex of the head are also two minute spines. The anterior angles of the thorax acute, behind which is a short spine or tooth, behind which is a stout elongate spine bidentate at the apex; the posterior angles are also armed with acute spines, not so long as the anterior pair; nodes of the abdomen unarmed; abdomen globose, deeply emarginate in front, the emargination receiving the posterior node; the head, thorax and nodes of the abdomen have distant large shallow punctures; abdomen very delicately shagreened, polished on the disk, and having a few scattered punctures.

Hab. Brazil. In the British Museum and my own collection.

3. *Cryptocerus argentatus.*

Female. Length 5 lines. Shining black; head finely and distantly punctured, rounded in front and convex above; the stemmata three, placed in a triangle wide apart; the lateral raised margins of the head narrow, commencing in front opposite the base of the mandibles, and gradually narrowing backwards to the posterior angles of the head, which are acute; prothorax acute at the anterior lateral angles; the metathorax on each side at the base produced into a broad acute angular tooth, and at the posterior angles also forming a longer spine curving slightly upwards; the first node of the abdomen produced posteriorly on each side into a sharp stout spine curving upwards; the second node has anteriorly on each side a stout acute spine curving outwards; the abdomen is very smooth and shining, and has on each side, nearly touching the basal angle, an ovate yellow macula, which is sprinkled over with silvery scales or hairs, the apical segments are covered with silvery hairs; the wings fusco-hyaline; the thorax minutely and distantly punctured; the legs outwardly are sprinkled with short silvery hairs.

Hab. Columbia. In my own collection.

4. *Cryptocerus D'Orbignyanus,* Westw. MSS., n. sp.

Female. Length 4 lines. Black, head and thorax covered with strong shallow punctures, the abdomen delicately and very closely punctured, the entire insect sprinkled with minute golden hairs; the produced lateral margins of the head rufo-testaceous anteriorly, the mandibles and antennæ of the same colour; thorax, the anterior and posterior angles acute, forming short spines; wings slightly fuscous, stigma fuscous, nervures pale testaceous, legs ferruginous; the first node of the abdomen produced in the middle laterally into a short acute spine; the second node has on each side anteriorly a recurved spine; abdomen elongate, narrowing slightly towards the base.

Hab. South America.

Of this species I have only seen the single specimen kindly lent to me by Mr. Westwood for description.

5. *Cryptocerus femoralis,* Westw. MSS., n. sp.

Neuter. Length $2\frac{3}{4}$ lines. Black, the head, thorax and legs covered with shallow punctures, each containing a minute glittering scale or hair; the lateral margins of the head expanded before the eyes, the margination testaceous, the hinder angles acute, the antennæ sprinkled with glittering hairs; the sides of the thorax anteriorly testaceous, the anterior portion transverse quadrate, behind which the sides are deeply notched, the notch containing a recurved spine; the metathorax transverse, its anterior margin arched, the lateral and posterior margin curved inwards, the posterior angles produced into a sharp spine; the nodes of the abdomen transverse, armed on each side with a sharp spine, which is bent backwards; legs four-sided, the section of which is a square; abdomen somewhat heart-shaped, sharply marginate, longitudinally finely rugulose, most strongly at the base.

Hab. Columbia.

This species is in the collection of J. O. Westwood, Esq., who kindly lent it to me for description.

6. *Cryptocerus unimaculatus*, n. sp.

Neuter. Size 3 lines. Head and thorax black, disk of the head rugose, most deeply so on the vertex, the raised lateral margins ferruginous, terminating opposite the eyes, scape of the antennæ and the flagellum beneath ferruginous; the thorax rugose, the anterior angles produced into a stout spine, the posterior angles have also a longer stout acute spine; the legs black; the head and thorax are both sprinkled with short bright golden hairs; each node of the abdomen has on each side an acute spine; abdomen ovate, emarginate at the base, an oblong black stripe runs from the apex to the middle of the abdomen; beneath black.

Hab. Brazil. This appears to be a rare species; I have only seen the single specimen in my own collection.

7. *Cryptocerus patellatus*, n. sp.

Neuter. Length $2\frac{1}{2}$ lines. Entirely ferruginous; the entire margin of the head curving upwards, forming the exact model of dish or bowl, which has a few large scattered punctures within; the posterior angles of the head produced laterally and bent slightly upwards; thorax without spines, somewhat oblong-quadrate, but narrower posteriorly; nodes of the abdomen transverse, acute at their outer angles; abdomen elongate, ovate, deeply emarginate at the base; legs very short and stout.

Hab. Brazil. Of this remarkable species I have only seen the single specimen in my own possession.

8. *Cryptocerus elegans*, n. sp.

Neuter. Length $2\frac{1}{2}$ lines. Head, antennæ and legs rufo-testaceous; margins of the head broadly expanded at the sides, narrowly so behind, and of a pale testaceous hue; eyes black; mandibles rufo-testaceous; thorax elongate, rounded in front, its lateral angles produced into spines curving backwards; the metathorax has three teeth on each side; the shoulders and teeth at the sides of the thorax pale testaceous; the posterior femora testaceous and having a minute tooth above; the first node of the abdomen rounded in front, curving outwardly at the sides to half its length, then abruptly curving inwards on each side, forming a narrow footstalk to the broad portion; the second is somewhat square, having on each side anteriorly a broad bent flattened spine; abdomen heart-shaped, having on each side at the base a large ovate pale testaceous macula, and a little beyond the middle on each side a pale transverse stripe; the entire insect is covered with shallow punctures, and sprinkled with very short glittering hairs or scales.

Hab. Columbia. This species is unique in the collection of J. O. Westwood, Esq., who kindly lent it to me for description.

9. *Cryptocerus Araneolus,* n. sp.

Neuter. 1½ line. Dull reddish brown, the lateral margins of the head raised and expanded before the eyes; at the eyes the margins are notched, the raised margins ferruginous, the extreme apex of the antennæ pale testaceous; thorax oblong, gradually narrowing towards the abdomen, divided in the middle by a transverse suture, the lateral margins crenulated; legs short and stout; the nodes of the abdomen transverse, and furnished on each side with an acute spine; abdomen ovate, marginate, and emarginate at the base; the whole insect covered with shallow punctures, each of which contains a bright golden hair.

Hab. St. Vincent's. In the collection of J. O. Westwood, Esq., and in my own.

10. *Cryptocerus pubescens,* n. sp.

Female. Length 2 lines. Brown-ferruginous; the head laterally in front of the eyes has a slightly raised margin; thorax quadrate, the anterior margin waved, the sides curving outwardly and the posterior margin curving inwards, and waved, the four angles acute; the metathorax has on each side an acute spine, which, as well as the first node of the abdomen, is hidden by the projection of the disk; the second node half-circular or half-moon-shaped; abdomen nearly rotundate, a dark stain runs down the centre, acute at the base, and gradually widening to the margin of the first segment; the entire insect is covered with erect pale hairs.

Hab. Adelaide, N. S. Wales. In the collection of W. W. Saunders, Esq., and in my own.

MERANOPLUS.

Sexes three—male, female, and worker, or neuter.

Female. Sides of the head not expanded, antennæ inserted before and above the eyes on each side at the base of the clypeus, the basal joint or scape nearly as long as the flagellum, received in repose, into a lateral channel or groove above the eyes in the sides of the head passing beyond them and nearly reaching the vertex; wings, the superior pair having one marginal and one complete submarginal cell, each being of about equal length; abdomen somewhat heart-shaped, attached to two elongate nodes.

1. *Meranoplus petiolatus*, n. sp.

Female. Length $3\frac{1}{2}$ lines. Head bright ferruginous, antennæ dark rufo-testaceous, the thorax of the same colour, longitudinally rugose, the lateral margins of the thorax parallel as far as the base of the wings, whence the sides are narrowed considerably to the metathorax, which has a short tooth on each side; wings pale, nervures pale ferruginous; legs ferruginous; the nodes of the abdomen subquadrate; abdomen ovate, rufo-testaceous and irregularly stained with black; beneath black and having a large rufous patch in the middle, which has a black stain in the centre; the entire insect has a thinly scattered erect pale pubescence.

Hab. Brazil.

A rare species apparently; I have only seen the single specimen in my own collection.

CATAULACUS, n. g.

Sexes three—male, female, and neuter, or worker.

Female. The sides of the head not expanded, the eyes not concealed; antennæ inserted before the eyes, received in repose into an oblique groove or channel in the cheek; scape of the antennæ grooved beneath for the reception of the basal portion of the flagellum; wings having one marginal and one complete submarginal cell, the discoidal cells obsolete; abdomen elongate in the female, ovate in the workers or neuters.

Male not known.

1. *Cataulacus Taprobanæ*, Westw. MSS., n. sp.

Neuter. Length 2 lines. Black, the head and thorax roughly longitudinally rugose, the vertex behind and a small central portion of the thorax anteriorly transversely rugose; the antennæ rufo-testaceous, the scape and extreme apex pale; sides of the head and thorax crenulated, the posterior angles of the latter armed with a stout spine; the tibiæ and tarsi rufo-testaceous, the nodes of the abdomen coarsely sculptured; abdomen ovate, finely shagreened and longitudinally and delicately rugose at the base and sides, the rugosity consisting of a series of raised striæ, which do not reach the middle of the abdomen excepting at the sides.

Hab. Ceylon.

This species is unique in the collection of the Entomological Society, to which it was presented by G. H. K. Thwaites, Esq., who captured it in Ceylon.

2. *Cataulacus Guineensis*, Westw. MSS., n. sp.

Neuter. Length $2\frac{3}{4}$ lines. Black, head and thorax longitudinally rugose-striate, most deep and coarse on the thorax; sides of the head crenulate, the scape ferruginous, apical joint of the flagellum testaceous, the palpi testaceous; thorax, the anterior portion transverse and inclining downwards towards the head, the sides crenulate, the posterior angles acute; behind the transverse portion the thorax becomes much narrower towards the metathorax, from which it is separated by a deep transverse suture; posterior angles of the metathorax produced into an elongate stout acute spine; the tibiæ and tarsi ferruginous; abdomen ovate, finely granulate, the nodes deeply and coarsely sculptured; the entire insect is sprinkled with erect pubescence.

Hab. Tropical Western Africa.

Unique in the collection of J. O. Westwood, Esq., who kindly lent it to me for description.

3. *Cataulacus parallelus*, n. sp.

Female. Length $3\frac{1}{2}$ lines. Black, the head longitudinally rugose-striate, the vertex emarginate, the emargination transversely rugose-striate; the scape of the antennæ and extreme apex of the flagellum ferruginous; thorax longitudinally rugose-striate; the metathorax on each side produced into a stout sharp bent spine, beneath which it is transversely sulcate; wings tinged with yellow, their nervures pale testaceous; the tibiæ and tarsi ferruginous; the first node of the abdomen coarsely sculptured transversely; the second longitudinally so; abdomen oblong-quadrate, finely aciculate at the base, beyond which it is delicately shagreened, and has towards the apex a few short scattered pale setæ.

Hab. Cape of Good Hope. Apparently a rare species; I have only seen the specimen in my own collection.

Onychognathus, n. g.

Head heart-shaped; eyes prominent, placed forwards on the sides of the head; mandibles elongate, projecting forwards in a line with the body; antennæ elongate, inserted near the base of the mandibles, 5-jointed; thorax narrow, a little longer than the head; abdomen attached to the thorax by two narrow elongate nodes, ovate.

1. *Onychognathus antennatus.*

Neuter. Pale rufo-testaceous, the mandibles armed at their extremity with two long spines or teeth, the upper one simple, the lower one forked at the apex; the anterior angles of the thorax have a short acute spine, a second short one is situated about the middle at the sides, and the metathorax is armed with two longer, slender, acute spines; legs elongate, very pale testaceous; abdomen nearly rotundate, slightly flattened, the first node elongate clavate, the second globose.

Hab. New Zealand. In the collection of the British Museum.

MISCELLANEOUS.

EUCRATEA CHELATA.

To the Editors of the Annals of Natural History.

Tynemouth, Northumberland, March 1853.

GENTLEMEN,—In the March Number of the Annals I perceive that the Rev. T. Hincks has had the good fortune to be the first to announce the discovery of external ovaries on *Eucratea chelata*.

While on a visit to Weymouth in May 1849, I picked up several specimens of that very beautiful zoophyte, with some peculiarly-shaped cells, which, with the aid of Dr. A. H. Hassall, I then ascertained to be ovarian vesicles.

I have since then from time to time delayed publishing that interesting fact, and my attention having been only within the last month recalled to the subject, by observing, in the Rev. D. Landsborough's 'Popular History of British Zoophytes,' that ovaries had been recently found on two other members of the family Eucratiadæ, I then resolved to send you a notice of the result of my observations on *Eucratea chelata*, and, much to my dismay, found that I had been forestalled by the Rev. T. Hincks.

Trusting, however, that further information on this point will be acceptable to some of your readers, I have great pleasure in forwarding to you a rough drawing of a specimen of *Eucratea chelata* in my possession from Weymouth, showing front and side views of the aperture of the ovary, which is always on the same side of the ovary, facing the aperture of the cell from which it springs. The aperture of the upper part of the ovary is on the inner side of the somewhat globular capsule, nearly semicircular, with a slight projecting process on either side near to its junction with that of the lower part, which exactly corresponds with the oblique subterminal aperture of the polype cell.

I am, Gentlemen, yours truly,

JOHN COPPIN.

A new Genus and Species of Crustacea. By JAMES EIGHTS.

This Antarctic species, from the New South Shetlands, belongs to the *Idotæa* family. It is remarkable for its gigantic size, the length being $3\frac{1}{4}$ inches, and the breadth across the middle $1\frac{3}{4}$ inch. It is also peculiar in having the six anterior legs short and monodactyle or anchoral, while the eight posterior are long, stout, triangulate, spinose, and end in a short claw. Superior antennæ short, half the inferior in length, having a very short flagellum; inferior pair with a multiarticulate flagellum as long as the basal portion. Form of body oblong-ovate. Abdomen 5-jointed, the last segment subtriangular with sinuato-arcuate sides, and subcarinate longitudinally along the middle above. Thorax also somewhat carinate along the middle of the back, and surface of segments sculptured: mandibles without palpi. The species is named by Dr. Eights, *Glyptonotus antarcticus.* The paper is accompanied by two handsome plates, representing a dorsal and ventral view of this fine species, and giving a separate view of the antennæ.—*Trans. Albany Inst.*

On the Coleopterous Insects of the genus Cebrio. By M. Guérin-Méneville.

The insect which forms the subject of these observations was described by Fabricius under the name of *Cistela gigas* in 1787; in 1790 it was made the type of the genus *Cebrio* by Olivier. The great difference existing in the structure of the antennæ between the males and the females induced Latreille in some of his earlier works to form a new genus with the latter, under the name of *Hammonia*; Leach also founded a genus for the reception of the females, which he called *Tibesia.*

In 1812 M. Guérin-Méneville observed, at Toulon, an instance of copulation between two insects, one belonging to the genus *Cebrio* and the other to *Hammonia.* The same discovery was also made by M. de Cérisy at about the same time. These facts, showing the insects to belong to the same species, were communicated to Latreille, to whom M. de Cérisy promised to make every endeavour to ascertain their metamorphoses, and thus render their natural history complete. In this he succeeded last year; but before giving his own account of his discovery, it may be as well to describe in a few words the known peculiarities of the habits of the perfect insect.

The *Cebriones* have hitherto only been met with in the perfect state. They fly in great numbers during the heavy autumnal rains, seeking the females, which however they can never see, as these never quit the earth; the males become sensible of the presence of the female and scratch the earth, so as to lay bare the extremity of her abdomen, when impregnation takes place. It is by going to places where several males are seen to alight, that the female, which attracts them in this manner, is found. Since 1812 these peculiarities have been the subject of observation both with M. Guérin-Méneville and M. de Cérisy, who have published notices connected with them in the 'Annales de la Soc. Ent. de France' and in the 'Revue de Zoologie'; but the larva has only just been discovered by M. de Cérisy.

He had long suspected that a yellow larva, of a cylindrical form and very hard, which he found in the earth at all seasons in places frequented every year by the *Cebriones,* might be the first state of these insects, but all his attempts to rear them proved abortive.

"This year," he says, "my perseverance obtained full success; I was fortunate enough to find a larva of larger size than usual, which had already begun to form a cavity which appeared to be intended for its metamorphosis. I took the entire mass of earth, which was pressed into a box made on purpose; on the 22nd of

June 1852 the larva ceased to move, and changed into a pupa on the 4th of July. On the 3rd of August this pupa gave birth to a very large female of *Cebrio gigas*.

"I wished to know how these larvæ could live at a depth of 50–60 centimetres in earth so dry, that during the summer a few plants could scarcely vegetate upon it. I endeavoured to ascertain how these insects could travel through a soil, which during long droughts becomes of an extraordinary degree of hardness. Several circumstances assisted to explain the whole to me. One day, whilst holding in my hand the earth which contained one of these larvæ, I felt the efforts which it made to open a way for itself, and found that it diffused a liquid for the purpose of softening the hard and compact earth, and that the first segment of its thorax possessed the faculty of enlarging by its dilatation in this moistened earth, the passages which the larva is obliged to pass through in search of its nourishment, which consists of roots.

"On the 8th of November last, I found, in a small space, three larvæ of different ages, from which we may conclude that they remain several years in the earth."—*Comptes Rendus*, Jan. 31, 1853, p. 225.

On the Reproduction of the Toad and Frog without the intermediate stage of Tadpole. By Edward Joseph Lowe, Esq., F.G.S., F.R.A.S.

The following brief remarks on the Toad (*Bufo vulgaris*) and the Frog (*Rana temporaria*) may perhaps be received with some degree of interest, as they are, I believe, contrary to the generally received notion of the procreation of these reptiles. Ray, and most naturalists, at least, consider toads and frogs as oviparous animals, yet it is apparent that they are viviparous as well, or if they do not bring forth their young alive, have the power of reproduction in a different manner to the ova and subsequent tadpole.

Mr. J. Higginbottom of Nottingham, who has paid great attention to this subject, has clearly proved the development of the tadpole to the perfect toad in situations wholly deprived of light, as I have through his kindness several times witnessed. My present remarks are intended to show that *occasionally* frogs and toads are reproduced in localities where it would be impossible for the intermediate stage of tadpole to have any existence.

First. *Toads deposit spawn in cellars and young toads are afterwards observed.*

Last summer several masses of spawn were procured from my cellar, having been found deposited amongst decaying potatoes, &c., and subsequently young toads were noticed. The cellar is free from water, and at a considerable distance from any brook.

Secondly. *Young toads are observed about hot-beds.*

In the kitchen-garden at Highfield House (which is entirely walled round) young toads have been noticed about the cucumber- and melon-beds. The gardeners have been in the habit of bringing toads to these beds to destroy the insects; these have continued amongst the warm damp straw all summer. It is after these beds have remained three or four months that the young ones have been noticed. Toads would have to travel nearly half a mile to reach this garden from the brook or lake, and also to mount a steep hill, besides taking the opportunity of coming through the door. Toads so small are not seen in any other part of the gardens.

Thirdly. *Young toads and frogs observed in abundance at the summit of another hill, whilst quite small.*

During the past summer, especially in the month of July, very many young toads and frogs were seen amongst the strawberry plants, apparently from a week to a month old. These might possibly have travelled from the brook a few hundred yards distant; yet it is strange, that with the exception of these beds, no young toads could be found elsewhere in the garden. A number of full-grown toads are mostly to be seen about these beds.

Fourthly. *Young frogs dug out of the ground in the month of January.*

In digging in the garden amongst the strawberry-beds (near where so many toads were observed last summer) in the middle of January in the present year, a nest of about a score young frogs were upturned. These were apparently three or four weeks old. This ground had been previously dug in the month of August and many strawberry plants buried; it was amongst a mass of these plants in a state of partial decomposition that these young ones were observed.

Fifthly. *Young frogs are bred in cellars where there is no water for tadpoles.*

In mentioning this subject to Mr. Joseph Sidebotham of Manchester (an active botanist), he informed me that young frogs, and in fact frogs of all sizes, were to be seen in his cellar amongst decaying dahlia tubers. The smallest of them were only about half the ordinary size of the young frog when newly developed from the tadpole. He further stated that there was no water in the cellar, and no means of young frogs entering, except by first coming into the kitchen, a mode of entry, if not impossible, highly improbable. Mr. Sidebotham never found any spawn.

It seems probable from the above, that frogs are occasionally born alive in situations where no water can be found for the spawn to be deposited in, and that toads are either reproduced in the same manner, or from the egg directly. The latter mode seems most likely, owing to spawn having been found previously to the young toads.

Mr. Higginbottom tells me the same remark on the birth of the Triton, without the stage of tadpole, has been mentioned to him.

These are the facts; should the subject be deemed worthy of further investigation, I shall be glad to continue observations upon these reptiles during the present year, or to make any experiments that may be deemed advisable.

METEOROLOGICAL OBSERVATIONS FOR FEB. 1853.

Chiswick.—February 1, 2. Very dense fog. 3. Overcast: cloudy. 4. Cloudy: rain. 5. Densely overcast. 6. Cloudy. 7. Fine: overcast. 8. Uniformly overcast. 9. Foggy: dusky haze: foggy: overcast: rain. 10. Cold rain: drizzly: clear. 11. Few snow-flakes. 12. Cloudy. 13. Overcast throughout: frosty. 14. Overcast: sharp frost. 15. Frosty: overcast: frosty. 16. Frosty: fine: clear. 17. Clear: slight snow. 18. Frosty, with brisk wind: snow-shower occasionally. 19. Dry and frosty: clear: frosty. 20. Frosty: large white clouds: clear and frosty. 21. Clear and frosty: fine: clear, with sharp frost at night. 22. Frosty: rain: overcast. 23. Drizzly: fine: clear and boisterous at night. 24. Clear and frosty: overcast: rain at night. 25. Cloudy: overcast: rain at night. 26. Boisterous, with rain. 27. Overcast: clear and frosty. 28. Clear and frosty: cold dry air: clear and frosty at night.

Mean temperature of the month	32°·53
Mean temperature of Feb. 1852	38 ·72
Mean temperature of Feb. for the last twenty-seven years...	40 ·06
Average amount of rain in Feb.	1·62 inch.

Boston.—Feb. 1. Foggy. 2, 3. Cloudy. 4. Cloudy: rain A.M. and P.M. 5, 6. Cloudy. 7. Cloudy: rain P.M. 8. Cloudy. 9. Cloudy: rain P.M. 10. Cloudy: rain and snow A.M. and P.M. 11. Cloudy: snow A.M. and P.M. 12. Fine: snow A.M. and P.M. 13. Fine: snow A.M. 14. Cloudy: snow A.M. 15, 16. Fine. 17. Cloudy: snow A.M. 18. Fine: snow A.M. 19. Fine. 20. Cloudy: snow A.M. 21. Fine. 22. Cloudy: snow A.M. and rain P.M. 23. Fine: snow P.M. 24, 25. Fine. 26, 27. Cloudy: snow P.M. 28. Cloudy.

Sandwick Manse, Orkney.—Feb. 1. Bright A.M.: fine, cloudy, aurora P.M. 2. Hazy A.M.: cloudy P.M. 3. Rain A.M. and P.M. 4. Rain A.M.: clear, aurora P.M. 5. Clear, frost A.M.: cloudy P.M. 6. Cloudy A.M.: showers, aurora P.M. 7. Bright A.M.: clear, frost P.M. 8. Clear, frost A.M. and P.M. 9. Rain A.M.: cloudy P.M. 10. Bright, frost A.M.: snow-showers P.M. 11. Snow-showers A.M.: snow-drift P.M. 12. Snow-showers A.M.: cloudy P.M. 13. Snow A.M.: clear P.M. 14. Snow, clear A.M.: clear, aurora P.M. 15. Sleet-showers A.M.: cloudy P.M. 16. Snow-showers A.M.: clear P.M. 17. Snow-drift A.M. and P.M. 18. Deep snow A.M.: snow-showers P.M. 19. Snow-showers A.M.: snow-drift P.M. 20. Snow-showers A.M. and P.M. 21. Cloudy A.M.: thaw, showers P.M. 22. Frost A.M.: cloudy, thaw P.M. 23. Snow-drift A.M.: snow-showers P.M. 24. Snow, cloudy A.M.: snow-drift P.M. 25. Snow-showers A.M.: snow, cloudy P.M. 26. Snow-showers A.M. and P.M. 27. Clear A.M.: fine, aurora P.M. 28. Snow, cloudy A.M.: clear, aurora P.M.

Mean temperature of Feb. for twenty-six previous years	38°·44
Mean temperature of this month	33 ·74
Average quantity of rain in Feb. for seven previous years......	4·23 inches.

All marked as *rain* after 11th is melted snow, viz. 1·77 inch.

The snow-storm began on the night of the 10th and continued till the end of February, being the most severe remembered for twenty-six years at least, except in 1838, when the snow continued all the month and all the previous January, except the first eight days. It has also been one of the coldest months during that time, the only one decidedly colder being February 1838, when the mean temperature was 31°·31. Some instances occurred of the snow being rolled up in hollow fluted cylinders, as formerly observed here and described in February 1847 *, but on a much smaller scale.

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* See our Number for April 1847.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London*; *by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse*, Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston.	Orkney, Sandwick.		Chiswick.		Boston.	Orkney, Sandwick.		Chiswick.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1853. Feb.	Max.	Min.	8¾ a.m.	9¼ a.m.	8½ p.m.	Max.	Min.	8¾ a.m.	9¼ a.m.	8½ p.m.	1 p.m.					
☾ 1.	30·192	30·160	29·88	29·92	29·97	32	28	29	41½	41½	n.	calm	sse.	....	....	....
2.	30·120	29·962	29·82	29·88	29·67	42	28	33·5	41	41	ne.	se.	sse.	....	....	....
3.	29·715	29·535	29·40	29·61	29·67	39	34	34	40	38½	se.	sse.	sse.	....	....	·28
4.	29·788	29·521	29·30	29.90	30·04	41	31	36	40	32	nw.	se.	calm	·17	·04	·32
5.	29·878	29·710	29·50	30·02	29·78	42	32	36	34	37	se.	ne.	s.	....	·20	....
6.	29·848	29·685	29·53	29·42	29·40	43	34	36	39	37	ne.	wnw.	w.	....	....	·06
7.	29·521	29·348	29·20	29·32	29·28	45	34	34·5	34	31	s.	s.	sse.	·01	....	·02
● 8.	29·230	29·052	29·00	29·25	29·33	40	26	34·5	32	30½	se.	sse.	e.	....	·20	....
9.	29·015	28·978	29·08	29·44	29·53	40	34	36	37	36½	e.	se.	n.	·02	....	·04
10.	29·324	29·081	28·90	29·66	29·73	37	28	36	35	28	ne.	ne.	ne.	·06	·16	·01
11.	29·368	29·362	29·13	29·86	29·92	36	27	30·5	26	25	n.	n.	ne.	....	·18	....
12.	29·494	29·388	29·20	29·68	29·94	34	27	28	22	28	ne.	ne.	nne.	....	....	·03
13.	29·632	29·584	29·38	29·86	30·00	34	26	30	33	31	e.	ne.	ne.	....	·02	....
14.	29·818	29·798	29·00	30·00	29·89	32	18	28	34½	33	ne.	n.	nne.	....	·10	·06
15.	29·818	29·796	29·50	29·94	30·10	35	23	25	36	35	nw.	nw.	n.	....	·07	·07
☽ 16.	29·820	29·784	29·52	30·02	30·05	38	25	27	32	33	n.	nnw.	n.	....	....	.07
17.	29·746	29·531	29·46	29·88	29·79	35	25	30	31	28	nw.	nnw.	n.	....	....	....
18.	29·530	29·494	29·24	29·65	29·56	36	16	27	34	26	n.	n.	calm	....	·12	....
19.	29·710	29·550	29·38	29·82	29·92	34	19	16·5	35	30	ne.	n.	n.	....	·15	·46
20.	29·802	29·444	29·60	30·07	30·15	36	23	19	34½	32	n.	n.	nw.	....	....	....
21.	30·094	30·050	29·77	30·06	29·82	38	19	26·5	34½	37½	nw.	nnw.	nw.	....	·07	·20
22.	30·010	29·870	29·63	29·93	29·77	38	30	33	36½	36	sw.	w.	n.	·08	....	·05
○ 23.	29·629	29·540	29·30	29·48	29·67	43	25	34	30	34	w.	w.	nw.	·02	·09	....
24.	29·754	29·305	29·45	29·55	29·55	40	32	30·5	37	32	nw.	nw.	n.	·09	·06	·14
25.	29·732	29·456	29·26	29·67	29·34	40	29	34	34	32½	n.	nw.	se.	·15	....	·18
26.	29·182	29·086	29·05	29·44	29·48	44	30	33·5	34	32	w.	sw.	n.	·09	....	·06
27.	29·752	29·441	28·74	29·70	29·85	39	22	34	32½	29	n.	sw.	n.	....	·12	·20
28.	29·900	29·809	29·27	29·70	29·64	40	24	32	39	34	nw.	n.	n.	....	·03	·25
Mean.	29·693	29·547	29·33	29·742	29·745	38·32	26·75	30·8	34·60	32·89				2·46	1·61	2·50

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XXXI.—*On the Occurrence of Palms and Bambus, with Pines and other Forms considered Northern, at considerable elevations in the Himalaya.* By Major Madden, H.E.I.C.S., F.R.S.E., M.R. Dublin Society*.

Having resided for several years in the British portion of the Himalaya Mountains, and more especially in the province of Kemaon, which borders on the Nepalese territories, I possessed opportunities for examining its botany, which up to that period had been investigated by native collectors only, and was thus enabled to determine the western extension of a number of plants, the existence of which had hitherto been supposed to be limited by Nepal. Among these were several palms, on the distribution and association of which, and the inferences to be drawn therefrom, I propose to lay before the Botanical Society a few facts for its consideration.

1. The most common of these palms is one which Dr. Royle has designated *Phœnix humilis*, and which he supposes may be identical with *Ph. acaulis* of Roxburgh, and which is probably a mere variety of *Ph. sylvestris*, the wild date tree of India, useless for its fruit, but yielding abundance of sap, which, in Bengal, is largely employed in the manufacture of sugar. *Phœnix humilis* occurs in great abundance and beauty in the forest belt all along the base of the mountains, up the warm valleys of the great rivers, and ascends the mountains to 5500 feet, being plentiful at that elevation in the vicinity of Almorah, the capital of the province, and in one or two instances which came under my observation reaching even a thousand feet higher. In its dwarfed form, *Phœnix humilis* is found at least as far N.W. as the Sutluj river, and is the only one of the family which, probably

* Read before the Botanical Society of Edinburgh, March 10, 1853.

owing to the aridity of the climate, is to be met with in that region*. In several places in Kemaon (Dwarahat for instance) I noticed its arborescent state (*Phœnix sylvestris*), attaining the height of 40 to 50 feet at an elevation of 5000 feet above the sea, surrounded at no great distance by extensive forests of *Pinus longifolia* and *Quercus incana*, the inferior limit of the former tree being about 2000 feet above the sea-level.

2. *Harina* (*Wallichia*) *oblongifolia*, a very beautiful palm, first described by Mr. Griffith, and observed by him in Assam. This I found in abundance in the damp and very warm valleys of the Surjoo and Kalee rivers, near the Nepalese frontier at Burmdeo, and for many miles up the interior, but never ascending higher than 3500 or 4000 feet on the mountain sides, and only where the localities afforded abundance of shade and moisture. To the N.W. of the province it occurred in the Bumouree Pass, and in the valleys below the recently formed station of Nynee Tal; and still further west, it just reaches the Patlee Doon, a valley in the S.E. of Gurhwal, beyond which a careful examination failed to detect any trace of it. This palm, the leaves of which bear a great resemblance to those of *Corypha* or *Arenga*, and afford a very durable thatch, forms dense thickets, and never attains the arborescent form.

3. *Chamærops Khasyana* (Griffith), of which a plant raised from seeds sent home in 1847 is before the Meeting, was first met with and described by Mr. Griffith in the Khasya (or Cosseeah) Hills between the plains of Bengal and the Burhampootra river. As this eminent botanist remarks, it comes very near *Ch. Martiana* of Wallich, a native of Nepal, at 5000 feet elevation; and further researches will, in my opinion, tend to the conclusion that they are, in fact, one and the same species.

Mr. Griffith's description as detailed in the Calcutta 'Journal of Natural History' is appended, with a few observations of my own to justify the opinion which I have formed of their identity.

As defined by this botanist, *Chamærops Khasyana* occurs in four localities of Kemaon, besides another (the Dhuj mountain), where I was informed on good native testimony of its presence in considerable quantities. Of these stations, the most remarkable for its elevation and the abundance and perfection of the palm is the Thakil mountain, named from it, an enormous mass

* Advancing to the N.W. however, in the Khybur Pass, and generally in the low, arid, mountainous parts of Eastern Afghanistan and Beloochistan, in north latitude 26°–35°, we find abundance of *Chamærops Ritchiana*, Griffith, *Maizurrye* of the Afghans, a dwarf species seldom above 2–3 feet high, and if not identical with, closely allied to *Ch. humilis*, the only European palm flourishing in very nearly the same latitudes, and in a very similar climate.

of magnesian limestone reposing on clay-slate, in the eastern extremity of Kemaon, its loftiest summits attaining the elevation of 8221 feet above Calcutta: the base of the mountain, as marked out by the deep gorges of the Surjoo and Kalee rivers, only 1500 feet above the sea, and occupied by a tropical vegetation, cannot be under sixty miles in circuit. The zone of *Pinus longifolia,* which forms vast forests on its declivities, extends vertically from 2000 to about 7000 feet; the summits, for perhaps 400 feet, are denuded of all arboreous vegetation, and exhibit, as usual in the Himalaya, bare tracts of mere rock*, or meadows of luxuriant grass (*Rhaphis Roylei, Arundinella, hirsuta,* &c.), *Ophelia, Gentiana, Saxifraga, Primula,* &c. Below these comes the zone where flourish luxuriant forests of *Quercus incana, lanata* and *floribunda, Acer, Ilex, Pavia, Rhododendron, Andromeda, Symplocos, Taxus, Berberis,* and other northern forms; amidst these, in damp shady glens on the north and south-east, but chiefly on the north-west exposure, the *Chamærops* is found in great numbers, forming clumps and rows, the trees rising from 30 to 50 feet high, each with its superb crown of large flabelliform leaves, rattling loudly to the breeze. At 6 feet from the ground the stems are 2 feet in circumference, but become thicker above. The flowers appear in April and May, and the fruit, which is of a dark glossy blue, about half an inch long, ripens in October, and at the period of my visit (March 20, 1847) lay strewed in abundance at the foot of the trees, where large beds of snow remained unmelted, and where rich beds of *Primula denticulata* were in full bloom. The lowest specimens observed were at about 6500 feet, but they reached their perfection in numbers and stature at 7800, from which we may fairly infer, that had circumstances been favourable by the addition of some thousand feet to the altitude of the mountain, they would have ascended considerably higher. But in the site actually occupied by them, the mean annual temperature cannot be under that of London†, and though the summer be very warm, snow generally covers the ground from November till March. On the ascent of the mountain, *Phœnix* was abundant both in its dwarf and arboreous forms at 4000 feet, while *Harina* forms extensive thickets in the river valley at its base.

The presence of *Chamærops* at such an elevation has its parallel in America, where, on the Andes of Quindiu and Tolima, in about

* A phænomenon, by the way, which illustrates the prophecy in Micah, iii. 12. "Therefore shall Zion for your sake be plowed as a field, and Jerusalem shall become heaps, and the mountain of the house as *the high places of the forest.*"

† *Ch. Martiana* has proved perfectly hardy at 19° Fahrenheit during the past winter. (Gardeners' Chronicle, April 9, 1853, p. 230.)

4° north latitude, Humboldt discovered *Ceroxylon Andicola* at from 5800 to 9500 feet, associated with a genus of Bambusidæ (*Chusquea*), which, as we shall presently observe, has more than one representative in the Himalaya also. He also informs us that on the western slope of Mexico, *Corypha dulcis* is mixed up in the forests of *Pinus occidentalis.*

Chamærops Khasyana appears also to occur on Dhuj mountain, a few miles north-east of the Thakil; on the Kaleemooudee range between the rivers Ramgunga and Goree; and in the valley of the Surjoo near Bagesur. In the north-west of Kemaon I discovered dwarf specimens in two localities, viz. at the base of the Sutboonga mountain south-east of the Gagur Pass, in very dense forest at 6500 feet elevation; and on the Berchoola, a spur of Bhutkot mountain, considerably further in the interior, and at about 8000 feet elevation. In neither of these stations could I find any examples with stems beyond a foot or two high, and this circumstance, as well as the fact that inquiry and investigation failed to detect any trace of their extension to the north-west, leads me to conclude that these points form the limit of the species in longitude. I must add, however, that in a paper addressed to Baron von Humboldt, the late Dr. W. Hoffmeister states that in the province of Gurhwal, on the descent from Dhunpoor to the Alacananda river (the main arm of the Ganges), he came upon a forest of *Pinus longifolia* at 6800 feet; "and it is very remarkable that the *Chamærops Martiana* (Wallich) is here in immediate contact with it, some tall stems of that palm being even scattered in among the pines" (Travels in Ceylon and India, English Translation, p. 495). But in 1849 I went over this very ground, and on the most careful scrutiny no such trees were to be seen or heard of; and it is certain that in his letters written on or near the spot, as well as in the 'Synopsis of Vegetation' (pp. 307, 507) for this very route, no palm is mentioned except *Phœnix humilis*, which I myself also found to be common and occasionally arborescent; and such I doubt not is what Dr. Hoffmeister really intended. I had the pleasure of meeting him at Simla the same year (1845) that he made his journey, and being then engaged in some researches on the Coniferæ of the Himalaya, and having never then visited Kemaon and south-east Gurhwal, he very kindly furnished me with some brief memoranda on their occurrence in those districts; and here too I find *Phœnix humilis* alone mentioned in the locality specified. Hence I am justified in considering the stations on Bhutkot and Sutboonga in Kemaon, as the most westerly at which *Chamærops* has hitherto been observed*. A species of *Musa* (plantain or

* A species of *Chamærops*, called Hemp Palm, has recently been discovered by Mr. Fortune in the northern provinces of China, Chekiang and

banana) is indigenous and abundant at a considerable elevation (7000 feet) in the eastern Himalaya north of Assam, and nearly to the same level in Sikkim: I have observed it only in one spot in Kemaon, the Bylchheena Pass, at about 4000 feet elevation, and was told that it occurred much more abundantly at a short distance, in the valley of the Kalee; but as I had not time to verify the report, it need not be more than thus briefly alluded to*.

There is however one more genus of the Monocotyledones, and allied to the Palms, worthy of introduction here, from the very great elevation to which it reaches in the Himalaya, and from its affinity and resemblance to the tropical genus *Bambusa*; I allude to the genus *Arundinaria* of the section Bambusidæ, of which at least four very distinct species occur in the Himalaya, and which have been referred to a new genus (*Thamnocalamus*) by my friend Dr. Falconer. They are familiarly known to European residents in the mountains as the "hill bamboo," and to the mountaineers of Gurhwal as the "Ringal," altered to "Ningala" in Kemaon. Of these, the lowest species in the vertical section is *Arundinaria falcata*, growing from 3500 to 8500 feet, and, like the rest, forming extensive and close thickets. The second is the *Arundinaria utilis* of Mr. Edgeworth, the Deo Ningala (or divine Ningala) of the natives, occurring from 7000 to 9000 feet. The third is variously named Geewasa, Purkha, Jhoomra, Suiura (Jurboota in Nepal, where all these species are also found); I am not aware that this is yet described; but its principal difference from the next is that the stems are solitary, not in clumps: it occurs from 7000 to 10,000 feet. The fourth species is the Tham, in Nepal Khaptur, also undescribed, at least unpublished, which has its zone from 8500 to 11,500 feet; only 500 feet, or less, below the inferior limit of the perpetual ice of the glaciers,

Kiangnan, where the winters are excessively cold. Plants sent to Kew in 1848 have "braved unharmed, and unprotected by any sort of covering, the severe winter now passed, 1849–1850" (Bot. Mag. March 1850, quoted in Proceedings of Bot. Soc. May 13, 1852). If this be *Ch. Martiana*, it proves the great extension and hardiness of that species; if different, it affords an additional corroboration of the line of argument adopted in the text.

* I am not aware of the exact locality in Nepal of the arborescent fern, *Alsophila gigantea*, but near Darjeeling in Sikkim, immediately to the east of that country, Dr. Hooker states that it flourishes between 4000 and 7000 feet above the sea; 6500 being there the upper limit of the palms; a species of *Caryota* reaching up to 6000, and *Calamus* as high, forty miles within the mountains; while *Pothos, Musa, Ficus, Piper* have species from 2000 to 7000 feet, and *Ficus* one species to 9500. But in the humid equable climates of the southern hemisphere, Australia, New Zealand, Tasmania, the arborescent ferns reach a much higher parallel of latitude, and attain the height of 40–50 feet.

and, with the second and third species, occupying nearly the entire zone of *all* the coniferous trees of the Himalaya, *Pinus longifolia* excepted, which is below them*. The most useful and remarkable of the four is *Arundinaria utilis*, which grows in fine clumps of many slender stems, from 20 to 40 feet high, extremely durable and applied to a great variety of purposes. The plant, like the true bambu, flowers but rarely, and the stems then die and fall. I was fortunate enough to collect considerable quantities of the seed near Pindree in 1846, which has, I believe, produced all the plants living in Great Britain and Ireland: three years afterwards, in a second visit to the alpine Himalaya, the stems which had fallen and died in that season were still perfectly sound, and I believe that the third and fourth species are nearly if not altogether as durable, but they never attain the stature of the Deo Ningala.

The bearing of the foregoing facts on the phænomena of geology is so obvious as to require little comment; the considerations most pressing on our attention being the necessity of great caution in drawing inferences as to the nature of climate from the presence of supposed tropical forms in ancient rock formations, and the facility with which we can now account for the juxtaposition of those forms with those of known temperate regions.

Here are palms, bambus, bananas growing amongst and above pines, firs, cedars, cypresses, yews, oaks†, maples, hazels, ash,

* "Bamboos in the general acceptation of the term (for remotely allied genera bear the same trivial English name) occur at all elevations below 12,000 feet, forming even in the pine woods, and above their zone, in the skirts of the Rhododendron scrub, a small, and sometimes almost impervious jungle." (Dr. J. D. Hooker, Excursion to Tonglo Mountain in Sikkim: Journal As. Soc. Bengal, May 1849, p. 424.)

† It must be remarked, however, that the oak, the pine, and other common Northern forms are even less justly adduced as the criteria of a cold climate than the palms are of a hot one. Our own *Quercus robur*, the Himalayan Q. *semecarpifolia*, with several Mexican and other species, flourish exclusively in low temperatures, but the great majority of the Indian species are natives of the moist warm regions of Nepal, Silhet, the Garrow and Khasya hills, Chittagong, Tenasserim, Martaban, Penang, &c. Such are sixteen out of the seventeen species enumerated by Roxburgh in the 'Flora Indica.' Professor Liebmann remarks (Oak-Vegetation of America, translated in Hooker's Journal of Botany and Kew Miscellany for 1852, p. 322): "It has hitherto been a prevailing notion that the oak-form is peculiarly characteristic of the temperate zone. But whether we look at the number of species, the beauty of the forms, or the size of particular organs (leaves, fruits, cups), we shall find their maximum in the tropical zone, that is, in the Sunda Islands of the Old World and tropical Mexico of the New." So also in the Himalaya, *Ulmus erosa* occurs at from 8000 to 10,000 feet; another species, erroneously as I think identified with the Chinese *Ulmus virgata*, between 6000 and 7000 feet; a third in the hot

and almost all the deciduous trees proper to a cold region of the globe. During violent storms and heavy rains it cannot but

valleys of Kemaon at 3000 feet; and a fourth, *Ulmus integrifolia*, allied to the last, abounds at the base of the mountains and all over the plains of India down to Coromandel and Guzerat. In the same warm plains we find *Ranunculus sceleratus*, as common and as luxuriant down the Ganges to Bengal as in Scotland: a *Clematis* (*C. Gouriana*) is so named from the old capital of Bengal where it was first discovered: a fine rose (*R. involucrata*) is wild in Behar at the foot of the Rajmahal hills: a blackberry (*Rubus distans*, Don) is found below the base of the Himalaya; while *Potentilla supina* and *Heynii* abound along the Ganges to Calcutta. Of the Coniferæ, several genera and species are confined to high temperatures; *e. g. Pinus longifolia* grows well at Calcutta, but perishes in our climate. *P. sinensis* flourishes on the coast of China, at Canton, and south of it. "One true pine is shown to be a native of Sumatra, *Pinus Merkusii*, Jungh. et De Vriese, Pl. Ind. Or. fasc. 1. tab. 1, probably the *P. Finlaysoniana* of Wallich, Cat. no. 6062, from Cochin China" (Kew Miscellany and Journal of Botany for April 1851, p. 127). The genera *Dammara, Podocarpus, Dacrydium*, have their greatest number of species in Nepal, Khasya, Malacca, Java, Penang, and Amboyna; even *Juniperus* has a species in Barbadoes (*J. Barbadensis*), and another (*J. aquatica*) at Canton; while *Cupressus glauca* is a native of Goa; *C. sempervirens* is quite at home at Agra, with *Thuja orientalis*. The Coniferæ, in short, are, as Dr. Lindley remarks (Vegetable Kingdom), "natives of various parts of the world, from the perpetual snows and inclement climate of Arctic America to the hottest regions of the Indian Archipelago."

On the other hand, several tropical genera besides those noted in the text have species at great altitudes in the mountains. Thns *Indigofera* has in the Himalaya *Indigofera pulchella* at 5000 feet, *I. heterantha* at 7000, and *I. Gerardiana* (*Dosua*, Don?) to 10,000; all large shrubs and forming extensive thickets. The beautiful *Acacia Julibrissin* ascends to 6500 feet. Dr. Hooker remarks (Journal of As. Soc. Bengal for May 1849, p. 426), that the general prevalence of bamboos, figs, and their allies the nettles, is a remarkable feature in the botany of the Sikkim Himalaya up nearly to 10,000 feet; "one species of this very tropical genus (*Ficus*) ascends almost to 9000 feet, on the outer range of Sikkim;" as *F. laurifolia* does to 6500 feet in the N.W. Himalaya. Gardner notices with surprise and admiration the prevalence of numerous species of this genus forming splendid trees in the forests of the Organ mountains, near Rio Janeiro. Of Laurineæ, *Cinnamomum* has one species in Sikkim to 8500 feet, and *Tetranthera* another to 9000 (Hooker, *l. c.*); while in the N.W. Himalaya, *Daphnidium, Litsæa*, &c. have species to the same elevation. In Sikkim, Dr. Hooker mentions *Balanophora* with species at 6000, and one even to 8000 feet; and Dr. Thomson found it near Kotgurh, thirty miles north of Simla, between 6000 and 7000. Of the generally tropical family Cinchonaceæ, the true Cinchonas reach 10,000 feet or more in South America; just as in the Himalaya I found *Leptodermis lanceolata* at 10,000 feet on Dudutoli mountain in Gurhwal. But these anomalies are far too numerous for a note. I must add, however, that the physical conformation of the Himalaya of itself greatly favours the probability of tropical and temperate forms becoming associated by storms, torrents, &c.; for while the deep warm valleys which penetrate fifty or sixty miles towards the summit line are filled with a tropical or semitropical vegetation, the lofty ranges which divide them are clothed with forests of the temperate types.

happen that some of these should be overthrown and buried beneath the huge landslips so prevalent at such crises, and there become fossilized to the perplexity of a succeeding race of geologists! Their difficulties and their errors might easily be enhanced and fortified by the addition of a very possible contingency in the animal kingdom, viz. the presence of the larger carnivora. The leopard is a constant and only too troublesome inhabitant of the Himalaya up at least to 9000 feet, and commits great depredations on the flocks. The tiger, too numerous at the base, and in the hot valleys of the Kemaon and Gurhwal mountains, is, I think, merely an occasional, though by no means very rare, visitor at that altitude in search of the larger deer; I have myself several times seen their footprints on the snow, with other marks of their having passed between 8000 and 9000 feet; at which elevation one friend of mine *met* a tiger in a thicket of Deo Ningala; and another who was on a shooting excursion fired at and wounded one up as high as 10,000 feet. Now, it is not at all impossible that one or more of these should perish in a storm and be buried in the same deposit as the palms and conifers, &c., and thus render the problem greatly more complicated.

So much for the mountains and the subtropical forms which flourish there; but the same result will be equally brought about in the hot plains of India by the transport of the northern plants through the agency of rivers and torrents. The Khasya hills, where Griffith first met the *Chamærops*, rise like a wall from the flats of Bengal, and in many parts of the Himalaya the exterior range rises in precipices to the height of 6000 to 8000 feet, clothed to the brink with oak, ash, maple, pine, cypress, Siberian crab, &c.: immediately beneath is the vegetation of the tropics. The cliffs are wearing slowly back, and many of these oaks, &c. must be carried down by their own weight and by the torrents to form the most heterogeneous mass with the Naucleas, Cinchonas, Vaticas, of the *Terai* Belt.

These reflections are forced on the mind at once in such localies as Nynee Tal Station in Kemaon.

But we may safely extend our view to the lower course and deltas of the three great rivers which ultimately drain the Himalaya, the Indus, the Ganges, and the Burhampootra. Mooltan and Sindh, on the first of these, are in many places covered with groves of *Phœnix dactylifera* and a forked palm, which I suppose to be *Hyphæne Thebaica,* the Doom palm of Upper Egypt: Behar on the Ganges, in like manner, abounds in the fine palm *Borassus flabelliformis*; and in Bengal, *Phœnix sylvestris* and *paludosa, Areca Catechu,* and *Cocos nucifera,* often form great woods. Annually, during the floods, the great rivers bring down numbers of the Himalayan Coniferæ, which, were the country uninhabited, would be carried to the sea and deposited with the spoils of the deltas themselves in the new formations, which the mud and silt of these great rivers are known to be slowly depositing*. We should thus be presented with the association of palms and pines, the occurrence of which is so well ascertained in the coal-measures and far up into the tertiary series; and even though we were able to demonstrate that these trees were *in situ*, we have still the alternative to dispose of, that to the present day palms and pines actually flourish on the same ground, before we can legitimately argue from their juxtaposition any anomalous conditions of the atmosphere, differing greatly from our present experience. The existence of the mammoth in the cold regions of Northern Asia, provided with hair and fur to protect it from the severity of the climate, might, *à priori*, warrant a presumption of an analogous fact in the vegetable kingdom, namely the existence of palms, or other tropical families, so organized as to enable them to contend with a very low temperature.

