THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'MAGAZINE OF BOTANY AND ZOOLOGY,' AND OF LOUDON AND CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

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VOL. VI.—SECOND SERIES.

LONDON:

PRINTED AND PUBLISHED BY R. AND J. E. TAYLOR.

SOLD BY S. HIGHLEY; SIMPKIN AND MARSHALL; SHERWOOD AND CO.; W. WOOD, TAVISTOCK STREET; BAILLIÈRE, REGENT STREET, AND PARIS: LIZARS, AND MACLACHLAN AND STEWART, EDINBURGH: CURRY, DUBLIN: AND ASHER, BERLIN.

1850.

"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.

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

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[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. 31. JULY 1850.

I.—*Outlines of a Monograph of the genus* Leontodon. By JOHN BALL, M.R.I.A.

AN examination of the species of the genus *Leontodon*, L., contained in my herbarium, and a comparison of the specimens with the descriptions of authors, has led me to perceive that, with the single exception of Koch, the most esteemed authors have but very imperfectly distinguished the species of this genus, or determined the natural groups into which they are distributed. Koch's Synopsis*, however, gives so complete and satisfactory an account of the forms belonging to the German and Swiss floras, that it might appear superfluous to attempt to add anything to his descriptions if they included a larger number of species, but in consequence of the region of his flora being so far limited, and of having myself observed and collected several species not included in his work, I am induced to propose the following arrangement of the forms known to me as the result of independent observation, in the hope that it may assist those botanists who, like myself, may have found the descriptions contained in other works incomplete and unsatisfactory.

I shall premise a few remarks upon the several organs from

* I should observe that reference is made herein exclusively to the first edition of Koch's 'Synopsis Floræ Germanicæ et Helveticæ.'

the variations in whose form and structure the characters of the species have been derived.

The structure of the root has been, as far as I am aware, neglected by all authors before Koch, and by many who have written since the publication of his work; it offers nevertheless a very valuable character by which plants, which in certain states nearly resemble each other, may with certainty be distinguished, and I altogether concur in the separation of the group of species which possess a fusiform vertical root, as a distinct section of the genus from those having a horizontal abruptly terminated rhizoma, though it is proper to remark that *L. Villarsii*, Lois., and *L. Rosani*, Ten., present a nearly intermediate structure, in conformity with the general law by which the *nexus* in a series of forms so complete as that of the *Cichoraceæ* is continually maintained.

The length of the scape or flowering stem, as compared with that of the leaves, can scarcely be deemed a trustworthy character; in *L. Taraxaci*, Lois., and perhaps also in *L. croceum*, Hke., the comparative shortness of the scape appears to be constant under all circumstances. That condition of the scape which is indicated by the drooping of the capitulum before flowering, as also the thickening of the upper portion of the scape, and the presence of leafy scales, are characters, which, though properly applicable to the description of certain species, are yet so variable in degree, that individual specimens may often be found to which specific characters drawn from these points scarcely if at all apply.

The variations in the form of the leaves in the several species furnish characters, which it is impossible to neglect, and yet, owing to the great diversity seen amongst individuals of the same species, which it is extremely difficult to define with accuracy. I may here express an opinion which has often been suggested to me in the course of attempts to unravel difficult groups of species, that the chief advance to be made in descriptive botany depends upon such accurate observation and designation of the forms of the leaf, as will enable us to comprehend in specific characters the phases of variation which the leaves of the same species undergo. Careful observation shows, as theory would have already suggested, that, amidst their endless variations, the leaves of plants belonging to distinct species are seldom if ever precisely similar, but the descriptive botanist frequently fails in assigning distinctive characters which really exist in nature. In *Leontodon* the depth of the incisions or indentations of the leaves is a point of little or no importance, but perhaps their *direction* has not been sufficiently attended to. I venture to think that in this respect Koch's appreciation of the importance of the characters drawn from the leaves is erroneous. I am also disposed to believe that the general form of the outline of the leaf is in a great degree constant.

The involucre furnishes characters which are nearly as difficult of definition as those derived from the leaves. The scales or phyllaries vary much in their number and breadth, and in the regularity of the order in which they are superimposed. In some of the species of the section *Asterothrix* the involucre is regularly imbricated with four or five rows of equidistant scales, while in the section *Apargia* we have two rows of scales of nearly equal length with a comparatively small number of short accessory scales at the base, and yet the series of intermediate forms is so complete that it appears impossible to assign definite characters which shall apply exclusively to each species.

The nature and amount of pubescence upon the leaves, stem and involucre are next to be considered. In some species the presence or absence of hairs seems to be determined by accidental conditions, but in the section *Asterothrix* the presence of a rigid stellate pubescence appears to be constant. This latter however varies much in its structure; in some species the hairs are truly stellate, consisting of a short stem crowned with a star, while in others the hairs (which may be termed furcate) are divided at the summit into two or three short branches not lying in the same plane. These branches or spines are usually straight, but sometimes recurved, forming minute hooks at the summit of the hair. In a few instances short irregularly branched hairs are seen to accompany the stellate pubescence.

As a general rule, stellate, furcate, and simple hairs do not occur together upon individuals of the same species, but I have observed simple furcate hairs upon the same specimens of *L. hastilis*, L., and *L. Rosani*, Ten., and I therefore doubt the propriety of relying implicitly on the character of the pubescence for permanent specific characters. In a few species the involucre is occasionally covered with long silky fuscous hairs of a much softer texture than those which are found on the leaves or stem; it may be doubted however whether these are constantly present in any species of the genus.

There are few genera of *Cichoraceæ* in which the fruit varies more in its form amongst the different species than in *Leontodon*. In some species the achenium possesses a beak more than equaling its own length, while in others the fruit is truly beakless. Owing to the difficulty of comparing dried specimens, from the uncertainty which must exist as to the complete maturity of the fruit, I have some hesitation in asserting my belief that the relative length of the achenium and beak is not always constant in the same species. The same observation may perhaps be applied to the degree of roughness of the ribs of the fruit.

The structure of the pappus has hitherto been considered to afford the surest and most constant characters throughout the entire of the *Cichoraceæ*. I am led to doubt the value of the characters by which Koch has divided his sections *Apargia* and *Asterothrix*, as I do not think that the differences pointed out by him in the structure of the pappus correspond to natural affinities or diversities in the general characteristics of those groups, or that the natural groups which he has proposed constantly exhibit the characters assigned by him.

I shall have to describe a remarkable form of this genus, very nearly allied to *L. hastilis*, in which all the rays of the pappus are either nearly devoid of their usual feathery plumes, or else lose that appendage at a very early period;—thus requiring a modification of Koch's character of the genus, where he says, "Plumulæ radiorum non deciduæ."

In distinguishing the sections of the genus, I have not followed Koch in giving the name *Apargia* to the small group of which *L. incanus* is the type; it seems to me more proper to retain that name for the larger group which he has named *Dens Leonis*, while his section *Apargia* should in my opinion be united to *Asterothrix*. If it be determined that the sections of the genus should be founded exclusively upon characters taken from the pappus, it will be necessary to subdivide Koch's section *Asterothrix* into two. I have thought it better merely to indicate the three groups which would thus be formed from the section to which I have given that name.

In accordance with views which I have at various times attempted to circulate amongst botanists, I shall in the following essay distinguish the subspecies, varieties, and less permanent forms of the species here described by fixed symbols, instead of adhering to the ordinary plan of affixing to such forms a Greek or Roman letter whose meaning is not established by any previous convention.

I have elsewhere* endeavoured to show that the introduction of a systematic notation for this purpose may conduce to objects much more important than the convenience and clearness which it would tend to impart to the details of descriptive botany. The naturalist is, as I believe, greatly dependent for those conceptions which are to enlarge and elevate the scientific character of his pursuit, upon such improvements in technical arrangement and notation as may assist in compelling order amongst the multitudinous forms of life which are exhibited to his observation.

Only by slow degrees, and by minute and comprehensive study

* Atti della sesta Riunione degli Scienzati Italiani, p. 505.—Report of he British Association for 1845: Proceedings of the Sections.

of the relations of closely allied forms, can we hope to arrive at distinct conceptions of the true nature of those fundamental groups whose existence under the name of species and genus we confidently affirm, but whose essential attributes we find ourselves unable to define *à priori*, and, still less, to recognize with certainty when presented to us in nature.

Adopting the definitions which appear to me best suited to the present imperfect state of our knowledge, I distinguish as a *species*, that group of vegetable forms, of which we are led by observation and analogy to believe, that the differences between the individuals composing it may be made to disappear by the continued agency of external circumstances either upon the individuals themselves or on their descendants. I denominate *subspecies* a group of similar forms capable of propagation over a definite area, not immediately altered in form by a change in external conditions, but not distinguished by characters usually found to be constant in the same group. In common with most other botanists, I style *varieties* those diversities of form which are not continued in the descendants of the individual, or which disappear speedily under the influence of new external agencies. As a provision for our ignorance, I distinguish as *lusus* those unusual conditions in which a marked difference from the ordinary form is exhibited by a small number of individuals, respecting which we are unable to assert whether it be the result of unusual external agency or of some specific or subspecific difference of organization.

Denoting that which appears to be the typical form of each species by the Roman capital **A**, and premising that in all cases I distinguish the subspecies by a Roman capital, and the corresponding variety by the small Roman letter, I propose the following symbols, which appear to be appropriate not only for the genus *Leontodon*, but for the entire natural order of *Cichoraceæ*.

+**D**; stem or scape more divided, capitula more numerous.
—**D**; stem or scape less divided or simple.
+**E**; plant more slender, leaves and divisions more acute, phyllaries narrower, florets less numerous.
—**E**; scape thicker, leaves broader, more blunt, phyllaries broader, florets more numerous.
+**F**; involucre clothed with long hairs, usually of dark fuscous colour.
+**G**; whole plant more glabrous, or entirely devoid of pubescence.
—**G**; pubescence more abundant.
+**I**; leaves more deeply cut.
—**I**; leaves less deeply cut or quite entire.

Where a subspecies or variety appears to differ from the typical form in more than one of the characters above denoted, two or more letters with the appropriate symbol are affixed. The use of Greek letters is reserved for those forms which I would denominate *lusus*.

I proceed to give diagnostic characters for the species and the more remarkable subspecies and varieties with which I am acquainted, subjoining occasionally critical observations derived from notes made in the course of an examination of the specimens contained in my herbarium. Such further information is added with respect to the distribution and synonymy of each species as appeared to rest on trustworthy authority.

LEONTODON, L. Involucrum imbricatum. Achenium columnare, sæpius in rostrum sensim attenuatum. Pappus conformis, persistens, plumosus, radiis exterioribus interdum brevioribus eplumosis. Plumulæ radiorum fere semper persistentes. Receptaculum subnudum.

Sect. I. OPORINA. Radix præmorsa. Pappi radii subæquales, omnes plumosi, ad basin dilatati serrulati. Capitula virginea erecta. Pili simplices.

1. *L. autumnalis*, L. Radice undique fibrosa; scapo diviso; foliis lineari-lanceolatis, vix acutis; pedunculis superne incrassatis, squamosis; acheniorum suberostrium costæ rugulosæ.

A. foliis pinnatifido-dentatis, lobis integris, subobtusis, linearibus; herba tota pilis simplicibus adspersa.

Hab. in graminosis Europæ præsertim septentrionalis frequens. Nascitur etiam in America boreali, dubitant tamen cll. Torrey et Gray an vere indigenus.

A + f. var. *pratensis*, foliis pinnatifido-dentatis; involucro fusco-villoso; scapo foliisque pilosis.

Hab. sparsim in pratis humidis. (Habui a *Scavaig, Isle of Skye*, Prof. Balfour; legi prope Cracoviam, et in montibus prope *Ambleside*, in Angliæ Comitatu *Westmoreland*.)

Syn. *Apargia pratensis*, Link.

— I, — d, + g. subsp. *palustris*, scapo subsimplici; foliis subintegerrimis, obsolete dentatis, glabris; capitulis parvis, in pedunculum attenuatis; involucri squamis glabris, atrovirentibus.

Hab. in paludosis, tam montanis quam maritimis. (Legi in Anglia, *Westmoreland Mountains*; *Black Mountains, Breconshire*; et in Hibernia, *Salt marsh by the Boyne near Drogheda*.)

+ F, — D, — I. subsp. *borealis*, scapo simplici, foliis subintegerrimis, obsolete dentatis; involucro fusco-villoso.

Hab. in torfosis subalpinis Europæ septentrionalis. (*Clova Mountains*, Prof. Graham et Prof. Balfour; *Sutherland*, Prof. Balfour; legi in Hiberniæ monte *Lugnaquilla* et in Scotiæ montibus *Grampians*.)

Syn. *Hieracium Taraxaci*, L. *Apargia Taraxaci*, Sm.

I possess specimens gathered by myself in the Eastern Pyrenees (*Val de Carol*), and on Brandon Mountain in Kerry, which, from the peculiarity of their habit rather than from positive characters, I was disposed to consider distinct; neither of the specimens were in fruit, and for the present I am inclined to refer them to a form of *L. autumnalis*, which I would distinguish as a variety of the subspecies *palustris*—**e**.

Sect. II. Apargia. Radix præmorsa. Foliola involucri interiora biseriata subæqualia; exteriora brevia. Pappi radii inæquales, interiores plumosi, ad basin dilatati, serrulati; exteriores breves, scabri. Pili simplices, seu furcati. Achenia suberostria.

2. *L. Taraxaci*, Lois. Radice præmorsa, fibris validis prædita; scapo simplici, superne sensim incrassato, subsquamoso; foliis lanceolatis, in petiolum attenuatis, subintegerrimis, vel lobato-dentatis, vel interdum inæqualiter pinnatifidis, lobis latis triangularibus; involucro laxo, fusco-villoso, pappo niveo.

Hab. in pascuis alpinis Galliæ, Helvetiæ, Germaniæ, et Italiæ superioris.

Syn. *Apargia Taraxaci*, W. *Hedypnois Taraxaci*, Vill.

This very distinct species appears to be confined to the Alps of Central Europe; I suspect that the Carpathian habitat recorded by Reichenbach should be referred to the following species. In both the flowering stem is shorter than in the allied species.

3. *L. croceus*, Rcbh. (an Hke.). Scapo simplici, superne aliquantum incrassato, subsquamoso; foliis lanceolatis, grosse et inæqualiter pinnatifido-dentatis, lobis triangularibus, integris; involucro piloso; pappo sordide albo. Herba tota subglaberrima.

Hab. in alpibus Austriacis et in Carpathis septentrionalibus. (Legi prope *Zakopana*, et in jugo alpino supra *Biala Thal* in Carpathorum montibus *Tatra*. Habui ex iisdem montibus sub nomine *L. Taraxaci* comm. Dr. Gerenday.)

Syn. *Apargia crocea*, Willd.?

I do not feel quite certain as to the synonymy of this species, the descriptions of the authors cited being incomplete. The Carpathian plant is intermediate between *L. Taraxaci* and *L. pyrenaicus*, but it is nearer to the former; the colour of the pappus affords a satisfactory character by which it may be distinguished.

4. *L. pyrenaicus*, Gouan. Radice præmorsa, undique fibrosa; scapo monocephalo, squamoso, superne sensim incrassato, ante anthesin nutante; foliis spathulato-lanceolatis, obtusis, versus basin repando-denticulatis, glabris vel pilis simplicibus adspersis; acheniis utrinque attenuatis vix rostratis, costis vix rugulosis.

A. *alpinus*, involucro fere glabro, scapo superne incrassato.
Hab. in pascuis alpinis Europæ mediæ, frequens.

Syn. *L. squamosum,* Lam. *Apargia alpina,* Willd. (*L. alpinum,* Jcq. sequenti referendum monente cel. Koch.)

+**E**, −**g**. subsp. *aurantiacus,* involucro pube brevi farinoso adsperso; scapo minus incrassato; ligulis aurantiacis.

Hab. in alpibus Carinthiæ et in Apenninorum jugo. (Legi prope *Heiligenblut,* Carinthiæ, et supra montem *Corno alla Scala* in Apennino Bononiensi.)

Syn. *L. aurantiacus,* Ten. (an Rcbh.). *Apargia aurantiaca,* Kit.?

This species and the glabrous forms of the succeeding one sometimes much resemble each other, especially before the formation of ripe fruit, but the characters assigned, especially the form of the leaf and the disposition of the denticulations towards the base of the leaf, will generally suffice to distinguish the present species.

I have not verified the character pointed out by Koch, in the narrow base of the rays of the pappus.

5. *L. hastilis,* L. Radice præmorsa, undique fibrosa; scapo monocephalo, sub-esquamoso, apice parum incrassato; foliis oblongo-lanceolatis, plus minusve inæqualiter dentatis, dentibus versus basin retrorsis; pilis bi-trifurcatis; involucri foliolis oblongo-linearibus; achenii erostris, costis parum rugulosis.

A. foliis, scapis, involucrisque hirtis; foliis profunde dentatis, lobis triangularibus angulatis.

Hab. in Europa et Asia temperata vulgaris, valde ludibundus; variat.

+**d**. scapo inferne bifurcato (legi in Monte *Righi* Helvetiæ).

−**g**. pilis frequentioribus brevioribus incanus, frequens in apricis Europæ, præsertim australioris.

+**i**. foliis acute runcinato-pinnatifidis, lobis dentatis.

Syn. *L. crispus,* Reich. et Thomas, non Vill.

Habui ab ipso cl. Reichenbach, atque iterum ab E. Thomas ad *Zermatt* in Valesia lectum. Ipse legi, in Galliæ montibus Arverniæ et Delphinatus, et in Italia superiori juxta Lacum Larium, necnon in convalle *Leventina.*

Adsunt etiam varietates plurimæ quæ subspecies sequentes appropinquant.

Syn. *L. hispidum,* L. *Hedypnois hispida,* Sm. *Apargia hispida,* Hort. *Hieracium incanum,* Poll.

+**G**. subsp. *danubialis,* foliis, scapis, involucrisque glabris, seu pilis raris furcatis nonnunquam etiam simplicibus adspersum. Frequens in montanis et umbrosis Europæ fere totius, sed omnino desideratur in Anglia et Hibernia ubi species frequentissime occurrit. (Habui etiam ex Persiæ Monte *Elbruz* a cel. Kotschy.)

Syn. *L. hastilis β. glabratus,* Koch. *L. hastile,* L. *L. danubiale,* Jacq. *Apargia hastilis,* Willd. variat. +**e** −**e**, +**i** & −**i**.

+**I**, +**g**. subsp. *hyoseroides*, foliis fere ad costam usque pinnatifidis, pinnis angustis, sinuato-dentatis; herba viridi, glaberrima, seu pilis nonnullis longiusculis adspersa. Legi in sinu alpino *Trift* dicto, prope *Zermatt* in Valesia.
Syn. *L. hyoseroides*, Welw. (?)

—**E**. subsp. *montanus*, scapo crassiore, superne magis squamoso; foliis latioribus, minus divisis, viridibus; involucri foliolis latioribus. Achenia videntur paululum longiora et magis muricata.
Habui a monte *Fouly* in Valesia ab E. Thomas, formam vix diversam legi in alpibus Sti Gothardi, et in Pyrenæis orientalibus.
Syn. *L. dubius*, Reich. *Apargia dubia*, Hppe.

The ordinary forms of the typical species and of the subspecies *danubialis* and *hyoseroides* are easily distinguished from the allied species by the irregular and unsymmetrical manner in which the leaves are cut and divided; the nearly entire-leaved varieties however, especially those of the subspecies *montanus*, approach very near to *L. pyrenaïcus*, as has already been remarked, but I believe that the characters given in the leaves and the fruit will always suffice to distinguish the two species. The entire absence of a subspecies so widely spread as *L. danubialis* from the region of the British flora, is worthy of particular remark as bearing upon some of the arguments upon the question of the origin of species derived from their distribution through definite areas of space.

6. *L. caucasicus*, Fisch.? Radice præmorsa (?); scapo tenui glabro; foliis runcinato-pinnatifidis, lobis conformibus angulatis retrorsis, cum involucro pilis raris simplicibus, vel nonnunquam furcatis, adsperso; involucri foliolis lineari-lanceolatis, acuminatis, achenio erostri, vix (aut ne vix?) muricato.
Hab. in subalpinis Caucasi (D.C. Prod.). Habeo specimen unicum incompletum a cl. R. F. Hohenacker.
Syn. *Apargia caucasica*, M. Bieb. (?); Reich. Fl. Exc. 853 (?).

The single imperfect specimen in my herbarium appears to me to be in all probability the plant of Bieberstein, but there are some slight differences between the description above given and that of the author. My plant approaches very nearly in appearance to some forms of *L. hastilis* + **G**, but I distinguish it by the generally simple hairs, and still more certainly by the regular and symmetrical divisions of the leaf, which resembles that of *Aposeris fœtida*, Less., but the lobes are more decidedly deflexed. The character here noted in the divisions of the leaf is of much importance in the *Cichoraceæ*.

7. *L. anomalus*, nobis. Radice brevi, obliqua, parce fibrosa; scapo monocephalo, supra medium hinc inde squamis linearibus instructo, cum foliis et involucro pilis rigidis bi-tri-uncinato-furcatis obtecto;

foliis incano-virentibus, exterioribus spathulatis, sequentibus oblongo-lanceolatis, antrorsum dentatis; involucri foliolis lineari-acuminatis; achenii suberostris costis muricatis, radiorum pappi plumulis deciduis.

Hab. in Apennino Apuano. In verticibus *Pagna della Croce** et *Tambura,* mense Julio, 1844, florentem, hanc stirpem detexi, iterum legi, mense Maio, 1848, juxta scaturigines Frigidæ in iisdem montibus, specimina nova prioribus omnino conformia.

Although this species much resembles *L. hastilis* **A**, I cannot doubt of the necessity for distinguishing it from all the forms of that species. Independently of the remarkable and anomalous character of the pappus, common to all the specimens from the different localities above mentioned, the hooked branches of the forked hairs, the narrower and more pointed phyllaries, and the rougher ribs of the fruit, furnish points of distinction amply sufficient to justify its introduction as a new species. The root also appears to resemble those of the two following species, and to indicate a transition from the horizontal abrupt rhizoma of the species hitherto described to the fusiform root which characterizes the following section.

8. *L. Villarsii,* Lois. Radice subfusiformi, obliqua, parce fibrosa; foliis inæqualiter pinnatifidis, lobis oblongis angulatis, utrinque pilis longis, albis, simplicibus, interdum apice brevissime furcatis, copiose vestitis; scapo tenui subglabro, superne, cum involucri foliolis exterioribus lineari-acuminatis, demum recurvis, pube brevissima stellata, pilis raris intermixta, parcius adsperso; achenii suberostris costis vix rugulosis.

Hab. in saxosis Galliæ australis, Pedemontii et (?) agri Forojuliensis, infrequens. Habeo e Gallia prope *Gap,* comm. cl. Jordan; atque ex Pedemontio juxta *Col di Tenda,* ubi detexit cl. Reuter.

Syn. *L. hirtum,* Vill., et forsan Linn. sp. 1123. *Apargia Villarsii,* W. *Picris hirta,* All.

This species, very distinct in appearance from the preceding members of this section of the genus, is closely allied to the following species, of which it might be considered a subspecies + **E** but for the differences found in the hairs and fruit of *L. Rosani.*

9. *L. Rosani,* D.C. Prod. Radice subfusiformi, obliqua, parce fibrosa; foliis oblongis, profunde pinnatifidis, segmentis spathulatis oblongisve, angulatis, e pilis longis albis, sub lente asperis, interdum simplicibus, sæpius apice bifurcatis, utrinque hirtis; scapo tenui subglabro, superne, cum involucri foliolis lineari-oblongis adpressis, pube brevissima stellata, pilis raris intermixta, adsperso; achenii vix rostrati, costis eminentibus muricatis.

Hab. in apricis Italiæ mediæ et inferioris haud infrequens. Legi in

* I possess a specimen of the common *L. hastilis* A. gathered at the same time on this mountain.

Hetruria (*Val di Chiana, La Verna, Fiesole, Apennino Pistojese*), semper tamen in montosis soli expositis.

Syn. *Apargia Rosani*, Ten. Stirpem Tenoreanam in regno Neapolitano nascentem nunquam vidi, hanc tamen ex diagnosi Candolleano, ipsissimam fore speciem quam ego jam plurimis annis in Hetruria observavi, nullum dubito.

This species is considerably larger in all its parts than *L. Villarsii*, nevertheless it is doubtful whether the adpressed outer scales of the involucre would afford a sufficient mark of specific distinction, but, in the present state of our knowledge of this group, we may assume that the roughness of the hairs with which the leaves are abundantly clothed, together with the muricated achenia, furnish characters which do not allow us to unite this with the last-mentioned species.

Sect. III. Asterothrix. Radix fusiformis, verticaliter descendens. Capitula virginea nutantia. Foliola involucri 3–5-seriata, imbricata. Pili stellati. Achenia muricata plus minus rostrata.

* *Pappus ut in* § II.

10. *L. incanus*, Scop. Radice simplici subramosa; foliis oblongis integerrimis, seu leviter denticulatis, e pilis subæqualibus brevibus stellatis utrinque incanis; involucri foliolis lanceolatis, atrovirentibus, cum scapo apice parce squamoso, pube brevissima stellata, pilis nonnullis furcatis intermixta, obtectis; achenio superne attenuato, ruguloso.

Hab. in montosis, præcipue calcareis Europæ mediæ. Habui ex alpibus Rhæticis (*Albula*, E. Thomas, *Tyrol*, Bartling), ex Carpathorum monte *Chocs*, comm. Dr. Flittner, atque ex collibus prope Vindobonam, a *Kovats*.

Syn. *Hieracium incanum*, L. *Apargia incana*, Scop. *Leontodon alpinum*, Vill. (see D.C. Prod. vii. p. 103).

+**D**+**E**. subsp. *arenarius*, scapo bi-trifido; foliorum indumento aliquantum breviori, involucri foliolis exterioribus recurvis.

Hab. in arenosis ad ripas fl. *Isonzo* prope *Goritz* unde possideo specimen unicum immaturum; prope Togliano et Monfalcone, Reich.

Syn. *Apargia Berinii*, Bartl. *A. arenaria*, Moretti. *A. canescens*, Sieb.

There are no characters assigned to *L. Berinii* in the descriptions of authors which justify its being retained as a distinct species, and it is doubtful even whether it should rank as more than a variety produced by the peculiar position in which it is found in the sandy detritus of the rivers in Friuli.

The character of the pubescence is identical in both forms, but it appears to be slightly shorter in the subspecies *arenarius*. In the ordinary form the stellate hairs of the scape become gradually shorter from the base upwards, and ultimately the radiated star with which each is crowned becomes nearly sessile.

11. *L. tenuiflorus*, D.C. Prod. Radice simplici, interdum 2–3-furcato; foliis oblongo-linearibus, integerrimis, obscure virentibus; pilis rigidis stellula brevi coronatis, obtectis, scapo sparsim squamoso, versus basin folio unico lineari seu oblongo-lineari instructo, glabro, vel pilis stellulatis paucis adsperso, superne, cum involucri squamis lineari-lanceolatis, pube rara brevissima subincano; achenio breviter rostrato, præsertim superne muricato.

Hab. in calcareis subalpinis Insubriæ. Legi juxta Lacum Larium copiose plerisque locis. (*Monte Crocione*, prope *Tremezzo, Villa Arcolani.*)

+**i.** foliis versus medium sinuato-dentatis.

Habui ex *Monte Salvatore* prope *Lugano* comm. E. Thomas.

Syn. *Apargia tenuiflora*, Gaud., descr. ex spec. a *Monte Salvatore* quæ nobis ad varietatem spectare videntur, cum forma Alpium Insubriæ solemnis gaudet foliis integerrimis, cæterum descr. Gaudiniano omnino conformis.

The less numerous hairs crowned with a shorter star might not suffice to distinguish this species, but the presence of scales and a cauline leaf on the stem, the narrower and longer involucral leaflets, and the more beaked and rougher fruit, furnish abundant points of specific distinction which have not been sufficiently pointed out.

This and the preceding species fall into the section *Apargia* of Koch; but that group, which is founded on a difference in the structure of the inner rays of the pappus, which in these are flattened and serrulate at the base, while in the succeeding species they are feathered throughout, appears to me quite artificial, as in all other important respects it is closely allied with the true *Asterothrices*; but I find that if the pappus alone be considered, it is scarcely correct to separate these from the preceding group which Koch has termed *Dens leonis*. All the rays of the pappus are not feathered in *L. incanus* and *L. tenuiflorus*, for I have always found a few short scabrous hairs; so that in the structure of the pappus these species exhibit a nexus between the two groups, which it might otherwise be desirable to distinguish as separate genera.

** *Pappi radii e basi plumosi, exteriores breviores interdum scabri.*

12. *L. saxatilis*, Reich. (?). Radice crasso, fusiformi; foliis antrorsum sinuato-dentatis pilis stellatis vestitis; scapo pilis raris adsperso; involucri laxiusculi foliolis lineari-lanceolatis, acutiusculis, glabris aut margine et dorso pilis brevibus rigidis ciliatis, in series 4–5 haud æquidistantibus instructis; achenio longe rostrata, præsertim in rostro muricato.

Hab. in regno Neapolitano et verosimiliter in tota regione mediterranea cum sequente confusus. Legi prope Neapolim juxta *Castellamare.*

Syn. *Apargia saxatilis,* Ten. Diagnosis Reichenbachianus videtur incompletus, nec satis liquet an vir celeb. verum *L. crispum,* Vill., cum *L. saxatili* conjungendum judicavit, sive stirpis Villarsianæ omnino ignarus fuit.

—i. foliis e collo radicis crebris, sinuatis, vix dentatis. Legi in rupibus præruptis Insulæ Capræarum prope Neapolim.

Finding the synonyms and descriptions of authors as to this and the following species to be very discordant, I have described the plants known to myself, and have given them the specific names which I have no doubt they were intended to bear by the authors to whom the original descriptions are respectively due.

13. *L. crispus,* Vill. Radice fusiformi; foliis antrorsum pinnatifido-dentatis, segmentis inæqualibus obtusis, e pilis rigidis stellatis incano-scabris; scapo interdum versus basin folio unico instructo, 8–12 pollicari; involucri subcylindracei foliolis omnibus anguste linearibus, adpressis, vix acutis, 4–5-seriatis, exterioribus cum scapo pilis stellatis illis foliorum conformibus tenuiter adspersis; achenio longe rostrato, præsertim superne spinelloso-muricato, dentibus diametrum rostri subæquantibus.

Hab. in Gallia meridionali. Legi juxta *Vaucluse,* habui ex *Departement de l'Ain* a cl. Jordan.

Synonyma ad varietatem spectant.

+e+g. gracilior, superne glaber, foliola involucri minus numerosa, achenio paulo minus muricato.

Hab. in apricis Carnioliæ et Istriæ. Habui a *Fiume* e manu Prof. Sadler.

Syn. *Apargia tergestina,* Hppe. *A. crispa,* Willd. *Leontodon hispidum,* Scop.

Not without hesitation I have decided on keeping distinct this and the preceding species. The structure of the involucre seems too far different to allow us to unite these otherwise nearly allied plants. In *L. saxatilis* the involucre is more lax, the phyllaries broader and more acute, the two inner series nearly equal in length, about twelve in number; in *L. crispus* they are longer, much narrower and blunter, and the two inner series are about twenty in number in the normal French plant, rather less numerous in variety **+e+g.** I must however admit, that it is not satisfactory to rest the distinction of species so far upon the characters of a single organ.

14. *L. biscutellæfolius,* D.C. Radice fusiformi; foliis lanceolatis, in petiolum attenuatis, subæqualiter serrato-dentatis, dentibus antrorsum versis acuminatis, obscure viridibus, pilis stellatis obtectis;

scapo interdum folio basilari instructo, superne glabrescente; involucri squamis lineari-acuminatis, laxiusculis, exterioribus recurvis, omnibus margine et dorso ciliatis; (achenii muricellati rostro brevi?).

Hab. in Apennino Neapolitano (*Tenore*) et Romano (*Moris*), in Tauria (*M. Bieb.*) Habeo specimina Taurica immatura e manu *Steveni* e quibus trahitur diagnosis noster.

Syn. *Apargia crispa,* var. *macrorhiza,* Ten. *A. hispanica,* M. Bieb.

—**G**. subsp. (?) *cinerascens,* nob. (descr. ex spec. immaturo), scapo foliis 2 instructo, versus basin cum foliis omnibus e pilis mollibus longe stellatis incano, superne cum involucro pube brevi stellata, pilis longioribus intermixta, vestito.

Habui specimen unicum ex Pisidia, comm. cl. Heldreich; specimen alterum quod cum priore nomine gaudet *L. biscutellæfolii* est omnino *L. asperrimus* noster.

The decided difference in the sculpturing of the leaf, the more lax and recurved phyllaries, and, as far as I can judge from unripe specimens, the shorter beak of the fruit, sufficiently distinguish this from the two last species. I am inclined to expect that complete specimens of my subspecies *cinerascens* will establish characters of specific value by which it should be distinguished, and I believe that it will be found to be intermediate between *L. asper* and *L. adhærens.*

*** *Pappi radii omnes plumosi, exteriores breviores.*

15. *L. asper,* Reich. Radice fusiformi; scapo simplici aut rarius bifido, basin versus folio unico lanceolato, superne squamis linearibus, instructo; foliis radicalibus lanceolato-spathulatis, in petiolum attenuatis, lobato-dentatis, segmentis inæqualibus triangularibus, viridibus, e pilis sub lente asperis apice stellatis, hispidis; involucri foliolis lanceolatis, acutiusculis, margine et interdum dorso ciliatis pilis brevibus stellatis, in series 4–5 æquidistantes imbricatis; achenio longe rostrato, superne muricato.

Hab. in Hungaria et Macedonia. Habui ex Banatu a cl. Wierzbicki, atque ex Montibus Carlova e manu Friwaldski; occurrit etiam in Germania boreali suadente cel. Reichenbach, necnon in Pyrenæis ad portum *Venasque,* et in Sicilia, auctore D.C. (Prod. vii. p. 103). Licet tamen dubitare de diagnosi stirpis diu confusæ præsertim quoad specimina pyrenaica, cum planta hungarica prædiligit loca saxosa calidiora montium inferiorum.

Syn. *Apargia aspera,* W. K.

Habentur synonyma plurima meo sensu omnino dubia. *Apargia questfalica,* Bönningh. (Reich.) *Apargia hispanica,* W. (sec. Koch); sed stirps Willdenoviana, quam Candollius *Asterothrici,* Cass., conjunxit, videtur ex diagnosi auctorum incompleta, bene distincta species.

This species is intermediate between the group of which *L. crispus,* Vill., is the type, and *L. asperrimus.* It is considerably larger and more robust in habit than the preceding species; the involucres are broader, subglobose, and more regularly imbricated. It is probably nearly allied to *Apargia hispanica,* W.

16. *L. adhærens,* Fzl. Radice fusiformi; foliis oblongo-lanceolatis, subintegerrimis aut interdum sinuato-dentatis, utrinque, cum scapo simplici et involucro, e pilis rigidis stellatis cano-hispidis; involucri foliolis quadrifariam imbricatis, lanceolatis, acuminatis; achenio breviter rostrato, parum ruguloso (in spec. immaturis); indumento totius plantæ variæ longitudinis e pilis sat longis, brevioribus, et subsessilibus intermixtis.

Hab. in Monte Tauro. Habeo specimina Kotschyana e manu clar. auctoris.

This species is easily distinguished by the presence of stellate hairs of various length; it is much smaller in stature than the last, but the involucre approaches to the succeeding species both in size and structure.

17. *L. asperrimus,* Boiss MSS. Radice fusiformi; foliis oblongis, lobato-dentatis, cum scapo striato, squamuloso, basi folio unico instructo, simplici aut furcato, pilis rigidis, sub lente muricato-asperis, apice brevissime stellatis, undique strigosis; involucri cylindracei foliolis quinquefariam imbricatis æquidistantibus, exterioribus lanceolatis, acutiusculis, margine et dorso pilis brevibus rigidis ciliatis, interioribus lineari-elongatis, obtusis, glaberrimis, acheniis (in spec. nostris abortivis) rostratis, muricellatis; (?) pappi radiis longe plumosis, triseriatis, inæqualibus; receptaculo fimbrillifero.

Hab. in Iberia, Persia, et Asia Minore. Habui ex Monte *Demawend* comm. cl. Kotschy, ex Caucaso orientali a cl. Hohenacker, atque ex Pisidia specimen supracitatum a cl. Heldreich communicatum.

Syn. *Scorzonera asperrima,* Willd. *S. hispida,* M. B. *Apargia strigosa,* M. B. (Fl. Taur. Cauc.) *Asterothrix asperrima,* Cass.

This very distinct species greatly exceeds in stature, and still more in the size of the floral parts, the preceding species; it will be seen however that it cannot properly be distinguished generically, being nearly connected in essential characters with *L. asper* and *L. adhærens,* while these in their turn can scarcely be separated even as a section of the genus from those which precede them.

Want of leisure and opportunity having prevented me from comparing my own specimens with those contained in more extensive herbaria, I shall merely quote the descriptions of three species which I have been unable to examine for myself, but which appear properly to belong to the genus; and I shall further add a list of the uncertain and unknown species which have been attributed to it, though most of the latter are probably either synonyms of the known species, or plants properly belonging to other genera.

Species mihi non satis notæ.

18. *L. Boryi,* Boiss. "Foliis radicalibus pinnatifidis, lobis obtusis subintegris, pilis rigidulis confertis apice trifurcatis hispidis, scapis folia superantibus pilis apice 2–3 furcatis hirtellis, involucro oblongo glabro, acheniis læviusculis longius rostratis, pappi setis exterioribus paucissimis."

Hab. in campis aridis Sierræ Nevadæ regni Granatensis ad altit. 6700–9500 ped.

Syn. *Apargia hispida,* Bory. *L. crispus β. Boryanus,* Webb.

Herba pygmæa affinis *L. crispo* sed distinctissima, ex D.C. Prod. unde trahitur diagnosis. Desideratur descriptio amplior quæ characteres certiores ex achenio et radice fusius ostendat.

19. *L. hispanicus,* Merat. "Caule foliisque sparse hirtis, pilis aliis simplicibus, aliis apice stellato-furcatis, involucro campanulato, acheniis (saltem immaturis) lævibus."

Hab. in collibus regni Hispano-Valentini.

Syn. *L. hispidum,* Cav. *Apargia hispanica,* Willd. *Asterothrix hispanica,* D.C.

"Corolla in sicco ut in *Tolpide* virescens. Variat caule scaposo monocephalo aut subramoso parce folioso 2–3-cephalo."

Species quoad affinitates dubia.

20. *L. lucidus,* D.C. "Glaberrimus, foliis radicalibus oblongo-cuneatis obtusis basi attenuatis obtuse pinnatifidis, lobo terminali ovato majore ; scapo foliis multo longiore, striato, sub capitulo parce bracteolato, involucri squamis lanceolatis margine subscariosis, acheniis muricatis."

Hab. in sylvulis circa Sarzanam detexit ill. D.C. In collibus Euganeis, Schouw, D.C. Forsan etiam in Samnio, et ad *Montem Miletto.*

Syn. *Apargia lucida,* Ten. (?)

Hæc stirps ex diagnosi Candolleano probe distincta est. Nunquam in Italia superiori mihi obvia fuit. An subspecies + **G** *L. anomali*? quum ex diagnosi affinis *L. hastili,* ab hoc novissimo acheniis dense muricatis præcipue differt. Adest analogia *L. hastilis* **A** et *L. danubialis,* qua facile videtur quanta diversitas inter formas unæ ejusdemque speciei in hoc genere sistere potest.

Species dubiæ et ignotæ.

21. *L. annuus,* Vis. *Hab.* in Ægypto.

Syn. *L. asper,* Forsk. non Rcbh.

22. *L. bicolor,* Turczaninow. *Hab.* in Sibiria baicalensi.

23. *L. borealis,* D.C. *Hab.* in Insula Sitcha. In America boreali-occidentali.

Syn. *Apargia borealis,* Bong. *Apargidium boreale,* Torr. & Gr.

Ex descr. Torreyano pappo non plumoso ceterisque notis ad Lactucaceas referendus.

24. *L. Brumati,* Schiede. *Hab.* in Istria, ad Tergestum.

25. *L. chilloensis,* D.C. *Hab.* prope Quito.
Syn. *Apargia chilloensis,* H. B. K.
Genus ex auctoribus valde dubium.

26. *L. collinus,* Turczaninow. *Hab.* in Sibiria baicalensi.

27. *L. coronopifolius,* Dsf. *Apargia coronopifolia,* Willd.

28. *L. dandaleus,* Sieber. *Hab.* in Creta.

29. *L. glaber,* Ucr. *Hab.* in Sicilia.

30. *L. macrorhizus,* Steud. *Hab.* in Regno Neapolitano.
Syn. *Apargia macrorhiza,* Ten.

31. *L. megalorhizon,* Forsk. *Hab.* ad *Dardanelles.*

32. *L. pinnatifidus,* nob. *Hab.* in Regno Neapolitano.
Syn. *Apargia pinnatifida,* Ten.

33. *L. Preslii,* D.C. *Hab.* in Sicilia.
Syn. *Apargia ciliata,* Psl.

34. *L. sublyratus,* Merat. *Hab.* in Galloprovincia.
Syn. Forsan *L. crispus,* Vill., var.

35. *L. variegatus,* D.C. *Hab.* Monte Video.

Before concluding, I shall add a few remarks on the geographical distribution of the species.

The entire genus belongs to the temperate regions of the old world. Of the well-ascertained species, which alone need be taken into account, a large proportion are confined to limited areas of distribution. The single species which forms the section *Oporina* is widely spread throughout the regions of the Scandinavian and Celtic floras, and may probably extend throughout the entire boreal zone and represent the genus in the western hemisphere. All the well-established subspecies and varieties of this species are found in Britain. Of the eight species forming the section *Apargia,* one only, *L. hastilis,* is spread over a wide area, being particularly common throughout the region of the Germanic flora. It is a singular fact, which I have already alluded to, that the hispid form of the species is alone seen in Britain, while the glabrous subspecies *danubialis* is equally common throughout central Europe. One species of the section *Apargia* is confined to the western portion of the Alps; a second inhabits the alpine region of eastern Europe, and a third, the Caucasian chain; while one other species probably extends throughout the whole subalpine zone of the mountains of central Europe. Two species appear to be confined to central and southern Italy, while the last remaining member of the group seems limited to the valleys of the maritime Alps. The section *Asterothrix* (if we should therein include *L. Boryi* and *L. hispanicus*) includes ten species which chiefly inhabit southern Europe. The two last-named belong to Spain, two more species belong to the alpine flora, two to the warmer parts of France and Italy, one to Hungary and Greece, and three to western Asia between Syria and the Caucasus.

It is worthy of remark, that here, as in many other natural groups, *e. g.* the *Pilosella* section of the genus *Hieracium*, the hairy clothing which is common to nearly all the species is found to be most abundant and of a more rigid character in the species which inhabit the continental region, farthest removed from the influence of the coast climate of the Atlantic.

II.—*Description of* Asplanchna priodonta, *an animal of the Class* Rotifera. By Philip Henry Gosse, A.L.S., M.M.S.

[With two Plates.]

The extreme interest of the discovery by Mr. Brightwell (recorded in the 'Annals' for September 1848) of the diœcious character of a species of the class Rotifera, induces me to mention the fact that a second (if not a third) species of the same genus has fallen under my notice.

In the course of a series of investigations on the Rotifera pursued during the last year, I received through the kindness of Edmund E. Bowes, Esq., water from many of the ponds of Walthamstow and its neighbourhood. A species of this genus was abundant in one of these in August, which in several particulars differed from Mr. Brightwell's; but it needs further examination before it can be established.

On the third of the present month (May 1850) I took many specimens of a species, which is certainly distinct from Mr. Brightwell's, and I think also from the Walthamstow one. I dipped them from the margin of the Serpentine in Hyde Park, close to the house of the Humane Society. A few days later I obtained a single individual of the same species from the lake in front of Kensington Palace.

Taking the elaborate description by Mr. Dalrymple in the Phil. Trans. for 1849, as the standard of the first detected species, I find that of the Serpentine to differ in several important particulars. It is not more than half as large, adult females averaging about $\frac{1}{48}$ of an inch in length, and none that I saw measuring more than $\frac{1}{42}$. The jaws are broader, are rather hooked or falcate at the tip than uniformly curved, and instead of the projecting tooth on the inner side they have this edge minutely serrated, with the tip forming two curved longer teeth. Each mandible carries a style or spine, proceeding from its back, and curving round nearly parallel with its extremity, forming a sort of accessory tooth. The whole apparatus reminds us of the maxillæ of an insect with the maxillary palpi. The other obvious distinctions are found in the form of the general outline, in that of the stomach, in that of the ovary, in that of the tortuous glandular threads (which Professor Ehrenberg calls seminal glands), in the arrangement of the tremulous tags, and in the form and size of the contractile bladder.

The form is that of a membranous purse, most delicately transparent, and therefore very difficult to detect with the naked eye. It is almost regularly oval, the *dorsal* side however being rather inclined to be the longer. The front is furnished with a coronet of muscular masses, carrying cilia, which form two vortices. The centre of the head, or space thus surrounded, rises into two low conical protuberances, set rather forward, over which several muscular threads ramify and cross each other: between these, rather behind, is an oval opening, the entrance of the pharynx, just within the margin of which on the hinder side is placed a small eye of a rich crimson hue, as a guardian to the passage. A ganglion supports it. On each side of the circumference a ganglionic lobe projects, which carries another red eye equally rich, but smaller. The eyes are beautifully distinct when viewed by reflected sunlight. The hind head terminates in two incurved thick processes, between which there is a rounded excision, and on each side of these curved lobes there is a little projection carrying a thick short seta. I feel little doubt that these organs, of which either one or two are found in most of the Rotifera, and which Ehrenberg calls respiratory tubes, are rudimentary antennæ. Threads with bifurcate extremities go from the centre of the head to each cone-top, each lateral eye and each antenna. Below the cones lies a kidney-shaped muscular cushion, to one lobe of which is attached the jointed dental forceps, pointing horizontally backwards, while the other and larger lobe is spread beneath, probably as a rest to support the prey while the teeth masticate and lacerate it. On the top of this cushion are seen several yellow glandular (?) spots varying in number. The mouth leads by a narrow œsophagus into a capacious membranous crop, ordinarily of a somewhat cubical form and much corrugated, but capable of great expansion, when its surface is seen to be covered with a beautiful network of muscular threads, with thickened points of interlacement. In Pl. I. fig. *a.* it is seen expanded, as when food is entering; in Pl. II. fig. *h.* it is in its ordinary state. I think that when the animal is cognizant of food brought to the mouth by the ciliary vortices, it suddenly expands the crop by the action of the muscles that go from it to the skin, when the water rushing in to the vacuum carries in the prey. Then the network of fibres contracts again and the prey is secured. The jaws, with their cushion, are placed within this cavity at the front anterior end; and immediately beneath the cushion (*not at the bottom of the crop*) opens the long delicate duct, composed of longitudinal and annular contractile tissue, which leads to the stomach. It is capable of immense dilatation, but commonly takes the form of a slender tube with the lower extremity swollen, where an oval pancreatic gland is attached on each side. The passage of a small morsel, such as a *Chilomonas* (see fig. *a*), shows that the walls of this organ are thick, leaving only a slender tube when corrugated. The stomach consists of several rounded lobes or sacculi, arranged in a somewhat hemispherical form, the convexity being downward. It is always of a yellowish hue. There is no anal orifice to the stomach nor any intestine; the remains of the food when digested are regurgitated by the contraction of the viscera and discharged through the mouth.

The reproductive system consists of the ovary, the ovisac, the contained ovum or embryo, the oviduct, and the vaginal orifice. In no specimen have I seen the ovary horned or band-shaped, but roundish and very small. It is seen in fig. *a* with its nuclei, with the ovisac wrinkled up in front of it: in figs. *h* and *i* it is behind and somewhat above the ovisac, which contains a developing ovum. Cells are seen forming in the ovum, and there are several large oil-globules of a salmon colour and of a high refractive power. Possibly the colouring matter of these reservoirs may be resolved into the red pigment of the eyes, and the yellow of the jaw-cushion and other parts. The ovum produces the living young in the ovisac, which, when matured, occupies the whole lower part of the parent, if a female young; but the male is much smaller. At length it escapes through the oviduct and vaginal aperture, and immediately swims freely away. All its organs, the eyes, teeth, stomach, muscles, rotating cilia, &c., can be seen with perfect distinctness long before expulsion, and its motions are strong and voluntary. On the upper side of the oviduct sits a contractile bladder, which when full is perfectly globular and small; being scarcely, if at all, larger than the two pancreatic glands put together. Round this, attached at or near its base, passes on each side a tortuous thread apparently glandular, which goes up along each side of the ventral region, and is attached to the head-mass behind the jaw-cushion. The middle part of each thread is wrinkled into a large plexus of four or five pairs of doublings, laid with some regularity; on this plexus are placed four tremulous tags directed inwards; making eight in all. None are visible on any other part of the threads. The presence of these organs, as well as of the contractile bladder, in the female, shows that these are not connected with impregnation.

Close to each plexus there is a minute orifice in the skin set round with short setæ, and a similar one is placed on each side of the back, but a little higher up. From each of these four apertures a thread floating freely in the cavity of the body goes towards the head, having at its contact with the aperture a thickened club-shaped ganglion or gland.

The muscles are very numerous, and exert a powerful action, especially in the syringe-like retraction of the head. The principal pair are broad ribbons extending down each side from the head to near the bottom of the body (see figs. *a* & *i*). Another similar pair run down one on each side of the back. The other longitudinal muscles are chiefly threads, sometimes forked at their insertions. Very fine threads also keep the viscera in their places: thus two are attached to the fundus of the stomach, tying it to the bottom of the body. The ovary is attached to these and also to a diagonal thread branching from one of the longitudinal pairs. At the lower part of the back are two transverse muscles, which do not extend round the body; their contractions frequently draw in the skin of this part in strong angular folds. All the cuticular insertions are in a skin separable from the outer integument. Across the body, near the upper part or middle of the back, go three parallel transverse threads, of which the uppermost has each extremity prolonged in two branches; viewed laterally (as in fig. *a*) they are often seen quite bowed, and appear perfectly free, except at their insertions into the skin. They often *seem* to connect one pair of longitudinal muscles, but are, as I believe, independent.