This phænomenon now rests on actual observation, and is quite in accordance with facts in other branches of natural history, zoology, ornithology and conchology, where several familiar instances might be alleged of tropical genera with few, or even solitary species extending far into the arctic and antarctic zones, where their occurrence and discovery immediately and extensively modified, or even reversed, conclusions drawn from the presence in geological formations of cognate forms. And such uncertainty must continue to rest on the result of our researches, till, abandoning the maxim, absurd in science, that "the exception proves the rule," we cease to look too exclusively to genera, aed allow to species their proper place and weight in our systems.

Description of the Palm referred to in the Text, from Griffith.

CHAMÆROPS KHASYANA.

"*Nov. Spec.* Trunco mediocri, petiolis per totam longitudinem denticulato-scabris, fibrillitio e fibris erectis rigidiusculis lamina reniformi-flabelliformi, profunde 60–65 partita laciniis induplicatis

* I can speak from observation as to the number of pines brought down by the Sutluj; and as long since as the age of Alexander the process must have been the same, for the fleet with which he descended to the mouth of the Indus was constructed of them. There is a regular business in catching the floating trees, and not a very safe one; for such is the impetuosity of the rivers, that the men employed are sometimes drawn by the timber (to which they have fixed large hooks) into the current, and are infallibly lost.

bilobis vel bipartitis lobis centralium brevibus obtusis recurvis, spadice (fructus) bipedali ramis primariis tribus, spathis subternis (basilaribus 2 rameo 1) pedunculum communem omnino tegentibus, fructibus oblongis livido-cæruleis.

"*Hab.* Khassya hills, on precipices at Moosmai and Mamloo. Alt. 4000 feet: not observed in flower or fruit.

"*Desc.** A palm of moderate height (the specimen measures 9–10 feet), the trunk 5 inches in diameter in the thickest parts, obscurely annulate. Under the *crown,* which is thick, is an oblong mass (2 feet long) of flattened bases of petioles and their retia, which are of stiff fibres.

"Leaves about $3\frac{1}{2}$ feet long; *petiole* 18 inches long, with irregular denticulate margins; *lamina* flabelliform reniform (so is the entire part of the leaf), 2 feet long by $3\frac{1}{2}$ feet wide; divisions about sixty-five, the lateral ones shortest, 12 to 14 inches long, but the deepest divided (viz. to within 5–6 inches of the apex of petiole), linear, their segments $1\frac{1}{2}$–2 inches long, narrow, acute; central, ensiform, reaching to within 10–12 inches of the apex of the petiole, about 16 inches long, shortly and obtusely bilobed, segments about half an inch long, with recurved points; intermediate divisions also ensiform, about 18 inches long, their segments narrower and deeper than those of the central; young leaves covered with thick, white, paleaceous tomentum.

"*Spadix* (fruit-bearing) 2 feet long, nodding, compressed; the lower half concealed by the *spathes,* of which there are three, two common ones, and one to one of the main branches. They are coriaceous, brown, with oblique mouths and bilobed limbs: the lowest is about a foot long. *Branches* of the *spadix* quite exserted, quite naked, the terminal one quite dichotomous; divisions many.

"*Spikes* 4 to 6 inches long.

"*Fruit* scarcely baccate, $\frac{1}{2}$ inch long, $2\frac{1}{2}$ lines broad, solitary or 2–3 together, but of distinct carpels, oblong, inequilateral, obliquely apiculate at the apex, surrounded at the base by the calyx, which has a stout cylindrical base, and three deep, broad, oblong divisions, by a corolla of three cordate ovate petals, equal in length to the calyx, and by six sterile stamina; on one side may be found two abortive villous ovaries. *Seed* oblong, with the ventral face rather deeply furrowed, the furrow not reaching quite to the apex, reniform on a transverse section. *Albumen* with a scaly surface, along this line presenting a cavity filled with spongy tissue; horny, otherwise equal. Embryo in the centre of the dorsal face.

* Entire? specimen of a trunk and crown, and two fruit-bearing spadices; these have been unnoticed since the return of the Assam Deputation in 1836: seeds since received have germinated.

"This species is closely allied to *C. Martiana*; it differs in its shorter stature, the petioles toothed throughout, in the nature of the rete and the texture of the leaves, which is more like that of *C. humilis*. The paleaceous tomentum much more developed, and the berries are bluish, not yellow. The divisions of the leaves are much the same, excepting the secondary segments of the central division, which are shallow, obtuse and recurved." (The Palms of British East India, by W. Griffith, in M'Clelland's Calcutta Journal of Natural History, No. 19. October 1844, pp. 341, 342.)

Chamærops Martiana is described at length in the pages immediately preceding the above, and is said to occur at Bunipa in the valley of Nepal, at about 5000 feet above the sea-level. As Mr. Griffith observes, the two palms are very closely allied: in my opinion they may still turn out to be identical. Among the supposed differences, that of "shorter stature" in *C. Khasyana* is quite unfounded: as I have already noticed, it occurs on Thakil mountain 50 feet high, whereas *C. Martiana* is only quoted at 20: the differences in the leaves may be accidental, for while Mr. Griffith states the laciniæ of *C. Martiana* to be "glaucous underneath," and omits any mention of it in the description of *C. Khasyana*, I found it equally true of the latter on the Gagur range. His description of the inflorescence and fruit is (note to page 340) chiefly from Martius in 'Pl. As. Rar.' iii. p. 5. t. 211, where, however, Mr. Griffith pronounces that "the representation of the inflorescence is probably quite wrong" (p. 341): and I suspect that the "yellowish," not "blue" fruit, may merely be due to the immature stage in which the former were observed; such at least is the case in others of this family: for instance, *Phœnix humilis*, before mentioned as common about Almorah, which exhibits various shades of yellow when unripe, but as it matures becomes of a dark blue. This plant Mr. Griffith was inclined to identify, very justly I believe, with *Phœnix acaulis*, from which to *Ph. sylvestris*, the common wild date tree of India, he observes (p. 352) that *Ph. dactylifera* and *farinifera* form complete transitions. I adopt Dr. Royle's specific name *humilis*, in preference to *acaulis*, as the shrub has frequently a stem several feet high, and may occasionally be observed in all gradations up to a tree of 50 feet. Young plants of the dwarf variety proper to Almorah are now flourishing at the Botanic Gardens, Edinburgh, and Glasnevin near Dublin.

XXXII.—*On the Genus* Pachybathron, *and on some new Species of* Marginella. By J. S. Gaskoin, Esq.

[With a Plate.]

Genus Pachybathron.

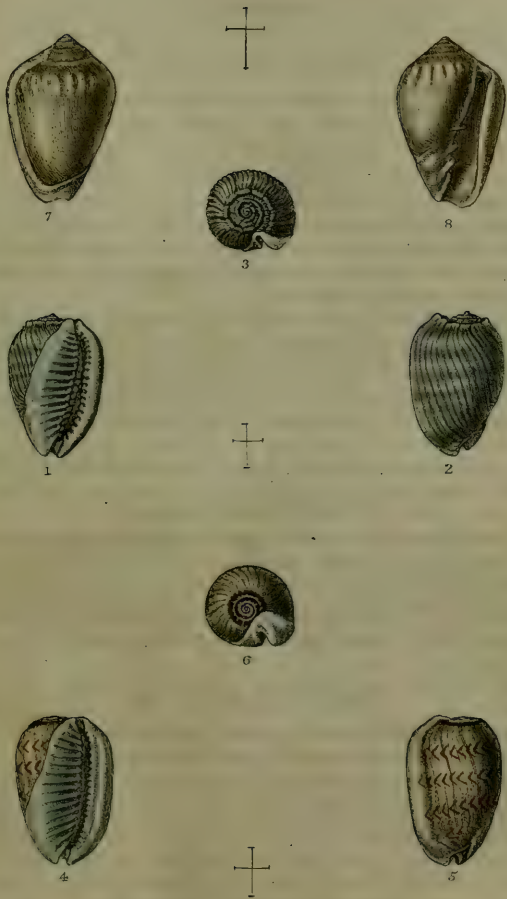
Testa subcylindrica, longitudinaliter striata, unicolor alba opaca, vel colore ornata; postice latior; varice lato, crasso, plano, ad marginem exteriorem abrupto, basin totam columellæ, partemque anteriorem tertiam testæ lateris efformante, et latitudine decrescendo ad dorsum canalis desinente, munita; spira plana, plus minusve acuminata, anfractibus apparentibus; apertura angustiuscula, elongata, parum arcuata, posteriori non rostrata, denticulis fortibus remotis trans basin sulcumque columellarem extensis; labro crasso, denticulato.

Shell subcylindrical, longitudinally striated, opake-white or with colour; greater diameter posteriorly; a broad, thick and flat varix, abrupt at its outer edge, forms the entire base of the columella and the anterior third of the side of the shell, and diminishing in width terminates on the dorsum of the channel; spire flat, more or less acuminated, volutions perceptible; aperture rather narrow, slightly curved, posterior extremity continuous; strong, distant denticulations extend over the base and columellar groove; lip thick and denticulated.

No complaint can be made that the species forming this new genus have been separated from any other, as they are now for the first time described. This genus possesses characters of *Marginella*, of *Cassis*, and of *Cypræa*; but differs so essentially from each, that I cannot associate it with any one of them.

Pachybathron cassidiforme.

Testa subcylindrico-ovata, opaca alba, leviter trifasciata, dorso longitudinaliter rude striata; spira brevissima, subacuminata; anfractibus quatuor prominulis, irregulariter crenulatis, ultimi margine posteriori carinam nodulosam extus sulco profundo circumdatam ad finem exteriorem aperturæ desinente, apice subobtuso prominulo; basi subrotundata, lata, crassissima, ad marginem exteriorem abrupte terminata, et trans partem tertiam anteriorem testæ lateris ad extremitatem columellarem desinente; apertura angustiuscula, parum arcuata; labro crasso, margine interiori exiliter denticulato; margine columellari dentes 12–14 lineares remotos, basin transeuntes et ad marginem interiorem sulci columellaris desinentes exhibente; sulco columellari lato, Ann. & Mag. Nat. Hist. S. 2. Vol. 11. Pl. XII.



minime profundo; extremitatibus planis, prominentioribus, carinatis, posteriori non rostrato; canali profundo, breviusculo.

Long. $\frac{25}{100}$, lat. $\frac{15}{100}$ poll.

Hab. ad insulam Sancti Vincentii. Mus. Gaskoin.

Shell subcylindrico-ovate, opake-white colour, three continuous bands a few shades darker than the shell traverse the dorsum; dorsum coarsely striated longitudinally; spire rather depressed, subacuminated, volutions four, irregularly crenulated; the posterior edge of the last whorl forms a coronated ridge at the base, of which a deep depression surrounds the shell terminating at the outer part of the aperture; base rather round, broad and very thick, abrupt at its outer border, and extends over the anterior third of the side of the shell terminating on the columellar extremity; aperture rather narrow, slightly curved; outer lip thick and finely denticulated along the inner edge; columellar side, about twelve or fourteen distant linear teeth traverse the entire base and terminate on the inner margin of the columellar groove; columellar groove shallow; extremities flat (perpendicularly), rather prominent and keeled, posterior end of aperture not rostrated; channel deep and rather short.

Long $\frac{25}{100}$, wide $\frac{15}{100}$ of an inch.

Hab. Island of St. Vincent. Cab. Gaskoin.

PLATE XII. figs. 1, 2, 3, thrice nat. size.

Pachybathron marginelloideum.

Testa subcylindrica, alba opaca, fascia brunnea spiram pleramque circumdante, fasciis tribus (quatuor?) lineis fulvis sagittæformibus interruptis cincta; dorso longitudinaliter leviter striato, sulcis remotis profundioribus parallelis excavatis impresso; spira plana, depressa (juniorum apice prominulo, obtuso), anfractibus 3–4, plus minusve crenulatis; basi rotundiuscula, lata, crassissima, ad marginem exteriorem abrupte latitudine decrescente et ad dorsum canalis desinente; apertura angustiuscula, parum arcuata, postice non rostrata; labro crasso, per totum marginem interiorem denticulato, latere columellari denticulis 12–13 fortibus remotiusculis linearibus a margine per basin usque ad marginem interiorem sulci columellaris extensis munito; sulco columellari lato, minime profundo; extremitatibus obtusis, crassis; canali brevi.

Long. $\frac{28}{100}$, lat. $\frac{16}{100}$ poll.

Hab. in India Occidentali. Mus. Gaskoin.

Shell subcylindrical, opake-white colour, a brown marking encircles the spire, and three (four?) reddish brown interrupted arrow-shaped bands traverse the shell; dorsum finely striated longitudinally, impressed with rather deep and distant parallel furrows; spire flat, depressed (in young individuals apex slightly prominent and obtuse), volutions 3–4, more or less crenulated; base rather round, broad and very thick, abrupt at its outer edge, covering the anterior third of the side of the shell, and diminishing in width terminates on the dorsum of the channel; aperture rather narrow, slightly curved, not rostrated posteriorly; lip thick, denticulated on its inner edge the entire length; columellar side has 12–13 strong, rather distant, linear denticulations extending from the outer margin of, and over the base, to the inner edge of the columellar groove; columellar groove broad and shallow; extremities obtuse and thick; channel short.

Long $\frac{28}{100}$, wide $\frac{16}{100}$ of an inch.

Hab. West Indies. Cab. Gaskoin.

Plate XII. figs. 4, 5, 6, thrice nat. size.

Marginella albina.

Testa oblongo-ovata, coniformis, opaca albicans; plerumque plus minusve postice coronata nonnunquam fortiter seu lævissime; spira brevi, subobtusa, anfractibus quatuor; apertura latiuscula, recta; labio externo crasso, lævi, edentulo; margine externo albo, prominente; labio interno lævi, antice dentibus quatuor prominentibus, postico tenui, distincto, ad aperturam subrectangulo; canali nullo.

Long. $\frac{36}{100}$, lat. $\frac{26}{100}$ poll.

Hab. in Australia. Mus. Gaskoin, Brit. Mus.

Shell oblong-ovate, somewhat coniform, opake-whitish colour, or of a light orange tint, the shoulder generally more or less coronated, often strongly; spire short, rather obtuse, volutions four; aperture moderately wide and straight; outer lip thick, smooth, edentulous; external margin white, strong and prominent, continuing on the edge of the dorsum forms the anterior plait; inner lip smooth, on the anterior portion four projecting teeth, the posterior thin and isolated, standing nearly at right angles with the aperture, the others white and parallel with the termination of the margin; channel none.

Long $\frac{36}{100}$, wide $\frac{26}{100}$ of an inch.

Hab. N.W. Australia. Cab. Gaskoin, Brit. Mus.

Plate XII. figs. 7, 8, twice and half larger than nat. size.

Marginella Albanyana.

Testa subcylindrica, tenui, lævi, nitida, pallidissime fulva, anfractu ultimo subtilissime striato; basi rotundata; apertura rectiuscula, angustiuscula, antice subexpansa; columella in medio subventricosa, antice rapide attenuata, subfornicata, oblique quadriplicata; labio in medio incurvato; margine lato, plano, crassiusculo, super spiram ad plicas columellari extenso; spira obliterata (juniorum subacuminata, prominula), anfractibus 4–5; canali nullo.

Long. $\frac{36}{100}$, lat. $\frac{18}{100}$ poll.

Hab. Albania, in Africa Orientali. Mus. Gaskoin.

Shell subcylindrical, smooth, shining, thin, semipellucid, very pale brown colour, very finely striated longitudinally; base round; aperture rather straight and narrow, wider anteriorly; columella in the middle portion subventricose, anteriorly attenuated and arched, having four oblique plaits; lips at the middle part incurvated; margin broad, even, rather thick, covering the spire and extending to the columellar extremity; spire obliterate (in young specimens rather acuminated, slightly produced), volutions 4–5; channel none.

Long $\frac{36}{100}$, wide $\frac{18}{100}$ of an inch.

Hab. Albany, east coast of Africa. Cab. Gaskoin.

In colour and general form this species is nearest allied to *Marg. pallida,* Lam., differing in its more cylindrical form, in being marginated, the obliteration of the spire, &c.

Marginella rufula.

Testa minima, oblongo-ovata, rufula, lævi, nitida, crassiuscula; fasciis quatuor rufis interruptis, antica tertiaque supra labrum saturatioribus, postica ab apertura infra suturam anfractuum ad apicem ornata; lineis albicantibus 7–8 dimidio antico columellæ arcuatis, circulatim accrescentibus, supra dorsum expansis, unde, ad suturam, aut super anfractus, longitudinaliter continuis; spira conica (apice subobtuso), $\frac{1}{3}$ testæ æquante, anfractibus 5–6, rotundatis; apertura antice subexpansa, postice acuti-angulata, intus pallide rufescente; columella rectiuscula, plicis quatuor subdistantibus, duabus anticis obliquis prominentioribus; labro crasso, parum arcuato, intus denticulato; margine lato, crassiusculo, antice supra dorsum ad extremitatem columellarem desinente. Columella, parte antica dorsi, plicis, margine, labroque, albicantibus concoloribus.

Long. $\frac{20}{100}$, lat. $\frac{10}{100}$ poll.

Hab. —— ? Mus. Gaskoin, specimen unicum.

Shell very small, subovate, rather thick, of a light red colour, smooth, shining; four reddish interrupted bands, the anterior and the third strongly coloured on the lip, the posterior extends from the end of the aperture, below the suture, on to the apex; seven or eight whitish lines curve from the anterior half of the columella, each in anterior succession expanding in curvature, and extending further over the back of the shell, and thence continue, longitudinally, some to the suture, others over the volutions of the spire; spire conical, subobtuse, $\frac{1}{3}$rd the length of the shell, volutions 5–6, rather round; aperture broadish anteriorly, angulated posteriorly; within, of a very pale-red colour; columella rather straight, four rather distant plaits, the two anterior oblique and the more prominent; lip thick, slightly curved, denticulated within; margin broad and rather thick, extending over the anterior portion of the columellar extremity. The columella, anterior part of the dorsum, the plaits, margin and lip, all of the same whitish colour.

Long $\frac{20}{100}$, wide $\frac{10}{100}$ of an inch.

Hab. ——? Brought by Belcher. Cab. Gaskoin, unique.

XXXIII.—*Remarks upon British Plants.*

By Charles C. Babington, M.A., F.R.S., F.L.S. &c.*

[Continued from p. 273.]

3. Hypericum Androsæmum.

In the recently received Fasciculus (vol. viii. fasc. 3) of Bertoloni's valuable 'Flora Italica,' it is stated that the *Hypericum Androsæmum* of Smith and other British botanists is not the plant so called by Linnæus. Bertoloni does not say that he has received the *H. anglicum* (Bert.) from Britain, but probably we ought to believe him to have done so. An examination of the materials within my reach has led me to a different conclusion from that arrived at by Bertoloni. I find that all the British specimens called *H. Androsæmum* that I possess belong to the true plant of Linnæus. I also believe that Bertoloni has rather too hastily quoted Curtis (Fl. Lond. i. t. 164) as giving a figure of his *H. anglicum*, for that plate well represents *H. Androsæmum*. Sowerby's plate (Eng. Bot. t. 1225) does indeed appear to be derived from some other species. Unfortunately Smith does not tell us, in his text to that plate, from whence the specimen there figured was obtained; but refers especially to Norfolk (N. Walsham, Wood Dalling, Costesy) for localities for his *H. Androsæmum*; stating that in that county it is most frequent.

Bertoloni also quotes the *Androsæmum grandifolium* of Reichenbach (Icon. Fl. Germ. vi. 70. t. 352) as belonging to *H. anglicum*. That figure is very incomplete, and seems not to represent the winged pedicels or acute leaves of *H. anglicum*, but may perhaps be intended for it. Reichenbach states that his plant

* Read before the Botanical Society of Edinburgh, March 10, 1853.

came from Switzerland, and adds, "Etiam planta anglica 'Isle of Arran, Buteshire,' huc pertinet." The *H. grandifolium* (Chois.) is an Azorean plant which I possess from Madeira.

Under these circumstances it becomes desirable to ascertain what plant is called *H. Androsæmum* in different parts of Britain: my specimens, correctly so named, are from Caernarvon, Tenby, Dunstafnage in Argyleshire, and Burrishoole in the county of Mayo. Dr. Balfour possesses it from Isles of Arran and Bute in Scotland.

In the month of August 1852, Dr. Balfour gathered at Glanmire near Cork, a large plant which is manifestly distinct from *H. Androsæmum*, and probably may be the *H. anglicum*. It is far more nearly allied to *H. hircinum* than to *H. Androsæmum*, from which latter species its winged pedicels, much larger flowers, much narrower and more pointed sepals which do not enlarge with the ripening capsule, relatively much longer petals, which are more than double the length of the calyx, styles equalling the stamens, or even exceeding them, and pointed oblong capsules, clearly distinguish it.

From *H. hircinum* it is separated by its flower-buds being considerably broader in proportion to their length, the petals clawed rather than narrowed to their base, the leaves broadly cordate-ovate-acuminate and pellucidly veined but only slightly pellucidly punctured. In *H. hircinum* they are (even when slightly cordate at the base, as is sometimes the case) almost exactly ovate-oblong and much both pellucidly punctured and veined. These differences are slight, and it is therefore quite possible that the plant found in Ireland may prove to be a state of *H. hircinum*. The habit of the plants is (I believe) so different that I am rather inclined to look upon them as distinct.

H. grandifolium (Chois.) has terete branches and peduncles, blunt leaves which are very much pellucidly punctured, narrow petals, and an ovate-conical capsule, *i. e.* apparently only slightly narrowed at its base. As Bertoloni justly remarks, the figure given by Choisy (Prod. d'une Monog. de la Famille des Hypericinées, t. 3) clearly shows that it is not the same as our plant, and this is confirmed by my specimen from Madeira.

Bertoloni appears to consider his *H. anglicum* as very much more closely allied to *H. Androsæmum* than is the case with the Irish plant, to which I provisionally apply the name of *H. anglicum*, and it is thus possible that he may have had something else in view when he conferred that name upon the plant before him; nevertheless his quotation of Reichenbach's plate is in favour of his plant being the same as ours.

H. Androsæmum and *H. anglicum* may perhaps be characterized as follows:—

1. *H. Androsæmum* (Linn.); stem shrubby compressed, leaves broadly subcordate-ovate blunt, cymes few-flowered, sepals broad unequal, *styles falling much short of the stamens, capsules* pulpy *blunt*.

H. Androsæmum, *Linn. Sp. Pl.* 1102, et *Auct.*

This plant is usually only slightly branched in its upper part. There is but little trace of a wing upon its stem or even upon its pedicels. The sepals and petals are of about equal length, and the former are afterwards much enlarged, so as greatly to exceed the very blunt globose capsule.

2. *H. anglicum* (Bert.?); stem shrubby 2-edged much branched, pedicels 2-winged, *leaves broadly cordate-ovate*-acuminate, cymes few-flowered, sepals ovate-lanceolate unequal, *styles equalling or exceeding the stamens, capsules oblong acute*.

H. anglicum, *Bert. Fl. Ital.* viii. 310?
H. Androsæmum, *Eng. Bot.* t. 1225.

Stem terete with two slight wings, erect, much and repeatedly branched, 3–4 feet high, reddish; branches opposite, terete below, 2-winged above. Leaves alternately opposite, large, sessile, broadly cordate-ovate-acuminate, acute, entire, with many fine pellucid net-veins, in the centre of each mesh of which near to the edge of the leaf there is a pellucid puncture, these punctures becoming more and more rare as the midrib is approached, green on both sides; ribs prominent and reddish beneath. Cymes terminating the stem and branches, small, once or twice triradiate, having sometimes below them one or two simple axillary solitary peduncles. Peduncles and pedicels 2-winged, jointed at some distance below the flower, thickened above the joining, at which there are two small deciduous bracts. Sepals unequal, ovate-lanceolate, acute, reflexed, not enlarged on the fruit, deciduous (?), with a few pellucid punctures, the larger ones 3 lines long and 1 line broad. Petals yellow, reddish externally, about three times the length of the sepals (I cannot satisfactorily determine the exact proportion in the dry specimens before me), broad, rounded at the end, shortly clawed, many-veined. Filaments exceeding the corolla. Styles about equalling the stamens. Capsules oblong, narrowed at both ends, with a long point formed of the persistent base of the styles. Mature capsules I have not seen.

Flowering in August. "In great quantity, apparently wild, on the banks of the Glanmire river near Cork." Dr. Balfour.

My friend Mr. J. Ball gave to me an imperfect specimen of an *Hypericum* gathered by him in the county of Dublin in 1837, which may prove to be *H. anglicum*, for it more resembles that plant than either of the allied species. I have a slight suspicion that Mr. Ball's plant did not grow in such a spot as to be satisfactorily considered as indigenous. Dr. Balfour informs me that he gathered the plant called *H. anglicum* in this paper at Culross in Scotland in July 1833, also that he has a specimen from the county of Galway "very like it."

It may be well to add the specific character of *H. hircinum* as follows :—

H. hircinum (Linn.); stem shrubby 2-edged much branched, pedicels 2-winged, *leaves ovate-oblong,* cymes few-flowered, sepals lanceolate unequal, styles equalling or exceeding the stamens, capsules oblong acute.

H. hircinum, *Linn. Sp. Pl.* 1103 et *Auct.*

4. Agrimonia odorata.

Until recently the only authority for the introduction of *Agrimonia odorata* into British botany was a single specimen gathered in 1842 in the island of Jersey by the Rev. W. W. Newbould. On the 9th of September 1852 I had the pleasure, in company with that gentleman, of finding it growing rather abundantly amongst bushes on the rocky shore of Lough Neagh in the county of Antrim, and within a few hundred yards of Shane's Castle. There it was intermixed with *A. Eupatoria,* and they conspicuously differed. They were out of flower at that season.

I learn from a letter addressed by Mr. Borrer to Mr. Newbould that Mr. Joseph Woods found *A. odorata* in the autumn of 1852 near to the Start Point in Devonshire, and near Gwithian in Cornwall.

A. odorata may be characterized as follows :—

A. odorata (Mill.); leaves interruptedly pinnate coarsely serrate hairy and with many minute glands beneath, calyx-tube of the *fruit bellshaped not furrowed,* exterior spines of the fruit declining.

A. odorata, *Mill. Dict.* n. 3; *Koch, Syn.* 245; *Mert. et Koch, Deutschl. Fl.* iii. 376; *DeCand. Prod.* ii. 587?; *C. A. Mey.* "*Bull. St. Pet.* x. 344," and *Ann. Sc. Nat.* ser. 2. xviii. 375; *Guss. Syn.* i. 527; *Ledeb. Fl. Ross.* ii. 31.

A. procera, *Wallr. in Linnæa,* xiv. 573.

This plant closely resembles *A. Eupatoria* in most of its characters, but is manifestly distinct when the fruit is observed. The bellshaped form of that part in the present species is very different from the obconic fruit of its ally. In this the outer rows of the spines of the calyx are directed downwards, and the inner rows exceed the limb of the calyx; the whole plant also is considerably larger than *A. Eupatoria,* which has its outer spines patent, but not having a downward tendency (although sometimes the act of pressing them for the herbarium pushes them in that direction), and its inner ones scarcely equal the limb of the corolla in length. The fruit of *A. Eupatoria* is deeply furrowed almost to its base, and becomes more manifestly so as it ripens; that of *A. odorata*, which has short shallow furrows on its upper half when young, usually altogether loses them as it advances to maturity. MM. Cosson and Germain (Fl. de Paris, 182) attempt to account for the difference of form, &c. of the fruit by attributing the presence of two achenes to the *A. odorata*, and of only one to *A. Eupatoria*. Undoubtedly such is generally the case, but I have found that the latter is often furnished with two achenes, and yet its fruit retains the usual form and sculpture.

A. odorata is usually larger in all its parts than its ally; its leaves are much more thickly covered with hairs, and have very many minute glands on their under side. These glands are the organs from which the rather agreeable scent proceeds which has caused the specific name.

The description of *A. odorata* in DeCandolle's 'Prodromus' (ii. 587) contains the words "foveolis obovatis usque ad basin productis, setis adscendentibus brevibus." In neither of these respects does it agree with the plant of more recent authors, except G. Don (Syst. of Gard. and Bot. ii. 563), who has translated that definition.

5. Matricaria maritima.

Much doubt has long attended the *Matricaria maritima*; and numerous attempts have been made to discover distinctive characters between it and *M. inodora*; but experience has uniformly shown that those pointed out were too inconstant to be of any value. Nevertheless most authors have retained them as species, and although, as will be seen below, I am persuaded that many of the plants called *M. maritima* are referable to a maritime state of *M. inodora*, still I am not as yet prepared to give up the original Dillenian species upon which the Linnæan plant is founded, but do not pretend to have succeeded any better than others in providing a specific character for it.

The *M. maritima* appears under that name in 'Linn. Sp. Pl.' (ed. 1. p. 891), where the *Chamæmelum maritimum perenne humilius, foliis brevibus crassis, obscure virentibus* of Dillenius (Raii Syn. ed. 3. 186. t. vii. f. 1) is quoted as its source. In that place Dillenius has given a description of it, to which, as the Synopsis is a common book, this reference will be sufficient. Linnæus also quotes his own 'Iter Westgothicum' (p. 148), where he had described the plant. That work is not of easy access, but a copy of this description will be found in Richter's useful 'Codex Botan. Linnæanus' (n. 6437). Linnæus there expresses his belief that if its radiant florets had not been toothed, it would have agreed with the plant of Ray's 'Synopsis,' and as that is now decided to be a character of very little value, we may consider his opinion as favourable to the identity of the plants. It is remarkable, that in the 'Sp. Pl.' ed. 3. he has *Chrysanthemum inodorum* (the *M. inodora* of Fl. Suec. ed. 2), and places under it "β. *Chamæmelum maritimum*, It. w. goth. 148," but also describes *M. maritima* as the plant of Ray's 'Synopsis,' and again makes the same reference to the 'Iter west-gothicum.' As these references necessarily belong to the same plant, it is manifest that an error has occurred which has naturally caused much of the doubt expressed by succeeding botanists; those who only knew the maritime form of *M. inodora* thinking that the reference was correctly placed under *C. inodorum*, and consequently *M. maritima* was an accidental repetition. As very few botanists appear to have been acquainted with the Dillenian plant, or that found at Billingen in Sweden by Linnæus, it has happened that the true *M. maritima* has nearly disappeared from books. Even those modern authors who separate the *M. maritima* from the *M. inodora* have usually described the maritime form of the latter under the former name. To Fries the credit is due of first, in modern times, directing attention to this fact, and making us acquainted with the true *M. maritima*. His valuable remarks upon the plants will be found in his 'Mantissa tertia' (pp. 115–117) and 'Summa Veg. Scand.' (p. 186). In the latter work he observes, that M. Gay of Paris thinks that two species are included under the name of *M. maritima* in Sweden. If, as is most probable, the two plants are the *M. inodora* β. *salina* and the true *M. maritima*, there seems no difficulty in acceding to M. Gay's views, although not allowing that the former of these plants is separable specifically from *M. inodora*. It is proper to remark, that Wallroth appears to have known that the *Matricaria* of saline districts was not necessarily the maritime plant of Dillenius, for in his 'Schedulæ Criticæ' (p. 485) he points out differences between his *Pyrethrum inodorum* β. *salinum* and the *P. maritimum* of Smith.

The following are as good specific characters as I have succeeded in drawing up for the plants. Taken as a whole I think that they may be so distinguished, but it is to be feared that no one part alone can be implicitly depended upon :—

1. *M. inodora* (Linn.); st. erect, leaves sessile pinnate, leaflets with many usually alternate capillary pointed segments, basal leaflets crowded clasping the stem not separated from the others, heads

solitary, phyllaries lanceolate blunt with a fuscous scarious torn margin, fruit with two glandular spots just below the elevated border.

M. inodora, *Linn. Fl. Suec.* ed. 2. 297; *DeCand. Prod.* vi. 52; *Fries, Mant.* iii. 115; *Hook. and Arn. Brit. Fl.* 242; *Gren. et Godr. Fl. Fr.* ii. 149; *Lloyd. Fl. Loir.-inf.* 139.
Chrysanthemum inodorum, *Linn. Sp. Pl.* ed. 3. 1253; *Koch, Syn.* ed. 2. 419.
Pyrethrum inodorum, *Sm. Fl. Brit.* ii. 900, and *Eng. Fl.* iii. 452; *Eng. Bot.* t. 676.
Tripleurospermum inodorum, *C. H. Schultz* ex *Koch Syn.* ed. 2. 1026; *Walp. Rep.* vi. 196.
Chamæmelum inodorum annuum humilius, foliis obscure virentibus, *Dill. in Raii Syn.* ed. 3. 186.

Stem smooth, angular, 12 to 18 inches high; the branches spreading. Rachis of the leaf enlarged at the base and furnished with many closely-placed leaflets which clasp the stem, and, as Wallroth justly remarks, resemble a comb; the next leaflets generally small and short, simple or simply forked; succeeding leaflets becoming gradually longer and more compound; all placed on the rachis at pretty regular intervals, except the closely-placed *basal ones, which are not separated from the lowest of the others by any markedly greater interval than those others are from each other.* Involucre flat. Phyllaries with the scarious border broadly fuscous. Radiant florets linear-oblong, blunt, 3-toothed at the end, white. Disk yellow. Receptacle (when the florets are all expanded) often twice as long as broad. Fruit with three prominent smooth ribs; having two internal and narrow, and one external and broad, rough spaces between the ribs; the glandular spots round.

β. *salina*; stem more diffuse often nearly prostrate, leaflets short fleshy, involucre umbilicate, disk broader, fruit with only the one external rough space and oblong glandular spots.

M. maritima, *Linn. Herb.*!; *Gren. et Godr. Fl. Fr.* ii. 149 (exc. Syn.).
Pyrethrum inodorum β. salinum, *Wallr. Sched. Crit.* 485.
Pyrethrum maritimum, *Sm. Fl. Br.* ii. 901, and *Eng. Fl.* iii. 452; *Eng. Bot.* t. 979; *Wilson in Hook. Journ. of Bot.* i. 271.
Tripleurospermum maritimum, *Koch, Syn.* ed. 2. 1026?

This plant is often very spreading and very fleshy. Its central upright or ascending stem does not bear nearly so large a proportion to the spreading and usually prostrate branches as is the case in typical *M. inodora*. In that the branches are usually very short absolutely, or at all events relatively to the upright central stem, and usually, if not always, ascend; in the variety *salina* the branches are frequently so much developed as to greatly exceed in length the primary stem, which is thereby weighed down and rendered distinguishable by careful observation alone. From inhabiting the sea-shore it has usually been called *P. maritimum*, but seems to differ materially from the plant of Dillenius to which that name was intended to apply. The receptacle is scarcely twice as long as broad, but is not constant in shape. Segments of the leaves furrowed beneath and opposite or alternate. Rachis of the leaves with a broad furrow enclosing a keel beneath.

Smith's *P. maritimum* is placed under this variety on account of his description and the figure in 'English Botany' agreeing far better with it than with the *M. maritima*. He intended to include the Dillenian plant, but appears to have been scarcely, if at all, acquainted with it. In Hooker's 'Journal of Botany' (*l. c.*) the accurate Mr. W. Wilson remarks, "Stem certainly not hollow. Segments of the leaves not wholly destitute of points. Seeds [fruits] of the ligulate florets with a deeply 4-lobed cup-shaped crown, below which, externally, are two yellow oblong bodies extending halfway down the seed, which is not in that part furrowed, though it is deeply so on the other side. Segments of the tubular florets keeled at the back, the line very prominent just below the apex of the segment. I consider it a mere variety commonly found on the sea-shore." An authentic specimen from him is the *M. inodora β. salina*.

M. inodora grows on cultivated land and waste ground. *β.* is found by the sea.

2. *M. maritima* (Linn.); stem diffuse, leaves pinnate, leaflets and segments opposite fleshy linear bluntish short, basal leaflets few small separated from the others, heads solitary, phyllaries oblong blunt with a scarious (pale) entire margin, fruit with two elongated glandular spots just below the elevated lobed border.

M. maritima, *Linn. Sp. Pl.* ed. 1. 891, ed. 3. 1256; *Fries, Mant.* iii. 115, et *Summa*, 186, et *Herb. Normale*, xii. 2!

Chamæmelum maritimum perenne humilius, foliis brevibus crassis, obscure virentibus, *Dill. in Raii Syn.* ed. 3. 186. t. 7. f. 1; *Linn. Iter. w. goth.* 148.

Stems much more branched near to the base, often prostrate, much shorter than those of *M. inodora*. Rachis of the leaves only slightly enlarged at the base, and furnished there with very few and short leaflets; these are followed by a long naked space, after which the rest of the leaflets are placed at pretty regular intervals and are nearly equal in size. The involucre appears to be flat. Phyllaries with their scarious border pale or narrowly fringed with pale purple. Radiant florets oblong, shorter in proportion than those of *M. inodora,* notwithstanding the heads being usually smaller, rounded and entire, or faintly 3-crenate at the end, white. Disk yellow. Receptacle hemispherical. Fruit with three prominent smooth ribs; an intermediate rough space externally, but no internal spaces (the whole internal surface being occupied by the smooth ribs); less compressed at the border, and more square than that of *M. inodora.*

I had the pleasure of having this plant shown to me by my friend Mr. Borrer growing at the place, Cockbush near West Wittering, on the coast of Sussex, where Dillenius found it; and am indebted to him for pointing out to me the probability of its being distinct from the *Pyrethrum maritimum* of Smith. I am also much indebted to the celebrated Fries for a specimen of the authentic *M. maritima* of Linnæus. These two plants agree very well, although it may be doubted if the Swedish plant is not more upright than that of England. Fries lays much stress upon the "ligulis nervoso-striatulis" of his *M. maritima,* a character which is well shown in his specimens. I do not find that the *M. maritima* of Sussex is so characterized. I possess a specimen, gathered in the island of Lewis, one of the Hebrides, which has its rays marked in that manner, but it is certainly not the *M. maritima* of Fries, and does not appear to be distinguishable from *M. inodora β. salina,* with which it agrees in having large flowers with long rays, umbilicate involucres, fuscous-edged (but usually entire) phyllaries, and similar leaves.

I have not seen any specimens of the true *M. maritima* from any British locality except West Wittering.

I may be allowed to express a hope that these remarks will direct the attention of botanists to the maritime *Matricariæ,* and thereby determine the points that remain doubtful, the value of their claims to distinction, and also their true distribution in Britain.

[To be continued.]

XXXIV.—*On the Genera of the Tribe* Duboisieæ. By John Miers, Esq., F.R.S., F.L.S.

Anthocercis.

This genus of Labillardière was first arranged together with *Duboisia* in a separate division of *Solanaceæ* by Mr. Brown (Prodr. 448). Mr. Bentham, first in Lindley's 'Introd.' p. 292, and subsequently in the 'Prodromus' of DeCandolle, x. 191, placed it among *Scrophulariaceæ,* in his tribe *Salpiglossideæ.* About four years ago (*huj. op.* iii. 170), I offered several remarks, with the intent of showing that it possessed many peculiar features not before observed, quite distinct from *Salpiglossis* and its allied genera, for which reason I suggested its association with *Duboisia* and *Anthotroche*, in a separate tribe (*Duboisieæ*), forming a section of an extensive group, distinct as well from true *Solanaceæ* as from *Scrophulariaceæ*, and which group I proposed as an intermediate family (*Atropaceæ*) between the large natural orders just mentioned. The reason of its being placed in *Scrophulariaceæ* by Mr. Bentham was obviously on account of its didynamous stamens, notwithstanding the presence of a rudimentary fifth: at that time, however, the closely allied genus *Anthotroche*, with five regular fertile stamens, was not known. I have since shown that nearly half the genera heretofore placed in *Solanaceæ* present unequal stamens, with a strong tendency in many to assume a didynamous character; while, on the other hand, several unquestionable Scrophulariaceous genera have five regular and equal stamens. The obliquity of the corolla and irregular dimensions of its segments, and the unequal size of the stamens or partial suppression of the fifth, are therefore no longer found to offer unerring limits of demarcation between those families, and I have pointed out the existence of other characters that can be more safely relied upon for this purpose, viz. the æstivation of the corolla and structure of the seed: these, taken in conjunction with the usual ordinary distinctions, afford a more certain guide. Judged by these rules, *Anthocercis* will be seen not to belong to *Scrophulariaceæ*, and the position assigned to it above mentioned appears to me the most natural that can be suggested.

One very remarkable feature is the peculiar æstivation of its corolla, which I find to be a constant feature in every species: the somewhat unequal segments of its border are rolled inwards, with their margins overlapping one another respectively; in some the dextral, in others the sinistral edge remains uppermost, and the segments thus folded are drawn closely together into a long conical bud, with the apices somewhat imbricately interlaced: this very peculiar mode of æstivation will be best understood by reference to the diagrams I have given (*loc. cit.* p. 170).

It has always four fertile stamens arranged in pairs, of which one pair is longer than the other, with a shorter sterile filament or a mere rudiment of one, or else a vacant space in the interval between the longer stamens: the filaments originate near the base in the throat of the short constricted portion of the tube of the corolla, where they are most frequently ciliated and much geniculated at their origin, forming a fornix that conceals the ovary; they then assume a more erect position around the style, curving outward towards the summit, and are all slightly inclined, together with the style, towards one side of the more expanded portion of the tube.

I have frequently alluded to the fact of the extrorse position of the stamens among the *Duboisieæ,* where it occurs constantly. In *Duboisia, Anthotroche,* and another genus to be proposed, each anther consists of a single hippocrepiform cell; but in *Anthocercis,* although the anther is equally reniform and extrorse, it is formed of two divaricated curving cells, closely united at their apex; this bursts externally by two lines parallel with the margin. This extrorse position of the anthers appears to be otherwise quite unknown throughout the Solanal alliance, and would lead us to suspect that the *Duboisieæ* really belonged elsewhere, did not all the other characters unquestionably place them here. This anomaly is probably explained by a circumstance that in the course of this investigation fell under my observation: in *A. gracilis* I found a single flower with its corolla much distorted, where two of the stamens were hippocrepiform, 1-celled, and extrorse, as in *Anthotroche,* and the other two were bilocular, with parallel cells, and introrse. A hint may be obtained from this accidental deviation from the ordinary form of development, and we may reasonably infer from the circumstance, that the unilocular hippocrepiform anther of *Anthotroche,* seen also in many genera of the *Scrophulariaceæ* and *Myoporaceæ,* is not formed, as has been usually supposed, by the confluence of the two cells, but by the total abortion of one of the ordinary lobes, the other and more external one assuming a crescent form, by its unrestrained development around a large globular pollen receptacle. We see a very close approximation to this irregularity in *Browallia,* where one of the anther-cells is much smaller and often very minute, always sterile, and void of pollen, while the other is reniform as in *Anthotroche.* In *Brunsfelsia* there is an evident confluence of two cells in a reniform shape, but in *Franciscea* there is a total abortion of one of the cells, and its curvature in a crescent form, as in *Anthotroche.*

For reasons assigned in another place, I have excluded *A. albicans* and *scabrella,* and added two that are new, making in all six species belonging to this genus, which are all found on the S.W. coast of Australia, between Swan River and King George's Sound. From an examination of these species I have found it necessary to modify, in the following manner, the character of this genus.

Anthocercis, Labill. Nov. Holl. ii. 19; R. Br. Prodr. 448; Endl. Gen. no. 3902; Iconogr. tab. 68; Benth. in DC. Prodr. x. 191.—Char. emendat.—*Calyx* campanulatus, 5-costatus, 5-fidus, laciniis acutis, carnosis, costis continuis, tubum æquantibus vel excedentibus, persistens. *Corolla* campanulata, tubo basi coarctato, hinc subito ampliato, limbo sub-inæqualiter 5-fido, laciniis acutis, sæpissime lineari-subulatis, patentibus, æstivatione applicativa, nempe loborum marginibus alterne dextrorsim et sinistrorsim mutuo supervolutis, apicibus sub-imbricatim internexis. *Stamina* 4, didynama, cum quinto postico ananthero sæpe rudimentario rarius deficiente, inclusa; *filamenta* complanata, imo latiora, et ad coarctationem tubi geniculatim inserta, et sæpius ciliata, superne attenuata et glabra, ad apicem paullo reflexa: *antheræ* extrorsæ, reniformes, bilobæ, profunde cordatæ, 2-loculares, utrinque rima margine parallela extus dehiscentes. *Pollen* oblongum, longitudinaliter 3-sulcatum. *Stylus* erectus, inclusus. *Stigma* pulvinatum, emarginato-bilobum. *Ovarium* subglobosum, disco carnoso plus minusve adnato obsessum, 2-loculare; *ovula* plurima, adscendentia, placentis imo dissepimenti tenuis superne fissi utrinque adnatis affixa. *Capsula* oblonga, rostrata, septicido-2-valvis, valvis integris, subcoriaceis, dissepimento incrassato discisso, imo clausis, superne e marginibus introflexis apertis, hinc columna placentari libera sistente. *Semina* plurima oblonga, subincurva; *testa* crustacea, foveis amplis scrobiculata; *embryo* in axi *albuminis* carnosi copiosi tenuiter teres, fere rectus, *radicula* infera, cotyledonibus brevissimis obtusis ejusdem diametri 4-plo longiore, et *hilo* infra medium ventrali evitante.—Fruticuli *Australasiæ occidentalis glabri sæpe viscosi*; folia *integra vel pauci-dentata, subsessilia*: panicula *pseudo-terminalis, vel ab axillis novellis pauciflora,* floribus *pedicellatis, folio bracteiformi donatis*; pedunculo *sæpe medio 2-bracteato et hinc articulato*: corolla *ochroleuca vel albida, intus sæpissime purpureo-lineata.*

1. *Anthocercis viscosa,* R. Br. Prodr. p. 448; Benth. in DC. Prodr. x. 191; Bot. Mag. tab. 2961; Bot. Reg. tab. 1624.—A. littorea, *Endl.* (*non Labill.*) *Iconog.* tab. 68;—fruticosa, orgyalis, glabra, ramulis viscosis, foliis glabris, rotundato-obovatis (junioribus cuneato-oblongis, sub-puberulis), e medio cuneatis, imo in petiolum brevem decurrentibus, crassiusculis, serrulatis, utrinque impresso- et viscoso-punctatis; pedunculo (seu ramulo) axillari, 1–3-floro, apice 2-bracteato, pedicello paullo supra bracteas articulato, calycis lacinulis foliaceis lineari-acutis, corollæ ochroleucæ amplæ laciniis oblongo-acutis, reflexis, tubo lineis 25 viridibus striato æquilongis.—Swan River.—*v. s. in herb. plur.* (Drummond), *et v. v. in hort. Kew. cult.*

Mr. Bentham mentions a variety, *A. Baueriana,* taken from

Bauer's drawing in Endlicher's 'Iconographia' above quoted, but I can perceive no difference in it from the typical plant, where the leaves are always more or less serrulate, and the tube of the corolla often somewhat narrower, as in the drawing referred to. This species has larger leaves and flowers than any other belonging to the genus, and is well distinguished by the many viscous glands imbedded in hollows on the surface of the leaves. The leaves are $1\frac{3}{4}$ to 2 inches long, including the petiole, and $\frac{3}{4}$ to $1\frac{1}{4}$ inch broad. The inflorescence is probably an abortive raceme. In Bauer's figure the peduncle above the bracts bears three flowers; all the specimens I have seen are 1-flowered, but that may result from the abortion of the others; the peduncle is 6 to 9 lines long; the bracts 4 to 6 lines in length; the pedicel, 9 to 12 lines long, is articulated a little above the point of insertion of the bracts; the tube of the calyx is 5 lines, its segments 5 to 6 lines in length; the corolla $1\frac{1}{2}$ to 2 inches long, the border, when expanded, $2\frac{1}{2}$ inches in diameter; in æstivation the lobes are somewhat unequal in length, the upper lobe is a little shorter, the two lower lobes are a trifle the longest of all, and upon this side are placed the two longer stamens, which are nearly the length of the tube, with a short rudimentary filament between them; the stamens are quite glabrous; the anthers are 2-lobed, bursting extrorsely.

2. *Anthocercis littorea*, Labill. Nov. Holl. ii. 19. tab. 158; Benth. in DC. Prodr. x. 191; Bot. Reg. tab. 212; Sw. Fl. Aust. t. 17; Botanist, t. 102;—fruticosa, glaberrima, foliis cuneato-oblongis, integerrimis, vel nonnullis interdum spinoso-paucidentatis, sessilibus; inflorescentia e ramulis novellis pseudoracemosa, floribus axillaribus, subsolitariis, pedicellis basi bracteatis, corollæ laciniis lineari-acutissimis, tubo duplo longioribus, filamentis imo ciliatis, antheris 2-locularibus extrorsis. —Swan River et King George's Sound.—*v. s. in herb. Hook.* (Fraser).

This species is very distinct from the former, its perfectly glabrous leaves being narrower, more thick and fleshy than in the former species; they are $1\frac{1}{4}$ inch long, 4 to 6 lines broad. The young axillary branchlets are floriferous, producing fresh flowers as they become elongated, from 6 lines or an inch in length, until they bear the appearance when in fruit of a many-flowered raceme 3 to 4 inches long: the pedicel is slender, 2–3 lines in length, becoming thickened in fruit, and 6 lines long; the calyx, 3 lines in length (including the linear fleshy segments of 2 lines), is 5-keeled; the corolla is 8–9 lines in length, of a sulphur-yellow colour, smooth outside; the tube is 3 lines long, sparsely clothed inside with pulverulent glandular down, the segments of the border are very narrow and acute, 5–6 lines in length, expanded, each with a rounded intervening sinus: the capsule, somewhat rostrated, supported by the persistent calyx, is 4–7 lines long, and contains numerous oblong seeds; it is 2-valved, somewhat fleshy, the valves being thick and coriaceous, completely septicidal below, and introflexed on their margins above, the placentiferous column, which is adnate below, free above, and split at its apex, remaining in the central space; the seeds are small and deeply scrobiculate; the embryo as above described.

3. *Anthocercis ilicifolia*, Hook. Bot. Mag. sub t. 2961; ibid. tab. 4200; Benth. in DC. Prodr. x. 192;—glabra, ramulis fistulosis, virgatis, foliis inferioribus oblongis vel obovatis, angulato-dentatis, dentibus subspinosis, subsessilibus, utrinque glabris (vel sub lente papilloso-glandulosis), textura quam præcedentibus tenuiore: inflorescentia subterminalis, valde ramosa et elongata, floribus alternis, distantioribus, pedicello filiformi e bracteis 2 sessilibus orto, calyce parvo 5-carinato, dentibus linearibus carnosis acutis, corollæ sulphureæ tubo campanulato, subventricoso, 15-striato, laciniis lineari-lanceolatis æquilongo.—Swan River (Drummond).—*v. s. in herb. plurimis.*

This species has a more herbaceous and virgate habit than the two preceding, from which it is readily distinguished by its compressed fistulose branching stems and thinner spinulose leaves; its primary branchlets are 10 inches long, its secondary 4 to 6 inches, and its ternary aphyllous and floriferous ramifications are 1 to 3 inches long; the pedicels are alternate, solitary, filiform, 3 lines long, and spring out of two sessile minute bracts; the calyx is sharply 5-keeled, $1\frac{1}{2}$ line long, the keels being extended into as many sharp setiform teeth, longer than the tube; the tube of the corolla is 3 lines long, somewhat ventricose, with five narrow linear segments of about the same length; the stamens are quite glabrous, geniculated at their insertion in the contracted base of the tube, the longer pair being about two-thirds of its length; the anthers consist of two nearly parallel lobes slightly cordate at base, fixed extrorsely on the filaments, and bursting by two furrows externally; the hypogynous gland is quite adnate, somewhat flattened, and supporting the oblong ovary; the style is filiform, 2 lines long; the capsule is 5 lines long, formed like that of the preceding species.

4. *Anthocercis glabella*, n. sp.;—glaberrima, subviscosa, ramulosa, ramulis debilibus, pallide viridibus, angulosis; foliis

lineari-oblongis, obtusis, imo angustioribus, sessilibus, carnosulis, glandulis viscosis minutissimis punctulatis; racemulo brevissimo, axillari, bracteato, 2–3-floro; pedicello sub-brevi; calycis viscosi segmentis linearibus, acutissimis, tubo 5-costato 3plo longioribus et corollæ tubum æquantibus; corollæ limbi laciniis linearibus, intus papilloso-rugosis, tubo infundibuliformi 3plo longioribus; staminibus 2 longioribus faucem vix attingentibus, 5to deficiente; capsula oblonga, longe rostrata, calyce suffulta.—Swan River.—*v. s. in herb. Mus. Brit.* Freemantle (Gilbert).

A species near *A. littorea*, differing in its much more slender habit, sub-herbaceous deeply angled stems and branches, and smaller and more linear leaves; here the divisions of the calyx are longer, equalling the length of the tube of the corolla, which is less campanulate than in *A. littorea*; the segments of the border are also narrower and much longer, being three times (not twice) the length of the tube. The leaves are fleshy, veinless, and exhibit under the lens a number of minute shining viscous glands; they are from 10 to 18 lines long, $2\frac{1}{2}$ lines wide, and 1 line broad at the base; the pedicel measures 3 lines; the tube of the calyx, somewhat viscous and deeply costate, is $\frac{3}{4}$ line, and its teeth $1\frac{3}{4}$ line long; the tube of the corolla is $2\frac{1}{2}$ lines, its segments $7\frac{1}{2}$ lines long; the immature capsule measures 7 lines in length and 2 lines in breadth.

5. *Anthocercis gracilis*, Benth. DC. Prodr. x. 192;—glaberrima, ramosissima, ramulis teretibus, tenuiter virgatis, striatis, fistulosis; foliis inferioribus . . . . , mediis spathulato-elongatis, in petiolum tenuem angustatis, carnosis, superioribus anguste linearibus, bracteiformibus; floribus solitariis, axillaribus, pedicello filiformi, calyce parvo, 5-carinato, corollæ tubo purpureo, 15-lineato, subventricoso, fauce glanduloso-pulverulenta, laciniis anguste linearibus, tubo 2-plo longioribus, filamentis glabris, 2 longioribus tubo dimidio brevioribus; capsula ovata, 2-valvi, valvis dissepimento lunato septicidali imo clausis.—Swan River (Drummond).—*v. s. in herb. Hook. et aliis.*

This has a habit almost herbaceous, and still more virgate and slender than the preceding; the lower leaves are wanting in the specimens I have seen; the medial leaves are 7 lines long, 2 lines broad at the rounded apex, diminishing into a long slender petiole; those above are of the same length and only $\frac{1}{3}$rd of a line broad: the pedicel is 2 lines long, the calyx 2 lines, the tube of the corolla 2 lines, the linear segments of the border are 4 lines in length: the capsule is 3 lines long and $1\frac{1}{2}$ line in diameter.

6. *Anthocercis anisantha*, Endl. Stirp. Austr. Decad. p. 13; Benth. in DC. Prodr. x. 192;—viscoso-pubescens, ramis ramulisque spinescentibus; foliis in ramulorum axillis fasciculatis, oblongo-cuneatis, obtusis, integerrimis; calycis dentibus tubo æquilongis, lineari-lanceolatis; corollæ laciniis anguste linearibus, tribus brevioribus; capsula ovata.—In Australiæ austro-occidentalis interioribus.

The tube of the calyx is said to be 1 line long, and its teeth of equal length: the tube of the corolla 2 lines, and its two longer segments of the same length.

7. *Anthocercis genistoides*, n. sp.;—fruticosa, glaberrima, spinulosa, valde dichotomo- et intricato-ramulosa, ramulis gracilibus, flexuosis, virgatis, striatulis, alaribus spiniformibus, mucroneque pungente apiculatis; foliis parvulis, sessilibus, anguste linearibus, carnosulis, spinis multo brevioribus; floribus paucis, solitariis, axillaribus, pedicello breviusculo imo 2-bracteolato; calycis glabri parvi 5-costati dentibus setiformibus; corollæ luteæ laciniis lineari-acutis, tubo 15-striato paullo longioribus, staminibus 2 longioribus tubo tertio brevioribus, filamentis imo subciliatis, antheris rotundatis, cordatis, 2-locularibus, extrorsim dehiscentibus.—Australia austro-occidentalis (Drummond, 86).—*v. s. in herb. Hook.*

This is evidently closely allied to the preceding, but differs in its perfectly glabrous habit and solitary small linear fleshy leaves, which are 4 to 6 lines long, half a line broad: the flexuose virgate branchlets are 5 to 10 inches long, terete, striated, perfectly glabrous, with numerous slender striated floriferous spines from 4 to 10 lines long, which are terminated by a hard sharp osseous mucronate point 1 line in length: the pedicel is 2 lines long; the tube of the calyx 1 line, its teeth the same length; the tube of the corolla 2 lines, its lobes 4 lines*.

Cyphanthera.

I propose to separate from *Anthocercis* those species, conforming with some others that I find undescribed, which differ in being more or less covered with dense tomentum formed of brachiate hairs, in a calyx of different form, but principally in its unilocular anthers, resembling those of *Anthotroche* and *Duboisia*, where the cell is concentrically bent around a globular polliniferous receptacle, and extrorsely fixed upon the filament, which is always glabrous:

* Drawings and analytical details of this and of the five first species, will be given in Supplementary Plates, at the end of the 2nd vol. of 'Illustrations of South American Plants.'

its capsule is not long, rostrated, 2-valved and septicidal, as in *Anthocercis*, but oval, more or less 4-valved and septifragal, with a lunated free dissepiment; it is intermediate with *Anthocercis* and *Anthotroche*. The observations made upon *Anthotroche*, which for the most part apply to this genus, need not be repeated here. The species of *Anthocercis* are glabrous or viscous, and are all found on the western coast of the Australian continent; in this genus, on the contrary, the species are all more or less tomentose, and, with one exception, found on the eastern side, or in Van Diemen's Land. Its generic name, like that of *Anthotroche*, is derived from the peculiar form of the anther, κυφὸς, *incurvus*; ἀνθηρὸς, *anthera*, and its character may be thus defined:—

Cyphanthera, gen. nov.—*Calyx* poculiformis, submembranaceus, 5-dentatus, persistens. *Corolla* tubuloso-campanulata, imo coarctata, hinc ampliata, limbi laciniis 5, subæqualibus, oblongis, interdum lineari-angustatis, patentibus, æstivatione (ut in *Anthocercide*) applicativa. *Stamina* 4, inclusa, didynama, cum quinto postico inter 2 longiora rudimentario, vel deficiente; *filamenta* glabra, imo complanata, et in coarctationem tubi geniculatim inserta, superne magis attenuata, apice reflexa; *antheræ* extrorsæ, rotundato-reniformes, hippocrepicæ, 1-loculares, extus rima circulari margine parallela 2-valvatim hiantes, tunc peltatæ, receptaculo pollinis in medio globoso. *Ovarium* oblongum, basi induvio corollæ circumscissæ circumdatum, et disco sublibero sublobato obsessum, 2-loculare; *ovula* plurima adscendentia, placentis imo dissepimenti superne fissi utrinque adnatis affixa. *Stylus* filiformis, longitudine staminum. *Stigma* emarginato-pulvinatum. *Capsula* subglobosa, calyce vestita, septifrage 4-valvis, valvis subcoriaceis, dissepimento incrassato, libero, lunato, medio utrinque seminifero. *Semina* plurima, et *embryo* ut in *Anthocercide*. —Fruticuli *in Australasia orientali et Insula Diemen crescentes, pube brachiato tomentosi*; folia *integra, sessilia, plus minusve tomentosa*; inflorescentia *breviter pseudo-racemosa, pedicelli e glandis stipitatis glabris cupuliformibus solitarii,* corolla *flava vel ochroleuca, lineis parallelis striata.*

1. *Cyphanthera frondosa*, n. sp.;—fruticosa, valde ramosa, ramis cortice rimoso in lineis interruptis elevato-striatis; foliis spathulato-oblongis, in petiolum brevissimum attenuatis, coriaceis, margine cartilagineo subrevolutis, supra glabris, subtus ferrugineis, subglabris, vel sub lente sparse glanduloso-pubescentibus, nervis breviter transversalibus (utrinque circiter 8) intra marginem arcuatim confluentibus; paniculis paucifloris,

terminalibus, axillaribusque, subtomentosis, bracteis linearibus, obtusis, membranaceis; calyce 5-dentato; corolla fere tubulosa, limbi laciniis acutiusculis, tubo duplo brevioribus; filamento rudimentario inter stamina longiora.—Sydney (in Hort. Bot. cult. et e Terra Diemen forsan introducta).—*v. s. in herb. Hewardi* (A. Cunningham).

This very distinct plant was placed by Cunningham as a species of *Myoporum*, and found in a bundle of specimens collected by him chiefly in the Botanic Garden at Sydney; from its resemblance to the following species, it has probably been introduced from Van Diemen's Land, or perhaps collected there by that botanist. The leaves are numerous, thick, coriaceous, of dull aspect, $1\frac{1}{2}$ inch long, including the petiole, upon the margins of which they are decurrent to the base, and 3 or 4 lines in breadth. The inflorescence is pseudo-paniculate, out of the approximated axils of the more recent branches, from the young crowded leaves of which proceed a number of aggregated short racemes of little more than half an inch long, all covered slightly with soft pubescence, and consisting of a number of linear bracts or leaflets, from the base of each of which a solitary pedicel arises; these, in fact, are probably only incipient branchlets, which, as in *Duboisia*, gradually lengthen into long seed-bearing ramifications: in this early state of development the flowers appear therefore crowded in the extremities of the younger growing branches; the bracts are linear, a line long; the pedicels are of equal length; the pubescent calyx, cupshaped and crowned with five short teeth, is $\frac{3}{4}$ line long; the somewhat tubular yellow corolla, marked with fifteen striated lines, is $2\frac{1}{4}$ lines long, including the oblong and somewhat acute segments of its border, which are one-fourth of its whole length, and slightly covered on both sides with short glandular hairs: the two longer stamens are $\frac{3}{4}$ the length of the tube, with a short rudimentary filament between them, and the shorter pair are about half the length of the others; the filaments are much dilated at base, smooth, and fixed a little above the base of the tube; the ovary is oblong, half immersed in the induvial base of the circumscissile corolla.

2. *Cyphanthera Tasmanica.* Anthocercis Tasmanica, *Hook. fil. MSS.*, n. sp.;—fruticosa, ramulis cinereo-tomentellis; foliis crebris, lanceolato-oblongis, apice obtusiusculis, e medio gradatim angustatis, imo linearibus et sessilibus, margine valde revolutis, sulcato-nervosis, supra stellato-scabridis, subtus pulverulento-tomentosis, pube cinerea aut flavescente; floribus pallide flavis, axillaribus, solitariis, e turionibus pseudo-paniculatis, pedicello imo bibracteato, calyceque cinereo-tomentosis, segmentis calycis corollæque linearibus; capsula glo-

bosa, 4-valvi, calyce vestita.—Van Diemen's Land.—*v. s. in herb. Hook. ex ora orientali* (Gunn, 1992).—Kelveden, Great Swanport (Backhouse).

This species has great analogy with the former, but bears a much lighter aspect. It is a shrub from 6 to 10 feet in height, the branches densely tomentose; the leaves, somewhat crowded, are 1 or $1\frac{1}{2}$ inch long, 5 or 6 lines in breadth, with the margins much reflexed, attenuated at base into a short petiole, stellately scabrous above and tomentose beneath: the inflorescence is of the same character as the last species, but the flowers are much larger and of a brighter yellow; the pedicel is $1\frac{1}{2}$ line long; the tube of the calyx is more campanulate, about 1 line in length, the segments being linear, acute, and of the same length as the tube; it is altogether tomentose inside as well as outside: the tube of the corolla is more infundibuliform, 3 lines long, and the segments of its border of the same length, linear-oblong and acute at the apex, the whole pubescent outside; the longer stamens are two-thirds, the shorter pair one half the length of the tube; the style equals the longer pair of stamens; the ovary is oblong, half a line long, seated in a free cupuliform disk; the capsule is nearly globular, about 2 lines in diameter, and 4-valved, two seeds only being perfected in each cell.

3. *Cyphanthera cuneata*, n. sp.;—fruticosa, ramis decurrenti-angulatis, nitidis, foliis spathulato-oblongis, obtusiusculis e medio sensim in petiolum brevissimum cuneatis, margine subrevolutis, pallidis, vetustioribus utrinque glabris, superne minutissime punctato-rugosis, subtus viscosis, nervis brevibus transversalibus intra marginem arcuatis, junioribus stellato-pubescentibus, vel pilis mollibus brachiatis tomentosis; floribus in ramulis novellis brevibus pseudo-paniculatis, pedicellis gracilibus, e cupula crassa singulatim ortis, articulatis; calyce 5-dentato glabro, corollæ omnino glabræ tubo campanulato infundibuliformi calyce 4-plo longiore, laciniis acutis patentibus tubo paullo brevioribus.—Novæ Hollandiæ Prov. Camden.—*v. s. in herb. Lindley.*

In this plant the leaves in their form and venation resemble those of *Duboisia myoporoides*, but they are much smaller and of thinner texture; they are $1\frac{3}{4}$ inch long, including the petiole of 3 lines, and are 4 lines broad; the young floriferous branchlets are barely half an inch long, the lower nodes are furnished with small leaflets, the upper nodes are bare; the pedicels, $1\frac{1}{2}$ line long, are solitary out of each node, which is always stipitate and cupular as in the preceding species and in *Duboisia*: the calyx, of thin texture, is half a line in length and breadth; the tube of the corolla is 3 lines long, the segments $1\frac{1}{2}$ line, all quite glabrous and yellow.

4. *Cyphanthera albicans.* Anthocercis albicans, *Cunn. in Field N.S. Wales, App.* 335; *Sw. Fl. Austr.* t. 16; *Benth. in DC. Prodr.* x. 192;—fruticosa, ramosissima, undique tomento brachiato cinereo vestita; foliis parvis, oblongis, margine subrevolutis, subsessilibus, patentibus, supra cinereo- subtus albido-tomentosis; floribus axillaribus et subterminalibus, pedicellis solitariis e cupula sessili ortis, calyce brevi poculiformi, carinato, glabro, rarius pubescente, dentibus late-lanceolatis acutis cum carinis continuis, corollæ ochroleucæ glabræ laciniis lanceolatis, tubum subcylindricum striatum subæquantibus.—Nova Hollandia, in mont. prope Bathurst.—*v. s. in herb. Hook.* (A. Cunningham), *et v. v. in hort. Kew. cult.*

This is much branched and densely crowded with small grayish tomentose leaves 3 to 5 lines long, $1\frac{1}{2}$ to 2 lines broad; the flowers proceed from the extremities of the very young branchlets, which are densely clothed with thick cottony tomentum, out of which issue four or five alternate projecting glabrous hollow cups, some of which are bare, but generally from each arises a solitary slender woolly pedicel 1 line long: the calyx is commonly glabrous, very rarely pubescent, a line long: the tube of the campanular corolla is 2 lines long, and its segments are about the same length.

5. *Cyphanthera tomentosa.* Anthocercis albicans, *var.* tomentosa, *Benth. in DC. Prodr.* x. 192;—fruticulosa, ramis virgatis, cano-tomentosis; foliis sessilibus, oblongis, margine revolutis, basi latioribus, refractis, supra cano-pruinosis, subtus cano-tomentosis; floribus paucis, in axillis solitariis, calycis campanulati ecostati dense tomentosi dentibus late ovatis, subacutis; corollæ ochroleucæ glabræ laciniis oblongis, acutis, tubum striatum subæquantibus.—Nova Hollandia in "Peele's range," flum. Macquarie.—*v. s. in herb. Hook. et Mus. Brit.* (A. Cunningham, no. 240).

Although closely related, this appears more than a mere variety of the former species, differing in its more slender and more virgate habit, the shape of its more refracted and more distant leaves, its much shorter and white tomentum, and the shape of its tomentose calyx. The leaves are much more diffuse, somewhat conduplicate, 5–7 lines long, 2 lines broad; the pedicel is 2 lines long, rather stout; the calycine cup is barely a line long and wide, with five broad triangular teeth of nearly equal length; the corolla is about the size of that of the former species.

6. *Cyphanthera scabrella*. Anthocercis scabrella, *Benth. in DC. Prodr.* x. 192;—fruticulosa, tota pube substellata scabrella, ramulis gracillimis, elongatis; foliis parvis, elliptico-oblongis, margine revolutis, breviter petiolatis; floribus ad apicem ramulorum novorum subsolitariis, pedicellis gracilibus calyce 2–3-plo longioribus, calycis glabri laciniis lanceolato-subulatis, sinubus latiusculis; corollæ parvæ laciniis linearibus, tubo subduplo longioribus.—In Novæ Hollandiæ montibus cæruleis.—*v. s. in herb. Hook.* (A. Cunningham).

This is a plant with still more slender branches than the last, with more glabrous and smaller leaves, and all sparsely covered with very short rigid ramose or branching hairs, making it almost scabrous: the leaves are about 4, rarely 5 lines long and 2 lines broad, upon a very short slender pubescent petiole: the flowers are few and almost solitary at the termination of the nascent branchlets, upon a capillary pedicel 3 lines in length; the calyx, including the narrow teeth, which are half its length, is 1 line long, it is membranaceous with rounded intervals between the teeth; the corolla is tubular, campanular above, marked with fifteen dark parallel lines, and the border is divided into five very long linear segments: the shorter pair of stamens are half the length, the longer pair two-thirds the length of the tube, with a fifth filament intermediate with the latter and half the length of the former, bearing at its apex a small glandular lobe: the ovary is seated on an adnate disk with its margin undulated, and the style is articulated at its base.

7. *Cyphanthera ovalifolia*, n. sp.;—fruticosa, ramis subpubescentibus, ramulis virgatis, dense griseo-tomentosis; foliis parvulis, ovalibus, patentibus, sessilibus, margine revolutis, crassis, supra fusco- subtus griseo- vel fulvo-tomentosis, pube brevissima rigida, intricato-brachiata; floribus brevissime subpaniculatis, 1–2–3-ve, axillaribus, pedicellis 1-floris, singulo e cupula stipitata orto; calycis utrinque hirsutuli brevis segmentis acutis, tubo æquilongis; corollæ laciniis oblongo-acutis, tubum campanulatum calyce duplo longiori 15-striatum subæquantibus; capsula parva, globosa, imo calyce induta.—Nova Hollandia, W. M'Arthur.—*v. s. in herb. Hook.* (Backhouse).

This species is very much of the same aspect as the three preceding, but is readily distinguished by its spreading, small, oval, sessile leaves, densely covered with thick tomentum; these are 3 to 4 lines long, $1\frac{1}{2}$ to $2\frac{1}{2}$ lines broad; the axillary raceme is very short, presenting the appearance of three or four alternate cupshaped nodes, out of each of which (or some of them are abortive) proceeds a slender pedicel 1 line long, bearing a calyx of equal length, which is pubescent within, as well as outside; the campanular corolla, of which the tube is $1\frac{1}{2}$ line long, has rather broad acute segments of the same length; the stamens are of the same proportional length as in the preceding species, with a very short sterile filament between the longer pair; the disk, adhering to the base of the ovary, has an undulating or lobed margin: the capsule is globular, nearly 2 lines in diameter, and half enclosed in the persistent calyx, has four thickly coriaceous valves, containing six seeds and a ligneous crescent-shaped dissepiment.

8. *Cyphanthera microphylla*, n. sp.;—fruticulosa, intricato-ramulosa, ramulis flexuosis vel dichotome brachiatis, striatulis, viridulis, glabris; foliis minutis, sessilibus, ovalibus, carnosulis, ramulisque junioribus viscoso-scabrellis; floribus solitariis, axillaribus, pedicello elongato, calyceque poculiformi breviter 5-dentato glanduloso-scabrellis; corollæ flavæ laciniis oblongis, obtusiusculis, tubo utrinque glabro sub-campanulato vix brevioribus, intus glanduloso-pubescentibus; staminibus tubo paullo brevioribus, fere æquilongis, puncto rudimentario inter longiora.—In Australiæ austro-occidentalis interioribus.—*v. s. in herb. Hook.* (Drummond, 177, anno 1849).

This species is extremely different in its habit from any of the former, approaching more in appearance to *Anthocercis genistoides*, but the structure of its flowers and of its capsule is completely that of *Cyphanthera*: the leaves are scarcely a line in length and half a line in breadth, so that the plant appears almost aphyllous: the pedicel is from 2 to 3 lines long, the calyx is 1 line long, the tube of the corolla is 2 lines, the lobes $1\frac{1}{2}$ line in length; the longer stamens are nearly the length of the tube, the other pair very little shorter, the anthers being all 1-lobed, roundly hippocrepiform and extrorse, and after dehiscence, of the shape of a peltate disk with a globular prominence in the centre; the disk that surrounds the base of the ovary is entire and free on the margin, and the ovary is surmounted by a prominent 4-grooved gland, into which the style is articulated, as occurs in some other species. The capsule is small, globular, about a line in diameter, its four valves being thin and testaceous, its free lunate dissepiment membranaceous, and it contains 4 to 6 seeds, which are almost the length of the valves*.

* A sketch of each plant and analytical details of the structure of each species of this genus, will be shown in supplementary plates, at the end of the 2nd vol. of 'Illustrations of South Amer. Plants.'

XXXV.—*On Marine Vivaria.* By William Thompson, Esq.

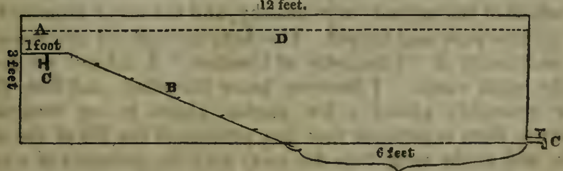
To the Editors of the Annals of Natural History.

Gentlemen, Weymouth, April 8, 1853.

Believing as I do that the suggestions of Mr. Warington, the experiments of Mr. Gosse, and the successful adaptation by Mr. Mitchell at the Gardens of the Zoological Society, of the principle of maintaining a balance between animal and vegetable life in confined sea-water, will cause Marine Vivaria to be generally introduced throughout the country; it has appeared to me that my contribution of notes thereon might possibly prove useful. Since the spring of 1850 I have unintentionally paid attention to the subject, as will appear. It has during the whole of that time been a custom of mine in my almost daily rambles along the sea-shore and very numerous dredging excursions to bring home any marine animals I may have met with, and place them in vessels filled with salt water in order to study their habits. I began by changing the salt water of the littoral species twice a day, leaving them without water for an hour or so each time; thus intending to represent the tides: this I could do as the sea is not fifty yards from my house, consequently sea-water is easily procured. It however struck me that the constant changing of the water was attended with what might turn out to be unnecessary trouble; I then tried changing it only once a week, many died in consequence, and those that survived (amongst which were *Carcinus mænas* and *Actinia mesembryanthemum*) were undoubtedly in a very sickly state. Some little time after, a storm threw on the beach a quantity of weeds attached to pieces of stone; amongst them *Delesseria sanguinea, D. ruscifolia, D. hypoglossum,* also *Rhodymenia laciniata, R. jubata,* and *R. ciliata* attracted my attention by the beauty of their fronds. I took them home and placed them in a vessel of salt-water which contained Crustacea, Echinodermata, Testacea, Zoophytes and other things the result of a day's dredging; I watched them daily in order to change the water as soon as I detected my prisoners becoming sickly, and (with the exception of one or two that died and which I removed) to my astonishment at the end of a month the whole of the animals were healthy, and the water remained in my opinion pure and limpid. This fact, through my ignorance of the rudiments of "Chemistry of Creation," I did not set down to the right cause. I however knew the effect, and from that time invariably placed a few marine plants in my vivarium, knowing from experience that they prolonged the life of the animals, and at the same time did away with the necessity of a constant change of water. It was my idea that the plants acted as a filter by withdrawing the impurities from the water and thus keeping it sweet, not knowing the fact to be that they consumed the carbonic acid gas, and gave off oxygen for the supply of the animals. Thus it was left to others to find out and account for what accident had thrown in my way, and to adopt that principle which my ignorance had prevented me from availing myself of. Having said thus much, I will proceed to give the results of my experience on the subject; first, as to prolonging the health and life of the captives; and secondly, as to a few of the species most easily kept in confinement. And first as to prolonging their life, no one will doubt that after supplying them with proper air, one of the main points to ensure success, is as far as artificial means will allow to assimilate their state of captivity to their state of freedom, and this has been my chief object in the experiments I have made. I began at first by changing the water every tide during the day, but only for the littoral species, such as *Trochus umbilicatus* and *cinerarius*, *Littorina*, *Rissoa* and *Purpura* amongst shells, and *Carcinus Porcellana* and *Athanas* amongst the Crustacea; this I found very troublesome, and I then thought the same end might be attained by placing weed-covered pieces of stone in the pans in such a way as that their apices might rise above the water, thus giving the animals power to suit themselves as to the depth of water; this I found succeeded well; I therefore only changed it once a day, and eventually every other day; I then extended it to a week, but unsuccessfully, until accident caused me to place some plants of *Delesseria* and *Rhodymenia* in the vessel as detailed in the former portion of this paper.

From my experiments, I suggest the following plan, in respect to the manufacture of Vivariums. Never having seen one it is possible some of my suggestions may already be in use. I should propose that the bottom be made of well-seasoned varnished wood, for the facility it affords of attaching battens to it, and that supposing the tank to be 12 feet long, the bottom should incline upwards, say at half the length, with a ledge of a foot wide at the top (I send a sketch, to elucidate my meaning,

A. The ledge. B. The incline. C. C. Taps. D. General level of water.



on a scale of 3 feet to an inch). When the tank is full there should be only about 6 inches water over the ledge; the inclined plane I would have represent the zones of the sea, the ledge should represent high and low-water mark; I should fasten battens across the incline, in order to attach stones and weeds at different levels, and also sand; as plants as well as animals, it is well known, affect different levels. I may mention amongst plants, *Chylocladia articulata*, which is a beautiful species, but must be left dry occasionally. I propose also that a tap be fixed at one end of the tank, so as to draw off gradually as much water as will leave uncovered the ledge at the top of the incline, the ledge to remain uncovered a short time every day; this I intend to represent the tides, and the advantage I expect to derive from this plan is:—First, we should give those species, such as *Chylocladia*, *Corallina*, amongst plants, and Littoral Crustacea and Testacea, as also the Nudibranchs, which are left dry by the tide twice a day, a near approximation to their state of freedom; and secondly, the water when poured back, which I propose it should be, would freshen up the water in the tank on the same principle that at sea, they stir up the water casks to freshen the water. I propose a Vivarium of this construction, only in the case of but one being used. I am, however, convinced, the far better plan would be to have separate tanks, but all fitted with taps. I should suggest that for the strictly littoral species the tank should be only a foot in depth, and the bottom on such an incline that about 2 inches of water should lie left for about half its length, and in this tank the chief plant should be *Fucus serratus*. I think the larger and more voracious carnivorous Mollusca, such as *Buccinum undatum*, should be kept in a tank by themselves, as they can be easily fed on *Mytilus edulis*, *Patella virgata*, or indeed on offal; and with them you might place the Starfish, Decapoda, that is the larger Macroura, the Anomoura and Brachyura. These might easily be fed; and with respect to food generally, the carnivorous mollusca we see can be provided for: the vegetable feeders will be amply supplied by the plants and Confervæ. But this is not the case with the Bivalves, some of the Zoophytes and Nudibranchs, but more especially the bivalves; they will exist some time without food, but it would be more satisfactory to know that this cruelty was not inflicted upon them; the greater number of the bivalves bury themselves, and most of them swallow mud and sand and decayed vegetable matter, probably on account of the animalculæ and other minute animals they may obtain. What is then to be done in their case? I admit the difficulty and cannot solve it: you must either procure their food, or exclude them from the vivarium; and as they generally burrow, I fancy they will be no great loss to the sight-seeing public. As to the Starfish and Sea-Urchins they are essentially carnivorous, as I can testify having seen a *Pecten opercularis* in the stomach of *Solaster papposa,* the edges of the oral disc being so tightly drawn over it, that I could not get the *Pecten* out without tearing the *Solaster,* this, by the by, shaking my faith in the opinion of some naturalists, that the Starfish seizes its prey by everting the stomach. I have also seen *Cyprea europæa* in the stomach of *Palmipes membranaceus.* Many others of our most showy Testacea are carnivorous, and they must be cared for; others, no doubt, live on minute Entomostraca and other bodies constantly floating in the ocean. Many, if not all of the Annelides, are carnivorous (in the extended use of the word as contradistinguished to vegetable feeders), as also are the *Holothuriæ*; it is clear then that their food will sooner or later require, in a confined place, to be replenished, especially if you wish them to breed. It is my opinion this might be managed by introducing the different species of *Talitra,* which are very prolific, and I believe, feed on decaying weed and decaying animal matter; I know they very soon clear all the muscles from a dead fish; they might thus be turned to account as scavengers. If the balance between the carnivora and their prey is not kept up by this means, it is clear the tank would soon be depopulated. With respect to *Actinia* they are easily satisfied, a Muscle or *Pecten* now and then is all that *A. crassicornis* or *A. coriacea* require; as to *A. dianthus* I have kept one for two months in a pan quite alone; it has not fed the whole time, for three weeks of that time the water was not changed, neither were any plants placed with it. For six weeks I have kept *Actinia clavata* (mihi) in a pomatum pot in the same state, and it is now as lively as when taken. With respect to the safe carriage of specimens, I am of opinion the better method of packing them is in damp *Fucus serratus*: this will apply to the greater number; many we know must be moved in water, and I am confident I shall succeed in a plan I am about to try, for sending fish by rail alive; and I do not despair of seeing the lovely *Wrasse* family, located under the paternal care of Mr. Mitchell, with other fish equally interesting, but less beautiful, adorning the Vivaria, by which the ingenuity of man and his knowledge of chemistry have enabled many a scientific person to observe, and many a casual observer to see some few of the treasures of the ocean, and to point out to the inhabitant of inland towns, that the ocean has her gems and her flowers equal to the earth, and even stars in her depths. And now I would suggest a word or two to those who manage places of public resort where Marine Vivaria are, or are about to be established. Many of the animals and some of the plants will be but partially seen in the tanks, and there is one all but insurmountable difficulty in naming them, so as that the unscientific observer may be enabled to identify them, as the animals will be in constant motion; to remedy this I suggest that around each tank should be placed glass cases or tables containing specimens of all living in the tank and properly named; this, I think, would enable the public to identify the species, it would also instruct and amuse; by this plan you might also point out the burrowing bivalves, which, although in the tank, would be seldom visible. I believe the public exhibition of Marine Vivaria will bring them into almost universal use as ornaments to the drawing-room or for purposes of instruction in Museums, Literary Institutions, and perhaps even in the school-room. Should this be the case, the labours of sea-side naturalists will be called into requisition, and a better class will enter into the supplying specimens.

I will now give a list of some of the more easily obtainable species to place in a vivarium. I am very fortunate in obtaining species here, and it is but seldom that I have not also some rarity in my possession.

Of shells I recommend species of *Pholas, Scrobicularia, Donax, Tapes, Cardium, Mytilus, Crenella, Tellina, Nucula, Pectunculus, Pecten, Chiton, Patella, Acmea, Pileopsis, Fissurella, Puncturella, Emarginula, Haliotis, Trochus, Phasianella, Littorina, Lacuna, Rissoa, Truncatella, Apporhais, Cerithium, Scalaris, Natica, Velutina, Laminaria, Murex, Purpura, Nassa, Buccinum, Fusus, Trophon, Mangelia, Cypræa, Ovula, Cylichna, Amphisphyra, Tornatella, Akera, Bulla, Scaphander, Philine, Aplysia, Pleurobranchus.*

Of Echinodermata the most showy are—*Solaster, Uraster, Palmipes, Comatula, Asterina, Asterias, Cribella, Ophiocoma, Echinus* and *Spatangus.*

Of Crustacea, all the species; as also the *Cirrhipeda* and *Annelides.*

Of sea plants I strongly recommend *Fucus serratus* as a useful, and the whole of the Rhodosperms as lovely additions, and some few of the Melanosperms; but the colours of the Chlorosperms or green sea-weeds are so fugitive, that it is with regret I cannot recommend a family of which the beautiful *Bryopsis* is a member.

I am, Gentlemen, yours very obediently,

William Thompson.

XXXVI.—*Rambles in Ceylon.* By Edgar Leopold Layard, Esq.

To Richard Taylor, Esq.

[Continued from p. 314.]

Anarajahpoora, Wednesday, 30th April, 1852.

My dear Sir,—Here I am, in the City of the Kings, now the abode of ruin and desolation: torrents of rain are falling day and night: a rushing mountain stream, called the Malwatteoya, bounds our walks, for walk we will, in spite of the rain. Our friend G. is on the other side of it, and cannot get to us, as the very natives dare not cross the rope bridge: the flood has reached it, and is about a foot deep over it. A dry suit of clothes would, indeed, be a luxury: I have not had one on since I left Damboul. As to drying anything, it is in vain to think of it. All my birds are spread on boards about the room, and at the least gleam of sunshine out they go to keep them from moulting. In this state of confinement I cannot do better than resume my letter, and inflict on you an account of my doings since I left Damboul.

Well, then, on Sunday morning the 27th, I drove to Koodakakerawe, twelve miles; the road was as changeable as the nature of the country—sometimes hilly and sometimes swampy. Over the hills I was bothered with the loose rolling stones, and on the low lands the road was often 18 inches deep in mud. In some of these places the natives had cut watercourses across the road to lead the water from field to field. In these gullies the buffaloes had wallowed and dug up the ground with their horns, and in several instances my gig sunk in up to the axle. Muttu and I had then to jump out and give the vehicle a lift, and by the united and repeated efforts of horse and man we pushed through. However, the road-maker is abroad, and all these will soon be mended. At Koodakakerawe there was no rest-house or Ambelam of any sort; I, therefore, begged shelter in the house of a native, who gave me a half-finished shed to sleep in. Chair and table were luxuries quite unknown here, and as it rained the whole day, I passed most of it in bed. I, however, did one deed of mercy—I shot two pariah dogs. The wretched animals had been both wounded by some passing Coolies, and exhibited dreadful sores, full of maggots. This is a horrible and frequent consequence of wounds in this country, particularly with animals, owing to the apathy of the native to the misery of his dependent brutes. In this instance a great part of the head of one of the dogs was cleared of skin, and in the other I could see the bowels from a large hole in the poor beast's flank. I asked the owner why he had not put some kind of medicine on it. He simply smiled, and asked what was the use? I then proposed killing them. At this he, like all his race, was horrified. "What! kill the poor brutes! they have a right to live: how cruel I was!" I had him here. "Did he think they could live?" "No, certainly, they could not." I, therefore, obtained permission to shoot, and terminated their miseries and their lives together, with a rifle-ball—a merciful and instantaneous death. It is a fact, that rather than destroy the life of an animal whose existence is a burden to itself, the Cingalese will see it perish by degrees in agony.

I passed in this morning's drive the tomb of some native, but as I have only once before seen one similar, I think the practice here followed rare, and worth noting. The tomb was covered with a standing clay top or roof, on which was painted the figure of the deceased, with some kind of an inscription at the foot. The colours seemed to be composed of clays and charcoal, and the foot of the picture lay on the foot of the grave, while the head was supported on poles, so as to incline it to an angle of about 40°. The other instance alluded to was in the Pasdoom Corle, and the slab of mud and wattles contained two figures—a man and his wife, I presume.

How true it is, that the life of a naturalist is one of never-ending enjoyment! Little as I know of the vast book of nature so liberally opened to me in the East, how varied and interesting are the incidents supplied at all times and seasons! Happening to lift my eyes from my book, they fell on the half-finished mud-nest of a mason wasp (*Odynerus*?), on which the busy architect was hard at work with her natural trowel: how deftly she spread her mortar, ever and anon flying off for more! At length, having finished the cell, which occupied her some three hours, she flew away, and presently returned with a green caterpillar, which was thrust through the narrow round opening left in the surface; another, and another followed, till the cell was full, when, depositing her egg, she carefully closed the entrance and flew away.

I have frequently selected one of these flies for observation, and have seen their labours extend over a period of a fortnight or twenty days; sometimes only half a cell was completed in a day; at others as much as two. I never saw more than twenty cells in one nest; seldom, indeed, that number; and whence the caterpillars were procured was always to me a mystery. I have seen thirty or forty brought in, of a species which I know to be very rare, in the perfect state, and which I have sought for in vain, although I knew on what plant they fed. Then, again, how are they disabled and yet not injured so as to cause them immediate death? Die they all do, at least all I have ever tried to rear after taking them from the nest.

The perfected fly never effects its egress from the closed aperture through which the caterpillars were inserted, and when cells are placed end to end, as they are in many instances, the outward end of each is always selected. I cannot detect any difference in the thickness in the crust of the cell to cause this uniformity of practice. It is often as much as half an inch through, of great hardness, and, as far as I can see, impervious to air and light. How, then, does the enclosed fly always select the right end, and with what secretion is it supplied to decompose this mortar?

I never saw a mason wasp employ an old nest to rear another brood. It is not, however, useless on that account: it forms the cradle of a beautiful blue *Chrysis*; and before the introduction of gun-barrels, flutes, keys and key-holes, pens, and other tube-like articles, it was, I doubt not, extensively used. Man, with his inventions, has, however, supplied this lovely pest so many comfortable abiding-places, that the humble mud-dwelling of the *Odynerus* is neglected, and the dung-stoppered nest of the *Chrysis* is met with wherever a tube or keyhole strikes its fancy.

Starting from Koodakakerawe at daybreak on Monday the 20th, I visited the tanks in the neighbourhood, and procured a fine specimen of *Sarkidiornis melanotis*, Pen., which is apparently common in these tanks, of which there are no less than three within a mile of each other. Going along the road I at last saw, deliberately feeding along the grassy margin, a beautiful muntjac. Stopping the gig, I raised my rifle and fired at about eighty yards, and the welcome "thud" of ball came back to my ears. The buck staggered, fell, and then crept into the thicket: to jump out and run to the place was the work of a moment, but my quarry had disappeared into the densest jungle I ever saw. Penetrate it I could not, and some natives, who joined me on hearing the crack of the rifle, refused to aid me with their caicatties (billhooks), affirming that this animal, when infuriated by a wound, inflicted fearful injuries with its curved teeth and horns. I have no doubt, from what I gathered of their conversation, that when I was gone they brought their dogs and secured my game.

I reached Allittane, my next stage (twelve miles), at eleven o'clock, and took up my quarters in a temple Madua*, after promising that I would not permit my followers to enter and defile the temple itself.

This consisted of a simple shed, supported on posts, with a pyramidal framework in front of it, which is decorated on festival days. Both it and the Madua stood in an enclosure formed of strong stakes driven into the ground for the purpose of keeping off the elephants, of which I was told great numbers were roaming about. The Madua stood so close to this fence, that I am sure an elephant thrusting his trunk through the interstices could have pulled me out of bed if he had chosen. I heard them all round me through the night, passing and repassing to and from the tank, which was close by. The village was a few hundred yards off, and all my followers, with the exception of "Man Friday" and a Malabar servant of B.'s who was returning with me, decamped thither. This I discovered about midnight, when my horse, who was tethered to the head of my stretcher, alarmed by the very near approach of a herd of elephants, thrust his nose through my mosquito curtains and awoke me.

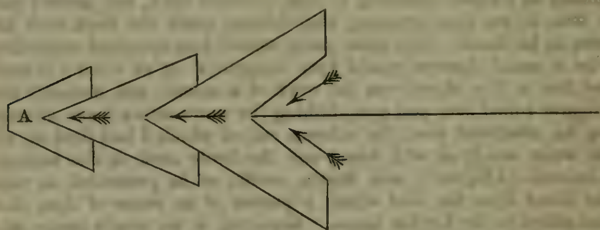
The tank is, or rather was, a very fine one, but, unluckily, the Bund has given way, and it is now little better than a large swamp. If it was in good repair it would irrigate many acres, but it is now nearly useless, and I could procure neither paddy nor straw for my cattle. The villagers said that they had not raised crops for two years, and that they lived principally on fish, with which the tank abounded; in fact, all these waters swarm with *Cyprini*, *Siluri*, and a species of *Cottus*, I think, from its appearance. What a treat an ichthyologist would have among the tanks and rivers of this country! The variety of fish is enormous, and well worth attention. I wish I knew some way of preserving them. The *Cyprinus* is the dominant family, and many of them grow so large that I cannot help thinking they might form a most valuable adjunct to the table of both rich and poor, if they were properly and carefully bred. Near the large towns and villages they should be protected during the spawning season, and the voracious *Siluri* destroyed. These latter rapacious

* Porch.

wretches hide in the mud and weeds of paddy fields, or swamps of any kind, and devour all that comes in their way. The natives catch large quantities by means of wicker baskets, funnel-shaped, like an English eel-basket, which they thrust down among the weeds, and then should the fish (aroused by the commotion all round it) attempt to escape, it knocks itself against the sides, and the blow being felt by the fisher, he introduces his hand through a hole, intentionally left at the top, and secures his finny prey. Many are also caught, along with other species, in ingenious creels shaped like a double funnel, which the natives place in the water-runs.

By the way, that word "creel" is a Scotch word, is it not? Surely it is derived from the Dutch "kraal," or else both spring from one root.

Another fish "kraal" of this country is a very ingenious and extensive undertaking; it often stretches half a mile across a river. Stout upright poles are driven into the bed of the stream and supported by stakes driven in slantingly against the current. Between the uprights smaller stakes are driven, which have been previously attached to skreens made of small rattans, firmly secured apart at equal distances. These skreens are each about ten yards long, and can be removed and rolled up at pleasure. At each end is a trap, shaped thus:—



The inner chamber A is the chamber of death, for from thence there is no retreat, and when the owner comes he attaches his canoe to the stakes, and, taking a small hand-net in his mouth, climbs over into the enclosure and dives down, feet foremost, and brings up the fish. Remarking once that the chambers were covered with netting, I asked the reason, and was told that several kinds of fish threw themselves over the sides when they found themselves in the snare; others climbed up the sticks and got over. Now, I can see you laughing at the idea of a *fish climbing*. Such is, nevertheless, the fact; I have been told it by too many to doubt it, and I have seen the species alluded to (a species of perch I think) travelling along a hot dusty gravel road in the mid-day sun. Its mode of progression was by means of the pectoral and ventral fins, which are armed with sharp spines. There is another, a marine species, which climbs up rocks and trees growing on the banks of the rivers or in brackish water. I was often puzzled to account for this power, till, having captured one, and placed it in a finger-glass, I found it clung to the sides by means of the two pectoral fins, which it had the power of drawing together so as to form an exhausted cup. The eyes of this species are very prominent and placed on the top of the head; they are very keen-sighted and rapid in their motions, and feed on small crustacea, upon which they spring with considerable certainty. They have a curious habit of darting along the surface of the water in a series of bounds without sinking, frequently ending their progress by springing 15 or 20 inches up a perpendicular wall, and sticking there, assimilating so closely to the stone, that, if the eye be once taken off, it becomes difficult to rediscover them.

While my dinner was preparing I strolled down to the tank, on which I detected, for the first time, a fine pair of the white-tailed fish eagles (*Pontaëtus Icthyaëtus*, Horsf.), which were breeding in the trees on the Bund. Taking my rifle from one of the men who accompanied me, I stole towards one which perched on a dead tree: I crept through the jungle noiselessly till within 60 yards, and raised my rifle to fire, when a bright flame issued from a bush about 30 yards nearer the bird; the sharp crack of my little collecting gun followed, the noble bird fell headlong from its perch, and Muttu, stript to a piece of cloth a few inches square, arose from the cover of the small bush, dashed over the Bund and plunged into the tank: terrified for his safety, for I knew alligators abounded, I followed as quickly as I could, shouting to him to come back, and arrived just in time to see him, grinning with delight, reach the bank with his prize in his hand. Not three yards behind him appeared swimming what a casual observer would have thought a log of wood; to level and fire at this object was the work of a second, and instantly the alligator rolled over and over, lashing the water into a foam, champing his shattered jaws, the extreme end of which I had fired at, till the water was dyed with blood and the brute sank to the bottom. Kimboola (Alligator), said Muttu, coolly, as he proceeded to wipe the blood from the bird which a quarter of an ounce of dust shot had added to the Ceylon fauna. Rejoicing in my man's escape and in my prize, I returned to the Madua and got my dinner. The rain falling in torrents precluded my further shooting, so I cleaned the artillery, punched a few rifle patches, and got things snug for the night. Muttu skinned the eagle, and while watching him I caught sight of two of the large squirrels among the topmost branches of a clump of high trees. The wonderful agility of these creatures, as I watched them through my little observing telescope, was surprising: the chase was evidently an amorous one, and the lady was coquetting in the most amusing manner, darting about and often eluding her pursuer so entirely, that I concluded she had purposely given him the slip: she would then innocently present herself to his view again, and let him approach near enough to attempt familiarities, when away she would bound, literally flying from tree top to tree top, leaving the disappointed lover to follow as best he might; matters, however, being finally settled to the satisfaction of all parties, the pair trudged off to find, I suppose, a snug resting-place for the future little *Sciuri*.

When they were gone and the lamp was lit, I found a fresh object of interest to look at. This was the large hairy-legged spider (called *Tarantula* by the Europeans) hunting his game. I knew they fed on cockroaches (*Blattæ*), but was not aware how they captured them: now my curiosity was to be gratified; still I am at a loss to know why the cockroach did not escape. When I first saw them they were at least a yard apart, the spider with his legs slightly doubled and his body raised, the cockroach facing him and directing his antennæ with an undulating motion towards his foe. I saw the spider approach by almost imperceptible degrees to within a foot: here a long pause ensued, both parties eyeing each other; suddenly a rush, a scuffle—both fell to the ground, and when the *Blatta's* wings closed (extended, I suppose, in falling), I saw the spider had him by the under side of the throat, with the body under his abdomen, and supported by the last pair of legs. He retired to a corner, and after some time I heard his powerful jaws at work. Next morning, before daylight, I found the soft part of the body devoured, and nothing but the head and the thorax, with the elytra attached, remaining. When I left the shed, the remnants were moving briskly away to the nearest ant's nest. So it is that nothing is lost or perishes in vain. Scorpions, too,—the large black fellows I mean (*Scorpio africanus*?)—feed on *Blattæ*. How do they catch them? sluggish as is the one, and active as is the other. Can there be any fascination? Several species of *Sphegidæ* and a curious-shaped minute black *Ichneumon* feed on them. A brilliant blue *Sphex* only attacks them in the larva state. After digging a hole between the bricks of our floors, the lovely fly hies away up to the roof and into odd crannies and nooks where the broom cannot penetrate. Suddenly he alights, and, flapping his wings, enters a crack and reappears, dragging out by the horns an immature and wingless cockroach: slowly he descends the wall, walking backward and leading the unresisting, disgusting vermin by the horns. Finding this slow work, he gives it a sudden jerk, and, having fairly loosened it from the wall, drops it and follows it to the ground. Gaining the excavation, the doomed wretch is thrust in head foremost and buried alive.

"Who enters at such griesly door,
Shall ne'er, I ween, find exit more."

As I sat reading I was attracted by a commotion in my horn-mug, which, full of the muddy water we were compelled to drink, had been placed at my elbow. This I found to proceed from a water beetle, who had darted into it in his flight. How do these creatures so accurately discover the position of water, even in small quantities, as to be able to fly into it at once? It is no uncommon thing, in rainy weather, when the perfect insects are stirring, to hear a knock against your drinking-glass while at table, and to find one of the numerous kinds of water beetles in it, for several species have the same habit. I have often watched the largest of them ascend the sides of the glass by means of the suckers on the centre of the forelegs, attain the rim, and take to flight again.