The coronet of thickened masses that surround the head is probably muscular, bearing the cilia. Just below this there is a series of five or six annular threads set in the inner skin, which are probably muscular and aid in the complex movements of the head. The reniform cushion that bears the jaws is doubtless composed of powerful muscles; and the delicate stomach with its tube, the great crop and the ovisac, are covered with muscular network.

As a nervous system, each of the three eyes rests on a mass that appears ganglionic; the clubbed masses at the lateral apertures are probably of the same character; and the interior of the body contains a number of very delicate threads floating freely in the contained fluid, which have thickened knobs here and there, especially where they anastomose (see fig. *i*).

Such is the anatomy of the female. But the observations of Mr. Brightwell and Mr. Dalrymple had taught me to look for a distinct male, which I accordingly searched for. Many individuals I examined, but all were females; at length I found a small specimen which appeared likely to be a male; but it soon died, and I was uncertain. Soon after, I saw the developing young in a pregnant female, that seemed different from the ordinary embryos; and in hope that this might be a male, I isolated the parent. At length I had the satisfaction of seeing it born, and of finding it exactly the same as the one I had taken, but widely different from the female. Another was produced in the same evening from another parent, likewise under my eye. The ejection, though occupying only a few seconds, was not so instantaneous as I had observed it in the Walthamstow species. Both of these new-born males I placed with several females, but no intercourse took place, and I again isolated them for the night with sufficiency of water; but in the morning one was dead and the other dying. Judging from these, the first I saw must also have been newly born.

The length of these specimens was $\frac{1}{110}$ inch. They had a general agreement in outline with the female. But the outlet corresponding to the vagina was at the very bottom of the ventral side, which ran down to a point, while the dorsal side was rounded off (see figs. *e* & *f*). At the base of this tube was a globular sperm-sac, with a short thick penis in front (see *f*); the whole nearly surrounded by a delicate glandular mass. The place of the stomach was occupied by a long sac having a slender neck originating from the front part of the head-mass, and at the bottom broadly attached to the sperm-bag. This whole organ was filled with minute granular matter except three or four clear globular bladders: the sperm-bag showed a structure very similar. The principal muscles agreed with those of the female. The tortuous threads and their plexuses were represented by two thickened glandular bodies extending from the head-mass to the foliaceous substance surrounding the sperm-bag. The drawing of the head-mass was taken from a dying specimen, and probably needs correction; the three eyes however were present, situated as in the female, but no trace of jaws was discernible, even on pressure; nor any crop nor true stomach. These were very active, swimming rapidly about, and scarcely still an instant. On one or two occasions I observed one of the males with a slender process protruded to a considerable length from the sexual orifice, and adhering to the glass by its tip; moving round on it as on a pivot.

The stomach of the female is frequently occupied with animals; the smaller *Anuræa*, as *A. aculeata*, *curvicornis* (?) and *stipitata* (?), which are abundant in the water, seem to constitute its chief food. I have taken one with the species last named in its stomach, which after about an hour was ejected and swam about as lively and apparently uninjured as ever. In one I saw several specimens of a long slender Fragillaria *loose in the cavity of the body*; and in the stomach of another the long cell of a Conferva. On several I observed a small parasitic *Colacium.*

As it is manifest that the characters of the genus *Notommata* of Prof. Ehrenberg will not apply to these animals, I propose to form them into a new genus, under the name *Asplanchna* (*a* priv., *σπλάγχνον, viscus*), alluding to the remarkable absence of the intestinal canal. It may be thus characterized:—

Gen. Asplanchna.

Animal rotatorium, ex *Hydatinæorum* familia, pede, intestino, et ano carens; ocellis, mandibulisque instructum; sexibus sejunctis.

The three species as yet detected may be thus defined:—

1. *Asplanchna Brightwellii.*

A. ♀ mandibulis unidentatis; ocello unico; stomacho ovali, longitudinali; vesica lobata, majore; corpusculis tremulis filo extenso affixis; ovario bicornuto. Long. cir. $\frac{1}{24}$ unc.—♂ mandibulis, pharynge, et stomacho carens; corpore truncato. Long. cir. $\frac{1}{40}$ unc.
Hab. Norwich, Leamington.

I have honoured this species with the name of Mr. Brightwell, its first discoverer and describer.

2. *Asplanchna priodonta.*

A. ♀ mandibulis serratis; ocellis tribus; stomacho hemisphærico, transverso; vesica sphærica, minore; corpusculis tremulis filo contortuplicato affixis; ovario subgloboso. Long. cir. $\frac{1}{48}$ unc.—♂ corpore acuto. Long. $\frac{1}{110}$ unc.
Hab. Serpentine River, Kensington Gardens.

The name alludes to the notched edge of the jaw; *πρίω, serro, ὀδοὺς, dens.*

3. *Asplanchna Bowesii.*

A. ♀ mandibulis edentulis; stomacho ovali, longitudinali; vesica lobata, majore; [corpusculis tremulis non observatis;] ovario bicornuto. Long. cir. $\frac{1}{36}$ unc.—[♂ non vidi.]
Hab. Walthamstow.

This species I have named in honour of the esteemed relative to whom I owe my acquaintance with it.

EXPLANATION OF PLATES I. and II.

Plate I.

a. Female: lateral aspect; right side. The head is expanded; the crop is distended in the act of engulfing prey, two *Chilomonads.* A similar animalcule is seen on the point of entering the sacculated stomach. The contractile bladder is seen near the vagina, contracted. The ovisac is empty and wrinkled; lying in front of the ovary. To avoid confusion, the tortuous threads, with the tremulous tags and the muscles, shown, are those of one side only.

b. Female: vertical aspect of the head. The upper side is the occiput, where are seen the two incurved lobes, the small antennæ, and (more forward) the lateral eyes. In front are the two conical masses, and between them, but on a lower level, the forceps-like jaws, with their cushion, pointing towards the pharyngeal tube, which is furnished with an eye near its margin.

c. The jaws, seen vertically, under pressure. The delicate serratures on the edges, the two terminal points, and the accessory uncini are shown.

d. The jaws seen laterally. The serratures are cut in the *upper* edge, which seems to project inwardly. The terminal points are unequal, the upper being the longer. The uncini are attached to the lower edge.

e. Male: dorsal aspect.

f. Idem: lateral aspect; right side. The globular organ near the lower part is the sperm-sac, with a short bifid penis below it; the preputial sheath opens near the pointed extremity of the body. Above the sperm-sac a granulated organ is seen extending from it to the front of the head. Muscular threads, both longitudinal and transverse, are seen, as is also one of the tortuous glands, like a thickened cord. The pharyngeal eye and one lateral eye are represented.

Plate II.

h. Female: left side. The head is retracted; the crop is corrugated in its ordinary condition of repose: the bladder is distended: there is a developing ovum in the ovisac, which has several conspicuous oil-globules. One of the dorsal and one of the ventral orifices are well seen. Some of the organs represented in *a.* are not repeated here.

i. Female: dorsal aspect. The head expanded; the cilia rotating; the pharyngeal tube, with its eye, the jaws lying on their cushion, and the crop beneath, are seen; below which is the long, tubular, very expansible stomach, with its two pancreatic glands, terminating in a wide sacculate portion. (Perhaps the latter might be properly considered as an intestine.) On each side is the tortuous gland, and the developing ovum is shown below all. The powerful muscular bands that retract the head, the subordinate muscular threads, and the transverse threads are well seen; as are the extremely delicate floating filaments of nervous (?) matter, with their numerous ganglia.

P.S. Since the above was written, I had the pleasure of finding, on the 30th of May, *A. Brightwellii* very numerous in several of the little pools on Hampstead Heath. *Volvox globator, Dinocharis tetractis, Anuræa serrulata,* and other interesting forms were found with them. The females of the *Asplanchna* were much more numerous than the males, perhaps in the ratio of a hundred to one. I gladly bear testimony to the accuracy of Mr. Dalrymple's anatomical figures of this species.—P. H. G.

III.—*Description of the* Entomostraca *of the Pleistocene Beds of Newbury, Copford, Clacton, and Grays.* By T. Rupert Jones, Esq.

[With a Plate.]

The history of the recent British Entomostraca has lately been completed by Dr. Baird, and the Entomostraca of the "Carboniferous," "Permian," and "Cretaceous" formations of Britain have been described by Mr. M'Coy and myself: some progress has thereby been made towards the completion of a general history of the British Entomostraca, recent and fossil. Still however a great proportion of the fossil species remain undescribed, and the following account of the pleistocene Entomostraca is intended as a contribution towards the filling up of this deficiency.

Family Cyprididæ, *Baird* (Brit. Entom. p. 14).

Entomostracous crustaceans, minute, aquatic; *animal* inclosed in a bivalved carapace.

1. Genus Cypris, *Müller.*

Gen. Char. Animal swimming, provided with two pairs of plumed antennæ, and two pairs of feet. Inhabiting fresh-water.

1. *Cypris setigera,* nobis. Length $\frac{1}{23}$ inch. Pl. III. fig. 3 *a, b, c.*

Carapace ovate, somewhat pear-shaped. *Valves* convex; elliptical on the dorsal and nearly straight on the ventral border; narrower and slightly flatter anteriorly; covered with fine spines; bordered anteriorly and posteriorly by narrow, rounded, marginal ridges. *Right valve* narrower, straighter on the dorsal, and more incurved on the ventral margin than the left valve.

Dorsal aspect acute-oval; *anterior* oval.

This species approaches *Cypris aurantia,* Jurine (Baird, Brit. Entom. p. 159. n. 15. tab. 19. fig. 13); but it differs from it in being smaller and less gibbous, and in having spines, anterior marginal ridge, and a perfectly different pattern of *lucid spots.*

Plentiful in the peat-beds of Newbury, Berks.

2. *Cypris Browniana,* nobis. Length $\frac{1}{28}$ inch. Pl. III. fig. 1 *a, b, c, d.*

Carapace short and broad, somewhat square. *Valves* convex, depressed anteriorly, smooth. *Left valve* subquadrangular, obliquely rounded anteriorly, semicircular posteriorly; slightly arched on the dorsal and ventral borders. *Right valve* smaller than the left, subreniform.

Dorsal aspect elongate-oval; *anterior* obtusely ovate.

Plentiful in the freshwater deposit at Clacton, Essex. This species is named after John Brown, Esq., F.G.S. of Stanway, to whom I am indebted for the use of an interesting series of Entomostraca collected by him from the Clacton beds.

3. *Cypris tumida,* nobis. Length $\frac{1}{33}$ inch. Pl. III. fig. 2 *a, b, c.*

Caparace tumid, rounded. *Valves* strongly convex, especially on the posterior third; rounded obliquely anteriorly, semicircular posteriorly; strongly arched on the dorsal, and nearly straight on the ventral border.

Dorsal aspect suboblong, elongate-obtuse-ovate.

Rather rare: at Grays, Essex.

For this and the other species from Grays and Copford I am indebted to Mr. Pickering of Thames Street.

4. *Cypris gibba,* Ramdohr. Mag. Gesellsch. Naturf. Berlin, t. iii. fig. 13–17. Length $\frac{1}{25}$ inch. Pl. III. fig. 4 *a, b, c.*

Syn. *Cypris biplicata,* Koch, Deutsch. Crust. H. 21. t. 16, 1838.

Carapace oblong. *Valves* rather depressed; impressed with closely-set, circular punctations; rounded anteriorly and posteriorly; incurved at the middle of the ventral border; deeply marked across the centre by an irregular sulcus or two parallel sulci, strongest towards the dorsal border. The extremities of the recent carapace are fringed with fine hairs. *Right valve* somewhat smaller than the left.

Dorsal aspect elongate-oval or lanceolate; *anterior* ovate.

Occurs in the deposits of Clacton and Grays. Common in a recent state: Regent's Park, Notting Hill, Charing.—T. R. J.

2. Genus Candona, *Baird.*

Gen. Char. Animal creeping, provided with two pairs of antennæ, *upper pair* plumed, *lower pair* hooked; and two pair of feet. Inhabiting fresh and brackish water.

1. *Candona lucens,* Baird, Brit. Entom. p. 160. n. 1. tab. 19. fig. 1. Length $\frac{1}{15}$ inch. Pl. III. fig. 8 *a, b, c.*

Carapace somewhat reniform in the adult state, elliptical when young. *Valves* convex, smooth, white and shining; arched on the dorsal, sinuated on the ventral border. *Extremities* narrow, rounded; *the posterior* widest and produced obliquely downwards. The recent shell is hairy at the margins of the extremities.

Dorsal aspect elongate-acute-oval; *anterior* acute-ovate.

Common both in the recent state and in the deposits of Newbury, Copford, Clacton, and Grays.

2. *Candona reptans,* Baird, Brit. Entom. p. 160. n. 2.tab. 19. fig. 3, 3 *a*. Length $\frac{1}{8}$ inch. Pl. III. fig. 7 *a, b, c.*

Carapace oblong. *Valves* convex, glabrous, and in the recent state green, and fringed at the extremities with hairs; nearly straight on the dorsal, slightly sinuated on the ventral border; rounded posteriorly, and obliquely rounded anteriorly; *anterior extremity* slightly narrower and flatter than the posterior.

Dorsal aspect elongate-acute-oval; *anterior* suborbicular.

Common in the recent state. Fossil at Newbury, Clacton, and Grays: not rare.

3. *Candona torosa,* nobis. Length $\frac{1}{20}$ inch. Pl. III. fig. 6 *a, b, c, d, e.*

Carapace oblong, varying in length according to age. *Valves* convex; bearing a marginal ridge at the anterior extremity; bounded anteriorly and posteriorly; straight on the ventral and more or less arched on the dorsal border according to age, especially the right valve, which is smaller than the left and narrower posteriorly. The surface of valves is marked with closely-set pittings, coarse in the older specimens, and is raised in adult specimens into 5–7 tubercles. Young specimens in general have the surface almost even, or marked by a slight transverse sulcus near the centre and just posterior to the *lucid spots,* which indicate the position of the first-developed tubercle; 3–4 tubercles on the posterior moiety of the valve, and 1–3 smaller anteriorly become apparent afterwards. Occasionally well-developed tubercles are present even in very young specimens; and on the other hand individuals reach their full growth without being marked with more than one anterior tubercle.

The hinge is considerably developed, the hinge-margin of the right valve bearing anterior and posterior sets of "knurlings," which are received into corresponding furrows on the hinge-margin of the opposite valve.

Dorsal aspect irregular acute oval; *anterior* somewhat hexagonal.

This well-marked species occurs abundantly at Grays, and is also plentiful in a living state in the Gravesend ditches. I have to acknowledge Mr. Pickering's kindness in favouring me with the recent specimens of this interesting species.

3. Genus Cythere, *Müller.*

Gen. Char. Animal creeping; provided with two pairs of antennæ,—*upper pair* simple and setiferous, *lower pair* furnished with a long filament,—and three pairs of feet. Inhabiting fresh and salt water.

1. ? *Cythere trigonalis,* nobis. Length $\frac{1}{11}$ inch. Pl. III. fig. 5 *a, b, c.*

Carapace-valve triangular, convex, finely punctated; *extremities* obliquely rounded; *the anterior* much broader than the posterior extremity; *ventral border* nearly straight; *dorsal border* angular. *Hinge-margin* oblique and slightly developed. *Right valve* narrower than the left. *Dorsal aspect* acute-oval.

A unique specimen of this interesting form occurs at Clacton, and is identical with an undescribed recent species from Pegwell Bay, except that the latter has teeth or blunt spines on the anterior and posterior margins, as is usual with the genus *Cythere.*

A smooth form, var. *lævis,* which occurs plentifully at Grays, differs from the Clacton specimen merely in the want of pittings.

Cythere trigonalis approaches distantly in form some old specimens of *Cypris tristriata,* and it more nearly resembles *Cythere Hilseana* of the cretaceous formation, but differs materially from both in the structure of its hinge.

P.S. In a paper lately read before the Geological Society, Mr. W. J. Hamilton notices the occurrence of an extensive deposit of freshwater marl in the Cambridgeshire Fens, in which, in company with still existing land and freshwater mollusks, the following Entomostraca occur:

Cypris minuta, *Baird.**	Candona lucens, *Baird.*
——— setigera, *nobis.*	——— reptans, *Baird.*
——— gibba, *Ramdohr.*	

EXPLANATION OF PLATE III.

Fig. 1. *Cypris Browniana* + 16: *a,* left valve; *b,* right valve; *c,* dorsal profile of both valves; *d,* anterior profile of both valves.

Fig. 2. *Cypris tumida* + 16: *a,* left valve; *b,* dorsal profile of both valves; *c,* anterior profile of both valves.

Fig. 3. *Cypris setigera* + 16: *a,* right valve; *b,* dorsal profile of both valves; *c,* anterior profile of both valves.

Fig. 4. *Cypris gibba* + 16: *a,* left valve; *b,* dorsal profile of both valves; *c,* anterior profile of both valves.

Fig. 5. *Cythere trigonalis* + 8: *a,* left valve; *b,* dorsal profile of both valves; *c,* anterior profile of both valves.

Fig. 6. *Candona torosa* + 16: *a,* left valve, young; *b,* left valve, adult; *c,* right valve, adult; *d,* dorsal profile of both valves, adult; *e,* anterior profile of both valves, adult.

Fig. 7. *Candona reptans* + 8: *a,* left valve; *b,* dorsal profile of both valves; *c,* anterior profile of both valves.

Fig. 8. *Candona lucens* + 8: *a,* left valve; *b,* dorsal profile of both valves; *c,* anterior profile of both valves.

N.B. The carapace-valves and the dorsal profiles are figured with the anterior extremity upwards; and in the anterior profiles the dorsal margins are uppermost.

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* Brit. Entom. p. 155. n. 6. tab. 18. figs. 7, 8.

IV.—*Observations on the* Lacunæ. By William Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, Norfolk Crescent, Bath, May 1850.

I mentioned in my paper on the *Littorinidæ* in the May 'Annals,' 1850, that I was preparing a memoir on that branch of the family which is termed *Lacuna*, and that I had reserved the description of the *Littorina littoralis* as a standard of comparison with its animals: I also stated my opinion, that they ought to merge in *Littorina* as species. I now present notes thereon, which I beg may be considered the sequence and termination of my former paper, and which, with the addenda, will render it nearly complete. The present observations are the result of an examination and comparison of many living examples of the *Littorina littoralis* and the *Lacuna pallidula* of authors, which latter species, with me, will now be the type of a section of the *Littorinæ,* as I am confirmed in my views that the genus *Lacuna* is superfluous, and its species ought to pass to *Littorina.* My remarks embrace the *Littorina vincta,* "*puteolus*" and "*crassior,*" which, with the *L. pallidula,* include all the varieties of the *Lacunæ* of authors. I am inclined to think I have named more species than really exist, and that they may be reduced to three, the "*crassior*" being considered, when denuded of the epidermal laminæ, a strong, elongated, smooth, plain light brown subcarinated variety of that variety termed "*quadrifasciata,*" which I have seen with the same oblique epidermal laminæ; but as the animal of the "*crassior*" has not been observed, this view cannot be received as certain. Though I have only examined the *L. pallidula,* I have little doubt that in all essentials the other species called *Lacunæ* agree with this type of a section of the *Littorinæ,* making allowance for the variation of species. I have given copious notes of the *L. littoralis* in comparison with the *Littorina pallidula,* mihi, and leave it to malacologists to draw their own conclusions, reserving to myself, as a finale, a short comparative summary.

Littorina littoralis, Linnæus.

Animal spiral; mantle pale yellow, fleshy, but even with the margin of the aperture; the head is a cylindrical wrinkled muzzle capable of considerable extension, usually pale red on the neck, but the colours are very variable in this species, being yellow, orange, red-brown, and occasionally all the hues of lead-colour to nearly black; the under part of the foot is always white or yellow-white; the buccal disk is pale yellow, subcircular, with a vertical fissure, within which the white ribbon-like spiny tongue is seen at its alternate opening and closing; it is when extracted nearly an inch long, and the anterior folded jaws are supported by the usual corneous plates and buccal apparatus. The tentacula are pale yellow-brown, each having two fine longitudinal lead-colour lines running laterally from base to point, long, setose, conically tapering to not a very fine point; eyes small, on short offsets at the external bases. Foot at rest subcircular, in action an elongated oval, well rounded in front and behind, constricted moderately at the anterior third of the length, the other two-thirds margined with light drab opake transverse flakes, posteriorly puckered or jagged, with a central longitudinal depressed line. The anterior part of the pedal disk forms a terminal arcuated channel, which gives that part of the foot the aspect of having a narrow upper lobe separated from the pedal disk forming a pair of narrow labia; the upper posterior portion of the operculigerous membrane in this species is very slightly laterally expanded, and though not emarginate with caudal appendages, as in *Littorina pallidula,* is often sinuated and sometimes finely cloven; the operculum is nearly the shape of a vertical section of a pear, brown horn-colour; nucleus sublateral, leaning on the columella, with about $2\frac{1}{2}$ gyrations, the last of which rapidly coalesces with the outer margin of the plate. The animal has the true alternate undulatory longitudinal characteristic progression of the *Littorinæ*. The neck is simple, without lobes. The branchial plume is single on the left side with 35–40 or more very fine long close-set pectinations, many of which in certain positions of the animal may be seen under the mantle without dissection. The orifice of the anus and the canal of the sac of viscosity are seen on the right side; in the female the matrix and its orifice, with the anterior part of the ovary, and in the male, the verge. The fæcal pellets are pale red and exactly oviform: I mention this point, as I have sometimes found it a good distinctive aid. I have mentioned rather more than can be seen without dissection; and I will only enter so far on the anatomy of this species, as to observe, that I have carefully compared numerous specimens of the *L. littorea, L. pallidula* and *L. littoralis,* and I can pronounce all the internal organs, including the œsophageal ganglia, absolutely identical, allowing for the modifications of colour in the different species. The male organe générateur supplies the position of the matrix in the female, and the testis that of the ovary; the former springs under the right tentaculum, and is composed of two portions, the basal one being a tumid, annulated or ridged figure, dentated exteriorly, with the minute orifice at the external angle; the other angle is produced into a yellow, conical, arcuated, pointed, rather long process, the only use of which would appear to be that of an organe excitateur.

Lacuna, Turton.

Nerita pallidula, Da Costa.

Littorina pallidula, mihi.

Animal spiral, nearly white throughout; mantle simple, tumid at the margin, but even with the aperture of the shell; the head is a cylindrical produced annulated muzzle; the upper part of the neck has two short flake-white diverging lines imbedded in the ground colour; the disk is transversely oval with a vertical fissure, within which the white spiny tongue can be seen in action. The tentacula are long, setose, and taper conically to their termini, with rather small eyes raised on short external offsets. The foot is always white below, pale drab or yellowish white, or white, above, of oval shape in quietude, when on the march oval-elongated, rounded anteally and posteally, with occasionally slight emarginations behind, very considerably contracted at the anterior third of the length, with a pale flaky border; the other two-thirds have an intense flake-white margin. There is the central longitudinal fissure or groove that gives the animal the undulatory quality of progression, by alternate halves of the foot, which action is the principal generic characteristic of the true *Littorinæ.* The thin upper membrane that bears the operculum extends nearly to the junction of the foot with the body; the anterior terminus of the foot is slightly grooved, forming a sort of upper and under lobe or pair of shallow labia; the operculigerous lobe is expanded laterally beyond the pedal limits into minute wing-like processes, and at the terminal point is subcircularly scalloped out; the lateral margins forming usually two, sometimes three or four very short, white, caudal fillets of different lengths, variously shaped, but usually compressed and slightly triangular; these are occasionally in the same species either rudimentary or quite obsolete. The single light brown respiratory plume can in certain positions of the animal be observed branching from left to right; it has 35–45 or more long, slender pectinations; also there may be seen, without dissection, the short white termination of the rectum, accompanied by the excretory canal of the sac that contains the viscous fluid. The neck of the animal is simple and free from membranous lappets, as are all the *Littorinæ.* The fæcal pellets are elongated, slender, subcylindrical, having the apices tipped with a dark hue. The verge is a long, simple, arcuated, flattish, pale yellow process, regularly tapering from its insertion under the right tentaculum to a fine point. The operculum is pale horn-colour, subelliptic; nucleus excentric, sublateral, abutting on the columella, with 2½ volutions, the last of which rapidly unites with the margin. We repeat the remark on the internal organs of the *Littorina littoralis,* in comparison with this species, that they are identical.

I conclude this portion of my paper by a few comparative observations. Malacologists will observe that in the two species the internal and external organs are *essentially* the same; the only variations are, that in *Littorina pallidula,* the caudal filaments, the expansions of the operculigerous lobe and the form of the organe générateur, are not precisely similar to the parts in *L. littoralis*; the former are very variable specialties and cannot be depended on: *ex. gr.* the *Lacuna puteolus* of authors is without caudal processes, or at least they are obsolete; the same observation may be made of the *Rissoæ,* no two animals of the same species being similar in respect of caudal accessories, and many are without them. The male organs of the two undoubtedly vary in structure; the groove or lacuna in the pillar, from whence the generic title, is a mere modification of the umbilicus, which, from its variableness, is not of specific value, and is quite misapplied to generic determination. All the variations we have mentioned are specialties of slight consideration, which cannot be put in competition with the essential generic characters of the foot, and its singular plan of locomotion, which stamp the so-called *Lacunæ* of authors as genuine members of the genus *Littorina.*

Addenda to the memoir on the Littorinidæ, *page* 352 *of the May 'Annals,'* 1850.

Littorina littorea.

The pectinations of the branchial plume of nearly all the *Littorinæ,* instead of being 16–20, vary from 45–60; they are pale brown, long, slender and close-set; an examination under the microscope sanctions this correction. Having repeated, this 20th of May, a series of fresh observations on some hundreds of the *Littorina rudis* in comparison with the *L. tenebrosa* and *L. jugosa* of authors, I am authorized to say, that the identity in figure and action of their internal and external organs has further satisfied me of the propriety of regarding them as varieties of the *L. rudis*; the only differences are colour and size, resulting from the various complicated incidents attached to *habitat.* I omitted to observe that the *Littorinæ* are destitute of head and neck lappets, and that the operculigerous lobe is small, simple, and not co-extensive with its organ.

Rissoa ulvæ.

Having repeated the examination of two of the varieties of *R. ulvæ* found at Exmouth, the one having a pale horn-colour shell with flat volutions, the other tumid and red-brown, with the animal rather larger and of a darker lead-colour than the former, I am enabled to state, that I cannot discover the slightest organic difference between the two, and their action and habitudes are identical; the variation arises from habitat; the one, the pale variety, is found lurking under stones, the other exposed in the open patches of the green oozes of the estuary. The shells are so different in aspect, that the conchologist would pronounce them distinct, but malacology steps in, and offers a practical example of the superiority of its attributes by showing the two to be identical. Both the varieties have the under part of the foot aspersed with sulphur-yellow, opake, minute flakes. The operculigerous lobe fully covers that organ, and extends a little on each side, beyond the pedal disk, or forms what by some are called minute wings. The foot is perfectly rounded behind, and in almost all specimens more or less emarginate, though in some scarcely visible, in others decidedly so at several points of the arcuation; it is truncate and well auricled in front, without a medial line. There is invariably a very short cylindrical process or fillet exserted from that part of the mantle which lines the anal canal or upper angle of the aperture. I am unable to say anything as to its use: whether such an appendage exists in other minute congeneric species, and from its minuteness has passed without observation, must be left for future examination. I consider this species a *Rissoa*: though it has not the decided caudal filament, and pointed pedal termination of the typical *Rissoæ*, we must not forget that there are some *Rissoæ* with rounded tails and rudimentary or obsolete posterior terminations.

Rissoa parva.

To my string of varieties attached as synonyms to this species, I beg to add all those of the *R. inconspicua*; and I believe the *R. labiosa* of authors is only an elongated variety of it, as the former is a dwarf one, the "*parva*" of the coralline zone; the other is the "*parva*" of the highest parts of the littoral zone. We thus see the one is rendered dwarf by the absence of light, green food, and depth of water; the other having all these advantages, shows their effects in a more exuberant animality.

I beg that the *R. scalariformis* attached as a synonym to *R.*

parva in the May 'Annals,' 1850, page 359, by mistake, may be considered as cancelled, as well as the parts of lines 39 and 40 now quoted: "The *R. scalariformis* has the plicæ more numerous, white and delicate."

I am, Gentlemen, your most obedient servant,
WILLIAM CLARK.

Exmouth, June 17th, 1850.

POSTSCRIPT.—Since the above was in type, I have reviewed at this place, in a living state, all the *Lacunæ* of authors, except the "*crassior*," and I think I am authorized to be still more "tenax propositi," that they are a section of the genus *Littorina*, and cannot be severed from it without violence to true generic value. I find them all with variable excrescences of the operculigerous lobe of the foot; the *Lacuna puteolus*, which is a distinct species, has the lateral appendages large, but the caudal filaments very short and often obsolete; the *L. pallidula* has the lateral wing-like extensions, with 2–4 very short caudal fillets; the "*quadrifasciata*," a variety of the "*vincta*," besides the accessories of the "*pallidula*," has a very short style at the central posterior point of the pedal disc; the "*crassior*" I have mentioned above. The *Lacuna fasciata* of authors is referable to the *L. vincta*, and not to the *L. puteolus*.

It appears very doubtful if these alated lateral extensions and caudal filaments are of much generic value, from their variableness in many species and almost total absence in others; I think that they may be considered as analogous to the variation of certain organs in other animals; we may observe that the caudal appendage of the dog, even when unmutilated, are very variable; contrast the greyhound with the setter, terrier, bull or shepherd's dog: but surely no one will contend that the variations in these points, either in the molluscum or the dog, have generic value; if any of these animals were without caudal terminations and operculigerous lobes, that circumstance might contribute to establish generic value; but I speak with reserve on this point, because in *Pleurotoma*, malacologists do not separate the species with operculigerous lobes from those which have none, as the *P. septangulare* with a decided operculum, and *P. Ginnanianum* without a trace of one, are styled *Pleurotomata*; here the total absence or presence of opercula has not hitherto been held of importance in a generic point of view, *à fortiori*; mere variations of these organs can be, in this respect, of little value. The points of support, then, for the establishment of the genus *Lacuna*, rest on the lateral and caudal variations of the operculigerous lobes of the foot, some difference in the organe générateur and in the lacuna or groove in the columella of the shell, which is merely an incomplete umbilicus that is very conspicuous in some species, in others almost closed up, and often in the same species, the *Puteoli*, it is sometimes apparent, and frequently scarcely visible; in all other respects these *Lacunæ* are similar to the *Littorinæ*. In opposition to these pretensions, I repeat, that all the so-called *Lacunæ* have invariably the form of the pedal disc of the *Littorinæ*, accompanied by the overwhelming characteristic vermicular alternate quality of progression which is almost exclusively confined to that genus, and which must, as I think, fix the *Lacunæ* of authors for ever as one of its sections.

With regard to the aid derived from the tongues of the Gasteropoda for generic or specific distinction, I am inclined to think its importance overrated, because no two species of the same genus have a precisely similar disposition of the rachis, uncini, and arrangement of the spines and interweavings of the lingual riband: this fact sets at rest generic views; the tongues, at best, are of mere specific value: I have examined hundreds, and can make nothing of them that can at all be depended on, from their extreme variable structures. The tongues of great numbers of the minor species cannot without extreme difficulty be obtained by the scalpel, they can only be detected after maceration and compression under a powerful microscope, and the comparison of these minute species is attended with difficulties and very unsatisfactory results. The ootheca of the mollusca may be useful in comparison, if they can be obtained and identified to belong to certain species.

I conclude, and insist on the foregoing positions in the paper and postscript, with as much tenacity as courtesy will allow to the phrase; I cannot even consent that the *Lacunæ* be considered a subgenus of the *Littorinæ*; I think the term subgenus an unsatisfactory and hybrid expedient, to attempt to express an intermediate state that does not exist; with me subgenera are resolved either into distinct species or genera. If I might consider that those who use the term subgenus mean to define it as an aggregation of particular or aberrant species of a distinct genus, I would accept the definition, but not the term, which ought to be section, as that of subgenus seems to imply something beyond divisional arrangement.—W. C.

V.—*On* Scopolia, Anisodus *and* Mandragora.

By John Miers, Esq., F.R.S., F.L.S.

Scopolia.

A single species only of this genus is recorded, and it seems to possess a considerable range, for it is found in Illyria, Croatia, and the southern portions of Hungary: although thus frequent, it cannot have attracted the notice of botanists, for I have not been able to find in any herbarium, sufficiently satisfactory specimens from which a careful analysis of its characters could be made. A small plant raised in Kew Gardens has, however, afforded the means of examining its flower in a living state, but I was disappointed in watching the development of its fruit, as it seems to require a more genial climate than ours, at the early season in which it appears, to perfect its capsule: every search in different herbaria for a specimen of its fruit has proved unsuccessful. A very good analysis of the genus is seen in Nees's 'Gen. Pl. Germ.,' but this does not explain the structural formation of its fruit. I have pointed out the existence of the curious apical gland covering the upper moiety of the ovarium in *Hyoscyamus*, as the cause of the transverse opening of its capsule; that of *Physochlæna* appears to originate from a similar cause, only in a more modified degree. In *Scopolia* there is seen a slight thickening of the upper portion of the ovarium, as in the last-mentioned genera, and at the same time it is supported by a thick fleshy basal gland as in *Physochlæna*. In *Hyoscyamus* the operculum is hard, thick, osseous and hemispherical; in *Physochlæna* it is flat and discoid: it remains to be seen therefore in what state this exists in *Scopolia*. From the indications offered by dried specimens farther advanced towards maturity than the living flowers above alluded to, it appears to resemble the structure of the last-mentioned genus. Unable to examine the fruit of *Scopolia*, I have copied, in the following generic outline, the characters of the capsule and seed, entirely from Nees's description and figure above quoted.

SCOPOLIA, Jacq. (char. emend.).—*Calyx* turbinato-campanulatus breviter 5-dentatus, persistens. *Corolla* infundibuliformi-campanulata, 15-nervis, limbi fere integri lobis 5, brevissimis, obtusiusculis, æqualibus, æstivatione tubo subplicato, lobis imbricatim dispositis. *Stamina* 5, æqualia, inclusa, imo tubi orta; *filamenta* brevia, basi dilatata et pilosula, superne teretia, glabra; *antheræ* ovatæ, connectivo dorsali articulatim affixæ, imo cordatæ, 2-loculares, loculis adnatis, rima marginali dehiscentibus. *Ovarium* conicum, disco carnoso 5-lobo basi cinctum, 2-loculare, ovulis plurimis, placentis valde incrassatis dissepimento utrinque adnatis. *Stylus* erectus, longitudine staminum. *Stigma* capitatum, obsolete bilobum. *Capsula* subgloboso-turbinata, coriacea, calyce membranaceo persistente inclusa, 2-locularis, apice operculatim dehiscens. *Semina* plurima, placentis crassis affixa, ovoidea, reniformia, *testa* granulosa, hilo laterali. *Embryo* teres, intra albumen subcarnosum hamato-arcuatus, *radicula* paulo incurvata, ad angulum basalem spectante, cotyledonibus hemicyclicis semiteretibus æquilonga.—Herba *in Europæ orientalis alpinis indigena, glaberrima,* radice *perennante*; folia *gemina, altero minori, elliptica, acuta, in petiolum longum attenuata*; flores *solitarii, longe pedunculati, penduli, inter foliorum paria orti*; corolla *luride aurantiaco-purpurea.*

1. *Scopolia carnoliaca,* Jacq. Observ. i. 32. tab. 20. Scopolina atropoides, *Schult. Æstr. Fl.* i. 844. Hyoscyamus Scopolia, *Linn. Mant.* pl. 46; *St. Hil. Fl. Fr.* 20. tab. 6; *Bot. Mag.* tab. 126; *Nees, Gen. Pl. Germ.* cum icone;—foliis oblongis, acuminatis, basi attenuatis et in petiolum longum crassum decurrentibus, inferioribus alternis, caulinis geminis, rarius 3-nis, flore solitario pendulo. In sylvis Illyriæ et Hungariæ.

Anisodus.

In noticing this genus (*huj. oper.* iii. 166), I had arranged it near *Atropa,* on account of the analogy offered by the structure of the corolla in that genus, and of the apparently fleshy pericarpial covering of its immature fruit; since that period I have had an opportunity of examining its ripened capsule, and now find that it must take its place among the *Hyoscyameæ,* after *Thinogeton,* and thus bordering upon *Atropa.* The ovarium is small, conical, and half invested below by a very thick fleshy yellow disc; its apical gland, in the young state, is not so strongly developed as in *Hyoscyamus,* though it is distinctly visible, and may be considered, in like manner, as an extension of the base of the style: as the process of fructification advances, the basal disc disappears, and the lower portion of the ovarium takes a rapid increment both in length and diameter, and the pericarpial covering becomes more and more attenuated, until at length it forms a thin and brittle shell, composed of a loosely cohering epicarpial and an endocarpial pellicular integument with a thin semiligneous mesocarpial intervening plate: the opercular apex is smaller, in proportion, than in *Hyoscyamus,* flatter, thick and coriaceous, somewhat 4-lobed, and bursts away from the lower shell by a ruptured circumscissile line of dehiscence, as in the genus last mentioned. The border of the corolla is not plicate, as stated by Endlicher and other authors, but on the contrary, distinctly imbricate in æstivation. The following may be considered as an outline of its generic features.

Anisodus, Link. (Char. reform.).—*Calyx* magnus, tubulosus, infra medium subinflatus, 10-costatus, 5-dentatus, dentibus brevibus, inæqualibus, obtusis, persistens, in fructu non augescens. *Corolla* campanulato-tubulosa, imo contracta, medio inflata, tubo carnosulo calycis longitudine, limbo brevi 5-partito, lobis rotundatis, reflexis, tenuioribus, uno majusculo in alabastro interiore, æstivatione omnino imbricativa. *Stamina* 5, æqualia, inclusa, erecta; *filamenta* teretia, basi dilatata, imo tubi inserta. in alabastro pubescentia, demum glabra; *antheræ* oblongæ, imo cordatæ, sinu apicifixæ, 2-loculares, loculis parallele connatis, intus longitudinaliter dehiscentibus. *Ovarium* conicum, imo disco magno carnoso plurisulcato circumdatum, 2-loculare, placentis valde incrassatis, pluri-ovulatis, dissepimento utrinque adnatis. *Stylus* teres, longitudine staminum. *Stigma* clavato-bilobum, subcompressum. *Capsula* ovata, subcoriacea, fragilis, 2-locularis, calyce reticulato 10-costato recondita, apice horizontaliter ruptilis, operculo deciduo, subplano, sub-4-lobo, crasso-coriaceo. *Semina* plurima, reniformia, compressa, *testa* leviter punctulata. *Embryo* intra *albumen* carnosum hamato-arcuatus, teres, *radicula* paulo curvata, angulo basali spectante, *cotyledonibus* semiteretibus uncatis æquilonga.—Herba *Nepalensis,* radice *perennante,* folia *oblonga, geminata, altero minori, petiolata*; flores *solitarii, axillares, nutantes.*

1. *Anisodus luridus,* Link, Icon. Select. Pl. Ber. 77; Nees, Linn. Trans. xvii. 72. Nicandra anomala, *Link & Otto, loc. cit.* tab. 35. Whitleya stramonifolia, *Sweet, Brit. Fl. Gard.* ii. tab. 125. Physalis stramonifolia, *Wall. Cat.* 2632 *et in Roxb. Fl. Ind.* ii. 242;—herba elata, dichotome ramosa; foliis oblongis, utrinque acutis, basi subinæqualibus, supra glabris, subtus flavidis, floccoso-tomentosis, petiolo crassiusculo; flore nutante, pedunculo pubescente, petioli longitudine, calycis tubo 10-angulato, angulis costatis, pilis articulatis pubescentibus; corolla viridi-lutea, demum lurido-purpurascente.—Nepal, *v. s. in herb. Wall., in herb. Hook., et v. v. in hort. Kew. cult.*

This plant is cultivated in the Kew Gardens, where it assumes a shrubby appearance, about 5 or 6 feet high, with large and copious foliage: its stems are annual, appearing each spring from its large perennial root. The leaves are about 7 inches long and 3½ inches broad, on a fleshy channeled petiole of about 1 inch in length, the geminate leaf being about half that size. The peduncle also, 1 inch long, springs from the interval between the two petioles. The calyx is somewhat fleshy in texture, subangular, with ten prominent pubescent nervures, and with intermediate reticulations; it is campanular below, broadly tubular and somewhat cylindrical above, about 1 inch in length and nearly an inch in diameter, being surmounted by five broad triangular teeth of unequal size, and from 1 to 4 lines in length.

The corolla is of fleshy texture, about an inch long, 9 lines in diameter at the mouth, and somewhat broader in the middle, being contracted at the base to a diameter of 4 lines; it is smooth outside and woolly within; the lobes of the border are quite glabrous, nearly round, and reflexed, the margins overlapping each other; they are of much thinner texture, and in æstivation the larger lobe is altogether interior, the adjoining one being generally exterior, while the intermediate lobes are convolutely imbricated; the filaments are quite erect, 9 lines long, terete above, much flattened below, and inserted in the contracted base of the tube; they are pubescent in bud, quite smooth after the flower opens, the anthers being 3 lines long and $1\frac{1}{2}$ line broad. The ovarium is 4 lines long, conical, 3 lines broad at base, where it is encircled by a large yellow fleshy 10-grooved disc, 4 or 5 lines in diameter. The capsule is oval, smooth, somewhat stipitate upon the withered disc, is 10 lines long, 7 lines in diameter, with a coriaceous operculum and a large fleshy coriaceous honeycombed receptacle bearing many flattened reniform seeds, of about a line in diameter. The ten nerves of the persistent calyx become thickened, hard, and woody, the intermediate portion of the tube being dried and reticulated, almost cancellately so. I observed that the style falls away on the withering of the corolla, and is not mucronately persistent on the berry, as stated by Nees and Endlicher. I noticed also in the living flower the constant character of two or three processes at irregular distances, white, fleshy, compressed, linear, pointed, and two or three lines long, between the calyx and corolla, and originating apparently from the base of the former. I have not been able to meet with any native specimen of this plant by which to ascertain whether this be as constant a feature as that observed in a cultivated state*.

Mandragora.

This genus, though differing widely from *Atropa* in habit, greatly resembles it in the form of its calyx and corolla, and the structure of its fruit: as in *Atropa*, the lobes of its corolla possess an imbricated æstivation. The following is an amended generic character:—

Mandragora, Tournef. (Char. emend.).—*Calyx* urceolato-tubulosus, 5-angularis, laciniis 5, lineari-acutis, nervo prominulo notatis, erectis, tubo fere duplo longioribus, in fructu augescens et persistens. *Corolla* infundibuliformis, limbo 5-partito, laciniis subrotundatis, expansis, æstivatione imbricatis. *Stamina* 5, sub-æqualia, inclusa; *filamenta* infra medium corollæ

* Full generic details of this genus will be shown in a supplementary plate of the 2nd vol. of the 'Illustr. South Amer. Plants.'

inserta, imo fornicata, crassiora et pubescentia, superne filiformia, glabra; *antheræ* erectæ, oblongæ, cordatæ, apice attenuatæ, connectivo dorsali imo affixæ, 2-lobæ, lobis parallele adnatis, antice rima longitudinali dehiscentibus. *Ovarium* ovatum, disco parvo carnoso lobulis 2 prominentibus dissepimento oppositis insitum, 2-loculare, placentis valde incrassatis dissepimento utrinque adnatis, multi-ovulatis. *Stylus* filiformis, apice inflexus. *Stigma* clavato-bilobum. *Bacca* magna, calyce aucto membranaceo suffulta, 2-locularis. *Semina* plurima in pulpam nidulantia, reniformia. *Embryo* teres, in albumen carnosum hemicyclico-arcuatus, *cotyledonibus* semiteretibus, *radicula* hilo basali spectante fere duplo longioribus.—Herbæ *perennes in Europa Australi indigenæ, acaules,* radice *crassa, carnosa,* folia *radicalia, conferta, petiolata, basi attenuata, integerrima, undulata*; pedunculi *radicales, conferti, uniflori, apice incrassati.*

1. *Mandragora officinalis,* Linn., Flor. Græc. tab. 232; Walpers, Rep. iii. 104.
2. *Mandragora vernalis,* Bertol., Com. Bonon. ii. 388. tab. 23; Gærtn. ii. 236. tab. 131; Walp. id. 105.
3. *Mandragora præcox,* Sweet, Brit. Fl. Gard. ii. tab. 198; Walp. id. 105.
4. *Mandragora microcarpa,* Bertol., Com. Bonon. ii. 391. tab. 25; Walp. id. 105.

The above generic character is formed in great measure from a plant I had an opportunity of examining in its living state, probably *M. microcarpa.* Its leaves are numerous, spreading, all radical, lanceolate, acuminated at both ends, and decurrent on a thick fleshy purplish petiole; they are undulated and somewhat sinuous on the crenulato-dentate margin, rough on both sides, with several small tubercles bearing minute articulated hairs; the very fleshy broad midrib, and about seven pairs of prominent pinnate nerves, with intermediate reticulated veins, are clothed with rather short articulated pubescence; they are about 10 inches long, exclusive of a petiole of 2 inches, and 3 inches broad. Several peduncles spring from the base of the petioles; they are erect, pubescent, thickened above, about $1\frac{1}{2}$ inch long and 1-flowered. The calyx consists of a short campanular tube 2 lines long, with five equal narrow linear acuminated erect segments, each 4 lines long; the corolla is tubular, somewhat funnel-shaped, about 6 lines in length, and 4 lines in diameter in the mouth; the lobes of the somewhat oblique border are oblong, overlapped at base, tapering and obtuse at their summit, of a pale blue or lilac colour, each marked with three parallel nervures and numerous anastomosing veins, and are slightly expanded. The stamens are equal, hairy and slightly arched at their origin, slender, smooth, and erect above; the anthers connive around the included stigma, and are oblong, cordate and apiculated; like those of *Hyoscyamus,* they are articulated upon a prominence of the dorsal connective. The ovarium is seated upon a short hypogynous gland with two prominent lobes, opposite the furrows of the dissepiment; these lobes remain after the growth of the ovarium, but the gland itself soon disappears. The stigma is capitate, somewhat 2-lobed, and covered with numerous viscose papillæ. I observed the fruit of a specimen in M. de Boissier's herbarium (*M. microcarpa* from Malaga); here the persistent calyx preserves the same form, the tube growing to a diameter of 7 lines and a length of 6 lines, while the erect lobes in addition are 9 lines long; it is membranaceous, reticulated, and incloses an oval berry crowned with the persistent style, being 7 lines long and 5 or 6 lines in diameter; the seeds are flat, reniform, oval, and about $1\frac{1}{2}$ line long*.

VI.—*Descriptions of* Aphides. By Francis Walker, F.L.S.

[Continued from vol. v. p. 395.]

86. *Aphis Viburni.*

Aphis Viburni, Fabr. Syst. Ent. 737. 18; Sp. ii. 386. 23; Ent. Syst. iv. 216. 28; Syst. Rhyn. 298. 28; Gmel. ed. Syst. Nat. i. 2208; Sulz. pl. 11. fig. 1, 2; Scop. Ent. Carn. 396; Schrank, Faun. Boic. ii. 111. 1203; Stew. El. ii. 111; Enc. Meth. Ins. pl. 115. fig. 9; Sir Oswald Mosley, Gard. Chron. i. 684; Rusticus, Ent. Mag. i. 218.

Viburnifex, Amyot, Ann. Soc. Ent. Fr. 2de série, v. 478.

This species feeds on *Viburnum Opulus* and *V. lantana* from March till November.

The viviparous wingless female. It is hatched in the beginning of March, and is then linear, very small, and of a dull dark green colour, paler beneath; sometimes it has dark bands across the back: the feelers and the legs are black, short, and stout: the eyes, the mouth, and the nectaries are also black. The young ones in the middle of April are pale green, spindle-shaped, slightly convex, not shining: the feelers are hardly half the length of the body; their tips, the tip of the mouth, and the eyes are black: the abdomen is pale orange around the base of the nectaries, which are nearly one-sixth of the length of the

* An analysis of the generic features of this genus will be given in one of the supplementary plates to vol. ii. of the 'Illustr. South Amer. Plants.'

body. The body is elliptical, convex, plump, velvet-like, very dark olive-green, and covered with a white bloom: the feelers are black, pale yellow at the base, and not more than one-fourth of the length of the body: the nectaries are not more than one-twelfth of the length of the body: the legs are black, short and stout; the shanks except their tips are pale yellow. In the middle of April it may often be seen sitting under a leaf surrounded by its offspring, which have comparatively pale and flat bodies: it disappears in the beginning of July, and returns again in the autumn.

1st var. The body is black.

The viviparous winged female. While a pupa the body is black, and has a row of transverse white spots on each side of the abdomen: the feelers are more than half the length of the body: the nectaries are about one-tenth of the length of the body: the legs are moderately long; the fore-thighs and the shanks except their tips are white: the wings are unfolded before the middle of May, and are, as usual, at first milk-white, and afterwards become colourless, and very much longer than the body; the wing-ribs are very pale green, or almost white; the brands are dull buff; the veins are pale brown.

1st var. The body is black: the feelers are rather shorter than the body: the mouth is dull yellow towards the base: the nectaries are about one-sixth of the length of the body: the shanks are very dark yellow with black tips; the fore-thighs are yellow at the base: the wings are slightly tinged with gray; the wing-ribs, the brands, and the veins are brown.

The oviparous wingless female. The body is elliptical, convex, shining, pale yellow: the feelers are pale yellow, black towards the tips, and rather less than half the length of the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are black, and hardly one-sixth of the length of the body: the legs are pale yellow; the knees, the feet, and the tips of the shanks are black; the hind-shanks are broad.

1st var. The body is tinged with green.

2nd var. The body is tinged with red.

3rd var. The body is pale red.

4th var. With six rows of black spots on the back.