About an hour before sunrise, next morning, my faithful old horse again awoke me by thrusting his nose into my face, and after getting my usual dish of *canjie* (rice boiled very thoroughly with water and cocoa-nut milk) we started from this place. The road was in first-rate order, with the exception of one spot, which for badness yielded the palm to none other in the whole journey: it was a rapid descent into a nullah*, with a steep ascent on the other side, both covered with large stones, the bridge across the ravine being broken down: there was nothing for it but to scramble through as best we might.

I again this day added a prize to the Ceylon fauna, a pair of the racket-tailed shrikes.

Edolius paradiseus, L.—The song of these birds is very pleasing, and they have also the curious chattering note of the other *Dicruri*, of which we have six species in this country.

E. paradiseus, L. and *D. longicaudatus*, A. Hay, are both of them found about Anarajahpoora, the latter very common and extending throughout the Wanny† and the Jaffna peninsula, where also *D. cærulescens*, L., joins it.

D. edoliformis, Blyth, is not uncommon in the Ambagamoa range of hills, at about 2000 feet elevation. *D. macrocercus*, Vieill., is common about the jungle in the neighbourhood of Colombo, if indeed it is the true *macrocercus* and not a new and smaller species.

D. leucopygialis, Blyth, is also common about Colombo, and is a new species named by Mr. Blyth from specimens I have sent him.

I should here remark that my nomenclature of the birds of this country has been obtained from that gentleman.

Without his kind and ready assistance I should never have been able to explore the natural history of my adopted country so successfully. Guiding my inquiries and suggesting others—sending me large cases of bird skins for comparison—liberally paying from his own funds for the transit of specimens sent to him for identification, and then presenting them in my name to the Calcutta Museum—and all for a perfect stranger—I am indeed indebted to him.

About nine o'clock I reached Mehintally, whence a road branches off leading to Anarajahpoora; some natives told me the river between us and that place, called the Malwattyoya, was rising,—so I hurried along (not however omitting to shoot two more racket-tailed shrikes), and arrived at the banks of the river, now rolling down a muddy turbid stream. No time was to be lost; so Muttu, who swims like a fish, stripped and went over the river to find the ford; on this even the water took him to the arm-pits;—taking off my clothes I tied them in a bundle on my head, and Muttu seizing the rifle, and I my beautiful shrikes, in we went, steadying each other. Gaining the opposite bank, I hung my birds on a tree, dressed, and shouldering the rifle, set off to walk to the old city to procure help. How far I had to go I did not know,—so I hastened along, heedless of sculptured stone or fern-clothed tree. Though I had been driving among the prostrate remains of "towers o'erthrown" during the morning, here

* Creek. † Jungle or wild land.

indeed the remains were prodigious,—huge fragments met me at every turn,—when suddenly coming on the village, I found myself bewildered among a labyrinth of square stone columns standing in every imaginable angle; emerging from these, I found myself in the principal street. Selecting the only tiled house I could see, I hurried to it, and found my friend B. was at his office. He immediately joined me, as my arrival had been noted by a hundred eyes and reported,—a white face in Anarajahpoora (with the exception of B.'s) being quite a rarity. A hearty shake of the hand and a few hurried questions and answers—What's the matter?—where is the buggy?—have you broken down?—and in a moment away ran a dozen men with ropes and poles. In the course of an hour, horse and gig, bullocks and bandy, were safe in the stable.

But what a house was B.'s! and what a room I entered! meteorological instruments and 4-ounce elephant guns, the latest periodicals in English, French and German, and elks' horns, philosophical books, elephants' tails, and boxes of bird skins, cases of insects, papers of shells, piles of dried plants, bottles of snakes, &c. &c. &c. occupied every nook. A large bookcase of rough timber groaned with the weight of books on every conceivable subject, and amidst the chaos sat B.'s native amanuensis, patiently copying long Latin lists of plants, not one word of which could he understand—what a task!

"Glorious weather!" said B., rubbing his hands. "What for?" I replied, glancing dismally at the pouring rain.

"Oh, for my sluice," said B.; "I have been repairing the old sluice of the lesser tank and am conducting the water into the town; it is sure to be running now; it was almost up to the level this morning and must be over by this time: we'll go out and have a look at it after dinner."

Here a shivering wretch, in a state of seminudity and covered with mud, came up to the door and salaamed; B.'s face brightened, a few words passed, and B. jumping up snatched his hat; "All right," he exclaimed, "I thought so—the water is flowing—let's go and see the first trickle that has run down the old water-course for I don't know how many centuries."

Off we went in the pouring rain, threading our way along the jungle till we came to the bank, where B.'s working party were busy clearing out the last remnants of rubbish from the ancient drain.

The water was indeed running through the stone portals built for it centuries ago, but long unused and neglected. B. was delighted, and I must confess I somewhat shared his enthusiasm. He has cleared the ruins of many an ancient fane from the jungle that surrounded them, at his own expense, and opened up all the space between his house and one of the dagobas, round whose stone terrace we strolled when the rain ceased a little.

I was disappointed at the first near view of these stupendous structures, but on walking round I could pretty well estimate their size, and a broken place set a new idea working in my head,—the bricks here were plainly visible,—and I could not help mentally calculating the vast number that had been used to form this mass.

On our return home we found a note from G., who stated that he had come down to the river, but thought it too dangerous to attempt; he had been detained eighteen hours at the Sitt-aar the previous day. We have sent to tell him the water is falling, and if the rain hold up he may venture tomorrow, and we will come down to help him.

Anarajahpoora, 7th May.

We start tomorrow morning, so I must write up my "log," as it is doubtful if I shall be able to do so again till I reach Jaffna. G. joined us early on the morning of the 1st of May, and, as much as the state of the weather permitted, we wandered about, visiting the ruins and tanks, collecting specimens as opportunities offered. G. has brought a Portuguese with him to stuff his birds, and between us we have 13 shrikes, 4 specimens of the lesser hornbill, 2 pair of the lovely little ring ducks, and many others. I have also a new *Papilio*, of the swallow-tailed group, which I look upon as a great prize; I caught it on the edge of the large tank. It is the only specimen I have seen.

The following description will give you some idea of it. Expanse of wing 3 inches; ground colour a pale green; two dark brown bands run from the anterior margin of the upper wing about two-thirds down the interior margin of the lower wing, the outermost nearly touching the exterior vein of the discoidal cell; three angular patches of the same colour run from the anterior margin to the central nerve of the upper wing, while the whole exterior margin is occupied by a broad angular band divided by a row of nine spots of the ground colour, circular near the apical angle and oval or semilunar towards the anal angle; this band is extended round the exterior margin of the lower wing, the spots assuming a deep crescent shape towards the interior margin. Tail 8 lines in length, with a dark centre stripe.

Body and thorax longitudinally banded with three dark brown bands, antennæ black.

I have a *Unio*[30] new to our fauna, which I discovered in the river here; it is a shorter and thicker shell than *U. marginalis* (which is also found with it) and never grows to the same size. Length 1 inch 9 lines, breadth 10 lines. Umbones generally eroded, ligament prominent; general colour of shell brownish-green; in young specimens the green predominates and the umbones are longitudinally sculptured. Found under sand, but not very common.

The tanks and river have each supplied me with a separate species of *Paludomus*[31] and varieties of *Melania elegans* and *Pyramis*[32]. These two species are subject to great variation in shape and colouring, or else many species are classed with them.

M. elegans is found throughout the island in paddy-fields, tanks, rivers and mountain-streams, imbedded in mud or sand. Caltura river furnishes the longest-spined species. *M. Pyramis* is found in

[30] This *Unio* has not come to hand.—W. H. Benson.
[31] *Paludomus Chilinoides*, Reeve.
[32] Vide supra, note 8.

similar situations, but does not bury itself so much; the most remarkable specimens I have found occurred in a small artificial well in the curious formation of the Jaffna district already described. The shell is thin, light, corneous, closely striped with dark waving lines, 1 inch 3 lines long in some instances, and $5\frac{1}{2}$ lines in diameter; the animal a brilliant green. This little well had a slight accumulation of mould at one end, in which a crop of bullrushes had taken root; on these the *Melaniæ* fed and flourished in company with large numbers of *Planorbis indicus*[33], which likewise exceeded in size all I have hitherto seen, with one exception, also found in the same province, in a pond between Jaffna and Chavagacherry. Here they exceed 9 lines in diameter, with a lip 4 lines across and considerably recurved, reminding one of the mouth of a bugle.

We have three other *Melaniæ* in the island, all found in the Caltura river (the Calloo ganga); the largest[34], if the apex was not always eroded, would measure upwards of 3 inches in length;—I have it 2 inches 4 lines, and not full-grown. A specimen now before me measures, axis $1\frac{3}{4}$ inch, diameter 9 lines; the colour is a shining dark brown, in some instances almost black; the aperture and columellar lip brown, inside white; the whorls are granulated in the young shell, the granulations disposed in stripes, generally five in number. As the shell grows older they become confluent, and the shell appears simply spirally striated. The next in size[35] would be, if not decollated, about—axis $1\frac{3}{4}$, diameter $\frac{1}{2}$ inch; dark brown, verging on black, lip deep chestnut-brown; the surface is highly granulated in longitudinal wavy lines; in some instances the striæ rise abruptly on the shoulder, forming on every other one an obtuse elevated tubercle.

The last is a handsome shell[36], seldom attaining more than 1 inch in length, although one I possess (the largest out of many thousands collected) measures—axis 1 inch 5 lines, diameter 5 lines. The colour is a lightish horn colour, aperture whitish, surface granulated throughout in wavy longitudinal lines, transversely spirally striated. In this specimen the mouth is elegantly dentated. Should this prove new, I should wish it called after my lamented friend Dr. George Gardner, in whose company I found it during a pleasant excursion we took. This species is abundant beneath the fine sand of the Caltura river within the tidal range; the previous one is found occasionally in the mud below the bridge, but its great haunt is a muddy stream which falls into the river a few yards above the bridge.

Jaffna, May 17th.

Safe back again, buggy and horse as sound as ever, and the journey accomplished for the first time; 408 miles have been passed over by the same horse, 337 of which he has been between the shafts, sometimes scrambling through mud holes, at others sliding down rocks,

[33] *Planorbis Indicus*, Bens., J. A. S. 1836, is *P. Coromandelicus*, Fabr.

[34] Not received unless intended for *Pirena atra*, which is marked from the Southern part of the island.

[35] A variety of the Javanese *Melania Winteri*, V. d. Busch.

[36] *M. lirata*, Bens., var. *semigranosa*, V. d. Busch.

now dragging through a river, and now jumping over a fallen tree; we have not had an upset—not broken a trace.

On the 8th, the river being passable, we recrossed and came on to Maddewatchy, previously mounting to the top of the Mehintally hill, to have a last look at the glorious scenery, and to try and find more of the singular little *Streptaxis*[37], one live specimen of which rewarded my toil; it measures—axis 3 lines; diameter $3\frac{1}{2}$ from the centre of the apex to outside of the peritreme, $3\frac{3}{4}$ lines continuing the line across to the other side; the length is only $1\frac{1}{2}$ line more. Colour corneous; shell semidiaphanous, slightly striated at the suture; mouth lunulate; lip reflected, notched posteriorly at the junction with the body-whorl, lip with one single tooth. Animal livid: found under stones.

On the 9th we made Vavonia Vlancolom, and on the 10th Trambacolom, stopping at Oenandie, where is a fine tank, on which I shot a specimen of *Threskiornis melanocephalus*, and a fine wild pig; we also found many deer, but missed them. At Trambacolom we wandered about and found abundance of deer, pigs, and peafowl, and I got the nest of *Alcippe nigrifrons* (Blyth), one of my new species. It was built in a low thorny bush, and composed of grasses woven together in a dome, with the entrance near the top; eggs two in number (quite fresh), white slightly freckled with pink spots.

On our return home we found Muttu had shot three fine specimens of *Buceros pica*, and as he had only the little collecting gun and half its usual charge (or *one-eighth of an ounce* of shot), two of the birds were alive; one of them however died that night, the other is alive now. If it falls off its perch, it catches itself by its bill and raises itself like a parrot; we feed it with raw meat, and hope it will live. When resting on the ground the whole tarsus is employed to support the body, but on a thick branch they sit very upright; one of them bit a Cooly, and I really believe would have taken the finger off had I not caught hold of his mandibles, which required great force to open; the man's finger was cut to the bone on each side. On the 11th we got to Kanagariencolom, where there is a tolerable rest-house. Here the road begins to show the sand of the northern peninsula and the soil is full of iron pyrites.

On the 12th we came on to Ambamani, where we found the rest-house without any walls and only partially roofed; turning out the cattle we found in it, we took possession. In the evening, as usual, we went out shooting, looking for elephants and deer—lesser specimens there are none; I got one deer and G. a pea-fowl. Next morning (the 13th) we came on to Vattaketchy, where there is a good rest-house on the edge of a paddy-field, consequently it is nicely cool. I bagged another deer and nearly had an adventure with a cheeta while returning home by moonlight; he however let us pass unmolested.

The next morning (the 14th) we shot our way to Elephant Pass,

[37] *Streptaxis Layardiana*, Bens. MSS. A second tridentate species, *Str. Cingalensis*, Bens. MSS., from Howagam Corle, has since been received from Mr. Layard.

G. killing a couple of deer at Candavilly; G. also nearly added me to the list of killed, for having separated from each other, his rifle-ball passed through the neck of a fine buck, and turning against the spine, glanced over my head.

Leaving the buggy and cart to follow at leisure, G. and I galloped over to Mohomalie, where D., whom you may remember I had left at Karandie, was now stopping. Our friends hardly knew us, soiled and travel-worn as we were, and with beards several inches long. A hearty welcome and a recapitulation of our adventures made the evening fly swiftly, and by daylight next morning we took Her Majesty's mail for Jaffna, from whence I now "wish you heartily farewell." E. L. LAYARD.

XXXVII.—*A Revision of the Genera of some of the Families of Conchifera or Bivalve Shells.* By J. E. GRAY, Ph.D., F.R.S., V.P.Z.S. &c.

[Continued from p. 44.]

SOME conchologists have been inclined to pay great attention to certain characters in the animal and marks on the Bivalve shell, which the examination of an extensive series shows to be of only secondary importance in some genera and species.

1. The existence and depth of the siphonal sinus in the submarginal scar have been considered of the greatest importance, for it is believed that its depth shows the length, and its absence the absence of the siphons.

When the inflection is very deep, it does show that the animal, as in *Tellinidæ,* has long and retractile siphons, for the inflection is produced by the edge of the fan-like muscle which retracts the siphons; but several genera of *Corbiculidæ* and *Lucinidæ* have well-developed siphons though they have no inflection; but then the siphons of these genera are only contractile, and not withdrawn into the cavity of the mantle by any special muscles.

In some genera with retractile siphons, the length of the siphons and consequently the depth of the siphonal inflections vary considerably in very nearly allied species, sometimes so much so, that the presence of the siphons in several species is scarcely to be discovered. This is the case with certain species of *Chione,* and they thus gradually pass into the genus *Circe,* which have all the other characters of that genus. Yet Messrs. Forbes and Hanley (Brit. Moll. i. 446), on this character, place *Chione* in *Veneridæ,* and *Circe* in the family *Cyprinadæ* with *Astarte* and *Isocardia.*

It may be observed, that there are other families as well as *Veneridæ,* which generally have elongate retractile siphons and deep siphonal inflections, that contain some species which are without them, or at least have them so slightly developed as not to be distinguished; thus, *Anapa* in *Paphiadæ* agrees with *Paphia* in all the characters except in being destitute of any appearance of a siphonal inflection, but the species of *Paphia* and the other allied genera differ greatly in the depth of the inflection.

It may be remarked, that though some genera of families which generally have a siphonal inflection are sometimes without it, I have not yet observed any genus which appeared to belong to a family usually without any retractile siphons or siphonal inflection, provided with one, and the absence or presence is generally a good family character, but one which must not be solely depended on.

On the other hand, the absence of a (contractile) siphon cannot be considered an unfailing character of a family; for though the genus *Nucula* has, like the other genera of *Arcadæ*, no siphons, yet in *Leda* and *Yoldia*, both so nearly allied to *Nucula*, that some authors have refused to separate them, the one has short and the other long separate siphons. The genus *Lithophagus* differs from other *Mytilidæ* in having united siphons varying in length, but in *L. patagonicus* (D'Orb. Voy. Amér. Mérid. t. 82. f. 24) they are half as long as the shell.

The structure of the siphons appears to be of considerable importance, that is to say, if they are furnished with retractor muscles which have a fan-like end which forms the siphonal inflection on the inner surface of the shell, or are only contractile; but all siphons with or without these muscles are more or less contractile, and, as I have shown in the preceding observations, the size of the retractor muscles appears to decrease until it becomes absolutely wanting in the same family.

2. Some authors regard the entire or partial union and separation of the siphons as of considerable importance, but it is only necessary to look at the figures of the animals of the different genera and indeed species of the same genus of *Veneridæ, Solenidæ* and *Mactradæ*, to discover that this is a character of secondary importance, as being exceedingly liable to vary in nearly allied species; nevertheless it is often useful to distinguish those species from one another, and also some groups of genera.

3. The adhesion or separateness of the leaves of the mantle is another character which has been considered by some as infallible, yet the extent to which the leaves are united generally varies in the species of the genera which have this character, as the species of the genus *Solen* for example; but sometimes two genera of the same family have the mantle leaves free and adherent; this is the case with *Mactra* and *Lutraria* of *Mactradæ*. Leach indeed separates the latter from the family and places it with *Mya* on that account, but no one who has studied

the animal and shell with attention can sanction such a separation. Messrs. Forbes and Hanley in the same manner separate *Venerupes* (*Irus*) from *Tapes* for this reason, placing the former in *Gastrochænidæ* and the latter in *Veneridæ*. The adhesion of the mantle leaves also varies in degree in some genera, like *Lutraria*, where they are united when the animal is alive; but separate easily from each other after death or when the animal is preserved in spirits, which is not the case with *Myadæ* and other families.

It is to be observed, that the animals which live permanently in holes in rocks, as *Pholadidæ*, *Gastrochænidæ*, *Saxicavidæ*, or live nearly permanently sunk in the sand on the sea-coast, as *Solenidæ*, *Myadæ*, *Saxicavidæ*, *Corbuladæ*, *Pandoridæ*, *Solenomyadæ*, *Lasiadæ*, or in the sand of rivers, as *Glauconomidæ*, have the mantle-lobes united, leaving only a greater or smaller aperture in front for the passage of the foot.

Secondly, the animals which live sometimes sunk in the sand, and at others move about on the shore, have the lobes free beneath for the more easy movement of the foot, as the *Veneridæ*, *Tellinidæ*, *Mactradæ*, *Cyprinadæ*, *Cardiadæ*, *Corbiculidæ*, &c. But the species of those animals which live most in the sand or in holes, as the *Venerupes* of *Veneridæ*, and *Lutraria* of *Mactradæ*, and the *Petricolæ*, have the mantle-lobes more united like those of the former group, which they most resemble in habits. *Tapes* and *Venerupes* of the latter group, and some of the former, as *Saxicava*, are often provided with a beard by which they attach themselves to the rocks, when they have been ejected from their holes, or have been cast on places where they cannot form a cavity for their protection.

Lastly, the genera which affix themselves to marine bodies by a byssus passing out between these valves, or by the outer surface of the valves themselves, so that they are always exposed, or which live in holes in coral, like *Pedum*, or sunk head down in the sand, like *Pinna*, with the shell wide open at the top, have the mantle-lobes generally free all round, except at the cardinal, and sometimes on the hinder edge.

The only exceptions to these observations which have occurred to me are in the genera *Chamostrea* and *Myochama*, abnormal forms of *Anatinidæ*, which are attached by the outer surface of one of the valves, and the two very anomalous families of *Tridacnidæ* and *Dreissenidæ*, both living attached by a beard to other bodies, and generally more or less entirely exposed like the last group, but they have the mantle-lobes united like the families of the first category.

Lamarck, Messrs. Forbes and Hanley and others have arranged the families of Bivalves according to the adhesion and separation of the mantle, beginning with those most united and passing to those most free, overlooking the fact, that the separation and union of the mantle depend greatly on the habit of the animal, and that when the habit of a genus approaches to that of a different family, the mantle agrees more in character with that family than with its normal form; yet these authors would scarcely have arranged the genera according to their habitation alone.

4. The position of the cartilage has been regarded as a character of as much importance for the distinction of families as it is for the separation of genera.

In certain families, as *Paphiadæ, Crassatelladæ, Corbuladæ, Pandoridæ, Anatinidæ, Myadæ, Lasiadæ, Leptonidæ, Mactradæ,* it is always internal and placed in a particular cavity separate from the ligament.

In other families, as *Veneridæ, Cardiadæ, Carditidæ, Glossidæ, Astartidæ, Solenidæ, Unionidæ,* &c., it is always external and marginal on the inner side of the ligament.

But in *Tellinidæ* and *Lucinidæ,* which have the cartilage generally external and marginal and under the ligaments, some genera have it placed in a triangular internal cavity distinct from the ligament, as in *Amphidesma* and *Loripes*; and have the other characters of the animal and shell so like the typical genera of the families, that it is impossible they can be separated from them. And further, there are some genera in these families where the cartilage is situated in such an intermediate manner, as to be partly internal and partly marginal, so as to form a passage between the above-named genera and those which are of the normal form; showing that in these families the situation of the cartilage is of comparatively little importance except for the distinction of the genera.

A considerable variation in the structure of this part is to be found in the family *Arcadæ* and its allies. In *Arca* and *Pectunculus* the cartilage is placed in angular lines on and partly over the beaks. In one genus allied to *Pectunculus* it is placed in a subinternal triangular central cavity. In *Nucula* and its allies it is placed in a regular internal central cochleate cavity, as in *Mactradæ,* which has caused those genera to be formed into a family and placed near to it; and in *Solenella* it is external, marginal on the inside of the ligament, and furnished with a rather large fulcrum like *Solenidæ,* which has caused that genus to be arranged near this family; yet when the animals of these families are examined and compared, they are found so nearly to resemble each other, that they must be arranged together in one group all characterized by the peculiar pectinated form of their hinge-teeth.

A similar variation is to be observed in the family *Pteriadæ*: in *Malleus, Baphia, Pteria* and *Margaritiphora,* the cartilage is in a single central triangular pit; in *Crenatula* it is divided into several portions, each placed in a separate marginal pit; and in *Melina* it is placed in numerous marginal pits which form cross grooves on the talus of the thickened hinge-margin.

[To be continued.]

BIBLIOGRAPHICAL NOTICES.

Revue et Magasin de Zoologie. Par M. F. E. Guérin-Méneville. Nos. 4–6, April–June 1852. Paris, 8vo.

I. Zoological Miscellanies:—Notices and observations on some Vertebrata new to the Fauna of Provence, by M. Z. Gerbe (IV. pp. 161–174).

These consist of—

1. Notice on *Certhia Costæ,* Bailly, giving an account of the occurrence of this bird in the "Basses Alpes," together with a description of the bird, and a statement of the points in which it differs from *C. familiaris*; this paper is accompanied by a plate (pl. 8) showing the characters of the two birds.

2. Observations on *Strix Tengmalmi,* Gmel., stating that this bird is common in the mountains of Provence.

II. Note on a new European species of *Hippolaïs,* by M. Z. Gerbe (pp. 174–175). Of this bird M. Gerbe gives the following character:—

Hippolaïs pallida. H. supra pallide griseo-olivacea, subtus ex albo flavescens; oculorum ambitu superciliisque sordide flavescentibus; remigum secundus sexto brevior; rectricibus duabus utrinque extimis margine interno albidis.

Colore et conformatione cum *H. elæica* convenit; ab illa autem discrepat magnitudine, qua eam antecellit, longitudine rostri, alarum, caudæ, remigumque proportione.—Hab. in Hispania.

III. Descriptions of three species of *Rodentia* belonging to the genus *Arvicola* (VI. pp. 257–270). This portion of the paper contains only the description of one species (*A. leucura*), the character of which was published in the last Number of the 'Annals.' A coloured figure of this animal is given on pl. 11 of the present volume of the 'Revue et Magasin de Zoologie.'

IV. Monograph of the family of *Torpedinidæ,* &c., by M. Aug. Duméril (IV. pp. 176–189; V. pp. 227–244; and VI. pp. 270–285).

The author commences by observing that but few animals are furnished with an apparatus for the production of electrical phænomena, and that these are all fishes. Those in which the existence of these organs has been ascertained are the fishes forming the family *Torpedinidæ,* of which M. Duméril here describes seventeen species, the

Malapterurus electricus, a Siluroid fish inhabiting the Nile, and the *Gymnotus electricus*, or Electrical Eel of South America. Similar organs have also been attributed to three other fishes, but their existence has not been proved. These are the *Trichiurus electricus*, *Tetraodon electricus*, and *Rhinobatus electricus*.

The author then passes in review the various opinions which have from time to time been put forth as to the possession of electrical properties by the various species of Rays; the evidence existing on the subject being, in his opinion, insufficient to establish the fact of the existence of such properties, although the matter may still be regarded as doubtful. He then proceeds to some general observations on the history of this branch of Ichthyology, and afterwards passes to the description of the electrical organs of the Torpedo, and of those parts of its anatomy which appear to be immediately connected therewith; the details of this description are for the most part derived from M. Savi's paper on the same subject. Then follow descriptions of the genera and species. Of this part of the work the following is an abstract:—

Family TORPEDINIDÆ (*Torpédiniens*).

Body discoid, flat, rounded, smooth and naked; tail short, fleshy; ventral fins (*catopes*) immediately behind the pectorals (*pleuropes*); dorsal fins (*epiptera*) one or two, or entirely wanting; nasal valvules united to form a single lobe, with its margin free; teeth pointed; possessing an electrical apparatus.

This family, according to M. Duméril, contains five genera, of which one is here described for the first time. Of these he gives the following synoptical table:—

Dorsal fins or epiptera	distinct	with two eyes	eyes distant from the spiracula		1. Torpedo.
			eyes close to the spiracula	tail longer than the disc	2. Narcine.
				tail very short	3. Hypnos (n. g.).
		with but one eye			4. Astrape.
	wanting				5. Temera.

Genus 1. TORPEDO, Duméril.

To this genus M. Duméril refers seven species, of which he gives the following tabular arrangement:—

Disc	more or less orbicular.	base of tail very broad	ventrals elliptical	dorsal fins large	2. T. marmorata, *Risso*.
				dorsal fins small	3. T. trepidans, *Val.* (T. hebetans, *Lowe*?)
			ventrals circular		4. T. panthera, *Ehrenb.*
		base of tail a little narrowed	1st dorsal broad and rounded	spiracula annular	1. T. oculata, *Belon.*
				spiracula reniform	6. T. Nobiliana, *Bonap.*
			1st dorsal long and tapering		5. T. Sinûs Persici, *Kämpf.*
	nearly quadrangular				7. T. occidentalis, *Storer.*

Genus 2. NARCINE, Henle.

This genus also contains seven species, of which four are described as new. M. Duméril does not seem to be aware of the two species of this genus described by Sir John Richardson in the British Association Reports for 1845, and in the Proceedings of the Zoological Society for March 1840; these will raise the number of species included in the genus to nine. M. Duméril gives the following synopsis of the species known to him :—

Disc	elliptical	outer angle of the ventral fins rounded		1. N. brasiliensis, *Olf.*
		„ „ pointed		2. N. Timlei, *Bloch.*
	pentagonal	lateral margins very unequal	eyes smaller than the spiracula	3. N. indica, *Henle.*
			eyes equal to the spiracula	4. N. maculata, n. s. (Java).
		lateral margins nearly equal		5. N. microphthalma, n. s. (India).
	nearly circular	caudal fin elongated and narrow		6. N. nigra, n. s. (Brazil).
		„ rounded		7. N. macrura, n. s. (Indian ocean).

Genus 3. Hypnos, n. g.

Disc elongated, a little emarginate at the middle of its anterior margin; spiracula very close to the eyes, bordered with a crown of numerous long teeth; no cartilages to the lips; mouth large, semilunar, not protractile; teeth pointed, not passing the margin of the jaws, of which they occupy the whole length, and to which they are parallel; bridle of the nasal valve attached to the anterior margin of the upper lip; tail very short, only passing the posterior margin of the ventral fin by the length of the caudal, which is very small; two dorsal fins, first smaller than the second.

This genus contains but one species, which M. Duméril describes and figures (pl. 12) under the name of *H. subnigrum*. It is from Australia.

Genus 4. Astrape, Müll. and Henle.

Of this genus M. Duméril enumerates only two species—*A. capensis*, derived as implied by its name from the Cape of Good Hope—and *A. dipterygia*, Cantor, from the Straits of Malacca.

Genus 5. Temera, Gray.

This genus includes but one species—*T. Hardwickii*, Gray.

M. Duméril closes his memoir with a note upon the fossil Torpedo (*T. gigantea*) found in the Monte-Bolca, near Verona.

V. Descriptions of new species of Lepidoptera belonging to the Museum of Paris, by M. H. Lucas (second and third decades, IV. pp. 189–198, and VI. pp. 290–300).

These descriptions, like those previously published by the same author, are unaccompanied by any diagnoses. The species are as follows :—in No. 4,—

1. *Papilio Phronius*. Resembles *P. Proteus*. From Cayenne.
2. *Papilio Zeuxis*. A little smaller than *P. Proteus*, to which it is allied. From Venezuela.
3. *Papilio Bochus*. Confounded by Cramer and Godart with *P. Æneas* of Linnæus; it is larger than that species and comes near *P. Vertumnus* and *Proteus*. From Cayenne.
4. *Papilio Orbignyanus*. Allied to *P. Proteus*. From the environs of Corrientes.
5. *Papilio Gayi*. Allied to *P. Æneas*. From the environs of Cusco.

6. *Papilio Neodamas.* Very near *P. Polydamas* and *Protodamas.* From the Antilles.

7. *Euterpe Cæsarea.* Smaller than *E. Charops,* to which it is allied. Inhabits Columbia.

8. *Euterpe Notha.* Wings white with black nervures, and more or less spotted and edged with black. Inhabits Venezuela.

9. *Euterpe Hebra.* Wings blackish brown, with a greenish white band, which is much broader on the posterior wings than in *E. Nimbice.* From Columbia.

10. *Euterpe Cora.* A little smaller than *E. Nimbice.* From the environs of Cusco.

In No. 6—

1. *Euterpe Telasco.* From Cusco.

2. *Euterpe Semiramis.* Allied to *E. Nimbice* and *Toca,* but with the wings more strongly toothed. From Columbia.

3. *Euterpe modesta.* Allied to the preceding. From Cusco.

4. *Euterpe Sebennica.* From Mexico.

5. *Leptalis Beroë.* Allied to *L. Amphione.* Bogota.

6. *Leptalis Lewyi.* Somewhat like *L. Nemesis,* but with the anterior wings not acuminate at the apex; the inferior wings not traversed by a black line. Also from Bogota.

7. *Leptalis Euryope.* Allied to the preceding. From Mexico.

8. *Leptalis Fœdora.* Like the preceding, but smaller. From Venezuela.

9. *Leptalis Kollari.* Allied to *L. Thermesia*; wings white; anterior with a black spot at the apex; posterior bordered with black. From Venezuela.

10. *Pieris Cæsia.* Somewhat allied to *P. Calydonia*; wings brownish black; superior with a large bluish white longitudinal band, and a smaller transverse band of the same colour; inferior with the costal margin and the disc bluish white. From Quito.

VI. Observations made in America upon the habits of various species of Humming-birds, followed by some notes upon the anatomy and habits of the Hoazin, the Caurale and the Savacou, by M. Emile Deville (V. pp. 209–226).

The author was five years in South America attached to the scientific mission of M. de Castelnau; during this period he occupied himself with the study of the habits of birds, of the geographical distribution of animals, and as far as was practicable of comparative anatomy. The present paper contains the author's notes upon the subjects indicated in its title.

On Humming Birds.

After giving a general view of the habits and mode of life of these beautiful little birds, the author proceeds to record the peculiarities of those species which he had an opportunity of observing in South America.

According to M. Deville these birds are met with throughout

Brazil, frequenting flowers in every possible situation. He thinks that their principal nourishment consists of small insects, although they may also suck the juices secreted by flowers. They are constantly on the wing and exceedingly quarrelsome, continually fighting for the possession of some particular flower. In perching they generally select a very elevated branch, and always one that is deprived of its leaves; they sometimes, in this situation, emit a plaintive song.

They pair, and both sexes take part in the incubation and bringing up of the young. The species observed by M. Deville were—

1. The Topaz Humming-bird (*Trochilus moschitus*). This is one of the most common in Brazil. It is particularly attached to the flowers of the Malvaceæ, and in places where these exist in large quantities the birds may be met with by myriads, constantly on the wing, and emitting a peculiar cry resembling ti-ri-ri-ri. They are to be seen in the greatest abundance from 7 or 8 o'clock in the morning to noon, and from 2 to 6 o'clock in the afternoon. Their breeding season is in December.

2. Swallow-tailed Humming-bird (*T. hirundinacea*). This bird frequents the banks of rivers, flies very rapidly, and is very bold. It is found all the year in Brazil, but seems to be most common from August to October.

3. Dingy Humming-bird (*T. lugubris*). This bird frequents thick woods and must be sought for at the flowery summits of trees. It flies very rapidly. It is most abundant in November and December.

4. Magnificent Humming-bird (*T. strumaria*). The nourishment of this bird consists principally of small insects which it captures whilst flying, darting from the tip of a dry branch to which it constantly returns after every capture. It is not the least frightened at the sight of men.

5. Tufted Humming-bird (*T. ornatus*). This, which is one of the smallest birds of Brazil, is to be met with, although always in small numbers, about the flowers of the orange trees.

6. Eared Humming-bird (*T. auritus*). This bird is met with from July to September in the *capoeiroes* or overgrown abandoned plantations. It prefers red flowers and flies very rapidly, constantly emitting a rough note.

7. Ruby Humming-bird (*T. colubris*). Of this species two varieties differing in size are met with, one being a third larger than the other. Its flight is heavy and noisy like that of a humble-bee. It prefers the flowers of orange trees, and those of the *Lantana rosea*.

8. Castelnau's Humming-bird (*T. Castelnaudii*, Bourc. and Muls.). This bird is very rare; it keeps below the flowers of a species of *Mimosa*, the sweetness of which attracts many insects. Its note is very sharp, and its flight very rapid and noisy. It was found near Cusco in Bolivia.

9. Sappho Humming-bird (*T. Sappho*). This bird inhabits the warm valleys of Bolivia. Its note is disagreeable, its flight light; it lives in little troops.

10. Cora Humming-bird (*T. Cora*). This bird appears during

the months of February, March, April and May, in moist places on the banks of the river Rimac, near Lima. It lives in flocks of eight or ten couples. Its flight is very light.

On the Hoazin (*Opisthocomus cristatus*).

This bird is one of those whose position has always been embarrassing to ornithologists. By Linnæus and some other authors it was placed amongst the Gallinaceous birds; Temminck referred it to his order *Omnivori*; Vieillot to the Passerine birds; whilst by Latreille it was included in a small order intermediate between the Gallinaceous and Passerine birds established by him for the reception of the pigeons and some other birds. This according to the views of M. Deville is its true position.

The author here describes the anatomy of the bird and the structure of its beak and tongue (the latter organs being figured on pl. 9). He states that it is entirely a phytophagous bird, the contents of its stomach always consisting of the leaves of a tree known in Brazil by the name of *Aninga*, in Guiana by that of *Moucou Moucou* (*Arum arborescens*, Linn.). It lives in large flocks on the banks of rivers, creeks and florid savannahs, where the above-mentioned tree grows abundantly. Its note is a rough, grunting cry. It has an odour of *castoreum*, which its flesh also possesses, so that it is not used as food. It nidificates in the lower parts of trees, forming its nest of branches covered with some softer matter; the female lays three or four eggs of a dirty white colour with scattered red spots. This bird inhabits Brazil, Peru, and Guiana.

On the Caurale (*Helias phalenoides*, Vieill.).

M. Deville furnishes a few anatomical observations on this bird, which he says lives in solitude on the banks of rivers and about marshy ground, feeding upon insects, mollusca and small fishes. It is excessively timid; its note is a weak whistling, to an imitation of which it will reply. It flies very lightly, and rarely perches during the day; at night it perches on trees, where it also nidificates. The female lays three or four oval eggs of a crimsoned yellow colour with some spots of brick-red and violet-brown. It lives in Brazil, Peru, and Cayenne.

On the Savacou (*Cancroma*).

Of this bird M. Deville also gives a few anatomical details. The bird lives in pairs in the neighbourhood of water, and feeds upon insects, mollusca and fishes. It is very fierce. The author thinks that there must be several species of this genus.

VII. Description of a new species of *Cotinga* brought by MM. de Castelnau and Deville from South America; by MM. Deville and Sclater (V. pp. 226–7). The authors give the following character of this bird:—

Cotinga porphyrolæma, Dev. and Sclat. C. supra nigra, dorsi plumis pennisque, nisi primariis, albo-marginatis, infra gula violacea purpurea: rostro et pedibus nigris: uropygii plumis laxis admodum elongatis. Long. tot. m. 0·175; alæ m. 0·095; caudæ m. 0·065.

Inhabits moist woods in Peru, where it keeps at the tops of the trees. It generally lives in pairs; its flight is very light.

VIII. Studies on the *Anodontæ* of the Aube, by H. Drouet. Second article (V. pp. 244–251, and VI. pp. 285–290).

In this article the author describes those *Anodontæ* of the Department of the Aube which belong to the second and third groups of the genus,—the *Anatinæ* and *Piscinales*, that is to say, the species allied to *A. anatina* and *piscinalis*. Of the first of these groups there are three species—namely,

5. *A. anatina* (*Mytilus anatinus*, Linn.).
6. *A. Rayii*, Dup.
7. *A. parvula*, Drouet. (*A. coarctata*, Potiez and Michaud; the name changed because previously employed for an American species.)

The second group also includes three species—namely,

8. *A. piscinalis*, Nilss.
9. *A. Milletii*, Ray and Drouet.
10. *A. rostrata* (Kok.), Rossm.

We defer giving the characters of these species until the completion of the memoir.

These numbers also contain reports of the meetings of the Academy of Sciences from the 29th of March to the 21st of June 1852, and also some notices of new works.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

April 15, 1853.

On the Identity of Structure of Plants and Animals.
By Thomas H. Huxley, F.R.S.

The lecturer commenced by referring to his endeavour last year* to show that the distinction between living creatures, and those which do not live, consists in the fact, that while the latter tend to remain as they are, unless the operation of some internal cause effect a change in their condition, the former have no such inertia, but pass spontaneously through a definite succession of states,—different in kind and order of succession for different species, but always identical in the members of the same species.

There is, however, another character of living bodies—*Organization*, which is usually supposed to be their most striking peculiarity as contrasted with beings which do not live; and it was to the essential nature of Organization that the lecturer on the present occasion desired to direct attention.

* "On Animal Individuality," Annals, vol. ix. p. 505.

It is not mere external form which constitutes Organization. On the table there was a lead-tree (as it is called), which, a mere product of crystallization, possessed the complicated and graceful form of a delicate Fern. If a section, however, were made of one of the leaflets of this "tree," it would be found to possess a structure optically and chemically homogeneous throughout.

Make a section of any young portion of a real plant, and the result would be very different. It would be found to be neither chemically nor optically homogeneous, but to be composed of small definite masses containing abundance of nitrogen imbedded in a homogeneous matrix having a very different chemical composition. The lecturer explained that it would save a great deal of confusion if two new terms were adopted—that of *Endoplast* for the imbedded masses (*Primordial utricle, nucleus, contents* of authors); that of *Periplastic substance* for the matrix (*cell-wall, intercellular substance* of authors). In all young animal tissues the structure is essentially the same, consisting of a homogeneous periplastic substance with imbedded endoplasts (*nuclei* of authors), as the lecturer illustrated by reference to diagrams, and he therefore drew the conclusion that the common structural character of living bodies as opposed to not living, is the existence in the former of a local physico-chemical differentiation; while the latter are physically and chemically homogeneous throughout.

These facts, in their general outlines, have been well known since the promulgation in 1838 of the celebrated cell-theory of Schwann. Admitting to the fullest extent the meritorious service which this theory had done to physiology, the lecturer endeavoured to show that it was infected by a fundamental error, which had introduced confusion into all later attempts to compare the vegetable with the animal tissues. This error arose from the circumstance that when Schwann wrote, the primordial utricle in the Plant-cell was unknown. Schwann therefore, who started from the structure of Cartilage, supposed that the corpuscle of the cartilage cavity was homologous with the "nucleus" of the vegetable cell, and that therefore all bodies in animal tissues homologous with the cartilage corpuscles were "nuclei." This conclusion is a necessary result of the premisses; and therefore, the lecturer stated that he had carefully re-examined the structure of Cartilage, in order to determine which of its elements corresponded with the primordial utricle of the Plant,—the important missing structure of which Schwann had given no account.

The general result at which he had arrived was this:—*In all the animal tissues the so-called nucleus* (Endoplast) *is the homologue of the primordial utricle* (Endoplast) *of the Plant, the other histological elements being invariably modifications of the periplastic substance.*

Upon this view it becomes easy to trace the absolute identity of plan in the organization of Plants and Animals, the differences between the two being produced merely by the nature and form of the deposits in or modifications of, the periplastic substance.

Thus in the Plant, the endoplast of the young tissue becomes a primordial utricle, in which a "nucleus" may or may not arise; it persists for a longer or shorter time, and may divide and subdivide, but never becomes metamorphosed into any kind of tissue.

The periplastic substance, on the other hand, undergoes metamorphoses quite independently of the endoplast (a point which has been greatly overlooked, and which the lecturer illustrated by the mode in which the peculiar cells of the Sphagnum leaf acquire their thickening fibre *after the total disappearance of the primordial utricle*); these changes are,—1. chemical; 2. morphological. The chemical changes may be either the conversion of the cellulose into xylogen, &c., or the deposit of salts, silica, &c. Again, the periplastic substance around each endoplast may remain of one chemical composition, or it may be different in the outer part (intercellular substance, woody matter) from what it is in the inner (cellulose wall).

Then, as to the morphological changes in the periplastic substance, they may consist in the development of cavities—*vacuolation* (development of intercellular passages), or in *fibrillation* (spiral fibres, &c.).

It is precisely the same in the Animal.

The endoplast may here develope a nucleus (*e.g.* cartilage corpuscle in some cases), or, as is more usual, it does not; it persists for a longer or shorter time; it divides and subdivides, but it never becomes metamorphosed into any tissue.

The periplastic substance, on the other hand, undergoes quite independent modifications. By chemical change or deposit it acquires horn, collagen, chondrin, syntonin, fats, calcareous salts, according as it becomes epithelium, connective tissue, cartilage, muscle, nerve or bone; and in some cases the chemical change in the immediate neighbourhood of the endoplast is different from that exteriorly, whence the assumption of distinct walls to the cartilage and bone corpuscles; of "cell-contents" and of "intercellular substance," as distinct histological elements.

The morphological changes in the periplastic substance in the Animal again, are of the same nature as in the Plant,—Vacuolation and Fibrillation (by which latter term is understood not only the actual breaking up in definite lines, but the tendency to do so). Vacuolation of the periplastic substance is seen to its greatest extent in the "Areolar" Connective Tissue;—Fibrillation, in Tendons, Fibro-cartilage and Muscle.

In both Plants and Animals then, there is one histological element, the Endoplast, which does nothing but vegetatively repeat itself: the other element, the Periplastic substance, is the subject of all the chemical and morphological metamorphoses in consequence of which specific tissues arise. The differences between them are mainly,—1. That in the Plant the endoplast grows and, as the primordial utricle, attains a large comparative size; while in the Animal the endoplast remains small, the principal bulk being formed by the periplastic substance; and 2. in the nature of the chemical changes in the periplastic substance in each case. This does not, however, always hold good, the Ascidians furnishing examples of animals whose periplastic substance contains cellulose.

In conclusion, the lecturer endeavoured to point out that the value of the cell-theory was purely anatomical; and that the attempts which had been made to base upon it some physiological explanation of the facts of life,—by the assumption of cell-force, metabolic force, &c. &c.,—were no more philosophical than the old notions of actions of the vessels, &c., of which physiologists have lately taken so much pains to get rid.

ZOOLOGICAL SOCIETY.

March 25, 1851.—William Yarrell, Esq., Vice-President, in the Chair.

Descriptions of new species of Nassa, in the Collection of Hugh Cuming, Esq. By Arthur Adams, F.L.S. etc.

[Continued from p. 325.]

Subgenus Alectrion, Montfort.

Shell bucciniform; spire elevated; inner lip with the callus moderately developed; outer lip dentate, or serrate at the margin.

A. Shell papillose; inner lip spread.

1. Nassa seminodosa, A. Adams. *N. testá ovato-conicá, acuminatá, lævi, nitidá, fulvo-fuscescente; suturá tuberculis moniliformibus ornatá; longitudinaliter plicatá, plicis supernè subnodulosis; anfractu ultimo anticè transversim sulcato, labio lævi, cum callo tenui expanso obtecto, labro anticè dentato intus lirato.*

Hab. Island of Annaa, South Seas, on the reefs (*H. C.*). Mus. Cuming.

B. Shell smooth, polished.

1. Nassa mucronata, A. Adams. *N. testá ovato-conicá, sublævi, nitidá, longitudinaliter plicatá, lutescenti fusco variegatá; anfractibus rotundatis, ultimo gibboso; spirá acutá, mucronatá; labio lævi; labro intus lirato.*

Hab. Dumaguete, isle of Negros, 11 fathoms, black sand (*H. C.*). Mus. Cuming.

2. Nassa obliquata, A. Adams. *N. testá ovato-conicá, obliquá, lævissimá, nitidá; lineis fuscis transversis, fasciá pallidá ornatá, cinerescente, albo variegatá; labio lævi, simplici; labro intus lirato.*

Hab. Cagayan, province of Misamis, island of Mindanao, sandy mud, 25 fathoms (*H. C.*). Mus. Cuming.

3. Nassa punctata, A. Adams. *N. testá ovato-conicá; spirá acuminatá, lævi, cinereá, albido punctatá, lineolis fuscis transversis ornatá; labio callo tenui expanso tecto; columellá rugosá; labro extus incrassato, intus lirato.*

Hab. Puerto Galero, province of Albay, isle of Luzon, coarse sand, 6 fathoms (*H. C.*). Mus. Cuming.

4. Nassa lentiginosa, A. Adams. *N. testá ovato-conicá;*

spirâ acuminatâ, lævi, nitidâ, lutescente aut cinerescente, lineis undulatis confertis pictâ, lineolis fuscis transversis ornatâ; labio cum callo tenui tecto; columellâ anticè rugosâ; labro margine incrassato, intus valde lirato.

Hab. Masbate, 7 fathoms, sandy mud (*H. C.*). Mus. Cuming.

5. Nassa luctuosa, A. Adams. *N. testâ ovatâ, elongatâ, acuminatâ, subnitidâ, transversim sulcatâ, nigricante nonnunquam fasciis albo-articulatis ornatâ; anfractibus planulatis; labio callo nitido obtecto; columellâ anticè biplicatâ et tuberculis tribus instructâ; labro extus incrassato, intus valde lirato.*

Hab. Cagayan, province of Misamis, isle of Mindanao, under stones on the reefs (*H. C.*). Mus. Cuming.

6. Nassa stolida, A. Adams. *N. testâ ovato-conicâ; spirâ acuminatâ, solidâ, cinereâ, fusco maculatâ, longitudinaliter plicatâ; aperturâ anticè effusâ; labio reflexo, lævi, valde calloso; labro intus lævi, fusco alboque fasciato.*

Hab. ——? Mus. Cuming.

7. Nassa distorta, A. Adams. *N. testâ ovato-conicâ, nitidâ; spirâ acuminatâ, distortâ, pallidâ, cinereo variegatâ, lineis fuscis transversis ornatâ; aperturâ anticè valde effusâ; labio lævi, anticè biplicato; labro anticè producto, intus lirato.*

Hab. ——? Mus. Cuming.

8. Nassa marmorea, A. Adams. *N. testâ ovato-conicâ, lævi, nitidâ; spirâ subacuminatâ, albidâ, fusco marmoratâ, fasciis duabus pallidis ornatâ; anfractibus planiusculis; labio corrugato; labro extus varicoso, intus lirato.*

Hab. Cagayan, Mindanao, 25 fathoms, sandy mud (*H. C.*). Mus. Cuming.

9. Nassa spirata, A. Adams. *N. testâ ovato-conicâ, acuminatâ, lævi, nitidâ, albidâ, luteo-fusco nebulosâ; anfractibus convexiusculis, prope suturas angulatis; labio lævi; labro intus lirato, extus incrassato, anticè margine simplici non dentato.*

Hab. Swan River. Mus. Cuming.

C. Shell smooth or ribbed. Inner lip defined.

1. Nassa rufocincta, A. Adams. *N. testâ ovato-conicâ, subturritâ, albidâ, fasciâ transversâ rufâ ornatâ, longitudinaliter plicatâ, transversim striatâ; anfractibus subrotundatis; labio callo albo circumscripto tecto; labro extus marginato, intus sulcato.*

Hab. Honduras (*Dyson*). Mus. Cuming.

2. Nassa micans, A. Adams. *N. testâ ovato-fusiformi, albidâ, lævi, nitidissimâ; anfractibus convexiusculis supremis costellatis; labio callo tenui tecto; labro anticè crenulato, intus lirato.*

Hab. Cagayan, Misamis, Mindanao, 25 fathoms, sandy mud (*H. C.*). Mus. Cuming.

3. Nassa pallidula, A. Adams. *N. testâ ovatâ, subacuminatâ*

pallidâ, lævi, anfractu ultimo anticè transversim sulcato; suturâ canaliculatâ; labio cum callo circumscripto tecto; columellâ simplici; labro extus marginato, intus lirato.

Hab. Malacca, coarse sand, 10 fathoms (*H. C.*).

4. Nassa compta, A. Adams. *N. testâ ovato-conicâ, subturritâ, lævi, nitidâ, rufescente pallidè variegatâ; anfractibus convexiusculis, supremis costellatis; labio cum callo circumscripto tecto; columellâ anticè corrugatâ; labro margine incrassato, albo, subreflexo.*

Hab. Cape St. Antonio, Africa.

5. Nassa succincta, A. Adams. *N. testâ ovatâ, subturritâ, lævi, cinerescente; fasciâ pallidâ, cinctâ, anfractibus planulatis, supremis costellatis; suturâ subcanaliculatâ; labio cum callo incrassato circumscripto tecto; columellâ dentato-rugosâ; labro posticè inflexo, anticè valde sinuato et dentato, extus limbato, intus lirato.*

Hab. Masbate. Mus. Cuming.

6. Nassa zonalis, A. Adams. *N. testâ ovato-acuminatâ, lævi, nitidâ, longitudinaliter striatâ; anfractu ultimo transversim sulcato; lutescente, fasciis tribus transversis rufo-fuscis cinctâ; labio cum callo tenui expanso tecto; columellâ lævi; labro extus incrassato, intus lirato.*

Hab. Isle of Ticao, on the reefs (*H. C.*). Mus. Cuming.

7. Nassa sertula, A. Adams. *N. testâ ovatâ, acuminatâ, lævi, nitidâ, fulvâ, albo nebulosâ; anfractibus convexiusculis, supremis costellatis; labio cum callo circumscripto tecto; columellâ transversim corrugatâ; labro extus incrassato, intus lirato.*

Hab. Masbate, on the reefs (*H. C.*). Mus. Cuming.

8. Nassa semiplicata, A. Adams. *N. testâ ovato-conicâ, cinereâ, fasciâ pallidâ transversâ ornatâ, nitidâ, sublævi, longitudinaliter plicatâ, plicis in anfractu ultimo sæpè evanidis, interstitiis transversim striatis; labio callo circumscripto; columellâ transversim corrugato-plicatâ; labro extus albo marginato, intus lirato.*

Hab. Chusan (*Benson*). Mus. Cuming.

9. Nassa cinnamomea, A. Adams. *N. testâ ovato-acuminatâ, cinnamomeâ, lævi, nitidâ, lævigatâ, semipellucidâ, anfractibus convexis; labio simplici; labro extus marginato, intus sublirato.*

Hab. Dumaguete, isle of Negros, under stones, low water (*H. C.*). Mus. Cuming.

10. Nassa badia, A. Adams. *N. testâ ovato-acuminatâ, lævi, nitidâ, castaneâ; anfractibus planis, supremis longitudinaliter plicatis, anfractu ultimo transversim striato; labio simplici vix calloso; labro extus marginato, intus plicato.*

Hab. Sinaat, province of North Ilocos, island of Luzon, on the reefs (*H. C.*). Mus. Cuming.

11. Nassa mitralis, A. Adams. *N. testâ ovato-conicâ, acuminatâ, fuscâ, sublævi, longitudinaliter semiplicatâ; anfractibus*

planiusculis, ultimo anticè transversim sulcato; labio subcorrugato; labro extus marginato, intus valde lirato.

Hab. Isimimalan, isle of Negros, on the mud-banks (*H. C.*). Mus. Cuming.

12. Nassa serotina, A. Adams. *N. testâ turritâ, acuminatâ, serotinâ, anfractu ultimo anticè cingulis duabus elevatis articulatis ornato; transversim substriatâ, longitudinaliter plicatâ, plicis rotundis subdistantibus; aperturâ albâ; columellâ lævi, subcallosâ; labro extus incrassato, intus lirato.*

Hab. Australia.

13. Nassa pulchella, A. Adams. *N. testâ turritâ, acuminatâ, nitidâ, albidâ, luteo variegatâ, fasciâ fuscâ transversâ ornatâ; longitudinaliter plicatâ, plicis subdistantibus rotundatis tuberculis albis transversis instructis; labio calloso nitido; labro extus marginato, intus lirato.*

Hab. Cape of Good Hope. Mus. Cuming.

14. Nassa teretiuscula, A. Adams. *N. testâ subturritâ, acuminatâ, lutescente aut plumbeâ, fasciâ angustâ fuscâ transversâ ornatâ; lævi, nitidâ, longitudinaliter valde plicatâ; labio cum callo mediocri tecto; columellâ anticè tortuosâ, plicatâ; labro extus limbato, intus lirato.*

Hab. Eastern Seas. Mus. Cuming.

15. Nassa varicifera, A. Adams. *N. testâ turritâ; spirâ acuminatâ, pallidâ, fasciis fuscis duabus transversis ornatâ; anfractibus subplanulatis, varicibus albis, spiraliter instructis; suturâ canaliculatâ; columellâ anticè plicis tribus transversis; labro extus marginato, posticè angulato, intus valde lirato.*

Hab. Eastern Seas.

16. Nassa scalaris, A. Adams. *N. testâ ovato-conicâ, subturritâ, pallidâ, rufo-fusco fasciatâ; longitudinaliter costatâ, transversim liratâ; anfractibus rotundatis, tuberculis moniliformibus apud suturam; suturâ subcanaliculatâ; labio cum callo subexpanso tenui tecto; columellâ corrugatâ, anticè biplicatâ; labro anticè crenulato, intus lirato.*

Hab. Island of Corrigidor, 7 fathoms, coarse sand (*H. C.*). Mus. Cuming.

17. Nassa planocostata, A. Adams. *N. testâ ovato-conicâ, cinerescente, fasciâ rufo-fuscâ transversim cinctâ; costellis planis confertis longitudinalibus, interstitiis concinnè clathratis ornatâ; labio cum callo circumscripto tecto; columellâ transversim plicato-dentatâ; labio anticè denticulato, intus valde lirato.*

Hab. Payta, Peru, under stones, low water (*H. C.*). Mus. Cuming.

D. Shell scalariform, cancellated.

1. Nassa angulifera, A. Adams. *N. testâ ovato-conicâ, subturritâ, pallidè fulvâ; fasciâ fuscâ cinctâ, transversim sulcatâ, longitudinaliter plicatâ, plicis distantibus, posticè apud suturas*

angulatis; labio cum callo albo nitido tecto; labro margine subreflexo, intus crenulato.

Hab. Galapagos Islands, 10 fathoms (*H. C.*). Mus. Cuming.

2. Nassa nodicincta, A. Adams. *N. testâ ovato-turritâ; spirâ acuminatâ, pallidâ, lineis rufis transversis cinctâ, transversim sulcatâ; plicis distantibus longitudinalibus, apud suturas noduliferis ornatâ; labio cum callo albo lævi nitido tecto; labro extus varicoso, intus lirato.*

Hab. Galapagos Islands, 7 fathoms (*H. C.*). Mus. Cuming.

3. Nassa Sanctæ Helenæ, A. Adams. *N. testâ ovato-conicâ, subturritâ; spirâ productâ; anfractibus rotundatis, albidâ rufo-variegatâ, longitudinaliter costatâ, costis distantibus subnodosis; anfractu ultimo anticè transversim sulcato; labio lævi, calloso; columellâ anticè uniplicatâ; labro intus lirato.*

Hab. St. Helena, sandy mud, 20 fathoms (*H. C.*). Mus. Cuming.

4. Nassa cinctella, A. Adams. *N. testâ ovato-conicâ, albidâ, lineis fuscis transversis cinctâ, longitudinaliter valde plicatâ, plicis distantibus, liris transversis albis, interstitiis fuscis ornatâ; labio corrugato, vix calloso; labro extus varicoso, intus valde lirato.*

Hab. St. Helena, 20 fathoms, sandy mud.

5. Nassa corrugata, A. Adams. *N. testâ elongatâ, subturritâ, fulvescente, rufo nebulosâ; transversim liratâ, longitudinaliter plicatâ; plicis nodulosis; anfractibus convexiusculis; labio simplici, non calloso; labro intus lirato, margine crenulato; columellâ tortuosâ, anticè productâ.*

Hab. Eastern Seas. Mus. Cuming.

6. Nassa turrita, A. Adams. *N. testâ elongatâ, subturritâ, pallidè fulvâ; anfractibus rotundatis; suturâ subcanaliculatâ, longitudinaliter plicatâ, transversim liratâ, liris subnodulosis; labio cum callo tenui tecto; columellâ anticè abruptè truncatâ; labro intus valde lirato.*

Hab. ——? Mus. Cuming.

7. Nassa Japonica, A. Adams. *N. testâ turritâ, pallidè fulvâ, fasciâ rufo-fuscâ cinctâ; longitudinaliter plicatâ, cingulis transversis ad plicas nodulosis ornatâ, interstitiis longitudinaliter striatis; labio subrugoso; columellâ anticè productâ; labro intus lirato.*

Hab. Japan (*Dr. Siebold*). Mus. Cuming.

8. Nassa denticulata, A. Adams. *N. testâ ovato-conicâ, fulvescente rufo maculosâ; anfractibus convexiusculis, longitudinaliter plicatâ, transversim liratâ, liris planis, interstitiis tenuissimè longitudinaliter striatis; labio cum callo albo nitido tecto, anticè producto, libero; labro intus lirato, margine denticulato.*

Hab. ——? Mus. Cuming.

9. Nassa nivea, A. Adams. *N. testâ ovato-conicâ, candidâ, nitidâ; anfractibus planulatis plicis longitudinalibus distantibus,*

transversim sulcatâ; labio cum callo mediocri tecto, margine acuto producto; labro margine subcrenulato, intus lirato; columellâ anticè triplicatâ.

Hab. Batangas, island of Luzon, 21 fathoms, coarse sand (*H. C.*). Mus. Cuming.

10. Nassa plicatella, A. Adams. *N. testâ ovato-conicâ, fulvâ; labro albido; anfractibus subrotundatis longitudinaliter plicatis transversim liratis, liris ad plicas nodulosis; labio cum callo mediocri; columellâ anticè uniplicatâ; labro margine acuto, intus lirato.*

Hab. Wallwich Bay, Africa. Mus. Cuming.

Subgenus Tritonella, Adams; *Tritonia*, Fleming.

Shell turrited, cancellated; aperture rounded, not produced into an anterior canal; outer lip not dentate, with a marginal varix.

1. Nassa fuscata, A. Adams. *N. testâ ovatâ, spirâ acuminatâ, anfractibus convexiusculis, fuscâ, longitudinaliter plicatâ, transversim liratâ, plicis ad liras tuberculatis, interstitiis transversim striatis; columellâ rugosâ; labro posticè sinuato, intus dentato-lirato.*

Hab. ——? Mus. Cuming.

Subgenus Tritia, Risso.

Shell turrited; inner lip spreading; outer lip not dentate, without a marginal varix.

1. Nassa dealbata, A. Adams. *N. testâ ovato-conicâ, acuminatâ, subturritâ, albidâ, fasciâ pallidâ luteâ cinctâ; anfractibus planulatis longitudinaliter plicatis, plicis nodulosis, transversim liratis; columellâ tuberculato-dentatâ; labro extus incrassato, intus dentato-lirato.*

Hab. Dumaguete, isle of Negros, 11 fathoms, black coarse sand (*H. C.*). Mus. Cuming.

2. Nassa costellifera, A. Adams. *N. testâ ovato-conicâ, acuminatâ, albidâ, fusco-variegatâ, fasciâ fuscâ in ultimo anfractu longitudinaliter costulatâ, transversim liratâ; costellis nodulosis; anfractibus planiusculis; labio transversim corrugato-plicato; labro intus lirato.*

Hab. Curimas. Mus. Cuming.

3. Nassa trifasciata, A. Adams. *N. testâ ovato-acuminatâ; spirâ acutâ, productâ, pallidè cærulescente aut albidâ, fasciis tribus transversis rufis ornatâ, longitudinaliter subplicatâ, transversim sulcatâ; columellâ lævi, callo cum nitido expanso tecto; labro margine acuto, intus lirato.*

Hab. Vigo Bay (*M'Andrew*). Mus. Cuming.

Subgenus Desmoulea, Gray.

Shell subglobose, covered with a downy epidermis; spire short; apex papillary.

1. Desmoulea pinguis, A. Adams. *D. testâ ovatâ, abbreviatâ, ventricosâ; spirâ brevi, apice mucronato; anfractibus gibbosis, lutescente albo variegatâ; epidermide fusco villoso tectâ, transversim striatâ; labio calloso; columellâ lævi, anticè tuberculo unico, uniplicatâ; labro intus lirato.*

Hab. Senegal. Mus. Cuming.

2. Desmoulea pyramidalis, A. Adams. *D. testâ ovato-conicâ; spirâ acuminatâ, apice obtuso, violascente, longitudinaliter evanidè plicatâ, transversim sulcatâ; labio fusco subcalloso simplici; labro extus marginato, intus lirato.*

Hab. ——? Mus. Cuming.

3. Desmoulea crassa, A. Adams. *D. testâ ovato-conicâ, abbreviatâ, solidâ, lævi; spirâ obtusâ, apice violaceo; anfractibus supernè gibbosis, rufescente albo variegatâ, transversim sulcatâ; labio cum callo crasso tecto; columellâ transversim liratâ, anticè uniplicatâ, tuberculis duobus instructâ; labro intus lirato.*

Hab. Japan. Mus. Cuming.

4. Desmoulea Japonica, A. Adams. *D. testâ ovatâ, lævi, nitidâ, anticè transversim sulcatâ, fulvescente, maculis lineisque transversis fuscis ornatâ, albo variegatâ; labio anticè calloso; columellâ anticè tuberculis tribus instructâ; labro extus incrassato, intus lirato.*

Hab. Japan (*Siebold*). Mus. Cuming.

Subgenus Aciculina, A. Adams.

Shell turrited; inner lip with a circumscribed callus free anteriorly; outer lip with the margin thickened and flexuose.

1. Aciculina costata, A. Adams. *A. testâ turritâ, acuminatâ, serotinâ, nitidâ, longitudinaliter costatâ, transversim sulcatâ; labio calloso, anticè fusco, producto; labri margine subrecto, intus lirato.*

Hab. ——? Mus. Cuming.

2. Aciculina striata, A. Adams. *A. testâ ovato-turritâ, fuscâ, fasciâ pallidâ transversâ ornatâ, anfractu penultimo gibboso ad suturas longitudinaliter plicatâ, transversim valde striatâ; labio calloso; labri margine vix incrassato, intus lirato.*

Hab. San Nicholas, isle of Zebu, 5 fathoms, sandy mud (*H. C.*). Mus. Cuming.

3. Aciculina labiata, A. Adams. *A. testâ turritâ, acuminatâ, nitidâ, cinerescente, fasciâ pallidâ transversâ ornatâ, longitudinaliter costatâ, costis ad suturam nodulosis, transversim sulcatâ; labio fusco, calloso; labro margine incrassato, fusco, valde flexuoso, posticè sinuato, in medio producto.*

Hab. Malacca, coarse sand, 10 fathoms (*H. C.*). Mus. Cuming.

4. Aciculina glabrata, A. Adams. *A. testâ turritâ, acuminatâ,*

lævi, nitidâ, longitudinaliter substriatâ, albidâ, fasciis cinerescentibus maculisque fuscis ornatâ; labio calloso, anticè uniplicato; labri margine incrassato, flexuoso, in medio producto.

Hab. Philippines. Mus. Cuming.

5. Aciculina maculata, A. Adams. *A. testâ turritâ, lævi, nitidâ, albâ, maculis luteo-fuscis longitudinalibus ornatâ, transversim sulcatâ, sulcis distantibus; labio calloso, anticè producto; columellâ uniplicatâ; labro extus marginato, intus lirato.*

Hab. Banang, Sargassinan, isle of Luzon, muddy sand, low water (*H. C.*). Mus. Cuming.

6. Aciculina vittata, A. Adams. *A. testâ turritâ, albidâ, nitidâ, fasciâ transversâ fuscâ interruptâ ornatâ, transversim sulcatâ, longitudinaliter costatâ; labio calloso; columellâ bituberculatâ, et anticè valde uniplicatâ; labro extus varicoso, intus dentato-lirato.*

Hab. Ticao, coral sand, 6 fathoms (*H. C.*). Mus. Cuming.

MISCELLANEOUS.

On the Nervures of Leaves and their Distribution. By L. von Buch.

Fossil leaves can frequently only be studied in their form and neuration. The nervures have unfortunately been little noticed by botanists, as though they were of but little importance, and the laws which rule their numerous modifications have not yet been traced. It is to be regretted that, even in the best figures, the characters of the neuration of the leaves are badly represented, and sometimes even in contradiction to the laws of nature. This is the case not only with fossil, but also with living plants. I wish to draw the attention of botanists to this subject, and shall confine myself to some leaves of dicotyledonous plants which are readily procured for examination.

A leaf is an organ essential to the life of the plant. In its development it relinquishes the cylindrical form of the branches and twigs, and extends itself into a flat plate, one surface of which is turned towards the earth and the other to the sky. On the lower surface are the stomata which absorb carbonic acid from the air, decompose it, and set oxygen at liberty. Now this part of the leaf could not be developed, still less could it maintain itself in this extended condition, without the strong network of nervures which are found beneath the leaf. *The number of these nervures is fixed for each leaf; even for each species.* If the leaf grows extraordinarily, new nervures do not appear on this large surface; the number of nervures was fixed even in the closed bud. The irregularities in number in the bud are confined within such narrow limits, that they are of no importance in regard to the quantity of nervures. It is consequently necessary to indicate and fix this number in every drawing or description of a fossil leaf; without it new species cannot be determined.

When the secondary nervures of a simple leaf go from the central nervure to the margin or even a little beyond the parenchyma, these are nervures running towards the margin (*Randläufer*).

They are simple when the first pair of secondary nervures above the petiole is without tertiary nervures, as in the beeches, in *Alnus glutinosa* and *Castanea vesca*. If tertiary nervures arise from the lower side of the first secondary nervures, these are *winged* nervures.

The nervures however do not always attain the margin of the leaf. Very frequently they stop at a certain distance from the margin with so much constancy and regularity that they form a new and very extensive division which is capable of many subdivisions. This constitutes the system of *arched nervures*. Two neighbouring nervures are bent towards one another and united in an elegant arch so exactly, that it is only possible by close observation to ascertain where one stops and the other commences. Nevertheless, at the point of union there is always a small elevation, from which, usually close to the superior nervure, a common nervure arises, which goes to the margin of the leaf and terminates in a point or tooth of the margin. The superior nervure sends a branch downwards; but the essential branch curves upwards to join the secondary nervure next above it in a similar arch; this continues to the apex of the leaf. A series of continuous arches is formed, sometimes ten or more in succession. The lines of the folds of the leaf divide these arches in the middle, but do not attain the margin. This pretty form of neuration is one of the most common in our plants. It is exhibited in the *Hieracia*, the *Dipsaceæ*, and very distinctly in the *Epilobium angustifolium*; it is also met with in many shrubs and trees, such as the walnut, orange and lemon trees, and the holly. In tropical plants with projecting ribs it is always the case: drawings allow one to trace the course of the nervures, except that they do not indicate their continuation to the margin.

The nervures running towards the apex (*Spitzläufer*) are not less striking. In these the lateral nervures run in elegant curves from the base between the margin and the central nervure, uniting again with this nervure at or near the apex. In the latter case some more secondary nervures separate from the central rib, the last pair of which reunite with it at the point. The first are *complete*, as in nearly all the *Caryophylleæ*, in many species of *Laurus* and *Zizyphus*. The second are *incomplete*, as in *Cornus*, *Philadelphus* and *Ceanothus*.

Another neuration is especially exhibited by tropical plants; in this the nervure follows the margin from base to apex, completely surrounding the leaf and terminating exactly at the apex. Secondary nervures can scarcely ever attain the margin. They are generally very near one another and very fine; they divide and lose themselves in the nervures of the circumference. These are marginal nervures (*Saumläufer*). This form belongs to most of the *Myrtaceæ* and the *Banksiæ*; it is also probably that of *Buxus*.

There is evidently a multitude of other forms of neuration, which must be associated with the preceding. They ought to form the subject of a special work. It is only by this means that the apparent exceptions can be explained; such as the secondary nervures of *Oxyacantha*, *Galeopsis*, and *Euphrasia*, which do not terminate at the apex, but in the notches; the tertiary nervures of the *Ranunculi*; or the circumscription of the notches by the tertiary nervures in many species of *Acer*, with other analogous phænomena.

The above-mentioned forms, which are undoubtedly the most common, may be grouped as follows:—

Leaves are either *simple*, *digitate* or *pinnate*.

Simple leaves, which are composed only of one plate, have their neuration,—

A. Running towards the margin (*Randläufer*); when the nervures run from the central rib to the margin and terminate there; these are—

a. Simple, when no tertiary nervures arise from the secondary nervures.

b. Compound, when there are tertiary nervures.

B. Arched (*Bogenläufer*). Each pair of secondary nervures uniting to form an arch.

C. Running towards the apex (*Spitzläufer*). Two inferior secondary nervures running between the margin and the central rib to attain the apex of the leaf;—

a. *Complete*, when the two nervures actually reach the apex.

b. *Incomplete*, when the two nervures do not reach the apex.

D. Marginal (*Saumläufer*). The two lateral nervures of the base running towards the apex, following the margins throughout.—*Bibl. Univ. de Genève*, Oct. 1852, p. 161.

On the Occurrence of large quantities of the Shells of Anodon cygnea *on the sea-coast near Sandgate.* By Francis Brent, Esq.

Sandgate, March 21, 1853.

My dear Gray,—I noticed a curious circumstance this evening:—in walking by the sea-shore I perceived large quantities of the shells of *Anodonta cygnea* strewn along the beach,—either washed up at the top of high-water mark, or mixed with the drift weeds and rubbish. Nearly every specimen was more or less imperfect; in most instances one valve only, and part of the other remained; in many cases, however, there was a singular perforation of about a quarter of an inch in diameter in one of the valves, and in some instances both valves were perfect, but in those cases part of the muscles that open and close the shells remained. The quantity was so great, that in the distance of a mile I could certainly have collected a waggon-load. Now as this mollusk inhabits only fresh water, how comes it that so large a quantity should be found on the sea-coast? I can only account for the circumstance by the supposition that they had been brought there by birds, probably Royston crows, which, during the winter, have frequented this coast in great numbers; the herons also may have had a hand, or rather beak in it.

The military canal which runs between Sandgate and Hythe, at the distance of about a quarter of a mile from the sea, abounds with these large mussels, and during the winter, the water having been drawn off for some days, the bed was completely exposed, so that the unfortunate wretches, who possessed not the power of locomotion, fell an easy prey to the thievish crows and long-billed herons.

I have frequently noticed these crows hunting for snails along the sides of the cliff.

It would be a puzzle for future geologists, should by any chance the present beach be suddenly covered up, as they would find in a bed of sea-worn pebbles a stratum of freshwater shells, and not an inconsiderable one either. Some of these shells are nearly 7 inches wide or long.

Ever sincerely yours,

S. O. Gray, Esq. FRANCIS BRENT.

Sandgate, March 28, 1853.

In respect to "*Anodonta cygnea*," I am glad that Dr. Gray thinks the fact of the shells being found upon the beach worthy of record: he can make what use he likes of the information. I went this evening to have another examination of the spot, but can send you nothing more worthy to be mentioned.

I found that the shells were in the greatest quantity immediately over the bank of beach on the side nearest the canal, where the sea never comes except during storms, so that the shells were not placed there by the waves. I walked for nearly two miles without seeing any diminution of the number, and I have no doubt I could have found them nearly close to Hythe; in some places they were so thick, that I could scarcely put my foot down without treading on a shell or fragment. I think I told you that the shells were scattered on the land from the high-water mark nearly to the canal.

It has been suggested to me by a friend here, that these shells might have been washed out into the sea when the water was let out of the canal at the sluice gates. I can scarcely think this probable, as in that case they would not have been found inland from high-water mark—they would not have had the peculiar hole in them—they would have been found in a more perfect condition; and again, as the habit of the mollusk is to bury itself in the mud, the force of the stream must have been very great indeed to have dislodged it; whereas I noticed this evening, that although the gates were open the stream was flowing very slowly. I still, therefore, hold to my opinion, that they have been carried to the spot on which they are found by herons or Royston crows.

I have sent a small box containing some specimens addressed to Dr. Gray at the Museum.

Believe me, ever yours sincerely,

S. O. Gray, Esq. FRANCIS BRENT.

Description of a new genus of Gorgoniadæ. By J. E. Gray, Esq., F.R.S., P.B.S. &c.

The Coral here described was sent to me by Sir John Richardson. It is nearly allied to *Gorgonia*, but the branches are erect, clavate, and very rarely subdivided. The bark is very thick, formed of numerous close diverging cells radiating round a very thin, small, black compressed axis, each of the cells ending in a conical prominent tubercle closely covered externally with red calcareous spicula. The expanded base and the base of the stem and the interspaces between the cells are covered with smaller red calcareous granules.

This genus may be named and characterized thus:—

Gonigoria.

Coral clavate, slightly branched; the root dilated; axis horns black, compressed, thin; bark thick, calcareous, covered with conical tubercles, each covered externally with numerous close red spicula.

Gonigoria clavata.

Coral clavate, rounded at the end, simple, or rarely forked.

Hab. ——?

The coral is almost two inches high, and the thickest part is about one-third of an inch in diameter.—*Proc. Zool. Soc.*

Note on a species of Francolin. By Dr. Nicholson, H.E.I.C. Medical Service.

While in Arabia in February 1836, I proceeded into the interior as far as the town of Moosa, about twenty miles to the eastward of Mocha in Yemen, accompanied by Captain Bull of the Indian Navy, in quest of plants and other objects of natural history, as well as with the view of seeing the country. Having delivered our introduction to the chief of that district, he assigned us quarters in his palace and appointed an Arab huntsman to attend us—as well to show us game, as to be a guardian to our persons. We started at daylight, mounted on asses, and pursued our course to the eastward for about six miles, when at the foot of a range of hills, in a jungle or *Acacia arabica*, we came on several large coveys of guinea-fowl. We soon found that it was of no use to attempt to get a shot by walking after them, as they soon left us; so we followed, and whenever they entered a thick piece of jungle we ran up in time to get a shot at them, being pressed to take wing. In this way we made a very good bag, to which we afterwards added a bustard (differing from the Indian) and several small hares, which were very abundant. At the first shot I brought down, as I supposed, a couple of guinea-fowl, right and left, but on picking them up found that one of them was a fine species of Francolin.

Bill and legs coral-red, the latter with blunt knobs for spurs; the top of the head, a line under the eye from the angle of the mouth, and a patch below it, black; round the eye and some way down the neck, buff; breast and side covered with large patches of black, buff, and light blue or french-grey; all the back and other parts french-grey; the quills are light buff.

This magnificent bird we found afterwards in pairs, betraying the same habits as the two species of Francolin in India, the male often standing and crowing on some small eminence. These birds are fully as large as the gallina, which is not quite so large as the domesticated species, but as large as a good-sized fowl.

I propose for this bird the name of *Francolinus yemensis*.—*Proc. Zool. Soc.*

METEOROLOGICAL OBSERVATIONS FOR MARCH 1853.

Chiswick.—March 1. Snowing: sleet: clear and frosty. 2. Uniformly overcast: fine: overcast: slight frost. 3. Clear: fine: cloudy: clear and frosty. 4. fine: slight rain. 5. Rain. 6. Cloudy: slight rain. 7. Rain: foggy. 8. Uniformly overcast: rain: foggy at night. 9. Foggy: fine. 10. Overcast: fine: clear. 11. Foggy: fine: slight fog. 12. Dense fog: fine: foggy. 13. Slight fog: very fine: rain at night. 14. Rain: heavy rain: clear and frosty. 15. Hoar-frost: large masses of snow-like clouds: very fine: overcast. 16. Uniform haze: cloudy. 17. Densely overcast: clear and frosty at night. 18. Overcast: frosty. 19. Clear: dry air: frosty. 20. Fine: cloudy: frosty. 21. Slight snow: overcast: clear and frosty. 22. Cloudy and cold: clear and frosty. 23. Snow-showers occasionally. 24. Clear. 25. Clear: cloudy: clear and frosty. 26. Quite clear: fine: hazy. 27. Overcast. 28. Cloudy. 29. Foggy: dry cold haze. 30. Dry haze: very fine. 31. Very fine: rain.

Mean temperature of the month	37°·41
Mean temperature of March 1852	39 ·62
Mean temperature of March for the last twenty-seven years	42 ·52
Average amount of rain in March	1·40 inch.

Boston.—March 1. Cloudy: snow A.M. 2—5. Cloudy. 6. Cloudy: rain P.M. 7, 8. Cloudy. 9. Fine. 10. Cloudy. 11. Fine. 12. Cloudy. 13. Fine. 14. Cloudy: rain A.M., and rain and snow P.M. 15. Fine. 16. Cloudy: rain A.M. and snow P.M. 17. Cloudy: snow P.M. 18. Fine. 19. Fine: snow A.M. 20. Fine. 21. Cloudy. 22. Cloudy: snow A.M. and P.M. 23. Cloudy. 24. Fine. 25. Cloudy: snow A.M. and P.M. 26. Fine. 27. Cloudy: rain A.M. and P.M. 28—31. Fine.

Sandwick Manse, Orkney.—March 1. Cloudy A.M.: showers, thaw P.M. 2. Showers A.M.: showers, thaw P.M. 3. Fine, frost A.M.: clear, aurora P.M. 4. Fine, thaw A.M.: damp P.M. 5. Fine, clear A.M.: cloudy P.M. 6. Rain A.M.: clear, aurora P.M. 7. Bright A.M.: clear, S. aurora P.M. 8. Cloudy A.M.: clear, aurora P.M. 9. Cloudy A.M.: cloudy, aurora P.M. 10. Cloudy A.M.: clear, aurora P.M. 11. Bright A.M.: clear, aurora P.M. 12. Hazy A.M.: clear, aurora P.M. 13. Bright A.M.: hazy P.M. 14. Hazy A.M. and P.M. 15. Snow-showers A.M.: sleet-showers P.M. 16. Snow-showers A.M.: cloudy P.M. 17. Clear, frost A.M.: clear, aurora P.M. 18. Clear, frost A.M.: snow-showers P.M. 19. Snow-showers A.M.: clear, frost P.M. 20, 21. Snow-showers A.M. and P.M. 22, 23. Clear, frost A.M. and P.M. 24. Clear, snow A.M.: clear P.M. 25. Snow-showers A.M.: clear, frost P.M. 26. Drops A.M.: rain P.M. 27. Bright A.M.: fine P.M. 28. Bright A.M.: fine, aurora P.M. 29. Clear A.M.: fine P.M. 30. Bright A.M.: clear P.M. 31. Bright A.M.: cloudy P.M.

Mean temperature of March for twenty-six previous years ...	40°·46
Mean temperature of this month	38 ·24
Average quantity of rain in March for seven previous years .	2·30 inches.

·83 of that marked as rain is melted snow.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London*; *by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston, 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston, 8¾ a.m.	Orkney, Sandwick.		Chiswick, 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1853. March.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	29·696	29·653	29·36	29·67	29·29	39	24	34	31	39	sw.	s.	nw.	·27	....	·08
☾ 2.	29·503	29·389	29·15	29·50	29·82	45	27	36	38	36	nw.	n.	se.	·10	·04	·15
3.	30·087	29·840	29·66	29·99	29·96	40	21	32	32	33	ne.	n.	s.	....	....	·05
4.	30·113	29·982	29·80	29·84	29·71	46	35	34	41	38	s.	w.	s.	·02	....	....
5.	29·840	29·838	29·55	29·66	29·64	49	39	39	42	42½	sw.	s.	sse.	·12	....	....
6.	29·897	29·862	29·57	29·43	29·61	55	44	41	43	41	sw.	s.	w.	·02	....	·19
7.	29·937	29·917	29·60	29·77	29·76	54	34	46	42	38	sw.	n.	se.	·11	·05	·22
8.	30·043	29·932	29·60	29·60	29·77	50	29	44	42	40½	sw.	s.	ssw.	·03	....	....
● 9.	30·158	30·141	29·80	29·68	29·68	56	36	36	45	44½	s.	s.	sse.	....	....	·11
10.	30·191	30·151	29·79	29·52	29·11	55	27	41	41½	41	sw.	s.	ssw.	....	....	·02
11.	30·173	30·083	29·87	30·17	30·10	56	35	39	45	40	e.	ese.	sse.	....	....	....
12.	30·030	29·906	29·73	30·02	29·86	56	28	39	41½	39	e.	e.	se.	....	....	....
13.	29·823	29·622	29·50	29·81	29·74	61	37	36	41	40½	s.	e.	se.	·36	....	....
14.	29·627	29·515	29·18	29·73	29·79	50	25	45	41½	39	sw.	ese.	ese.	·18	....	....
15.	29·615	29·525	29·27	29·87	29·94	52	32	34	36	33	sw.	s.	e.	....	·43	·06
16.	29·631	29·594	29·33	29·99	30·07	41	31	41	35½	32	ne.	ene.	e.	....	·02	·02
☽ 17.	29·890	29·829	29·56	30·03	30·09	33	22	34	31½	28½	ne.	e.	e.	....	·17	....
18.	30·101	29·928	29·70	30·23	30·19	34	20	33	33½	31	e.	ene.	n.	....	·04	·02
19.	30·150	30·132	29·87	30·11	30·10	40	20	30	40	31	n.	n.	......	....	....	·10
20.	30·116	29·946	29·76	29·98	29·94	44	22	34	39	30½	w.	nnw.	ene.	....	·07	·06
21.	29·829	29·764	29·56	30·06	30·16	42	23	30	33½	32	s.	n.	n.	·01	....	·12
22.	29·887	29·859	29·67	30·15	30·16	42	24	35	36	30	n.	n.	......	....	....	·05
23.	29·855	29·829	29·67	30·08	29·99	40	23	33	36	33	ne.	ne.	......	·01	·11	....
24.	29·843	29·891	29·57	29·94	29·98	41	17	32	41	35	n.	n.	s.	·06	....	·09
○ 25.	29·916	29·847	29·66	29·92	29·92	41	18	33	40½	32	ne.	n.	......	....	....	·06
26.	30·025	29·966	29·75	29·80	29·57	44	17	28	37	41½	ne.	wnw.	w.	....	·04	·17
27.	30·063	29·999	29·72	29·86	30·02	50	27	39	42½	39	w.	w.	s.	....	....	·22
28.	30·150	30·129	29·90	30·05	30·10	48	21	33	45	41½	c.	n.	w.	....	·12	....
29.	30·141	29·995	29·90	30·06	29·96	48	26	34	47	41	e.	s.	s.	....	....	....
30.	29·831	29·691	29·61	29·80	29·70	58	29	35	44	38	c.	e.	se.	....	....	....
☾ 31.	29·704	29·422	29·40	29·63	29·46	57	40	43	43	43	s.	s.	se.	·19	....	....
Mean.	29·931	29·844	29·61	29·854	29·844	47·32	27·51	36·2	39·59	36·90				1·48	1·09	1·79

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 66. JUNE 1853.

XXXVIII.—*Description of* Orbitolites Malabarica (*H. J. C.*), *illustrative of the Spiral and not Concentric Arrangement of Chambers in D'Orbigny's Order Cyclostègues.* By H. J. Carter, Esq., Assistant Surgeon, Bombay Establishment.

[With a Plate.]

Orbitolites Malabarica (H. J. C.).

Description.—Free, discoidal, thin, plane or slightly concave on one side and convex on the other, smooth; presenting spiral lines on the surface extending from the centre to the circumference. Margin thick, round, rugoso-reticulate longitudinally, with one or more pores in the interstices; each pore being surrounded by a raised rim or border. Size, 1–30th of an inch thick at the circumference; 7 to 8–12ths of an inch in diameter (Plate XVI. B. figs. 1 & 3).

Internal Structure.—Composed of several layers of chambers, which are formed of as many turns of an inclined plane in a vertical spire; covered externally by a thin incrustation, through which the chambers may be seen with a magnifying glass of low power. Chambers arranged in *continuous* spiral rows extending from the centre to the circumference, and increasing in number outwards (fig. 2); alternate in adjoining rows, small in the centre, largest towards the circumference, and in the superficial layer on both sides, where they are oblong or ovoid vertically (fig. 4); each presenting two round apertures communicating with the next outer and inner chambers; the outer aperture of the external row opening on the margin (fig. 3). Septa straight (and being perpendicular to the, and alternate in adjoining, rows of chambers), forming *broken* spiral lines running in the opposite direction to them, so as to present the linear appearance seen on the case of an engine-turned watch (fig. 2); but with the exception, that in the former the lines increase in number outwards by the addition of more rows of chambers on the one hand, and more septa on the other, just as in *Orbitoides*. D'Orbigny's "coupe horizontale," therefore, of the latter (Cours élément. de Paléont. et Géol. vol. ii. p. 193) is not correct, for that is identical with the lines on the back of an engine-turned watch.

Locality.—Abounding in an impure, bluish-green limestone (of the Pleiocene of formations) about 30 feet beneath the surface at Cochin on the Malabar coast, the shells of which, though deprived of their animal matter, are still white and pulverulent, or semicrystalline.

Observations.—In my "Descriptions of some of the larger forms of Foraminifera in Scinde," p. 161 of this Journal, I have stated, that "D'Orbigny is not warranted in giving the distinguishing character of concentricity to the rows of chambers in his order *Cyclostègues*, for in his three first genera, which are all alike in this respect, we have seen that it is almost impossible to determine it; and in his last one, of which *Lycophris dispansus* is a type, it is evident that this is not the case, but, that the chambers are arranged subspirally."

I had always been impressed with the idea that a spiral arrangement of the chambers was the most persisting character in the discoidal Foraminifera, and although I had succeeded in demonstrating this in *Orbitoides* (*loc. cit.*), I could not do so in the other genera of D'Orbigny's *Cyclostègues*, from the smallness of the cells and their confusion in the centre of the species I possessed. In the one just described however, there is no doubt of it. The lines of chambers are thrown off from a vertical spire, in the form of sparks from a rotatory fire-work, as I have before stated of *Orbitoides*; and, if it be the case in one species of *Orbitolites*, it is most probably the case in all, and in D'Orbigny's genus *Orbitolina* also, which is but an extended form of the same structural foundation.

Hence if this reasoning be allowed, it must follow, that D'Orbigny's term for this order is a misnomer, for the chambers are not arranged in concentric circles as it would imply, but *spirally*, as in other discōidal Foraminifera.

I have named this species *Orbitolites Malabarica* from its locality, the specific differences between it and the other known species (with the exception of the spiral lines on the surface) not being recognizable by the unassisted eye.

Identity of Lamarck's *genus Orbitolites and* D'Orbigny's *Cyclolina*.—There appears to me to be very little difference between Lamarck's genus *Orbitolites* and D'Orbigny's *Cyclolina*, judging from the figures of the former, in tab. 73. figs. 13–16, of Lamouroux's 'Exposition Méthodique des Polypiers,' and of the latter, in tab. xxi. figs. 22–25, of D'Orbigny's 'Foramen.

Foss. du Bassin Tert. de Vienne.' Both are marginoporous, and both without pores on the surface (Carpenter, Quart. Geol. Journ. vi. p. 31); while the concentric circles represented in D'Orbigny's *Cyclolina cretacea* (*loc. cit.*) find their parallel also in Lamarck's *Orbitolites concava*. Carrying out this reasoning also, we find it stated by Dr. Carpenter (*loc. cit.*) respecting the Australian species of Quoy and Gaimard and *Orbitolites complanata*, that they "agree closely in every particular save the form of the superficial cells;" and as the former and *Orbitolites Malabarica* will be seen to be still more intimately allied, it also follows, that all these species should come under the genus *Orbitolites* of Lamarck. The chambers I apprehend are arranged spirally in all, though the superficial lines only appear to be so in *O. Malabarica*.

It therefore seems to me (though of course I make the remark with much deference) that D'Orbigny's genus *Cyclolina* should be a species in Lamarck's *Orbitolites*; then the latter genus would be characterized by a thin amorphous incrustation on the surface through which the chambers are more or less visible with a magnifying glass; and in D'Orbigny's *Orbitolina*, the incrustation would be characterized by its cellular structure, as in *Orbitoides*, rendering the species or varieties more or less convex on one or both sides. In this case the species in the "Descriptions, &c." to which I have alluded, called respectively *Cyclolina* and *Orbitolites*, should be called *Orbitolites* and *Orbitolina*.

Bombay, February 26, 1853.

EXPLANATION OF PLATE XVI. B.

Fig. 1. *Orbitolites Malabarica*, natural size.
Fig. 2. Portion of the centre magnified, showing the spiral arrangement of the chambers.
Fig. 3. Portion of the margin magnified, showing the marginal apertures.
Fig. 4. Portion of the internal, or opposite, side of the rows of chambers, showing similar apertures;—also the large oblong or ovoid chambers of the surface.

XXXIX.—*Remarks upon British Plants.* By Charles C. Babington, M.A., F.R.S., F.L.S. &c.*

[Concluded from p. 368.]

6. Myosotis alpestris.

Having had occasion to refer to the *Myosotis alpestris*, it may be allowed, and indeed seems desirable, to take this opportunity of

* Read before the Botanical Society of Edinburgh, April 14, 1853.

correcting an error into which I have fallen concerning it. A careful examination of the materials in my possession, combined with a belief that good botanists who were acquainted with *M. suaveolens* and *M. sylvatica* could scarcely fail to see their distinctness, caused me to express an opinion that the *M. alpestris* of Schmidt, which so many authors of high repute have combined with *M. sylvatica,* was probably a mountain form of it, and to be specifically separated from *M. suaveolens* (Kit.). In that view I was confirmed by specimens of *M. montana* of Besser, which is usually placed under *M. alpestris,* being apparently a form of *M. sylvatica,* with which Besser himself (Prim. Fl. Gal. Aust. i. 142) identifies it; and also examples of *M. lithospermifolia* (which is usually considered as identical with *M. alpestris*), gathered in Lucania and sent to me under that name by Prof. Gasparrini, proving to be *M. sylvatica.* Having now acquired much fuller information upon the subject, I find that *M. alpestris* of Schmidt and *M. suaveolens* of Kitabel must be considered as identical; and the mistake of separating them may be perhaps excused by the difficulties caused by wrongly named specimens and the insufficient descriptions of the older botanists. Tausch has done his best to separate them (Bercht. Fl. Böhm. ii. pt. 2. 123 & 124), but, notwithstanding his long descriptions, has failed to point out any available differences; indeed he has quite overlooked the attenuated base of the calyx and the absence of a keel from the fruit; although these are apparently the points upon which the most confidence is to be placed as distinguishing *M. alpestris* from *M. sylvatica.* It should be added, that for the latter character we are indebted to Dr. Godron (Fl. Lorr. ii. 129; Fl. Fr. ii. 533).

7. Thymus Serpyllum.

Fries, in the year 1814, in the 1st edition of his 'Novitiæ' (p. 35) gave a short but very imperfect character of a new plant named *Thymus Chamædrys,* reserving, as he states, the description of it for a future opportunity. This opportunity does not seem to have occurred until 1828, when, in the second edition of the same work (p. 195), he treated at considerable length upon the *T. Serpyllum* of Linnæus and his own *T. Chamædrys.* Since the latter period these plants have been a subject concerning which botanists have greatly differed in opinion, most writers considering that they were only varieties of one species, but a few following the example of Fries and distinguishing them. This diversity of view has probably originated from that majority not being acquainted with the living plants: the attainment of such a knowledge has been the cause of my own change of view. These plants well illustrate the difficulty which those solely, or chiefly, acquainted with allied species as preserved in an herbarium may have in appreciating their real distinctness. In this instance the technical characters to be found in books are scarcely sufficient for the separation of the plants, even when specimens of each are before the student; for it is found that the differences in the shape of the leaves, calyx, corolla, &c., and the distribution of the pubescence, are not so constant as to allow of certain dependence being placed upon them. It is to the habit of the plants that we must turn for a satisfactory distinction, and unfortunately that is seldom to be well seen in a dried specimen, although most marked in the growing plant. In *Thymus Serpyllum* there is a manifest difference between the flowering shoot and that which is intended to extend the plant. Quite prostrate and rooting shoots are produced each year, which grow from the end of the shoots of the preceding year, and do not flower: also there spring from the other axils of those old prostrate parts of the plant short erect or ascending shoots, which form a linear series, and of which each terminates in a capitate spike consisting of a very few whorls, and which die back to their base after the seed has fallen. The growing shoot is thus seen to be perennial and ultimately becomes woody, but the flowering shoot is annual. In very vigorous plants the growing shoot is sometimes seen to branch in a pinnate manner, and the flowering shoot similarly to produce short branches terminating in small capitate spikes, but their character as essentially growing and perennial, and flowering and annual shoots, is not altered by their luxuriance. This mode of growth causes the plant (especially if kept clear from weeds, as is the case in a garden) to present the appearance of a cushion of flowers surrounded by a prostrate fringe of leafy shoots.

In *T. Chamædrys* there is no such manifest separation into flowering and growing shoots, but they all are alike in their origin and appearance. The terminal bud often produces the strongest shoot, which itself ends in flowers, but has usually barren branches from some of its axils. It thus differs most materially from the *T. Serpyllum,* in which the terminal bud always produces a flowerless shoot to form the foundation for the flowering shoots of the succeeding year, and to terminate in a similar leaf-bud to that from which it sprung. A tuft of *T. Chamædrys* therefore has none of the beautiful regularity possessed by one of *T. Serpyllum,* but presents, from the centre to the circumference, a dense irregular mass of leafy shoots and flowers intermixed. In the autumn or winter these leafy shoots fall towards the ground, and such of them as become buried produce a few roots, increase in a cæspitose manner in the succeeding year and throw up intermixed leafy and flowering shoots. The flowering shoots do not usually die back to their base, as in *T. Serpyllum,* but only as far as the first axil in which a leaf-branch or its rudiment has been formed.

If these differences in the mode of growth be attended to, there can be no difficulty in distinguishing the plants, and, as I think, in being convinced of their specific distinctness. Unfortunately, however, it often happens that the plants grow so closely packed with other plants, that they have not room in which to show their true habit, and it is then not unfrequently rather difficult for an inexperienced person to determine which of the species is before him. This cannot take from the value of the difference of growth, but only adds to the difficulty of the botanist.

It has been already stated that the whorls of the flowers of *T. Serpyllum* are often so closely packed as to look like a short glomerule or head, although generally the one or two lowest placed whorls are at rather a greater distance apart than the rest. In *T. Chamædrys* the head is oblong, being formed of very much more numerous whorls, its lower part is usually much more lax, and there are several, often many, distant whorls below it.

The plants may be characterized as follows:—

1. *T. Serpyllum* (Linn.); *stems prostrate creeping,* leaves oblong or lanceolate narrowed into the flat fringed stalk, floral leaves similar, *flowering shoots ascending, flowers capitate,* upper lip of the calyx with three short triangular teeth, lower lip of two subulate teeth, *upper lip of the corolla oblong.*

T. Serpyllum, *Linn. Fl. Suec.* ed. 2. 208, et *Sp. Pl.* ed. 1. 590; *Sven. Bot.* t. 320; *Wahl. Fl. Suec.* 377 (excl. var. β.); *Reich. Fl. excurs.* 312, et *Fl. exsic.* no. 187!; *Fries, Nov. Fl. Suec.* ed. 2. 195, et *Herb. Norm.* v. 7!, et *Summa,* 197; *Eng. Bot.* t. 1514; *Curt. Fl. Lond.* i. 120; *Gren. et Godr. Fl. Fr.* ii. 657; *Hook. and Arn. Br. Fl.* 311; *Guss. Syn. Fl. Sic.* ii. 95.

T. angustifolius, *Pers. Syn.* ii. 130; *Reich. Fl. excurs.* 312, et *Fl. exsic.* no. 186!; *Wimm. et Grab. Fl. Siles.* ii. 165; *Ledeb. Fl. Alt.* ii. 390; *Spr. Syst. Veg.* ii. 696.

T. Serpyllum γ. angustifolius, *Koch, Syn.* ed. 2. 641.

Stem woody, much branched, prostrate, rooting, producing in its second year the erect annual usually short flowering shoots from the lower joinings, and a prostrate flowerless woody and persistent shoot resembling itself from the terminal or a few other buds at its end. Leaves narrowed in their lower half which together with the petiole is often fringed, rather conspicuously nerved beneath, often narrow. Whorls of flowers collected into a small terminal head, the lower ones being usually only slightly separated from the others. Upper lip of the corolla quadrangularly-oblong, conspicuously notched. Nuts globose, mealy, with a basal scar.

This plant varies considerably in appearance owing to the breadth of its leaves being inconstant, and individuals of it differing greatly in hairiness, but it is believed that the character derived from its habit may be depended upon. The nuts afford an apparently constant although minute distinction. The form of the upper lip of the corolla is stated by Bentham to vary, but it has proved constant as far as my observations have extended.

It appears to be quite certain that this is the true and exclusive *T. Serpyllum* of the 'Fl. Suec.' and the 1st edition of the 'Sp. Pl.' of Linnæus. His words in both of those works are—"T. floribus capitatis, caulibus repentibus, foliis planis obtusis basi ciliatis." In the 2nd edition of the 'Sp. Pl.' he altered the word "repentibus" into "decumbentibus," intending perhaps thereby to include the plant now called *T. Chamædrys,* in which the stems cannot well be said to creep, although they do ultimately become decumbent. In his herbarium there are several specimens upon papers pinned together; they consist of examples of the plants called *T. Serpyllum, T. angustifolius* and *T. Chamædrys,* but that which is marked with pencil and also with ink as intended to correspond with the 'Sp. Pl.' ed. 1. is the *T. angustifolius* of Persoon, and therefore the plant described above as the true *T. Serpyllum.* The above synonymy also shows that this is the plant called *T. Serpyllum* by the best writers. Bentham (Lab. 343, 344, and in DeCand. Prod. xii. 201) combines the *T. Serpyllum* and *T. Chamædrys* of Fries to form his *T. Serpyllum,* but doubtfully separates from it the *T. angustifolius* of Persoon. It will have been already seen that I believe him to be in error (resulting from a neglect by most authors of the habit of the plants); for although he has rightly separated the *T. angustifolius* from *T. Chamædrys,* he has erroneously distinguished it from *T. Serpyllum,* and also incorrectly joined the *T. Chamædrys* with the latter.