5th var. With a large red spot at the base of each nectary.

6th var. The head is pale gray.

7th var. The hind-shanks are pale brown.

8th var. The tip of the abdomen is black.

The oviparous wingless female? The body is small, oval, slightly convex, very deep black with a slight white bloom, and it has a rim on each side of the body: the abdomen is tapering towards the tip: the feelers are black, white towards the base, and full half the length of the body: the mouth is paler towards the base: the nectaries are about one-tenth of the length of the body: the legs are dull white; the knees, the feet, and the tips of the shanks are black; the hind-legs are dark gray, and are very broad. In the beginning of November.

The winged male. The body is black: the fore-border and the hind-border of the fore-chest are very dark yellow: the feelers are black, rather thick till near their tips, and nearly as long as the body: the mouth is black, dark yellow towards the base: the nectaries are black, and full one-sixth of the length of the body; the legs are black; the fore-thighs are dark yellow at the base: the wings are slightly gray, and very much longer than the body; the wing-ribs are yellow; the brands are pale brown; the veins are brown. It appears in the beginning of November, and then pairs with the yellow female before mentioned.

Length of the body $\frac{1}{2}$–$\frac{3}{4}$ line; of the wings $1\frac{1}{2}$–2 lines.

In the spring these *Aphides* dwell in clusters on the stalks of the guelder rose buds which open and inclose them with a snowy drapery; in the autumn they multiply when the tree is adorned with clusters of red shining berries; and November, when the leaves assume a bright scarlet hue, is the egg-laying epoch. The leaves of the wayfaring tree on which it feeds in the spring curl up, and protect it from injury.

87. *Aphis Xylostei*, Schrank.

Aphis Xylostei, Schrank, Faun. Boic. ii. 1. 107; Reaum. Ins. iii. 286; Deg. Ins. iii. 96. 16. pl. 7. fig. 8–13; Gmel. ed. Syst. Nat. i. 2210; Fonscol. Ann. Soc. Ent. x. 167. 6.

A. Loniceræ, Sir Oswald Mosley, Gard. Chron. i. 628.

Xylosthaphis, Amyot, Ann. Soc. Ent. Fr. 2de série, v. 479.

The viviparous wingless female. The body is small, oval, rather flat, pale green, covered with white powder: the head is darker: the feelers are very pale, but darker at the base and at the tips, shorter than the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are black, and about one-sixth of the length of the body: the tube at the tip of the abdomen is pale yellow: the legs are pale yellow; the hips and the hind-thighs are darker; the feet and the tips of the shanks are black.

1st var. The thighs are nearly all black.

The viviparous winged female. The body is green: the head, the chest, the breast, the feelers, the nectaries, and the legs are black; the shanks and the fore-thighs excepting their tips are pale yellow.

88. *Aphis Cerasina*, n. s.

The viviparous wingless female. The body is rather small, elliptical, flat, greenish yellow with two irregular black lines on each side of the abdomen: there is a row of small tubercles on each side of the body: the feelers are pale yellow, black towards the tips, and not half the length of the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are white, and not one-fifth of the length of the body: the legs are yellow and rather short; the knees are brown; the feet and the tips of the shanks are black.

1st var. The body is pale yellow.

2nd var. The body is pale yellow with two large green spots on each side of the abdomen.

Found on *Cerasus Avius*, the wild cherry, near Carlisle in the middle of November.

89. *Aphis Carduina*, n. s.

The viviparous wingless female. The body is rather small, oval, somewhat flat, pale green: the front is narrow and rather bristly, and has a tubercle on each side: the feelers are yellow, and much longer than the body; the tips of the joints are black: the first and the second joints are angular; the fourth is much shorter than the third; the fifth is as long as the fourth; the sixth is not half the length of the fifth; the seventh is about four times the length of the sixth: the mouth is pale yellow; its tip and the eyes are black: the tube at the tip of the abdomen is short: the nectaries are pale green with black tips, and nearly one-fourth of the length of the body: the legs are long and pale yellow; the knees, the feet, and the tips of the shanks are black. In the beginning of November.

The viviparous winged female. It is like the wingless insect in colour, but somewhat darker about the chest: the wings are colourless, and much longer than the body; the second vein diverges from the first, but is nearly parallel to the third; the second fork of the latter begins a little after one-third of the length of the vein, and its lower branch converges slightly towards the second vein; the second fork is beyond two-thirds of the length; the fourth vein is curved moderately and equally throughout its length, and the angle of the brand whence it springs is very slight.

Length of the body $\frac{1}{2}$ line; of the wings $1\frac{1}{2}$ line.

Found on the thistle from June till November.

90. *Aphis Jacobææ*, Schrank.

Aphis Jacobææ, Schrank, Faun. Boic. ii. 123. 1242; Kalt. Mon. Pflan. 68. 49.

Found on *Senecio Jacobæa* in the summer.

The viviparous wingless female. The body is rather small, oval, convex, deep black: the limbs are also black: the feelers are somewhat shorter than the body : the mouth is dull green at the base : the nectaries are as long as one-fifth of the body : the legs are of moderate length : the fore-thighs are dull green at the base. When very young it is linear, and dark green.

The viviparous winged female. In colour it resembles the winged Aphis : the wings are slightly tinged with gray, and are longer than the body ; the wing-ribs are dull yellow ; the brands and the veins are black.

91. *Aphis Helichrysi,* Kaltenbach.

Aphis Helichrysi, Kalt. Mon. Pflan. i. 102. 77.

A. Balsamitæ, Müll. Zool. Dan. Prodr. 109. 1262.

This little Aphis feeds on *Helichrysum chrysanthum, Balsamita suaveolens, Anthemis tinctoria, A. Matricaria, Achillæa Ptarmica, A. Millefolium, Senecio vulgaris, Myosotis.*

The viviparous wingless female. The body is oval : the front is somewhat convex and slightly serrated : there are no tubercles at the base of the feelers, which are setaceous, and rather less than half the length of the body ; the fourth joint is much shorter than the third, but more than half its length ; the fifth is a little shorter than the fourth, and the sixth has the same proportion to the fifth ; the seventh is fully as long as the third, and much more slender than the other joints : the nectaries are about one-fifteenth of the length of the body : the legs are rather short, pale green. The young ones in its body amount to twelve and upwards.

The viviparous winged female. While a pupa it is nearly elliptical, slightly convex, grass-green, rather smaller than *A. Dianthi* : the feelers are pale green with brown tips, and hardly half the length of the body : the eyes are dark brown : the mouth is pale green with a brown tip : the nectaries are dark green, not more than one-twelfth of the length of the body : the legs are dull green, rather short ; the feet are brown.

When the wings are unfolded the body is green : the head and the disc of the chest are dark : the feelers are black excepting the base, and more than half the length of the body : the legs are yellow ; the feet, and the tips of the thighs and of the shanks are dark green : the wings are colourless, and much longer than the body ; the bend of the rib-vein between the angle where it sends forth the fourth vein and its tip is shorter than in *A. Tanacetina,* and the fourth vein is more curved ; the third vein is forked a little after one-third and again a little after two-thirds of its length ; the second vein is very nearly parallel to the lower part of the third vein ; the first vein is nearer at its source to the second than the second is to the third, but it diverges more at the tip. In the wings of *Aphides* the third vein has in its upper division a course conformable or parallel to the fourth vein, while the direction of its lower division agrees with that of the second vein.

92. *Aphis Tanacetina*, n. s.

The viviparous wingless female. The body is elliptical, convex, yellowish green: the front is slightly convex, not notched: the feelers are setaceous, and rather less than half the length of the body; the first and the second joints have no angles; the fourth joint is much shorter than the third, but more than half its length; the fifth is a little shorter than the fourth, and the sixth has the same proportion to the fifth; the seventh is nearly as long as the third; the tips of the joints are brown: the tip of the abdomen is not compressed, but rounded, and has no tube: the nectaries are linear, and as long as one-sixth of the body: the legs are rather short; the feet are brown. The young ones which it contains exceed twelve in number.

The viviparous winged female. It resembles the wingless insect, but is darker about the head and about the chest: the feelers are brown excepting the base, and a little shorter than the body: the tips of the nectaries are brown: the wings are colourless and very much longer than the body; the brand has a distinct angle where it sends forth the fourth vein, and the distance thence to its tip is about one-fifth of its whole length, and less than half the space between the tip of the brand and the tip of the fourth vein: the fourth vein is moderately curved at the base, and nearly straight towards the tip; the third springs from the brand at one-fifth of the length of the latter, and is forked before one-third and again a little after two-thirds of its length; the second and the third veins are nearer to each other at the base than are the third and the fourth; the first and the second are still nearer to each other than are the second and the third, but they diverge more before they reach the hind-border. Found in August on *Tanacetum vulgare.*

Length of the body $\frac{2}{5}$ line; of the wings $1\frac{1}{2}$ line.

Variations in the wing-veins.—1st var. The third vein has its first fork long after one-third and its second a little after two-thirds of its length.

2nd var. The third vein sends forth its first fork at half its length, and it has no lower branch to its second fork.

The oviparous wingless female. This much resembles the viviparous wingless female, but the hind-shanks are somewhat wide, and rather darker than the rest. It appears in the middle of October.

93. *Aphis Cratægaria*, n. s.

The viviparous wingless female. The body is oval, convex, yellowish green, smooth, shining: the feelers are pale yellow, slender, setaceous, brown towards the tips, longer than the body: the eyes are red: the mouth is pale yellow with a brown tip: the nectaries are yellow with brown tips, and about one-fourth of the length of the body: the legs are pale yellow, long and slender; the feet and the tips of the shanks are brown: when young it is grass-green, paler beneath: the head is yellowish: the feelers are about half the length of the body, and the nectaries are one-fifth of its length; their tips are brown. Before the end of April.

The viviparous winged female. The body is rather large and grass-green: the head and the disc of the chest and that of the breast are reddish brown: there is a row of black spots on each side of the abdomen: the eyes and the feelers are dark brown, and the latter are a little longer than the body: the mouth is pale green with a brown tip: the nectaries are pale green, and as long as one-fourth of the body: the legs are long, and pale yellow; the feet, and the tips of the thighs and of the shanks are brown: the wings are colourless; the wing-ribs are pale yellow; the brands are very pale brown; the veins are brown.

1st var. The feelers and the eyes are black, and the former are dull green at the base: the tip of the mouth is black: the legs are pale green; the knees, the feet, and the tips of the shanks are black: the wing-ribs are pale green.

94. *Aphis Cratægi,* Kaltenbach.

Aphis Cratægi, Kalt. Mon. Pflan. 66. 47.

The viviparous winged female. While a pupa it is gray and nearly elliptical: the eyes and the feelers are black, and the latter are rather less than half the length of the body: the mouth is gray: the breast is dull red: the nectaries and the legs are gray, and the former are hardly one-twelfth of the length of the body. When the wings are unfolded it is black: the feelers are much shorter than the body: the mouth is dull yellow with a black tip: the legs are black; the thighs at the base, and the shanks except their tips are yellow: the wings are colourless, and much longer than the body; the wing-ribs are almost white; the brands are dull pale yellow; the veins are brown.

95. *Aphis Hederæ,* Kaltenbach.

Aphis Hederæ, Kalt. Mon. Pflan. i. 89. 65.

A. Ilicis, Kalt. Mon. Pflan. i. 88. 64.

It feeds on *Hedera helix* and *Ilex aquifolium.*

The viviparous wingless female. The body is oval, convex, plump, pale green, covered with white powder: the feelers are white, pale brown at the base and at the tips, and much shorter than the body; the fourth joint is much shorter than the third; the fifth is a little shorter than the fourth; the sixth is full half the length of the fifth; the seventh is rather longer than the fifth: the eyes are black: the mouth is white with a brown tip: the nectaries are black, and about one-twelfth of the length of the body: the legs are of moderate length; the thighs are pale green; the shanks are white; their tips and the feet are brown.

BIBLIOGRAPHICAL NOTICES.

An Elementary Course of Geology, Mineralogy, and Physical Geography. By D. T. Ansted, M.A., F.R.S. &c. 8vo. London: Van Voorst.

It is unnecessary at the present day to enlarge upon the advantages of geological science; relieved from the prejudices which affected its early progress, and soaring above the mere attempt to excite our wonder by descriptions of the singular and apparently grotesque forms of animals, which were once the denizens of our planet, it has become a science not only of many valuable truths, but as a means of enlarging our views of those universal laws by which the physical history of the earth has been governed. The certainty of its facts and their practical applications have rendered a knowledge of it essential to all those engaged in the varied pursuits of mining, engineering and agriculture. A science intimately connected with our mineral wealth and commercial prosperity, could not fail to be recognized and supported by the Government, and the result is the establishment of the Museum of Practical Geology, under the management of Sir H. De la Beche and its efficient corps of officers both in the cabinet and the field. Already has this institution yielded the first fruits of its practical utility, and given a greater impetus and infused a spirit of inquiry into the general principles of the science, and we do not doubt that when the enlarged views of its able and zealous director are fully developed, geology will become still more popular amongst all classes. Taught as a subject of special instruction in our Universities and Colleges, its importance has not been overlooked in those smaller academies, where the teachers, fully aware of the real principles of education—that of imbuing the mind with a knowledge of facts and their bearing on the practical purposes of life—have, without neglecting the classical studies, judiciously introduced a course of instruction in natural and physical science. Introductory works are therefore requisite, not as simply teaching the facts of geology itself, but as embracing a wider field and yet presenting in a condensed form, its intimate connexion with and dependence upon other branches of knowledge. In this respect the volume before us is extremely useful, nor could we anticipate that Prof. Ansted's constant practice as a teacher and lecturer would fail to assist him in producing an educational manual serviceable alike for the traveller or student, more especially as the general plan of the work, although far from being a copy, is somewhat similar to the 'Cours Elémentaire' of M. Beudant, which we have long considered as one among the most useful of introductory books.

The work is divided into four parts,—Physical Geography, Mineralogy, Descriptive Geology and Practical Geology. Under the first head are comprised, the general condition of matter at the earth's surface, and the changes that take place by the action of the various forces of gravitation and cohesion, heat, light, electricity, &c., the effects produced by the changes of temperature, climate, and by atmospheric, aqueous and organic agencies, as well as the reaction of the interior of the earth on the external surface, as evinced by earthquakes, volcanoes, springs, &c. in modifying that surface. The study of this section is important to the geological student, for in the scheme of nature no fact stands by itself, but is insensibly blended with the various cosmical phænomena going on around, and he who does not inquire into the changes which are daily passing before his eyes,—more or less influencing the organic and physical features of the earth,—will fail to comprehend fully the value and beneficence of those laws which have governed the past material arrangement of the earth's crust, and by which the œconomy of nature is sustained. Mineralogy, or the description of the materials of which the surface is composed and their combinations, is somewhat fully treated, the author having selected for his arrangement the chemical nomenclature of M. Dufrenoy, with remarks from the works of Mohs, Dana, Nicol, &c., and the illustrations from Regnault's 'Chimie.' The portion devoted to Descriptive Geology contains an interesting chapter on the law of distribution of organic remains, and their importance in the classification of different formations; we could have wished the subsequent part, descriptive of the arrangement of the inorganic materials, somewhat enlarged as regards the geology of England, and that a few more illustrations of the characteristic fossils had been inserted. Considering however the author's intention to be that of producing a work not only for the English student, but for the civil and military engineer whose occupations may carry them to distant regions, this brevity of local description is compensated for by the general abstract of the geology of the globe as at present ascertained. Some minor inaccuracies occur in this part, for instance the fossils figured at p. 387 as belonging to the Great Oolite, are only found in the Inferior Oolite, and no mention is made under the cretaceous system of the abundance of phosphatic matter, which has of late so much attracted the attention of our agriculturists.

The concluding part of the work, and which considerably enhances its value, contains a concise account of the practical applications of the science, a knowledge which must be always available when anything is undertaken concerning the earth, either as the basis of operations, or the source whence all valuable materials are obtained. Under this head therefore the student will find a brief but interesting outline of the application of geology to agriculture, engineering and architecture, such as the mechanical condition and chemical composition of rocks, derivation and properties of soils, the principles of drainage, and many other points of agricultural geology; also an account of the earthy minerals used in construction, their durability, powers of resistance, &c. The important subject of the supply of water from various sources, more especially as connected with that of the metropolis, is fully treated; and here we find some new and striking observations on the nature and character of the water-bearing strata around London, more especially the chalk, and the probable quantity of that useful element derivable therefrom, as deduced from geological investigation. Associated with this section is the nature of mining operations, and their reference to geological structure, in which the subject of coal-working is concisely treated, as well as some practical remarks on the various operations connected with the mining of iron, salt, and the other valuable mineral riches of this country; we must however state that this portion of the work would have been rendered much more useful to the student, if the author had introduced a few woodcuts illustrative of some of the principal points connected with the various methods adopted in the working, ventilation and drainage of our mines.

A useful glossary of scientific terms, a general outline of the geology of India, and a series of examination papers are appended to this volume, which, notwithstanding its brevity on some points, may be safely consulted as an introduction to the science by the general reader, as well as form an elementary manual for the traveller and student.

An Arctic Voyage to Baffin's Bay and Lancaster Sound in search of friends with Sir John Franklin. By Robert A. Goodsir, late President of the Royal Medical Society of Edinburgh. London, Van Voorst, 1850.

This plain and unaffected narrative will be read with interest, not only by those who share the anxiety arising from the uncertainty hanging over the fate of those of whom Mr. Goodsir went in search, but by others who wish to gain a clear impression of the distinguishing features of arctic voyaging. The author sailed in the "Advice" whaler in March 1849 in search of his brother, who accompanied Sir John Franklin. His voyage extended through Davis's Strait round the head of Baffin's Bay, and the vessel was enabled to make an exploration into Lancaster Sound; with how little success we unfortunately know. Not discouraged by this, however, the author has started again this spring on the same quest.

In this little volume, which is founded upon the journal kept during the voyage, we find not merely a record of the routine of a whaling voyage, with a vivid description of the exciting hunts and perilous attacks which ensue when the ship arrives at the fishing grounds, but the author gives us his impressions of the various sights and natural phænomena as they came upon him with the force of novelty; thus furnishing us with just the kind of information which has especial interest at the present time. The nature of the dangers arising from the concussion of the ice floes, the "nip," the cutting of ice docks, the operations of tracking and towing, &c., are clearly explained, and enable the reader to realize the peculiar characteristics which attend these voyages in the icy seas. A few notes on natural history are interspersed, but the author describes a whaling voyage as particularly unfavourable to the pursuits of the naturalist, very few opportunities of observation being afforded to him, even where, as in his own case, the master of the ship affords all the facilities in his power.

We can recommend this book as an exceedingly pleasant and readable little volume, and take our leave of it with hearty wishes for the success of the author in his present, second search.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 22, 1849.—Harpur Gamble, Esq., M.D., in the Chair.

MONOGRAPH OF THE FAMILY LIMNADIADÆ, A FAMILY OF ENTOMOSTRACOUS CRUSTACEA. BY W. BAIRD, M.D., F.L.S. ETC.

Jean Frederic Hermann, in his 'Mémoire Aptérologique,' published at Strasbourg in 1804, described and figured an Entomostracous crustacean, which from its resemblance to the genus *Daphnia* of Müller and its large size, he called *Daphnia gigas*. About thirty years previous to that time, he tells us, his father discovered a number of these interesting little animals in a deep ditch near Strasbourg filled with clear rain-water and well-stocked with weeds. Struck with their beauty he collected several dozens of specimens, and placing them in a vessel full of water less pure than that which the ditch contained, took them home. By the time he reached his house however they were all dead but one, and he only succeeded in preserving two specimens in spirits of wine. Linnæus had long before that described a species of *Monoculus* in his 'Fauna Suecica,' under the name of *Monoculus lenticularis,* found in Finland. His description is very brief, and Hermann (*père*) considering it probable that his animals might be identical with the species described by Linnæus, preserved the shells or bucklers of the little creatures which had died, and distributed them among his friends and correspondents. He sent some more particularly to the celebrated Müller, at that time engaged in working out the history of the Entomostraca, and entreated him and his other friends to inform him if they considered the specimens he had sent to be identical with the *Monoculus lenticularis* of Linnæus. Müller and his other correspondents all replied that they were not able to inform him, as they did not know Linnæus's insect—and from that time up to the period at which the younger Hermann's 'Mémoire Aptérologique' was published, neither father nor son had ever again succeeded in finding these animals. Nothing farther seems to have been known of any species belonging to the family till M. Adolphe Brongniart in 1820, in the sixth volume of the 'Mémoires du Muséum d'Histoire Naturelle,' published a description of an animal found by him in a pool of fresh water at Fontainebleau, which he considered (I think erroneously) as identical with the *Daphnia gigas* of Hermann. Of this species he formed his genus *Limnadia,* and at the same time entered fully into the details of the structure and habits of the animal. In the 'Bulletin de la Société Impériale des Nat. de Moscou' for 1830, M. Krynicki has described a third species belonging to the family, which he found in Russia. M. Audouin, in the 'Annales de la Société Entomologique' for 1837, announced to the Society that he had received specimens of another species of the same family, found by M. Bravais, a naval officer, near Oran on the coast of Africa, in a little marsh of brackish water; and in the same year M. Straus Durckheim published a description and good figure of a fifth species found by Dr. Rüppell in Abyssinia. M. Guérin-Méneville, in the 'Magazin Zoologique' for the same year, 1837, has published the description of a sixth species brought from the Mauritius, collected there by M. Desjardins; and finally, M. Joly, in the 'Annales des Sciences Naturelles,' 2nd series, vol. xviii. 1843, has published an elaborate memoir upon a species collected by him at Toulouse.

From a careful examination of the figures and descriptions given by these authors, it is evident that these animals do not belong all to the same genus. It is perhaps in vain now to attempt to ascertain the species mentioned above as described by Linnæus. Hermann says, the animal described by him "is very likely to be in reality the *Monoculus lenticularis* of Linnæus;" and upon examining the Linnæan cabinet in the possession of the Linnæan Society, I have found one mutilated specimen of a species belonging to this family which bears much resemblance to that figured by M. Hermann. As there is no ticket attached to the specimen, it is impossible now to decide whether this is really the individual originally in the possession of Linnæus; but if it be, it confirms my opinion, derived from comparing the figures and descriptions of the two species given by Hermann and Brongniart, that the latter author is decidedly in error in considering them to be identical. The species found at Fontainebleau is the true representative of the genus *Limnadia,* whilst that of Strasbourg forms the type of another genus. This genus was indicated by Audouin and Straus Durckheim in the same year; the former proposing for the species brought by M. Bravais from Oran, the name of *Cyzicus*; and the latter for that brought by Dr. Rüppell from Abyssinia, the generic name *Estheria.* From the simultaneous publication of these two generic names, it is difficult to decide which should stand; and M. Joly, apparently feeling the difficulty, has proposed a third name, taking as the type the species found by him at Toulouse, and calling it *Isaura.* As M. Audouin merely indicates the genus without giving a description of either genus or species, whilst M. Straus details at full length both generic and specific characters, and figures the typical species, I propose adopting his name and retaining the generic name *Estheria,* a name originally proposed by Dr. Rüppell himself.

The genus *Limnadia* thus at present contains two species:—

1. *Limnadia Hermanni* of Ad. Brongniart.
2. *Limnadia Mauritiana* of M. Guérin.

The genus *Estheria* at present contains three species:—

1. *Estheria gigas*, the *Daphnia gigas* of Hermann, identical with the *Cyzicus Bravaisii* of Audouin and the *Isaura cycladoides* of Joly.
2. *Estheria tetracera*, the *Limnadia tetracera* of Krynicki.
3. *Estheria Dahalacensis*, Straus Durckheim.

To these three species I now propose adding six others, all in the collection of the British Museum.

Legion BRANCHIOPODA.

Order Phyllopoda.

Family Limnadiadæ.

Animal almost entirely enclosed within a buckler or carapace resembling exactly a bivalve shell. Feet all branchial; from eighteen to twenty-seven pairs in number. Antennæ four pairs; the two superior used as organs of locomotion. Eyes two; closely approximated.

Genus Limnadia, Brongniart.

Carapace very large in proportion to the size of the animal, which appears not to fill much more than half of it. Head small, and having a little behind the eye a small pear-shaped body on its dorsal margin. Caudal segment truncate and terminating in two diverging lamellæ, ciliated on their under margin. Small antennæ club-shaped. Jaw foliated. Carapace beautifully transparent, of a whitish colour and very thin and delicate. Valves nearly quite smooth or only showing two or three slight concentric ridges on their anterior margin, and when highly magnified, numerous very minute dots or puncturations.

The animals swim on their back, and no males have ever as yet been observed.

Sp. 1. Limnadia Hermanni.

L. Hermanni, Ad. Brongniart, Mém. du Mus. d'Hist. Nat. vi. t. 13. f. 1–2, 1820. Desmarest, Consid. gén. sur les Crust. 379. t. 56. f. 1, 1825. Latreille, Cuv. Règn. Anim. iv. 173, 1829. Bosc, Man. d'Hist. Nat. des Crust. ii. 236, 1830. Guérin, Magaz. de Zool. Class 7. t. 21. f. 12, 1837. Lamarck, An. sans Vert. 2nd edit. v. 185 (note). M. Edwards, Hist. Nat. Crust. iii. 362. No. 1. Cuv. Règn. Anim. edit. Crochard, Crustacés, t. 74. f. 1, 1*a*.

Carapace-valves of a rounded oval form, and permitting only the terminal branches of the large antennæ and the tips of the caudal lamellæ to pass beyond their margins; antennules of the length of the peduncles of the large antennæ, club-shaped and crenulated on their upper edge; large antennæ nearly half as long as the body, and having in each branch 12 joints; feet 22 pairs in number; caudal lamellæ of considerable length; carapace of a clear transparent white colour, and nearly quite smooth on its surface. On the anterior half we see two or three concentric striæ or rather delicate ridges running parallel with the lower margin, and when examined by a microscope of considerable power, we can detect the whole surface of the valves covered with numerous minute dots or puncturations. These do not appear raised, but as if they were mere opacities in the otherwise clear transparent shell.

Hab. Fontainebleau. British Museum; sent to Dr. Leach by M. Brongniart.

Sp. 2. LIMNADIA MAURITIANA.

L. Mauritiana, Guérin, Mag. de Zool. Class 7. t. 21. f. 1–11, 1837; Iconogr. Règn. Anim. Cuv. t. 33. f. 2. M. Edwards, Hist. Nat. Crust. iii. 363. No. 2. t. 35. f. 7–8. Burmeister, Organiz. of Trilobites, Ray edit. t. 6. f. 15.

Carapace-valves of an oval shape, slightly pointed at the extremities; antennules club-shaped, not crenulated on the upper edge, and considerably shorter than in preceding species, and the branches composed of only 9 joints in each; feet 18 pairs in number; caudal lamellæ shorter than in preceding species and more spine-shaped.

Not having seen this species I am unable to describe the structure of the carapace.

Hab. Island of Mauritius, *M. Desjardins.*

Genus ESTHERIA, Rüppell.

Carapace smaller in proportion to the size of the animal than in preceding genus, the animal nearly filling the entire cavity; head large and somewhat projecting beyond the margins of the valves; no pyriform organ; caudal segment large and terminating in four lamellæ in form of strong curved hooks; small antennæ linear or slightly tapering towards the apex; jaws fleshy; carapace of a translucent horny or yellowish colour, of moderate thickness, and showing numerous strong concentric ribs; the surface between the ribs is generally strongly punctate or striated, presenting considerable variety in their sculpture, which affords good specific characters; the animals swim on their belly, and many males are found among them.

A. *Valves of carapace dotted or punctate on the surface.*

Sp. 1. ESTHERIA GIGAS.

Syn. Daphnia gigas, Hermann, Mém. Aptérol. 134. t. 5. f. 4–5; t. 9. f. *a*, 1804.

Cyzicus Bravaisii, Audouin, Ann. de la Soc. Entomol. vi. Bulletin, p. 9, 1837.

Isaura Cycladoides, Joly, Ann. des Scien. Nat. 2nd ser. xviii. t. 7, t. 8, t. 9, f. 1–44, 1843.

Estheria Cycladoides, Lucas, Explor. Scient. de l'Alger. Crustacés, 81, 1845.

Limnadia Hermanni, Koch, Deutsch. Crust. H. xxxv. t. 10.

Monoculus lenticularis? Linnæus, Faun. Suec. 2051. No. 8; Syst. Nat. ed. 12th, 1059, No. 8.

Carapace-valves of a rounded oval form, resembling considerably the shell of a Cyclas; of a horny amber colour and translucid; anterior extremity rather broader than posterior; both finely rounded; beaks prominent, situated nearer the anterior extremity of the carapace, which is much more convex at that part than elsewhere; the two valves are marked with concentric striæ or ribs, varying from

20 to 26 in number. When viewed under the microscope, the structure of this carapace presents the following appearance : the ribs are strongly marked and are somewhat prominent, the lower edge being beaded or ornamented with a line of raised round dots of a rather regular figure. The surface between the ribs is slightly concave, and is marked very distinctly with numerous raised dots or punctations of a rather irregular form and size.

Hab. Strasbourg, *Hermann.* Toulouse, *Joly.* Oran, *M. Bravais.* Algeria, *Lucas.* Regency of Tunis, *Mr. Frazer.* Brit. Mus.

That this is the *Daphnia gigas* of Hermann I think there is no doubt, and quite different from the *Limnadia Hermanni* of Brongniart. The body of the *Limnadia* is entirely enclosed within a carapace, regularly oval, transparent, and of a whitish colour. That of the *Daphnia gigas,* according to Hermann, is enclosed within a carapace of the colour of amber, horny, transparent, oval, with the back gibbous, keeled, and edged with brown. The carapace of the *Limnadia* is smooth, or offering only two or three zones parallel to its free edge. That of the *Daphnia gigas* has 7 rings or parallel zones on the two lower thirds of its body, and to judge from the figure given by Hermann, has several more on the upper portion. In structure and form it thus agrees with the characters of the genus *Estheria,* and appears to me to be perfectly identical with the *Isaura Cycladoides* of Joly.

Sp. 2. Estheria Melitensis, Nobis.

Carapace-valves of an elongated oval form, considerably narrower at the posterior than the anterior extremity ; of a light horny colour, and semitransparent. Anterior extremity rounded ; the beaks situate near that extremity and prominent, causing that part of the shell to be much more convex than any other portion. Ribs somewhat prominent, the surface between them slightly concave and completely covered with numerous very small dots or raised punctations of rather a regular figure. The lower edge of each rib is beaded like the last, but the dots are smaller. The shell is considerably more elongated than in preceding species, and the beaks are more prominent and rather nearer the anterior extremity. The colour is much lighter ; the ribs rather less prominent, and the punctations on the intermediate spaces much smaller and a great deal more numerous.

Hab. Pool of rain-water at Malta, *Rev. Mr. Hennah.* Brit. Mus.

Sp. 3. Estheria polita, Nobis.

Carapace-valves obovate, resembling in form the shell of a *Pisidium.* Anterior extremity somewhat broader than posterior, much more convex and gaping. Beaks prominently elevated, and situated near the anterior extremity. The shell is of a light yellowish horny colour internally and externally, and of a fine glossy polished appearance and finely pellucid. The ribs are numerous, about 27 in number, elevated, and smooth. The spaces between are slightly concave, and are beautifully dotted with numerous small *impressed* punctations.

Hab. India, *Captain Boys.* Brit. Mus.

Sp. 4. Estheria Brasiliensis, Nobis.

Carapace-valves elongately obovate and pisidiform. Anterior extremity much broader than posterior, much more convex, and gaping. Beaks prominent and situated near anterior extremity. The shell is of a uniform dull horny colour and appearance externally and internally, very thin and translucent. Ribs numerous, elevated and smooth. The intermediate spaces are slightly concave, and appear roughened all over with numerous very small dots. This is a larger species than the preceding, and is much more elongated in form,—not possessing the fine polished appearance which distinguishes it, but appearing as if covered with a very thin epidermis.

Hab. Brazil, *Mr. Sowerby.* Brit. Mus.

Sp. 5. Estheria Dahalacensis.

E. Dahalacensis, Rüppell & Straus, Mus. Senkenberg. ii. 119. t. 7. f. 1–15.

Carapace-valves irregularly quadrilateral. Anterior extremity slightly rounded, posterior extremity cut sloping or with beveled edges. Dorsal and ventral margins both straight. Beaks rather prominent, placed near anterior extremity. The carapace is of a light horny colour and lustre, both internally and externally, and translucent. The ribs are about 14 in number and rather prominent. The spaces between them are slightly concave and covered with very numerous exceedingly minute raised dots or punctations, and a good many much larger intermixed.

Hab. Dahalac, Abyssinia, *Rüppell.* Mus. Dom. J. O. Westwood.

B. *Valves of carapace longitudinally striated on their surface.*

Sp. 6. Estheria donaciformis.

Nuculina donaciforme, Parreyss MSS. in Mus. Brit.

Carapace-valves shortly obovate and pisiform; anterior extremity broader than posterior, more convex but not gaping; beaks prominent, placed near anterior extremity; the carapace is quite opake, of a light brownish yellow externally, of a dull lustre and with a spot of dark purple and of a metallic lustre on the anterior margin and on the dorsal edge behind the beaks; the interior is of a beautiful shining lustre and of a deep purple colour; the ribs are numerous and rather unequal; the spaces between them are striated longitudinally; the striæ, when examined by the microscope, being irregular and of a somewhat complicated structure, near the edge of the rib frequently forming loops and running one into the other.

Hab. Abeid, Kordofan, *Parreyss.* Sent to the British Museum Collection as a species of mollusk belonging to the genus *Nuculina,* and called *Nuculina donaciforme.*

Sp. 7. Estheria Boysii, Nobis.

Carapace-valves broadly obovate; anterior extremity convex, gaping, much broader than the posterior, which however is rounded and obtuse; beaks prominent, placed near anterior extremity; carapace opake; externally of a dull shining grey colour, with the anterior extremity, beaks, and dorsal edge of a purplish tint possessing a somewhat metallic lustre; the interior is of a light purple tint and somewhat shining lustre; the ribs are numerous, about 34 in number, and prominent, and the surface between them is striated longitudinally and impressly punctate, the striæ extending across one-half the space, the other half being occupied with the punctations.

Hab. India, *Capt. Boys.* Brit. Mus.

Sp. 8. Estheria similis, Nobis.

Carapace-valves elongate obovate; anterior extremity considerably broader than posterior, which is rather narrow; beaks very prominent, placed very near anterior extremity; carapace opake; colour externally and internally the same as in last; the ribs are numerous and prominent, the first 7 or 8 rather broader than the rest, smooth, and flattish; the remainder sharply prominent, and having on their surface a row of sharp angular beads; the surface between the ribs is deeply striated, the striæ extending nearly quite across the space. This species differs from the preceding in being smaller, more elongate in proportion; in having the posterior extremity considerably narrower and sharper, and the beaks nearer anterior extremity, and in having the ribs beaded.

Hab. India, *Capt. Boys.* Brit. Mus.

Sp. 9. Estheria tetracera.

Syn. Limnadia tetracera, Krynicki, Bull. Soc. Imp. Nat. Moscou, 1830, 176. t. 7. f. 1, 2. M. Edwards, Hist. Nat. Crust. iii. 363. No. 3.

Isaura tetracera, Joly, Ann. Sc. Nat. 2nd ser. xviii.

Carapace-valves broadly obovate; anterior extremity broader than posterior, which is obtusely rounded; beaks prominent, very near anterior extremity.

Not having seen this species I cannot describe the structure of the carapace.

Krynicki describes this species as a *Limnadia,* but at the same time remarks "that it ought to form the type of a new genus."

Hab. Neighbourhood of Charkow, Russia, *Krynicki.*

June 12.—W. Spence, Esq., F.R.S., in the Chair.

Letters had been received from Richard Hill, Esq., W. C. Kelaart, Esq., R. J. Bourchier, Esq., and Dr. Bland, Corr. Members.

Mr. Kelaart's letter was dated San Fernando, Trinidad, May 6. Among other interesting intelligence he states that he has "no doubt of the existence of a large Red Monkey, and according to some, of a white one also, inhabiting the woods of this island; and although no specimens have yet been procured, the promises of several of the proprietors give hope of a speedy solution of the question as to what species these animals may belong."

Mr. Gray exhibited, from the collection of J. H. Hora, Esq., a female specimen of *Ovis Gmelini,* from Tauri in the Persian Gulf.

It was peculiar for the large size of the tuft of hair over the orbital gland, which was closely matted together by the secretion from it;

the nostrils are surrounded by a distinct narrow callous edge; the callosity occupies the space between the nostrils and a narrow central band down to the lips; the body is covered with very close soft hair, and on the haunches and other parts where the hair is longer, it retains its softness, but approaches to the quill-like character of the Roebuck; the upper part of the body is ochraceous yellow, the lower part paler and whitish; the head is paler yellowish, and the hairs on the forehead and face are tipped with whitish.

The following paper was read:—

1. On the variation in the Teeth of the Crested Seal, Cystophora cristata, and on a new species of the genus from the West Indies. By J. E. Gray, Esq., F.R.S. etc.

In a paper which I lately communicated to the Society on the genus *Bradypus*, I drew their attention to some variations in the form of the lower jaw, which were not accompanied by any appreciable difference in the external appearance of the specimens; I now wish to bring before the Society some variations which I have observed in the teeth of the different skulls of the Crested Seal which I have received from Greenland. I consider it of more importance to record these variations, as the formation of the teeth in the family of Seals has been considered as affording one of the best characters for the distinction of the species.

Several zoologists have considered the Crested Seal of the northern and the Proboscis Seal of the southern hemisphere as belonging to the same genus; but though there are several characters which are common to both, they are very easily distinguished.

The grinders of the Proboscis Seal are only slightly plaited on the crown, all have only simple subcylindrical roots, which are cylindrical in the young animal, and enlarged, short, and clavate in the adult specimens. The grinders of the Crested Seal, on the contrary, are rather tubercular and very closely and strongly plaited on the crown, and this character is seldom obliterated by age, and in most of the skulls the 4th and 5th grinder of both jaws have two roots, and the root of the 3rd grinder is partially divided on the outer side; but in some adult skulls (probably belonging to the males?) the roots of the 4th and of the 1st, 2nd and 3rd grinders are enlarged and simple-rooted, and in one young skull the 4th grinder is also simple-rooted.

I shall proceed to give the variations to be observed in the following skulls, all received from Greenland:—

1. No. 332 *b. in Brit. Mus. Cat.*—The skull of an adult or aged specimen: the crowns plaited, the roots of all the grinders enlarged and short, club-shaped and simple, separated from the crown by a narrow collar.

2. No. 332 *a.*—Skull of adult: the crown worn; the root of the 1st, 2nd, 3rd, 4th, rather enlarged, oblong club-shaped, rather elongate, the root of the 5th grinder compressed, of the left side simple, of the

right partially divided into two short roots continued in grooves on each side.

3. No. 332 *c*.—Skull of an aged specimen: the crowns plaited and tubercular, the roots of the grinders rather enlarged, the root of the 3rd grinder rather compressed, simple, with a groove on the outer side of the 4th and 5th grinders, scarcely enlarged, and divided into two distinct diverging roots.

4. No. 332 *h*.—Skull of nearly adult: the crown of few grinders remaining plaited; the root of 4th and 5th grinder of the left side, as shown by the cavities, divided into two roots; of the 4th grinder of the right side simple, with a slight groove on the outer side, and of the 5th grinder two-rooted, like the similar grinder on the other side.

5. No. 332 *d*.—Skull of nearly adult, wanting the grinders; but the cavity for the grinders shows that the 4th grinder on both sides had a short clavate root with a slight central groove on the outer side, and the 5th grinder on each side had two separate roots.

6. No. 332 *e*.—Skull of a half-grown animal: the crown plaited and tubercular, the 4th grinder on each side with ovate, short, simple roots, and the 5th grinder with compressed truncated simple roots; the grinders are rather further apart than in the other skull.

7. No. 332 *f*.—Skull of a very young animal: the crowns are very distinctly plaited, the 4th and 5th grinders of both sides have two distinct roots, and the 3rd grinder has a groove down the middle of the outer side. In all these skulls the grinders are close together, forming a nearly continuous line.

8. Is the skull of a young female of the Seal caught in the Orwell on the 29th of June, 1847, described and figured by Dr. W. B. Clarke, and now in the Ipswich Museum. This skull very much resembles No. 6 (No. 332 *e*.) in proportions and distance of grinders, but is only about two-thirds the size, and the blood-vessel on each side the palate, which in that skull is open, is here partly covered over with a thin layer of bone; the 4th upper grinder has a compressed simple root with a groove on the lower part of its outer side, and the 5th grinder is two-rooted. It is to be observed, that the Orwell specimen, No. 8, was a female, and that the nose of this and of skull No. 6 differ from the others in being rather longer, and in the grinders being rather further apart: is this the character of the female sex? and in both these skulls the 4th grinder is single-rooted: is that also a sexual character? It is to be hoped that the Danish or American naturalists who have the opportunity of examining these seals, will determine the question.

It would thus appear, from what I have stated, that in this genus the form of the root of the grinders is very liable to variation; I have not observed any similar variation in the teeth of any other seal, and still believe that the form of the roots affords a good character in most of the genera.

We have lately received from the West Indies the skin and skull of a seal which evidently belongs to the same genus as the crested seal of the northern hemisphere. The skull, or rather the teeth, when compared with those of the Greenland specimens, induce me to believe that it is distinct from them. It chiefly differs in the form of the outer upper cutting teeth and canines. In *all* the specimens, both old and young, from the North Sea, the outer upper cutting teeth and the canines are narrow and compressed. In the West Indian skull, which is that of a very young specimen, the outer upper cutting teeth and the canines are broad, strongly keeled on each side and longitudinally plaited within. In this skull the 4th grinder has only a single root, and the 5th grinder has two; the crowns of the teeth are plaited and tubercular like those of the North Sea specimens. The face is rather broader than in a skull of the northern kind of nearly the same size. This species may be called *Cystophora antillarum.*

We have received an imperfect skin of a seal from Jamaica, which was brought home by Mr. Gosse. It is unfortunately without any bones. The whiskers are short, thick, white, cylindrical, regularly tapering, and without any appearance of a wave or twist. In this character it most agrees with *Phoca barbata.*

July 10.—Harpur Gamble, Esq., M.D., in the Chair.

Mr. E. Doubleday exhibited specimens of the larva, pupa, and perfect insect of *Sirex gigas,* an insect mostly very rare in Great Britain. These specimens were sent to Mr. Gray from Bath by Mr. Brunel, and were accompanied by fragments of the wood on which the larvæ had fed.

It appears that about eighteen months since a quantity of larch-trees were cut in the neighbourhood of Bath, and after having been used as scaffolding-poles in the repairing of one of the churches of the city, were applied to a similar purpose at the railway-station. From these poles thousands of individuals, chiefly females, of *Sirex gigas,* are now coming forth. From the specimens exhibited, it would seem that the larvæ prefer the soft sap wood to the more solid internal part of the trees, penetrating this part longitudinally at a little distance from the bark, the perfect insect gnawing its way through when ready to make its appearance.

Mr. Doubleday remarked that there was here ample evidence to disprove St. Fargeau's idea, that this fine insect is a parasite upon some timber-boring beetles, an opinion already controverted by Mr. Westwood and others. The larva, pupa, and perfect insect are beautifully figured by Ratzeburg in his work on insects injurious to forests; but he gives no details of the habits of the insect, nor any figures indicating the mode of life of the larva.

The following papers were read:—

1. Description of Two New Species with the characters of a New Genus of Trochilidæ. By John Gould, F.R.S. etc.

Genus Heliodoxa, Gould.

Bill straight or slightly curved downwards, of moderate length;

nostrils covered by an operculum; wings pointed, rigid, of moderate size, and well-adapted for sustaining flight; tail of moderate size, considerably forked; feet of moderate size; the outer toe and claw shorter than the inner toe and claw; the hind toe and claw the shortest of all; tarsi clothed with fine feathers.

Species, *H. jacula, H. Leadbeateri* (*H. Otero*?), *H. rubinoïdes*, and *H. rubinia*?

HELIODOXA JACULA, Gould.

Male: crown of the head, breast and abdomen resplendent metallic green; in the centre of the throat a crescentic mark of metallic blue; the metallic green of the crown running to a point towards the occiput; back of the neck, back, and upper wing-coverts bronzy green; under wing-coverts and flanks grass-green; wings purplish brown; upper tail-coverts purplish brown with green reflexions; under tail-coverts dark brown with green reflexions; tail considerably forked and of a bluish black; thighs and tarsi white; feet blackish brown; bill black.

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

Female: crown of the head and upper surface green; throat shining metallic green, the white bases of the feathers showing through and giving the throat a speckled appearance; tail bluish black tipped with white; in some specimens the lores are buff, and a line of the same hue extends beneath the eye; thighs white; under tail-coverts dull green; bill black.

Hab. Santa Fé de Bogota.

Remark.—This splendid new species, which I have recently received from Santa Fé de Bogota, is precisely of the same form and about the size of the *T. Leadbeateri* of authors.

ERIOPUS SIMPLEX, Gould.

The entire body obscure olive-green; the crown of the head and back of the neck tinted with purple; rump and upper tail-coverts a very little brighter than the back; under tail-coverts dull bluish purple; wings purplish brown; tail considerably forked, and black with purplish reflexions; thighs and tarsi thickly clothed with snow-white plumes; bill and feet black.

Total length $4\frac{3}{8}$ inches; bill $\frac{7}{8}$; wing $2\frac{1}{4}$; tail 2.

Remark.—The only specimen I have seen is in the collection of E. Wilson, Esq.; it is most nearly allied to *E. cupreoventris*, but its uniform dusky colour renders it conspicuously distinct. It was received in a collection sent from Santa Fé de Bogota.

2. DESCRIPTIONS OF SIXTEEN NEW SPECIES OF BULIMUS, IN THE COLLECTION OF H. CUMING, ESQ., DISCOVERED BY MR. WILLIAM LOBB IN THE ANDES OF PERU. BY LOVELL REEVE, F.Z.S.

1. BULIMUS CLAUSILIOIDES. *Bul. testâ elongato-turritâ, sinistrali, compressè umbilicatâ, anfractibus novem, supernè obscurè*

costatis, longitudinaliter creberrimè et minutissimè rugoso-striatis, columellâ verticaliter reflexâ, aperturâ subquadratâ, labro tenui, simplici; colore murino.

Hab. Andes of Caxamarca, Peru; W. Lobb.

Very like a *Clausilia* in form, and of a silken aspect, arising out of the very close and minute development of longitudinal striæ.

2. Bulimus nigropileatus. *Bul. testâ acuminato-ovatâ, subampliter umbilicatâ, anfractibus septem, convexis, obtusè subrugoso-striatis, columellâ verticaliter reflexâ, aperturâ ovali, labro simplici; albidâ, basin versus obsoletè fusco-fasciatâ, apice nigro.*

Hab. Chachapoyas, Alto Peru; W. Lobb.

It is probable, from the faintly-banded appearance of this shell, that this is but the pale variety of a darker type.

3. Bulimus foveolatus. *Bul. testâ oblongo-ovatâ, tenuiculâ, subventricosâ, haud umbilicatâ, ad apicem obtusâ, anfractibus quinque ad sex, convexis, longitudinaliter obtusè plicato-striatis, punctis oblongis spiraliter lineatim exsculptis, infra suturas plicato-crenulatis, apicem versus peculiariter foveolatis, suturis rudibus, anfractu ultimo obliquè descendente, columellâ latâ, depressiusculâ, obliquè recedente, aperturâ oblongo-ovali, labro subincrassato, vix reflexo; intensè olivaceo-brunneâ, infra suturas pallidè unifasciatâ, suturis albidis, columellâ labroque cærulescente-albis, aperturæ fauce iridescente-lilaceâ.*

Hab. Vitoe, near Sarma, Alto Peru; W. Lobb.

This is the species which Dr. Pfeiffer has assigned to the *Bulimus Mahogani* of Sowerby, Conch. Illustr. f. 59; a species of the *B. rosaceus* or *hæmastoma* type, of which I can find no description or tidings.

The species under consideration will be found, on comparison with Sowerby's figure, to be of a more oblong form, more acuminated at the apex, and very peculiarly indented round the upper sutures, reminding one very much of the indentations in the shells of *Phorus*.

4. Bulimus depstus. *Bul. testâ subacuminato-ovatâ, compressè umbilicatâ, anfractibus septem, rotundatis, lævibus, supernè depressiusculis, minutè plicato-crenulatis, columellâ reflexâ, aperturâ parviusculâ, labro simplici, intus extusque ustulato-fuscâ, hic illic saturatiore-strigatâ.*

Hab. Chachapoyas, Alto Peru; W. Lobb.

A thin shell, approaching in form and colouring to the *Bulimus nux*, from which it differs in being of lighter structure, and having a more rounded aperture.

5. Bulimus scitulus. *Bul. testâ subfusiformi-oblongâ, vix umbilicatâ, anfractibus octo, leviter convexis, lævibus, columellâ parum reflexâ, aperturâ subangustâ, labro simplici; albidâ, purpureo-cæruleo tinctâ, basin versus ferrugineo-rufâ, lineis subtilibus albis, irregulariter undulatis, creberrimè longitudinaliter notatâ.*

Hab. Chachapoyas, Alto Peru; W. Lobb.

Neatly marked with fine white waved lines upon a purple-blue ground, tinged towards the base with a bright rust-red.

6. Bulimus cuzcoensis. *Bul. testâ acuminato-oblongâ, subcylindraceâ, subcompressè umbilicatâ, anfractibus octo, leviter convexis, sub lente striatis et corrugato-indentatis, columellâ reflexâ, aperturâ parviusculâ, labro simplici; fulvescente-spadiceâ.*

Hab. Cuzco, Bolivia; W. Lobb.

Of a delicate nankeen colour throughout.

7. Bulimus prætextus. *Bul. testâ acuminato-oblongâ, subcylindraceâ, subampliter umbilicatâ, anfractibus octo, leviter convexis, lævibus vel obscurè indentatis, columellâ latissimè reflexâ, aperturâ parviusculâ, labro simplici, paululùm reflexo; lacteâ, cæruleo-nebulatâ, maculis rotundatis albidis promiscuè floccatâ, lineis minutis albidis undulatis longitudinaliter creberrimè notatâ, apice fuscescente.*

Hab. Andes of Caxamarca, Peru; W. Lobb.

A delicate blue-clouded shell, sprinkled with a few white flakes, and very closely marked with fine white lines, which are irregularly waved and sometimes ramified like veins.

8. Bulimus Lobbii. *Bul. testâ subcylindraceo-oblongâ, compressè umbilicatâ, aperturam versus subobliquè tumidâ, anfractibus octo, leviter convexis, lævibus vel obscurè indentatis, columellâ latè expansâ, aperturâ obliquè effusâ, labro reflexo; albâ, vittis longitudinalibus fuscescentibus et purpureo-castaneis irregulariter conspicuè pictâ, ponè labrum et aperturæ fauce purpureo-nigricante.*

Hab. Banks of the Maranon, near Balsas, Peru (on branches of a species of *Jatropha*); W. Lobb.

This fine species is of a delicate cream-white, striped longitudinally by distinct ribands of light brown and dark purple chestnut, without any of intermediate tint. Immediately behind the lip there is more of the dark purple chestnut, approaching to black, and the interior of the aperture is coloured with the same, having a somewhat metallic hue.

I have the pleasure to name it in honour of Mr. William Lobb, botanical collector of Messrs. Veitch and Son, the eminent nurserymen of Exeter, to whose zeal in the pursuit of natural history the discovery of these interesting species bears honourable testimony.

9. Bulimus purpuratus. *Bul. testâ subacuminato-ovatâ, compressè umbilicatâ, anfractibus sex, convexis, longitudinaliter rugoso-corrugatis, ad suturas plicato-crenatis, anfractu ultimo ventricosiusculo, columellâ reflexâ, labro simplici; purpureo-fuscâ, lineis albidis hic illic longitudinaliter interruptâ, basi et aperturæ fauce albidâ.*

Hab. Andes of Caxamarca, Peru; W. Lobb.

A rather stout, rough shell, stained with dark purple brown.

10. Bulimus rhodolarynx. *Bul. testâ acuminato-ovatâ, basin*

versus obliquè ventricosâ, ampliter umbilicatâ, anfractibus septem ad octo, subrotundatis, lævibus, sub lente striis obliquis elevatiusculis et spiralibus incisis minutè decussatis, aperturâ suborbiculari, columellâ labroque latè reflexis; roseo-albicante, intus purpureo-roseâ.

Hab. Banks of the Aparimao, Alto Peru; W. Lobb.

Distinguished by its very delicate purple-rose interior, the colour of which is seen through the substance of the shell.

11. Bulimus decussatus. *Bul. testâ acuminato-oblongâ, basi rotundatâ, subcylindraceâ, compressè umbilicatâ, anfractibus octo, leviter convexis, longitudinaliter corrugato-striatis, ad suturas subcrenulatis, columellâ latè reflexâ, labro tenui, simplici; pallidè stramineâ, strigis brevibus rufo-fuscis longitudinalibus et obliquis fasciatim decussatis peculiariter notatâ.*

Hab. Andes of Caxamarca, Peru; W. Lobb.

Singularly characterized by the bands of short brown streaks, ranging obliquely in the direction opposed to the lines of growth.

12. Bulimus myristicus. *Bul. testâ acuminato-oblongâ, basi subobliquè rotundatâ, compressè umbilicatâ, anfractibus octo ad novem, planulato-convexis, longitudinaliter striatis, infra suturas subcrenulatis, columellâ latè reflexâ, labro simplici; albidâ, vittis irregularibus castaneis et fuscescentibus confertim longitudinaliter pictâ.*

Hab. Andes of Caxamarca, Peru; W. Lobb.

This differs but little from the preceding species in form and detail of sculpture; yet there is a marked distinction in the style of painting.

13. Bulimus alto-peruvianus. *Bul. testâ acuminato-ovatâ, tenuiculâ, ampliter compressè umbilicatâ, aperturam versus obliquè ventricosâ, inflatâ, anfractibus septem, convexis, apicem versus creberrimè elevato-striatis, striis spiralibus incisis sub lente minutè decussatis, columellâ latè verticaliter reflexâ, aperturâ obliquè suborbiculari, labro effuso, non reflexo; fulvescente lacteâ, apicem versus cærulescente, lineis castaneis subdistantibus irregulariter longitudinaliter notatâ, maculis brevibus contrariè obliquis bifasciatim pictâ, macularum serie unicâ infra suturas.*

Hab. Chachapoyas, Alto Peru; W. Lobb.

The painting of this delicate and boldly convoluted shell is singularly characterized by two bands of short oblong chestnut spots or dashes, ranging obliquely in a direction contrary to that of the painted lines.

14. Bulimus alutaceus. *Bul. testâ oblongo-ovatâ, umbilicatâ anfractibus septem, convexis, creberrimè corrugato-striatis, aperturâ ovali, columellâ reflexâ, labro vix reflexo; intensè ustulato-castaneâ, zonulâ unicâ albâ medio cingulatâ, labro albo.*

Hab. Cuzco, Bolivia; W. Lobb.

The entire surface of this shell is sculptured longitudinally with very closely-packed crinkled striæ.

15. Bulimus primularis. *Bul. testâ acuminato-ovatâ, tenuiculâ, subventricosâ, umbilicatâ, anfractibus septem, lævibus, columellâ tenui reflexâ, labro simplici; albidâ, basin versus vividè luteâ, fasciis castaneo-nigris quatuor aut pluribus, nonnullis multò interruptis, cingulatâ.*

Hab. Chachapoyas, Alto Peru; W. Lobb.

Of simple structure, but abundantly characterized by its bright primrose colour and dark basal bands.

16. Bulimus columellaris. *Bul. testâ cylindraceo-elongatâ, haud umbilicatâ, anfractibus septemdecim ad octodecim, planis, angustis, obliquè subobsoletè striatis, anfractu ultimo ad basin subangulato, columellâ tortuosâ, leviter recedente, aperturâ subquadratâ, ad basin effusâ; roseo-albicante, apicem versus lividocærulescente et rufescente.*

Hab. Andes of Caxamarca, Peru (under stones at an elevation of 12,000 feet); W. Lobb.

An interesting *Pupa*-like species, distinguished by its square effuse aperture and erect columnar form.

BOTANICAL SOCIETY OF EDINBURGH.

May 16, 1850.—Professor Fleming, President, in the Chair.

The following papers were read:—

1. "On *Colchicum autumnale*," by James M'Grigor Maclagan, Esq. In this paper the author considered the plants known to the ancients by the name of *Colchicum* and *Hermodactylus*, and endeavoured to show from the writings of Dioscorides, Paullus Ægineta and others, that these names are synonymous. He then gave a history of the uses of the plant in a medical point of view, and after describing the structure and characters of *Colchicum autumnale*, *C. montanum* and *C. variegatum* or *Illyricum*, proceeded to notice the first of these species particularly. He detailed various experiments which he had made as to its mode of propagation by corms, and as to the quantity of starch and colchicine in the corm at different epochs of its growth; and concluded by a general view of its pharmaceutical uses.

2. "On *Dickieia*," by John Ralfs, Esq. The author described the characters of the genus, and showed how it differs from *Schizonema*. He then characterized *D. ulvoides* (Berk. and Ralfs), and *D. pinnata* (Ralfs). This paper will be published in the 'Annals of Natural History' and the Society's Transactions.

3. "On *Arum maculatum*," by James Kay, Esq. The object of this paper was to show, that, judging from the venation and development of the spathe, it is to be considered as a modification of the lamina of the leaf, and not of the petiole as some have supposed.

Mr. Stark showed a mode of making cells for the microscope by cutting off thin slices of gutta percha tubes and fastening them on glass by means of a gentle heat. He exhibited under the microscope several preparations of sea-weeds put up in this manner.

A note was read from Mr. C. Eyre Parker, containing some observations on *Narcissus biflorus*.

Mrs. Robertson of Braendam, near Stirling, sent a notice (accompanied by fresh specimens) of the discovery of *Buxbaumia aphylla* in large quantity on Ben Ledi. Fresh specimens of the *Buxbaumia* were likewise exhibited from Mr. Ogilvie of Dundee, having been gathered by him on the Sidlaw Hills, along with *Bæomyces roseus.*

MISCELLANEOUS.

NOTES ON MEDUSÆ AND POLYPES.

H.M.S. Rattlesnake, Cape York, October 1849.

My dear Sir,—You will probably be interested in knowing what I have been about for the last year. I have examined (in most cases very carefully) species of the following genera of Acalephæ and Polypes: Physophoridæ, *Velella, Porpita, Physalia* (a good many new points), *Stephanomia, Athorybia, Agulina, Rhizophyra*; Diphydæ, *Rosacea, Cuboides* (two species), *Abyla* (three species), *Enneagonea*; Medusidæ, *Sinope* (?), *Xanthea, Geryonia, Cytæis, Cephea, Oceania, *Bugainvillea, Tima, Aglaura* (?), *Pelagia, *Willsia*; Polypes, *Tubularia,* besides some genera altogether new. The two I have marked thus * will interest you, as you describe them in your "*Naked-eyed Medusæ.*" *Bugainvillea,* I may mention, has its generative organ in the thickness of its outer membrane of the stomach; *Willsia* developes bodies mostly resembling those in *Sarsia prolifera* and *gemmifera,* at the angle formed by the two first divisions of each of the four radial canals. The structure of the *Tubularia* is also very interesting. I was for a long time astonished at what appeared to be its very wide geographical distribution, until I discovered one day that it was attached in large masses to the ship's bottom!

I have found much that was new to me in all respects, but nothing that contradicted in any important matter the results at which I arrived in the paper on the *Medusæ.* On the other hand, I can speak much more confidently on some points advanced only with hesitation before. I believe that I shall be able to show you on our return evidence amply sufficient to prove,—1st, that the Hydroid and Sertularian Polypes, the Hydrostatic and ordinary Acalephæ, and the Helianthoid Polypes form one large family, which, from their invariable and peculiar "thread-cell," I propose to call the "Nematophora;" 2nd, that this great family consists further of two subdivisions, the number of which as affixed, if we consider one subdivision, and strictly analogous and parallel if we consider the two subdivisions as thus:—

Nematophora.

Hydroidæ.	Actinidæ.
Corynidæ.	Zoanthidæ.
Sertularidæ.	Sarcoidea.
Physophoridæ.	Pennatulidæ.
Diphydæ.	Madreporidæ.
Medusidæ.	Beroidæ.

I believe that I have already evidence enough on the "Hydroid" side, but on the other I have done nothing, or next to nothing. It is a very difficult investigation, but if this intolerable heat leaves me energy enough I will do something towards it. I am unwilling to write hastily or without due evidence on this matter (especially since the establishment of my views must, as it seems to me, necessitate the total re-arrangement of the "Radiata"), and I mean therefore merely to go on making observations until we return to England. If then I find any means offer itself of publishing my results on an appropriate scale, well and good; if not, I suppose I must content myself with feeling like a "mute, inglorious Hampden," and like a good philanthropist, pity the public for its loss.

I have a great advantage in the society and kind advice (to say nothing of the library) of Mr. MacLeay in Sydney. Knowing little of his ideas, save by Swainson's perversions, I was astonished to find how closely some of my own conclusions had approached his, obtained many years ago in a perfectly different way. I believe that there is a great law hidden in the "Circular system" if one could but get at it, perhaps in Quinarianism too; but I, a mere chorister in the temple, had better cease discussing matters obscure to the high priests of science themselves.

Keeping well in mind the old adage about "too many irons in the fire," I have nevertheless been able to make a few scattered observations on other animals than the Acalephæ, and I mean to embody those on the Mollusca—comet-wise—making the "*anatomy of Firola and Atlanta*" the nucleus whereunto to append a tail of observations on the genera, which will I think possess some interest, referring to the nervous system, structure of buccal mass, and the existence of a peculiar urinary system. I will send this from Sydney to the Secretary of the Zoological Society, with a request that you may, if so inclined, have the first perusal of it.

Our return appears to be very uncertain, perhaps not for a couple of years. If in this remote corner of the earth I can be of any service to you either in a scientific or any other way, pray consider my best exertions as at your command. A letter addressed to me at Sydney will always reach me. Yours very faithfully,

To Prof. E. Forbes. THOMAS H. HUXLEY.

On the Circulatory Apparatus and the Organs of Respiration in the Arachnida. By M. EMILE BLANCHARD.

It is well known that M. Blanchard, in opposition to the generally received opinion, admits the existence of a peritracheal circulation in insects; the following are some new observations which have been made upon the Arachnida, and appear completely to confirm his opinion. The Arachnida present favourable conditions for studying the relations existing between the circulatory and respiratory systems, as there are tracheary Arachnida, pulmonary Arachnida, and lastly pulmo-tracheary Arachnida, in which we can see the insensible transition of one system into the other. In the pulmonary Arachnida, the blood which has served for the nutrition of the organs becomes lost in the lacunæ; it then introduces itself into the respiratory organs, *i. e.* in the substance of the lamellæ forming the pulmonary sacs, thence it is brought to the heart by particular vessels. In the other two groups the same holds good, except that the vascular system is of a higher grade than that of insects.

What do we find, says M. Blanchard afterwards, in higher animals, where the respiratory organs are localized? We always find that the blood gets into contact with the air by circulating in the lamellæ forming the pulmonary or branchial sacs; now, in those animals in which the respiratory system is disseminated throughout the body, by means of tracheæ, ought not the law to remain the same? The pulmo-tracheary Arachnida furnish, in this point of view, a valuable intermediate stage. The pulmonary sac is prolonged in the form of minute, very slender tubes, which are true tracheæ; now if the blood circulates between the two laminæ of the vascular sac, it is probable that it also circulates between the two laminæ of the trachea, and must not the same thing occur in those Arachnida which are solely tracheary? M. Blanchard has confirmed these deductions by numerous injections. On introducing a liquid into the circulatory system, either by the heart or the lacunæ, he has always injected the intermembranular space of the tracheæ.—*Comptes Rendus de l'Académie des Sc.* Janv. 28, 1850.

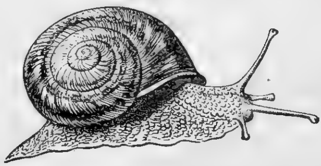
LONG-SUSPENDED VITALITY OF A SNAIL.

To Richard Taylor, Esq.

Sir,—Instances have frequently occurred proving the extraordinary powers of vitality which some of the Mollusca possess. Several species belonging to the family Helicidæ have been known to remain alive for upwards of two years in a torpid state, without the possessors of the specimens having even been aware that the shells contained living inhabitants. An extraordinary instance of this power possessed by snails has recently occurred here, which may prove interesting to many of your readers. In March 1846 a series of shells was presented to the British Museum by Charles Lamb., Esq., collected by him some time previously in Egypt, Greece, &c. Amongst these were two specimens from Egypt of the *Helix maculosa* *, Férussac, "the Snail of the Desert," as it is generally called, and which is found in great abundance living in the dry and arid deserts of Egypt and Syria. On the 25th of March 1846 the two specimens were fixed upon tablets and placed in the collection amongst the other mollusca of the Museum. There they remained summer and winter, fast fixed, gummed down upon the tablet, and immured in their prison till March 1850, four entire years after they had been first placed there, and without the slightest suspicion having been awakened that one of them contained a living inhabitant. How long they had been in the possession of Mr. Lamb before he presented them to the Museum I do not know. About the 15th of March 1850, having occasion to examine some shells in the same case as that in which these two Helices were contained, I observed that in one of them a thin glassy-looking

* *Helix maculosa,* Von Born, Férussac, Hist. Nat. Moll. Terr. et Fluv. t. 28. f. 9–10.

covering, the *epiphragm*, had spread over its mouth, and with evident signs that it was but recently formed. Rather surprised at this appearance, I removed the two specimens from the tablet, and placed them in tepid water. After the lapse of ten minutes I had the pleasure of seeing the animal of one of the specimens begin to gradually come forth, and in a few minutes more walk along the surface of the basin in which it was placed. I immediately upon that removed it from the water and placed it in a tumbler, where it began to crawl up its side. Next day I supplied it with a small portion of cabbage-leaf, of which it partook readily, though in small quantity. The animal in the other shell was found to be dead. It is not the least curious part of the story that the shell of the living animal was an injured shell, and had been repaired by the animal before it was collected by Mr. Lamb, though it evidently had not had time to perfect the mouth. It is still alive and feeds readily, preferring cabbage-leaf to lettuce or any other kind of food I have yet tried. It is now engaged in the process of completing the mouth of its shell, having since March made a small addition to its growth. It has been confined for some time past in a long glass jar about 18 inches high, and it seems to prefer climbing up to near the top of the jar to remaining at the bottom. A week ago I placed in the jar as a companion to it a very dark variety of the *Helix hortensis*, and the two seem to live quite harmoniously together. The accompanying sketch by Miss Waterhouse is one of the illustrations for a little work on Recent and Fossil Shells by Mr. Woodward of the British Museum, which is to form a part of Mr. Weale's series of Scientific and Practical Manuals.—W. Baird.



British Museum, June 24th, 1850.

WAY IN WHICH TOADS SHED THEIR SKINS.

At vol. v. p. 430 of the 'Annals' for this year is an account, by W. Turner, of the manner in which he saw a toad shed its skin. This statement does not materially differ from that given in Bell's 'British Reptiles,' except in one point. Bell describes the cuticle as "pushed by the two hands into the mouth in a little ball, and swallowed at a single gulp." I have this morning witnessed an exhibition of this remarkable œconomy in the disposal of his old clothes, by one of the large Jersey toads, of which I received two living specimens a few days ago. Observing the back parts of the animal to be bright and moist, and seeing it raise its hand, as if to scratch its back, I at once perceived what was going on, and summoned my family to witness the process. The toad continued, at intervals of a few seconds, to open its mouth wide, and at the same time to assist the removal of the cuticle, by stretching its arm and contorting its body, much in the way we see our amateur boatmen of the Cam divest themselves of those seamless knitted jackets, which they pass over their heads. A great part of the cuticle had already disappeared from the hinder quarters, and I observed a continuous and almost imperceptibly slow progression of what remained round one of the corners of the mouth and down the throat. In this way the cuticle became removed in proportion as it was detached. The whole of the left side was cleared first, with the exception of a small tattered fragment that adhered round the fingers, and which I did not observe to be removed by the mouth. The right arm was then more successfully liberated, the cuticle slowly disappearing round the right angle of the mouth, much as we might fancy a long strip of ribbon maccaroni would descend if carefully swallowed without a rupture. I did not notice any direct pushing of the cuticle by the hands into the mouth; nor yet any pellet formed of it, to be bolted at a single gulp. Whether there has been any mistake in the description of the process adopted by our English toads I will not venture to assert, but certainly my own pet swallowed his Jersey jacket in a very gradual and deliberate manner.—J. S. Henslow, Hitcham, March 11.—*Gardeners' Chronicle,* June 15, 1850.

On the Habitat of Cypræa umbilicata, *Sowerby.* By Ronald Gunn, Esq. In a letter to J. E. Gray, Esq.

Mr. Gunn, the enthusiastic and intelligent naturalist in Launceston, Van Diemen's Land, from whom we have received so many productions of that island, has most kindly sent to the British Museum a fine specimen of the above shell, which was described by Mr. Sowerby in the Appendix to the Tankerville Catalogue. Mr. Gunn in his letter observes:—

"Cowries, found upon the east shore of Barren Island, one of Hunter's islands, N.W. of Van Diemen's Land. Considerable numbers of the dead shell of this species were to be seen lying upon a deep bed of the dead shells of a species of *Pectunculus.*

"I will send you a Cowry which is new: it is most closely allied to *Cypræa eximia* of Strzelecki, 'Physical Description of New South Wales and Van Diemen's Land;' at all events it is not figured in Reeve's monograph of the genus. It is larger than *C. eximia.* I am not perfectly clear that it will prove to be the same; if so, it will corroborate an opinion which I have some time held, that the *C. eximia* was not a fossil, but carried inland by the aborigines, and fell from near the surface to the position in which it was said to be found."—*From the Proceedings of the Zoological Society for Nov.* 1849.

GLYCERIA PEDICELLATA.

It is of importance to notice, that in my paper "On a supposed new species of *Glyceria*" in the 'Annals' for February 1850, I erroneously conjectured the identity of my *Gl. pedicellata* with *Gl. plicata* α, of Mr. Purchas. Having examined some authentic specimens from that botanist, I find that *Gl. pedicellata* must be referred to his *Gl. fluitans* β 2.

I shall suppress any further remarks that I might at present feel inclined to make on these plants, in the hopes of shortly arriving at more certain knowledge.—F. Townsend.

Supplementary Note to Mr. R. Jones's paper on Fossil Entomostraca.

Mr. J. Brown, of Stanway, informs me that he has lately found some specimens of *Candona reptans* in a freshwater deposit at Edwardstone in Suffolk.—T. R. J.

Erratum in Mr. Owen's Notes on the Hippopotamus.

Vol. v. p. 515. Instead of 350 miles above Cairo, it should have been 1350 miles.

METEOROLOGICAL OBSERVATIONS FOR MAY 1850.

Chiswick.—May 1. Cloudy and cold. 2. Fine: clear: frosty. 3. Clear: very dry air: overcast: sharp frost at night. 4. Fine: showery. 5. Cloudy: some angular hail at 6 P.M. 6. Constant rain. 7, 8. Drizzly. 9. Heavy clouds: fine: clear. 10. Clear: cloudy. 11. Fine. 12. Slight shower: fine. 13. Fine: very dry air: rain at night. 14. Cloudy and fine. 15. Fine: cloudy: clear and frosty. 16. Fine. 17. Overcast. 18. Foggy: rain: cloudy. 19. Very fine: cloudy. 20. Uniformly overcast: fine: clear. 21. Fine: cloudless: overcast: rain. 22. Rain: clear at night. 23. Cloudy: clear. 24. Slight fog: dry haze. 25. Cloudy: fine: showery. 26. Showery: overcast. 27. Cloudy: overcast. 28. Fine: showery: clear. 29. Cloudy and fine. 30. Foggy: dry haze: clear. 31. Fine: slightly clouded.

Mean temperature of the month	51°·14
Mean temperature of May 1849	55 ·19
Mean temperature of May for the last twenty-three years ..	54 ·22
Average amount of rain in May	1·84 inch.

Boston.—May 1. Cloudy. 2, 3. Fine. 4. Cloudy: rain early A.M. 5. Cloudy: rain P.M. 6. Cloudy: rain A.M. 7, 8. Rain: rain A.M. and P.M. 9. Rain: rain A.M. 10, 11. Cloudy. 12, 13. Fine. 14. Rain A.M. and P.M. 15. Rain: rain A.M. 16. Fine. 17—19. Cloudy. 20. Rain: rain A.M. 21. Cloudy. 22. Cloudy: rain A.M. 23. Fine. 24. Fine: rain P.M. 25, 26. Cloudy: rain A.M. 27. Cloudy: rain A.M. and P.M. 28. Fine. 29. Cloudy: rain P.M. 30. Fine. 31. Cloudy.

Applegarth Manse, Dumfries-shire.—May 1. Slight frost: very cold east wind. 2. Slight frost: wind changed to west P.M. 3. Frost still: slight shower P.M. 4. Cold and ungenial: one sharp shower. 5. Frost: fall of snow: hills white. 6. Frost: clear and cold. 7. Frost hard: is this May? 8. Cloudy A.M.: hail: rain P.M. 9. Frost hard again: most unseasonable. 10. Heavy rain: cleared P.M. 11. Rain in the night: slight shower A.M. 12. Occasional sharp showers. 13. Cold: fair and clear. 14. Fair and clear: keen and cold P.M. 15. Frost again: hail: keen and cold. 16. No frost: cloudy: mild. 17. Fine: cloudy: mild. 18. Fine: air feels moist. 19. Shower in the night: cold east P.M. 20. Parching cold east wind. 21. Warm and sultry: change great. 22. Very warm: thunder and heavy rain. 23. Very warm: thunder: a few drops. 24. Very warm: fair and fine. 25. Soft rain all day: genial and growing. 26. Soft rain all day: blessed change of weather. 27. Rain: fair P.M. 28, 29. Fair throughout: fine. 30. Fine: thunder: shower. 31. Fine: thunder: a few drops.

Mean temperature of the month	49°·1
Mean temperature of May 1849	50 ·5
Mean temperature of May for the last twenty-eight years ...	51 ·1
Average rain in May for twenty years	1·69 inch.

Sandwick Manse, Orkney.—May 1. Clear: fine. 2. Fine: clear. 3. Showers: sleet-showers. 4. Hail: snow-showers. 5. Snow: snow-showers. 6. Clear: drops. 7. Clear: showers. 8. Damp: clear. 9. Frost: clear: cloudy. 10. Cloudy: drops. 11. Showers: hail-showers. 12. Showers: sleet-showers. 13. Bright: rain: clear. 14. Clear: rain: clear. 15. Bright: cloudy. 16. Damp. 17. Fine. 18. Cloudy: fog. 19. Hazy. 20. Bright. 21. Bright: showers: fog. 22. Fine: fog. 23. Cloudy. 24. Hazy: fog. 25. Hazy: rain. 26. Hazy. 27. Cloudy: fine. 28—31. Bright: fine.

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

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8½ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1850. May.	Max.	Min.		9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9½ a.m.	8½ p.m.								
1.	30·078	30·048	29·67	30·10	30·11	30·26	30·24	51	28	45·5	51½	37½	44½	41	ne.	n.	n.	n.	......	......	......	......
2.	30·274	30·197	29·82	30·18	30·13	30·18	30·09	56	23	45	52	31½	44	45½	ne.	nw.	nw–w	w.	......	......	......	......
3.	30·271	30·115	29·82	30·07	29·90	29·94	29·90	61	41	49	53	32½	45	39	sw.	wnw.	w.	nw.	......	......	......	·12
☾ 4.	29·979	29·728	29·55	29·90	29·62	29·81	29·74	60	32	49	50	35½	39	34	sw.	wnw.	nw.	n.	·08	·05	......	·26
5.	29·617	29·583	29·25	29·56	29·66	29·74	29·84	60	38	50	42	32½	41½	35	n.	wsw.	ne.	n.	·35	......	......	·16
6.	29·581	29·550	29·36	29·70	29·69	29·78	29·68	45	41	44	49	30½	41½	45	ne.	ne.	ne.	wsw.	·68	·07	......	·01
7.	29·497	29·448	29·30	29·68	29·53	29·67	29·58	48	44	47	52½	28	48	45	e.	ne.	se–e.	sse.	·04	·02	......	......
8.	29·573	29·369	29·00	29·37	29·42	29·42	29·55	51	39	44	41	38	44	35	nw.	n.	n w-n	nw.	·22	·50	0·05	......
9.	29·933	29·742	29·40	29·74	29·78	29·70	29·63	54	29	41	50	29	40	42	ne.	nnw.	nw.sw	s.	......	·11	......	·30
10.	29·997	29·959	29·55	29·54	29·60	29·36	29·43	60	43	44	53½	39½	50	42	sw.	w.	sw.	w.	......	......	......	·08
● 11.	29·981	29·952	29·49	29·65	29·62	29·43	29·47	62	47	53	53½	43	45½	43	sw.	w.	sw.	w.	·01	......	......	·08
12.	30·002	29·946	29·47	29·69	29·88	29·42	29·88	65	35	53	53	37½	42	40½	nw.	wnw.	w.	nw.	·01	......	......	·13
13.	30·109	30·082	29·69	30·09	30·04	30·06	29·93	62	33	50	53½	36	43	42½	ne.	ne.	nw.	wnw.	·04	......	......	·15
14.	30·082	29·916	29·60	29·87	29·90	29·98	30·04	59	41	47·5	54½	42	44	40	sw.	w.	n–ne.	n.	......	·05	......	·10
15.	29·916	29·902	29·55	29·94	29·90	30·05	29·91	52	25	42	51	30½	45½	45	ne.	nnw.	n–ne.	wsw.	......	·08	......	......
16.	29·947	29·930	29·57	29·81	29·78	29·75	29·83	55	37	46	58	40	48	46½	n.	nw.	nw.	wnw.	·01	·04	0·50	·11
17.	29·927	29·877	29·50	29·82	29·74	29·86	29·76	66	43	58·5	60½	46½	52	47	nw.	calm	wsw.	se.	·02	......	......	......
☽ 18.	29·782	29·767	29·36	29·63	29·60	29·65	29·70	68	40	57	58	47	52	47	nw.	w.	sw.	ese.	·01	......	......	......
19.	29·797	29·766	29·43	29·67	29·74	29·87	30·00	72	44	60	58½	45½	50	47	e.	sse.	se.	se.	......	......	......	......
20.	29·745	29·692	29·37	29·80	29·71	30·12	30·05	69	46	48·5	54	42½	53½	48½	e.	n.	ne.	ne.	·02	·10	......	......
21.	29·749	29·684	29·38	29·72	29·66	29·96	29·82	68	49	52	66	46½	51½	48	ne.	n.	w.–e.	se.	·11	......	......	......
22.	29·592	29·519	29·17	29·52	29·40	29·64	29·59	64	44	52	68½	52	58½	48½	ne.	calm	e.	ese.	·06	......	......	·11
23.	29·518	29·467	29·08	29·44	29·50	29·59	29·63	72	41	61	68	45	51½	50	w.	ne.	se.	ese.	......	·20	0·50	......
24.	29·461	29·387	29·00	29·43	29·40	29·61	29·61	67	50	61·5	67	50½	50	46½	e.	ene.	ne.	e.	......	......	......	......
○ 25.	29·563	29·506	28·97	29·30	29·23	29·55	29·36	65	48	62	63	47½	51	48½	sw.	ssw.	e.	e.	·03	·17	......	......
26.	29·716	29·614	29·05	29·19	29·28	29·27	29·27	64	49	60	54½	49	50	49	sw.	ssw.	s.	ese.	·03	·10	......	·18
27.	29·737	29·692	29·22	29·45	29·52	29·36	29·57	64	46	61	62	49½	55	52	sw.	s.	s.	......	·02	·16	......	·05
28.	30·167	29·980	29·43	29·70	29·94	29·70	29·93	63	42	60·5	63	50	55	49	sw.	w.	s.	wsw.	·10	·15	......	......
29.	30·221	30·137	29·70	30·00	30·00	29·98	30·04	72	45	64	63	50½	56½	52½	s.	sw.	s.	se.	......	·06		......
30.	30·050	30·026	29·60	29·98	30·00	30·07	30·10	70	46	60	66	51	58½	52	e.	e.	e.	se.	......	......	0·70	......
31.	30·201	30·090	29·68	30·09	30·14	30·15	30·22	76	41	61	69	48½	57	54	e.	nw.	s.	sse.	......	......	......	......
Mean.	29·873	29·796	29·42	29·730	29·723	29·771	29·786	61·97	40·32	52·5	56·7	41·4	48·62	45·17					1·84	1·86	1·75	1·84

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 32. AUGUST 1850.

VII.—*Chronological Exposition of the Periods of Vegetation and the different Floras which have successively occupied the surface of the Earth.* By M. Adolphe Brongniart*.

If, after having studied fossil plants in regard to their organization, so as to determine their relations to the vegetation now existing, without attending to the geological position they occupy, we compare the different forms which have inhabited the surface of the earth at different epochs of its formation, we shall perceive that great differences present themselves in the nature of the vegetables which have been successively developed, and have replaced those destroyed by the revolutions of the globe and the changes in the physical condition of its surface.

These are not merely specific differences, slight modifications of the same types; more frequently they are profound differences, in such sort that new genera or families take the place of genera and families destroyed and completely distinct; or a numerous and varied family is reduced to a few species, whilst another, poorly represented by a few rare individuals, becomes all at once numerous and predominant.

This is what strikes us most commonly in passing from one geological formation to another; but in considering these transformations collectively, a more general and more important result presents itself in an unmistakeable manner, namely the predominance in the most ancient times of Acrogenous Cryptogamic plants (Ferns and Lycopodiaceæ); later, the predominance of Gymnospermous Dicotyledons (Cycadeæ and Coniferæ) without the admixture yet of a single Angiospermous Dicotyledon; finally, during the cretaceous formation, the appearance and soon the predominance of Angiospermous plants, both Dicotyledons and Monocotyledons. These very remarkable differences in the

* From the Ann. des Sc. Naturelles, Botanique, 3 Sér. vol. xi. p. 285, May and June 1849. Translated by Arthur Henfrey, F.L.S.

composition of the vegetation of the earth, to which I called attention long ago, and which all recent observations, properly appreciated, appear to me to confirm, show that we may divide the long series of ages which have presided over this successive birth of the different forms of the vegetable kingdom, into three long periods, which I shall denominate, the reign of the Acrogens, that of the Gymnosperms, and that of the Angiosperms.

These expressions merely indicate the successive predominance of each of these three great divisions of the vegetable kingdom, and not the entire exclusion of the others; thus in the two first, the Acrogens and the Gymnosperms exist simultaneously, only the former prevail at first over the latter in number and in size, while in the later period the converse holds. But during these two reigns, Angiospermous plants appear to be wholly absent, or are only announced by a few rare signs, doubtful and very different from existing forms, marking moreover the presence of a few Monocotyledons rather than that of Angiospermous Dicotyledons.

Each of these three reigns thus characterized by the predominance of one of the great divisions of the vegetable kingdom, is commonly subdivided into several periods, during which forms very analogous, belonging to the same families and often to the same genera, are perpetuated; then these periods themselves comprise several epochs, during which vegetation does not appear to have undergone any notable changes. But in many cases we are still without materials for establishing these last subdivisions with precision, either from the fact that the exact geological position of the strata which inclose the impressions of the plants is not well determined, or that the mode of distribution of the species of plants in the different layers of the same formation, has not been carefully made out. I doubt not therefore that these different epochs, during which the vegetation has preserved its characters in an invariable manner, will be multiplied much more considerably than can be done in the actual state of our knowledge, when carefully collected materials have been brought together in greater abundance.

For the moment, I believe the following general division may be admitted :—

I. Reign of the Acrogens.

1. *Carboniferous Period.*

(Not divisible into distinct epochs in the existing state of knowledge.)

2. *Permian Period.*

(Forming but one epoch.)

II. Reign of the Gymnosperms.

3. *Vosgesian Period.*

(Constituting a single epoch.)

4. *Jurassic Period.*

Keupric epoch. Liassic epoch. Oolitic epoch. Wealden epoch.

III. Reign of the Angiosperms.

5. *Cretacean Period.*

Subcretacean epoch. Cretacean epoch. Fucoidian epoch.

6. *Tertiary Period.*

Eocene epoch. Miocene epoch. Pliocene epoch.

In reviewing these different epochs, I shall enumerate the different species of fossil plants which have been observed in the formations corresponding to them. In the carboniferous period, I shall only indicate the genera and the approximative number of species comprised in each of these genera, the characters of the vegetation of this period being strongly marked and resting essentially on the nature of the genera. The number of species, especially in those genera rich in species, cannot be established very accurately, because many of the species described by authors often require a fresh examination in order to suppress synonyms, and because even many of these species have only been indicated by names and have not yet been described or figured. In the other periods I shall give, as far as possible, the complete list of described species belonging to each particular epoch, because the same genera are not unfrequently perpetuated through several successive epochs, the differences depending in great part on specific distinctions.

I. Reign of the Acrogens.

The great predominance of the Acrogenous division, and in particular of the families of Ferns and Lycopodiaceæ, the considerable number of species of the first of these families, the great development of the plants of the second, and the arborescent form of the Lepidodendron, form part of the most striking characters of this epoch; but we must nevertheless add the presence of families, altogether anomalous, which we arrange in the Gymnospermous division, but which differ in an evident manner from the actually existing families of this division. These families ceased to exist at the close of this reign of the

Acrogens, which is at the same time that of the anomalous Gymnosperms, Sigillárieæ, Nœggerathieæ and Asterophylliteæ.

1. *Carboniferous Period.*

This long period begins with the appearance of the first terrestrial vegetables deposited in certain layers of the transition formations, and extends to the new red sandstone which covers the coal formation; in fact, all through this period there is no important difference between the forms of the plants; they are of the same families, the same genera, and often the same species; and in the existing state of our knowledge on this subject, a flora of the plants of the transition formations would not differ more from that of a true coal formation, than the floras of different strata of one single coal basin, or those of different, closely contiguous coal basins, do from each other.

I will besides call attention to the fact, that the real epoch of several of the formations considered as transitional, which contain carboniferous layers with impression of plants, is often badly determined, and remains an object of doubt and discussion for geologists; that several are perhaps nothing but true coal formations accompanied by rocks modified by metamorphic phænomena, and that in so far as these deposits have not been referred with certainty to the formations clearly defined under the names of *Devonian, Silurian* or *Cambrian rocks,* the specific comparison of their fossil vegetables with those of the coal formations will furnish no useful results.

The only coal strata considered by many distinguished geologists as more ancient than the ordinary coal formations, which are very rich in fossil plants, are those of the borders of the Lower Loire, between Angers and Nantes; now the impressions which they contain belong to all the genera of the ordinary coal formations, without exception, and do not furnish, collectively, any character by which to distinguish them from these.

I may add, that observations made quite recently upon a carboniferous rock,—very ancient, for it is covered by strata containing fossil animals characteristic of the Silurian formation,—confirm this opinion as to the extension of the coal vegetation up to the origin of the transition rocks; in fact, in a memoir by Mr. Sharpe on the Geology of the Environs of Oporto, I find that tolerably thick and numerous layers of coal which are covered by schists with trilobites, orthides, orthoceratites, graptolites, &c., contain a few impressions of plants, and these impressions, all Ferns, although rather imperfect, appear, according to Mr. Bunbury, identical or extremely near to well-known species of the ordinary coal formations. These are *Pecopteris cyathea* and *muricata,* and *Neuropteris tenuifolia.*

What I have just said of the rocks which appear more ancient than the coal formation, applies equally to the red sandstone which covers it. The fossils which I have seen from this formation do not differ at all from those of the upper layers of the coal formation proper. But, if the vegetation of our globe was maintained without undergoing great changes during all this period of time, it is no less certain that there were often very striking changes in the species during the deposit of these different strata. Thus, in the same coal basin, each layer often contains several characteristic species, which are not met with either in more ancient or more recent strata, and which the miners have recognized as distinctive marks of these layers.

M. Græser, of Eschweiler, has distinctly observed this fact and announced it to me. At St. Etienne also I have ascertained it in several of the layers worked in that basin. And, to cite an example, I will add that the layers which appear the lowest in this basin, contain abundance of *Odontopteris Berardii*, with very broad pinnules, without a trace of any other *Odontopteris*, while the upper layers of the quarries of Treuil very frequently exhibit *Odontopteris*, unmixed with any other species. In general each layer of coal is only accompanied by the remains of a rather limited number of plants. Sometimes this number is extremely restricted, especially in the oldest strata, and scarcely reaches eight or ten. In other cases, and more generally in the middle and upper layers, the number becomes more considerable; but I think it very rarely exceeds thirty or forty species. We see that each of these little local and temporary floras, which has given birth to a layer of coal, is extremely limited. This is, moreover, what we still see in our own times in large forests, and above all in those composed of Coniferæ, where one or two species of trees overshadow only four or five different Phanerogamous plants and a few mosses.

But in order to discover whether these little floras, so restricted in time and space, characterized so many special epochs of the vegetation of the globe, it would be necessary to determine their succession in several of the principal coal basins of Europe, and to see if the nature of the vegetation has been modified in the same manner in these different basins; in a word, if, in the different countries, the vegetation was the same everywhere at the same epoch, or was subject to local variations analogous to those which render different, at the present time, the vegetation of a forest of *Pinus sylvestris* in Germany, a forest of *Abies taxifolia* in the Vosges, of *Picea excelsa* in the Jura, and *Pinus Pinaster* in the Landes.

I am persuaded that the study of this point, if made in a sufficiently complete manner, would show that there are some general changes due to the succession of time, such as the predominance of certain genera or certain specific forms, combined with other differences altogether local, or due to an influence of the geographical position.

Thus it appears to me to result from many local observations, that the *Lepidodendra* would be more abundant in the old strata than in the upper layers of most of the coal-measures; that the true *Calamites* would often be in the same position; that the *Sigillariæ* would appear to predominate in the middle and upper layers; that the same would be true of the Coniferæ; and it is only indeed in the upper layers of St. Etienne, Autun, &c., that their branches are found, at least in France.

But these facts, which I indicate with much reserve, from observations which I have made in different coal basins of France, the more require to be generalized by observations gathered in other localities, that the position of the layers is often enveloped in much obscurity, and differently determined by the most distinguished geologists.

Thus the enumeration of the genera with the approximative indication of the number of species, which will presently be given, represents the totality of the plants which have flourished on the whole surface of the globe explored by geologists, during the long series of ages which the coal period comprehends, and not the vegetables which grew at the same time and in the same place.

It will be noticed, also, that the necessity of distinguishing frequently, as different genera and species, the different organs of an identical plant, sometimes apparently augments the number of species of a family, the number of species of which it would only be requisite, in this case, to determine by the study of the organ occurring most frequently and presenting the clearest specific differences.

Flora of the Carboniferous Period.

A. *Marine Vegetation* (peculiar to the transition formations).

Algæ.

Chondrites	2
Amansites	3

B. *Vegetation of the land or fresh water.*

Amphigenous Cryptogamia.

Hypoxyleæ.

Excipulites	1

Hymenomycetes.

Polyporites	1

Acrogenous Cryptogamia.

Filices.

* *Fronds.*

Cyclopteris	5
Nephropteris	4
Neuropteris	32
Odontopteris	10
Dictyopteris	3
Sagenopteris	1

Adiantites	6
Sphenopteris	30
Hymenophyllites	6
Trichomanites	1
Tæniopteris	2
Desmophlebis	3
Alethopteris	13
Callipteris	4
Pecopteris	80
Coniopteris	7
Cladophlebis	8
Oligocarpia	1
Scolicopteris	1
Chorionopteris	1
Asterocarpus	3
Hawlea	1
Senftenbergia	1
Woodwardites	1
Lonchopteris	2
Glossopteris	2
Schizopteris	1
? Aphlebia	1

** *Petioles.*

Zygopteris	1
Selenopteris	4
Gyropteris	1
Anachoropteris	2
Ptilorachis	1
Diplophacelus	1
Calopteris	1
Tempskia	4

*** *Stems.*

Caulopteris	5
Protopteris	2
Zippea	1
Asterochlæna	1
Karstenia	2

LYCOPODIACEÆ.

§ 3. *Lepidodendreæ.*

Lepidodendron	40
Lepidostrobus	8
Lepidophyllum	8
Ulodendron	9
Megaphytum	4
Halonia	3
Lepidophloios	3
Knorria	2

§ 4. *Psaronieæ.*

Psaronius	30
Heterangium	1
Diplotegium	1

EQUISETACEÆ.

Equisetites	3
Calamites	10

Gymnospermous Dicotyledons.

ASTEROPHYLLITES.

Calamodendron	6
Asterophyllites	20
Hippurites	1
Phyllotheca	1
Annularia	5
Sphenophyllum	8

SIGILLARIEÆ.

Sigillaria	35
—— Stigmaria	6
Syringodendron	2
Diploxylon	1
? Ancistrophyllum	1
? Didymophyllum	1

NŒGGERATHIEÆ.

Nœggerathia	10
Pycnophyllum	2

CYCADEÆ.

? Colpoxylon	1
? Medullosa	2

CONIFERÆ.

Walchia	4
Peuce	1
Dadoxylon	7
Palæoxylon	2
Pissadendron	2

Angiospermous Dicotyledons.

None.

Monocotyledons.

Very doubtful and imperfectly known.

Musæites primævus	1
Cromyodendron radicans	1
Palmacites carbonigenus } ———— leptoxylon }	2
Myeloxylon (Medullosa elegans)	1
Musocarpum	2
Trigonocarpum	7

By summing up these numbers, and avoiding at the same time, as far as possible, repetitions resulting from the repetition of different organs probably belonging to the same plants, such as the leaves, petioles and stems of the Ferns, &c., we arrive at the following figures for the different families:—

Amphigenous Cryptogamia	6	*Gymnospermous Dicotyledons*	135
Algæ	4	Asterophyllites	44
Fungi	2	Sigillarieæ	60
Acrogenous Cryptogamia	346	Nœggerathieæ	12
Filices	250	Cycadeæ?	3
Lycopodiaceæ	83	Coniferæ	16
Equisetaceæ	13	*Angiospermous Dicotyledons*	0
		Monocotyledons (very doubtful)	13
	352		148

352 + 148 = 500

The first fact which strikes us in this table, is the small number of the plants which constituted this flora of the ancient world. It is true that this reckoning of the fossil vegetables of the carboniferous period includes scarcely any but the species of the coal formations of Europe; but nevertheless those of North America have now furnished a considerable contingent, and the observations already made suffice to prove that most of the species are identical with those of Europe.

Thus, while this enumeration only comprehends 500 species, the existing flora of Europe is composed of more than 6000 Phanerogamia; that of Germany, or rather of Central Europe, alone, more than 5000; and by including the Cryptogamia these numbers would rise to at least 11,000, and to 9000 for the flora of Central Europe alone.

The flora of the carboniferous period therefore comprises at most a twentieth of the number of plants now growing on the surface of the soil of Europe, and yet this number of species corresponds to the whole of a long period, during which various species were successors to others; so that it may be admitted, with much probability, that never more than a hundred species existed contemporaneously. We see how great was the poverty, and especially the uniformity of this vegetation, above all in relation to the number of species, compared to the abundance and variety of the forms of the existing period.

The complete absence of ordinary or Angiospermous Dicotyledons, and that almost as complete of the Monocotyledons, explains, moreover, that reduction of the ancient flora; for at the present time these two divisions of the vegetable kingdom form at least four-fifths of the total number of known existing species. But the families also, so few in number, existing at that epoch, contain absolutely many more species than they present now on the soil of Europe. Thus the Ferns of the carboniferous period in Europe comprehend about 250 different species, and the whole of Europe now only produces 50 species.

In the same way, the Gymnospermia, which now only comprise in Europe about 25 species of Coniferæ and *Ephedreæ,* then contained more than 120 species of very different forms.

These families, existing alone and much more numerous then than they are now in the same climates, if we embrace the entire carboniferous period, were still more remarkable for the very different forms under which they presented themselves; thus among the Cryptogamia we observe genera of Ferns now completely destroyed, and several arborescent species; the *Equiseta* or allied plants almost arborescent; the Lycopodiaceæ forming gigantic trees; all forms now unknown, either in the entire world or at least in the temperate zones.

Among the plants that we range with the Gymnospermous Dicotyledons, the differences are still more striking, for they constitute families completely extirpated since that epoch; such are the Sigillarieæ, the Nœggerathieæ, and the Asterophylliteæ.

The characters of the vegetation during the carboniferous period may be thus summed up:—

Complete absence of Angiospermous Dicotyledons;

Complete or almost complete absence of Monocotyledons;

Predominance of Acrogenous Cryptogamia and forms unusual and now destroyed in the families of the Filices, Lycopodiaceæ and Equisetaceæ;

Great development of the Gymnospermous Dicotyledons, but resulting from the existence of families completely destroyed, not only now but from the close of that period.

Must we suppose that this vegetation, thus reduced to forms which we are led to consider as the most simple and least perfect, owed that special nature to its being a first phase of the development of the organization of the vegetable kingdom, which had not yet attained to the perfection it subsequently arrived at; or was it due to an influence of the physical conditions in which the surface of the earth was then placed? This we are unable to decide.

I will merely recall to mind, that I have already noted the analogy this predominance of Acrogenous Cryptogamia establishes between the vegetation of this first period and that of the small islands of the equatorial and southern temperate zones, in which the maritime climate exists in the fullest condition.

At the same time this predominance is not such that it involves, as during the carboniferous period, the exclusion of Phanerogamous plants; and that complete exclusion would seem more favourable to the idea of a gradual development of the vegetable kingdom.

Lastly, we are not sufficiently acquainted with the influence of the nature of the atmosphere upon the life of vegetables, when prolonged throughout their entire existence, to know whether important differences in the composition of that atmosphere, and above all the (very probable) presence of a greater proportion of carbonic acid, might not favour the existence of certain classes of the vegetable kingdom and oppose that of other groups.

I will terminate this sketch of the vegetation of the carboniferous period, by directing attention to the facts that the coal formation, which, almost solely, contains the remains of it, is evidently a terrestrial and freshwater formation; that the layers of coal which it contains are the result of the accumulation *in situ* of the remains of the plants, which covered the soil in the same manner as the layers of peat or the vegetable mould of great forests; that it is only in certain exceptional circumstances that these layers alternate with layers containing the remains of marine animals, and can be considered as the result of the transport in the sea of the terrestrial plants which occur in them.

This vegetation of the great carboniferous period disappeared almost completely with it; the Permian period which succeeded presents only a kind of residue already deprived of the majority of its most characteristic genera; and during the Vosgesian period, or that of the *grès bigarré,* we find no longer any trace of it.

I cannot close this account of the vegetation of the carboniferous period without saying a few words on the incomprehensible exception to this regular and uniform distribution of fossil vegetables which would be afforded by the anthracitic formations of the Alps, if they belonged really to the epoch of the lias, as held by M. Élie de Beaumont and several other distinguished geologists who adopt his opinion. I cannot discuss here the reasons, derived from geological observations properly so called, which have led M. de Beaumont to this conclusion; I am aware of all the weight which the so accurate and well-directed observations of my learned friend possess in science; but when we see that the researches which so many scientific men and collectors have made, have shown that the plants contained in these strata are without exception those of the coal period, without the intermixture of a single fragment of the fossil plants of the lias, of the Jurassic epoch, of the *keuper,* or of the *grès bigarré,* we seek in vain for an explanation of this unparalleled fact, and ask whether the few shells which have chiefly contributed to cause the reference of these formations to the Jurassic period, are a very positive proof of this geological position. Their small number, their state of preservation so imperfect that their specific determination is impossible or very doubtful, do these allow us to attribute to them more value than to that *ensemble* of numerous vegetables, the greater portion well determined specifically, which are found in these anthracitic strata? In 1828 I gave a list of these fossils comprising 25 species, 20 of which were determined specifically, and were all identical with the species of the coal formation. Mr. Bunbury has just executed a similar task on the collections deposited in the Museum of Turin, and has arrived at the same result; and I will add, that, several years ago, I received from M. Scipio Gras, engineer-in-chief of mines at Grenoble, collections of the fossils of the mines of Lamure and La Tarentaise, which contained more than 40 species, among which a great number belonged to the most characteristic genera of the coal formations. Such are the Sigillarias, eight or nine in number, five well determined; *Stigmaria ficoides*, three *Lepidodendra*, a *Lepidophloios*, *Annularia longifolia* and *brevifolia*; in a word, the whole *ensemble* of the coal vegetation, such as it is exhibited at St. Etienne or Alais.