This plant inhabits heaths and dry barren ground, flowering throughout the summer. I have specimens from Thetford, Suffolk; Gogmagog Hills, Cambridgeshire; Isle of Wight; Bath; West Cornwall; Barmouth; Snowdon; Orkney Isles; S. Isles of Arran, Co. Galway; and the coast of the county of Antrim.

2. *T. Chamædrys* (Fries); *stems similar* diffuse ascending 2–4-fariously hairy, leaves broadly ovate with a flat winged stalk, floral leaves similar, flowers whorled and capitate, upper lip of the calyx with three triangular teeth, lower lip of two subulate teeth, *upper lip of the corolla semicircular.*

T. Chamædrys, *Fries, Nov.* ed. 1. 35, ed. 2. 197, et *Summa,* 197, et

Herb. Norm. v. 6 !; *Reich. Fl. excurs.* 312, et *Fl. exsic.* no. 188 et 189!; *Gren. et Godr. Fl. Fr.* ii. 658.
T. Serpyllum, *Wimm. et Grab. Fl. Siles.* ii. 163; *Ledeb. Fl. Alt.* ii. 391; *Spreng. Syst. Veg.* ii. 696; *Bieberst. Fl. Tauro-Cauc.* iii. 402 (non *Linn.*).

Stems woody, slightly and irregularly branched, procumbent or ascending, not creeping but rather cæspitose, producing leafy stems and flowering shoots irregularly. Leaves ovate, usually broad (and some rounded) below, or very shortly narrowed into the petiole which is fringed, less prominently nerved than those of *T. Serpyllum.* The lower whorls of flowers distant, the uppermost usually forming a large oblong head. The upper lip of the corolla is semicircular and appearing to be quite entire, but has usually a deep notch in its centre, having the sides so placed as to touch each other and become unapparent except upon minute inspection. Nuts roundish, a little compressed, with a basal apiculus, reddish.

The plant now under consideration varies even more than *T. Serpyllum,* but the variations are unfrequent. In its usual state the stems ascend with a curve so as to present the top of the spike to the eye. This spike, of which the joints are shorter than the length of each of the cymes forming the false whorl, is generally about an inch in length (rather more than less), and has below it from one to four distant whorls of flowers. The extreme variation from this type is seen in a plant called *T. sylvestris* by Schreber as we learn from Reichenbach, which was gathered by Mr. Borrer and myself in a damp hollow on Box Hill. In this curious plant the stems are long filiform and nearly simple, with very many distant whorls of flowers and no trace of a terminal spike or head. Its leaves are all large and very broad (the length being to the breadth relatively as three to two in many instances), and their presence at the end of the stems where they quite hid the young flowers gave a very peculiar appearance to the plant. The shape of the leaves, the structure of the flowers, and the form of the seeds, show that this singular plant is a state of *T. Chamædrys.*

In this species also the form of the upper lip of the corolla and that of the nuts has proved constant in every specimen that I have examined, although the notch in the former is sometimes found to be open. The general shape also of the leaves is probably to be trusted, viz. that their broadest point is above the middle in *T. Chamædrys* and below that point in *T. Serpyllum.* It does not appear to me that the same confidence can be placed in the distribution of the hairs upon the stem; for I find that although the stem of *T. Serpyllum* is often uniformly hairy, its hairs are also not unfrequently arranged in two or four rows, the intermediate spaces being glabrous. It was this fact which led me erroneously to suppose that the common British plant ought to be considered as the *T. Chamædrys* of Fries, and caused me to so name it in the 3rd edition of my 'Manual.' In the 'Fl. Silesiæ' (p. 167) attention is justly directed to the fact that in *T. Serpyllum* the elongated forms have the more slender shoots, whilst in *T. Chamædrys* the more extended the shoots the thicker they become.

I possess *T. Chamædrys* from the Devil's Ditch in Cambridgeshire; Box Hill, Surrey (*T. sylvestris*); and How Capel, Herefordshire. It flowers throughout the summer, and, I think, likes rather a damper and more shaded situation than its ally.

In all probability these two species will be found throughout the kingdom, but it is to be desired that botanists should carefully note their presence in all parts of the country in order that their true distribution may be ascertained.

XL.—*Further Observations on the Animal of* Diplommatina (*including a Note by* Capt. T. Hutton). By W. H. Benson, Esq.

Dr. J. E. Gray, and after his example Dr. L. Pfeiffer, being at issue with Capt. Hutton and myself on the subject of referring the genus *Diplommatina* to the operculated or inoperculated pulmoniferous Testacea, the holders of the latter opinion being moreover those who have studied the animal in a living state on its native mountains, and who ground their persuasion on the view of many hundred specimens, while the maintainers of the contrary part can only refer to two or three Museum* specimens which must have passed through several hands before submission to scientific examination, anything which can tend to throw light on the question will be acceptable to conchologists.

The occurrence of a single operculum in a living specimen, or in one conveyed from the Himalaya to England, secured from all risk of being tampered with, either ignorantly or designedly, would be sufficient to settle the matter in the affirmative, even although thousands should be found destitute of this accessory piece; but I cannot allow that such a certainty has yet been arrived at as to induce us to reject the accumulated evidence of opposing observations. No apology will be necessary for the publication

* Dr. Pfeiffer's note, 'Monograph,' p. 121, "Cl. Benson operculum non observavit, tamen in copiosis Musæi Britannici speciminibus adest, et ideo genus familiæ Carychiadarum adnumerat," leads to an erroneous conclusion. Dr. Gray has assured me that there are only two or three opercula in the British Museum.

of the following communication from Capt. Hutton, which reached me last month. I am enabled to add some corroborative evidence from a subsequent examination of my own collection.

Capt. Hutton writes as follows:—"Unfortunately when you asked me to look at living specimens of *D. folliculus* the ground was white with frost; nevertheless I sallied forth into the forests and extended myself among the frozen leaves, beneath which and stones I procured a few, but I soon became so cold that I was obliged to desist. I have just examined two living specimens under a strong glass, but can find no operculum even though I have deliberately pulled them to pieces atom by atom, and I still adhere to my former opinion that they belong truly to the *Carychiadæ*." "Besides this I have a box containing many hundreds (I might say thousands perhaps), and there is not a trace of a loose operculum among them, so that I say again, Gray must have been misled by the operculum of some other species in the same box with them."

Since my return to town I have examined 139 specimens, in my collection, of the three Himalayan species, taken by Capt. Hutton at Simla near the Sutlej, and by myself at Landour, between the Jumna and Ganges, and at Neinee Tal in Kemaon, to the north of Rohilkhund, three widely distant mountain localities. Of these 73 were specimens of *D. folliculus* (47 being collected by myself); 64 of *D. costulata* (63 being also collected by myself); and 2 of *D. Huttoni*, collected by Capt. Hutton at Simla. In 138 specimens there was not a vestige of an operculum, and in only one was the aperture covered by a thin translucent membranaceous epiphragm (without any vestige of a spiral or other organization) which hermetically closed the mouth of the shell, extending even over the reflected portion on the parietes.

The tooth-like plait on the columella has already been regarded by me as militating against the theory of an operculum, and I consider that the occurrence of an epiphragm, which has evidently been deposited by the animal itself, is a strong additional argument in favour of those who would refer the animal to the inoperculated Pulmonifera.

The Simla specimens were sent to me some fifteen years ago by Capt. Hutton, and, with those which I collected myself, have been enclosed in quills and small boxes; have never since been out of my own possession; and, when necessarily under the custody of others, have been secured in well-fastened chests beyond all suspicion of having been meddled with; and yet not a single loose operculum is to be found in the corked quills, &c. in which they were contained.

With such facts before me, and with all respect for the perfect good faith of Dr. Gray's observations, I am irresistibly led to the conclusion that the opercula assigned by him to *Diplommatina* were adventitious, and that if not assignable to the young of *Alycæus strangulatus* which is found abundantly in company with *Diplommatina*, they must belong to some other shell, and have become accidentally mixed with specimens to which they did not originally belong.

Since the publication of the observations contained in p. 286 of the 'Annals' for April, I have inspected specimens of *Diplommatina minor*, Gr., and am fully satisfied that it has no real connexion with *Diplommatina*. The aspect of the aperture is quite Cyclostomatous; that of *Diplommatina* is far from being so. Pfeiffer calls it a dubious species; I have no hesitation in rejecting it from the genus, and consider that if it should be, as is most probable, provided with an operculum, that circumstance will in nowise affect the question as regards the true species. I add a note on the characters. The aperture is circular, and at once indicates a *Cyclostoma*; the peristome is interrupted above and is double; the inner lamina, which is subporrect and expanded, being divided from the outer reflected lip by a sulcus. The two upper whorls alone are closely and obtusely costulate, the rest are smooth; there is no trace of an internal plica. The doubling of the peristome is effected in a different manner from that of the *Diplommatinæ*, in which the retro-relict second lip is only visible laterally, and not in front as in *Cyclostoma minus*.

In Mr. Gaskoin's two specimens of the Australian *Diplommatina*, the internal columellar plica is to be detected.

London, May 1853.

XLI.—*On the Genera of the Tribe* Duboisieæ. By JOHN MIERS, Esq., F.R.S., F.L.S.

[Continued from p. 381.]

ANTHOTROCHE.

THIS genus was first made known by Endlicher in his 'Genera Plantarum,' p. 1404, his short description of the only species being published in his 'Nov. Stirp. Mus. Vindob.' p. 7. It was placed by him among the *Salpiglossideæ*, but referred by Mr. Bentham to *Solanaceæ*, no doubt because of the more isomerous structure of its flowers. I first called attention in 1849 to the singular fact of the extrorse position of the stamens, and confirmed the general analogy of its characters to *Anthocercis*. Lately it has been noticed by M. A. DeCandolle, 'Prodr.' xiii. 676, as a genus to be excluded from *Solanaceæ,* and referred to *Scrophulariaceæ,* because of its unilocular reniform anthers; its generic character there given is literally copied from the original diagnosis of Endlicher, entirely omitting the remarkable features indicated by me (*huj. op.* iii. 171). The unilocular anther, as in *Verbascum,* is however not peculiar to the *Scrophulariaceæ,* for though occurring in several cases, it is there more an exception than a general rule, being at the same time common in other families, for instance in the *Myoporaceæ*: indeed, abundant evidence has been given to prove, as I have remarked in regard to *Anthocercis,* that neither the structure of the anther, nor even the didynamous character of the stamens, are by themselves sufficient to retain a doubtful genus within the limits of the *Scrophulariaceæ.* The fact, in combination with other circumstances, that manifestly determines the position of *Anthotroche* among the *Atropaceæ,* rather than in *Scrophulariaceæ,* is the structure of the seed; this resembles that of *Anthocercis, Cyphanthera* and *Duboisia*; it is cylindrical, slightly curved, containing, enveloped in albumen, a nearly straight cylindrical embryo, with minute cotyledons, and a terete radicle pointing to the base of the seed, the hilum being on the lateral ventral sinus. Whatever may be its true position, one conclusion is certain, that where *Anthocercis* is placed, *Anthotroche* must accompany it. This agreement is evident, not only in their similarly extrorse stamens, but in the æstivation of the corolla; this last feature is not so easily distinguished in the last-mentioned genus, on account of the shortness of the lobes of its border, and their being densely covered on both sides with long branching hairs, which, being closely interlaced, conceal the margins. It differs however from *Anthocercis* and *Cyphanthera* in the more expanded and almost rotate form of its corolla, its shorter and more obtuse lobes, and in its stamens being all perfect and equal in number to the segments of the border, although one of them is somewhat shorter. The peculiarity in the form of its anther consists in its being, like that of *Cyphanthera* and *Duboisia,* roundly discoid and deeply reniform; its attachment to the filament is in the deep sinus upon the side looking toward the style, while the external face is marked by a nearly annular groove that runs concentrically near the margin: along this line it bursts widely open, in an almost peltate form, by its two nearly equal gaping valves, showing a globular prominence in the middle, which is the receptacle of the pollen. This structure is the result, as I have already shown (p. 370), of the total abortion of one of the lobes that ordinarily constitute an anther, and not, as generally supposed, of the confluence of the two lobes. *Anthotroche* offers another distinguishing feature, in its perfectly free cup-shaped disk, that invests the base of the ovary: this must not be confounded with a somewhat similar appearance in *Anthocercis* and *Duboisia,* where the corolla breaks away by a circumscissile line, leaving a membranaceous cup surrounding the base of the ovary, as in *Lycium, Fabiana, Nierembergia, Sessea, Vestia, Cestrum* and some others: the disk, although also existing in *Anthocercis* and *Duboisia,* is not free to the base, as in *Anthotroche,* but is wholly adnate, and often inconspicuous, its obsolete lobes being sometimes almost free. The segments of the calyx and corolla are frequently six, when the stamens correspond in number: under the usual pentamerous development, one or two of the lobes of the border and one of the stamens are sometimes smaller and defective, but this appears always caused by the injuries produced by insects, to which the flowers are subject, rather than the consequence of any real irregularity.

The following is an amended description of its generic character:—

ANTHOTROCHE, Endl. Gen. Pl. p. 1404; Nov. Stirp. Mus. Vindob. 7; A. DC. Prodr. xiii. 674.—Char. emend.—*Calyx* campanulatus, ultra medium 5–6-fidus, laciniis subacutis, extus lanato-tomentosus, intus glanduloso-pubescens, persistens. *Corolla* extus lanato-tomentosa, tubo basi breviter cylindrico, dein late campanulato, limbo explanato-rotato, 5–6-partito, laciniis subæqualibus, utrinque tomentosis, æstivatione (ut in *Anthocercide*) applicativa. *Stamina* 5–6, inclusa, tubi coarctatione ex annulo dense tomentoso orta, *filamenta* hinc complanata, valde geniculata et barbata, superne glabra, et tenuiora, apice reflexa; *antheræ* rotundatæ, profunde cordatæ, versus sinum affixæ, extrorsæ, 1-loculares, 2-valves, rima hippocrepiformi extus dehiscentes, receptaculo pollinis in fundum globoso. *Pollen* globosum, reticulatum. *Ovarium* obovatum, dimidio basali disco libero cupulari carnoso margine crenato circumdatum, 2-loculare: *ovula* plurima, adscendentia, placentis utrinque dissepimento adnatis affixa. *Stylus* filiformis, apice incurvus. *Stigma* clavatum, sub-bilobum. *Capsula* ovata, calyce recondita, 2-locularis, septifrage 4-valvis, valvis coriaceis, dissepimento plano, lunato, coriaceo, soluto, imo seminifero, superne fisso. *Semina* tereti-oblonga, subincurva, *hilo* infra medium faciei ventralis affixa, *testa* favoso-scrobiculata. *Embryo* (sec. Endl.) in axi *albuminis* carnosi, *cotyledonibus* brevissimis obtusis, *radicula* infera tereti, basi incurva, imo spectante.—Frutex *Australasiacus ramosus, pube brachiato densissime lanato-tomentoso vestitus*; folia *alterna, ovata vel obovata, integra, crassiuscula, brevissime petiolata, juniores in ramulis novellis valde conferti, et hinc* flores *solitarii, subses-*

siles, parvi, violacei, valde approximati, et subterminales: calyx et corolla *dense tomentosi.*

1. *Anthotroche pannosa*, Endl. *loc. cit.*; Walpers, Rep. iii. 236; DC. Prodr. xiii. 676;—fruticosa, tomento cinereo dense pannosa, ramis pedalibus, ramulis alternis, foliis obovatis vel ovatis, obtusissimis, basi nonnihil attenuatis, brevissime petiolatis, crassiusculis, adultis stellato-pubescentibus, junioribus densissime tomentosis, imbricatim aggregatis; floribus solitariis, subsessilibus, imo bracteatis, limbo violaceo, lineis purpureis picto, capsula calyce immutato obtecta.—Australasia, ora orientali ad Swan River.—*v. s. in herb. Hook. et Lindley.* (Drummond).

This plant has a very peculiar aspect, greatly resembling that of *Leucophyllum*, being densely covered with long grayish tomentum, the hairs of which are, in like manner, flexuosely branched and matted together, and often stellated at some of the joints; this falls off in the older leaves, which are then marked by several distinct stellated points. The leaves are 10 to 12 lines long (including the very short petiole of half a line) and 5 to 6 lines broad; they are entire, fleshy, without apparent nervures, somewhat rugose, and concolorous on both sides: the young leaves and flowers are crowded in the nascent branchlets, the corolla being small and of a violet hue: the tube of the calyx is 2 lines long, terminated by five equal teeth 3 lines in length, the obtuse bract being 3 lines long and 1 line broad; the basal contracted portion of the tube of the corolla is $1\frac{1}{2}$ line long, 1 line in diameter, hence it is suddenly campanular, another line longer, and 3 lines in diameter across the mouth, where it is terminated by five subequal expanded segments, each $1\frac{1}{2}$ line long and 1 line broad, expanded to a diameter of 6 lines. The capsule is $2\frac{1}{2}$ lines long and broad; the seeds are $\frac{1}{2}$ line in length and barely $\frac{1}{8}$ line in diameter: in the structure of the capsule and seed there is much analogy with that of *Leucophyllum**.

Duboisia.

This genus, first established by Mr. Robert Brown in his 'Prodromus,' is very closely allied to *Anthocercis, Cyphanthera* and *Anthotroche*, scarcely differing from the former except in its baccate fruit. It was subsequently well figured by Endlicher in his 'Iconographia,' from drawings of the celebrated artist Ferd. Bauer, who accompanied Mr. Brown in his Australasian travels. It was placed by Mr. Bentham in his tribe *Salpiglossideæ*, but

* A figure of this plant, with ample details of its structure, will be given in a supplementary plate in the 'Illustrations of South Amer. Plants.'

subsequently I pointed out the features that separate it from the *Scrophulariaceæ*, and suggested its true position in the system among the *Atropaceæ*, in the tribe *Duboisieæ* (*huj. op.* iii. 165). Since the description of the typical plant, now forty-three years ago, no other species has been known, and that was called *D. myoporoides* by Mr. Brown, on account of the similarity of its habit to *Myoporum*. This genus, indeed, serves to connect the *Atropaceæ* with the *Myoporaceæ*, as at present limited, through *Disoon*, which has a monopetalous corolla with five equal segments, having an imbricated æstivation, with the same peculiar involution of the margins, as in the *Duboisieæ*. Like *Anthotroche* it has didynamous stamens, with similarly formed anthers, only that they are introrse: it has also a bilocular ovarium, but each cell has only a solitary suspended ovule; its fruit is also drupaceous and bilocular; of its embryo nothing is known: should it even have a superior radicle, as is most probable, its ordinal tendency would even then appear to lean more towards the *Scrophulariaceæ* than to the *Myoporaceæ*. The same may be said of *Nesogenes*, judging from the description given of its structure. The chief distinction between the *Scrophulariaceæ* and the bilocular section of the *Myoporaceæ* consists in the different direction of the embryo, but this character is of little value, as it arises merely from the more pendent or ascending position of the ovules, and in both cases the radicle points alike to the hilum. We must remember that exceptional cases of this kind occur in *Scrophulariaceæ*, for instance in *Leptorhabdos*, *Melampyrum* and *Tozzia*, which also have only two suspended ovules, where sometimes only a single seed becomes perfected, and where from its pendulous position the radicle is superior, contrary to the usual character of the family. Under such views, the ordinal tendencies of *Leptorhabdos* and *Disoon* appear to point in the same direction, from which the baccate fruit of the latter would not exclude it, because, although a rare occurrence in *Scrophulariaceæ*, this does sometimes occur, as in *Halleria*, &c.: in *Atropaceæ* it is more frequent. Consequently it would be more consistent to refer to *Scrophulariaceæ* all the genera of the *Myoporaceæ* possessing a bilocular ovarium, where the ovules are attached to a simple dissepiment, and to confine the limits of the *Myoporaceæ* to those genera where the dissepiment is so greatly produced and introflexed as to produce four distinct cells, and often other pseudo-cells. The latter, according to the views of most botanists, offer a structure closely approaching that of the *Verbenaceæ* and *Borraginaceæ* (the *Echial* alliance of Prof. Lindley): the former clearly belong to one of the orders of the great *Solanal* alliance as above suggested: the distinction in point of structure is considerable and manifest. In habit, *Disoon* and *Nesogenes* are said scarcely to resemble Myoporaceous plants. Many points of analogy between these genera and *Sclerophylax* are deserving of attention. The genus last mentioned has a tubular corolla, the segments of which have an involuted æstivation, as in *Disoon*; five stamens, one of which is smaller; a superior bilocular ovarium, with a single suspended ovule in each cell; the fruit is an indehiscent 2-celled carcerule, enclosed in the augmented calyx, with a single suspended seed in each cell, the somewhat terete embryo being enclosed in albumen with a small superior radicle. It differs, however, in the form of the anthers and the peculiar growth of the calyx in fruit. We must not forget, too, the analogy existing between *Disoon* and the *Selaginaceæ*, in their hippocrepiform 1-locular anthers, their didynamous stamens, and the structure of the ovary, fruit and seed. These genera, for the reasons above given, are probably more allied to the *Scrophulariaceæ* than to the *Verbenaceæ*. Mr. Bentham's view is probably well founded, that the true *Myoporaceæ* do not differ ordinally from the *Verbenaceæ*, which is confirmed by the occasional presence of albumen, as I have observed, in the seeds of the latter family.

Another novel point of structure in the *Duboisieæ* is worthy of our consideration. The placentæ are adnate to the base of the simple dissepiment, the upper portion of which is membranaceous and marked by a thickened nervure, where, as the ovary enlarges, this part becomes split and separated into two lateral portions, attached respectively to the opposite walls of the pericarp: consequently both the berry of *Duboisia* and the capsules of *Anthocercis*, *Cyphanthera* and *Anthotroche* are incompletely bilocular in the summit, and the dissepiment becomes more or less lunulate, as occurs in several genera of the *Goodeniaceæ*. Another fact, at the same time, should be remembered, the great approach in the character of the æstivation of the corolla among the *Duboisieæ*, to that existing in the *Goodeniaceæ*.

There is little to add to the observations already made upon the structure of this genus, except to indicate an error in its generic character, as given in the 'Prodromus' (DC. x. 191), where the radicle is said to point to the basilar hilum: this is an oversight; the radicle certainly points to the base of the seed; but the hilum, as in *Anthocercis* and its congeners, is seen upon the ventral face, a little below the middle, in the sinus of its slight curvature. Mr. Bentham there points to an error in Endlicher's interpretation of Bauer's analysis above referred to, wherein the seed is mistaken for the placenta, and a tubercle of the seed for the seed itself: whatever may have been Bauer's intention, I can confirm the truth of the above remarks from my own observation, with this difference, that the areolæ represented in the plate, and said to be tubercular rugosities, are in fact deep hollows. The mode of its inflorescence is very peculiar, and similar to that of *Cyphanthera*.

The following designation of its generic features will be found to be more in accordance with the facts just enumerated:—

DUBOISIA, R. Br. Prodr. 448; Endl. Gen. n. 3906; DC. Prodr. x. 191.—Char. emendat.—*Calyx* parvus, campanulatus, æqualiter et breviter 5-dentatus, mox corollæ incremento sæpe fissus, et tunc sub-bilabiatus, persistens. *Corolla* late tubulosa, tubo superne vix ampliore, imo supra basin demum circumscisso, limbi laciniis 5, oblongis, obtusiusculis, tubo 4to brevioribus, patentibus, nervosis. *Stamina* 4, inclusa, didynama, cum rudimento quinti inter 2 longiora; *filamenta* paullo supra basin tubi inserta, hinc geniculata et dilatata, superne linearia, 2 majora tubo dimidio, 2 minora tubo 4to breviora, apice recurva; *antheræ* extrorsæ (iis *Anthotrochidis* similes). *Ovarium* ovatum, corollæ tubi reliquo imo indutum, 2-loculare; *ovula* pauca, dissepimento utrinque placentifero adnata, adscendentia. *Stylus* filiformis, brevis, apice declinatus. *Stigma* clavatum, 2-lobum. *Bacca* parva, globosa, vel ovata, calyce immutato fisso suffulta, 2-locularis. *Semina* pauca perfecta (6–8), adscendentia, oblongo-cylindrica, incurva, ad dissepimentum subtenue superne incompletum utrinque adnata; *testa* crustacea, foveis magnis scrobiculata, *hilo* paullo infra medium in sinu ventrali; *embryo* in *albumine* teres, subincurvus, *cotyledonibus* brevissimis, *radicula* infera basi spectante et ut in *Anthocercide* hilo evitante.—Arbuscula *Novæ Hollandiæ*; folia *alterna, lanceolato-oblonga, glaberrima, integra*; paniculæ *ex axillis ramulorum novorum iterumque conjugatim brachiatæ, brachiis* (*uno sæpe abortivo*) *utrinque e nodis geminatis cupularibus bracteatis ortis*, bracteis *cito caducis*, pedicello *terminali semper inter cupulas ultimas surrecto*; flores *parvi, pedicellati, cærulescentes*; baccæ *parvæ, nigræ*.

1. *Duboisia myoporoides*, R. Br. *loc. cit.*; Endl. Iconogr. tab. 77; DC. Prodr. *loc. cit.*—Notelæa ligustrina, *Sieb. Fl. Nov. Holl. Exs.* 259. *non Vent.*;—omnino glabra, foliis lanceolato-oblongis, obtusiusculis, e medio in petiolum elongatum gracilem sulcatum gradatim angustatis, utrinque concoloribus, crassiusculis, nervis plurimis parallelo-divergentibus intra marginem cæsim arcuatis immersis; ramulis floriferis, brevibus, erectiusculis; fructiferis demum valde elongatis, et tunc quam folio magis deflexis, horizontaliter patentibus: pedicellis solitariis, in dichotomiis paniculæ terminalibus, brevibus: baccis piso minoribus, nigris, calyce fisso suffultis.—Novæ Hollandiæ ora

orientali.—*v. s. in herb. Hook., Nov. Holl.* (Sieber), *River Hastings* (Fraser), *Port Macquarie* (Backhouse), *Sydney* (hort. bot. cult.).—*In herb. Heward, Illawarra* (A. Cunningham).

Bauer's figure, above referred to, gives an excellent representation of this plant when in fruit: at first, however, the younger flowering shoots assume the appearance of very branching panicles, the lower ramifications being alternate, the upper ones opposite and dichotomously branching, with a single flower in the intervals; they are about 3 inches long, but when the fruit becomes ripened, they attain a length of 6 or 10 inches, and are much more deflexed than the axillary leaf from which they spring: most of the bracts fall away, but others, especially the lower ones, grow ultimately into leaves: the pedicels are 2 lines long in flower, and 3 lines in fruit; the calyx is $\frac{3}{4}$ line long; the corolla 2 lines in length, and is said to be of a bluish lilac colour: it flowers in October: the berry is $1\frac{1}{2}$ line in diameter*.

XLII.—*Notes on some British Zoophytes.* By Wyville Thomson, F.R.P.S. &c., Lecturer on Botany, Univ. and Marischal College, Aberdeen.

[With a Plate.]

Before describing what I consider as an addition to an obscure group of zoophytes allied to the *Sertulariadæ*, I shall premise a few remarks on the peculiarities of one of its immediate neighbours—*Coppinia arcta*. I shall do this in order to illustrate more fully the relations of the new genus.

Coppinia differs from all other known full-grown *Sertulariadæ* in having no common axis to its polypidom. Each polyp seems to be possessed of a separate curved tube, one extremity free and of a stout horny consistence, the other somewhat flask-shaped, much thinner, and imbedded in a coherent mass of horny granules. This spongy matrix is hollowed out into a layer of minute areolar chambers.

Additions to the colony appear to take place by the budding of the hydræ at the base of the tube-like cell, by which process a new hydra is formed, which is separated from its parent, secretes a tube-cell of its own, and ultimately excretes a quantity of granular matter which pushes it back still further from the rest of the community.

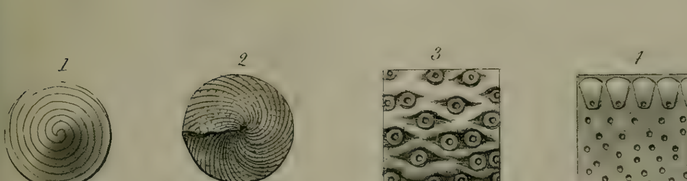
This interstitial propagation goes on only to a certain extent,

* Analytical details of this species will be given in a supplementary plate, in the Illust. of South Amer. Plants.

A

W. Thomson del.

B



J. Carter del.

J. De C. Sowerby

as the mass never loses its definite shape, and never increases in size beyond a certain point. The propagation of this species by means of planulæ has been most correctly described by Sir John G. Dalyell (Rare and Remarkable Animals of Scotland, vol. i. p. 224). The planulæ appear to be free buds developed from the base of the hydra, escaping into the cavities of the areolar matrix.

The free extremity of the tube-cell is provided with a valve-like operculum, which closes on the retreat of the polyp and after its death.

The species which I am about to describe, and which I shall call *Reticularia immersa,* differs from *Coppinia* and approaches the other Sertularians in having its polyp-cells springing from a common horny tube. This tube is in the form of an anastomosing, investing network, and is immersed in a homogeneous horny secretion, from which the minute, curved polyp-cells, differing little in calibre from the common tube, stand out.

The propagation of this species has not been observed.

Reticularia, n. g.

Animal, a Sertularian polyp of a greenish colour, with numerous smooth, solid tentacula; very minute. Polypidom, a parasitical investing network of horny tubes, immersed in a homogeneous horny crust. Polyp-cells short projections of the netted tubes, arc-shaped, with circular, patulous orifices without opercula.

R. immersa, n. s.

I have found this species pretty frequent at Newhaven, usually investing *Sertularia abietina.* Aberdeen, P. Forbes, Esq.

Coppinia arcta appears to have but a slender title to a position among the *Campanulariadæ,* where Dr. Hassall originally placed it, and some of its allies seem to dwell among them with as little cause. The four *Laomedeæ* have undoubted right, and *Campanularia lacerata,* which has been shown by Mr. Hincks to be referable to this genus (Hincks in lit.); and so have *Campanularia volubilis, C. caliculata* and *C. integra.*

Mr. Hincks has however shown that the so-called *Campanularia syringa* is a true Sertularian; its near ally *C. minutissima* (Hincks) may probably accompany it. *C. dumosa* appears to be nearly allied to *Coppinia*; the connecting link *Reticularia* possessing much of the habit of *C. dumosa* united to the investing crust of *Coppinia.*

Probably, when their reproductive processes have been more fully made out, these three last may form a small group intermediate between the Sertularians and the Campanularians.

I have sent a specimen of *Reticularia* to the British Museum.

EXPLANATION OF PLATE XVI. A.

Fig. 1. *Coppinia arcta.* Two full-grown polyps and polyp-cells; another forming between them.
Fig. 2. *Reticularia immersa* investing a polyp-cell of *Sertularia abietina.*
Fig. 3. Portion of the crust still more enlarged.

XLIII.—*Observations on Relative Position; including a new Arrangement of Phanerogamous Plants.* By B. Clarke, F.L.S. &c.

[Continued from p. 200.]

[With three Plates.]

Part III.

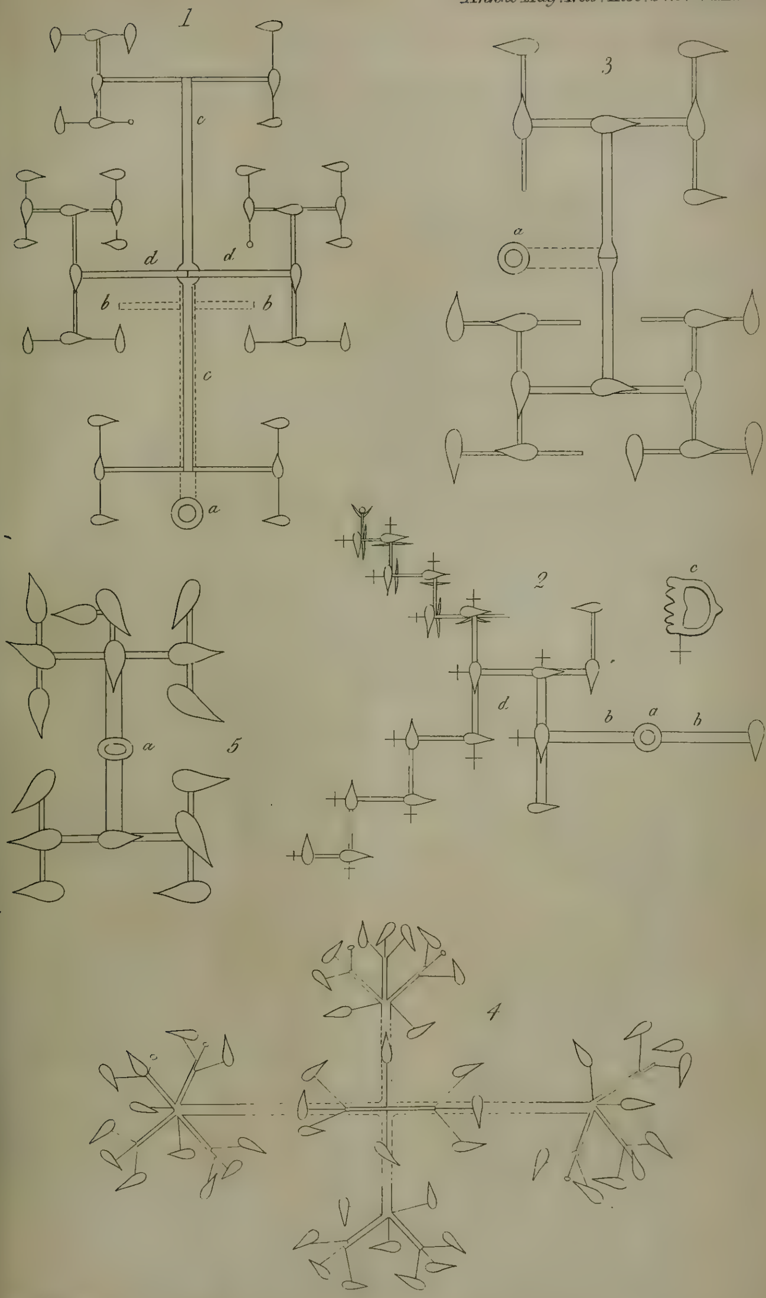
On the Structure of Ovaries consisting of a Single Carpel; to which is added a Table of the Position of the Carpels in Dicarpous Ovaries.

With reference to the position of the single carpel, the most obvious mark has been taken as a guide to the placenta or ventral suture, such as the origin of the style from one side of the ovary, the parietal attachment of the ovules; and when from being erect, or pendulous from the apex of the ovary, they failed to answer this purpose, the existence of a furrow or fissure on one side only of the style, such as occurs in Amygdaleæ, has been adduced as an evidence. But that the peculiarities of structure from which its position is in certain cases inferred may be better understood, the following notes are subjoined, accompanied in some instances with remarks on affinities and other details, the Natural Orders being consecutively arranged as in Tables I. and II.

Endogens.

Pontederaceæ. The ovary of *Pontedera lanceolata* is remarkable for agreeing with that of *Centranthus ruber* in two of the three cells being much reduced in size and barren, and the raphe of the single pendulous ovule is lateral also in both, that of *Pontedera* being more strongly marked than usual. Of the three carpels of *Pontedera*, two are obliquely posterior and one anterior, the latter only being fertile.

Marantaceæ. Of the three carpels of *Maranta dichotoma*, two are obliquely posterior and one anterior, with but little variation. Of these, two are barren and their cavities suppressed; but in this instance either of the three carpels is indifferently the



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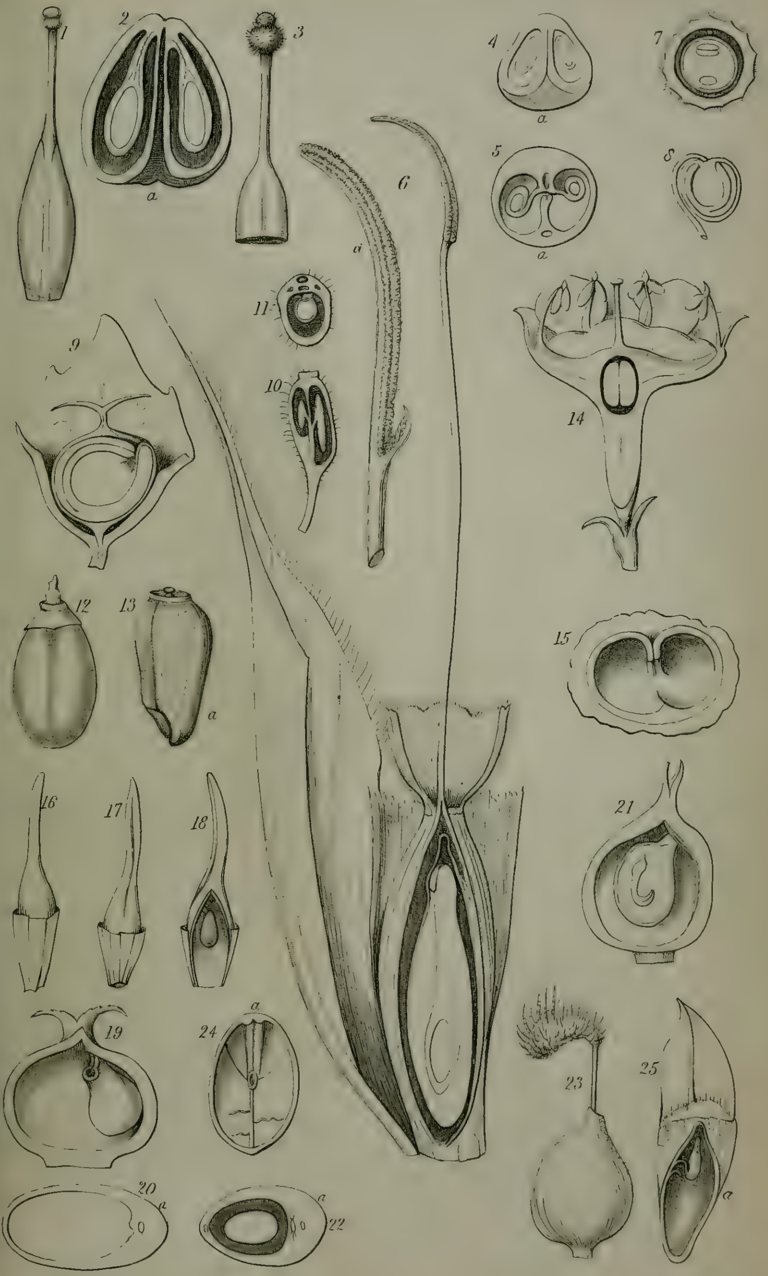

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J. De C. Sowerby sc.

fertile one, and on this account *Maranta* is considered as Heterocarpous.

ARACEÆ. In this and in the allied families the position of the carpels when two appears variable; thus, in a species of *Pothos* all are right and left; in a *Wallichia* they are anterior and posterior, with very rare exceptions; and in dicarpous ovaries frequently occurring in *Sparganium ramosum,* they are variable and sometimes oblique.

In *Typha* and *Sparganium* the single carpel is very frequently posterior, and in *Arum* I have endeavoured to show always so. (See Part IV. *Arum maculatum.*)

HETEROCARPOUS EXOGENS.

This division, although several nearly allied families are excluded, is yet in itself a natural assemblage; the connexion however between the Gentianal and Nymphal Alliances is weak, but as some of the genera of Orobanchaceæ have the placentation dorsal, there may be a direct affinity existing between them. (See also Part IV. *Hydropeltis.*) *Villarsia nymphæoides* also corresponds with *Nymphæa alba* in the ovules being horizontal with the raphe for the most part on the upper surface.

GENTIANACEÆ. In *Leianthus* the carpels are anterior and posterior, and also in *Erythræa littoralis,* but in *E. centaurium* occasionally right and left, and *Chlora perfoliata* agrees with the latter species. *Chironia* and *Villarsia* also form partial exceptions to the lateral position of the carpels in this family in presenting an irregular arrangement, some of the carpels being anterior and posterior and others oblique.

CERATOPHYLLACEÆ. In *Ceratophyllum* a transverse section of the ovary presents no appearance by which the position of the carpel can be determined, but the stigma is unilateral and curves posteriorly with but little variation, sometimes curving down behind the ovary; in addition to this it is grooved more or less deeply, and this groove deepens towards the base in front. The posterior surface is rounded and not stigmatic. (Pl. XIV. figs. 1 & 2.)

But the attachment of the female flowers and young branches is somewhat different, each bud or young branch arising from the axil of a leaf, but the female flowers rather from the stem between two leaves: whether this should be taken into consideration in determining the position of the carpel remains a question.

CHLORANTHACEÆ. The only indication of the position of the carpel in *Chloranthus* is that the stigmatic tissue obliquely crosses the thickened summit of the ovary and always descends on its anterior side. The ovule has obviously the appearance of being suspended from a funiculus arising in the base of the ovary and adherent to its dorsum. (Pl. XIV. fig. 5.)

PIPERACEÆ. In fully developed ovaries of *Piperomia magnoliæfolia* the stigma is always grooved on its anterior surface, but is rounded posteriorly; this furrow is also prolonged down to the ovary terminating in a small depression on its summit. (Pl. XIV. figs. 3 & 4.)

The ovary also nearly resembles that of *Houttuynia cordata* when reduced to a single carpel, which leaves no reason to doubt but that in Piperaceæ the carpel is posterior.

SAURURACEÆ. In almost all the spikes of *Houttuynia cordata* there are in the upper part dicarpous ovaries, the carpels of which are for the most part anterior and posterior, but occasionally right and left; in sixteen instances (these being all that were observed of ovaries reduced to a single carpel) it was always directly posterior, no trace of a second being present.

RANUNCULACEÆ. In *Actæa* the greater part are lateral, otherwise indifferently anterior or posterior.

DILLENIACEÆ. Variable, or more frequently posterior.

MAGNOLIACEÆ. In *Tasmannia* variable from anterior to posterior.

MENISPERMACEÆ. The ovary of *Menispermum laurifolium* consists of three carpels, one anterior and two obliquely posterior, and when reduced to a single carpel its position varies from anterior to obliquely posterior.

ANACARDIACEÆ. In three genera variable, and in *Malosma* more frequently posterior than anterior. *Spondias*, which has been regarded as the type of a distinct family, agrees with Anacardiaceæ in having the raphe averse.

LAURACEÆ. The ovary of *Sassafras officinale* closely resembles that of *Prunus* and other Amygdaleæ, the stigma being capitate, and the style furrowed on one side and rounded on the other. In *S. officinale* there is also at the base of the style a small depression in which the furrow in the style terminates; the capitate stigma is also somewhat notched by the furrow extending into its margin, and the ovule is attached to the same side of the ovary at or below the depression at the base of the style (Pl. XIV. figs. 6, 7 & 8). The carpel is variable in its position, being frequently posterior, but in *Laurus nobilis* it is for the most part lateral.

Notwithstanding this near approach in structure to Amygdaleæ, the carpels in a dicarpous ovary of *S. officinale* appeared to be united by their edges forming a one-celled ovary, the styles being also partially united. In *Tetranthera* also the ovary consists of a single carpel.

Santalaceæ and Loranthaceæ. In *Thesium* the funiculus is either anterior, posterior or lateral, and such also are its variations of position in *Mysodendron,* two of the ovules being rudimentary (or wanting ?), and I believe also in *Loranthus*. So nearly do these families approach each other, that it is a question if they are really distinct; for although in *Mysodendron* the nucleus is destitute of integuments, yet it is inverted, the funiculus being attached to it on the averse side relatively to the central placenta, from which attachment a thickened rib descends to its lower extremity; the embryo also is at the upper part of the nucleus, and the funiculus curves over the embryonal sac to reach its point of attachment (vide fig. 3 in Plate II.). The apparent calyx of *Mysodendron* may be regarded as bracts originating at the base of the ovary and adhering to its sides, as an analogous structure occurs in *Abelia* and *Linnæa,* where the bracts are not adherent. And although in Santalaceæ this character is wanting, yet there is a tendency to adhesion of the bracts as in *Thesium,* where they are adherent to the peduncles in the greater part of their extent. The adhesion of bracts to peduncles is also a common occurrence in Loranthaceæ, which offers an explanation for those situated at the base of the ovary becoming adherent to its sides.

Elæagnaceæ. *Hippophaë* variable and more frequently posterior; *Elæagnus* variable and more frequently anterior.

Stilbaceæ. Having expressed an opinion that in this family the female flowers are apetalous, I can now add that a more recent examination of the species of *Stilbe* leaves no reason to doubt that they are really so, and also leads to the supposition that the flowers consist principally, if not entirely, of hermaphrodites and females; it becomes a question therefore whether Empetraceæ might not be associated with them, and possibly Batideæ. In *Stilbe* the smaller cell is sometimes entirely suppressed, and the fertile cell in some species is almost uniformly posterior, being only occasionally anterior. (Pl. XIV. figs. 9 & 10.)

Lythraceæ. In *Peplis* nearly all right and left; in *Lythrum* most frequently anterior and posterior; and in *Pleurophora* always so. In *P. pungens* the larger cell is always posterior, the anterior being sometimes almost suppressed.

Podostemaceæ. This Order is placed near Lythraceæ as being an apetalous form of it; the stamens are distinct or monadelphous in both; in Lythraceæ the posterior stamens are sometimes deficient, and this may prove to be an explanation of the unilateral position of the stamens occurring in Podostemaceæ; and it seems doubtful if there exists any differential character in the ovary and ovules.

Nyctagineæ. In the ovary of *Mirabilis* a flattened tuberosity with a depression in its centre, situated at the base of the style, shows the ventral side of the carpel, the stigma curving down on the opposite side (Pl. XIV. figs. 11, 12 & 13). The relative position of the ovary is more evident if the flower is examined in an early stage some time before it expands, as the style at the time of expansion becomes much elongated and loses its curvature. The carpel is always lateral and internal (Pl. XIII. fig. 3), *i. e.* its dorsum is next the internal branch of the dichotomy, between the forking of which the flower is situated; and *Cuphea* may be considered as analogous to *Mirabilis* in the position of its larger cell*. From this peculiarity Nyctagineæ are placed in connection with the Silenal instead of with the Urtical Orders.

Salvadoraceæ. The affinities of *Salvadora* have by most writers been considered as uncertain, but supposing the raphe to be next the placenta, the position of the fertile carpel would then nearly agree with that of *Plumbago,* being however not so frequently posterior. Its foliage also agrees with that of some species of *Statice* in having a granulated appearance, and two or three species have dotted leaves resembling those occasionally occurring in Myrsinaceæ.

Plumbagineæ. In *Plumbago* and *Statice* the position of the funiculus is variable, being anterior, less frequently lateral, and rarely posterior; the mode of growth in *Statice* is however complicated, which occasions its position in that genus to be less obvious.

Brunoniaceæ. This genus, usually considered as belonging to the epigynous series, if not of uncertain affinity, should rather, I would suggest, be arranged with Primulaceæ and its allies for the following reasons. The position of the raphe in *Brunonia* agrees nearly with that of the funiculus in *Plumbago* in being anterior or lateral, rarely posterior, from which it may be inferred, that in both these genera the fertile carpel is variable from anterior to posterior, the latter position predominating (Pl. XIII. fig. 5). *Brunonia* may also be regarded as approaching Dipsaceæ in having the same mode of growth as *Morina* and Valerianaceæ, *i. e.* regularly dichotomous, each capitulum in *Brunonia* consisting of six or eight fascicles, each of which contains a centre of growth, the ramifications of which are formed by the pedicel of each flower in succession becoming the axis of the two succeeding; the scales also surrounding the calyx may be compared to the involucel of Dipsaceæ, and in the adhesion of the anthers an analogy may be traced with Calyceraceæ.

* The irregularity of the flower in *Cuphea* is considered to be from side to side, and the mode of growth irregularly dichotomous, each flower being terminal.

Plantagineæ. In *Littorella* the axils are three-flowered, the central being axis to the two lateral; in this family the raphe is next the placenta, but it is here feebly marked, and I can only say that it is variable, being rarely, but I believe occasionally, anterior, from which it would appear that the fertile carpel is for the most anterior or lateral, thus approaching Dipsaceæ in this character.

Illecebraceæ. In *Illecebrum* and *Herniaria* the stigmas are all anterior and posterior, the ovary consisting of two carpels united by their margins; and the seed is erect, having the radicle always curved down on the posterior side, thus agreeing with *Atriplex* and *Chenopodium Bonus Henricus* both in the position of the stigmas and of the cotyledons and radicle. In *Paronychia* the examination is difficult in consequence of the diminutive size of the ovary; in two or three instances however the funiculus was evidently anterior (in *P. capitata*), and in others apparently so, no variation being observed.

Chenopodiaceæ and Amaranthaceæ. In Chenopodiaceæ and Amaranthaceæ the ovary has the appearance of consisting of carpels united by their margins as in Polygonaceæ, Alsineæ, and Illecebraceæ, the ribs of the ovaries, if any are present, being opposite the stigmas, and when the stigmas are two being equally marked on both sides *. In *Beta*, &c. the funiculus adheres to the side of the ovary, and this adhesion is for the most part anterior, rarely right or left; but if the funiculus is free, as in *Rhagodia*, it still has the same position, being also in either case opposite a stigma when the ovary is digynous. As the funiculus in these instances is the remains of a central placenta, the position of the ovule shows a tendency to the production of the single carpel for the most part posterior as in Piperaceæ, and surely this is placed beyond doubt when it is recollected that in *Atriplex* and *Chenopodium* when the seed is erect the cotyledons are anterior.

In *Gomphrena* the funiculus is lateral and the stigmas right and left, which may be regarded as an approach of Amaranthaceæ to Nyctagineæ, and also to Polygonaceæ, as in *Polygonum*, when dicarpous, the carpels are all right and left.

Epacrideæ. The ovary of *Acrotriche cordata* is not unfrequently one-celled, and the position of the carpel is then variable, being frequently posterior.