With regard to the explanation drawn from a transport from distant regions where this vegetation had persisted, it becomes less admissible daily, as the number of specimens increases, and as we see that not a single specimen of the plants peculiar to the liassic period occurs intermixed with them.

2. *Permian Period.*

The nature of the plants which appear peculiar to this epoch is far from being determined in a very positive manner, for the very few localities in which have hitherto been found fossils that we can regard as belonging to this period, are perhaps actually not of completely identical and really contemporaneous formation. Thus, are the bituminous and cupreous schists of the Mansfeld country, referred by all geologists to the *Zechstein*, and the sandstones of Russia classed by MM. Murchison and Verneuil in the Permian formation, really contemporaneous? Finally, the slates of Lodève, considered by MM. Dufresnoy and Élie de Beaumont as dependents on the *grès bigarré*, but so different from the *grès bigarré* of the Vosges in their flora,—are they more properly classed in this period, which would thus be a sort of passage from the coal formation, so well characterized, to the Vosgesian period, or in that of the *grès bigarré*, which differs from it in such a marked manner?

These doubts as to the identity of the epoch of formation of the three principal localities which would furnish the materials for a flora of this period, lead me to enumerate these three local floras separately.

1. Flora of the Bituminous Schists of Thuringia.

Algæ.

Caulerpites selaginoides, *Sternb.*
—— pectinatus, *Sternb.*
—— sphæricus, *Sternb.*
Zonarites digitatus, *Sternb.*
Chondrites virgatus, *Munst.*

Filices.

Tæniopteris Eckardii, *Germ.*
Sphenopteris dichotoma, *Alth.*
—— Althausii, *Brong.* (Caulerp. patens et dichotoma, *Alth.*)
Sphenopteris Gœppertii, *Geinitz.*
—— bipinnata, *Geinitz.* (Caulerp. *Munst.*)
Pecopteris crenulata, *Brong.* (Caulerp. crenulatus, *Alth.*)
Pecopteris Martinsii, *Brong.* (Alethop. Martinsii, *Germ.*)
Pecopteris Schwedesiana, *Dunk.*—Frankenberg.

Coniferæ.

Cryptomerites Ulmanni, *Brong.* (Cupressus Ulmanni, *Bronn.*)–Frankenberg.
Walchia (not determinable specifically).

2. Flora of the Permian Sandstones of Russia.

Filices.

Odontopteris permiensis, *Brong.*
—— Strogonovii, *Morris.*
—— Fischeri, *Brong.*
Neuropteris salicifolia, *Fisch.*
—— tenuifolia, *Brong.*
—— flexuosa, *Brong.*?
—— macrophylla, *Brong.*?
Sphenopteris erosa, *Morris.*
—— lobata, *Morris.*
Sphenopteris incerta, *Brong.*
Alethopteris Grandini, *Brong.*?
Callipteris Gœppertii, *Brong.*
—— Wangenheimii, *Brong.*

Equisetaceæ.

Calamites gigas, *Brong.*
—— Suckowii, var. major, *Brong.*

Lycopodiaceæ.

Lepidodendron elongatum, *Brong.*
——, species doubtful.

Nœggerathieæ.

Nœggerathia cuneifolia, *Brong.*
—— expansa, *Brong.*

3. Flora of the Slaty Schists of Lodève.

Filices.

Neuropteris Dufresnoyi, *Brong.*
Sphenopteris artemisiæfolia, *Brong.*
—— tridactylites, *Brong.*
—— platyrachis, *Brong.*
Alethopteris Christolii, *Brong.*
Callipteris heteromorpha, *Brong.*
—— Carionii, *Brong.*
Pecopteris hemitelioides, *Brong.*
—— oreopteroides, *Brong.*
—— plumosa, *Brong.*
—— abbreviata, *Brong.*
—— dentata, *Brong.*
—— Lodevensis, *Brong.*

Asterophyllites.

Annularia floribunda, *Sternb.*

Coniferæ.

Walchia Schlotheimii, *Brong.*
—— piniformis, *Sternb.*
—— Sternbergi, *Brong.*
—— eutassiformis, *Brong.*
—— hypnoides, *Brong.*

More details respecting the species just enumerated will be found,—for those of the Permian formation, in the work already cited, of MM. Murchison, de Verneuil and Keyserling (vol. ii. p. 1), on the Geology of Russia; for those of the slate quarries of Lodève, in the 'Description Géologique de la France,' by MM. Dufresnoy and Élie de Beaumont (vol. ii. p. 145). It is evident that there are great specific differences between the plants of these localities, and that, up to this time, no species common to all can be recognized. Are these differences to be attributed to the influence of the great diversity of geographical position, or is there, besides, a difference of epoch of formation between these rocks? The only character which tends to approximate the last two floras, is the relation which both possess to that of the coal formations, of which they appear to be a kind of extract, and of the more recent strata of which they especially remind us.

As to the plants of the bituminous schists of the Mansfeld country, they are so few in number and appear to have been deposited under conditions so different, that it is difficult to compare them with the other two floras. However, the species of *Sphenopteris* are extremely alike in these three formations, and perhaps an accurate comparison would establish the identity of several of them: the *Pecopteris crenulatus* of Ilmenau is perhaps only an imperfect state of the *Pecopteris abbreviata* of Lodève; finally, the species of *Callipteris* of the Permian rocks and of Lodève have very intimate relations with each other and with the *Callipterides* of the coal formation.

We will add, relatively to the bituminous schists of Thuringia, that several of their fossils appear to be marine plants, the number of which would become far more considerable did we not suppress all the imperfect impressions which have been described as such, and which are merely altered fragments of Ferns or Coniferæ.

[To be continued.]

VIII.—*Description of* Lerneonema Bairdii. By Dr. James Salter.

[With a Plate.]

To the Editors of the Annals of Natural History.

Gentlemen, British Museum, June 1st, 1850.

The accompanying sketch and description of a remarkable animal belonging to the order Lerneadæ has been lately sent me by Dr. Salter of Poole. It evidently belongs to the genus *Lerneonema* of M. Edwards, but presents some peculiarities which distinguish it from the only two species of that genus hitherto found in this country. The want of an apparent head and the possession of only one horn-shaped appendage caused me to fear that that part of the animal, in the specimen from which the drawing was made, was imperfect, a portion of the head having perhaps been torn off in removing it from the herring to which it was attached. In reply however to my inquiries upon that subject, Dr. Salter assures me that there could be no mistake as to the state of the head, as he had examined it very carefully.

"I could discover," he says, "no fracture or injury to either of the specimens, so I have no doubt of their integrity, and they appeared both exactly alike. Besides the drawing I sent you, I made a figure at another time, and both drawings, made from the animal itself, are exactly alike." Unfortunately the specimens were lost, having been, along with the herring to which they had been attached, thrown away by Dr. Salter's servant in mistake. As I know Dr. Salter to be an accurate observer, I think the accompanying sketch and description are worthy of a place in your Journal, and I therefore willingly comply with Dr. Salter's request to forward them to you for insertion.

I remain, yours truly,

W. Baird, M.D.

The animal, to which I have applied the name *Lerneonema Bairdii*, was presented to me by my friend Mr. Jordan of Teignmouth, who obtained it from the coast of Devonshire. It was found adhering to the eye of a herring, and by its side, attached to the same cornea, was a smaller one, similar to it in every respect but its size. The colours were, at the time it was fresh, remarkably bright, flesh-coloured and green.

It appears, from its general form, to belong to the genus *Lerneonema*, though it does not strictly come within the definition of it given by Dr. Baird, who says that the head is "furnished with *two* or *three* simple curved horn-shaped appendages;" whereas in this individual there is but one simple hook. In every other respect it falls within the generic description, and here the discrepancy is probably from the definition not being sufficiently comprehensive.

This *Lerneonema* differs little from *L. spratta*, excepting in the form of the head.

The *head* of *L. Bairdii* consists of one simple hook (Pl. VII. B. fig. 3 *a*) composed of a little horny cylindrical thread bent upon itself in the form of a hook, pointed at its free extremity and attenuated where it joins the neck, the intermediate portion being somewhat, though slightly, swollen out. This hook, if extended, would measure about one line and a half.

The *neck*, which measures about three-sixteenths of an inch, is flattened laterally, so that, when viewed in front or behind, it appears a mere line (fig. 2 *b*), but when seen on one side its dimensions are more considerable (fig. 3 *b*). Its edges are serrated, and present about nine or ten serrations on each edge. At the point where the neck joins the head the structures are greatly attenuated, so that the head can move freely in any direction.

The *body* is a little more than five-eighths of an inch long, and of a flesh colour. It is laterally compressed in its upper third, and becomes quite flat where it joins the neck (fig. 2 *c*); its lower two-thirds are rotund (fig. 2 *d*): it terminates inferiorly by a little process which projects in front and beyond the attachment of the ovarian tubes (fig. 3 *e*). Viewed on its side, it forms a long narrow ellipsis (fig. 3 *d*).

The *ovaries* are an inch and four lines long; cylindrical and uniform in size throughout their entire length. Their colour is the brightest emerald-green. The ovaries are a little constricted at their attachment to the body, which itself bulges out, and at the junction there is a small scale, which overlaps the point of union (fig. 4). When the animal was quite fresh, there were indications of several articulations or divisions along the ovarian tubes; but these, as well as their very brilliant colour, have been lost by immersion in spirit. Magnified about twenty diameters, small tubercles are seen on the surface of the ovarian cylinders, especially near their extremities (fig. 5).

Hab. Attached to the cornea of the eye of a herring (*Clupea harengus*) from the Devonshire coast, near Teignmouth.

Poole, Dorsetshire, May 25, 1850.

EXPLANATION OF PLATE VII. B.

Lerneonema Bairdii.

Fig. 1. Natural length.
Fig. 2. Enlarged about two diameters, and viewed from behind: *a*, the hook; *b*, neck; *c*, compressed part of body; *d*, rotund part of body; *f*, *f*, ovaries.
Fig. 3. *Lateral* view: *a*, *b*, *c*, *d*, *f*, as above; *e*, depending process from body.
Fig. 4. The extremity of the body, showing the attachment of the ovaries (magnified 20 diameters).
Fig. 5. Extremity of ovary, showing small tubercles on its surface (magnified about 20 diameters).

IX.—*Observations on* Furcellaria fastigiata, *Huds., and* Polyides rotundus, *Gmel.* By Dr. Robert Caspary.

[With three Plates.]

As Harvey, in his 'Manual of the British Marine Algæ' of 1849, still observes, p. 146, that *Furcellaria fastigiata*, Huds., and *Polyides rotundus*, Gmel., "can scarcely be distinguished, when out of fruit, except by the root and the rounded axils of the branches," it is by no means idle work to show, by an accurate examination of the internal structure of these two plants, that in reality there exist characteristic differences in the formation of their cells, and that those differences are so striking, that every accurate observer will by them be enabled to say, from the examination of an ever so minute portion of the stem of these Algæ, even in the absence of fruit, root and branches, whether he has before him a portion of *Furcellaria fastigiata* or *Polyides rotundus*.

We shall first describe the structure of the cells in *Furc. fastigiata* and in *Pol. rotundus*, then point out minutely the differences in the internal structure of both plants, and conclude with giving the generic characters of them.

Before commencing the description of *F. fastigiata*, I ask the reader to look at fig. 1. Pl. IV., which represents a transverse section of the stem of *F. fastigiata*, and at fig. 2, exhibiting a longitudinal section of it. A glimpse at these figures will show that the stem is composed of four different sorts of cells, or even of five, if we count the two different forms of the outermost stratum of cells as two different sorts. The different sorts of cells forming the stem of *Furc. fastigiata* are the following :—

1st. The epidermal cells, forming the stratum A in fig. 1 & 2. The walls of these epidermal cells are transparent, colourless, or with a slight green, rarely with a brownish tinge, the intercellular spaces filled up entirely with a transparent, colourless, slimy (?) mass. Strong iodine colours all light yellow. The contents of these cells are brown, roundish, elliptical or oval grains, *which are not free in the cells, but attached to the walls*; by this property they are particularly distinguished from the following stratum of cells B, fig. 1 & 2, *which contains free, uncoloured, transparent grains* in great quantity. The epidermal stratum A shows in the form of the cells two differences in the outer part of it, *a*, fig. 1 & 2, and in the inner part of it, *b*, fig. 1 & 2. The outer part *a*, fig. 1 & 2, of the epidermal stratum contains two or three layers, rarely only one layer of polygonal small cells standing perpendicular upon the axis of the stem, the walls of which are almost entirely covered with brown grains. Fig. 3 shows these cells in a transverse section, and fig. 4 represents them as seen from above, where they show themselves 4–7-sided and cornered. The relative proportion of their breadth : width : length = 1 : 1 : 2 to 4. The view of these cells from above shows in their contents two concentric circles, but a glimpse at fig. 3, which represents them as seen from the side, explains these two circles directly, as the darker outermost is formed by the profile of the grains on the walls of the cell, and the innermost is the space in the interior of the cell, free from brown grains, but exhibiting a light brown colour. because the uppermost wall turned to the observer is covered also with the layer of brown grains. The same epidermal cells are in the sporangium not so sharply cornered polygonal, but rounded on the angles. The absolute measure of these outermost epidermal cells, taken with a screw micrometer, is the following :—

Breadth in	
3 together	=0·0116‴ Paris.
3 „	=0·0101
6 „	=0·0174
3 „	=0·0112
3 „	=0·0113
3 „	=0·0125
3 „	=0·0115
24	=0·0853

Length in
1=0·0129‴ Par.
1=0·0083
1=0·0132
1=0·0085
1=0·0087
1=0·0103
1=0·0115
1=0·0121
1=0·0109
1=0·0134
1=0·0100
1=0·0117
1=0·0128
1=0·0135
1=0·0123
1=0·0140
1=0·0129
1=0·0111
1=0·0109
1=0·0117
20=0·2307

Giving an average for the length of 0·0115‴ Par., and for the breadth or width 0·0035‴ Par. These outer epidermal cells show, although not always, a tendency to place themselves in radiating rows.

The inner part *b*, fig. 1 & 2, of the stratum A, is essentially formed exactly like the outer part; the cells are only far longer and broader than those of the outer part, the absolute measure of the length in eight being the following: 0·0195‴; 0·0184‴; 0·0181‴; 0·0502‴; 0·0238‴; 0·0176‴; 0·0402‴; 0·0563‴ Par.; all eight together=0·2431‴, giving an average for the length of 0·0303‴ Par. They are less covered with brown grains on the walls, and show in the transverse section forms approaching the globular, elliptical, oval, or often the rhomboidal. The relative proportion of their breadth : length = 1 : $1\frac{1}{2}$ to 3 or 4. I am not inclined to speak of *b*, the inner part of the epidermal cells A, as a peculiar stratum, for two reasons: first, because the transition-forms between the outer part *a* of stratum A, and *b* the inner part, are so gradual that no decisive difference between *a* and *b* could be found out, the common property being always the brown or brownish grains attached to the walls; and secondly, because this inner part *b* of stratum A is often almost entirely wanting in the stem. Fig. 5 represents four of these cells.

2ndly. A stratum of globose, oval or elliptical cells, the walls of which are transparent, uncoloured, with a greenish, rarely a brownish cast; the intercellular spaces between them are filled up with the same, probably slimy matter, as in the epidermal cells. The contents of this second stratum of cells, which in fig. 1 & 2 is represented in B and more highly magnified in fig. 6, are *free*, colourless, large, globose granules which iodine colours brown, if seen in mass, although, if we look at the single grains, these exhibit a cast of dirty violet. The relative proportion of the breadth of these cells to their length $=1:1\frac{1}{2}$–2. Their absolute size is nearly equal to the cells of the inner part of the epidermal stratum. Neither this nor the second sort of cells is "dichotomous."

3rdly. The third sort of cells is intermixed with the fourth sort in the middle of the stem; see fig. 1 & 2, C and D. This third sort of cells, having a relative proportion of breadth : length $=1:3$–8, consists of more or less cylindrical, horizontal or slanting cells, which run in all directions in the intercellular spaces between the perpendicular long cells of the middle of the stem. The cells of this third sort form strings, leaning with one end to the cells of the second sort, and changing probably slowly by degrees into the cells of the fourth sort, which latter I nevertheless could not succeed in ascertaining by direct observation. As these cells of the third sort therefore seem to be nothing else but a form mediating the transition between the second and fourth sort, their claim to be considered a peculiar sort may be doubted; but as their form nevertheless, even if their transition into the fourth sort should be established by direct observation, is very prominent, I describe them as a peculiar sort. Fig. 7 represents these cells. Their walls are like the walls of the second stratum, and their contents likewise colourless, globose grains, although these are often wanting. Iodine has the same effect upon the grains as upon those of the second stratum. Generally only two cells meet with their ends as in fig. 7, but occasionally three or four. Their absolute length is very different. I found in four the following length : 0·0277‴; 0·0285‴; 0·0391‴; 0·0557‴.

4thly. The fourth sort of cells of the stem of *Furcellaria fastigiata* is to be found in its middle, consisting of long, cylindrical cells, placed parallel to the axis and meeting each other at the ends, so that they form strings. The relative proportion of the breadth : the length of these cells $=1:15$–20. They are represented in figs. 1 & 2, occupying the last part on the right-hand side, marked C and D. Fig. 12. Pl. V. represents such a cell, and shows how it is at its ends connected with others. I believe I have seen, although very rarely and never with certainty, three cells meet at the same point, two from one side and one from the other. The absolute measure was in five the following: 0·1317‴; 0·1196‴; 0·1147‴; 0·1205‴; 0·0963‴, giving an average of 0·1165‴. Their walls consist of two layers, very rarely visible in a longitudinal section of the stem, as in fig. 12, but generally visible in the transverse section, as in fig. 14 & 15. These two layers do not show any difference, are transparent, colourless, and have a greenish tinge. Generally these long cells seem not to have any contents; rarely I observed very indistinctly defined grains in them, as in fig. 13; but that they have contents, probably slime, is shown by the fact that iodine colours their inside brown, whilst the wall exhibits a light yellow tinge. Harvey says in his 'Manual,' p. 146, "The axis of the stem consists of densely packed, longitudinal, interlacing and anastomosing filaments." Although I have seen upwards of 100 sections, longitudinal as well as transverse ones, I never observed any sort of interlacing or anastomosing, nor have I seen any connexion between these perpendicular cells, which are placed parallel to each other.

I believe that we are not justified in speaking of a root in the Algæ, from reasons which there is no occasion to state here, but I call that basal part with which an Alga is fastened, "disc of fixation." The mode of fixation and multiplying of the stems in *Furcellaria fastigiata* is the following. A stem C, which is fixed by a little disc, *a*, Pl. VI. fig. 19, sends out one to four or more horizontal, cylindrical, thin stems just above the disc of fixation. The chief stem in fig. 19 has above *a*, four such horizontal stems. These throw up at short intervals new perpendicular stems, as D, E, F, B, I, H, and produce here and there a disc of fixation, as at all the points marked *c*, and ramify often, as the stem A is thrown up by a branch of a main horizontal stem. The new perpendicular stems very soon send out again horizontal basal stems, such as are beginning to originate on the base of the perpendicular stems A and B at the point *b*, and these horizontal stems form as well discs of fixation as new perpendicular stems, and so on; but even in large plants the space occupied by the discs of fixation of all stems is not larger than about an inch in diameter.

In the young, growing points of the perpendicular stems, in their attenuated base, in the horizontal stems, and in the discs of fixation, the cells of the inner part of the epidermal stratum and the second stratum, *i. e.* all globose forms of cells, have disappeared, and almost all differences between the different sorts of cells which the stem and the receptacles show are abolished. The long perpendicular cells are in the apices of the growing stem, the attenuation of its base and the horizontal stem becoming very thin, often curved, and filled with brown grains, and the epidermal cells approach them in their form because they become longer, curved, lose all tendency of being placed in radiating rows, till finally in the discs of fixation, the apices of the horizontal stem and the utmost apices of the growing stem, all differences of cells are abolished. The disc presents one firm mass of long, irregularly curved, often parallel cells having brownish grains as contents, and being transparent in their walls, which no longer can be distinguished from the slimy mass filling up the intercellular spaces.

Furcellaria fastigiata has a double fructification in different individuals, both found in the often-described apical sporangia, in a very unbotanist-like manner called "pods;" first, zonate tetraspores, and secondly, large elliptical heaps of irregularly shaped spores, "conceptacular fruit," which was up to this time a desideratum. I found this fructification in specimens of *Furcellaria fastigiata* collected in January 1850 near Cromer.

In December and January zonate tetraspores are found in the sporangia, not forming exactly a stratum under the outer part of the epidermal cells, but collected in irregularly placed patches. The 'Manual' by Harvey of 1849, pl. 18 C, gives for the first time a representation of these tetraspores. We add a correct drawing of a section of the sporangium with tetraspores in fig. 17.

Fig. 18 represents the second sort of fruit, large elliptical heaps of dark brown, irregularly polygonal or rounded spores, without doubt developed altogether in one cell, surrounded with the cells of the third sort, except where they border upon the epidermal stratum. The second sort of cells is almost entirely wanting in these sporangia; and the fourth sort showed the peculiarity, that the contents of one cell were continued through the joining ends into the contents of the next cell, but this may have been a phænomenon of incipient decay.

A remarkable appearance, which is common to *Furcellaria fastigiata* and *Polyides rotundus*, are the soft, thickened, cylindrical-lanceolate, pale brown apices of some of the stems, as if they produced abortive sporangia. They are not only found, as Harvey says, on the truncated "apices as a second growth" (Phycol. Brit. Furc. fast. descript. to pl. 94), but on quite sound, uninjured stems; neither on individuals only having no sporangia, as Harvey observes, but very often together with sporangia bearing stems on the same bunch, although on different stems. Their structure is like that of the stem.

At the maturity of the spores the sporangia decay; the spores come out by forcing their way through the decaying epidermal cells, as easily observable if they are kept for a few days in sea-water, and by force of the waves the decaying sporangia are by degrees worn away and washed off, as remains of the sporangia still fixed to the stem entirely robbed of their epidermal coat are often met with; it seems therefore not accurate to say that "the receptacles fall off when ripe," particularly as they have no articulation; nevertheless it would be desirable to make more observations on this point.

The power of reproduction is very great in *Furcellaria fastigiata* as well as in *Polyides rotundus*. Stems are often found, which have been by accident cut off on the upper branches once, twice, or even three times, and so truncated, but which have always protruded again a new grown stem beyond the truncated parts. I figure one piece in which truncation has taken place three times (Pl. V. fig. 10).

Fig. 9 represents a transverse section of the stem of *Polyides rotundus*, and fig. 8 a longitudinal one. There are also four sorts of cells in the stem of *Polyides rotundus*:—

1st. The epidermal cells A, fig. 8 & 9. The walls colourless or with a slight brownish tinge; intercellular spaces filled up with a transparent colourless matter, probably slime. Contents brown grains, not free, but attached to the walls. This stratum of epidermal cells consists of two subdivisions. The outer part of the stratum, *a*, fig. 8 & 9, formed by small cells, placed in radiating rows; the breadth of these cells is almost equal to their length; the relative proportion of breadth : width : length = 1 : 1 : 1–$1\frac{1}{2}$, rarely to 2. Seen from above they exhibit themselves 4–7-sided, but the polygonals are so rounded on the corners that they represent a great approach to cylinders; four or five layers of such cells are generally to be met with, occasionally only three, but also six or more. Their absolute measure is the following:—

	Length in		Breadth in
	2 = 0·0073‴		3 = 0·0143‴
	3 = 0·0127		2 = 0·0071
	4 = 0·0184		1 = 0·0061
	4 = 0·0166		4 = 0·0141
	3 = 0·0127		2 = 0·0090
	4 = 0·0170		3 = 0·0105
	2 = 0·0098		4 = 0·0150
			4 = 0·0178
	22 = 0·0945		
Average	= 0·0043		23 = 0·0934
		Average	= 0·0041‴ Par.

Seen from above they represent as well as those of *Furcellaria fastigiata* two circles, which are to be explained in the same way as I have done with *Furcellaria fastigiata*. Fig. 28. Pl. VI. represents some of these cells in a transverse section.

The inner part of the epidermal stratum of cells, *b*, fig. 8 & 9, is in every respect like that of *Furcellaria fastigiata*, with this exception, that the walls of the cells never exhibit a greenish, but a brownish tinge.

The second sort of cells in *Polyides rotundus*, B, fig. 8 & 9, is entirely like the corresponding cells in *Furcellaria fastigiata*, fig. 1 & 2 B. Their absolute size was, 0·0347‴; 0·0280‴; 0·0313‴; 0·0304‴; 0·0257‴; 0·0235‴ par.

The second sort of cells is transformed, by their being placed in strings, by growing in length and taking a slanting direction to the axis of the stem, into the third sort. In fig 8 & 9 C these cells are represented running between the long perpendicular cells, but neither as horizontally as in *Furcellaria fastigiata*, nor in all directions as there, but slanting to the axis of the stem and less deviating from a straight line. They are also proportionally of a greater thickness than those of *F. fastigiata*. The walls of these cells are simple, transparent, colourless, their contents constantly globose, pellucid, colourless grains, which iodine colours just as brown, if seen in mass, or dirty violet, if seen single, as the grains of the second sort. The absolute measure in five was the following: 0·0510‴; 0·0167‴; 0·0160‴; 0·0452‴; 0·0482‴ par.

I am disposed to think that these cells of the third sort change by degrees into the cells of the fourth sort, but I have never been able to ascertain this by direct observation. The cells of the fourth sort are in the middle of the stem, fig. 8 & 9 D, running parallel to each other and the axis of the stem, being connected with each other at the ends; the relative proportion of their breadth : length = 1 : 8–15. They are not entirely cylindrical, but mostly much thicker at the ends than in the middle, so that they have the form of a femur. Fig. 11 & 16 show the greater thickness of the ends of these cells and the meeting of two. The wall colourless and transparent; the contents whitish, not well-defined grains, running one into another. I was never able to perceive clearly in the longitudinal section a double layer in the wall. Fig. 11 represents one of the cells having a triple outline on the outside, and one would therefore suppose that the wall consists of two layers, but the innermost two lines do not seem to indicate an inner layer of the wall, but a deposit of the granular contents of the cell along it. The transverse section however shows the double layers of the walls in the cells very clearly, just as in *Furcellaria fastigiata*: see fig. 14 & 15. The absolute measure of seventeen of these cells is, 0·0750‴; 0·0947‴;

0·0820‴; 0·0633‴; 0·0739‴; 0·0848‴; 0·0752‴; 0·1006‴; 0·0900‴; 0·1062‴; 0·0933‴; 0·1072‴; 0·1144‴; 0·1153‴; 0·1197‴; 0·1120‴; 0·0811‴, giving an average of 0·0934‴ par. These cells show no sort of "anastomosis," and there is no sort of cells in the stem of *Polyides rotundus* which is "dichotomous."

The stems of *Polyides rotundus* are all fixed, with one common large disc from which new stems originate. The construction of the disc of the points of the growing stems and their attenuated base is like that of the corresponding parts in *Furcellaria fastigiata,* with scarcely perceptible differences.

Polyides rotundus has two sorts of fruit. The epidermal outer layer of the stem produces outwardly, as a continuation of its own radiating epidermal cells, strings of small cells, the relative proportion of which in breadth : length is = 1 : 1–6. The strings of these cells run parallel to each other, cohering laterally by being imbedded in a transparent, colourless, slimy mass; the contents are a whitish granular substance.

These strings of cells form laterally on the upper part of the branches rounded protuberances, surrounding $\frac{1}{2}$ or $\frac{3}{4}$ of the periphery of the stem, being 1–1$\frac{1}{2}$ line thick and 1–4 lines long. Between these strings of cells are found singly-lying very large elliptical cells, with colourless transparent walls, containing crimson-coloured pear-shaped spores in great quantity, placed with their acute point to the centre of the cell. These clusters of crimson-coloured spores give the whole protuberance to the naked eye a rose-red colour. Fig. 20 exhibits such a cluster of spores with the surrounding strings of cells; *c–d* is the epidermal stratum of cells in the stem.

There does not exist any epidermis in these protuberances, as Greville rightly observes, although Harvey (fig. 1 & 5. pl. 95 in his Phycol. Brit.) conveys the idea of there being epidermis.

The other fructification of *Polyides rotundus,* which up to this time seems only to have been found by Mrs. Griffiths near Sidmouth, but was found also by me in specimens which were collected in January 1850 at Cromer, are tetraspores mostly divided crosswise, under the outer epidermal stratum in the swollen upper parts of the ramules. These tetraspores are elliptical, often not parted in four, but only in two or three sporules. Fig. 21 exhibits a part of a transverse section of a swollen ramule, with three tetraspores and one which is abortive. Fig. 22 & 23 show two spores parted crosswise; fig. 24 & 25 two, which only contain three spores, and fig. 26 & 27 two, only containing two: it might be thought that the two last are nothing else but four parted spores seen from the side; but this is not the case with those I figure, as I had opportunity of convincing myself.

Differences in the Structure of the Stem between Furcellaria fastigiata *and* Polyides rotundus.

1st. The epidermal outer stratum in *Furcellaria fastigiata* consists only of two or three, seldom more, layers of cells, which are two to four times longer than broad; breadth : length = 1 : 2–4. The epidermal outer stratum in *Polyides rotundus* consists of 4–5, seldom so few as three layers of cells, which are nearly as long as broad; breadth : length = 1 : 1 or nearly so.

2ndly. The third sort of cells arranged in strings have towards the axis of the stem in *Furcellaria fastigiata* an almost perpendicular direction or nearly so with little granular matter; whilst in *Polyides rotundus* they have a slanting direction towards the axis of the stem, and contain in most cases many grains.

3rdly. The fourth perpendicular sort of cells in the middle of the stem is in *Furcellaria fastigiata* rarely filled with a granular matter, cylindrical, not thicker at the junctures with the next cells than in their middle; the relative proportion of breadth : length = 1 : 15–20: whilst the corresponding cells in *Polyides rotundus* contain in most cases much granular matter, have the form of a femur, that is, are thicker at the junctures than in the middle, and are shorter than the cells in *Furcellaria fastigiata*; breadth : length = 1 : 8–15.

These differences, particularly the first, will enable every accurate observer to determine any portion of the stem of the two plants, be it ever so small, if it only admits of transverse and longitudinal sections.

All these observations were made on vigorous plants which had not been previously put into fresh water. Sea-water was employed under the microscope. Old decaying plants show many differences in their structure. There will come a time when it will be found necessary to give, in describing Algæ, not only the relative proportions of breadth and length of the cells, as is already now partly done, but also the absolute size of them.

I add at the risk, *ut acta ayam,* the generic character of both plants:—

Furcellaria fastigiata.

Frond cylindrical, dichotomous, cartilaginous, solid, fixed by many small discs, which are either sent out from the base of the perpendicular ones on the base of the perpendicular stems, or here and there on small, horizontal, often branched stems. The perpendicular stem composed of four sorts of cells, the walls of which are colourless or slightly tinged greenish or brownish. 1st. The epidermal layer with brown grains attached to the wall, cells horizontal: *a*, the outer part, consisting of 2–3 radiating layers; breadth : length = 1 : 2–4; average absolute size, length $= 0{\cdot}0115'''$ par.; breadth $= 0{\cdot}0035'''$ par.; *b*, the inner part, now and then wanting, breadth : length $= 1 : 2–4$; absolute length $= 0{\cdot}0303'''$ par. 2ndly. Oval or elliptical horizontal cells with colourless, roundish grains; breadth : length $= 1 : \frac{3}{2}–3$; absolute length $= 0{\cdot}0303'''$. 3rdly. Cylindrical or elliptical cells, joined at the ends, running in all directions, but more or less perpendicular upon the axis of the stem, now and then with colourless roundish grains; breadth : length $= 1 : 3–8$; absolute length $= 0{\cdot}0377'''$. 4thly. Cylindrical perpendicular cells of equal thickness in all parts, filled with a slimy mass; breadth : length $= 1 : 15–20$; absolute length $= 0{\cdot}1165'''$. Base, discs, growing points and horizontal stems composed of curved long cells, similar to the third sort of the stem, but filled with brownish grains. All intercellular spaces in the whole frond filled up with a colourless slimy (?) matter. Fruit of two sorts on different plants in apical, cylindrical-lanceolate sporangia: 1st, zoned tetraspores; 2ndly, elliptical, large, uncoloured cells, containing a great quantity of irregularly-shaped brown spores.

Polyides rotundus.

One disc of fixation, from which the frond arises. Frond consisting of cylindrical, dichotomous, cartilaginous, solid stems, containing four sorts of cells, the walls of which are colourless or slightly tinged brown. 1st. The epidermal horizontal stratum with brown grains attached to the walls: *a*, the outer part consisting of 4–5 radiating layers; breadth : length $= 1 : 1–2$; average absolute breadth $= 0{\cdot}0041'''$, length $= 0{\cdot}0050'''$ par. *b*, the inner part; breadth : length $= 1 : 2–4$; absolute length $= 0{\cdot}0278'''$. 2ndly. Oval or elliptical horizontal cells, with colourless, transparent, free grains; breadth : length $= 1 : \frac{3}{2}–3$; absolute length $= 0{\cdot}0278'''$. 3rdly. Elliptical or cylindrical cells forming slanting strings; breadth : length $= 1 : 3–8$; absolute length between $0{\cdot}0160'''$ and $0{\cdot}0510'''$. 4thly. Long, perpendicular, femur-shaped cells thicker at the ends than in the middle; breadth : length $= 1 : 8–15$; absolute length $= 0{\cdot}0934'''$. The disc, the base of the stems, the growing points consisting of curved, long cells, filled with brownish grains. All the intercellular spaces of the whole frond filled up with a colourless, slimy (?) matter. Two kinds of fruit: 1st, crosswise parted tetraspores in the swollen upper parts of the stems; 2ndly, colourless cells with a great quantity of crimson, radiating, pear-shaped spores; these cells being imbedded in protuberances on the sides of the upper part of the branches, which protuberances, having no epidermis, consist of undivided, nearly parallel strings of cells; breadth : length $= 1 : 1–6$, filled with a granular whitish matter.

I cannot conclude without expressing my warmest thanks to

Miss H. Nelson for having so kindly furnished me with fresh specimens of *Furcellaria fastigiata* and *Polyides rotundus* during this winter, collected near Cromer, which enabled me to make the foregoing observations.

X.—*Observations on the Animals of the* Bullidæ. By William Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, Norfolk Crescent, Bath, June 20, 1850.

I present an account of some of the animals of the *Bullidæ* which inhabit the South Devon coast at Exmouth. They are deposited in two groups, which undoubtedly as to essentials are of the same tribe, and have long been adopted: the one, *Bulla*, of which the *B. hydatis* and *B. lignaria* are the types, receives the species with external testacea; the other, *Bullæa*, is represented by *B. aperta*, and is the receptacle of those with concealed shells. From these roots some new genera have sprung, to meet the supposed requirements of modern discoveries, most of which are very minute; some are without eyes, all are without distinct tentacula or with the mere rudiments of them, and have the pedal lobe more or less reflected laterally on itself, and partially on the anterior end of the shell; in others the lax margins of the deep sinus, at the under part of the foot, which séparate it from the linear posterior portion, occasion it to appear nearly as simple as in the usual run of the Gasteropoda; this latter circumstance has led to some mistakes, as will appear in descriptions of the minute species.

All the species I have met with have the invariable distinguishing character of the tribe, the gizzard consisting of three testaceous, coriaceous or cartilaginous plates. I believe that every true *Bulla* and *Bullæa* have one or the other of these appendages; indeed it may be considered, that if an animal, however much it appears by the shell to belong to this family, has not the shibboleth of the gizzard, it is an alien to it.

The new genera of this tribe have been established by M. Lovèn, amongst them *Cylichna* and *Amphisphyra*, but the minuter species are so rarely met with alive, that they can scarcely be placed with certainty; and to add to the difficulty, the excellent Lovèn, one of the most careful observers, has I think fallen into some error with respect to the genus *Cylichna*, the generic diagnosis of which would appear, from our present notes on two of the species he has deposited therein, the *B. cylindracea* and *B. truncata*, not to be founded on correct bases. But what naturalist does not sometimes fail in his views, from various causes, especially in the investigation of the difficult tribes of the minuter animals? where is the critic, who, under such circumstances, would so egregiously misapply the phrase,

"Indignor, quandoque bonus dormitat Homerus"?

I propose to show that the *B. cylindracea* and *B. truncata* are congeneric with *B. hydatis*; if this is so, it may be further observed, that on analogical considerations it is extremely probable that M. Lovèn's *B. umbilicata,* which is also one of our indigena, is in the same category as to error, and with our *B. obtusa* and *B. mammillata,* not yet I believe observed, will turn out to be strict *Bullæ.* Until these minute creatures have had fresh examinations, this family cannot be settled; no conchological considerations will suffice. It may be that the unobserved species will afford valid generic distinction; but I think, from the constancy of structure of all the *Bullæ* that have been adequately observed, they will, though the presumption rests on analogical grounds, be found to have the tripartite gizzard and typical foot with its accessory lobe extending from one extremity of the animal to the other, with the sides more or less reflexed, producing the quadrilobated character of the tribe.

I can say little of the genus *Amphisphyra*; the only British species, the *B. hyalina,* is not found on our southern coasts, and the notices of it are so meagre, that at present it cannot be placed with safety. It has been stated to have neither gizzard nor head-disc; if so, it cannot belong to the *Bullidæ*; it is possible those parts in so minute a being may have escaped detection, and it may turn out a *Bulla.* Naturalists residing in the locality of this species should re-examine these points and communicate their notes.

The *Scaphander* of Montfort is synonymous with *Bulla,* and the *Philine* of Ascanius adopted by M. Lovèn, with *Bullæa*: though these ancient titles may have priority of date, still, whatever injustice may be done—and it would appear from the want of support of these genera, it cannot be great—it is impossible at this time of day to dispense with the *Bulla* of Linnæus and Lamarck, and *Bullæa* of the latter, which have been so long in use and universally acknowledged.

I have given a general and anatomical description of *Bulla hydatis* from many live individuals, which have enabled me to verify the observations of M. Cuvier, to fill up some gaps, and I believe to correct some errors, which, for the reasons I have assigned below, have escaped the attention of that prince of anatomists.

Bulla hydatis, Linnæus.

Animal, when fully extended, of an elongated oval shape. The upper or tentacular lobe, and that of the foot, with its reflected portions, are of a pale yellow, aspersed with very minute, close-set, sand-like, dark mouse or lead-coloured points throughout their external surface; the spots on that part of the mantle covered by the shell are larger and of intenser hue, so that the animal has altogether the aspect of being clothed in a close-sprinkled pepper-and-salt jacket. The sinus around the body, which divides the upper and lower lobes, is of a pale yellow white colour. The tentacular lobe of the head is small, of subquadrangular form, a little narrowed behind, where, as well as in front, it is gently sinuated, with slight emarginations at the centre of both ends, which by no means give their right and left extremities any pretension to be styled four tentacula, agreeably to M. Cuvier's view. The true mantle extends to the posterior part of the tentacular lobe, with its thickened rounded margin swelling out a little beyond the periphery of the aperture of the shell; that part of it covering the branchiæ, heart, bladder, matrix and testis is of firm texture; the portion within the posterior part of the spire, containing the liver, ovarium and oviduct, is a mere film, but stronger than would be supposed from its tenuity; at the posterior end of the shell the dorsal range is completed by the reflexion on it of the hindermost part of the pedal lobe. The anterior part of the under lobe forming the foot is precisely of the same length and width as the upper one, but more posteriorly it spreads like a fin, which is reflected on the sides of the shell; the disk then pursues its course for two-thirds of its length posteriorly, at which point its continuity is broken by a deep fissure, which only in a marked manner divides the plate, without injuring the fabric; on the right side near this channel the anus debouches; the pedal plate is then continued to the posterior end, becoming wider, and there, as before stated, is reflected on the posterior part of the shell.

It appears then that there are but two lobes, the upper or tentacular, and the pedal one, which though interrupted by the deep groove, is in reality a single plate, but from its posterior and anterior lateral reflexions, together with the tentacular disk, gives the animal the characteristic quadrilobated appearance of the tribe. The object of the pedal fissure is probably to give flexibility to the foot, and allow the lobes to act as fins, as the animal is equally an adept in natation and reptation.

Twenty years ago I observed hundreds of these creatures swimming and creeping on the fine mud in the lakes of the Mount Pleasant Warren near Exmouth; they however suddenly disappeared from the locality, and not one has been seen for many years; the animals now described were obtained near Swanage, Dorset.

The large circumferential canal of the separation of the upper and lower lobes is much more decided on the right than on the left side, as from the former we have a view of the orifice of the verge, the open seminal duct, and the common cavity of generation, the testis, and points of the branchiæ. The eyes are very distinct, situate far back on the tentacular disk, and not very close together; they are black, and sessile in the centre of a minute circular lucid spot; M. Cuvier has overlooked them. The fissure of the mouth is vertical; this is placed in the centre and between the tentacular and pedal disks; and on each side the mouth, within the groove, are two elegant conspicuous leaflets perfectly symmetrical, each consisting of twenty strands on each side the stem, which are largest posteriorly, and gradually diminish until they are lost at some little distance from the buccal orifice by suddenly turning inwards, appearing to pierce the groove and enter the buccal cavity; they are light yellow; the one on the right side is placed just above the seminal groove, the other on the left in a symmetrical position; the strands under the microscope appear to be glandular, without a leading vein or artery; they have the aspect of minute, wiry, dendroid filaments. These organs I should have taken for the salivary glands if M. Cuvier had not stated the presence of others of a strap-shaped form in another place, and as he has given nearly a similar form to the salivary glands of the *Aplysia*, *Helix aspersa* and other hermaphrodites, I must defer to such authority. I will return to this point. I have now described all that can be seen without dissection.

The vertical fissure of the mouth is faced by the anterior part of the tongue, which consists of two hemispherical portions, each furnished with fifteen obliquely arcuated yellow, wiry, horny strands, set with short transverse hooks bending posteriorly. This denticular apparatus does not extend through the large, oval, pale red fleshy buccal mass, and is not supported by distinct corneous plates, but by a tough coriaceous membrane. From the posterior end of the buccal mass the œsophagus proceeds straight to the gizzard; it is long, flat, broad and dilatable, accompanied by the two straps described by M. Cuvier as the salivary glands, which are fixed to each side of the anterior and upper part of the gizzard, and run on each side the œsophagus to the posterior end of the buccal mass, to which also on each side they are attached, apparently only to the external surface, and do not appear to pierce it. Under the microscope they have little appearance of being glandular or tubular, but have the aspect of loose muscular straps; they however spring from two small yellow spongy or granular bodies, situate on the upper part of the gizzard; these I presume are the salivary glands; if so, the straps are the excretory ducts. They lie on each side the œsophagus in the most lax manner: I should have called them œsophageal, gizzard and buccal mass retractors, as they are connected with all these organs, if M. Cuvier had not determined them to be salivary glands; but he is in error in stating, "L'hydatis les a très longues, inégales, et celle du côté gauche fourchue par son extrémité postérieure." We have in our cabinet perfect preparations of these organs, and can positively state that they are of the same length, entirely symmetrical, with both ends fixed to the gizzard and posterior part of the buccal mass; they do not float loose of different lengths and forms, as are represented in pl. 2. fig. 14. of M. Cuvier's memoir. Having dissected numerous specimens we are quite sure on this point. Though we admit the straps to be the salivary glands, *sub fide Cuvieri,* still we are much astonished that that great naturalist has not noticed the very visible dendroid leaflets on each side the mouth; we must consider them an additional pair of salivary glands: some mollusca have an upper and lower pair, and these would appear to be more adapted for such purpose than the slender strap-shaped filaments. I can only account for their not being noticed, on the supposition that the glandular leaves in M. Cuvier's specimens must have been so discoloured by the spirit as to have escaped attention. One word more on them: as they are situated exactly at that part of the groove which corresponds with the position of the œsophageal ganglions, it is possible that as these nervous masses are of larger volume than I ever saw in any other gasteropod, the glandular leaflets may excrete a liquor to invigorate and minister to the nervous influences: this is a mere conjecture: I would certainly incline to think them salivary glands.

Having mentioned the nervous system, it may be as well at once to notice it, as M. Cuvier scarcely alludes to it. From the point where the œsophagus commences at the posterior part of the buccal mass, it has on each side of it two distinct orange or lemon-colour large oval ganglions, each pair being connected by very strong threads, and the under part of the cordon is formed by two minute round orange ganglions—strange to say, fixed on the posterior part of the buccal mass, and connected by threads with the upper ganglions; these, when *in situ,* form a complete cordon of six medullary masses; from this circle exceedingly strong nervous filaments radiate to the head, the verge, and all the anterior parts of the body. The ganglionic cordon is connected with two large stomachal lemon-colour ganglions, which are apparent when the gizzard is removed; they are not quite of the same size, the one being lobed or double, the other is on the left side; these are removed from the œsophageal collar the length of the œsophagus and gizzard, which is very considerable, but all the masses are connected by nervous threads which bear being moved and examined by a stylet. The larger ganglion on the right supplies the gizzard, testicle, anus, branchiæ, the common cavity of generation, and also sends a thread to the liver; the smaller one on the left side throws off a filament to the gizzard, and furnishes the heart, liver, bladder, the ovarium and oviduct with the necessary threads. The gizzard is a strong, tubular, fleshy, cylindrical mass, inclosing three triangular ridged black plates, which grind the aliment down to a pulp; I could detect none in it nor in the intestine in a solid state. I should not omit to say that the gizzard is the stomach, and completely fills the cavity in which it is lodged; the intestine is of very large diameter, arising immediately from the posterior end of the gizzard; it does not form a duodenum of any particularity of shape, but by a crossing or two completes the circumvolution of the liver, being visible everywhere, of nearly the same size, and terminates posteriorly by a short rectum on the right side.

The liver occupies nearly the posterior half of the spire; it is of an intensely dark brown colour, minutely granular, pulpy, without much coherence: at its posterior end is the rather scanty white ramose ovarium, which, when the liver is well washed out, is easily observed; and from it the yellow white wrinkled oviduct, also most visible, springs from the ovary as a slender thread, but as it proceeds it increases rapidly in volume, and then as suddenly diminishes, terminating in the matrix by a fine thread. The matrix and its vestibule is a strong, yellow, tough, tubular subcylindrical organ, with a transverse constriction denoting the anterior chamber; it is, I think, erroneously marked *k*, and called the testis in M. Cuvier's pl. 2. fig. 14. of the memoir. The mistake has arisen from the latter organ lying close, but somewhat posterior to it, and is very different, being of much softer, flatter, more even and elongated form; its colour is pale drab. I think the flat, oval, yellow gland near the bladder and heart, which Cuvier states to be of unknown use, is an appendent to the testis; as I thought, through the transparent membrane, I could trace the excretory duct to the posterior part of that organ.

The bladder is as large as a small pea, of a pale red purplish mixed colour; it is nearly globular, and lies on the left side, full of a light pinkish liquid, not acrid but oily, with red brown specks in it; I have seen similar ones in the ova; its excretory duct crosses from the left side and certainly enters the matrix; it is doubtless a lubricating or an enveloping fluid for the ova; I think it has the latter function; it is never flaccid, but always distended: where is the source of the large mass of fluid? Its external coat appears a network of minute vessels, and I presume they are the ducts which distil the secretion from the larger veins. The "organe générateur" when not exserted lies doubled up in the œsophageal cavity; it is of trifid form, that is, finger, spindle, and club-shape, which latter portion extends to and lies on the gizzard; there is no internal connection between it and the testis. Of this I am sure, as in consequence of the shape and position of the parts, that fact admits of being accurately ascertained. It may therefore be considered as almost certain, that the long, slender, open groove, which by the muscular contraction of the sides can be closed so as to form a canal, extending from the orifice of the verge to the entrance of the common cavity, must be regarded as a continuation of the vas deferens of the testis, which passing under the matrix, or through it—which of the positions is doubtful—unites with the open canal that terminates at, but does not pass into that organ, and thus the vivifying influences are enabled to make the necessary contact. M. Cuvier's figure of the branchial plume presents a vertical and partly horizontal face. Having examined many specimens, it appears to me to be a single regular crescent-shape plume of eighteen or twenty short coarse strands, having the artery in the centre, lying in a crypt transversely between the vulva and the anus, floating free, except where under the mantle it is fixed to its roof and to the back of the animal; the heart is oval, white, and with the auricle placed as usual in a pericardium, at the base of the branchiæ. With regard to the veins and arteries I have not attempted to trace them; the circulation is of course complete; but if, as in *Aplysia*, there are any particularities attached to it, I do not think that they will easily be detected in so small an animal. There is nothing particular in the muscular system; it exhibits the usual masses of transverse and longitudinal fibres, which throw off from the internal surfaces the necessary muscular filaments. The *Bulla hydatis* may be considered as the type of the general aspect of the anatomy of the family of the *Bullidæ*.

The slight rectifications I have ventured to suggest, even if established, in no way detract from the general accuracy of the great anatomist I have alluded to; if I am right in my suggestions, it is entirely due to having at my disposal numerous living specimens; but M. Cuvier, I infer from his memoirs, had often only one or two indifferent specimens from spirit. His merits and labours exhibit a noble example of what may be accomplished by assiduous application, combined with a mighty genius; he is the pilot and Columbus of modern malacology, and even his successors have little more merit than as "imitatores;" for what we know he has taught us, and those who have gone beyond him in the useful drudgery of detail, must not forget that M. Cuvier, like Newton and Columbus, pointed out the path, and taught them the principia.

Bulla cylindracea, auctorum.

Cylichna cylindracea, Lovèn.

Animal cylindrical, elongated, convolute; mantle not thick, rarely produced beyond the front and lateral margins of the shell; it is edged with a series of minute red papillæ; the linear posterior accessorial lobe of the foot lies within it, and resting on the columella gives the mantle the appearance of being thickened; the surface of the shell in live and perfect specimens is covered with an olivaceous or orange-brown epidermis.

It is now necessary to make an extract from M. Lovèn's generic diagnosis: "Oculi sub eorum basi immersi; solea brevissima, ovato-quadrata; pallium limbo incrassato aperturam postice claudens." If our views of the mantle and foot are correct, it would appear that the linear posterior lobe of the foot has been mistaken for a component part of the mantle, giving that organ the crassitude mentioned by M. Lovèn. There are no eyes in this species. M. Cuvier ascribes to the genus *Bulla* four tentacula: what are called the superior pair, are, as we think, the posterior lateral flaps of the head-disc, being the floating margins of the solution of continuity of the disc from the neck; the inferior pair are the mere roundings of its anterior part, aided by a narrow circumferential groove and a central indentation, that give the aspect of ears; but neither pair have the similitude or functions of the tentacula of the Pectinibranchiata. The flaps occasioned by the deep sinus, at the *under* part of the foot, are quite as produced as the superior pair of M. Cuvier, and may as well be called tentacula; it is surely a misnomer to call these appendages by that term in any of the *Bullidæ*; their only use seems to be that of fins or paddles to assist in locomotion, either by creeping or swimming. The head-disc is usually white or pale yellow, of subquadrangular shape; it rests on and covers the foot, which is of similar form, and the central sinuations of the two coalesce. The foot, as in the type, extends from beyond the shell in front to its posterior extremity. At half its length from the front the continuity is interrupted by a deep hiatus, but at a lower level the linear or accessorial lobe progresses to the termination of the shell, lying in the narrow aperture. This structure has given rise to M. Lovèn's term "solea brevissima:" he has only described the anterior or active part of the foot, or one-half of it, overlooking the posterior linear portion; its apparent separation certainly puts on the appearance of a short distinct subangular foot, sinuated in front. These remarks, I think, explain, if I am not in error, M. Lovèn's mistake relative to the foot and tumidity of the mantle. The division of the foot by the deep groove is doubtless, as in *B. hydatis*, to increase flexibility, and its under marginal flaps, with the upper ones of the head, miscalled tentacula, are probably to assist both pedal and natatory locomotion. The progression of the present animal is very slow, though otherwise it is sufficiently lively, often turning from one side to the other. The sole of the foot is pale yellow or white, and is often well reflexed on itself at the sides, and sometimes up to the upper disc. The mouth is between the lobes, the fissure is vertical, and furnished with a buccal mass supported by corneous plates and a short spinous tongue. The stomach, as in the typical species, contains a gizzard composed of three minute, elongated, very black, rather pointed plates, flat within, convex without, and all of similar form. The branchial apparatus is a plume of short coarse strands lying in a crypt across the neck. The anus appears to terminate posteriorly, as that portion of the shell is always encrusted with sand, mucus, and fæcal matters. The general aspect of the animal varies from pure white to pale orange-yellow, with occasionally a tinge of green. It inhabits the coralline and laminarian zones.

This animal has the same leaflets at the sides of the buccal disc, mentioned in *B. hydatis*, with the groove that is the continuation of the vas deferens, and such of the other organs that could be observed in so minute a species scarcely differ from the type.

M. Lovèn mentions eyes imbedded in the skin; no appliances enabled us to detect them in this species; but whether they are there or obsolete, that circumstance is only specific: *ex. gr.* in *Natica monilifera* the eyes are obsolete, but in *N. Alderi* they are easily seen; the presence or absence of these organs is therefore not of generic value. All the other points being absolutely similar to the type, we are bound to consider the genus *Cylichna* as not applicable to *B. cylindracea.* We have a preparation to show that the linear posterior lobe of the foot lies in the narrow aperture of the shell, agreeably to the invariable characters of the *Bullæ*.

Bulla truncata, Montagu et auctorum.

Cylichna truncata, Lovèn.

Animal subcylindrical, convolute, flake-white; mantle hyaline, quite plain, extending occasionally beyond the margins of the shell. The head lobe is large, compressed, very slightly auricled, sinuated in the centre, and edged with a light lead-coloured line, which may be the reflexion through the hyaline tissue of the leaflets within the anterior part of the sinus between the lobes, mentioned as conspicuous in *B. hýdatis,* and presumed to be seen in the last species.

The mouth is between the head lobe and that of the foot. The animal carries the head rather beyond the foot on which it lies, so that it may be mistaken for that organ. The posterior division of the head-disc from the neck, with the deep central sinuations, give rise to what I call the flaps or fins, which in this animal are more extensive than in *B. cylindracea,* and have the shape of short, flat, triangular pointed fillets, lying like the ears of a hare close to each side of the neck; but when the animal in marching, after having fixed the foot, draws up the shell to meet the extension, its edges catch and raise them to an erect posture.

The eyes, though not large, are distinct and fixed in those species in which they are not obsolete, as in *B. hydatis,* and I believe in all other *Bullæ,* at the anterior internal bases of the so-called tentacular processes; they are not raised, but immersed in the surface of the skin: though they and the flaps or fins are in rather an advanced position, they are only seen when the animal is on the march, from its habitude at other times of keeping these organs under the shell; but in those of thin texture they may be seen through it. The foot, as in *B. cylindracea,* is one entire lobe, divided as in the type at the under part from its posterior linear accessory, which also lies within the mantle in the narrow aperture of the shell, by a deep solution of continuity. In this minute creature it is difficult to observe the connection and origin of the accessorial lobe with its principal; the deep groove or rather hiatus between the two portions of the foot causes the anterior division to assume the appearance, as M. Lovèn terms it, of "solea brevissima;" the mistake is very natural; the free floating margins resulting from its apparent division from the posterior lobe, give the appearance of a complete foot. The anterior part of the foot is rather shorter than the head-lobe, ovately subquadrangular and rounded at the front and posterior extremities, sinuated at the centre, grooved around the margin, and not at all auricled. I have at the present date observed thirteen of these animals for four or five days in sea-water, but I never saw any reflexion of the mantle; but the foot at times is considerably reflected laterally on itself and anterior part of the shell, and in quietude assumes the quadrilobated character of the tribe. The march of this animal is much more lively than in *B. cylindracea.* The mantle forms an anal sinus at the posterior part of the canal of the shell; there is a deep groove between the head and foot-discs. The branchial plume is deposited in a cavity across the neck. The buccal mass is a light fleshy palate, and may be seen through the head-lobe; the mouth leads by a long linear œsophagus to the stomach, situated in the last convolute cavity of the shell, in which is fixed a gizzard of three very small, dark brown, similar-formed, minutely dotted, oval, coriaceous plates, which can be seen in action through the transparency of the basal volution.

It appears that the only difference between this animal and that of *B. cylindracea* is, that in this the disc-flaps are more developed, and the eyes are distinctly visible; I therefore consider all the general remarks on the last species, not mentioned to prevent repetition, as applicable to *B. truncata*, which I think is appropriately deposited in the genus *Bulla*. The *Bullidæ*, like the *Helicidæ*, are hermaphrodites with mutual congression, and are oviparous.

Bullæa, Lamarck et auctorum.

Philine, Ascanius et Lovèn.

The type of this section of the *Bullidæ* is the *Bullæa aperta* of authors. This ancient species is so familiar with every malacologist, that to describe the external organs would be useless; the internal structure essentially agrees with that of *B. hydatis*, and is described and illustrated by M. Cuvier.

As to the minor *Bullææ* of the Exmouth coast, the rare *B. pruinosa* is our own discovery, and with the *B. catena* of Montagu and *B. punctata* of Adams were described by us many years ago in the 'Zoological Journal,' vol. iii. p. 339. To reproduce them would be an improper occupation of the valuable pages of the 'Annals' with old matter, and having no additional notes we only refer to our former descriptions, but we shall be glad to review them.

In conclusion, I observe, that a re-examination and comparison of all the minute species of both tribes of this family with each other, and with those that have not as yet been seen, may require new genera; but as the case now stands, I think that *Bulla* and *Bullæa* are sufficient. We all must object to the splitting and torturing mere specific differences to fabricate useless genera.

I am, Gentlemen, your most obedient servant,

WILLIAM CLARK.

XI.—*Notes on Crustacea.* By C. Spence Bate.

[With a Plate.]

Male Organs in the Brachyura.

I. The so-called false feet in the male *Brachyura* differ materially from those of the female, in both of which they serve an efficient purpose, that of assisting towards the development of a future generation.

In the female they form supports on which suspend the ova, until they are matured so far as to exist as independent creatures. But in the male they are more directly concerned in reproduction, being in fact the external sexual organs.

I am aware that the highest authority, M. Milne-Edwards, both in his 'Histoire des Crustacés,' as also in the 'Cyclopædia of Anatomy,' article "Crustacea," has denied this office to these organs, but I have frequently had ocular proof of the fact, having several times last summer taken *Carcinus mænas* in the act of copulation, under which circumstances I distinctly saw these styliform processes deeply inserted within the vulvæ of the female.

Since the above observations, I have given much attention in order to make out the whole anatomy of the part, which I have endeavoured to do by examining *Carcinus mænas, Portunus puber, Cancer pagurus* and *Xantho rivulosa.* They consist of two pair, the larger being anterior and attached to the first abdominal ring; the less or posterior to the second ring. In all except the edible crab, the second pair is very small, apparently rudimentary, and lie with their extremities inserted posteriorly into the larger pair. But in *Cancer pagurus,* though slight, they are equally long with the first pair, and have a joint peculiar to this crab situated near the centre, in addition to one, common to others, attaching it to the basal joint. The orifice of this pair is slightly frilled; it lies posteriorly against the first pair, which are the more important; these latter are styliform processes attached by a hinge to a calcareous continuation of the inferior dermal membrane of the abdomen, from the anterior centre of which extends a process which I presume assists both in the erection of the organ and the extension of the abdomen from the usual position beneath the thorax.

From the first joint of the fifth pair of legs (some having an orifice through the calcareous shell distinctly for its own passage, as *Cancer pagurus,* others opening through the flexible membrane, while in others again a notch exists which more or less approximates a separate opening), a membranous tube, being the vas deferens, passes out and enters at the second joint of the so-called false feet continuing through and terminating at the apex in an oval slit. I can only account for the confident manner of Prof. Milne-Edwards's expression in both places to which reference has already been made, that direct observation has shown that these styliform processes are not used except to direct the true organs towards the vulvæ, or perhaps to excite the female: "Ces appendices paraissent devoir servir à diriger les verges vers les vulves, et peut-être aussi à exciter ces derniers organes" (Histoire des Crustacés, vol. i. p. 169), by presuming that the slight membranous tube must have been ruptured, it being very fragile and delicate in its external passage.

I can only add, that I have preparations from which the accompanying illustrations are taken, in which they are distinctly seen as they may be by any who will but observe the living animal, being careful in turning back the abdomen that the canal be not broken.

Internally the tube unites with the testicle, which is a long white cord inflected repeatedly upon itself, and lies beneath the carapace on either side of the stomach. This is different from the *Paguridæ,* among which they extend into the abdomen.

II. Throughout the *Brachyura* the spermatozoa seem to resemble each other, and the only appreciable difference that I can make out is to be found in the cells in which they are produced, which vary slightly in shape, being generally round or oval in *Cancer pagurus,* more irregular in *Carcinus.*

But in the *Anamoura* (*Pagurus Bernhardus*) the cells differ, being long and narrow with a sharp and slightly turned point at one extremity and narrow and square at the other. But the spermatozoa themselves do not offer any difference from that of the preceding.

On Fertilization in the Female.

III. I have been induced to believe that crabs, like certain kinds of insects, have more than one brood to a single inoculation by the male; the data upon which I have formed this opinion is, that early in this spring (May) I took a female which had but recently set the larva at liberty, the hair-like connection, together with the shell of the ova, still remaining attached to the false feet. Upon afterwards dissecting this creature and examining the internal organs, I found them full of ova in a very early state of development.

Coupling this with what I believe to be a fact, that the male can only impregnate the female immediately after the shedding of the exuviæ, and that this in adult crabs only takes place once in the year, I must conclude that the ova within the gravid uterus could only have been fertilized, not by the immediate influence of the male, but through the agency of spermatozoa left within the cul-de-sac since the last or annual intercourse.

For days previously the male may be seen running about and hiding himself under stones, holding the female by one or more of his legs, the carapace being pressed against the sternum of the male; in this relative position they continue until the female throws off her calcareous clothing, when connexion immediately follows and continues for a day or two, perhaps until the shell again hardens.

IV. It is stated by Couch, in his 'Cornish Fauna,' that when the ova are matured the female detaches them by means of her feet and buries them in the sand, the friction of which frees the larva from the egg. This may be true as far as regards the *Brachyura*, but the manner in which I have observed the larva freed from the ova in *Pagurus Bernhardus*, is by their being passed through the branchial chamber.

During the attachment of the ova to the false feet of the parent, which in the female *Paguridæ* are bifid, but simple in the male, they are continually waved forwards and back in the surrounding medium: this movement supersedes the want of those flabellæform appendages which are attached to the false feet of the female *Brachyura*, and which fulfill, I presume, a similar office towards the ova as the true flabellæ perform for the gills, which is to excite a current over their surfaces.

When the ova are matured they are drawn off from their attachment, most probably by the assistance of the fifth or rudimentary pair of feet (which are very useful to the creature for many purposes), after which they are driven into the branchial chamber by the current which passes in to aërate the blood, while, in its passage through, the larva is freed from the membranous shell of the ova, and set at liberty.

A few which I examined that fell directly to the bottom of the shell which the crab inhabited, without passing through the gill-chamber, were not so freed from the egg, nor could they swim about as the others did.

EXPLANATION OF PLATE VII.

Figs. 1, 2. False feet of male, *Carcinus mænas*, shown anteriorly and posteriorly: A. The external portion of the vas deferens as it is seen passing from the first joint of the fifth pair of legs to the false feet.

Fig. 3. First pair of false feet in *Cancer pagurus*.

Fig. 4. Second pair of ditto ditto.

Fig. 5. Lateral view of first and second pair of ditto, showing their relative position: A. Process to assist in erection.

Fig. 6. Cells containing spermatozoa of *Carcinus mænas*.

Fig. 7. Ditto from *Cancer pagurus*.

Fig. 8. Ditto from *Pagurus Bernhardus*.

Fig. 9. Ditto from *Galathea strigosa*.

XII.—*On the different modes of Aquatic Respiration in Insects.* By M. Léon Dufour*.

Respiration in insects is either *atmospheric* or *aquatic*. But whatever be the mode of this respiration, the air respired is always destined to *circulate* in ramified channels, in *tracheæ,* in a *universal vascular* lung which transmits it to all the viscera, to all the tissues of the organism, with the definitive purpose of aiding nutrition. This is the anatomical feature which is the most remarkable and the most eminently characteristic of insects. This circulation of air has no exception.

The air may be inhaled either by external respiratory orifices, *stigmata,* or by special organs, *branchiæ,* which extract it from the surrounding water.

The numerous class of Insects then shares with the higher animals, the Vertebrata, this twofold mode of respiration, the *atmospheric* and the *aquatic*. This is one of the numerous examples of the harmonies of creation. And as, according to Leibnitz, nature never proceeds *per saltum,* I shall show in an aquatic insect, a mode of respiration intermediate between the atmospheric and the branchial. This is a new fact in science. Here is another of these harmonies. As in the vertebrated animals, so you will find in insects, species so organized as to be able to live both in the air and in water,—in a word, to be *amphibious*.

This is not all; there are insects which pass the first period of their life with a *branchial* respiration, and the second period, or the adult age, with an atmospheric respiration. You have the fellow of these organisms in some Batrachian reptiles.

But nature is far from restricting herself to such uniformity of plan as is sought to be imposed on her. She displays the immensity of her power and her resources in the variety of creatures, as in that of their mode of existence. By no means all aquatic insects have a branchial respiration. This latter form of respiratory apparatus is exclusively peculiar, as I have just intimated, to certain larvæ. *No* insect arrived at *the perfect state,* at that completed state of the organism in which the reproductive act must come into exercise, has a branchial respiration : at least only one example of this is known, that of the *Pteronarcys regalis,* Newp., a Neuropterous insect from North America. *All* the others, whatever be the medium they inhabit, earth or water, and irrespective of the order to which they belong, breathe air by the aid of stigmata; whereas, among the vertebrated animals, fishes are born, grow, and multiply with a branchial respiration.

* From the Comptes Rendus, vol. xix. p. 763.

I shall enumerate, in the following table, the various modes of respiration and respiratory organs of Insects :—

- Respiration.
  - Atmospheric.
  - Aquatic
    - branchial ; branchiæ
      - external
        - lateral
          - abdominal
          - thoracic
          - thoracic-abdominal
        - caudal
        - laminar.
        - setaceous or lamellar.
      - internal.
    - stigmatic.

Chapter I.—*Aquatic Branchial Respiration.*

§ 1. *External Branchiæ.*—The *abdominal* and *lateral* are ordinarily of the number of seven pairs; simple filaments in the *Sialis*; of variable forms in the different species of *Ephemera*; here in rounded laminæ, simple or double, appendiculated or not; there in lamellar tufts, simple or multiplied; otherwise in bunches reverted on the back and distichous; tubulous or simple, or compound in the *Phryganides*, the *Nemouri*, the *Perlidæ*. All these filaments, these laminæ, these lamellæ, are enriched with trachean embroidery which forms *aërigenous* organs.

The *caudal* branchiæ are observed in the larvæ of the Agrions. They are three oblong laminæ, traversed by trachean branches.

§ 2. *Internal Branchiæ.*—They are peculiar to some larvæ of *Libellula*. Those of the *Calopteryx* form a valuable type of transition which had not before been observed. It might be imagined, at first sight, that their three caudal laminæ were branchiæ; they are only fins or oars. The rectum is here the receptacle of the true branchiæ, which consist of three submembranaceous processes inserted at the internal side of that stercoral pouch.

The large nymph-larvæ of the *Libellula* and *Æshna* present the most complicated and most perfect type of rectal branchiæ.

In the long course of my anatomical investigations, I am surprised that, up to the last few years, I had never introduced the scalpel into the entrails of such interesting larvæ, already rendered so distinguished by the researches of Reaumur, Cuvier and Sukow; at having remained so long a stranger to the wonderful texture of their rectal branchiæ, those air-secreting organs. The following is merely an extract of an extensive investigation, which I hope soon to lay before the Academy.

The internal walls of the rectum of our large larvæ are traversed, throughout their length, by six regular and symmetrical columns, converging at the two extremities, each formed of two series of superposed or imbricated laminæ. These laminæ constituting the organ, traced to their intimate or elementary texture, are reduced, definitively, to a network, a subtle canvas of trachean divisions. These latter are attached by successive anastomoses to the branches, ramifications and trunks, which together constitute the general system of the aërial circulation. It is certainly more easy to follow up these connexions, these fine vascular anastomoses, in this minute animal, than in man or in the ox, and for a scalpel and practised eyes there is scarcely a possibility of mistake.

The last term of the organic composition would therefore be, in the branchiæ of the insect, as in those of the fish, a *vascular* woof; giving to this last word only its rigorous etymological or anatomical value. Only, in the fish, it is *blood*, and in the insect, *air* which is contained in the vessels of this woof.

The insect and the fish have consequently branchiæ. M. Duvernoy, in his just physiological appreciation of the respiratory apparatus in these two classes of animals, has called that of insects *pneumatic branchiæ*, a significative epithet, which, expressing the *aëriferous* function, establishes the differential character with the branchiæ of fishes, which are *sanguiniferous*.

Pursuing this parallel of the branchiæ, we see that those of fishes are placed on the sides of the head, and the water submitted to their action penetrates the mouth; it is a *hyobranchial* apparatus, according to the expression of M. Duvernoy. In our larvæ, the rectum is the receptacle of the branchiæ, and the water is received by the anus; the apparatus is thus *rectobranchial.*

I shall conclude this notice by an anatomical fact the more interesting, as it offers the most perfect analogy with what is observed in the branchiæ of fishes. After macerating in water, for two days, a larva dissected with a view to trace the mode of connexion of the vessels of the branchial lamina, I perceived that my pincers drew with ease a large shred of a hyaline membrane, which evidently was detached from the internal side of the rectum. I examined scrupulously this membranous shred, and what was my agreeable surprise to observe in it a serial arrangement of plaits representing the free edges of the branchial laminæ with all the details of their texture! I then eagerly directed my lens to the corresponding and denuded portion of the rectum; I found in place the branchial laminæ with all their anatomical attributes, but more distinct than before that exfoliation or decortication. I repeated this experiment, and obtained the same results. In fishes, the laminæ and the ridges of the branchiæ are similarly covered with a membrane furnished by the buccal mucus, as has been especially shown by MM. Duvernoy and Rosenthal.

Let us devote a few lines to the comparative physiology of this beautiful apparatus.

As above stated, these larvæ with rectal branchiæ imbibe and eject the ambient water by the anus. There is, therefore, alternate ingress and egress of the liquid, as there is ingress and egress of the air in atmospheric respiration; but in this double movement there is not that regularity, that isochronism, which is observed in the respiration of large animals. The water must remain in the rectum in order to bathe the branchiæ, for the accomplishment of the secretion of the vital air. The inspiration and expiration are effected by the mechanism of an external apparatus, the different pieces of which open and shut at the will of the animal. It is this mechanism that Reaumur called "*un jeu de piston.*"

I have just said that the branchiæ are clothed or lined by the mucus of the rectum; it is this mucus therefore which, alone, in direct and immediate contact with the water, effects, by its vital properties, by an exquisite elective sensibility of its organic chemistry, the separation of the respirable air; this it is which filters it, transmits it, and delivers it to the vascular woof of the branchial laminæ. Hundreds of these latter incessantly pay their aërial tribute to the great trachean channels which, like so many arteries, circulate, to the extreme limits of the organism, this vital air which imparts the assimilating faculty to the nutritive fluid, everywhere diffused or infiltrated.

Let us see whether, in the large animals with hyobranchial apparatus, nature does not adopt, with a few modifications, easily explained, the same process. What takes place in the respiratory act of fishes? Have they not also branchial laminæ, covered with the buccal mucus, which abstract from water the respirable air? Does not the oxygen taken from the ambient liquid serve to give the assimilating condition to the nutritive fluid? Up to this point do we not see, in the fish as in the insect, the same series, the same succession of functional acts, the same physiological object? In what then consists the difference? Evidently in the existence of a sanguineous vascular circulation in the fish, and in the absence of this same circulation in the insect. And since nature had substituted a circulation undoubtedly of air for a circulation of blood, must she not, in consequence of her equal solicitude for the maintenance of life in two organisms so distinct, know how to reconcile the means and the end? The nutritive fluid not being able to go and seek the air, the air comes to seek it in order to combine with it.

Chapter II.—*Stigmatic Aquatic Respiration.*

I have just described various modes of branchial respiration always occurring in exclusively aquatic larvæ. I proceed now to describe a *perfect* insect which has the privilege of a completely aquatic respiration, exercised not by branchiæ but by stigmata.

I know as yet only one small Coleopterous insect, scarcely a line in length, which has presented this last mode of respiration in a most undoubted manner: it belongs to the numerous family of the Curculionidæ,—it is the *Phytobius hydrophilus,* which I have lately described as a new species. The larva, the nymph in its cocoon, and the perfect insect, all three live, in the midst of the waters, parasitic on the deeply merged stems of the *Myriophyllum spicatum.* It is an aquatic species in the strict sense of the word.

The discovery of such a *habitat,* for a Curculio, was so new and extraordinary a fact as greatly to stimulate my curiosity. In order to observe at leisure its manœuvres, its peculiar habits, and especially its original mode of respiration, I placed a good number of individuals of this *Phytobius* in a large glass, in which I tried to imitate all the conditions of its native abode, and for more than a month I kept them within sight upon my desk. I had to take all imaginable precautions to obtain satisfactory evidence of this unusual fact. Long and patient attention convinced me that this insect remains constantly submersed, even during the night.

I watched all its movements in order to ascertain whether it came to the surface of the liquid to inhale air, like the *Hydrophili, Dytici, Corisæ, Nepæ,* &c., without success, although its colour, a whitish gray, singularly favoured my investigations. I assured myself also that it had not the faculty of enveloping itself with a layer of air, like several insects inhabiting the water and without natatory organs. It so happened that in this glass vessel containing my *Phytobii* there were also some minute *Dytici,* which I frequently observed to exsert the end of their abdomen in order to provide themselves with air, and a *Parnus Dumerilii* which presented the curious spectacle of its brilliant aquatic aërostat, its diving-bell.

I contemplated my Curculio during its long periods of immobility: my attentive eye followed it in its slow ambulations; I saw it at times scratching with its mandibles, browsing upon the *Myriophyllum*; but it did not attempt to come to the surface. I surprised it one day, having lost the hold of its floating support, swimming at some depth by the mere agitation of its feet, like the dog, or rather like the horse. It did not seem distrest at what I at first thought was an accident. I afterwards saw it—

and this spectacle was frequently repeated—quit its position for a more desirable branch, or to take a little swimming exercise which much astonished me, and the object of which I did not at first comprehend.

In this very lively exercise, which lasted for several minutes, it did not try to approach the surface or to get out of its prison. Its swimming seemed rather taking pleasure, and nothing led me to presume that it was struggling with the fear of drowning. It was evident that this active locomotion was directed at its will. It rose higher or lower, it made the round of the glass vessel, it passed through the tufts of the plant, without attaching itself to them. This exercise seemed an instinctive want. This wholly aquatic life, the acts of which I witnessed with so much interest, continued with signs of perfect health and well-being. The insect was in its destined element.

There is a singular fact, which I at first considered unimportant, but which repeated observation has led me to connect with the same functional object as the natatory exercise of which I have just spoken. In its grave attitude of immobility, the *Phytobius* from time to time agitated, almost convulsively, most frequently its intermediate feet, and sometimes also the others. This vibratile movement resembled St. Vitus's dance. With an excellent lens I examined the body of the insect, in the hope of finding something analogous to a respiratory act; but I did not perceive the least atom of air.

The fact of this normally immerged existence seemed to me therefore well established. It at once calls to mind the charming history which Audouin has described of the little Carabus, *Trechus* (*Bremus*) *fulvescens*, which, when immersed in its retreat during the whole of the high tide, nevertheless preserves its life; and also that more recently detailed in an excellent spirit of observation, by M. Laboulbène, relative to the mode of respiration of his *Æpus Robinii*, under the same conditions as the *Trechus* (*Bremus*) of Audouin.

But the case of our *Phytobius* is otherwise surprising and wholly exceptional. It has not, like the *Trechus, Parnus, Heterocerus*, &c., the resource of an impermeable down, a velvety tunic which might collect and entangle a layer of air around the body, for the service of the stigmata. Its tegumentary envelope does not present any down under the strongest magnifier. However, I hasten to say that the case of its body is clothed with a sort of close, perfectly impermeable, scaly covering, but which does not retain the air at its surface.

I asked myself sometimes if the *Phytobius* had not received the faculty of suspending its respiration, of holding its breath for a time, the duration of which we cannot calculate. My mind remained long in doubt upon this point. Ascribing this to the minuteness of the insect, and the imperfection of my optical instruments, I sought for a rational solution, a physiological explanation in the interpretation of an aquatic life, watched with all care. I think I have succeeded in this; I will state it in a few words. In those active natatory evolutions, as also in those brisk movements of the feet, when the insect is stationary, the air combined in the water is doubtless disengaged from it by this rapid beating; and its invisible elements, constantly directed toward the body by these centripetal impulsions, serve for a stigmatic respiration.

It is my intention to pursue the study of this phænomenon on some other insects, which, without branchiæ, without down, without fins, without oars, live nevertheless in the bosom of the waters.

XIII.—*Descriptions of* Aphides. By Francis Walker, F.L.S.

[Continued from p. 48.]

96. *Aphis Berberidis,* Kaltenbach.

Aphis Berberidis, Kalt. Mon. Pflan. 95. 70.

This beautiful insect sometimes abounds on the leaves of the cultivated barberry (*Berberis vulgaris*) from April till November, and also occurs on other species of *Berberis*; sixty or more of them dwell under one leaf, the colour is changeable, and becomes darker and more various in the later periods of the insect's yearly life, and especially in the egg-laying generation.

The viviparous wingless female. This is hatched in the early part of the spring, and is elliptical, rather flat, green, or pale greenish yellow, or dull yellow, but is more often pale or bright yellow; it is rarely spotless, and the green colour which usually adorns it appears first in a faint small spot on each side, where there is often a row of bright green spots various in size and in shape, and sometimes confluent, and forming a broken or an entire line. These marks are most conspicuous during the middle age; they are hardly seen when the insect is very young, and are almost lost in its full growth, and then it is also deprived of the velvet-like skin which distinguished its youth, and becomes more convex, shining and elliptical: the feelers are brown-yellow at the base, and about half the length of the body; sometimes they are white with brown tips: the mouth is pale yellow with a brown or a black tip: the nectaries are yellow or pale yellow, and from one-fourth to one-sixth of the length of the body; their tips are brown: the legs are pale yellow; the feet and the tips of the shanks are brown. In the summer it is sometimes the prey of an *Aphidius,* and then becomes very white and globular.

The viviparous winged female. The pupa differs as usual from the wingless Aphis in structure, but not in colour: the wings are unfolded in the middle of May, and at first they are milk-white, while the body is bright yellow, with buff streaks on the head and on the chest: it is afterwards dull yellow or pale yellow, and whitish on each side: the head and the disc of the chest and that of the breast are brown: the abdomen has sometimes short black bands on its back, and is covered beneath with a white bloom: the feelers are black, yellow at the base, and, more or less, shorter than the body; the fourth joint is more than half the length of the third; the fifth is as long as the fourth; the sixth is a little shorter than the fifth; the seventh is hardly shorter than the sixth; the nectaries are pale yellow, and sometimes spindle-shaped: the wings are colourless, the wing-ribs and the rib-veins are pale yellow; the brands are yellow or pale yellow, or brown; the other veins are brown.

The oviparous wingless female. It lays its eggs on the twigs at the end of October, when the winged females are still bringing forth young ones: it has in addition to the colours of the viviparous wingless female usually four rows of brown or of red spots on the back, and also a few small black spots, or two spots of rather large size, on each side of the abdomen: the feelers are brown with the base yellow, or white with brown tips, and about half the length of the body: the other limbs are yellow: the tip of the mouth, the eyes, the tips of the nectaries, the feet, and the tips of the shanks are brown or black; the hind-shanks are also brown, and are widened; their dark colour and their breadth are characteristic of many oviparous *Aphides,* but are peculiarly distinct in this species: the nectaries are from one-sixth to one-fourth of the length of the body.

The winged male. Appears in October, and then pairs with the oviparous female: it is yellow: the fore-chest except the border is gray: the middle chest, the middle breast, a row of short bands along the back of the abdomen, the tips of the nectaries, the knees, the feet, and the tips of the shanks are black: the eyes are dark red.

97. *Aphis Nasturtii,* Kaltenbach.

Aphis Nasturtii, Kalt. Mon. Pflan. i. 76. 54.

It feeds on *Nasturtium amphibium, N. officinale* and *N. sylvestre* in the summer.

The viviparous wingless female. The body is oval, convex, green, and mottled with yellow: the feelers are brown, pale yellow at the base, and more than two-thirds of the length of the body: the mouth is pale yellow; its tip and the eyes are black: the nectaries are dull green with black tips, and as long as one-sixth of the body: the legs are pale yellow; the knees, the feet, and the tips of the shanks are black.

1st var. The body is yellow, velvet-like, mottled with green: the feelers are yellow with black tips, and much shorter than the body: the nectaries are dull yellow with black tips, and as long as one-eighth of the body.

2nd var. The body is of a delicate green colour; the head is tinged with yellow: the feelers are yellow with brown tips, and rather less than half the length of the body: the mouth and the nectaries are yellow with brown tips, and the latter are as long as one-tenth of the body: the legs are yellow; the knees, the feet, and the tips of the shanks are brown.

The viviparous winged female. While a pupa it resembles the wingless female in colour, but the rudimentary wings are very dark green; it is sometimes yellow with interrupted green stripes on the back: the feelers are white with black tips and longer than the body: the mouth is white; its tip and the eyes are black: the legs also are white with darker feet.

98. *Aphis Humuli*, Schrank.

Aphis Humuli, Schrank, Faun. Boic. ii. 110. 1199; Kalt. Mon. Pflan. i. 36. 24.

A. Pruni Mahaleb, Fonscol. Ann. Soc. Ent. Fr. x.

Humulifex, Amyot, Ann. Soc. Ent. Fr. 2de série, v. 477.

It feeds on *Prunus spinosa*, *P. Mahaleb*, and on *Humulus lupulus*.

The viviparous wingless female. The body is rather long, narrow and flat, in shape between an oval and an ellipse, pale greenish yellow, with a vivid green stripe on the back, and a row of spots of the same colour on each side: the feelers are very pale yellow, darker towards the tips, and rather more than half the length of the body: the eyes are dark red: the mouth is pale yellow with a brown tip: the nectaries are very pale yellow, and rather more than one-fifth of the length of the body: the legs are pale yellow or greenish yellow, and rather long; the tips of the feet are darker.

99. *Aphis Prunina*, n. s.

The viviparous wingless female. The body is nearly elliptical, convex, thick, highly arched, grass-green, smooth, shining: the feelers are setaceous, pale yellow, darker towards their tips, and about one-third of the length of the body; the fourth joint is much shorter than the third, but more than half its length; the fifth is shorter than the fourth; the sixth is a little shorter than the fifth; the seventh is nearly as long as the third: the eyes are dark brown: the mouth is pale green with a brown tip: the nectaries are pale yellow, less than one-twelfth of the length of the body: the legs are pale yellow; the feet and the tips of the shanks are brown. In the middle of May.

1st var. A dark green stripe on the back: feelers pale green, brown towards the tips, and nearly one-fourth of the length of the body: the nectaries are pale green with brown tips, and about one-twentieth of the length of the body: the legs are pale green with brown feet.

2nd var. The body is pale greenish yellow, mottled with green, and having a green stripe on the back: the feelers are greenish white with brown tips, and less than one-third of the length of the body: the eyes are dark red: the mouth and the legs are greenish white, and the former has a brown tip; the feet are black: the nectaries are very pale green with brown tips, and nearly one-sixth of the length of the body.

3rd var. The body is small, oval, convex, plump, dull green: the front is slightly convex, and has no tubercles: the feelers are rather less than half the length of the body; the first and second joints are not angular; the fourth is much shorter than the third; the fifth is shorter than the fourth, and the sixth is shorter than the fifth; the seventh is very slender and longer than the fourth: the nectaries are not more than one-twentieth of the length of the body: the legs are rather short.

The viviparous winged female. The second vein diverges slightly from the first, but is nearly parallel to the third; the forks of the latter are variable in situation, but the second fork is usually rather long; the fourth vein is much curved in the early part of its course, and the angle of the brand whence it springs is very slight.

Length of the body $\frac{1}{2}$–$\frac{2}{3}$ line; of the wings 2 lines.

Common on the sloe in May.

100. *Aphis Prunaria*, n. s.

The viviparous wingless female. The body is oval, very plump and convex, dark brown: the front of the head has three slight tubercles: the feelers are about one-fourth of the length of the body; the first and second joints are not angular; the fourth is much shorter than the third; the fifth is shorter than the fourth, and the sixth than the fifth; the seventh is a little longer than the sixth: the nectaries are slightly tapering and about one-fifth of the length of the body: the tube at the tip of the abdomen is rather long; the legs are short.

On the sloe in May.

101. *Aphis Potentillæ*, n. s.

The viviparous wingless female. The body is pale yellow, slightly convex, nearly elliptical: the front is narrow, each side of it being occupied by an angular protuberance: the feelers are fully as long as the body; the first and the second joints are angular; the fourth is much shorter than the third; the fifth is shorter than the fourth; the sixth is much shorter than the fifth; the seventh is slender and twice the length of the sixth: the nectaries are fully one-fifth of the length of the body, which has no tube at its tip: the legs are moderately long.

Length of the body $\frac{3}{4}$ line.

On *Potentilla anserina* in June.

BIBLIOGRAPHICAL NOTICES.

The Tourist's Flora: a descriptive Catalogue of the Flowering Plants and Ferns of the British Islands, France, Germany, Switzerland, Italy, and the Italian Islands. By JOSEPH WOODS, F.A.S., F.L.S., F.G.S. Reeves, London. 8vo. Pp. lxxxii. 505.

THE appearance of this book has been long expected by us, and we can justly state that it has quite fulfilled all our expectations and well supports the high reputation of its author.

Mr. Woods is known to have spent many years in collecting and arranging the materials for the present work, with a view to which he has, we believe, visited all the more interesting localities mentioned in it. This amount of labour, combined with extensive botanical knowledge, has enabled him to produce a volume such as few if any other botanists were capable of writing.

"The intention of the present work is to enable the lover of botany to determine the names of any wild plants he may meet with, when journeying in the British Islands, France, Germany, Switzerland, and Italy," thus including in one book the plants of a far larger part of Europe than has been done by any preceding author; for Reichenbach's 'Flora Excursoria' omits Britain, France, and the greater part of Italy, but includes Hungary; and we are not acquainted with any other work of similar scope.

"To accomplish this object, I had," says the author, "to keep in view two important particulars,—to make the descriptions clear and distinctive, and at the same time to condense the whole as much as possible, so that the work might be comprised in a single volume, of a bulk not inconvenient for the use of the traveller." In both these objects he seems to have been pretty successful; although we do not always find the "difference at least sufficient to discriminate the plant from all the others contained in this work," to which he refers; yet in most cases it is well pointed out. The system of condensation appears, as far as the author was concerned, to have been carried to its extreme limits, but he has not been well seconded by his printer. We suspect a wish was present, perhaps unknowingly, to the printer and publisher to make a handsome, not a portable volume; for had his views corresponded with those of the author in this respect, the work might have been made much more useful, because smaller. Condensation in the printing has clearly been neglected.

The species are arranged in their natural orders, but the generic characters are removed from them and formed into a Linnæan synopsis of genera. Such a synopsis is highly useful, but we think that the work would have been more convenient if these characters had been placed at the head of each natural order, and the Linnæan synopsis reduced to the smallest possible limits.

The introduction contains some valuable remarks upon terminology, recommending new or restricted uses of words, in many of which we concur, but cannot do so in all cases; for instance, it seems most undesirable to use the term *elliptic* for a figure which is acute at both ends, and not for the mathematical figure so called, for it can only create confusion. If *elliptic* is to be used at all, it must be looked upon as the same as *oval.* We also consider "*triangular*" to be the correct term for a "form nearly triangular, where the stalk is attached to one of the sides," but cannot agree with Mr. Woods in using *deltoid* "where the insertion of the stalk also forms an angle, but where the upper and lower parts of the leaf are very unequal:"—*deltoid* must be held to mean 'like the Greek Δ', and therefore nearly the same as *triangular,* when applied to the outline of a thin leaf. The term *deltoid,* we believe, is chiefly used in the description of thick-leaved plants, and then describes the form of a transverse section of the leaf. The new term *haft,* denominating a "leaf-stalk accompanied by a membranous margin," is excellent, and will doubtless be generally adopted in English books; not so *joining,* used by our author for the *node* of other botanists, *joint* being by him restricted, as it ought to be, to the *internode.* "When of two parts, each measured from its own extremities, the dimensions are *equal,* I have used that term; but it not unfrequently happens, by the position of the parts, that the shorter may extend as far, or farther, than the longer. In that case it is *equalling* or *exceeding.*" This is an excellent distinction.

In noticing such works as the present, it is scarcely possible to do more than make a few remarks similar to the above, for a review is not the place for discussing the distinctness of species or the value of characters: on the former we will only remark, that our author has acknowledged many more species than we had expected; and of the latter, that we generally agree with him in his judgement upon them.

Very few new species are introduced, and the nomenclature is usually that of the works in common use in this and other countries, but the omission of any reference to authorities for the names renders it in some cases difficult to determine to what plants of other writers our author refers. Our attention has been drawn to a new and much-improved arrangement of *Atriplex,* in which the *A. patula* of Smith becomes *A. hastata, A. prostrata* is *A. triangularis,* Mr. Babington's *A. rosea* is changed into *A. Babingtonii,* and the English *A. laciniata* into *A. arenaria,* the latter two names being new ones required by the fact that the true *A. rosea* and *A. laciniata* are different from the plants which British botanists have been accustomed to consider such.

But we must conclude, and in so doing beg most strongly to recommend this work to our readers, who when travelling on the continent will find it invaluable; and if studying plants at home, will obtain from it a clue to much information contained in the floras of other countries which might otherwise escape their notice.

Zoology for Schools. By ROBERT PATTERSON. Simms and M'Intyre. London, 1850.

We are pleased to find that this little work, of the first edition of which we gave a favourable notice in May 1849 (Ser. 2. vol. iii. 396), has so soon reached a second edition, as it may be taken as a proof that its author's object has to some extent been attained: we mean the introduction of the study of Zoology into education. It is believed that a very considerable number of copies of this book has been ordered by the Board of National Education in Ireland for the use of the schools under their superintendence, and there can be no doubt that, if it is really learned by the children who attend these schools, they will have attained an amount of knowledge of much value to them. Mr. Patterson has long made it his object to cause natural history to become a subject of study in schools, and has produced in this work an excellent "first book," and in his 'Zoology for Schools' an equally good "second" one.

In our former notice we remarked, "the book is illustrated with a large number of woodcuts, but either from long wear or from carelessness in working, the present impressions are very inferior." It is highly gratifying to be enabled to say, that a very great improvement has been made, and that the cuts are now probably as good as we have any right to expect them to be in a little book where they are so numerous (246) and the price is so moderate. Far more attention has also been paid to the printing than in that edition.

In the Press.

Mr. P. L. Simmonds, well known as the conductor of the 'Colonial Magazine,' and one of the editors of the 'Farmer's Encyclopædia,' a gentleman of many years' experience in tropical husbandry, has just ready for the press a work on tropical agriculture, detailing the most approved processes for the cultivation and manufacture of all the chief vegetable products of tropical and subtropical regions, forming staples of commerce; as grain crops and roots, &c. yielding farinaceous substances, oleaginous plants, drugs, narcotics, and dye stuffs; spices; plants yielding textile substances available for dress and cordage; fruits and dietetic articles, as tea, coffee, cocoa, &c. Such a work has long been wanted, and embracing so wide a range of subjects, if properly dealt with, must be peculiarly interesting and valuable to planters and agriculturists generally in our colonies and foreign possessions, more especially on the eve of the great Exhibition of these productions in their raw and manufactured state next year.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

Feb. 7, 1850.—"On the development and homologies of the Molar Teeth of the Wart-Hogs (Phacochærus), with illustrations of a System of Notation for the Teeth in the Class Mammalia." By Richard Owen, Esq., F.R.S. &c.

The author commences by a brief statement of the facts and conclusions recorded in a paper by Sir Ev. Home on the dentition of the *Sus Æthiopicus*, in the Philosophical Transactions for 1799, p. 256; and gives the results of an examination of the original specimens described and figured by Home, and of other specimens showing earlier stages of dentition, which lead to the following conclusions as to the number, kinds, and mode of succession of the teeth in the genus *Phacochærus*. The tooth answering to the first milk-molar and first premolar in the upper jaw, and those answering to the first and second milk-molars and corresponding premolars in the lower jaw of the common Hog are not developed. Eight successive phases of development of the grinding teeth of the African Wart-hogs are described and expressed by the following notation:—

Phase.	No. of grinding teeth.		Kinds of teeth.
I.	$\frac{5-5}{4-4}$	viz.	*d* 2, *d* 3, *d* 4, *m* 1, *m* 2. *d* 3, *d* 4, *m* 1, *m* 2.
II.	$\frac{6-6}{5-5}$	viz.	*p* 2, *p* 3, *p* 4, *m* 1, *m* 2, *m* 3. *p* 3, *p* 4, *m* 1, *m* 2, *m* 3.
III.	$\frac{5-5}{4-4}$	viz.	*p* 3, *p* 4, *m* 1, *m* 2, *m* 3. *p* 4, *m* 1, *m* 2, *m* 3.
IV.	$\frac{4-4}{4-4}$	viz.	*p* 4, *m* 1, *m* 2, *m* 3.
V.	$\frac{4-4}{3-3}$	viz.	*p* 3, *p* 4, *m* 2, *m* 3. *p* 4, *m* 2, *m* 3.
VI.	$\frac{3-3}{3-3}$	viz.	*p* 4, *m* 2, *m* 3.
VII.	$\frac{2-2}{2-2}$	viz.	*p* 4, *m* 3.
VIII.	$\frac{1-1}{1-1}$	viz.	*m* 3.

These observations prove that, contrary to the opinion of Home and Cuvier, the Wart-hogs have deciduous teeth, succeeded vertically by premolar teeth; in the *Phacochærus Æliani*, at least, three deciduous teeth are, in some individuals, succeeded by as many premolar teeth; and, as a general rule, two deciduous teeth are displaced vertically by two premolars. The first true molar is remarkable for its unusually early development, which is followed by an unusually early abrasion and expulsion, when its place is obliterated by the second true molar being pushed forwards into contact with the last premolar. This tooth is as remarkable for its longevity, and remains after the wearing away and shedding of the second true molar, when the last true molar advances into contact with the last premolar, and the place of both the previously intervening true molars is obliterated. This unusual order of shedding of the molar teeth has given rise to the idea of the last large and complex true molar of the *Phacochœrus* being the homologue of both the last and penultimate grinders of the common Hog, which the author's observations refute; and he, also, is able to point out, by re-examination of the original specimen figured by Home in the Phil. Trans., the source of the erroneous idea that the common Hog had an additional true molar behind the large one symbolised by *m* 3, in the author's system of dental notation.

The nature and signification of the symbols proposed are explained and illustrated by a series of drawings. One of the fruits of the determination of the homology of a part is the power of giving it a name, and signifying it by a symbol applicable co-extensively with such homology. The limits are shown within which the homologies of individual teeth can be determined: they present the requisite constancy of character in a large proportion of the class Mammalia. Certain members of this class, *e.g.* the order *Bruta* and the *Cetacea vera*, have teeth too numerous and alike in form and mode of development to admit of being determined individually from species to species. Such mammalia have but one set of teeth, and the author proposes to call them 'Monophyodonts.' On the other hand, the orders *Marsupialia*, *Insectivora*, *Rodentia*, *Ruminantia*, *Pachydermata*, *Carnivora*, *Cheiroptera*, *Quadrumana* and *Bimana* have two sets of teeth, and might be called collectively, 'Diphyodonts.' Of the permanent teeth of this division of mammalia, some succeed the deciduous teeth vertically, others come into place behind one another in horizontal succession. The 'incisors' are determined by a character of relative position to the jaws and to each other: so likewise the 'canines.' The remaining teeth are divided into those which are developed in vertical relation to the deciduous molars, and push them out, and those that have not such relation, but follow each other horizontally: the term 'molar' is restricted by the author to these latter teeth, and that of 'premolar' to the former ones, which are always anterior to the molars. There is a remarkable degree of constancy in the number of these different kinds of teeth; in the placental Diphyodonts, *e. g.* the 'incisors' never exceed $\frac{3-3}{3-3}$, *i. e.* 3 on each side of both jaws, the 'canines' $\frac{1-1}{1-1}$, the premolars $\frac{4-4}{4-4}$, the molars $\frac{3-3}{3-3}$, $=44$; and this the author regards as the typical formula of dentition in the great proportion of the mammalian class above defined. It was rarely departed from by the primæval species that have become extinct, and is modified chiefly by defect or loss of certain teeth in the existing species. When the grinders are below the typical number, the missing molars are taken from the back part of their series, and the premolars from the fore part of theirs: the most constant teeth being the fourth premolar and first true molar; these are always determinable, whatever be their form, by the relation to them of the last tooth of the deciduous series. Thus determined, the homologies of the other grinders are ascertained by counting the molars from the first backwards, 1, 2, 3; and the premolars from the last forwards, 4, 3, 2, 1. The symbols are made by adding the initial *m* to the numbers of the molar teeth, and the initial *p* to those of the premolar teeth. The author concludes by pointing out the advantages of this system of anatomical notation.

Feb. 14.—1. "Supplementary Observations on the Structure of the Belemnite and Belemnoteuthis." By Gideon Algernon Mantell, Esq., LL.D., F.R.S., Vice-President of the Geological Society, &c.

In this communication the author describes his recent investigations on the structure of the two genera of fossil Cephalopoda, whose remains occur so abundantly in the Oxford clay of Wiltshire, namely, the Belemnite and Belemnoteuthis, as supplementary to his memoir on the same subject, published in the Phil. Trans. 1848*. In that paper evidence was adduced to show the correctness of the opinion of the late Mr. Channing Pierce as to the generic distinction of these two extinct forms of Cephalopoda.

As however several eminent naturalists had expressed doubts as to some of the opinions advanced by the author in his former memoir, figures and descriptions are given in the present notice, of beautiful and instructive specimens lately discovered in Wiltshire, and which he conceives establish his previous conclusions. Dr. Mantell then states as the result of his examination of several hundred examples, that our knowledge of the organization of the animal of the Belemnite is at present limited to the following parts, viz.—

1. An external *Capsule* or *periostracum* which invested the osselet or sepiostaire, and extending upwards, constituted the external sheath of the receptacle.

2. The *Osselet,* characterized by its fibrous radiated structure, terminating distally in a solid rostrum or guard, having an alveolus, or conical hollow, to receive the apical portion of the chambered phragmocone; and expanding proximally into a thin cup, which became confluent with the capsule, and formed the receptacle for the viscera.

3. The *Phragmocone,* or chambered, siphunculated, internal shell; the apex of which occupied the alveolus of the guard, and the upper part constituted a capacious chamber, from the basilar margin of which proceeded two long, flat, testaceous processes.

These structures comprise all that are at present known of the animal to which the fossil commonly called "*The Belemnite,*" belonged.