Combretaceæ. The style of *Combretum* is more or less oblique in its direction, as also the ovary, and the obliquity fre-

* To this it may be added, that the ovary of *Basella* evidently consists of three carpels united by their margins, three smaller ribs alternating with three larger, and the latter being continuous with the stigmas; the position of the ovule is uniform, and I believe corresponds with that of *Illecebrum*, &c.

quently differing gives the raceme a somewhat irregular appearance; on one side of the style is a furrow sometimes marked very faintly, but often quite distinctly, and occasionally it is deepened into a fissure for some distance below the stigma; and the opposite side is quite rounded, having the aspect of a dorsal surface. The position of the carpel, as taken from this character, is variable, and frequently posterior as in *Cratægus.*

Amygdaleæ. Variable, and in *Cerasus Laurocerasus* more frequently posterior.

Sanguisorbaceæ. The lateral attachment of the style readily shows the position of the carpel, which is best seen in the species of *Sanguisorba,* and can be ascertained by making a transverse section of a mass of flowers close to the axis, when the irregular position of the style will become obvious. The carpel is rather less frequently posterior than anterior, but in *Cliffortia* always lateral, as elsewhere referred to.

Daphnaceæ. In Daphnaceæ the lateral attachment of the style shows the position of the carpel, the ovule being pendulous from the same side; but in *Daphne* itself the position of the raphe must be taken as a guide, which in this instance may be relied on, because in *Pimelea* the raphe is next to the placenta. In *Struthiola* and *Passerina* the carpel is almost constantly lateral, in *Struthiola* perhaps always so, thus approaching Proteaceæ. Yet the relations of the parts of the flower to each other in Daphnaceæ and Proteaceæ are different, as in Daphnaceæ the carpel is opposite a sepal, but in Proteaceæ alternate with the two anterior. In Daphnaceæ the tendency to suppression of stamens is on that side which is opposite to the carpel, as in *Lachnæa,* where the larger stamens and sepals are anterior while the carpel is posterior, but in Proteaceæ both carpel and larger stamens are anterior. In *Pimelea* the carpels are all posterior, the axils being one-flowered; in *Daphne* the axils are two-flowered, and the ovary of each stands with its dorsum towards the axil; and *Daias* is a mixture of these, apparently from the axils being three-flowered. (Pl. XIV. fig. 14.)

Cinchonaceæ. In Cinchonaceæ, as also in Caprifoliaceæ, there is no regularity in the position of the carpels of dicarpous ovaries, as they are either predominantly anterior and posterior, or as frequently right and left, or neither of the two predominates, being often also oblique; and this, taken in connection with the fact, that in the genus *Ribes* alone all these variations take place, tends to show that the position of the carpels when two is a character of comparatively inferior value, unless that such frequent contrariety and irregularity should make it probable that the position of the fertile or single carpel would be variable. The raphe being taken as an index to the placenta, the fertile carpel in *Opercularia** fully corresponds with that of *Aucuba* in being more frequently posterior.

Caprifoliaceæ. In *Abelia* the position of the one-seeded and only fertile cell is variable, and more frequently posterior than the fertile carpel of *Viburnum,* and as in that genus the raphe is lateral. (Pl. XIII. fig. 4.)

Cornaceæ and Alangiaceæ. The ovary of *Aucuba japonica* is probably not compound, as there are no remains of an abortive carpel; when fully developed the stigma is unilateral and almost horizontal, being stigmatic and somewhat grooved on its upper surface, and smooth and rounded beneath; the ovule is not attached to the apex of the cavity, but to the upper part of that side (immediately below the apex) which is away from the stigma, and the placentation consequently varies with the position of the stigma, being anterior when it is posterior and *vice versâ* (Pl. XIV. fig. 15). In *Marlea* the two cells are for the most part unequal, the smaller one being often much reduced in size, and the position of the larger cell corresponds nearly with that of the single carpel of *Aucuba* in being more frequently posterior or lateral.

Garryaceæ. The ovary of *Garrya* has all the appearance of consisting of two carpels united by their margins, as the ovules are attached to opposite sides of the ovary near the apex, their attachment alternating with the stigmas. It may therefore be regarded as having the same structure as that of *Helwingia* with retracted dissepiments, and with that genus as being a near ally of Santalaceæ. It may further be compared with Lauraceæ and also Daphnaceæ, if in the latter family, when dicarpous, the placentation should prove to be parietal.

Proterocarpous Exogens.

The connexion between the Polypetalous and Monopetalous Orders is here not always so distinct as in the Heterocarpous Division, and whether Solanaceæ are a monopetalous form of Papaveraceæ is rather a question, but if arranged with Polemoniaceæ they would in Table III. be placed as before with their nearest allies.

Fumariaceæ. In *Fumaria officinalis* one carpel is larger than the other, and to it the seed is always attached and almost exclusively so, the hilum being oval (the junction between the two carpels is however not obvious externally, but is distinctly seen

* The axis is here compound, each capitulum consisting of several centres of growth indicated by small whorls of partially adherent ovaries. The raphe is for the most part anterior, being lateral or posterior in only two or three of six instances.

internally); and the position of the larger of the two carpels is uniform, being always on the opposite side of the flower to the spurred petal. The two carpels will be all anterior and posterior, or all right and left, according as the irregularity of the corolla, or the axis is regarded, the spurred petal being lateral, although by twisting of the peduncle becoming nearly posterior. As in Ranunculaceæ the spurred petal is posterior, the fertile carpel in *F. officinalis* may so far be considered always anterior.

Berberideæ. In *Epimedium* and *Berberis* the carpel is anterior, obliquely anterior or lateral, but a careful examination of several species of the latter genus failed to show any carpels posterior; in *Nandina*, however, it is occasionally but not frequently posterior.

Byttneriaceæ. In *Waltheria* the anterior position predominates, the carpel being rarely, if at all, posterior, which shows further the connexion between Malvaceæ and Phytolaccaceæ, where in *Rivina* the carpel is always anterior.

Tropæolaceæ. From the irregularity of the flower, the inequality of the stigmas and the oblique direction of the style in *Magallana*, it may be expected that the position of the two carpels is uniform, and also that the carpel corresponding with the elongated lobe of the stigma is the fertile one; if so, the two carpels are always anterior and posterior, as in the figure of the fruit in Cavan. Ic. iv. t. 374, the spur of the calyx is represented as being on the sutural side of the remaining cell; and this shows also that the position of the fertile cell is most probably uniform, being always anterior, as the spur of the calyx is posterior.

Amyrideæ. In *Amyris toxifera* the position of the carpel is variable, being frequently anterior, but only occasionally posterior; and the same variation I believe occurs also in Aurantiaceæ, and these two families are, more than any others that I am aware of, exceptions to the Proterocarpous character of this division.

Scrophulariaceæ. In *Pedicularis palustris* the anterior carpel is always larger in diameter and considerably higher than the posterior, and the anterior column of the style is also thicker. This is also the structure of *Mendozia* as described and figured by Martius in 'Plant. Brasil.,' and which has been before alluded to as having the fertile cell anterior (Pl. XIV. figs. 16, 17, 18, 19, 20 & 21). It should be observed also that in *Mendozia* the posterior cell is usually barren even at the time of flowering.

Verbenaceæ. In *Lippia dulcis* and *Lantana crocea* and *albida* (the only species examined) the stigmas are anterior and posterior, and the ovary two-celled, but with the cells right and left, the former having also the anterior portion of the stigma much larger. The placentation is the same as in the two anterior lobes of the ovary of Labiatæ, and the relation of the unequal stigmas of *Lippia* to the cells leaves no doubt but that here the ovary consists of a single carpel always anterior. (Pl. XV. figs. 1, 2, 3, 4 & 5.)

Mimoseæ. Having observed carpels posterior in three species of *Acacia* in which the inflorescence was dense, it was thought possible that this might arise from the flowers growing three in an axil; this however is no longer a question, as carpels posterior occur where the axil is always one-flowered; but the posterior position does not predominate, as in *Cerasus Laurocerasus*; and in three species having a globular inflorescence the carpel is always anterior or lateral, which may be explained by the carpels posterior being confined to the upper half of the spikes or almost exclusively so.

In two instances of dicarpous ovaries occurring in *Phaseolus vulgaris* the ovary was syncarpous with parietal placentæ (the carpels in their upper part being separate and diverging in a manner somewhat analogous to those of a *Reseda*, but to a greater extent), thus showing an approach in Papilionaceæ to Moringeæ and Polygalaceæ, as probably does *Ormosia* with two unequal stigmas. But in an instance of three carpels occurring in an *Acacia*, they were quite disunited.

Proteaceæ. In Proteaceæ with capitate flowers, such as *Mimetes* and *Leucospermum*, the carpel is always anterior, and its apparently lateral position in *Banksia* seems owing to the axils being two-flowered. And in *Grevillea*, where incomplete resupination sometimes takes place, it is always anterior if the irregularity of the flower is attended to, being alternate with the two larger and longer sepals. But in *Anadenia*, where the flower is regular, the carpel, although always anterior in the lower half of the racemes, varies in its position towards the summit, and in rare instances is perhaps posterior. The peduncles are however long and the axils two-flowered, and carpels posterior are not so frequent as in *Acacia*, being also confined to the upper part of the racemes. In *Anadenia* instances of two carpels occasionally present themselves which are quite disunited, from which it may be expected that the gland on the posterior side of the ovary in *Grevillea*, &c., is a rudimentary carpel.

Looking at the habit of Proteaceæ they might be expected to be derived from Daphnaceæ, but the flower more nearly approaches that of *Petiveria* in having the carpel alternate with the two anterior sepals, whereas in Daphnaceæ it is opposite a posterior or lateral one; and if *Anadenia* may be taken into comparison they would agree in being apocarpous, *i. e.* supposing Petiveriaceæ to be, like Phytolaccaceæ, apocarpous.

Callitrichaceæ. *Callitriche* is placed near Selagineæ for the following reasons : in Selagineæ the calyx sometimes consists of two lateral sepals which enclose the flower much like the bracts of *Callitriche ;* the embryo has short blunt cotyledons resembling those of Selagineæ (but still more reduced), and approaching *Stilbe* as described by Endlicher ; but the raphe is next the placenta in Selagineæ, and on that account the affinity of *Callitriche* is rather with the latter Order, between which and Podostemaceæ or Elatineæ it may be regarded as forming a connecting link.

Valerianaceæ. In *Valeriana officinalis* the mode of growth is the same as in *Scleranthus,* &c. The fertile carpel in the forking of each division of the inflorescence stands with its ventral suture towards the inner branch of the forking and the dorsal next the outer branch, the gibbosity of the corolla being anterior and coming forward between the two branches (Pl. XIII. fig. 1). The regularity of the position of the fertile cell is perhaps connected with the irregularity of the corolla, as they always have the same relation to each other, although in *Valerianella,* where the corolla is quite regular, the position of the carpel is the same. But in Valerianaceæ the fertile carpel has sometimes the appearance of being posterior; this however arises from the mode of growth being the same as that of *Centranthus ruber* (Pl. XIII. fig. 2), viz. dichotomous with the flower sessile between the rami, one branch of the dichotomy being regularly suppressed, except near the principal axis (Pl. XIII. fig. 2 *d*); in such a case therefore the fertile cell is next the remaining ramus, and constantly so, as it is always the external ramus that remains*. In this diagram the successive branchings are represented as springing from each other at right angles (instead of obliquely as in the plant itself), that the relative position of the fertile cell may be more evident ;—the cross indicates the position of the spur of the corolla. The same mode of growth occurs in *Fedia sagittifolia,* where the barren cells are inflated.

Dipsaceæ. In *Morina* and *Scabiosa* the placentation is lateral, and the former agrees closely with Valerianaceæ in the carpel being lateral and external ; and in *Dipsacus sylvestris* it is posterior with remarkable regularity, although, from the elongation of the style, the position of the usually unilateral stigma becomes variable. (Pl. XV. fig. 6.)

Calyceraceæ. The ovule is here attached to the posterior side of the ovary, but nearer its apex than in *Dipsacus sylvestris,* which occasions its placentation to be less obvious ; and the raphe is anterior, so that a partial adhesion of the anthers may prove to be the only distinction between the two Orders, as the involucel of Dipsaceæ occurs here also.

* See also the description of the figure.

SCLERANTHACEÆ. In *Scleranthus annuus* the flower is sessile between the two branches of a forked stem, each of which again produces a flower sessile between two succeeding branches; each flower therefore stands in the relation of axis to the two succeeding flowers; but this can only be observed in large specimens growing in cultivated ground, where all the branchings become fully developed. The funiculus is uniformly posterior to the seed, in which character it differs from Chenopodiaceæ and their allies, where it is either anterior or lateral. The seed of *Scleranthus annuus* has the cotyledons next the funiculus, which may form also another differential character between Scleranthaceæ and their allies. (Pl. XV. figs. 7, 8 & 9.)

TETRAGONIACEÆ. In *Tetragonia africana* and *Trianthema micrantha* the mode of growth is, in the smaller ramifications, the same as in *Scleranthus*, and the placentation shows the single carpel anterior or (in the latter) occasionally lateral.

STYLIDIACEÆ. In *Stylidium graminifolium* the posterior cell is always less in diameter, and also less in depth than the anterior, and this, in connection with the irregularity of the corolla, forms perhaps a sufficient analogy for anticipating that in a one-celled ovary the fertile carpel would be anterior*.

GOODENIACEÆ. In *Dampiera lavandulæfolia* the ovary consists of two carpels anterior and posterior, but is one-celled from the cells communicating, or rather imperfectly two-celled; the posterior cell is much shorter (not extending below the upper half of the anterior cell), contracted and barren, being sometimes so reduced in size as to be scarcely apparent; and the single ovule is attached to the posterior surface of the anterior cell near its base, having the raphe next the placenta.

ONAGRARIÆ and HIPPURIDEÆ. Of thirty-two ovaries of *Circæa alpina*† thirteen had two cells with an ovule in each; in twelve the posterior cell was empty, and in seven it was closed, leaving the ovary one-celled. When fertile it was less in diameter and also less in depth (Pl. XV. figs. 10 & 11). In the ovary of *Hippuris vulgaris* there is nothing in the structure either externally or within the cavity to show whether it consists of one or two carpels, nor yet in the style or stigma, as the latter is terete and pointed; but on the external surface of the bony nut of the mature fruit, there is found when it is denuded a

* This analogical argument has since been verified in the instance of *Stylidium adnatum*, where the ovary consists of a single carpel anterior; or if two are present the anterior only is fertile, as the ovules are always attached to the posterior angle of the cell.

† Taken from the plant in cultivation in the Botanic Gardens of Kew. When the ovary is two-celled the cells are all anterior and posterior, as also are those of *C. lutetiana*.

shallow furrow extending from its summit to its base, and this furrow is always posterior (Pl. XV. fig. 12). This may be taken as an indication of a single carpel uniform in its position, and (considering the near affinity of *Circæa*) in all probability anterior, the stamen also being anterior.

Compositæ. That a tendency exists in Compositæ to suppression of the posterior carpel is shown by the achenia of the Sunflower, and especially by those of *Centaurea*, where the anterior portion of the ovary is both larger and thicker than the posterior; and as in both these plants the stigmas are anterior and posterior, it would be difficult to account for the inequality of the ovary on any other hypothesis. In *Centaurea nigra* there is, besides the shrinking of the posterior portion of the ovary, a line on each side like a suture; there are also two others, one anterior and the other posterior; and as the flower is quinary, these four lines may be relied on as marking the presence of two carpels, and the two lateral of these the juncture between them: it frequently also occurs that two-thirds of the ovary are on the anterior side of the two lateral lines and sometimes more, so that the posterior half of the ovary becomes almost rudimentary, being also much shorter than the anterior from contraction at its base (Pl. XV. fig. 13). This latter character is also well represented in Dr. Lindley's 'Vegetable Kingdom,' the figure being that of *C. Cyanus*.

The ovary of *Aster sibiricum* has nearly the same structure as that of *Centaurea*, and the anterior portion of the stigma is in the marginal florets frequently elongated like that of *Ruellia* or *Stemocanthus** (vide fig. 9 in Plate II.). But it should not here pass unnoticed that the position of the stigmas, except where the style is thickened or very short, as in *Euxenia*, cannot be relied on as an index of the position of the carpels, as the style very commonly becomes twisted half round, of which *Lasthenia* is an example.

Chamælauciaceæ. In *Calytrix virgata* the placenta is central, is a prolongation of the pith, and is continued uninterruptedly into the style, and as neither style nor stigma exhibit any evidences of division the carpel must be wanting, and the style only a prolongation of the axis, as suggested by Dr. Schleiden in certain cases where the flower is superior. The cavity moreover is imperfect, being occupied by cross bands of cellular tissue. The ovules are attached to the anterior side of the central column, or very rarely more or less laterally, which can scarcely be regarded as a character less than equivalent to a single carpel

* To this it may be added, that the attachment of the ovule inclines more or less to the posterior side of the ovary, and the position of the raphe being uniform tends to show that that of the fertile carpel is also.

anterior, of which an instance occurs in the nearly allied *Bækia*, as shown by the parietal placentation of the two ovules. (Pl. XV. figs. 14 & 15.)

Bruniaceæ. In *Brunia lanuginosa* the ovary consists of a single carpel always anterior. (Pl. XV. figs. 16, 17 & 18.)

Umbelliferæ. The position of the odd carpel is perhaps in some cases variable, but in *Æthusa Cynapium* the anterior carpel is much more frequently fertile, which may arise from the posterior one being occasionally smaller; the carpels are very commonly all anterior and posterior, but this is not without exception, the anterior and posterior position however still predominating as in Araliaceæ.

Casuarinal Exogens.

The families derived more immediately from Gymnosperms through Casuarina differ, as far as is at present known, from other divisions of Exogens, in having the raphe in pendulous ovules always next the placenta, a character which becomes less frequent as Endogens are approached. The connexion between the apetalous and polypetalous forms of this section is sufficiently obvious and has been frequently referred to; but the affinities between the polypetalous and monopetalous forms are not of so decided a character. It may be observed, however, that in their coronet Asclepiadeæ may be compared to Passifloraceæ; that they have in some instances the habit of Euphorbiaceæ; and that *Rauwolfia* among Apocynaceæ is an approach both in structure and habit to the latter family. And Apocynaceæ may also be compared with Violaceæ in their crested anthers.

Asclepiadeæ and Apocynaceæ. In such genera of these families as I have examined, the raphe (in cases of ovules numerous and horizontal) is always on the under surface of the ovule, which occasions the seed in *Gomphocarpus*, having become depressed in subsequent growth, to be pendulous with the raphe next the placenta, and the ovules of *Liquidambar* have I believe an equivalent character, the only other instance of the kind when numerous I have met with. In *Rauwolfia* the ovules are two, pendulous, with the raphe next the placenta, the raphe becoming rather curved as it descends, as in *Roumea*.

Euphorbiaceæ. When my first Dissertation on the Position of the Carpels was read to the Linnæan Society, *Eremocarpus* was considered to have its single carpel variable, although it remained a question whether it was not sometimes posterior; but having more recently examined that genus, I ascertained that in upwards of fifty instances there were no carpels posterior, and it was doubtful if any were lateral. The inflorescence here consists of spikes or racemes, one of the flowers only being female. In *Mercurialis annua* the female inflorescence is peculiar, consisting of two female flowers growing from one side of an axil, the central bud of which some time after developes as a leaf-bud. Of the two flowers the internal one is a lateral branch of the axil, and the central undeveloped bud is its axis, and the external one springs from its peduncle at or near the base. As thus viewed the carpels are all anterior and posterior instead of right and left, as at first sight they might be supposed to be; and *Vinca speciosa* has apparently the same mode of inflorescence and position of carpels, those of *Apocynum* (where the inflorescence is regularly branched) being also anterior and posterior.

Stilagineæ. If the female flowers of *Antidesma* are compared with apetalous Flacourtiaceæ, their near approach will become obvious, and on that account Stilagineæ are placed near Lacistemaceæ.

Dipterocarpeæ. It is perhaps a question whether this Order and Chailletiaceæ are branches of the Urtical and Amental Alliances, as they agree in several parts of their structure with Tiliaceæ and Anacardiaceæ, and particularly with Chlænaceæ in having two collateral pendulous ovules with the raphe next the placenta. There appears also to be in Dipterocarpeæ a strong tendency to a free central placenta, the dissepiments in *Vateria* being very fugitive, although the central column is continued up into the style.

Cucurbitaceæ. The ovary of *Sicyos angulata* consists apparently of two or three carpels united by their margins, and from the form of the ovary and placentation (supposing this to be its structure) the fertile carpel is for the most part anterior, but may perhaps be occasionally lateral if not posterior*.

Moreæ. In *Broussonetia* and *Morus* there are two stigmas terminating two ribs in the ovary; one of these ribs is much thickened, and to it the ovule is attached. The attachment of the ovule is therefore an evidence of the position of the carpel, which is readily ascertained by making a cross section of the ovary. The ventral side of the ovary, besides being thickened, has also a more vascular appearance, as if the rudiment of a second carpel were present (Pl. XV. figs. 19 & 20). In *Morus*

* I find, contrary to my expectation, that the raphe is here not next the placenta but turned directly away from it, which seems to require that Cucurbitaceæ should be stationed in the Ficoidal Alliance, which would then bring them into closer relation with Onagrariæ and Campanulaceæ, to the former of which, according to Auguste de St. Hilaire, they are most nearly allied. The ovule is attached to the apex of the cell, but a slender and entire cord of fibres continued from the raphe (which is quite distinct) crosses over the exostome and passes down the opposite side of the ovary.

nigra carpels posterior are very rare, even if the apparently posterior carpels are really so; but *Broussonetia* and *Ficus* show a decided contrariety in the position of the fertile carpel, although it is much less frequently posterior than in any other direction; perhaps not more frequently so than in some species of *Acacia*.

Urticaceæ. In *Parietaria officinalis* the stigma is entirely unilateral and always curves away from the axil; the posterior side of the ovary is rather less curved, and there are appearances of a faintly marked suture (Pl. XV. fig. 23). The ovary of *Urtica urens* has the stigma sessile, but the ovary is always more curved on one side, which proves to be always the anterior; it is probable therefore that *Urtica* corresponds with *Parietaria* in the position of the carpel.

Cannabineæ. The axis is here (as it frequently is in two-flowered axils) compound, as Mr. Brown has termed it, that is, the two flowers are to be understood as springing from a central axillary bud which remains undeveloped. Thus, in *Cannabis*, the axils of the bracts are two-flowered from the suppression of the central bud, which sometimes developes as a leaf-bud, and gives origin to a short branch, and the two stigmas in each flower are anterior and posterior to the central point of the axil. The seed is pendulous with a superior radicle, which is always on the external side of the ovary directly away from the axil laterally, the cotyledons being on the axillary side. In its early stages the ovule appears to be pendulous from the apex of the cell, but in the ripened seed its attachment inclines distinctly to the posterior side, though less so than in *Humulus*. On the internal side of the ovary (that is, next the central point of the axil) a thickened rib somewhat grooved extends from the attachment of the ovule to its base, which, considering also the position of the radicle and cotyledons, is doubtless the placenta; this rib appears as if consisting of two columns, whereas the rib on the opposite or external side of the ovary is single and acuminated; and each of them is opposite a stigma, the ovary being otherwise merely membranous (Pl. XV. fig. 24). The structure of the ovary, therefore, is the same as that of *Elatostemma* and *Morus*, and, taken in connexion with the position of the cotyledons and radicle, leaves no doubt that the fertile carpel is always anterior.

In the two-flowered axils of *Humulus* the same relations are maintained as in *Cannabis*, and when the flowers are increased to three or four, the developed carpel is still always on the flattened side of the bractlet or sepal infolding the ovary, the margin of which in the two first flowers is external or away from the axil, so that it has the same relation to the one-sided bractlet. The ovule is pendulous, not precisely from the apex but rather from the posterior side of the ovary, and so much so as to show clearly that the carpel is anterior.

Ulmaceæ. In *Ulmus montana* and *Celtis orientalis* the ovary consists of two carpels, which is shown in the latter instance by the stigmas remaining only two when the ovary becomes bilocular; and the attachment of the pendulous ovule to the more prominent of the two ribs of the ovary (which, as in *Morus*, are opposite the stigmas) may therefore be regarded as an indication of the position of the placenta, and consequently of the fertile carpel. This is also the structure of *Elatostemma* among Urticaceæ. (Pl. XV. figs. 21 & 22.)

Casuarineæ. In *Casuarina* the attachment of the seed rather above the middle of the posterior angle of the cell is relied on as an evidence of the position of the carpel. The ovary has the same structure as that of *Ulmus* and *Morus*, as the stigmas are two, and the posterior side with which the seed is connected is much thickened (Pl. XV. fig. 25). The fertile carpel is anterior with the same regularity as the scale-like ovary of *Pinus*; the position of the stamen is also uniform, and has all the appearance of being anterior.

Myricaceæ. The ovary of *Myrica quercifolia* bears evidences of being compound, consisting of two or three carpels united by their margins as in Lacistemaceæ, and *Myrica* may thus connect that family with Urticaceæ and Cupuliferæ; the position of the carpels when two (the usual number) nearly agreeing with those of *Quercus* when two-celled.

Cupuliferæ. In Cupuliferæ the position of the carpels when two is variable, in *Corylus Avellana* all being anterior and posterior, the axils being two-flowered from the central bud remaining undeveloped; but in *Quercus Robur* when dicarpous nearly all right and left, and therefore the single carpel could not be in the latter case always anterior as in *Casuarina*. But the instance of *Fagus sylvatica* perhaps shows the position the single carpel would occupy in that genus; the inflorescence consists of two flowers terminating a branch, the central terminal bud of which is abortive, and the two flowers are thus opposite each other. Each ovary consists of three carpels, two of them lateral and one anterior; of these the anterior is the larger, and the anterior cell is I believe more frequently fertile than the others, as also in *Castanea vulgaris*. Possibly there is an analogy between this enlargement and that of the anterior carpel of *Schweiggeria*.

Betulaceæ. *Betula* is remarkable in having a three-flowered axil, the carpels in the central ovary being right and left, while those of the two lateral are anterior and posterior (the central flower being considered as axis to the lateral); but as the ovary is winged, this probably arises from the pressure of the bracts or the dense growth of the catkin, as it frequently takes place in the central flowers of *Ulmus*. As the wings are dorsal, the central fruit could not stand with its carpels anterior and posterior, and the two carpels of *Alnus*, which are not winged, having the same position as in the two lateral flowers of *Betula*, show the latter to be in their true relation to the axil.

PLATANACEÆ. *Platanus* is always referred to as having an ovary consisting of a single carpel, and if so, its position would be variable in the greatest degree; but it is rather a question whether it does not consist of several distinct carpels, as it is not uncommon to meet with five or six arranged in a circle, the ventral suture of each being towards the centre and the carpels in close contact with each other, no sepals intervening. The carpels are however so irregular, that the attempt to ascertain whether they are single or form part of a whorl has proved as yet unsuccessful.

EXPLANATION OF PLATES XIII. XIV. AND XV.

PLATE XIII.

*** These diagrams are formed exclusively from nature, each of them being taken from one specimen only of each plant.

Fig. 1. A vertical view of the position of the fertile carpel in a branch of *Valeriana officinalis*:—*a*, the stem from which the branch springs; *b, b*, the first pair of ramuli. The axis between the second pair *c, c*, and the third pair *d, d*, being vertical is not represented. The central bud of the branch is abortive at the third forking, and the ramuli *c, c*, are abortive at their first forking.

Fig. 2. *Centranthus ruber*:—*a*, the axis; *b, b*, two opposite branches; *c*, a transverse section of an ovary. Two bracteæ are represented at the base of each ovary on one of the rami, and the cross indicates the position of the spur of the corolla. This diagram represents the internal branch of each forking, as regularly suppressed after the branch *b* has twice forked; so that the branch, the stamen, and the fertile carpel are then all lateral and external, the origin of the filament being on the same side of the flower as the fertile carpel. This occasions the fertile cell to look at first sight as if it were next the axis, but the flower, when both branches are developed as between the first two forkings *d*, has its spur coming forward between the two branches, the spur having then obviously the same position and relations as the gibbous process in *Valeriana officinalis*.

Fig. 3. represents the mode of growth and the position of the carpel in the ramifications of a branch of a *Mirabilis*:—*a*, the axis.

Fig. 4. represents the variable position of the fertile carpel in the cyme of *Viburnum Opulus*; the carpels are, perhaps, more frequently posterior than here represented, and more so in other species.

Fig. 5. *Brunonia australis*. The diagram represents the mode of growth, and (supposing the raphe to be next the placenta) the position of the fertile carpel in two of the dense fasciculi forming the capitulum:—*a*, the axis.

Plate XIV.

Fig. 1. An ovary of *Ceratophyllum demersum*; and 2. the anterior surface of the stigma.

Fig. 3. The ovary of *Piperomia magnoliæfolia*; and 4. the axis divided perpendicularly, an ovary and its bract being left attached.

Fig. 5. A perpendicular section of the ovary of *Chloranthus inconspicuus.*

Figs. 6 & 7. The ovary of *Sassafras officinale*; and 8. a section of the same, showing the placentation and the position of the raphe, which is to some extent artificially separated.

Fig. 9. The fruit of a *Stilbe* (*S. virgata*?); and 10. a transverse section of it.

Fig. 12. An ovary of *Mirabilis jalapa* before the flower expands; 11. the same at an earlier stage; and 13. the same after the flower has expanded, showing the ventral suture.

Fig. 14. A flower of *Pimelea decussata,* a portion of the tube of the calyx and wall of the ovary having been removed so as to show the placentation:—*a,* the anterior side.

Fig. 15. A perpendicular section of the ovary and ovule of *Aucuba japonica.*

Fig. 16. An ovary of *Pedicularis palustris.*

Fig. 17. A flower of *Mendozia puberula,* a portion of the corolla and wall of the ovary having been removed to show the position of the fertile cell:—*a,* its lower lip; 18. a fruit of the same; 19. a section of it showing an immature seed in the upper cell, and the remains of the barren cell behind it; 20. a section of a fruit of *M. puberula* (var.); and 21. a flower of *M. aspera*:—*a,* the lower lip of the corolla (ascertained to be so by the position of the didynamous stamens).

Plate XV.

Fig. 1. The anterior aspect of the ovary of *Lippia dulcis*; and 2. a transverse section of it near the base:—*a,* its anterior side.

Fig. 3. The anterior aspect of the ovary of *Lantana crocea*; 4. a transverse section of it near the middle:—*a,* its anterior side; and 5. a transverse section near the base:—*a,* the anterior side.

Fig. 6. An ovary of *Dipsacus sylvestris* in longitudinal section crowned by the calyx and surrounded by the involucel. The bract (of which there is one to each flower in front) is depressed, but is always quite distinct from the involucel, not forming a part of it. Stigmas rarely two, but often a rudiment of a second as represented by *a.*

Fig. 7. A transverse section of a fruit of *Scleranthus annuus,* showing the cotyledons to be next the funiculus, but this figure is otherwise partially incorrect, being rather a diagram.

Fig. 8. A section of a seed of *Gomphrena globosa,* showing the relation of the radicle to the funiculus.

Fig. 9. *Atriplex laciniata*; part of the perigone having been removed and the embryo exposed.

Fig. 10. A perpendicular section of a 2-celled ovary of *Circæa alpina*; and 11. a transverse section of a 1-celled ovary of the same.

Fig. 12. A fruit of *Hippuris vulgaris* (the external integument having been removed), showing the shallow furrow on the posterior side of the bony endocarp.

Fig. 13. A fruit of *Centaurea nigra* as seen laterally—*a,* being the anterior angle.

Fig. 14. *Bækia* sp.; a section of the flower; and 15. a transverse section of the fruit showing the projections into its cavity, to the posterior of which the seeds are attached.

Fig. 16. The dorsal aspect of the ovary of *Brunia lanuginosa*, the limb of the calyx having been removed; 17. the sutural aspect; and 18. the same as seen laterally, showing also the placentation.

Fig. 19. A perpendicular section of the ovary of *Morus nigra*; and 20. a transverse section of the same:—*a*, the thickened side to which the ovule is attached.

Fig. 21. A perpendicular section of a young fruit of *Elatostemma montana*; and 22. a transverse section of the same:—*a*, the thickened side to which the seed is attached.

Fig. 23. An ovary of *Parietaria officinalis.*

Fig. 24. A transverse section of the ovary of *Cannabis*:—*a*, the axillary or posterior side.

Fig. 25. A caryopsis of *Casuarina equisetifolia* in longitudinal section:—*a*, its anterior angle. The seed (which fills the cavity) having been removed, its attachment with another which is immature is seen at the upper part; the perfect seed having become pendulous and half anatropal during its growth to maturity.

XLIV.—*On some points relating to the Structure and Mechanism of the Wolf-fish* (Anarrhichas Lupus). By Edwards Crisp, M.D.*

I am desirous of bringing before the Members of the Society some facts relating to the organization of this singular animal, which, as far as I know, have not yet been especially noticed by comparative anatomists.

The character and habits of the fish are so well known that it would be loss of time to dwell upon them; indeed the external form of the head, large mouth, and the peculiarity of the dental apparatus, are at once indicative of the nature of its food and of the ferocity of its disposition.

Although not unfrequently taken on the British coast, it is supposed that the *Anarrhichas* seldom attains its normal size on our shores. In the North of Europe they are sometimes found 6 or 7 feet in length, but here they rarely exceed 3 or 4 feet. Of five specimens that I have examined (all taken near the British coast) the length (from the nose to the root of tail-fin) was as follows:—

1st. 3 feet 2 inches.	2nd. 3 feet 1 inch.	3rd. 3 feet.
4th. 2 feet 9 inches.	5th. 2 feet 7 inches.	

The dental apparatus of this fish, I believe, differs from that of all others that we are acquainted with. Hunter alluded to it in 1774, and Mr. André in the 'Philosophical Transactions'

* Communicated by the Author, having been read before the Zoological Society of London, March 8th, 1853.

(vol. 74) gives a drawing of the jaws and teeth, as well as a short description of the mechanism of these parts. Professor Owen, however, in his 'Odontographia,' 1845, is more minute in his account of the structure of the teeth, including their external forms, &c. Mr. Yarrell and others have likewise described it; but I do not know of any accurate description of the general form of the viscera, and it appears to me, that the contemplation of the visceral, in conjunction with the dental organization of this animal will add much to the interest of the subject.

The specimen which I have recently dissected, and parts of which I now exhibit, especially attracted my notice in consequence of the escape, *per anum*, of a large piece of rough whelk-shell about an inch and a quarter in length, and in some parts $\frac{3}{4}$ of an inch wide. And in passing a stream of water through the alimentary canal, I collected from the excreta these portions of whelk-shell and hermit-crab, which could be felt externally in the intestines. They are large, sharp, irregular in shape, and apparently not acted upon in the slightest degree by the gastric juice. This circumstance struck me as being very remarkable, as in the great majority of fish that I had examined, I found no bones in the intestines, so powerful and rapid are the digestive powers of the stomach in this class of animals.

Let us now then take a glance at some parts of the structure of the *Anarrhichas*, and first of the mouth and alimentary canal. The mouth is furnished with strong jaws, a large number of teeth of a peculiar form (as exhibited by the specimens), a thick angular tongue well fitted for directing the crustacea and mollusca (upon which the animal chiefly feeds) between the teeth, and with very powerful muscles to assist in the process of shell-crushing. If the mechanism of this mill is carefully examined, it will be seen that the large and pointed grappling irons formed by the front teeth are for the purpose of securing the prey, whilst the crushing process is performed by the conical molars in the jaws and palate, assisted by the powerful action of the tongue, which when elevated serves to keep the shell between the palatine teeth and those of the lower jaw. It is essentially an apparatus for crushing and breaking, not for grinding and pulverizing; the form of the alimentary canal, as will be seen hereafter, not requiring this mode of preparation of the food.

The teeth in these fish vary much both in shape and number; thus in four skeletons now before me, the largest measuring 3 ft. 2 inches, the shortest 2 ft. 7 inches No. 1. has 75 teeth, 41 blunt and 34 pointed. No. 2. 85 teeth, 43 blunt and 42 pointed. No. 3. 80 teeth, 60 blunt and 20 pointed. No. 4. 70 teeth, 39 blunt and 31 pointed. There is another remarkable circumstance respecting the teeth of this animal. In two of the four specimens the long process of the premaxillary bone contains teeth, but in the remaining two they are absent; nor does the absence appear to depend upon age, judging from the specimens alluded to.

In only one specimen of six that I have seen are the front teeth perfect, a circumstance readily accounted for from the nature of the food and the ferocity of the fish, which, when captured, bites at everything presented to it. The one on the table snapped a large stick with the greatest ease, and Mr. Quekett tells me that he has met with several of the spines of the larger *Echini* broken by the teeth of this animal. Another reason may be mentioned likewise why the teeth are so often broken. The alveolar process is very slight, and the crown of the tooth is but imperfectly attached to the bone beneath, so that it would not require much force to fracture it.

The œsophagus is very short, and large in diameter. The stomach, which has no cæcal appendages, is about 5 inches in length, thick, and muscular, and furnished with rugæ, which, towards the pylorus, present a honeycomb-like appearance. The pyloric opening is supplied with a strong valvular ring, which is very dilatable, and would readily admit the passage of large pieces of shell into the duodenum. The intestines, from the mouth to the anus, measure 46 inches, and are of large size throughout, measuring (when distended) from 1 inch to an inch and a quarter in diameter. On comparing these with the intestines of the Carp weighing 6 lbs., the contrast is most remarkable, for although the alimentary canal of the latter fish is 40 inches long, the calibre of the tube is at least four-fifths less than that of the *Anarrhichas*. The anal opening is very large.

The liver is of a whitish colour and fatty. The gall-bladder very large, holding 11 drachms of water by measurement. The spleen (milt) of an oval form, and resembles somewhat the spleen of a large gallinaceous bird. The kidneys are 10 inches in length, the urinary bladder rather small, and the air-bladder is wanting. The subjoined is the weight of the various organs.

Weight of fish $12\frac{1}{2}$ lbs.; length 2 ft. 9 inches.

Weight of liver 1880 grains; spleen 110 grs.; kidney 506 grs.; heart 120 grs.

The blood globules of this fish do not differ from those of many other species that I have examined.

In a future communication my endeavour will be to show, by the aid of the microscope, the structure of the lining membrane of the alimentary canal, which probably possesses some peculiarities which enable it to resist the hard, rough and angular pieces of shell that are constantly in contact with it. My object in this paper has been more particularly to point out the large diameter of the alimentary tube, its important connexion with the nature of the food and the dental apparatus, and the enormous size of the gall-bladder; points, as far as I know, that have not been before specially alluded to.

21 Parliament Street, April 23, 1853.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

March 25, 1851.—William Yarrell, Esq., Vice-President, in the Chair.

1. On a new species of the genus Montifringilla. By John Gould, F.R.S.

For a knowledge of this species we are indebted to Lord Gifford, by whom several examples were killed in Thibet. It is intimately allied to *Montifringilla Gebleri*, but differs in being of a larger size, in the darker colouring of the head and face, and in the deeper tint of the back and rump; the latter part is moreover ornamented with a patch of blood-red, which has suggested the specific name of *hæmatopygia* as an appropriate appellation; it also differs from *M. Gebleri* in being destitute of the orange-red mark on the shoulders.

Montifringilla hæmatopygia.

Face and forehead brownish black, gradually blending into the light greyish brown of the upper surface; rump stained with blood-red; upper tail-coverts brown, tipped with dull white; tail dark brown, each feather margined externally with white; wing-coverts hoary; wings dark brown, the first four primaries narrowly edged with white, the next five primaries with a broad streak of white along the basal portion of their external webs, terminating in a line with the extremities of the secondaries, which are externally fringed with hoary; spurious wing dark brown, margined at the base with whitish; under surface very light brown, gradually becoming paler, until on the under tail-coverts the hue is buffy white; bill and feet bluish black.

Total length, $6\frac{1}{2}$ inches; bill, $\frac{1}{2}$; wing, $4\frac{1}{4}$; tail, $2\frac{1}{2}$; tarsi, 1.

2. On some new species of Trochilidæ. By John Gould, F.R.S.

Mr. Gould exhibited some remarkably fine examples of the *Trochilus Jardinii* of Bourcier, and then characterized the following species:—

Trochilus (—— ?) amabilis.

Crown of the head shining metallic green; chin black; breast beautiful shining blue, with a line of lustrous green commencing at the angle of the bill, passing down the sides of the neck and surrounding the base; upper surface bronzy green; tail-coverts and central tail-feathers greenish bronze; lateral tail-feathers brownish black; wings purplish brown; under surface like the upper, but less brilliant; centre of abdomen and under tail-coverts grey, the centre of the latter bronzy green.

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

Hab. New Grenada.

Remark.—About the size of *T. albirostris.*

PHAËTHORNIS GRISEOGULARIS.

Head, upper surface and wing-coverts bronzy brown; upper tail-coverts rufous; ear-coverts blackish brown; wings purple brown; base of the tail dark brown, the apical third of the two central feathers dark grey, tipped with white, the apical third of the next feather on each side grey on the inner web, buff on the outer web, and tipped with white; the three lateral feathers on each side tipped with buff; under surface sandy buff, with a wash of dull grey down the chin and a crescent of black across the breast; upper mandible black; basal two-thirds of the under mandible yellow, apical third blackish brown; feet yellow.

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

Hab. Columbia.

Remark.—Nearly allied to *P. Eremita* and *P. pygmæa,* but differing from them in being of a larger size, in the total absence of any crescentic black mark on the chest, in having the throat clouded with dark grey instead of buff, and the two central tail-feathers tipped with grey and their shafts black.

3. NOTE ON THE SUBORBITAL GLAND OF THE NYLGHAU. BY H. N. TURNER, ESQ., JUN.

Among the cranial characters of the genus *Portax* I have adduced the want of a suborbital depression, and the existence of a smooth line running along the surface of the bone; and as I had observed appearances of a suborbital sinus in the living animal, which I could not detect in the dried specimens, I felt much interested in the examination of the parts in one that recently died in the Gardens, and which Mr. Mitchell kindly forwarded to me for dissection.

Externally there is a slight pit immediately in front of the orbit, and anteriorly to it a small longitudinal fold of the skin, in the middle of which is a little round pore, through which exudes a yellowish secretion, furnished by a gland placed just underneath. The gland itself is slightly larger than a hazel-nut, and is laid upon the surface of the bone without any fossa to receive it, but is firmly attached to the smooth line before observed. The tendo oculi, and a few fibres of the orbicularis palpebrarum are attached to it.

The small pit immediately in front of the orbit is merely the space below the tendo oculi, between the gland and the rim of the orbit. In the Nylghau, the existence of a "lacrymal sinus" has usually been acknowledged; but it affords a good example of the incertitude with which we can ever deny that it exists in a species of which fresh specimens have not been examined with a view to this character, and in which no traces of the organ are discernible, either in the dry skin, or in the existence of a fossa in the skull.

4. Letter on the Deal-fish, from Dr. Duguid to Dr. Barker. Communicated by Mr. Yarrell.

"Kirkwall, 5 March 1851.

"In April 1829, I received from Mr. Strang, Sanday, a specimen of a fish which had been found on the shores of that island, with a request that I should give him some information about it. He mentioned that he had met with many specimens during a series of years,—that it was well known to the natives of the island, by whom it was called the *Deal*-fish, and that they often found it thrown ashore, and even occasionally used it as food. I easily ascertained, from the works to which I had access, that it was a fish unknown to the British *Fauna*, but could not determine what it really was. The specimen being a good deal mutilated about the head and abdomen, and in a state of partial decomposition, I did not attempt to preserve it, but drew up as correct a description of it as its condition admitted of, which I sent to Dr. Fleming, along with all the information about it which I could obtain from Mr. Strang, and also a somewhat rough drawing. Dr. Fleming wrote, of date 8th May, 1829, at once determining the fish to be the *Gymnogaster arcticus* of Brunnich, or *Vaagmaer*, as described by Cuvier in his 'Règne Animal,' ii. 246, a native of the seas of Iceland;—at the same time mentioning some slight discrepancies, which more perfect specimens, since procured, have completely removed. With my consent, he drew up a notice of it, which was inserted in the 4th volume of 'Loudon's Magazine of Nat. Hist.,' along with a plate from the drawing sent. This article I have not met with, having merely seen Yarrell's quotations from it. Since 1829 I have met with seven or eight specimens, some of which were mutilated by birds, and some quite entire, and from the latter I have ascertained the existence of ventral fins, which are exceedingly minute and rudimental, and easily overlooked, more especially if the specimen be not quite fresh and perfect. I am now therefore enabled to say with certainty that there can be no doubt of the identity of the fish occurring in these islands with the *Vaagmaer*, as described and figured in Yarrell's Supplement to the 1st edition of his 'British Fishes,' from information supplied by Professor Reinhardt of Copenhagen, and there named *Trachypterus vogmarus*. In the first figure, given at page 14, the ventral fins are much too long and conspicuous, but they are quite correctly represented in the vignette at page 18. The late Dr. John Reid, of St. Andrews, published an article in the Annals of Nat. Hist., June 1849, describing a specimen of the *Trachypterus Bogmarus* thrown ashore on the coast of Fifeshire, in which he says, 'No unquestionably genuine specimen of this rare fish has, as far as I am aware, been hitherto found in the British seas; for the description and figure of the fishes thrown ashore in Orkney, supposed to be specimens of the Deal-fish or *Vaagmaer*, given by Dr. Fleming on the authority of Dr. Duguid, *differ in so many im-*

portant points from the Vaagmaer as must excite doubts as to their identity.' Now Dr. Reid has not stated what the important points of difference are between my description and that of Prof. Reinhardt. It is true there is one important point—important as determining the proper classification of the fish—the existence or non-existence of ventral fins. These I did not detect; but it is not surprising, considering their minuteness, and the mutilated condition of the only specimen I had then seen. We have at this moment three dried ones in the Orkney Museum, not so perfect as could be desired, but sufficiently so to determine this point, as well as the identity of the fish with the Icelandic Vaagmaer. It is strange also that Dr. Reid never mentions the existence of ventral fins in his specimen at all, and that also, while he denies that the fishes thrown ashore in Orkney are the *Deal-fish* or Vaagmaer, he should forget that the popular name *Deal*-fish is strictly of Orcadian origin."

5. On an undescribed species of Megapodius. By L. Llewellyn Dillwyn, Esq., F.G.S., F.Z.S. etc.

My friend Mr. James Motley, who is now conducting the operations of the Eastern Archipelago Company in Labuan, has lately sent me home a box of zoological specimens which he has collected in that island, and among the birds was the pair of the Megapodius, one of which I now produce; it is, I believe, identical with the species in the British Museum sent home by Mr. Cuming from the Philippine Islands. In the catalogue accompanying the specimens, and in several letters which I have received from him, he has described some of the habits of these curious birds, and deeming that original observations, however scanty, on the habits of almost any animal from that remote region might not be uninteresting to the Society, I have abstracted from his communications to me the following notice respecting them:—

These birds are said to be principally confined to small islands, and to such more especially as have sandy beaches; they are not uncommon in Labuan, but are, however, very rarely to be seen, as they are very shy, and frequent dense flat parts of the jungle, where the ratans grow and where the luxuriance of the vegetation renders concealment easy.

The Malays snare them by forming long thick fences in unfrequented parts of the jungle; in these they leave openings at intervals in which they place traps; the birds, running through the cover in search of food, meeting the obstruction caused by the fence, run along it till they come to one of the openings, through which they push their way and are trapped.

Their food principally consists of seeds and insects.

In walking they lift their feet very high from the ground, and set up their backs something like guinea fowls; they frequently make a loud noise, like the very loud screech of a chicken when caught.

They are very pugnacious, and fight with great fury by jumping upon one another's backs and scratching with their long strong claws.

The eggs are of a fine dark cream-colour, and of very large size, three of them weighing nearly as much as a full-grown bird. According to the general account given to Mr. Motley by the Malays, each bird lays about eight or ten at each time of breeding; the place they select for depositing them is always situated near the beach, and close within the edge of the jungle, and here they bury them in the sandy soil to the depth of about eighteen inches; over the place where they are thus buried the bird collects a large heap of shells and rubbish, so that a person who has seen their nest has no difficulty in finding it again; the eggs thus deposited are left to be hatched by the heat of the sun, and this the natives assert requires between three and four months to complete. Mr. Motley himself found upon breaking an egg which had been thus situated for nearly six weeks, that it contained merely the embryo of a chick, about as much advanced as that of a hen's egg at four days. Some other eggs which were brought him, but which he had no means of ascertaining how long they had been laid, he buried in a box of sand about 3 feet deep and exposed to the weather. At the end of about three weeks a young bird came up, not downy, but covered with little shafts or pens ready to form feathers. One of the Malays employed by Mr. Motley saw it emerge, and said that it just shook off the sand and ran away so fast that it was with difficulty caught. On the next day, when Mr. Motley first saw it, it appeared to him to be about half-grown. From the first it fed itself without hesitation, scratching and turning up the earth like an old bird. Two more afterwards emerged in the same state. According to Mr. Motley, the sexes are alike, except that the naked skin about the head is redder in the male than in the female.

In his investigations respecting the nidification of these birds, Mr. Motley was much assisted by Mr. Low, who is resident in the island.

As the Philippine specimens brought home by Mr. Cuming have not yet been characterized, I propose to name this species

MEGAPODIUS CUMINGII.

Sp. Char. Olivaceous brown above; blackish slate colour with a slight olivaceous tinge below; the feathers on the throat and nape are thinly dispersed, so as to leave that part nearly bare; on the hind head the feathers are somewhat lengthened, forming a kind of crest; bill black at the base, yellowish towards the tip; legs, feet and claws black; the bare skin about the head is redder in the male than in the female.

	in.	lin.
Length from the tip of the bill to the end of the tail, about	14	0
——— of bill from gape	1	1
——— of bill from front	0	10
——— of wings	8	6
——— of tail, not quite	3	0
——— of tarsus	2	1
——— of middle toe	1	11
——— of hallux	1	5

The front toes are nearly equal, the middle toe being rather the longest, and the inner one shortest.

To the foregoing account some additional details of considerable interest may be subjoined. These details, although dated Labuan, July 1850, were not received until after Mr. Dillwyn's communication :—

Extract from a Letter from Mr. Hugh Low, dated Labuan, 4th of July, 1850.