Of the *Belemnoteuthis,* the fossil cephalopod which Prof. Owen

* An abstract of which appeared at p. 388 of the first volume of the present series of this Journal.

regards as identical with the Belemnite, many examples of the body with eight uncinated arms, and a pair of long tentacula, having an ink-bag and pallial fins, have been discovered. The osselet of this animal, like that of the Belemnite, has a fibro-radiated structure, investing a conical chambered shell; but this organ, for reasons fully detailed in the memoir, the author considers could never have been contained within the alveolus of a Belemnite; the soft parts of the animal of the Belemnite are therefore wholly unknown.

Many beautiful specimens of Belemnites and Belemnoteuthis were exhibited by Dr. Mantell to the Society, in proof of the statements contained in the memoir.

2. "On the PELOROSAURUS; an undescribed gigantic terrestrial reptile, whose remains are associated with those of the Iguanodon and other Saurians, in the Strata of Tilgate Forest." By Gideon Algernon Mantell, Esq., LL.D., F.R.S., Vice-President of the Geological Society, &c.

The author had for a long while entertained the idea, that among the remains of colossal reptiles obtained from the Wealden strata, there were indications of several genera of terrestrial saurians, besides those established by himself and other geologists. The recent discovery of an enormous arm-bone, or humerus, of an undescribed reptile of the crocodilian type, in a quarry of Tilgate Forest in Sussex, where Dr. Mantell had many years since collected numerous teeth and bones of the Iguanodon, Hylæosaurus, &c., and some remarkable vertebræ not referable to known genera, induced him to embody in the present communication the facts which his late researches have brought to light

The humerus above-mentioned was found imbedded in sandstone, by Mr. Peter Fuller of Lewes, at about 20 feet below the surface; it presents the usual mineralized condition of the fossil bones from the arenaceous strata of the Wealden. It is four and a half feet in length, and the circumference of its distal extremity is 32 inches! It has a medullary cavity 3 inches in diameter, which at once separates it from the Cetiosaurus and other supposed marine saurians, while its form and proportions distinguish it from the humerus of the Iguanodon, Hylæosaurus, and Megalosaurus. It approaches most nearly to the Crocodilians, but possesses characters distinct from any known fossil genus. Its size is stupendous, far surpassing that of the corresponding bone even of the gigantic Iguanodon; and the name of *Pelorosaurus* (from πέλωρ *pelor*, monster) is therefore proposed for the genus, with the specific term *Conybeari*, in honour of the palæontological labours of the Dean of Llandaff.

No bones have been found in such contiguity with this humerus, as to render it certain that they belonged to the same gigantic reptile; but several very large caudal vertebræ of peculiar characters, collected from the same quarry, are probably referable to the Pelorosaurus; these, together with some distal caudals which belong to the same type, are figured and described by the author.

Certain femora and other bones from the oolite of Oxfordshire, in the collection of the Dean of Westminster, at Oxford, are mentioned as possessing characters more allied to those of the Pelorosaurus, or to some unknown terrestrial saurian, than to the Cetiosaurus, with which they have been confounded.

As to the magnitude of the animal to which the humerus belonged, Dr. Mantell, while disclaiming the idea of arriving at any certain conclusions from a single bone, states that in a Gavial 18 feet long, the humerus is 1 foot in length; *i. e.* one-eighteenth part of the length of the animal, from the end of the muzzle to the tip of the tail. According to these admeasurements the Pelorosaurus would be 81 feet long, and its body 20 feet in circumference. But if we assume the length and number of the vertebræ as the scale, we should have a reptile of relatively abbreviated proportions; even in this case, however, the original creature would far surpass in magnitude the most colossal of reptilian forms.

In conclusion, Dr. Mantell comments on the probable physical conditions of the countries inhabited by the terrestrial reptiles of the secondary ages of geology. These highly-organized colossal land saurians appear to have occupied the same position in those ancient faunas as the large mammalia in those of modern times. The trees and plants whose remains are associated with the fossil bones, manifest, by their close affinity to living species, that the islands or continents on which they grew possessed as pure an atmosphere, as high a temperature, and as unclouded skies as those of our tropical climes. There are therefore no legitimate grounds for the hypothesis in which some physiologists have indulged, that during the "*Age of Reptiles*" the earth was in the state of a half-finished planet, and its atmosphere too heavy, from an excess of carbon, for the respiration of warm-blooded animals. Such an opinion can only have originated from a partial view of all the phenomena which these problems embrace, for there is as great a discrepancy between the existing faunas of different regions, as in the extinct groups of animals and plants which geological researches have revealed.

The memoir was illustrated by numerous drawings, and the gigantic humerus of the Pelorosaurus and other bones were placed before the Society.

Feb. 28.—"On the Communications between the Tympanum and Palate in the Crocodilian Reptiles." By Richard Owen, Esq., F.R.S. &c.

After citing the descriptions by Cuvier, Kaup, Bronn, and De Blainville of the Eustachian tubes and the foramina in the base of the cranium of the recent and extinct Crocodiles, the author gives an account of the nerves, arteries, veins and air-tubes that traverse these different foramina, and thus determines the true position of the carotid foramina and posterior nostrils in the *Teleosauri* and other fossil *Crocodilia*, which had been a matter of controversy amongst the authors cited. In the course of these researches the author discovered a distinct system of Eustachian canals superadded to the ordinary lateral Eustachian tubes, which he describes as follows:—

"From each tympanic cavity two passages are continued downwards, one expands and unites with its fellow from the opposite side to form a median canal which passes from the basisphenoid to the suture between that and the basioccipital, where it terminates in the median canal continued to the orifice described by M. De Blainville as the posterior nostril. The second passage leads from the floor of the tympanic cavity to a short canal which bends towards its fellow, expands into a sinus and divides: one branch descends and terminates in the small lateral foramen at the lower end of the suture between the basioccipital and the basisphenoid: the other branch continues the course inwards and downwards until it meets its fellow at the median line of the basioccipital, and it forms the posterior primary division of the common median canal: this soon joins the anterior division, and the common canal terminates at the median opening below. Membranous tubes are continued from the three osseous ones, and converge to terminate finally in the single Eustachian orifice on the soft palate behind the posterior nostril. The mucous membrane of the palate lines the various osseous canals above described, and is continued by them into the lining membrane of the tympanum."

With regard to the homologies of the above described air-passages, the author states that the lateral canals answer to the simple Eustachian tubes of Lizards and Mammals, and that the median canal, with its dichotomous divisions, is a speciality peculiar to the Crocodilian reptiles.

The memoir was illustrated by nine drawings of the size of nature.

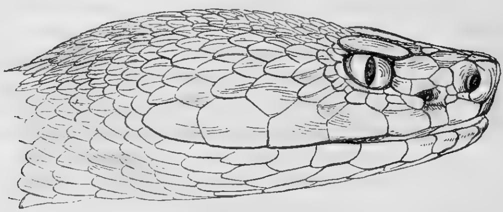
ZOOLOGICAL SOCIETY.

July 24, 1849.—John Edward Gray, Esq., F.R.S., in the Chair.

The following papers were read:—

1. Notes on the Serpents of St. Lucia. By Lieut. Tyler, R.E. Communicated by the Secretary.

Of the snakes of the island of St. Lucia, the most numerous species is the "*Rat-tail*;" then follow the "*Couresse*," the "*Clibro*," and the "*Tête Chien*;" and in this order I propose to give you, as I promised, a short description of each.



1. Craspedocephalus atrox, Gray. The Rat-tail Serpent.

This much-dreaded serpent, which attains a length of from five to six, and sometimes even seven feet, and a circumference of from four to five inches, bears a strong resemblance, as to its shape and nature, to the common Rattle-snake of America, and is the more dangerous from its being unprovided with the means of warning its victims.

The Rat-tail appears to be ovoviviparous; and it is said that after producing her young she leaves them for a short time, and that she devours those among them which she finds in the same spot on her return. This seems to be a most improbable construction to place upon the fact of their being sometimes found in the belly of the mother, which to my idea rather tends to corroborate statements which have been already made of the female's opening her mouth in cases of danger, and the young rushing down her throat for protection. The scales of the Rat-tail are large in proportion, and carinated; the number of abdominal scuta is 213, and there are 69 pairs of subcaudal squamæ. The head is heart-shaped, very large at the back, and flat, and is covered with small scales; the eye resembles in some measure that of the cat, though, as in all the serpent-tribe, it is without outer lids, and therefore apparently always on the watch, which appearance is kept up even after death. The shape of this serpent differs from that of the others hereafter mentioned, in being more broad, or lying more flatly on the ground; and the tail, instead of tapering gently from the body, becomes suddenly small, and, as the name implies, is much like that of a rat. When not in motion, the Rat-tail is almost invariably coiled up in a circle, with its head on the top. Its movements are fortunately not so rapid as those of the other serpents of the island, and to this circumstance may be attributed the advantage always gained over it by its deadly enemy the Clibro, which will be presently referred to. The Rat-tail is armed with two fangs, or hollow teeth, placed one at each side of the extremity of the upper jaw, frequently seven-eighths of an inch in length, with a small slit at the point and towards the front, through which the poisonous liquid, a yellow viscid matter, is ejected; and it has two rows of teeth down the centre of the mouth for purposes of deglutition.

An important point in the history of this serpent is the method of treating its venomous bites. If the wounds caused by these be not at once attended to, the most fatal consequences ensue, and within a short space of time. Should the fang penetrate any large blood-vessel, and inject therein any of the poisonous matter, I suppose that no remedy would be of avail: but under ordinary circumstances, if the wound can be at once laid open, a ligature tied between it and the heart, and sucked, then rubbed with a mixture of lime-juice, rum and salt, and intoxication and sleep produced by administering rum-punch with plenty of lime-juice in it to the patient, there is little danger of loss of life; as is proved by the fact, that out of thirty soldiers treated in this way some time since in this island, only one died.

The person sucking the wound has nothing to fear if he has no sore in his mouth.

There are native "*panseurs*" who pretend to the knowledge of certain herbs, which they mix with rum, gunpowder, salt and lime-juice, and place upon the wound in the shape of a poultice, after well-cutting, sucking and squeezing it, and concoctions of which they cause the unfortunate patient to drink; but they appear to produce no decided relief to the patient, and although perhaps very good as poultices to any inflammatory wounds, I do not imagine that these herbs possess any antidotal properties to the venom of the serpent. It is calculated that at the least twenty persons die annually in St. Lucia from the bites of these serpents; and, as I have often heard it stated that in nineteen cases out of twenty the patient recovers, it may be inferred that 180 people per annum are maimed or dangerously wounded by them.

2. ——— ? ——— ? The Couresse.

The Couresse is a beautifully-formed little snake, perfectly harmless, from two and a half to three feet in length, and seldom attaining more than $2\frac{1}{8}$ inches in circumference, with 96 abdominal scuta and 86 rows of subcaudal squamæ.

Its small head, bright attractive eye, quick and elegant motion, and its tapering body and tail, present a remarkable contrast to the corresponding characteristic of the last-mentioned Rat-tail serpent.

The colour of the Couresse varies much; they are generally found of a dark blue colour, with white and grey variegations of every possible shape; sometimes however yellowish brown prevails, but spotted in a similar manner; the belly is white, slightly tinged with blue, and at the point of junction of the abdominal and other scales is always found a dark spot.

Four rows of small teeth are to be found in the upper jaw and two rows in the lower. The head is covered by large scales.

The Couresse cannot exist long without water, and will even drink milk. When kept in a box with a vessel of water for their use, they are more frequently found in the water than out of it, this being their only protection against their deadly enemies the ants.

This snake is oviparous: the longest diameter of the eggs is five lines, the shortest three lines. It feeds upon lizards, crapauds, mice, and other small animals and reptiles.

3. Coluber constrictor? The Clibro.

The Clibro is found in this island as long as five and six feet, and as large as from three and a half to four inches in circumference. It is perhaps one of the most remarkable and useful of its species: it has 236 abdominal scuta and 72 rows of subcaudal squamæ, is of a bluish colour with a white belly, and after its change of skin shines like marble. The head is small, covered with large scales, and the eye dark blue and opake. There are four rows of small teeth in the upper jaw and two in the lower. The longest diameter of the egg is eighteen lines, the shortest nine.

One peculiarity of the Clibro is its apparently total disregard of man.

But its great singularity consists in its choice of food. It lives principally upon other serpents, and of those chiefly the Rat-tail, which it has not the power of killing until after it has swallowed it, whose bite, so fatal to the human species and all other animals (in some cases killing even horses), has no effect upon the Clibro; for I have myself seen distinctly on more than one occasion, in their combats, the fang of the Rat-tail enter into the body or head of the Clibro, and bring blood from the spot, while the Clibro has taken no more notice of it than to get the head of the Rat-tail into his mouth as quickly as possible and begin to swallow him. I have satisfactorily proved that the Clibro does not kill his prey before he has swallowed it, by allowing a Clibro to swallow a Couresse, all excepting the very point of his tail, then pulling him out, after a short interval giving it to him again, pulling out the Couresse by the tip of his tail as before, and keeping him alive for months afterwards.

The common belief is that the Clibro, when bitten by the Rat-tail, rubs himself in a grass which is commonly found in uncultivated land; but this I have at all events shown to be an unnecessary proceeding on the part of the Clibro.

It may not be uninteresting to describe here a fight which I witnessed some months since between a large Clibro and Rat-tail, the latter being nearly half as thick again as the former, but not so long; they were each however upwards of four feet in length.

Upon being placed together in a barrel, the Clibro immediately seized the Rat-tail by the middle, and twisted three times round him, in doing which the Rat-tail bit him in the back, and drew blood; they both then remained perfectly quiet for a few seconds, when the Clibro moved his head slowly up behind his own body, and looking over it, advanced under its cover, to the point which lay nearest to the head of the Rat-tail, which was between four and five inches distant; waiting about a couple of seconds in this position—the Rat-tail never having moved all this time—the Clibro made a dart, and with almost incredible rapidity seized the head of the Rat-tail in his mouth, and began to swallow him, which he accomplished in rather more than three hours.

But the Clibro does not confine itself to snakes of other species, for on one occasion I lost a large Clibro by its being eaten by another. The two had lived for weeks together in the same drawer, and there was no great difference between them in size: having offered them food a few days previously, they refused it, and on my next visit I found only one in the drawer. Not being able to discover the means of egress of the missing Clibro, I then began to remark that the one in the drawer was thicker than usual, and after taking him out and disturbing him a little, he vomited up his late friend in a half-digested state, but enough of him was left to enable me to recognise his scales.

4. Boa diviniloqua, Dum. et Bibr. The Boa.

The St. Lucian Boa, which is called by the natives "*Tête Chien*," from the resemblance of its head to that of a greyhound, is found in great numbers in cane-pieces, where it is highly valued as a means of destroying rats, but so feared that few natives can be induced to touch or even approach very near to it.

This fear is however perfectly unnecessary, as although it constantly leaves its teeth in the object of its attack, no result more than from the scratch of a thorn ensues.

The general length of the Boa of this island is from eight to ten feet, and it is rarely found longer than fourteen feet. It feeds upon rats, birds, cats, rabbits, fowls, and all small animals. Its head is covered with small scales, unlike the generality of harmless serpents. The scales over the body are small and smooth, and beautiful tints may be observed in them when exposed to a strong light or in the sun. The abdominal scuta are 280 in number, and the subcaudal squamæ consist of 70 rows. I believe the Boa to be viviparous, from some young having been cut out of the womb of a dead female.

The Boa has the property of being able to live for a great length of time without food, water, and almost without air. I have witnessed cases of their existing in drawers and boxes unopened for months, and I have been told upon good authority of a case of a Boa looking as well and as fat after thirteen months of this species of confinement as before it.

I am unable to fix any regular period for the changes of skin to which all serpents are liable, and which appears greatly to depend upon the state of their stomachs.

2. Characters of three new Genera and Species of Lepidoptera. By William Wing, M.E.S.

Fam. Noctuidæ.

1. Caligatus, n. g.

Palpi short, ascending; densely clothed with scales; penultimate joint long: *antennæ* bipectinated at the base, and bearded ♂: *head* small, rounded, nearly concealed: *thorax* with a large, acute crest in front: *abdomen* long, furnished with two anal tufts, ♂: *anterior wings* acute at tip, broad, dentate, slightly deflexed; *posterior wings* abbreviated. Type,

Caligatus Angasii, n. sp.

Sp. Ch.—Body and base of the anterior wings of a bright fawn-colour, with a triangular diaphanous patch at the costa, another of an oval form between the costa and posterior margin, and a nearly square patch in the centre of the outer margin. General colour of the apical half of the wing pink, varied with yellow and fawn-colour; posterior wings diaphanous, with a broad ashy brown margin marked with a triangular yellow spot, and a lunular pink spot at the inner angle; cilia of all the wings white. In the male the metatarsi and tibiæ are densely clothed with long hair-like scales, making them appear very broad and flat. I have named this species after Mr. Angas, who has recently explored the highly interesting country of which this is a native, the Cape of Good Hope. In the collection of the British Museum.

2. Trichomaplata, n. g.

Palpi short, ascending; penultimate joint somewhat wedge-shaped *antennæ* long, bipectinated at the base: *thorax* with a very small crest in front; scapular plates furnished with long pencils of hairs: *body* long, tufted at the extremity, ♂: *anterior wings* deflexed, lanceolate, entire. Type,

TRICHOMAPLATA VITTATA.

Sp. Ch.—Head and thorax ashy grey; abdomen ferruginous; anterior wings pinkish white, with a deep ferruginous mark on the anterior margin near the costa, and a strong ferruginous vitta extending from the shoulder to the posterior angle of the outer margin; posterior wings subdiaphanous, with the inner margin fulvous.

Hab. Brazil. In the collection of the British Museum.

Fam. HYPONOMEUTIDÆ.

3. PALPARIA, n. g.

Palpi large; penultimate joint with a large triangular patch of scales extending horizontally; terminal joint recurved: *thorax* broad, slightly depressed: *anterior wings* oval, apex acute; *posterior wings* broad, ciliated; apex acutely oval: *posterior tibiæ* large and broad. Type,

PALPARIA LAMBERTELLA.

Sp. Ch.—Thorax and anterior wings of a rose-pink colour, with two longitudinal yellow lines extending from the shoulder to the apex and posterior angle of the outer edge respectively; posterior wings yellow, shading into orange towards the apex; abdomen yellow. Larva depressed, 16-footed, whitish green, slightly hairy, solitary.

In the collection of the British Museum.

This species was reared by Mr. Lambert in Australia.

November 13.—William Yarrell, Esq., in the Chair.

The following papers were read:—

1. DESCRIPTION OF A NEW SPECIES OF TUPAIA DISCOVERED IN CONTINENTAL INDIA BY WALTER ELLIOT, ESQ. BY G. R. WATERHOUSE, PRES. ENT. SOC. ETC.

Of the species of Tupaia about to be described, three specimens were forwarded to me by W. Elliot, Esq., who, in a letter which accompanied them, states that they were procured from the hills between Cuddapah and Nellox, in what may be termed the Eastern Ghats.

Mr. Elliot, it appears, had abstained from describing and naming this animal from his not having the means of instituting a comparison between it and the known species of the genus. From the comparison which I have made, I am quite satisfied that it is distinct from the three species found in the Indian islands, as well as from the animal described by M. Isidore Geoffroy in Bélanger's 'Voyage aux Indes-Orientales*,' which latter was discovered by M. Bélanger at Pegu in the southern part of Birmah. I propose to name the new species after its discoverer, whose researches in Indian zoology merit high praise.

TUPAIA ELLIOTI.

The Tupaia of the Eastern Ghats is about equal in size to the *T. Tana*, but differs in the comparatively pale colouring of its fur, in having the tail less bushy, and in the smaller size of its teeth. Its head is shorter

* P. 105, pl. 4.

than is the head of the animal last mentioned, and consequently considerably shorter than that of the *T. ferruginea,* or of the Tupaia of Pegu, the head of which is said to be 2″ 2‴ in length, in which respect it agrees very closely with the *T. ferruginea.* The fur is rather less soft than in *T. Tana,* and its general hue on the upper parts of the body is palish rufous brown, very indistinctly freckled with dusky. On the hinder parts of the back the darker penciling is almost entirely wanting, and hence the tint is more uniform; whilst over the shoulders, and especially on the crown of the head, the black or dusky penciling is very evident. The sides and under parts of the body are of a rich yellow tint: on the abdomen the hairs are of an uniform colour—almost of a golden yellow; but on the sides of the body is a moderately distinct penciling of dusky. The chin, throat and chest are of a paler hue than the abdomen, and in parts they are nearly white. The orbits are of the same pale tint, and there is a shoulder-mark (as in other species of the genus) which is nearly white. The feet are clothed above with yellow hairs, and are entirely naked beneath, where they appear to have been flesh-coloured in the living animal. The tail is depressed. The hairs on this organ are of a rich rufous brown tint; but each hair has a narrow dusky ring, if we except those which cover the mesial part of the under surface, which are shorter than the rest, and which are of an uniform ochre-yellow. The specimen from which this description is drawn up is a male, and evidently adult, having all the true molars well-developed, as well as the hindermost of the false molars, which is the last tooth to show itself in these animals. Its dimensions are as follows:—

	in.	lin.
From tip of nose to root of tail, about	7	9
Length of tail, including the hair, about	9	0
———, not including the hair	7	6
From nose to ear	1	8*
Height of ear	0	4
Width of ditto	0	9
Length of fore-foot and nails	0	11
——— of nail of middle toe of ditto	0	2
——— of hind-foot and nails	1	8
——— of nail of middle toe of ditto	0	2

With regard to the remaining two specimens sent by Mr. Elliot, one is a young animal, being about half-grown, and the other is an adult female, which differs from the adult male in being of an uniform, and very pale, rufous tint on the upper parts of the body, and of a pale yellow on the under parts. The throat, cheeks and shoulder-mark are yellow-white. I suspect it is an accidental variety. It appears to have but four mammæ, two of which are situated on the lower part of the abdomen, and the remaining two near the insertion of the fore-legs.

The skull of *Tupaia Ellioti* is smaller, considerably shorter, and has a broader muzzle than that of *T. ferruginea,* whilst on the other

* In *T. ferruginea* the length from nose to ear is full two inches.

hand it is longer and larger than that of *T. Javanica*, which is remarkable for the shortness of the facial portion. These differences approximate the skull under consideration to that of *T. Tana*; there are, however, ample differences between the skulls of *T. Ellioti* and *T. Tana*. The skull of the former of these two animals is rather smaller than that of *T. Tana*, has the muzzle relatively shorter, the nasal bones shorter, and broader behind; the zygomatic arch deeper, and the perforation in the malar bone much smaller (less than half the size). In the structure of the teeth, moreover, there are some differences worthy of note. The incisors and premolars in *T. Ellioti* are relatively smaller than in *T. Tana*; but a more important distinction—and one which distinguishes the new *Tupaia* from the other three species noticed—consists in the form of the third premolar: it here resembles the last, or fourth premolar in all respects, excepting in being of smaller size; having like that tooth a distinct inner lobe: this lobe in the other species of *Tupaia* is represented only by a minute and indistinct tubercle. The corresponding lobe in the last premolar in *T. Ellioti* is larger than usual, and so is the posterior inner lobe of the true molars. Subjoined are the principal dimensions of the skulls of the four* species of *Tupaia*.

	T. Tana.		*T. Tana.*		*T. ferruginea.*		*T. ferruginea.*		*T. Ellioti.*		*T. Javanica.*	
	in.	lin.	in.	lin.	in.	lin.	in.	lin.	in.	lin.	in.	lin.
Total length of skull	2	4	......†		2	$0\frac{1}{2}$	2	$0\frac{3}{4}$	......†		1	$4\frac{3}{4}$
Length of ditto to the posterior margin of the auditory bulla	2	$0\frac{1}{2}$	2	1	1	9	1	10	1	$7\frac{1}{4}$	1	$2\frac{1}{2}$
Width of ditto, measuring from the outer surface of the zygoma	1	$0\frac{2}{3}$	......		1	$0\frac{1}{4}$	1	$0\frac{1}{2}$	0	$10\frac{1}{2}$	0	$9\frac{3}{4}$
Width of ditto between orbits	0	$7\frac{1}{4}$	0	7	0	$6\frac{3}{4}$	0	7	0	$6\frac{2}{3}$	0	$6\frac{1}{2}$
Length of palate	1	$3\frac{1}{4}$	1	$3\frac{1}{4}$	1	$0\frac{1}{2}$	1	$1\frac{1}{3}$	0	11	0	$8\frac{1}{2}$
——— of nasal bones	0	$11\frac{1}{2}$	0	11	0	$8\frac{1}{3}$	0	9	0	7	0	$4\frac{2}{3}$
Width of ditto in front	0	$1\frac{3}{4}$	0	$1\frac{2}{3}$	0	$1\frac{3}{4}$	0	$1\frac{5}{6}$	0	$1\frac{1}{2}$	0	$1\frac{1}{3}$
——— of ditto behind	0	$2\frac{1}{2}$	0	$2\frac{2}{3}$	0	$2\frac{1}{3}$	0	$2\frac{1}{2}$	0	$3\frac{1}{4}$	0	$1\frac{1}{3}$
Length from anterior part of first premolar to hinder margin of last true molar	0	$9\frac{1}{2}$	0	$9\frac{2}{3}$	0	9	0	9	0	$7\frac{1}{2}$	0	6
Length of lower jaw	1	$6\frac{2}{3}$	1	7	1	$5\frac{1}{3}$	......		1	3	0	10
Height of ditto, measured from apex of coronoid process	0	$6\frac{1}{2}$	0	$6\frac{1}{4}$	0	$6\frac{3}{4}$	......		0	$6\frac{1}{6}$	0	$5\frac{1}{4}$

2. On new species of Mammalia and Birds from Australia. By J. Gould, F.R.S., F.Z.S. etc.

The collection recently sent home by Capt. Owen Stanley and Mr. MacGillivray, the able naturalist of H.M.S. 'Rattlesnake,' now exploring the coasts of Northern and Eastern Australia, is a very fine one; it has been procured on what may be considered hitherto untrodden ground, I cannot therefore do better than give a list of the

* I do not include the "*Tupai de Pégou*," because it is not yet determined that that animal is a distinct species from the Tupaias of the Indian Islands.

† The occipital portion of the cranium is wanting in the specimen.

whole,—such lists, showing the geographical distribution of species, being in the highest degree valuable. I have said that the collection is a very fine one, and I must not omit observing that much credit is due to Capt. Stanley for affording the naturalist the requisite opportunities for obtaining so many interesting species; nor is a lesser meed of praise due to Mr. MacGillivray, for the very excellent manner in which the specimens are prepared, and the accuracy with which all the information connected with them that could be obtained has been noted down. The collection of Quadrupeds and Birds only has been placed in my hands for examination, with a view to my publishing such novelties as it may contain in my works on these subjects; after which the specimens are to be sent to the British Museum. The period that has elapsed since the arrival of the collection has been far too short to admit of my investigating the subject as I could wish; I shall therefore, on the present occasion, exhibit some of the species that appear to me to be new, and defer my remarks upon the entire collection to the next or some future meeting of the Society.

I shall now proceed to describe two species of mammalia and two species of birds from this collection, as follows:—

PTEROPUS CONSPICILLATUS, Gould.

Sp.Ch.—Crown of the head black, slightly grizzled with buff; round each eye a large oval patch of deep brownish buff, which advances on the sides of the face and shows very conspicuously; at the nape a broad crescent-shaped band of deep sandy buff, which extends down the sides of the neck and nearly meets on the breast; centre of the back glossy black, slightly grizzled with grey; cheeks, chin, all the under surface and rump, black, slightly grizzled with buff; ears and wing-membranes naked and of a deep purplish black; claws black.

Hab. Fitzroy Island.

This species is about the size of *Pteropus poliocephalus*, but has a somewhat larger head and much larger and more powerful teeth, and is moreover rendered conspicuously different from that species by the nuchal band being of a deep sandy buff instead of deep rust-red, and not continuous round the neck; by the crown of the head and back being almost jet-black; and the eyes being conspicuously encircled with deep buff (whence the specific name); in which latter character it assimilates to *P. funereus*, but scarcely to any other. Respecting this species Mr. Macgillivray writes: "Is this not new to Australia? It is not *funereus*, of which see skull No. 7 and skin No. 8, nor is it *poliocephalus*. Of its habits I extract the following note from my journal: 'On the wooded slope of a hill on Fitzroy Island I one day fell in with this bat in prodigious numbers, looking while flying along the bright sunshine (so unusual for a nocturnal animal) like a large flock of rooks: on close approach a strong musky odour became apparent, and a loud incessant chattering was heard; many of the branches were bending under their load of bats, some in a state of inactivity suspended by their hind claws, others scrambling along among the boughs and taking to wing when disturbed. In a very short time I procured as many specimens as I wished, three and four at a shot, for they hung in clusters, but unless killed outright they remained suspended for some time: when wounded they are handled with difficulty, as they bite severely, and on such occasions their cry reminds one of the squalling of a child.' "

Phalangista (Pseudocheirus) nudicaudata, Gould.

Sp. Ch.—Head, all the upper surface, the sides of the body, and the outer sides of the limbs, brownish grey; the tips of the hairs with a silky appearance; under surface of the neck and body and the inner sides of the limbs pale buff; the colouring of the upper and under surface distinctly defined on the sides of the body, but gradually blending on the limbs, the rump and root of the tail, which is thickly clothed on its basal third and naked for the remainder of its length; hands, feet, and naked portion of the tail pinky flesh-colour.

	inches.
Length from tip of nose to root of tail	12
——— of tail	8
——— of fore-feet, including the nails	3
——— of hind-feet, including the nails	$3\frac{1}{2}$

Hab. Cape York, the most northern point of Australia.

This species differs from all the other Australian members of the genus, in having the apical three-fourths of its tail entirely destitute of hair; in the light-coloured mark on the rump, somewhat resembling that on the same part of the Koala; and in its short dense fur and short ears.

The above description and admeasurements are taken from a female said to be about two-thirds grown. The ears are exceedingly short and rounded, and the fur is remarkable for its extreme density and for its resemblance to that of the Koala.

Ptiloris Victoriæ, Gould.

Sp. Ch.—Male: general plumage rich deep velvety black, glossed on the upper surface, sides of the neck, chin and breast with plum-colour; feathers of the head and throat small, scale-like, and of a shining, metallic bronzy green; feathers of the abdomen very much developed, of the same hue as the upper surface, but each feather so broadly margined with rich deep olive-green, that the colouring of the basal portion of the feather is hidden, and the olive-green forms a broad abdominal band, which is sharply defined above, but irregular below; two centre tail-feathers rich shining metallic green, the remainder deep black; bill and feet black.

Female: all the upper surface greyish brown, tinged with olive; head and sides of the neck dark brown, striated with greyish brown; over each eye a superciliary stripe of buff; wing-feathers edged with ferruginous; chin and throat pale buff; remainder of the under surface, under wing-coverts, and the base of the inner webs of the quills rich deep reddish buff, each feather with an irregular spot of brown near the tip, dilated on the flanks into the form of irregular bars; bill and feet black.

Total length, $10\frac{1}{2}$ inches; bill, $1\frac{3}{4}$; wing, 5; tail, $3\frac{1}{4}$; tarsi, $1\frac{1}{4}$.

Hab. Barnard's Isles.

Remark.—This new species must be placed in the first rank of the many beautiful birds inhabiting Australia; indeed there are few from any part of the world that can vie with it in the richness of its colouring; and I cannot possibly have a better opportunity than now presents itself of paying a just tribute of respect to our most gracious Queen, by bestowing upon this lovely denizen of the Australian forests the specific appellation of *Victoriæ*;—I say of the Australian forests, for although the specimen from which my description is taken is from the Barnard Isles, within the Barrier Reef and only a few miles from the north-eastern shore of Australia, I have evidence, in the notes of the late Mr. Gilbert, that it inhabits the mainland, since he states therein that the Rifle-bird inhabits the northern as well as the southern part of Australia; in which he was in error; the bird he saw in the northern part of the country being doubtless the one here described.

It is very nearly allied to the *Ptiloris paradiseus*, but is a smaller bird, with a still more gorgeous colouring. It may be distinguished from that species by the purple of the breast presenting the appearance of a broad pectoral band, bounded above by the scale-like feathers of the throat, and below by the abdominal band of deep oil-green, and also by the broad and lengthened flank-feathers, which show very conspicuously.

Sphecotheres flaviventris, Gould.

Sp. Ch.—Male: crown of the head and cheeks glossy black; orbits, and a narrow space leading to the nostrils naked, and of a light buffy yellow, or flesh-colour; all the upper surface, wing-coverts, outer webs of the secondaries, and a patch on either side of the chest, olive-green; chin, chest, abdomen and flanks beautiful yellow; vent and under tail-coverts white; primaries and inner webs of secondaries black, edged with grey; tail black, the external web and the apical half of the internal web of the outer feather on each side white; the apical half of the second feather on each side white; the next, or third, on each side with a large spot of white at the tip; bill black; feet flesh-colour.

Female: striated on the head with brown and whitish; all the upper surface olive-brown; all the wing-feathers narrowly edged with greenish grey; under surface white, with a conspicuous stripe of brown down the centre of each feather; vent and under tail-coverts white, without striæ.

Total length, $10\frac{1}{2}$ inches; bill, $1\frac{1}{8}$; wing, $5\frac{3}{4}$; tail, $4\frac{1}{4}$; tarsi, $\frac{7}{8}$.

Hab. Cape York.

Remark.—Of the same size as *Sphecotheres Australis*, but may be distinguished from that and every other species of the genus by the beautiful jonquil-yellow of its under surface.

3. Descriptions of three new species of Indian Birds. By J. Gould, F.R.S. etc. etc.

1. Ruticilla grandis, Gould.

Sp. Ch.—Crown of the head and the basal portion of the primaries and secondaries white; forehead, cheeks, chin, throat, back, wing-coverts, and the apical portion of the primaries and secondaries black; abdomen, lower part of the back, upper and under tail-coverts and tail rich rufous; bill and feet black.

Total length, 7 inches; bill, $\frac{3}{4}$; wing, $4\frac{1}{8}$; tail, $3\frac{1}{4}$; tarsi, $1\frac{1}{8}$.

Hab. Afganhistaun and Thibet.

Remark.—This, the largest and one of the best-marked species of the genus, is nearly allied to the *aurorea* of Pallas.

2. Yunx indica, Gould.

Sp. Ch.—Upper surface pale brown, finely freckled with grey, and blotched, particularly down the back of the neck, on the centre of the back, and on the wing-coverts, with brownish black; primaries brown, crossed on their outer webs with regular bands of deep buff, and toothed on their inner webs with the same hue; remainder of the wing-feathers like the upper surface, but crossed by broad, irregular bands of brown; tail like the upper surface, but crossed by narrow, irregular bands of brownish black; sides of the throat and neck crossed by numerous narrow bars of blackish brown, the cheeks the same, but somewhat paler; on the centre of the throat a spatulate mark of chestnut-red; centre of the abdomen and under tail-coverts pale buffy white, with a fine stripe of brownish black down the centre of each feather; flanks crossed by irregular bars of brownish black; bill pale horn-colour, deeper at the tip; legs apparently yellowish flesh-colour.

Total length, $7\frac{3}{4}$ inches; bill, $\frac{7}{8}$; wing, $3\frac{5}{8}$; tail, $3\frac{1}{4}$; tarsi, $\frac{7}{8}$.

Hab. Afganhistaun and Thibet.

Remark.—Nearly allied to the *Y. pectoralis* of Southern Africa, but differs from that species in being of a larger size, in the lighter hue of the centre of the abdomen, in the striæ down the centres of the abdominal feathers being less strongly defined, and in the under tail-coverts being buff instead of rufous.

3. Sitta leucopsis, Gould.

Sp. Ch.—Crown of the head and back of neck jet-black; all the upper surface deep blue-grey; primaries black, edged with grey; centre tail-feathers blue-grey; lateral feathers black, tipped with blue-grey; the two outer ones on each side with a small spot of white on the inner web near the tip; face, chin, throat, breast, and centre of the abdomen white, the latter slightly washed with buff; flanks and under tail-coverts bright chestnut; bill black, with a blue-grey base; legs grey.

Total length, 5 inches; bill, $\frac{7}{8}$; wing, $3\frac{1}{8}$; tail, 2; tarsi, $\frac{3}{4}$.

Hab. The Himalaya Mountains.

Remark.—This is doubtless the species described by Mr. Blyth in his observations on the Sittinæ as nearly allied to the *S. cæsia*, without however assigning to it a specific name, an omission which I have now ventured to supply.

BOTANICAL SOCIETY OF EDINBURGH.

June 13, 1850.—Professor Fleming, President, in the Chair.

A new Part of the Society's Transactions was laid on the table, and will shortly be ready for distribution to Subscribers.

Dr. Balfour announced that the Commissioners of Woods and Forests had agreed to form a Botanical Museum in the Garden, and he called upon all who were interested in the cause to contribute liberally, for the public benefit, specimens of woods, fruits, and vegetable products, articles of vegetable manufacture, fossil plants, drawings, &c.

Mr. Priestley read a paper on some British Carices, in which he described *C. montana, C. intermedia* and its varieties, *C. Œderi, C. Bœnninghausiana,* and *C. Persoonii.*

The following papers were read:—

1. In abstract, a paper by Dr. Hoffmann, Professor-Extraordinary of Botany in the University of Giessen, on the roots of Umbelliferous plants, in which he describes the roots of *Daucus Carota,* both in the wild and cultivated state, alluding to their structure and composition in different stages of growth.

2. Mr. M'Nab, "On the effects of Lightning on Trees." He remarked:—"A few days ago I accidentally heard of a tree which had been struck by lightning on the 5th inst. (June 1850) at Pitferrane, Fifeshire, and being anxious to ascertain the species, I wrote for a small branch, with any history which could be given regarding it. I have just received the leaves shown, which prove it to be the *Ulmus montana.* My object in bringing the notice before the Society, is to ascertain from its members any varieties of trees known to them as having been struck by the electric fluid. About this time last year a very large oak on the grounds of John Wauchope, Esq. of Edmonston, was shattered to pieces; and a few years previously a laburnum standing close to the oak was likewise destroyed. While on a tour over a portion of the American continent some years ago, I had several opportunities of observing gigantic trees torn to pieces by electric influence. In every instance observed they were oaks. During a thunder-storm I found the workmen (chiefly in Canada) resorting to the beech-trees for protection, from an idea that they were not liable to be struck by lightning; certain it is that I saw none, notwithstanding the prevalence of large-sized beeches in many districts. The elm above alluded to at Pitferrane had an iron fence standing close to it, which was supposed by the inhabitants to have had some influence in attracting the fluid. The above observations are thrown out, in the hope of ascertaining if there be anything in the composition of one species of tree rendering it less liable than another to electric influence."

Mr. Brand stated that he knew a marked instance of a beech in Aberdeenshire having been struck by lightning. The horse-chestnut and ash were likewise mentioned by other members as having been struck.

Dr. Balfour made some remarks on *Cleghornia,* a new genus of Apocynaceæ, named by Dr. Wight, in honour of Dr. Hugh Cleghorn.

Mr. Evans directed attention to a curious instance of the effects of the graft upon the stock, which had occurred in a tree at Morningside House, the residence of Mr. J. Deuchar. The tree in question is *Pyrus Aria*, grafted upon *P. aucuparia* as a stock. Its entire height is 18 feet, and the stock forms a clean trunk to the height of 4 feet, where the union of the graft and stock is conspicuously shown. At 13 inches from the base of the trunk there are shoots of *P. aucuparia*, and at the height of $1\frac{1}{2}$ foot, *branches of P. Aria appear* (being $2\frac{1}{2}$ feet *below* the point of junction), while farther up the trunk a branch has been accidentally taken off, which is believed to have been *P. aucuparia*.

Mr. M'Nab exhibited a peculiar creeping form of *Sarothamnus Scoparius* (common broom), which had been sent from Alderney; but he could give no farther information respecting it, as the specimen was not accompanied by a letter.

MISCELLANEOUS.

THE VELVET-LIKE PERIOSTRACA OF TRIGONA.

Dr. Fleming, at a late meeting of the Royal Physical Society, made some remarks on the velvet-like periostraca of *Trigona ventricosa* of Gray. He mentioned that "he had brought this subject under the notice of the Society, in the first place to correct an erroneous statement which Mr. Gray, of the British Museum, had made on his authority in the 'Annals and Magazine of Natural History,' No. 22, for October 1849, and in the second place to combat views which Mr. Gray had advocated as to the origin of the so-called velvet-like periostraca. It was stated that an imperfect experiment by burning had indicated the siliceous nature of the crust, and that the conclusion thus drawn was mentioned to Mr. Gray. Subsequent experiments however had demonstrated it to be *carbonate of lime*. Dr. Fleming then adverted to the composition, structure, and position of the mass, as indicating a substance wholly unconnected with the inhabitant of the shell, organically, but exhibiting the characters of an imperfectly developed *sponge* of the genus *Grantia*. He exhibited examples of two different species with similar traces of *Grantia*, and concluded by producing three specimens of the common *Pecten opercularis* with a band of sponge around the margin, similar in position to that on the *Trigona*, but composed of *siliceous* spicula, and belonging to the genus *Halichondria*. The fringe of a *Zoophyte* growing on the ligamental or siphon margin of the shell of the *Trigona*, referable to the genus *Laomedia*, was pointed out as supporting the opinion that the velvet-like coat of calcareous spicula was likewise unconnected with the secretions of molluscan life."

Note.—The correction respecting the nature of the *spicula* is important, but I cannot agree with the Professor as to their origin. I might be more easily convinced if I saw a perfect specimen of a species of *Trigona* without the velvet-like coat, or with the coat assuming a branched or foliaceous sponge-like form.—J. E. Gray.

MONSTROUS FLOWERS OF PELARGONIUMS.

The following extract from a paper read by Mr. Sowerby at the Conversazione Meeting of the Royal Botanic Society in the Regent's Park, describes an interesting case of monstrosity. After pointing out the distinguishing characters of the genera *Geranium* and *Pelargonium*, Mr. Sowerby proceeded to say, "The gardener, as in this case, when he finds nothing but external beauty to recommend a plant, endeavours, by selecting the most perfect and then cultivating it highly, to increase in the succeeding produce both the beauty of colour and of form; and as the beauty of form depends upon the same elements as that of colour, that is, as before explained, upon the indication of perfect adaptation to the end, or the resemblance of that indication, so a full round form is especially aimed at by the cultivator of flowers, and the Pelargonium-fancier endeavours to obtain five broad and equal petals, to form a round flower, with the upper two deeply and brilliantly coloured to produce a contrast to the three lower and light-coloured ones; but with all his care the flowers do not come constant, and now and then one will play the truant and sport as he calls it, and this commonly happens amongst the most petted or highest cultivated varieties. When the dark colour disappears from the upper petals altogether, and the petals become equal in size and form, it will be observed that the characteristic tubular nectary also disappears. The want of the nectary or honey-tube is also accompanied by a regular arrangement of five anther-bearing and five abortive filaments. The white varieties are less liable to this change than those with rose- or salmon-coloured petals, and it is also rare among the new fancy varieties; frequently it occurs in the central flower of the truss. In some flowers the nectary is only shortened, and in others a small spot will remain on one petal when the nectary is absent. In the fancy variety called *Yetmannianum grandiflorum*, which has spots on all the petals, the spots become equal, the two large spots being reduced. An additional petal also accompanies the change in a few cases. One plant of the Beauty of Clapham, a rose-coloured variety, has almost every flower changed more or less. Thus it appears that cultivation not only makes one species of plant appear to run into another, but may destroy a remarkable generic character, consisting of the presence of an important organ in the flower, &c. Thus the gardener seems by over-cultivation to reduce his flower to a lower standard, but I do not think this is exactly the case; for although he may apparently reduce a Cape Pelargonium to an European Geranium in the eye of a botanist, or partly so, still he would have a more truly beautiful flower if he could obtain a full truss of large rose-coloured or pink flowers: we would recommend a trial of the seed from these sporting flowers."

THE TRANSFORMATION OF MOLLUSCA.

It has been supposed that *Sars* was the first naturalist who had observed that the young of the Gasteropodous Mollusca, when they were first hatched, were of a very different form from their parents.

Forskäl, in his description of Animals of the East, published in 1775, in describing *Helix Ianthina*, p. 127, observes :—"Ianthina in vasculo aqua marina pleno, viva servata; altero mane mortua, e labiis proboscidis extrusit membrum globosum apice umbilicatum, hyalinum, venis longitudinalibus, violaceis. In fundo vitri parvæ arenulæ videbantur puniceæ; quæ microscopio inspectæ, cochleæ erant, matrem testa simulantes, non colore; corpore quoque dispari; nam *ad aperturam duo vela transversa, subrotunda, pilis tremulis ciliata*; quibus pulli hi remigabant: quique sine dubio soboles erant majoris conchæ; quum aqua aliis hospitibus non mixta fuerat. Quid? quod, in multis aliis vitris postea viderim Ianthinas demittere tales conchulas, matrem circumnatantes. Matricem in proboscide esse putaverim, quum alia non apparuerunt ejus vestigia." In tab. 40. f. *c* 6, these young *Ianthinæ* with the two fins are well figured. His editor gives no explanation of the figure, hence probably it has been overlooked. —J. E. Gray.

Notice of the occurrence of Eleocharis uniglumis, *Link, near Blackness Castle, Linlithgowshire.* By John T. Syme, Esq.*

Among the plants recorded as British since the publication of the Society's Catalogue in 1841, the *Eleocharis uniglumis*, Link, is mentioned in the second edition of the 'Manual of British Botany' as having been found at "Aberdeen, Dr. Dickie, and Barvas, Isle of Lewis." I have found it also in Mull and near Swanbister, Orkney, but I am not aware that it has been noticed in this neighbourhood until it was found in the botanical excursion made by Prof. Balfour and his class on Saturday June 1st, 1850, when it was discovered growing in a marsh to the east of Blackness Castle, Linlithgowshire.

It is very probable that it is by no means a rare plant; but as it is similar in habit to *E. multicaulis*, I subjoin the characters by which it may be distinguished both from that and from *E. palustris*, to which it is in reality much more closely allied.

In *E. uniglumis* the root is creeping quite as much as in *E. palustris*, while it is very slightly so in *E. multicaulis*, which may be easily pulled up by the hand. The glumes are *acute* with a *very narrow* membranaceous margin. Stigmas 2; "nut obovate obtuse, rather compressed, shorter than the *four* bristles." [I have never seen the perfect fruit myself, but give the characters from the Manual of Brit. Bot. ed. 2. p. 349, and Koch, Syn. Flor. Germ. ed. 2. p. 852.]

In *E. multicaulis* the glumes are *obtuse* with a *broad* membranaceous margin. Stigmas 3; nut oblong ovate, acutely triquetrous, as long as the 6 bristles. The sheaths of the stem are also much more obliquely truncate than in *E. uniglumis*, in which they are nearly transverse at the upper extremity. The nuts are of a darker colour according to Koch.

It must be confessed that *E. uniglumis* comes very near to *E. palustris*, which is however usually much larger and stouter; but the

* Read before the Botanical Society of Edinburgh, July 11, 1850.

only differences I have been able to see are, that the membranaceous border of the glumes is much *narrower* in *E. uniglumis,* and that the lowest glume surrounds the spike *entirely,* while in *E. palustris* it surrounds only *half* of the spike.

All the places where I have seen *E. uniglumis* have been on the sea-shore, usually in company with *Blysmus rufus,* but in Germany it is found inland.

The object of this paper is to direct the attention of young botanists to this plant, with the expectation of hearing of its discovery in other stations, which must be my excuse in bringing it before the Society.

84 Great King Street, Edinburgh, June 18, 1850.

On the Names of the Victoria Water Lily. By J. E. Gray, Esq.

This plant has three names very nearly alike, and two of them appear to have originated from errors of the press.

Mr. Schomburgk, on the 11th of May 1837, sent through the Geographical Society a letter to the Botanical Society of London, containing the description of this beautiful Water Lily, accompanied by two drawings and a leaf of the plant. He proposed to call it *Nymphæa Victoria,* but before the paper was read, it was observed that the plant appeared to form a genus intermediate between *Nymphæa* and *Euryale.* The paper was slightly altered to make this change, and in a report of the Proceedings of the Botanical Society, which appeared in the Athenæum Journal of the 9th of September 1837 (p. 661), Mr. Schomburgk's description is printed entire, as that of a "new genus of Water Lily named *Victoria Regina* by permission of Her Majesty." Mr. Schomburgk's paper was again read and his drawings exhibited at the meeting of the British Association on the 11th of September 1837, by me, and I am reported to have "remarked, that this splendid plant would form a new genus with characters intermediate between *Nymphæa* and *Euryale,* and proposed to name it *Victoria Regina*:" see Report in Mag. of Zool. and Bot. for October 1837, vol. ii. p. 373. Schomburgk's description and an engraving of the plant, copied from his drawing, appeared in the next number of that Journal, which came out on the 1st of November 1837 (vol. ii. p. 441. tab. 12*). The description was reprinted again, with copies of Mr. Schomburgk's drawing of the plant and his details of the flower, in the Proceedings of the Botanical Society, p. 44. t. 1 & 2. So much for the name *Victoria Regina,* Schomburgk.

In the 'Magazine of Zoology and Botany,' by a mistake of the engraver, the plate is lettered "*Victoria Regalis Schomburgh,*" though the proper name is used in the text. This second name has not been

* It is to be observed that the title-page of the volume bears date 1838, but the number containing the description and figure was published on the 1st of November 1837. This date on the title has misled some botanists. Thus Sir W. Hooker quotes that description as if it had not appeared in that work until 1838: see Bot. Mag. 3rd series, vol. iii. t. 4275–4278.

anywhere adopted. In the index to the Athenæum Journal for 1837, p. vii, under the head Botanical Society, occurs, "Schomburgk on the *Victoria regia*, p. 661," which is evidently an error of the press, as the name in the page referred to is *V. Regina.*

Shortly after the appearance of the description and figure in the 'Annals of Zoology and Botany,' and after Sir William Jardine had returned them, Capt. Washington, R.N., then Secretary of the Geographical Society, borrowed from the Botanical Society the original description and drawing of the plant made by Mr. Schomburgk, with the intention of their appearing in the Journal of the Geographical Society with Mr. Schomburgk's Journal of his Travels. Instead of this being done, the papers found their way into the hands of Dr. Lindley, who printed for private distribution twenty-five copies of an essay on this plant, entirely derived from Mr. Schomburgk's paper, and illustrated with highly embellished copies of Schomburgk's drawing. In the essay he adopted the view which had been stated before the Botanical Society and British Association, that it formed a genus intermediate between *Euryale* and *Nymphæa* (see Bot. Reg. 1838, p. 11), but he called the plant *Victoria regia,* thus continuing the error of the printer of the 'Athenæum.'