"I have been using great exertions to procure for the Earl of Derby a very remarkable Gallinaceous bird, the existence of which I ascertained only three months back; having no books I am unable to refer to its genus, but it is nearer a Guinea fowl than anything else. I heard from the natives that such a bird existed, and that its eggs were occasionally to be procured. I offered a dollar each for all they would bring me; and first one was brought, afterwards five, but I could not succeed in hatching either of these under fowls. The first, after having been set upon for a month, was picked to pieces by its foster-parent, and the chick had apparently but just begun to form. The five eggs were addled. Having learned that the birds abounded on a small island, about a hundred miles along the coast, I hired a boat and five men, and sent them, about fourteen days since, with snares, &c., to endeavour to catch some of the old birds and to seek for the nests, this being the laying season, and to gather plants of *Phalcinopsis*, which grows on the same island (Pulo Tigu and Pulo Guya). They returned yesterday, bringing with them 102 eggs and only two birds, both of which had their legs injured by the snares. The sight of the eggs and birds have perfectly astonished me, the body of the former being no larger than that of a bantam, while the egg is as long, though not so broad, as that of a Chinese goose. The men say that on the different islands they visited they found a good many nests, which are placed at a little distance from the sea-shore, in the jungle of small islands, the spot being invariably marked by a large collection of sticks and branches. The eggs are found about three feet deep in the sand, and the men assure me that the bird has no communication with them except by rasping away the sand. The man I employed has lived all his life on small islands, hunting for tortoise-shell, and well knows the habits of the bird; he says the eggs are hatched entirely by the sun's heat, or rather the heat in the sand. One of the birds he brought died this morning, and I shall put its skin together with some of the eggs in a box, that you may send them to Earl Derby. I do not like to take the liberty of writing to his lordship myself, but if I can succeed in getting a lot of young birds, I shall not fail to send them to him by the very first opportunity. I have placed some of the eggs under fowls, and some in sand out of doors; some also in sand in a warm house, where I can regulate the temperature; and I have hopes of rearing, or at least of hatching, some of the chicks, if the eggs are still good: but I think that by sending the men again in three months' time with snares I might catch a lot of the young ones hatched naturally, and be able to rear them. The bird is said not to be found on the mainland: the eggs are reported excellent eating.

"Aug. 12. Of the eggs I wrote to you so much about last mail, one only has hatched: the chick came up full-fledged from under three feet of sand, and immediately ran about with the most surprising activity. It eats rice, ants' eggs, &c. with the greatest avidity, and as it is now three weeks old, I have every hope of preserving it. More of the eggs appear to have chickens in them, and I hope will hatch. The bird, as I have ascertained, is an undescribed species of *Megapodius*."

April 8, 1851.—Professor Thomas Bell, Sec. R.S., in the Chair.

The following papers were read:—

1. On the Structure of the Teeth of the American and Indian Tapirs. By John Tomes, F.R.S.

It is now upwards of fifteen years since the attention of physiologists and comparative anatomists was drawn to the structure of the tissues which enter into the composition of the dental organs. In 1678 Leeuwenhoek communicated a paper to the Royal Society, on the Structure of the Teeth and other Bones, in which he described the dentinal tubes. His researches, however, were not confirmed by subsequent observers, and indeed were almost entirely overlooked until the period to which I have referred. Purkinjé, in 1835, confirmed the correctness of Leeuwenhoek's observations, at the time unconscious that the tubular structure of the dentine had been previously recognised. He also described the structure of the cementum.

Prof. Retzius was in the same year engaged in examining the structure of the dental tissues, and published the results in 1836. In 1837 Prof. Retzius published a work on the subject, the substance of which was in 1839 printed in our own language by Mr. Nasmyth.

In the latter part of 1837 I was engaged in examining the dental tissues, at that time unconscious that the subject had occupied the attention of the German or Swedish anatomists. In June 1838 the results of my examination were read before the Royal Society. In September of the same year, Prof. Owen read a paper on the Structure of the Teeth, before the British Association. In 1840 the publication of Prof. Owen's 'Odontography' was commenced, and completed in 1845. In this work will be found descriptions of the structure of the teeth of animals belonging to each division of Vertebrata.

In these various essays the authors agreed generally in the main facts of dental structure, and in each successive publication new facts were related. Judging from the amount which had been published, it might have been concluded that the subject was well nigh exhausted. Such however was not the case: many blunders, in the hurry which is incident to a new subject, had been committed and required correction, while many important facts had failed to be recognised. Prof. Owen pointed out that in the Order Edentata the teeth are destitute of enamel, while it is present in the other mammalian orders, with the exception of a few isolated cases.

Having neglected the subject of dental structure for some years, in consequence of more urgent pursuits, in 1847 I again entered on the inquiry, which to me possessed great attractions, not only on account of various modifications which are to be found in the arrangement of the components of the tissues in different animals, but also in minor modifications in the teeth of the same animal.

My inquiries were first directed to human teeth; the results, both as regards structure and development, were published in my 'Lectures on Dental Physiology and Surgery,' 1838. The teeth of marsupial animals next occupied my attention. In this order it was found that the dentinal tubes are continued into and form a considerable portion of the enamel, excepting only in the Wombat. The results of these investigations will be found in the Second Part of the 'Philosophical Transactions' for 1849.

By the help of this Society I have been enabled to make an extensive series of investigations in the teeth of the Order Rodentia, with results which have far exceeded my expectations. Each family, as arranged by Mr. Waterhouse, has its peculiar structure of enamel, an account of which, with illustrations, is published in Part 2 of the 'Philosophical Transactions,' 1850.

Having, by way of preface, given a very cursory and imperfect indication of what has been done in dental structure, or rather of what has been recognised as peculiar to certain groups of mammalian animals, in order to show that the subject is not without importance, I shall proceed to lay before the Society certain peculiarities which I find exist in the teeth of the two Tapirs, and which are, to the best of my belief, confined to those creatures. It should however be understood, that similar conditions may be found in the teeth of other animals, but at present I believe they have not been seen. I have myself examined numerous examples from each of the mammalian orders, and from the great majority of the genera, and have failed to find a condition of dentine similar to that of the Tapir's tooth. Under these circumstances, it may, I think, be fairly assumed to be characteristic of those animals, and hence has a degree of importance which it otherwise would not possess. With this impression, I have thought it desirable that the facts should be recorded.

The dentine of the molar teeth, when exposed by making a longitudinal section through the centre of the crown and fangs, and reducing it sufficiently thin to be viewed by transmitted light, is seen to be composed of tubes which pursue a uniform course. Those which are destined to reach the highest parts of cusps or ridges pursue a straight course, subject to slight undulations, while others, which pass to the sides of the cusps, are turned in the latter part of their course away from the central line of the cusps or ridges; others again, which pass to the lowest points of the depressions on the masticating surface of the tooth, follow a tolerably straight course. The dentine which forms the sides of the tooth is occupied by tubes which in the outer third of their course describe a bold curve outwards, the convexity of which is directed towards the crown of the tooth, but on approaching the enamel turns a little upwards. In the fangs of the teeth, the dentinal tubes, in addition to describing a double curve, are subject to strongly-marked secondary undulations. The dentinal tubes, as they leave the pulp-cavity for the crown of the tooth, have a diameter of about the 7500th of an inch, which is gradually diminished to the 15,000th. When within a short distance of the enamel, they suddenly dilate into a more or less oval cell, from which a few very minute tubes pass off towards the line of junction of the enamel and dentine. The bulbous terminations of the tubes are more constant and larger about the prominences of the cusps, and diminish in size and frequency on the sides of the tooth, where the enamel becomes thin, at the termination of which they altogether cease. The bulbs have an average diameter of about 3450, and are in length about the 1000th of an inch. In addition to the terminal dilatations, the coronal tubes are subject to occasional dilatations in their course. It is by no means uncommon to find instances where a peripheral layer of cells lies underneath the enamel, into which the dentinal tubes pass, and through which an anastomosis is effected; but in no other teeth save those of the Tapir do the coronal tubes terminate in well-marked and uniform cell-like dilatations having distinct parietes. I have pointed out several examples, in my paper on the teeth of Rodentia, in which these peripheral cells are found, but they are irregular in shape, have not distinct parietes, and are entered by the ultimate branches of the dentinal tubes; whereas in the Tapir the cells are formed by the expansion of the tubes, which previous to the expansion give off few if any branches. Some however subdivide once or twice in their course; in which case the smaller of the divisions do not commonly dilate into terminal cells, but form anastomoses with other tubes similarly circumstanced.

In the fangs the dentinal tubes leave the pulp-cavity with a diameter of the 7500th of an inch, and speedily dilate to the 6000th. During the greater part of their course they give off very minute, hair-like, short branches; but when near their termination they increase in size, turn a little upwards towards the crown of the tooth, and send out numerous branches, the majority of which pass from the lower sides of the tubes. The ultimate branches pass into the granular tissue, which, interspersed with irregular cells, forms the outer part of the dentine of the fangs. Near the neck of the tooth the granular dentine exists as a thin layer, which becomes thickened and more opake from the greater number of cells in the lower part of the fang.

Partially obliterated vascular canals enter from the surface of the fang, and proceed in straight lines through the dentine to the pulp-cavity. In the Indian species similar vascular canals proceed from the pulp-cavity towards the ridges of the masticating surface, and appear to terminate in loops. They have a diameter of about the 1000th of an inch. In a molar tooth of the American Tapir, for which I am indebted to the Society, vascular canals do not exist in the crown. This difference will, if found to be constant, serve to distinguish the molars of the two species. Near the extremities of the fangs the dentine graduates insensibly into the granular condition, and this again into the cementum, without offering any generic peculiarities.

The cementum is in no part of the fang very abundant, as compared with the amount which is found in the teeth of many other animals. Near the neck of the tooth it is arranged in minute rods or columns, similar to that which I have described as existing in the teeth of many Rodents. In this situation it is destitute of lacunæ; but in tracing it downwards towards the root of the tooth, where it is increased in quantity, lacunæ possessing the usual characters are found. In addition to the lacunæ the cementum is traversed in parts by ill-defined canaliculi, which proceed from the surface of the fang in tolerably straight lines.

In tracing a longitudinal section of a molar tooth downwards from the crown to the end of the fang, it will be seen that at places the dentine has been removed and the space filled up with cementum. Here and in other parts the cementum is abundantly supplied with vascular canals.

The enamel does not differ in any material points from that of the teeth of Ruminants. The fibres have a minutely granular appearance and have a diameter of about the 5000th of an inch. On the sides of the tooth they pursue an outward course, and make one bold curve, the convexity of which is directed towards the masticating surface, while on the crown of the tooth their course is waved and irregular; an arrangement which no doubt adds much to the strength of the tissue in that part where the greatest strength is required.

In the incisor teeth similar peculiarities may be observed, but they are much less strongly marked than in the molar teeth. Vascular canals are, too, of less frequent occurrence in the incisor teeth.

I hope on a future occasion to be enabled to lay before the Society a statement of the peculiarities which pertain to and are characteristic of other groups of animals.

2. Description of a new genus of Bivalve Shells, and a Sea Egg, from New Zealand. By J. E. Gray, Esq., F.R.S., P.B.S. etc.

Mr. Richard Taylor, of Wanganui, New Zealand, has kindly sent to the British Museum a series of marine and freshwater shells, collected by him in 1847. Among many other interesting specimens is one which combines the form and internal appearance of a *Solen* with the hinge-characters of a *Mactra*, and evidently forming the type of a genus not hitherto observed. It may be thus named and characterized:—

Vanganella.

Shell equivalve, oblong, transverse, thin, compressed, rounded behind, rather produced and tapering in front, covered with a thin, hard, polished periostraca; the inner surface of each valve straight, with two diverging, thickened ribs just within the stars of the abductor muscles, which are large and far apart, and the upper front edge of the valve double; siphonal inflection short, broad; hinge-tooth of left valve folded together, moderate; of right valve small, separate; lateral teeth short, small, close to hinge-tooth of left valve double; the ligament small, just within the cardinal edge, not separated by any shell plate from the cartilage, and partly hidden from view by the upper edge of the hinge-margin; the cartilage very large, inclosed in a large, elongate, shallow, triangular pit on the upper part of the hinder internal rib.

The position of the cartilage-pit and the internal ribs at once separate this genus from *Spisula*.

Vanganella Taylorii.

Shell rather compressed, white, smooth, covered with a pale brownish-white polish; periostraca darker coloured on the upper part of the front edge; the upper hinder slope irregularly wrinkled with periostraca.

Hab. New Zealand.

Arachnoides Antipodarum.

Body rather convex, with five broad sunken grooves, rather more than one-third the width of the sections of the body, and forming inflexed spaces on the edge of the circumference; ambulacra nearly straight, and regularly diverging, without any isolated pores between the end of the ambulacra and the circumference of the body.

Hab. New Zealand. Coast of Wanganui.

This species is easily known from the *A. placenta* of the North Sea (Agassiz, Monog. t. 21. fig. 25–42) by its being rather larger and considerably more convex, and in the grooves edged above by the ambulacra being broader compared to the sections of the shell. It differs also in having the ambulacra nearly straight and without any isolated pores between them, as in the edge of the shell figured by Agassiz, t. 21. f. 39.

The specimen was unfortunately broken in the carriage from New Zealand, and the part of the shell containing the ovarial pores was destroyed.

The upper and lower part of the shell is supported by compressed perpendicular columns, about one-third the width of the disk; near the oral disk there are placed five pairs of short processes for the support of the jaws; the jaws are triangular; they agree, as does the disposition of the spire, tubercle, and all the other external characters, with the northern species as figured by Agassiz from the specimen in the Museum collection.

3. Remarks on the Genus Hapalotis. By John Gould, F.R.S.

With the view of correcting some errors respecting the members of the genus *Hapalotis*, and of describing two new species, Mr. Gould exhibited an extensive series of specimens, including several species of this curious form of Rodent, from his own collection: viz.—

1. Hapalotis albipes, Licht.

2. Hapalotis apicalis, Gould, n. s.

This new species is about the size of, and similar in colour to, *H. albipes*, but it has larger ears, and its feet, which are perfectly white, as in that animal, are much more delicately formed, and the tail is nearly destitute of the long brushy hairs towards the tip; the eye is also much smaller.

Face and sides of the neck blue-grey; upper part of the head, space between the ears, the ears and upper parts of the body, pale brown interspersed with numerous fine black hairs; under surface white; flanks mingled grey and buffy white; fore feet white, with an oblique mark of dark brown separating the white from the greyish brown of the upper surface; hinder tarsi and feet white; basal three-fourths of the tail brown, apical fourth thinly clothed with white hairs.

	inches.
Length from the tip of the nose to the base of the tail	8
——— of the tail	$8\frac{1}{2}$
——— of the tarsus and toes	$1\frac{3}{4}$
——— from the tip of the nose to the base of the ears	$1\frac{3}{4}$
——— of the ears	$1\frac{1}{8}$

3. Hapalotis hirsutus, Gould.

Mus hirsutus, Gould in Proc. Zool. Soc. part x. 1842, p. 12.

Since this singular species was brought from Port Essington by Mr. Gilbert, at the close of 1841, a second and more perfect individual, also from the northern coast of Australia, has been deposited in the British Museum.

This is the largest species of the genus.

4. Hapalotis conditor, Gould in Sturt's Narr. of Exp. to Central Australia, vol. i. pl. in p. 120; vol. ii. App. p. 7.

5. Hapalotis longicaudatus, Gould, Proc. Zool. Soc. part xii. p. 104.

6. Hapalotis Gouldii, Gray, App. to Grey's Trav. in Australia, vol. ii. pp. 404, 413; List of Mamm. in Brit. Mus. Coll. p. 116.

H. Richardsonii, Gray, on specimens in Brit. Mus.
H. macrotis, Gray, on specimens in Brit. Mus.
H. Mitchellii, Gould, Mamm. of Australia, part i. pl. 15.
Hab. Western and Southern Australia.

7. Hapalotis murinus, Gould, Proc. Zool. Soc. part xiii. 1845, p. 78.

Hab. South Australia and the Liverpool Plains in New South Wales.

8. Hapalotis cervinus, Gould, n. s.

The whole of the head, upper surface and sides of the body, of the most delicate fawn colour, interspersed with numerous fine black hairs on the head and back; whiskers greyish black; nose and under surface white; tail pale brown, lighter beneath; ears very large, somewhat pointed, and nearly destitute of hairs.

	inches.
Length from the tip of the nose to the base of the tail	$4\frac{1}{2}$
——— of the tail	$5\frac{1}{2}$
——— of the tarsus and toes	$1\frac{1}{4}$
——— from the tip of the nose to the base of the ears	$1\frac{1}{8}$
——— of the ears	$1\frac{1}{8}$

This beautiful species was brought from the interior of South Australia by Captain Sturt. It is one of the smallest members of the genus, and is remarkable for the delicacy of its colouring and for the large size of its tail in comparison with that of its body.

BOTANICAL SOCIETY OF EDINBURGH.

April 14, 1853.—Prof. Balfour, President, in the Chair.

The following papers were read:—

1. "On new species of *Caulerpa*," by R. K. Greville, LL.D. This paper will appear in the 'Annals of Natural History' and the Society's Transactions.

2. "Remarks on British Plants, Part III.," by C. C. Babington, M.A. (See p. 427.)

3. "Notes of a Tour in the Hartz Mountains in 1850, Part I.," by W. L. Lindsay, M.D.

This communication consisted chiefly of an account of the Hartz forests, the circumstances which have tended to their destruction, and the measures now taken to preserve them.

4. "On the Characters of the Order *Solanaceæ*," by T. Anderson, F.B.S. The object of this paper was to place before the Society the new arrangement of these plants proposed by Mr. Miers (Annals, Ser. 2. iii. & ix.), and to draw additional reasons for adopting his view from the chemical properties of the plants. He stated that—

"At least so far as our knowledge goes of the chemical history and action on the animal œconomy of the *Atropaceæ* and *Solanaceæ*, a notable correspondence between botanical characters and physiological properties may be observed; or in other words, by this new arrangement, plants of analogous actions are more closely united, a result of no mean importance. As a proof of this statement the *Atropaceæ* from its botanical characters comprehends the genera *Atropa*, *Mandragora*, *Datura*, *Hyoscyamus*, and *Nicotiana*, all of which are eminently poisonous, and with the exception of the last genus, and this rather doubtful, possessed of the power of dilating the pupil and rendering the iris insensible to the stimulus of light. Since the first introduction of the natural systems, this action on the pupil has been considered as a most characteristic mark of the *Solanaceæ*, along with well-defined narcotic properties, but the order was known to contain, besides some plants of very feeble narcotic properties, many others entirely destitute of any such action. Among these may be mentioned the *Solanum nigrum, Dulcamara, tuberosum, oleraceum, auriculatum, æthiopicum,* and *esculentum* used as food, *Solanum crispum* considered a tonic by the natives of S. America, and in truth the vast genus *Solanum,* composing nearly $\frac{1}{6}$th of the order, is not to be designated a poisonous genus. To mention another anomaly in the old order :—The various species of *Capsicum* are stimulant, and in considerable doses have caused death from inflammation of the alimentary canal, but they never produce the slightest approach to narcotism.

"When Mr. Miers's characters are applied to the old order, all its known narcotic plants are allotted to the *Atropaceæ,* and the author thought he might safely say that in the *Solanaceæ* there is not one plant deserving the appellation of a narcotic. The only statement he found of any plants of Miers's *Solanaceæ* producing dilatation of the pupil, is by M. Dunal in an essay published many years ago, in which he said that he thought he had seen *Solanum nigrum, villosum, nodiflorum,* and *miniatum,* on their expressed juice being applied to the eye, produce a very slight dilatation and insensibility of the organ to a bright light, and this condition, he further remarks, continues only from four to five hours, but up to this time Mr. Anderson had found no authentication of these remarks.

"When we examine the alkaloids of the two families, we find the same difference in their action. Solanine derived from many sources, although poisonous, does not, on the authority of Soubeiran, dilate the pupil, whereas all the alkaloids of the *Atropaceæ,* such as atropine, hyoscyamine and daturine, and perhaps nicotine, exert a wonderful power on the iris even in very minute quantity."

5. "Register of the flowering of certain hardy plants in the Royal Botanic Garden, Edinburgh, compared with the flowering of the same species, and in most cases the identical plants reported on during the three previous years," by James M'Nab, Curator.

6. "On the effects of the past winter on the Coniferæ and other plants in the open ground in Golden Acres Nursery," by Mr. P. S. Robertson.

ENTOMOLOGICAL SOCIETY.

April 4, 1853.—Edward Newman, Esq., President, in the Chair.

J. J. Stevens, Esq., of Bogota, presented specimens of a Coleopterous larva, infested by a species of *Sphæria,* with a note upon its habits. "The grub is never found in trees, but underground, in timber previously rotten, and on lands from which fern has been extirpated, but roots still left behind in a state of decomposition. In the living state they are very well known, but in the hardened state with the fungus growing from the mouth, they are very rare, and always dead. The first specimen brought to me had a green bud protruding from the mouth, and resembled a green pea when it first bursts the soil."

Mr. Douglas exhibited living larvæ of a *Solenobia* or *Talæporia* produced from eggs laid by a female, without connection with the other sex.

The Rev. Joseph Greene, in a paper on the means of collecting pupæ of Heterocerous Lepidoptera, observed that the most productive trees were the elm, oak, ash, poplars, beech and willow; by digging at the roots, he had procured from *Elm,—Smerinthus tiliæ, Petasia cassinea, Tæniocampa populeti, Cosmia diffinis, Xylina semi-brunnea,* &c.

Oak,—Notodonta trepida, N. Chaonia, N. dodonæa, Geometra papilionaria, &c.

Ash,—Pœcilocampa populi, Acronycta ligustri, Geometra illustraria, &c. He stated that the most productive localities were scattered timber trees in meadows and parks, more especially in the neighbourhood of farms, villages and towns, the borders of woods, and under the thick moss on roots of trees, in the open places. On the general habits of pupæ he observed, that they were always found nearly close to the surface, and within 2 or 3 inches of the trunk, often concealed in the roots of clumps of grass.

Mr. Waterhouse communicated to the Meeting the results of his examination of the British species of *Hydrochus* and *Ochthebius.* He stated that his object had been, first, to ascertain what species existed in England; and secondly, by what names they were known both at home and abroad.

Of the first-mentioned genus little need be said; he found three species only in our collections, viz.:—

1. *Hydrochus brevis,* of German, French and English authors.
2. —— *elongatus,* also of continental and English authors.
3. —— *angustatus,* of Müller, Germar, Mulsant, Stephens, &c., very commonly known by the name *crenatus,* having been erroneously regarded as the *Elophorus crenatus* of Fabricius; that insect, however, proves to be (according to Erichson) the *Latridius porcatus.*

Of the genus *Ochthebius* Mr. Waterhouse was acquainted with ten British species, viz.:—

1. *Ochthebius marinus,* of continental authors, and of Stephens.
2. —— *æneus,* Waterh., Steph.
3. —— { *margipallens* (Latreille), Mulsant. / *pusillus,* Waterh., Steph. }
4. —— *pygmæus,* Stephens, and continental authors.
5. —— *bicolon,* Stephens, and continental authors.
6. —— *rufimarginatus,* Steph.
7. —— *exaratus,* Mulsant.
8. —— { *æratus,* Stephens. / *nanus,* Stephens (a dark variety). / *pellucidus,* Mulsant. }
9. —— { *punctatus,* Stephens, Mulsant, &c. / *hibernicus,* Curtis. }

Subgenus *Enicocerus,* Stephens.

10. —— { *exsculptus,* Sturm. / *Enicocerus viridi-æneus,* Steph. / *Gibsoni,* Curtis. / *tristis,* Curtis. }

Mr. Westwood read a paper on some new Coleoptera from China and Ceylon, with a notice of the habits of the Coleoptera of Hong Kong; the species are characterized as follows:—

1. *Callirhipes Templetonii*, Westw.

C. fusco-nigra, luteo-sericea, capite et pronoto sub lente fere impunctatis; elytris opacis punctis majoribus, lineisque nonnullis subelevatis; antennis brunneis, in mare longissime ramosis; pronoto subtrigono, postice supra subplano, utrinque impressionibus tribus in triangulum dispositis (mas).—Long. lin. 8.
Hab. in insula Taprobana.

2. *C. Championii*, Westw.

C. piceo-nigra, elytris magis castaneis, subnitidis, punctatissimis; capite carina elevata inter antennas, clypeo verticeque antice concavis; antennis articulis 2bus basalibus exceptis, brunneis; pronoto subtrigono, postice subplano, utrinque impressionibus tribus in triangulum dispositis (fem.?).—Long. lin. 9.
Hab. in insula Taprobana.

3. *Rhipicera* (*Oligorhipes*) *tessellatus*, W. W. Saunders.

R. nigra, sub lente punctatissima, dense et irregulariter albido setosa; prothorace 4 impresso; elytris castaneis, punctatis, albido-sericeo-maculatis, lineisque elevatis obliquis notatis (fem.).—Long. lin. 11.
Hab. in Australasia.

Fam. Elateridæ.

Genus Lichas, Westw.

4. *Lichas funebris*, Westw.

L. nigra, nitida, sub lente punctatissima, cinereo setosa; elytrorum punctulis in lineas nonnullas, versus suturam alterasque paucas discoidales distantes dispositis, maculisque numerosis, irregularibus discoidalibus, setarum nudis notatis; corpore infra nigro; cinereo-setoso, abdomine magis piceo, lateribus nigro submaculatis.—Long. lin. 10–12.
Hab. in China prope Hong Kong.

Fam. Telephoridæ.

Genus Eugensis, Westw.

5. *Eugensis palpator*, Westw.

E. rufo-fulva, opaca, punctata, fulvo setosa, antennis palpis et dimidio apicali elytrorum nigris.—Long. lin. 3.
Hab. in insula Taprobana.

Fam. Longicornes.

Genus Clytellus, Westw.

6. *Clytellus methocoides*, Westw.

C. cyaneo-niger, pronoto striato-punctato; elytris basi carneo-castaneis rude oblongo-punctatis, ultra basin glaberrimis nigro-cyaneis nitidissimis lævibus, apicibus albo hirtis.—Long. lin. 2 vel 3.
Hab. prope Hong Kong, China.

MISCELLANEOUS.

On the Reproduction of Frogs and Toads without the intermediate stage of Tadpole. By the Rev. L. Jenyns.

To the Editors of the Annals of Natural History.

Gentlemen,—I have read with much interest the observations of Mr. Lowe in your last April Number respecting the *occasional* reproduction of Frogs and Toads without the intermediate stage of Tadpole. The facts he mentions call, perhaps, for some further investigation before the conclusions which he draws from them can be considered fairly established. The subject, however, deserves attention; and any other facts that can be adduced of a similar kind may assist in throwing light upon it. I would accordingly just mention that, in my 'Observations in Nat. History' (p. 203), I have recorded the circumstance of toads inhabiting the cellars at Bottisham Hall, from which they can make no escape, but where, nevertheless, they may often be noticed in the spring *in copulâ*, and where I have also seen young toads, though I never noticed any spawn-deposits. I have also alluded, in my 'Manual of British Vertebrate Animals' (p. 305), to the circumstance of specimens of the common Newt or Eft being found on land, as Sheppard had previously remarked, "of all sizes, from 1 to 4 inches in length, but never in any other than a perfect state." Shaw too had noticed the same thing, and regarded it as an argument in favour of this species being viviparous. I was always very much at a loss to account for the presence of these small individuals in places where there was no water within a considerable distance, particularly in one given spot, a damp out-building, where they might constantly be found concealed under stones. My impression at the time was that they must have been bred in the merest puddles caused by rains, which soon drying up obliged them to exchange their native element as *larvæ* for another, before they would have ordinarily attained the perfect form; and that this led to the gills being cast prematurely to enable the animal to accommodate itself to its new circumstances. But I think it more probable now, after what Mr. Lowe has stated in the case of frogs and toads, that these individuals may have been *born on land in the state in which they are found,* and that in fact gills never existed, or disappeared almost immediately after birth.

I am, yours &c.,

L. Jenyns.

Researches on the Fecundation and Formation of the Embryo in the Hepaticæ and Ferns. By H. Philibert.

I. *Hepaticæ.*—1. In the Hepaticæ as in the Mosses, the organ called *epigonium* which envelopes the capsule almost until its arrival at maturity is a true ovule, reduced to the nucleus, in which an embryo is developed.

2. This epigonium or nucleus is lined by a membranous embryo-sac.
3. The embryo developed in this ovule is represented by the capsule with its pedicel.
4. The nucleus and the embryo-sac are closed at first and open a little before fecundation.
5. The embryo-sac contains a free vesicle which produces the embryo by its development. This embryonal vesicle exists before the opening of the nucleus and consequently before fecundation.

II. *Ricciæ.*—6. In the Ricciæ there exist a nucleus, an embryo-sac, and an embryonal cell exactly like those of the Mosses. This embryonal cell, however, instead of producing a capsule with its pedicel, merely becomes enlarged, and the sporiferous cells are formed immediately in the interior of this membranous sac, which is itself enveloped by the epigonium.

III. *Ferns.*—7. The Ferns have ovules exactly like those of the Mosses and Hepaticæ, also consisting of a nucleus formed of a simple layer of cells and lined internally by an embryo-sac.
8. In the Ferns these ovules are produced on a very simple frond, which is the immediate result of the germination of the spores. The embryo which is formed in these ovules reproduces the original plant, as in the Phanerogamia.
9. The ovule or nucleus of the Ferns is at first closed at the apex and opens for fecundation; it contains before its opening an embryonal cell which produces the embryo by its development.
10. The embryo of the Ferns consists of a primary leaf, a primary root, and a conical base representing the stem or the axis of the plant. The primary root is not a continuation of the stem as in the embryo of the Phanerogamia; it is oblique, and from this character the embryo of the Ferns may be called *plagiorhizal.*
11. This character still exists in the developed plant. Each leaf has its proper root, which separates almost immediately from the stem, and takes an oblique direction towards the earth.
12. In the Ferns, Mosses and Hepaticæ, the base of the embryo is turned towards the base of the ovule, and the apex towards its summit or *micropyle*; so that it is in a position the reverse of that which it occupies in the Phanerogamia.—*Comptes Rendus,* Dec. 13, 1852, p. 851.

MODE OF DETERMINING THE OPTICAL POWER OF A MICROSCOPE. BY PROFESSOR HARTING OF UTRECHT*.

The optical power of a microscope may be said to consist of three qualities, viz. magnifying power, defining power, and penetrating power. Although the first is the quality to which most importance is generally attributed, the practised observer well knows that it is of far less consequence than the second and third. And although there

* Translated by the Editor of the Monthly Journal of Medical Science, from 'Het Mikroskoop,' vol. i. p. 407.

are a variety of simple means by which the magnifying powers of microscopes may be ascertained and compared, it is to be regretted that science has not yet suggested any easy and infallible mode of testing their powers of definition and penetration. *Definition* appears mainly to depend upon the amount of exactitude with which the spherical and chromatic aberrations of various parts of the instrument are balanced and corrected. *Penetration* chiefly depends upon the "angle of aperture" of the object-glass, *i. e.* upon the *angular width* of the luminous pencils passing from each point of the object through the lens. The brightness of the image increases as the square of the diameter of the lens or mirror which produces it; hence it is obvious that of two lenses of equal focal length and refracting power, that which is the wider and can transmit the broader pencil of rays, will give the brighter image. If the effective diameters of two such lenses be $=1$ and 3, there will be *nine* times as much light in the image formed by the second as in the image formed by the first. Of course there will be, in the image formed by the second lens, parts clearly visible, which in the image formed by the first lens were too feebly illuminated to affect the retina of the observer. When the aberrations are perfectly corrected, *i. e.* when the rays passing from the object through the centre and margins of the lens are refracted without chromatic dispersion and to the same foci, the maximum of defining power is attained, and the penetrating power of the lens is likewise a maximum for that angle of aperture. It does not, however, follow that a lens of greater angular aperture is not superior in penetration, nor that a lens of exquisite penetrating power, *i. e.* capable of exhibiting the most feebly illuminated parts of an image, must necessarily be one of good defining power, *i. e.* capable of exhibiting sharp outlines on bodies of extreme minuteness, or of resolving or separating the dots, stripes, etc., of the more difficult test-objects. With these preliminary observations, which may be regarded as an imperfect abridgement of different chapters in Harting's excellent treatise, we proceed to lay before our readers his very ingenious and beautiful method for testing the qualities of definition and penetrating power.—*Editor.*

I conclude by noticing another method of testing the optical power of the instrument, which, although rather troublesome, appears to me among the best, permitting us, as it does, to ascertain with a great degree of accuracy and certainty, the utmost limits of penetrating and separating power possessed by a microscope, and hence easily to express numerically its optical qualities in the most varied circumstances.

This method consists simply in subjecting to observation under the microscope the dioptric images of certain minute objects instead of the objects themselves. These images can be diminished at pleasure by withdrawing to a distance from the lens the object which forms them; and hence we have it in our power to measure the extreme limits at which the object continues to be visible.

For the formation of the dioptric images, achromatic object-glasses might be used; but even where those of the shortest focal length are employed, the object whose image it is required to form must be placed at a great distance. This would cause various difficulties, and only be practicable with a microscope placed horizontally—unless, indeed, the object selected were very minute, in which case the accurate determination of its diameter (from which that of its image must be afterwards deduced) would be rendered difficult.

Small air-bells in a fluid are for this purpose far better. I employ by preference a watery solution of powdered gum arabic, which always contains numbers of such air-bells originating in the air entangled among the particles of the powder. The water employed should have stood for a considerable time freely exposed to the air, or been shaken up with air for some time; for when we use water which is not saturated with air, the bubbles in the fluid gradually become smaller, and images formed in them decreasing in magnitude, cause errors in the subsequent measurements, as we shall actually find to be the case.

A drop of the fluid must then be placed on a clean glass object-slide, and covered with a good clear mica plate, a ring-shaped piece of paper being interposed, in order to prevent the flattening of the air-bells by pressure. The object-slide is then placed under the object-glass upon the stage of the microscope, and an air-bell of suitable size for the formation of the images is sought for. All do not give images of the same degree of sharpness; a peculiarity dependent on the fact that some air-bells are in contact with the covering-plate, and consequently have their spherical form disturbed to some extent, or on the presence of small molecules in the fluid above or beneath the air-bell, or even in its interior, causing some haziness of the image, just as defective polish of a glass lens would do. It will, however, be always easy to find some* which will form images of the utmost distinctness and purity. This may be ascertained in the first instance by holding between the mirror and stage some easily recognized object, *e.g.* a piece of paper or the like. The image is always formed on the under surface of the air-bell, which must consequently be brought nearer to the object-glass than when it is desired to bring its margins into focus.

The object whose image is to be the subject of examination should be placed upon an apparatus, which can be moved upwards and downwards in the space between the mirror and the stage. In some microscopes this can hardly be done, either from the space being too limited, or in consequence of the drum-like form of the foot of the microscope which quite envelopes the space. If such microscopes, in

* The following example will demonstrate this. I brought a printed page of a book to such a distance from an air-bell that the length of the image of the whole page was $\frac{1}{7}$th millimetre=about $\frac{1}{180}$th of an inch, and that of the image of each letter about $\frac{1}{480}$th millim.=$\frac{1}{12000}$th of an inch. In spite of their minuteness, these images, formed by reflected light, possessed such clearness and sharpness, that under a magnifying power of 154 diameters, the whole page was, without difficulty, legible.

place of a mirror, be provided with a reflecting prism, the object may be placed opposite the side external to the microscope. The instruments best adapted for the manipulation which we are describing are, however, those whose illuminating apparatus consists of a mirror and converging lens, which can be shifted up or down. The lens being removed from the ring which supports it, the object is substituted in its place. The relative magnitudes of object and air-bell must be such that the image shall be exceedingly minute when the object is tolerably near to the stage. On afterwards increasing the distance between the object and air-bell, it is not difficult to find the limit at which the image (under a given magnifying power) is barely visible.

Of course it is impossible to measure *directly* the dimensions of this most minute visible image, for our best micrometric methods will here be found of no avail. Yet their size may be estimated with extreme accuracy in the following manner. At the same distance from the air-bell and in place of the object used, substitute another body, such as a piece of card, of 4 to 5 centimetres $=1\frac{3}{5}$ths to inches diameter, which has been exactly measured. Let this be now again measured just as if it were a real object. By dividing the real diameter by the apparent diameter, the amount of diminution is found; and this is the same for all objects at a like distance from the air-bell. We have, consequently, nothing to do, in order to find the amount of diminution of the image of the more minute object, but to divide its *true* diameter by the figure expressing the diminishing power.

For example, let the true diameter of the greater object be 5 centimetres =to 1·969 English inch, and the diameter of its image = 32·2 micromillimetres*, = ·00127 English inch, then the figure expressing the amount of diminution will be $\frac{1\cdot969}{\cdot00127}=1553$ very nearly. If now the smaller object have a diameter of 175 micromillimetres = ·00689 English inch, then must its image at the limit of vision be in diameter $=\frac{\cdot00689}{1553}=\cdot0000044$, or about $\frac{1}{225,000}$th of an English inch. When exact micrometric methods are employed, it is easy in this way to estimate the diameter of an image even to millionth parts of a millimetre, *i. e.* to 25,400,000th parts of an inch.

As for the object suitable for these investigations, it is plain that we have an extensive choice. To find the limit of vision for bodies of a round or long thread-like form, grains of pearl sago, or vegetable bodies, such as mustard-seed or the pollen-granules of many plants, hairs of animals, metallic wires, &c., may be employed. Small round openings and chinks may serve for the determination of the visibility of positive images of light. In the last case care must of course be taken, by means of suitable screens, to shut off all light except what passes through the aperture. To determine the defining power, metallic wire-gauze is a suitable object, or two holes placed near each other in a black metallic plate. The images of such objects resemble exactly a double star viewed through a telescope (*kijker*). The bodies may likewise be placed in different circumstances in order to

* The micromillimetre is equal $\frac{1}{1000}$ millimetres = ·0000394 English inch.

ascertain the influence of these upon the limits of vision. Thus we may use as an object a very thin glass capillary tube placed in water, and compare it with tender organic tubes and vessels, which may also be seen in water, but whose limit of visibility is of course far more circumscribed than that of absolutely opake objects.

In fact this method admits of innumerable variations, and is consequently of most extensive application. Besides, when proper precautions are taken, it gives results perfectly sure and comparable. Especial care is, however, requisite in the mode of illumination. For it is certain, that when the field has a clear white ground, the contrast causes minute opake bodies (*i. e.* objects which are dark by transmitted light) to continue visible, which against a grayish or light-blue back-ground could not be seen. Hence it is by no means indifferent to receive on the mirror light from a white cloud, from a dull overcast, or clear blue sky. Artificial light cannot be used in these experiments, for the image of the flame becomes diminished like the object, and hence a clear field of view is not to be obtained. The observations must consequently be made by daylight; and whenever comparable results are sought for, the mirror should always be directed to the clear, blue, cloudless sky—this being a distinct atmospheric condition to which others in similar circumstances may refer in conducting the same experiment. The mode of ascertaining the limit of vision, with a given amount of illumination, may be gathered from different examples in the body of this work*. It will likewise be found that for all such observations, even when the highest magnifying powers are employed, the *flat* mirror is perfectly sufficient, since in the image in the field of view formed by the air-bell, all the rays proceeding from the mirror are united and constitute an object of considerable luminous intensity.—*Monthly Journal of Medical Science*, April 1853.

MARINE VIVARIA.

To the Editors of the Annals of Natural History.

Weymouth, May 24, 1853.

Gentlemen,—With reference to plants for Marine Vivaria I have to state, that some species, if not all, do equally well without their roots being attached. On the 4th of May I placed a few mollusks in a glass 8 inches in height and 4 across; I also placed in it a plant of *Rhodymenia palmata*, but which had no root attached; I therefore attached it by means of a thread to a small piece of stone in order to keep the plant erect. This plant alone has supplied the water with oxygen to this day, and appears as healthy as the day it was put in, now three weeks since. The animals are alive and the water has not been changed.

I am, Gentlemen, yours obediently,

William Thompson.

* It is unnecessary to introduce any examples here, the author's description of his method being both full and suggestive.—Editor.

LABIDOCERA MAGNA.

My dear Sir,—In my paper in the 'Annals' for last March, I stated that *Labidocera magna* comes from the Pacific: will you allow me to take this opportunity of correcting my mistake? It inhabits the Atlantic S. lat. 18° 40′, W. long. 2° 30′.

Believe me, yours sincerely,

To Dr. Francis. J. Lubbock.

Observations on the Anatomy of the Antennæ in a small species of Crustacean. By John D. M'Donald, M.D., Assistant Surgeon to H.M.S.V. Torch.

The little crustacean which is the subject of this paper was taken in considerable numbers in the voyage from St. Vincent to Rio Janeiro. There are several anatomical peculiarities mentioned, but the most remarkable is the structure of the right antenna of the male. These organs are in the female perfectly symmetrical, and resemble that of the left side in the male; and although in the very young state of the latter sex the right antenna differs but little in external appearance from the left, yet the peculiar hypertrophied condition of the modified segments in the corresponding organ of the adult male is to be distinctly traced in a rudimentary state.

As the animal lives in the open ocean, none of the limbs are adapted for walking; but when placed in a vessel of sea-water, they rested upon their antennæ on reaching the bottom, and paddled themselves about by their fore-limbs and tail.

The author remarks that in all their movements the males exhibit a tendency to turn towards the left side, and concludes the rationale of this fact to be, that the brain on the right side being more developed at the part from which the right antenna derives its nerves, a corresponding predominance is given to the power of the locomotive organs on that side.

When fully developed, each antenna in both sexes consists of twenty-five segments. Of these, the first thirteen present nothing remarkable; but all the remaining pieces on the right side enter into the composition of the curious prehensile organ which forms the principal subject of the paper.

This organ is composed in the following manner:—The fourteenth and four following segments are dilated into a large flask-like organ, the neck of which is eked out by the nineteenth and twentieth. The next two segments are fused together, and are articulated with the foregoing by a simple joint, and the whole of the remaining segments form another piece similarly articulated with the intermediate piece; so that the whole results in two simple joints susceptible of flexion in one direction only. On the eighteenth segment is a barbed process having its apex directed backwards, and its anterior border beset with sharp teeth. Two processes of the same nature, but differently placed and more elongated, lie side by side upon the fore-part of the first compound segment. This piece and that which succeeds it act upon each other like a pair of jaws, each furnished with an array of sharp conical teeth, while the last compound member of the series plays over the upper surface of the eighteenth segment.

The author then proceeds to describe the muscles which move this complex apparatus. The extensors are small and feeble, but the flexors are, as might be anticipated, more complex and powerful. They are two in number. The first has its origin in the large flask-like dilatation, and is inserted by a tendon into the second compound piece, from which the second muscle arises, and is inserted, also by tendon, into the third piece.—*Proc. Roy. Soc.*

METEOROLOGICAL OBSERVATIONS FOR APRIL 1853.

Chiswick.—April 1. Rather boisterous: fine. 2. Cloudy: fine: hazy. 3. Overcast: showery. 4. Cloudy: very fine: rain. 5. Densely overcast: rain: clear. 6. Overcast throughout. 7. Overcast: very fine: clear. 8. Fine: heavy thunder-storm: clear at night frosty. 9. Clear: fine, but cold: overcast. 10. Overcast. 11. Overcast: fine: overcast. 12. Clear: fine: overcast. 13. Cloudy and cold: rain: clear: sharp frost at night. 14. Cloudy. 15, 16. Overcast throughout. 17. Fine: overcast. 18. Very fine. 19. Cloudy: rain. 20. Low white clouds and cold. 21. Rain. 22. Constant rain. 23. Fine. 24. Heavy rain. 25. Snow early A.M., boisterous, with rain. 26. Fine. 27. Hoar-frost: very fine. 28. Light haze: fine. 29. Cold rain. 30. Overcast: very fine.

Mean temperature of the month	44°·93
Mean temperature of April 1852	44 ·81
Mean temperature of April for the last twenty-seven years	47 ·21
Average amount of rain in April	1·65 inch.

Boston.—April 1. Fine: rain A.M. 2. Fine: rain P.M. 3. Cloudy: rain P.M. 4. Cloudy: rain A.M. and P.M. 5. Cloudy. 6. Cloudy: rain P.M. 7. Fine. 8. Cloudy: rain and hail A.M. and P.M. 9. Fine. 10, 11. Cloudy. 12. Fine. 13. Cloudy: rain A.M. 14—18. Cloudy. 19. Cloudy: rain P.M. 20. Cloudy: rain A.M. 21. Cloudy. 22. Cloudy: rain A.M. 23. Fine. 24. Fine: hail A.M. 25. Rain: rain A.M. and P.M. 26. Fine. 27. Fine: rain A.M. 28. Fine. 29. Cloudy: rain P.M. 30. Cloudy.

Sandwick Manse, Orkney.—April 1. Drizzle A.M: rain P.M. 2. Damp A.M. and P.M. 3. Showers A.M.: damp P.M. 4. Hazy A.M.: showers P.M. 5. Showers A.M.: cloudy, S. aurora P.M. 6. Rain A.M.: showers, S. aurora P.M. 7. Showers A.M.: showers, S. aurora P.M. 8. Hail-showers A.M. and P.M. 9. Clear A.M.: rain P.M. 10. Showers A.M.: rain P.M. 11. Bright A.M.: cloudy P.M. 12. Showers A.M.: clear P.M. 13. Drops A.M. and P.M. 14. Clear A.M.: cloudy P.M. 15, 16. Drops A.M. and P.M. 17. Bright A.M.: drops P.M. 18. Showers A.M.: drops P.M. 19. Drops A.M.: rain P.M. 20. Clear A.M.: clear, fine, aurora P.M. 21. Hoar-frost A.M.: clear, fine, aurora P.M. 22. Bright A.M.: hazy, large halo P.M. 23. Showers A.M.: drops P.M. 24. Bright A.M.: sleet-showers P.M. 25. Sleet-showers A.M.: hail-showers P.M. 26. Bright A.M.: clear P.M. 27. Showers A.M.: drops P.M. 28. Clear A.M.: showers P.M. 29. Bright A.M.: clear P.M. 30. Cloudy A.M.: clear P.M.

Mean temperature of April for twenty-six previous years	43°·44
Mean temperature of April 1852	47 ·64
Mean temperature of this month	44 ·49
Average quantity of rain in April for seven previous years	1·73 inch.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London;* *by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1853. April.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	29·479	29·354	28·94	29·02	28·88	57	36	48	43	43	sw.	s.	e.	·07	·07	·04
2.	29·782	29·644	29·24	29·05	29·25	56	36	45	45½	43	w.	sw.	calm	....	....	·20
3.	29·705	29·510	29·32	29·35	29·42	54	42	48	45	45	s.	s.	se.	·12	·12	·24
4.	29·760	29·662	29·30	29·47	29·23	62	50	49	48	46	sw.	wnw.	s.	·14	·16	....
5.	29·976	29·775	29·40	29·25	29·50	61	43	54	47	46	w.	w.	sw.	·02	·10	·36
6.	29·948	29·828	29·46	29·37	29·31	59	41	47·5	52	43½	sw.	wsw.	wsw.	·02	....	·18
7.	29·806	29·726	29·28	29·32	29·57	57	32	50	45½	41	w.	sw.	nw.	....	·02	·21
● 8.	30·119	29·809	29·46	29·87	30·14	53	28	46	41	36½	n.	w.	n.	·06	....	·10
9.	30·304	30·175	29·94	30·10	29·72	50	31	39	43	45	n.	nnw.	w.	·04	·07	·01
10.	30·128	30·039	29·67	29·88	29·96	55	29	51	44½	43½	nw.	nnw.	sw.	....	....	·12
11.	30·161	30·082	29·76	29·80	29·94	60	37	50	46	41	w.	nnw.	wnw.	....	....	·40
12.	30·015	29·887	29·66	29·94	30·11	56	32	46·5	44	40	nw.	nnw.	n.	....	....	·06
13.	30·057	29·892	29·64	30·13	30·04	48	22	40·5	43	42	n.	nne.	nw.	·04	·06	....
14.	30·145	29·999	29·70	30·01	30·05	57	31	44	45	44½	n.	n.	wnw.	....	....	....
15.	30·166	30·105	29·79	30·01	29·95	51	42	45	49	45	nw.	nw.	w.	....	....	·04
☽ 16.	30·098	30·088	29·75	29·86	29·75	55	39	49·5	47½	45	nw.	nw.	w.	....	....	....
17.	30·068	29·997	29·64	29·80	29·80	58	45	53	48	48	w.	n.	s.	....	....	....
18.	30·070	30·000	29·70	29·81	29·76	65	38	51	48	51	n.	w.	ssw.	....	....	·20
19.	29·896	29·760	29·53	29·60	29·66	56	37	58·5	52	41	sw.	ssw.	nw.	·07	....	·05
20.	29·775	29·716	29·40	29·72	29·71	55	38	46	47	40	nw.	nnw.	calm	·25	·06	·38
21.	29·518	29·440	29·24	29·64	29·61	55	42	51	46	41	se.	sse.	calm	·28	....	....
22.	29·486	29·315	29·16	29·58	29·62	51	36	45·5	47½	41	e.	e.	calm	·24	....	....
○ 23.	29·879	29·765	29·46	29·56	29·54	54	32	46	44	43	w.	nnw.	wnw.	·09	·04	·06
24.	29·858	29·570	29·45	29·53	29·56	47	31	45·5	44½	41	sw.	w.	wsw.	·60	....	....
25.	29·526	29·266	29·00	29·67	29·82	41	31	40	43	37½	n.	ne.	e.	·16	·17	·43
26.	29·805	29·668	29·33	29·84	29·82	53	25	43	46	39	nw.	n.	n.	....	·24	....
27.	29·872	29·836	29·56	29·71	29·71	60	28	42	47	42½	sw.	n.	calm	....	·06	·12
28.	29·821	29·718	29·57	29·79	29·84	56	40	44	45	43	e.	ese.	s.	....	....	....
29.	29·634	29·586	29·43	29·83	29·81	56	37	49·5	48	41	e.	ne.	ese.	·38	....	·10
☾ 30.	29·808	29·665	29·36	29·72	29·76	66	31	52	52	44	sw.	w.	se.	....	·33	....
Mean.	29·888	29·762	29·47	29·674	29·694	55·46	35·40	47·3	46·23	42·76				2·58	1·50	3·30

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END OF THE ELEVENTH VOLUME.

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