In Miscellaneous Notices attached to the 'Botanical Register' for 1838, p. 9–18, Dr. Lindley having been enabled to examine a specimen of the flower in a bad state, which Mr. Schomburgk had sent home in salt, gave some further details, and for the first time published an account of the plant under the above name, and this name has been adopted by several succeeding botanists, who have quoted it as *V. regia* of Lindley. I think, however, that this account proves that the name of *Victoria Regina,* which received the sanction of Her Majesty, was the one first used and published, and has the undoubted right of priority; and I must add, as a personal disclaimer, that I have always considered that both the generic and the specific name properly belonged to Mr. (now Sir Robert) Schomburgk, for it was he who proposed that the plant should be dedicated to the Queen; and the slight alteration made in his paper before it was read at the Botanical Society, was caused by our having the means of comparison in London which he had not at Berbice, and was regarded by me as a simple act of friendship, such as was due to a person in his situation. In fact the alteration would never have been made public, if the original manuscripts of Mr. Schomburgk had not been allowed to pass out of the possession of the Botanical Society, to whom they were sent.

On the Organization of the Malacobdellæ.
By M. Emile Blanchard.

The *Malacobdellæ,* which belong to the group of the Class Vermes, have sometimes been arranged in one division of this class, sometimes in another; Milne-Edwards has endeavoured to determine the exact place they should occupy.

In a previous memoir published in 1845, M. Emile Blanchard had shown that, from their nervous system, it would be impossible to leave them in the group of the *Hirudines* in which they had been placed. The other new characters, observed by M. Blanchard, confirm this opinion, and appear to show that the *Malacobdellæ* should constitute a particular division, completely independent of the *Annelides*, the *Hirudines*, and the *Anevormes*? (*Trematodes planaris*).—*Comptes Rendus*, Nov. 26, 1849.

Monograph of the recent species of Trigonia, *including the description of a new species from the Collection of H. Cuming, Esq.* By Arthur Adams, R.N., F.L.S. &c.

Trigonia, Bruguière.

Testa æquivalvis, inæquilateralis, transversa, trigona, interdum suborbicularis; dentes cardinales oblongi, lateraliter compressi, divaricati; duo in valvâ alterâ, utroque latere transversim sulcati; quatuor in alterâ, uno tantum latere sulcati; ligamentum externum, crassum, marginale; impressiones musculares duæ.

Shell equivalve, mostly inequilateral, transverse, rather triangular, sometimes suborbicular; cardinal teeth oblong, laterally compressed, divaricated, two in one valve transversely grooved on both sides, four in the other grooved on one side only; ligament external, thick, rather short, marginal; muscular impressions two, distinct, lateral; palleal impression very nearly entire.

Trigonia margaritacea, Lamarck. *T. testâ suborbiculatâ, radiatim costatâ, intus margaritaceâ, costis elevatis, verrucosis, subasperis; margine plicato.*

Shell rather compressed, with 20 or 23 rather narrow, nodulose, radiating ribs; the hinder ribs very compressed, all excepting the front ribs wide apart.

Hab. Van Diemen's Land; *Ronald Gunn, Esq.* (Mus. Cum.)

Trigonia margaritacea, *Lamarck, Ann. du Mus.* tom. iv. p. 355. pl. 67. fig. 2.

T. pectinata, *Lamk.*

Trigonia Lamarckii, Gray. *T. testâ subventricosâ, solidâ, costis 20–26 angustatis planiusculis nodulosis radiantibus, costis areæ posticæ confertis angustatis, costis omnibus confertis nodulosis.*

Hab. in Novâ Hollandiâ.

Shell rather ventricose, solid, with 20 to 26 narrow, flat-topped, nodulose radiating ribs; the ribs of the hinder slope narrow, rather crowded; ribs convex, all close together and nodulose.

Hab. New Holland, Port Jackson; *Mr. Stutchbury.* (Mus. Cum.)

Varies, with the inside white, salmon-coloured, yellow, or purple bronze.

Trigonia Lamarckii, *Gray, Annals of Nat. Hist.* 1838, p. 482.

Trigonia Jukesii, A. Adams, n. sp. *T. testâ ovato-trigonâ,* *posticè truncatâ, margine sinuato, radiatim costatâ, costis circa 20–24, elevatis, tuberculato-nodosis, tuberculis rotundatis, obtusis, margine ventrali valdè pectinato.*

Shell ovately trigonal, posteriorly truncated, the margin sinuated, radiately ribbed; ribs about 20–24, elevated, tubercularly nodose; tubercles rounded, obtuse, ventral margin strongly pectinated.

Hab. Cape York, 6 fathoms; *J. Jukes, Esq.* (Mus. Cuming.)—*From the Proceedings of the Zoological Society for Nov.* 27, 1849.

OBITUARY.—THE REV. WILLIAM KIRBY.

In our present Number we have to record the death of our venerable friend the Rev. William Kirby, M.A., Rector of Barham, Suffolk, at that place, where he had resided sixty-eight years, on Thursday, July 4, in the 91st year of his age.

Mr. Kirby was Honorary President of the Entomological Society of London, President of the Ipswich Museum, and Fellow of the Royal, Linnæan, Zoological and Geological Societies, besides being honorary member of several foreign societies, and has left behind him an imperishable name as one of the first entomologists of this or any age. This title he would have assured to himself had he written no other work than his 'Monographia Apum Angliæ,' published in 1801, in two volumes, 8vo, in which, from materials almost wholly collected by himself, and the plates of which were mostly etched by his own hand (having taken lessons in the art for this express purpose), he described upwards of 200 of the wild bees of this country, with a largeness and correctness of view as to their family (or as they are now considered, generic) divisions, that excited the warmest admiration of British and foreign entomologists. But when to this great work we add his other entomological labours—his numerous and valuable papers in the Transactions of the Linnæan Society, particularly those on the genus *Apion*, and on the order *Strepsiptera*; the 'Introduction to Entomology,' written in conjunction with Mr. Spence; the entomological portion of his Bridgewater Treatise 'On the History, Habits and Instincts of Animals;' and his description (occupying a quarto volume) of the Insects of the 'Fauna Boreali-Americana' of Sir John Richardson; it will be evident how largely and successfully he has contributed to the extension of his favourite science; and all this without encroaching in the slightest degree on his professional or social duties; for, while ranking so high as an entomologist, he was during his long life a most exemplary and active clergyman, beloved by his parishioners of all ranks, and one of the warmest of friends, and most simple-minded, kind-hearted, and pious of men.

We add the following notices from the Literary Gazette:—

"Mr. Kirby's grandfather, John Kirby, born in the year 1690, was the author of 'The Suffolk Traveller,' a work of no mean reputation in its day. Mr. Kirby's uncle, Joshua Kirby, was the author of Dr. Brook Taylor's 'Perspective made Easy;' he was an intimate acquaintance of Gainsborough, and frequently his adviser; and such was Gainsborough's regard for his friend, that he made a special request in his will that he might be buried by his side—a desire which was carried into effect. This Joshua Kirby afterwards became a great favourite with His Majesty George II., and received through his patronage the office of comptroller of the works at Kew. Mrs. Trimmer was his daughter, and consequently first cousin to the subject of this memoir.

"Mr. Kirby was born in the year 1759*, at Witnesham Hall, in the county of Suffolk, the residence of his father, who was by profession a solicitor; he was educated at the grammar school in Ipswich, whence he removed, in his 17th year, to Caius College, Cambridge. Here he pursued his studies with diligence, and laid so good a foundation, that he subsequently earned the reputation of being a sound and accurate scholar. In the year 1781 he took the degree of B.A.; in the year 1782 he was admitted into holy orders, having been nominated by the Rev. Nicholas Bacon to the joint curacies of Barham and Coddenham. By his exemplary conduct in the discharge of his parochial duties, he so gained the esteem of Mr. Bacon, that he left him by his will the next presentation to the rectory of Barham; to this he was inducted in the year 1796, so that for sixty-eight years he exercised his ministry in the same charge, residing also in the same parsonage-house. Always of an observant turn of mind (having at an early period evinced a great fondness for natural science), he had not been long resident at Barham before his attention was called to the habits of various insects which he met with in his daily walks. He was encouraged by some friend to pursue this study, as one opening before him a wide and extensive field of research; the fact of there being but few beaten paths did not prevent his entering upon it, and from this time the study of the insect world became his constant source of recreation and amusement.

"In contemplating the character of this man of piety, Christians may rejoice and thank God for his example; science, too, may rejoice and point in triumph to his name, standing forth, as it does, to the world, as that of a true philosopher, who was permitted for a long series of years to afford an example of a man, whose faith was not only undisturbed and unshaken by investigation of the intricate mechanism of the wonders of nature, but whose humility was deepened as his knowledge increased; whose admiration and praise were heightened by contemplating the wonders he discovered; whose gratitude and hope were enlarged at the signs of goodness and of mercy which he traced.

"Of the many virtues which adorned his private life we forbear to speak; at the same time there is one which stands so prominently forth, and which has been so severely tested in his intercourse with the world, that we must not omit to notice it. We allude to that real

* Our information states that Mr. Kirby was baptized at Witnesham, Sept. 19th, 1758. His mother was Lucy, daughter of Mr. Daniel Meadows of the same parish.

and genuine humility which even the most casual observer could not fail to mark—a correspondent of the highest literary characters, welcomed wherever he turned by the great and learned, receiving the most flattering testimonials and votes of thanks from individuals, from chartered bodies, and from foreign societies—not one of these circumstances could awaken pride, but the contrary, gratitude. The only view in which he regarded these things was, that having undertaken a task, he had done his utmost; the kindness and liberality of others supplied the praise."

METEOROLOGICAL OBSERVATIONS FOR JUNE 1850.

Chiswick.—June 1, 2. Very fine. 3, 4. Fine, but air excessively dry. 5. Slight haze: sultry. 6. Overcast: rain. 7. Cloudy and boisterous: showery. 8. Dull and cloudy: fine. 9—11. Very fine. 12. Fine: cloudy. 13. Cloudy: clear. 14. Uniformly overcast: rain: showery. 15. Rain: clear at night: frosty. 16. Clear: cloudy and fine. 17. Very fine. 18. Cloudless: very dry air: large distinct halo round the sun at noon. 19—22. Very fine. 23. Hot: quite cloudless. 24, 25. Hot, with slight dry haze. 26. Hazy: hot and sultry: heavy rain at night. 27. Rain: fine. 28. Hazy: rain. 29. Cloudy: very fine: clear and cold. 30. Fine: cloudy.

Mean temperature of the month	59°·26
Mean temperature of June 1849	59 ·30
Mean temperature of June for the last twenty-three years ...	60 ·88
Average amount of rain in June	1·88 inch.

Boston.—June 1. Cloudy. 2—5. Fine. 6, 7. Cloudy: rain P.M. 8, 9. Cloudy. 10, 11. Fine. 12, 13. Cloudy. 14. Cloudy: rain A.M. and P.M. 15, 16. Cloudy. 17. Cloudy: rain, with thunder and lightning A.M. 18, 19. Fine. 20. Cloudy. 21. Fine. 22. Cloudy. 23. Fine. 24. Fine: thermometer 88° 2 o'clock P.M. 25—27. Fine. 28. Fine: rain A.M. and P.M. 29, 30. Cloudy.

Applegarth Manse, Dumfries-shire.—June 1. Fine: fair: very warm. 2. Fine: very warm. 3. Fine: getting cloudy. 4. Fine: still cloudy. 5. Shower A.M.: thunder. 6. Shower A.M.: heavy rain P.M. and thunder. 7. Showery A.M.: fair P.M. 8. Showery all day. 9. Fair, but getting cloudy. 10. Slight shower early: fair P.M. 11. Slight shower early: fine day. 12. Rain and wind all day. 13. Rain during the night: fair all day. 14. Rain nearly all day. 15. Fair all day, and fine. 16. Fair and fine: cloudy P.M. 17. Rain early: fine day. 18. Fine all day. 19. Cloudy, but fine. 20. Fair and fine: getting moist P.M. 21. Showery. 22. Cloudy: rain during night. 23—25. Very fine all day. 26. Very fine: fresh and invigorating. 27. Parching east wind. 28. The air highly electric. 29. The air highly electric: a few drops. 30. Rain P.M.: continued all night.

Mean temperature of the month	57°·6
Mean temperature of June 1849	53 ·3
Mean temperature of June for twenty-eight years	55 ·9
Rain in June for twenty years	3·16 inches.

Sandwick Manse, Orkney.—June 1. Fine. 2, 3. Fine: warm. 4. Fine. 5. Rain: fog. 6. Damp: cloudy. 7. Drops: showers. 8. Drops. 9. Drops: rain. 10. Fine: rain. 11. Showers: clear. 12. Rain: showers. 13. Drizzle: showers: drizzle. 14. Bright: drops. 15. Bright: clear. 16. Fine: clear: fine. 17. Fine. 18. Fine: cloudy. 19. Cloudy. 20. Showers: cloudy. 21. Rain: thunder: showers. 22. Bright: rain. 23. Cloudy. 24. Bright: clear. 25, 26. Cloudy. 27. Bright: cloudy. 28. Bright: clear. 29, 30. Bright: drops.

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

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1850. June.	Max.	Min.	8¾ a.m.	9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.	8¾ a.m.	Max.	Min.	9½ a.m.	8½ p.m.	1 p.m.							
1.	30·323	30·274	29·86	30·20	30·22	30·25	30·30	74	38	56	72	49½	63	53	ne.	ene.	sw.	s.	......	......	......	......
2.	30·366	30·355	29·88	30·29	30·30	30·30	30·33	76	40	60	73	49	62	59	e.	e.	s.	calm	......	......	......	......
☾ 3.	30·417	30·272	29·88	30·29	30·22	30·31	30·25	75	37	58·5	74	55½	66	59	e.	ese.	s.	s.	......	......	......	......
4.	30·214	30·078	29·73	30·13	30·00	30·13	30·09	78	44	61·5	72	52½	63½	57½	e.	sse.	ssw.	n.	......	......	......	......
5.	30·005	29·814	29·49	29·84	29·67	29·90	29·71	78	55	59	65½	51	55½	53	s.	sse.	ssw.	w.	......	......	......	·10
6.	29·699	29·539	29·13	29·46	29·26	29·52	29·35	62	49	67	60	49	56½	51	sw.	sw.	e.–s.	enc.	·03	......	......	·08
7.	29·737	29·539	29·00	29·17	29·50	29·27	29·38	66	43	60	59	50½	55	51	sw.	wsw.	w.	w.	·06	·10	......	......
8.	30·000	29·886	29·43	29·70	29·87	29·54	29·72	69	41	60	59	45	54	50½	sw.	w.	w.	w.	·03	·09	0·37	......
9.	30·197	30·141	29·68	29·96	29·95	29·85	29·85	74	40	59	60	49½	58	52	sw.	w.	sw.	s.	......	......	......	·04
● 10.	30·118	29·890	29·60	29·91	29·79	29·84	29·78	80	50	68	62	52	60½	45	s.	w.	s.	calm	......	......	......	·10
11.	29·899	29·844	29·34	29·65	29·74	29·50	29·60	80	46	65	62	53	53½	51	w.	w.	w.	w.	......	......	......	·38
12.	29·918	29·696	29·33	29·50	29·30	29·36	29·19	68	47	63	59	51	51	52½	sw.	wsw.	ssw.	calm	......	......	......	·11
13.	29·716	29·672	29·09	29·28	29·46	29·19	29·44	66	42	58·5	59	47½	51½	48	w.	w.	w.	nnw.	·04	......	......	·21
14.	29·742	29·442	29·20	29·44	29·34	29·55	29·66	58	45	62	54½	48	49	45	sw.	sw.	sw-ne	nne.	·19	......	......	·04
15.	29·859	29·507	29·12	29·60	29·78	29·76	29·88	57	30	53	58	43½	47	45	ne.	n.	nne.	n.	·04	·22	......	......
☽ 16.	30·041	30·019	29·60	29·88	29·89	29·93	29·97	67	36	52	60	39½	49	48	ne.	e.	nne.	se.	......	......	0·75	......
17.	30·144	30·070	29·65	29·90	30·00	30·00	30·08	68	35	60	60	48	55	49	sw.	s.	s.	calm	......	......	......	......
18.	30·290	30·247	29·78	30·11	30·18	30·17	30·16	75	42	62	64½	50	53	52	w.	sw.	w.	sse.	......	·03	......	......
19.	30·370	30·339	29·88	30·22	30·20	30·09	30·07	78	48	60	65	60½	59	56	n.	calm	sw.	wsw.	......	......	......	......
20.	30·278	30·187	29·76	30·13	30·07	29·99	29·93	81	47	69	59½	55	60	55½	s.	calm	s.	sw.	......	......	......	·21
21.	30·175	30·121	29·63	29·94	29·90	29·76	29·67	81	46	66·5	60	54	57	53	sw.	sw.	sw.	sw.	......	......	......	·09
22.	30·206	30·177	29·60	29·92	29·99	29·76	29·79	82	47	69	59	54	56	55	w.	wsw.	s.	wsw.	......	......	......	·20
23.	30·256	30·222	29·66	30·10	30·19	30·03	30·20	86	54	67·5	68	55½	54½	52	nw.	w.	s.	sw.	......	......	0·20	·08
○ 24.	30·244	30·162	29·67	30·16	30·14	30·06	30·13	83	49	73	70	58½	54	50	e.	calm	s–sw.	sw.	......	......	......	......
25.	30·153	30·000	29·57	30·11	30·00	30·08	30·03	82	49	72	72	52	51	52	se.	ne.	sw.nw	w.	......	......	......	......
26.	29·954	29·851	29·44	29·91	29·93	29·95	29·99	84	53	72	67	50	53½	51½	se.	wsw.	nw.	wnw.	·69	......	......	·10
27.	30·038	29·983	29·40	30·03	29·98	30·10	30·02	69	49	63	65	47	53	51½	e.	......	e.	sse.	·01	......	......	......
28.	29·819	29·631	29·35	29·82	29·63	29·71	29·63	69	53	65·5	65	48	63	50	e.	ne.	sw-w.	sw.	·31	......	......	......
29.	29·858	29·738	29·22	29·57	29·62	29·48	29·41	66	43	58	61	44	54	50	sw.	nw.	w.	sw.	......	·16	......	......
30.	29·947	29·963	29·40	29·65	29·60	29·46	29·53	71	55	60	57½	48	51	51½	sw.	sw.	sw.	wsw.	......	......	0·95	·25
Mean.	30·066	29·955	29·51	29·862	29·860	29·828	29·838	73·43	45·10	62·7	66·7	50·3	55·63	51·65					1·40	0·60	2·27	1·99

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 33. SEPTEMBER 1850.

XIV.—*The Natural Relations between Animals and the Elements in which they live.* By L. Agassiz*.

Among the early attempts to arrange animals in a systematic order, we find almost universally, that the natural elements in which their different tribes live are introduced as the fundamental principle of their classification. During the sixteenth and seventeenth centuries, the great works published upon natural history by Gesner, Rondelet, Belon, Aldrovandi and others, acknowledge this as the only basis of their arrangement of the animal kingdom. Even at a later period, when characters derived from the animals themselves, rather than from the external circumstances in which they dwell, had been introduced into our systems, we still find a prevailing influence of such considerations upon the circumstances of the natural subdivisions of animals. As soon however as the study of comparative anatomy had shed its brilliant light upon this question, those views were entirely abandoned, and the whole animal kingdom was finally arranged according to its internal structure. The introduction of this principle was hailed as a new æra in the history of our science; and after Cuvier had applied it to a general revision of the whole animal kingdom, it was and has been universally acknowledged as the only safe foundation of a natural classification of animals.

The recent progress in zoology, and of the various branches of natural history connected with it, has however opened the prospect of further improvements, even upon the basis on which our classification at present rests. For embryology is already displaying its vast influence upon zoological questions, and the time is not far distant when its share in the natural arrangement of animals will be as large as that of comparative anatomy itself,

* From Silliman's American Journal of Science and Arts, No. 27, May 1850.

and when information derived from all possible quarters shall have equally its due influence upon our natural methods. A desire to investigate the various questions bearing upon classification has led me to revise the subject of the natural relations which exist between animals and the elements in which they live. The connection between animals and the surrounding media in which they live has of late been so entirely disregarded, that it is time to reconsider this question with all the attention its importance demands, since we find in it a decided relation to the structure and functions of all animals. For though it is plain that the mere living in water or upon dry land is in itself of slight importance, as there are so many animals which dwell in the two elements although having the same *identical* structure, it should not be overlooked that the greater number of aquatic animals have structural peculiarities common to all, and that the same is the case with the terrestrial or aërial animals. For instance, all those which live upon dry land breathe directly the atmospheric air, and have a respiratory apparatus adapted for direct introduction of this element into their systems, while aquatic animals breathe through apparatus of a different structure adapted to a permanent contact with aërated water. This circumstance alone would suffice to show that the natural relations of animals with the elements in which they naturally dwell, is in direct connection with at least some of their structural peculiarities. But there are other circumstances which may lead to the conviction that this connection has not merely reference to the structure of their respiratory apparatus, but influences their whole organization. The greater pressure under which aquatic animals are maintained throughout their life modifies, in many other respects, their organization. In many of them the surrounding element has largely a direct access into the cavities of the body or even into their tissues; so that a direct and universal influence of the surrounding media must be acknowledged throughout the animal kingdom as soon as we take into consideration all their peculiarities. This influence will be appreciated more correctly, if we consider it separately in each great group of the animal kingdom as established upon anatomical evidence.

After removing the Whales from the Fishes, it will be plain that the Cetacea must be considered simply as an aquatic type of the class of Mammalia, and that the connection which exists between them and the element in which they live will not affect at all the views which we shall entertain about that class, and only allow us to consider within more natural limits, the true relation which exists between fishes and the natural element in which they are found. The circumstance that so many birds are aquatic in their habits will no longer prevent us from considering the class of Birds as a most natural group in the animal kingdom, the limits of which are well defined by anatomical evidence; and the relations of aquatic birds to the waters upon which they alight or in which they dive, will only be considered within the limits of a well circumscribed natural group. The same may be said of Reptiles; and the circumstance that so many of their types are almost entirely aquatic, while others are terrestrial, will by no means prevent us from viewing them as a natural class, in which the connection with either main land or the water shall appear as a subordinate feature.

Again, the class of Insects, which is so thoroughly aërial throughout almost all its types, at least in their perfect state of development, circumscribed as it is within natural limits upon anatomical evidence, will appear to us as a type which shall bear no relation in our mind to the class of Birds, although their movement through the atmosphere be apparently so similar.

But, although we remove in this manner almost completely the circumstance of animals dwelling either in water or upon main land as influencing in any way our general classification of the animal kingdom, it were a great mistake to lose sight entirely of this most intimate relation among the natural secondary groups of animals under their different types.

The value of these considerations has become more apparent, since the outlines of the leading divisions in the animal kingdom have been made in detail by allowing the results of embryology to have their due share of influence upon our classification; and the object of these remarks is chiefly to show that there is a universal relation throughout the animal kingdom between their structure and gradation and the elements in which they live; that in all the four great types of the animal kingdom, the aquatic groups stand, in natural classification, lower than the terrestrial, and that this connection is so intimate as to extend even to the subdivisions, and so much so, that I have arrived at the conviction that in an otherwise well defined natural division, the aquatic tribes should be placed below the terrestrial ones; that even in narrowly circumscribed families the aquatic genera rank below the terrestrial, and that even in natural genera the aquatic species are inferior to the terrestrial ones. But before considering those minor divisions let us take a general glance at the four great types of the animal kingdom, beginning with the Radiata.

If we consider the type of Radiata as it is still circumscribed in some of our most recent works upon the animal kingdom in general, we may fail to discover this intimate connection between their natural types and the media in which they live. But if we reduce the type of Radiata to those classes which I consider as alone truly representing that type, we shall be at once struck with the remarkable result, that all these animals are aquatic, nay, that, with one single exception, they are all marine. But before this can be acknowledged, it must be shown that the type of Radiata should be reduced to the three classes of Polypi, Jelly-fishes and Echinoderms; and that, among the Polypi, there are large numbers of animals now united which do not all belong to that class. The most extensive range acknowledged by some zoologists in the type of Radiata includes Infusoria, with the Rotifera, and also intestinal worms. Without entering for the present into a full discussion of the natural character of all the animals which have been included in the class of Infusoria, I may limit my remarks to a few critical points, in order to show that the Polygastrica, and even the Rotifera cannot be ranked among Radiata.

In the first place, the Rotifera constitute a particular group among Infusoria, as Ehrenberg himself has acknowledged. They differ so completely from the Polygastrica as to forbid entirely their union in a natural classification. The only question is whether they can remain among Radiata, and, if not, where they should be placed. There is so little analogy between the structure of Rotifera and the structure of true Radiata, that ever since the beautiful illustration of their forms and structure as given by Ehrenberg, most naturalists and anatomists have felt inclined to remove them to another type of the animal kingdom. Their resemblance to the Articulata has appeared to some so striking as to warrant, in their opinion, their removal to the class of Crustacea among Entomostraca, while others have considered them as more closely allied to worms. But I may say that all, or almost all, naturalists at present understand the necessity of removing them from among Radiata into the great type of Articulata.

This point is no longer in question; the only remaining doubt respecting them is whether they should rank among the lower Crustacea or among the worms in the wider sense. As for the Polygastrica, we meet with greater difficulties in attempting to classify them; for this group, as understood by Ehrenberg, consists still of most heterogeneous beings which do not even all belong to the animal kingdom. Recent investigations upon the so-called *Anentera*, including the families of *Baccillaria* and Volvocine Infusoria, have satisfactorily shown, in my opinion, and in that of most competent observers, that this type of Ehrenberg's Polygastrica without gastric cavities, and without an elementary tube, are really plants belonging to the order of Algæ in the widest extension of this group; while most of the Monas tribe are merely moveable germs of various kinds of other Algæ. As for the other Polygastrica which Ehrenberg combines in this division of Enterodela, I am satisfied that they also constitute still a heterogeneous group belonging to different types of the animal kingdom; and that most of them, far from being perfect animals, are only germs in an early state of development. The family of *Vorticellæ* exhibits so close a relation with the Bryozoa, and especially with the genus *Pedicellina*, that I have no doubt that wherever Bryozoa should be placed *Vorticella* should follow, and be ranked in the same division with them.

The last group of Infusoria, *Bursaria, Paramecium* and the like, are, as I have satisfied myself by direct investigation, germs of freshwater worms, some of which I have seen hatched from eggs of *Planaria* laid under my eyes. This being the case, we see that, without exception, the whole class of so-called Infusoria must be dissolved into its various elements and divided partly among the Articulata, and partly among Mollusca in the widest extension of those groups (if it can be shown that Bryozoa belongs also to the type of Mollusca), that large numbers of them belong to the vegetable kingdom, and others are simply germs of other types, and that no single one of them belongs to the type of Radiata.

If we next consider the Polypi, we find them constituting another main group and most natural class, to which indeed some heterogeneous types have been annexed: upon the removal of these however that class constitutes a very natural division of the type of Radiata, among which they form the lowest class. The natural groups which require to be removed from Polypi are,—first, the so-called Hydroid Polypi, which, though truly radiated animals, do not belong to this class, but are, as I have shown from their structure, and as might long ago have been inferred from their development, true members of the class of Medusæ, among which they constitute a type of stalk animals, as crinoids among star-fishes*.

The Bryozoa also are not constructed upon the plan of Radiata, as has long been shown by Milne-Edwards and others. Their true position is among Mollusca, and embryonic investigations upon Ascidia have satisfied me that Bryozoa, compound, and simple Ascidia, form a natural series of well-connected types leading to the true Acephala among ordinary Mollusca, among which Bryozoa will form a natural group of compound animals, bearing the same relation to the ordinary bivalve shells that common corals bear to the simple Actiniæ and Fungiæ. Though the doubts entertained about the Foraminifera among Bryozoa would not affect at all the points under discussion, I may as well state

* See my paper upon the homologies of radiated animals with reference to the classification of the so-called hydroid polypi, read before the American Association for the Advancement of Science, held in Cambridge, August 1849; also my lectures upon comparative embryology, delivered before the Lowell Institute, Dec. 1848, and Jan. 1849.

at once that I have arrived at the conclusion that the Foraminifera constitute the lowest type of Gasteropoda, and exemplify under permanent forms the state of division of their germs in their embryonic development. Thus circumscribed, the class of Polypi constitutes a very natural group containing only animals of an identical radiated structure, the organization of which is at present very satisfactorily known.

The class of Medusæ has been from the beginning so well characterized and circumscribed within so natural limits, that it has undergone since its establishment only slight modifications by the removal of some few genera: and after the position of the so-called Hydroid Polypi among them shall have been generally acknowledged, I believe it will undergo scarcely any new changes in its extension, though we may still expect extensive improvements, which are indeed very much needed, in the characteristics and internal arrangement of their natural families. Considering their structure, the Medusæ rank immediately above Polypi.

The Intestinal Worms have long been placed among Radiata, and considered as a natural class in this great type of the animal kingdom, notwithstanding so many striking differences in the plan of their structure. This position was assigned to them upon the ground of the radiated arrangement of parts around the head and the vascular form of some of their genera, and also upon the supposed want of a nervous system in all of them. But since the discovery of nerves in all of their types, and since the most intimate relations have been discovered between them and so many other external worms, their complete separation from the Annelides as a distinct class is hardly recognized now by any modern investigator. And the necessity of combining the intestinal parasitic worms into one great natural group with the other external free worms is becoming daily more evident to all, so that whatever position be assigned to Annelides in the great type of Articulata, Helminths have to follow them, and must therefore be removed from the type of Radiata. This point is undisputed now, though there may be a difference of opinion as to the propriety of admitting, to one great class, all Worms, or of subdividing them into minor natural groups.

The third class among Radiata is that of Echinoderms, which has been circumscribed within most natural limits since the reunion of Holothuriæ and Crinoids with the common star-fishes and true Echini. Whoever is familiar with the embryonic development of Echinoderms, which has been extensively investigated of late, will acknowledge an intimate relation between them and the other two classes of Radiata, and not be willing to assent to the proposed separation of Echinoderms as one great type in the animal kingdom, placed upon an equal footing with Mollusca, and will consider their separation from Polypi and Medusæ, as proposed by Dr. Leuckardt, rather as a retrograde step, than as an improvement upon the general classification of animals. To me the type of Radiata, embracing the three classes of Echinoderms, Medusæ and Polypi, constitutes, in its circumscription illustrated above, a most natural group of the animal kingdom, all the members of which are intimately connected by a close uniformity in the plan of their structure, but present a remarkable gradation of their types in the manner in which this structure is developed in each of their classes. And the circumstance that even in the higher ones, which contain chiefly free moveable animals, we have some few representatives attached permanently to the soil upon a Polyp-like stalk bearing the radiated animal crown, shows further the intimate connection which exists between them all. Radiata consist therefore of three classes only, which in their natural gradation rank as follows: Polypi lowest, next Medusæ, and highest Echinoderms.

As soon as we have removed in this way all the classes or families which do not strictly belong to the type of Radiata, we cannot fail to perceive at once that all the remaining animals which must be considered as truly radiate are not only all aquatic, but, with a single exception of the genus *Hydra*, all strictly marine; from which we are allowed to infer, that, in the plan of the creation, the radiated structure is incompatible with a terrestrial mode of life. We see that the lowest degree of development of the whole animal kingdom is entirely marine; and that it has been so throughout all ages in the history of our globe, is shown by the large numbers of Radiata found from the earliest periods through all geological epochs up to the most recent, and the entire absence of radiated animals in any of the freshwater deposits. The circumstance that no single genus among Radiata contains freshwater animals, further shows that this type in its main features is not better adapted for a fluviatile existence; or, we may say in other words, that the plan involved in the structure of radiated animals is chiefly adapted to the sea. We might perhaps even say, if in this stage of the investigation it would not seem premature to go so far, that the lower types of animals are not only entirely aquatic, but exclusively marine. The fact of so large a number of aquatic animals as Radiata being so exclusively marine, undoubtedly shows that the connection of organic structure with the ocean involves peculiar circumstances, which fresh waters by no means afford to a similar extent. Whether this is especially connected with the greater density of the medium or not I am not fully prepared to say, though I am inclined to believe that it is so, from the circumstance that Radiata are so constantly killed by the contact of fresh water, as I have ascertained by direct experiment upon Polypi, Medusæ and Echinoderms, some of which are struck with almost instantaneous death when brought into fresh water, and decompose with astonishing rapidity. I have seen, on dropping an Ophiura into fresh water, all the articulations dismembered and entirely separated within a few minutes.

No one of the three other great types of the animal kingdom is either so exclusively marine, or even so exclusively aquatic as that of Radiata; for among Mollusca we have quite a number of terrestrial genera, and even a large number of freshwater genera and families.

Among Articulata we notice also large numbers of freshwater species, and a still larger number of terrestrial forms. Finally, among Vertebrata we find the most promiscuous occurrence of marine, freshwater and terrestrial forms. It is now important to ascertain whether we may trace, beyond the Radiata, a direct relation between structure and the element in which animals live, and whether the gradation of this structure has any reference to the surrounding media, as it unquestionably has among the Radiata.

Let us first consider the Mollusca, and perhaps revise their classes in a zoological point of view before undertaking the investigation of their relations to the media in which they dwell, allowing in this revision a due influence to embryology as far as it can influence this question at present.

The number of classes which should be admitted among Mollusca is the first point of importance we have to consider. Since the Barnacles or Cirripedia, which Cuvier still considered as a class among Mollusca, are now known to belong to the type of Articulata, and to be most conveniently combined with Crustacea, we have five classes of Mollusca left, if we follow Cuvier's arrangement of these animals, as he distinguishes Cephalopoda, Pteropoda, Gasteropoda, Acephala and Brachiopoda, as so many distinct classes of the type of Mollusca in the order of gradation just mentioned. It will hardly be necessary at present to insist upon the close relation which exists between Brachiopoda and the other bivalve shells. Indeed, anatomical investigations of these animals have shown that they are not only constructed upon the same plan, but that the differences between Brachiopoda and ordinary Acephala are scarcely as great as the differences which exist between Ascidia and Lamellibranchiate Acephala, which Cuvier nevertheless placed in one and the same class. We shall therefore consider Tunicata, Brachiopoda and Diphyra, as one great natural class under the name of Acephala, to which we also refer, as mentioned above, the type of Bryozoa, which has been so long combined with Polypi. As to the Pteropoda and Gasteropoda, though they are still generally considered as two classes, we shall, for reasons explained elsewhere*, and from embryological evidence, place the Pteropoda below the Gasteropoda proper, not as an intermediate type between Gasteropoda and Cephalopoda; for the Pteropoda are rather an embryonic type, exemplifying, in a permanent form, that stage of development of common Gasteropoda when they are provided with large vibracula, and a thin symmetrical shell deciduous in so many of them; bearing to that state of development of the common Gasteropoda the same relation which the Foraminifera bear to a still earlier period of their embryonic growth, when the yolk is undergoing its process of gradual successive division, which seems to me to be exemplified in a permanent form in the numerous cells into which the body of Polythalamia or Foraminifera is naturally divided. If this view be correct, the class of Gasteropoda would therefore consist of the three types of Foraminifera, Pteropoda and true Gasteropoda, among which we would place the Heteropoda lowest, and the Pulmonata highest, both on account of their structure, and on the ground of the peculiar mode of development of the Pulmonata.

The third class is that of the Cephalopoda, which has always been circumscribed within natural limits since the Foraminifera have been removed from it. The position which I ascribe here to the Foraminifera will appear very natural to those who are equally conversant with the succession of fossil types in geological periods, and with embryology, and who know, as we have seen it to be the case also among Radiata, that the higher classes reproduce in their lower forms types analogous to the lower ones. For the great number of fossil chambered shells, existing in earlier geological periods, is very striking when we compare those old representatives of the class of Cephalopoda with their condition in the present period of the creation, and the natural gradation and analogy between Bryozoa as the lowest type of Acephala with the Foraminifera as the lowest type of Gasteropoda, and the chambered shells of old ages as lower types of Cephalopoda will remind us of similar relations between Polypi as the lowest type of the animal kingdom, the so-called Hydroid Polypi as the lowest type of Acalephæ, and Crinoids as the lowest type of Echinoderms, which are strictly parallel cases in two of the great types of the animal kingdom.

If we now start from these modifications in the classification of Mollusca which rest entirely upon anatomical and embryological considerations, to appreciate the relations between the three classes of this type, and the media in which they naturally live,

* See a paper upon the homologies of Gasteropoda and Acephala with reference to the systematic position of Pteropoda, Foraminifera, Brachiopoda and Bryozoa, read before the American Association, &c.

we cannot fail to be struck with the circumstance, that all Acephala, with one single exception, are aquatic, as are also Cephalopoda, and that we have only terrestrial representatives among Gasteropoda. Next, it must be obvious, that among Acephala we have fewer freshwater representatives than among Gasteropoda, as the freshwater types of Acephala belong truly to two groups, one of which has very few freshwater families, whilst among Gasteropoda we have quite a variety of fluviatile and terrestrial types.

The first thing which must strike us in this type, when contrasting it with the Radiata, is the circumstance of a far larger proportion of freshwater forms and of the introduction of a number of terrestrial ones. This simple fact in itself would go to sustain the hint thrown out above, that a higher organization in the animal kingdom is better adapted to the fluviatile and terrestrial life than a lower structure; as among Radiata we have not one single terrestrial type, and only a single fluviatile one; whilst the Mollusca, the structure of which is formed upon a plan decidedly higher than that of the Radiata, present already a large increase of fluviatile types, with the addition of very many terrestrial ones. But this view will at once be sustained to a most unexpected extent if we consider which of the Mollusca are aquatic and marine, which are fluviatile, and which are terrestrial. Beginning with the Acephala, we have then, in the first place, all the Polyp-like Bryozoa and Tunicata, and the compound Tunicata entirely marine, with the exception of a few genera of freshwater Bryozoa. And it is very interesting to notice that freshwater animals among Mollusca are of the lowest type of their class, as also was the first and only freshwater Radiate,—showing thus that the types to which they belong are not adapted to rise into any of their higher developments into the forms best fitted for other elements.

Next we notice the Brachiopoda, which are all, without exception, marine. Next Lamellibranchiata, mostly marine, though some of their types are fluviatile. So the entire class of Acephala is aquatic and chiefly marine, and its fluviatile types belong to its lowest group and to its highest. This circumstance has raised the question with me, what is the proper position to assign to the *Naiades* among the Lamellibranchiata; and upon due consideration of their peculiar characters, and especially of the circumstance that their mantle is entirely open, that they have no prolonged syphons whilst there are such even among Ascidia, I am inclined to suppose that they rank highest among Lamellibranchiata, and that Monomyarians should rank between Brachiopoda and Dimyarians. The reason for assigning to *Naiades* this higher rank, rests upon the homology traced between the foot of Gasteropoda and that of Acephala, and between the reduction of the mantle upon the sides of the foot which it no longer incloses in Gasteropoda, and also the higher position of the gills under the margins of the mantle, all peculiarities in which *Naiades* bear closer resemblance to common Gasteropoda than any other of the Acephala. Thus this class of Acephala, though chiefly marine, with a few representatives of its lowest types in fresh water, would reach its highest degree of development in one family, which is entirely fluviatile.

Among the Gasteropoda we have again the Foraminifera as the lowest type, entirely and without exception marine; Pteropoda, which rank next, entirely and without exception marine; Heteropoda, which follow, equally marine; and among the true Gasteropoda, which in their class are decidedly the highest, we find first, fluviatile and then terrestrial families. And now the question is, among these, what is the respective position of the marine families, of the fluviatile families, and of the terrestrial families? There are among them such structural peculiarities as will decidedly settle the question. If we set aside for a moment the few branchiate freshwater Gasteropoda, we have a large number left which are pulmonate, and which live in fresh water and upon land, and which as a whole we may contrast with the branchiate true Gasteropoda, which are almost all marine, with the few exceptions of *Valvata* and *Paludina* and *Ampullaria*. Now which of these two types rank highest will not be a matter of doubt as soon as it is remembered that Phlebenterata are among branchiate Gasteropoda, and by their general structure rank below the others; so that we shall have the marine branchiate Gasteropoda follow immediately the Heteropoda, to which they are more or less closely allied through the Phlebenterata, and, above all, the Pulmonata. But here arises a new question. This family of Gasteropoda is partly fluviatile and partly terrestrial; and we may further ask, which should rank higher? No one familiar with the forms of these animals will hesitate in answering this question. We need only compare the development of their tentacles, their forms and position, and the development of their organs of sense, to be satisfied that *Helices* and *Limax* rank above *Planorbis* and *Limnæa*; so that the natural gradation established by their structure among the upper groups in the class of Gasteropoda, agrees with their natural connection with the elements in which they live in the order which I have assigned to these, the types of Gasteropoda, which are lowest, being exclusively marine; the highest, equally fluviatile and terrestrial; and among these the fluviatile ranking immediately above the marine, and the terrestrial ranking highest, and the proportion of the fluviatile in the whole class being still larger than in the class of Acephala, inasmuch as the structure of Gasteropoda is also a higher degree of development of Mollusca than that of Acephala, and the first terrestrial type in the animal kingdom in the gradation of its structure making its appearance in the class of Gasteropoda.

The Cephalopoda are highest among the Mollusca as a class. They rank so high, as to rival, in the complication and development of their structure, even some of the Vertebrata; and strange to say, we have among them only marine types, not a single fluviatile representative, nor a single terrestrial one. This fact would at first seem to be in direct contradiction with the statements made before, if it were not for the circumstance that this class in itself, as represented in our days, does not seem altogether reduced in comparison with the other two, if we could not be satisfied that its perfect period of development were the former geological ages when its numbers were far greater than at present, a circumstance which places the whole class in peculiar relations to its type, which must be rather appreciated under the point of view of the conditions which prevailed in former ages, when the ocean covered more extensively the whole surface of the globe than at present; so that the type with its high organization must be considered more with reference to its development in former ages, than to what it is now, as at present the class is proportionally reduced; and it is well known, and it will be further mentioned with reference to other types, that in earlier periods, however high animals might have ranked by their structure, they were all marine, as we know fishes to have been the only representatives of Vertebrata in earlier periods.

At this stage of the investigation, a comparison between Mollusca and Radiata shows, that, though the former advance further in their fluviatile development, and even reach with some few of their types a terrestrial mode of existence, there is not yet a single family among them which is entirely terrestrial, nor a single class which is either entirely fluviatile or terrestrial, this connection with the higher conditions of existence being only introduced among some few of their representatives, which we are allowed from other data to consider as the highest in their respective groups.

If we now pass to the great group of Articulata and begin as before by revising their zoological arrangements as based upon anatomical and embryonic data, we shall have at the outset to settle the limits of their classes and their relative positions.

The first point which we have here to investigate, is the question whether the Articulata in the widest extension of this group constitute one single natural type, or whether they should be subdivided into two equivalent groups, as has been proposed by those who would restore the division of worms, in its widest sense, as a great division equal in zoological importance to the type of Mollusca, and unite the Arthropoda, Crustacea and Insects to form another group of equal value.

The great diversity among worms seems at first to warrant, in some degree, such an arrangement. But as soon as we consider the metamorphosis which insects undergo, and compare their earliest stages of growth with the structure and forms of worms, we cannot fail to perceive, that notwithstanding the many peculiarities which characterize worms, they are, after all, only one of the permanent modifications of the same type as Crustacea and insects, among which last the characters and forms of a large number of worms are reproduced as transient states of growth; so that upon the most natural view, and especially if we allow embryology to have its due weight in fixing our opinion, we must consider worms, with all their diversified forms, Crustacea in all their diversity, and Lepades, Arachnidæ and Insects, to constitute one single undivided natural type in the animal kingdom. Assuming upon the foundation alluded to, and without entering into a detailed argument upon this question, that this is the right view of this subject, the next question is about the number of classes into which these Articulata should be subdivided. Taking here again anatomical and embryological evidence as our guide, and remembering what was said above of intestinal worms, we shall find that the most natural combination of the different groups of Articulata will bring them all into three classes, one containing those in which the body is either more or less distinctly articulated, or in which indications of transverse wrinkles in the skin are scarcely marked or wholly wanting, but in which, however developed these joints may be, they never combine in such a manner as to divide the body into distinct ridges, in which the form is always elongated and vermiform, never provided with articulated rings, however numerous and diversified the locomotive appendages may be, and in which the foremost joints hardly ever assume a peculiar structure with the appearance of a head. This class, for which the name of Worms is best retained, will contain the Helminths and Annelides, exclusive however of the vermiform parasitic Crustacea, which embryology has taught us to refer unhesitatingly to the class of Crustacea. The extraordinary diversity which exists among these animals renders it rather difficult to subdivide them into natural groups, and to assign to these groups a natural succession agreeing with the gradation of their structure, as there are so many, the development of which is as yet very imperfectly known, and others which undergo so complicated metamorphoses as to leave great doubt respecting their natural relations to each other. However, there can be no doubt that the Helminths rank lower than the Annelides, for their structure indicates plainly their inferiority, and their mode of existence within other animals shows that they do not even reach that degree of independence which might allow them a free existence.

Among the Annelides, again, there will arise similar difficulties respecting the relative position of the branchiate types of that group which are provided with external appendages, performing simultaneously the functions of respiratory and locomotive organs, and those families which are deprived of external appendages, or which have stiff bristles upon their joints, independent of their aërial respiratory organs. Indeed at present the position of earth worms and leeches among the Annelides has not been the subject of any direct investigation as regards their relative position and rank. But if I were allowed to be guided by the impressions I have received from the study and comparison of the larvæ of insects, I should be inclined to consider the Annelides with external gills as inferior to those which have no such appendages, and place the lumbricine Annelides highest in the class. So that the Helminths should be placed lowest in the class of worms; next the Branchiate Annelides with external branchiæ; next those having internal branchiæ, and highest those with aërial respiratory sacs.

The second class in the type of Articulata is that of the Crustacea, the natural circumscription of which can hardly be in any degree a matter of doubt, for these animals, with their distinct articulations and aquatic mode of respiration, external appendages and particular mode of combination of the rings of their body, wherever they are combined to subdivide the body into distinct regions, are so peculiar as to determine well the natural limits of this class, to which we refer also the Cirripeda, notwithstanding their transformations, also the Lernæan parasites, though they may assume in their parasitic mode of existence so extravagant forms, and an appearance so entirely different from that of common crustacea. In this class, again, the parasitic vermiform types rank lowest; next follow the Entomostraca, and highest the Malacostraca, in most of which the anterior rings are combined into a distinct region, assuming a peculiar appearance differing widely from the posterior free moveable rings. The circumstance that among Crustacea the organization reaches a point where the anterior part of the body assumes so peculiar an appearance, leaves no doubt as to the relative position of the Crustacea among the Articulata; they rank higher than worms; though they must be placed below the insects, notwithstanding their perfect circulation and their otherwise highly developed structure; for, in every respect, insects considered as a whole class, are more highly organized, their higher types assuming a division of the body into three distinct regions;—undergoing also far more extensive metamorphosis, and assuming finally an aërial mode of respiration, to which the Crustacea do not reach. For these reasons, which I have illustrated more fully on another occasion, I have no hesitation in placing the class of insects highest among Articulata, and in comprising in one class the true insects with the Arachnida and Myriopoda, which are only lower degrees of development of the more special types of true insects; the Myriopoda representing in a permanent state of development, and with the structure of true insects, the form of their caterpillars; the spiders with their cephalic and thoracic rings united into a cephalothorax representing their chrysalis in a permanent state of development; and the true insects, with their three distinct regions, the so-called head, thorax and abdomen, ranking highest among them, as well for their more extensive metamorphosis as for the characteristic division of the body, the reduction of their locomotive appendages to a peculiar region, the complication of their chewing apparatus, and the development of their wings. The true arrangement of the different members of this class however is readily indicated by the remarks already made upon this class, and we shall not hesitate to consider the Myriopoda as their lowest type, and to place the Arachnida next above them, and then true insects, among which the sucking tribes rank highest.

If we now consider the connection of these three classes with the elements in which they are developed, and in which they permanently live, we cannot fail to be struck with the fact that two of their classes are either parasites or entirely aquatic, for even the terrestrial worms live in moist ground or on the bark where moisture is constantly accumulating; and these two classes we have seen to be the lowest of the type, while the class of insects, which in their perfect development are all terrestrial or aërial, constitute the highest type.

Reviewing the secondary groups of all these classes also in the same connection, we find that the lowest of all not only live in a fluid medium, but require the existence of other animals in whose cavities they find shelter and means of subsistence; and among those which have an independent mode of life, we find that the marine worms are probably lower than the fluviatile and terrestrial,—at least, if the view expressed above respecting the relative position of the Lumbrici and branchiate Annelides be correct.

In the class of Crustacea we have exclusively aquatic animals, and we find that among them those which live as parasites upon other animals rank lowest. The distinction however between fluviatile and marine types in this class does not seem to be in strict accordance with their gradation, for we have fluviatile Decapods which cannot be considered as higher than the crabs, unless it were shown that the shortened body of the Brachyural Decapods is the result of a retrograde metamorphosis, which I am however not inclined to suppose, as we have some crabs which are in the habit of leaving the water to dwell upon the main land. The occurrence of parasitic Crustacea upon freshwater fishes, again, seems to indicate that here the parasitism prevails over the influence of the surrounding media; and we should not wonder at this circumstance, as a parasitic mode of development dependent upon the prior existence of organized beings is not only a prominent feature in the mode of existence of so many Worms and Crustacea, but also even of many of the Insects, especially of the tribe of Arachnida and Diptera, at least in some earlier periods of their existence. In this connection it is an interesting fact to notice that the American freshwater Crustacea, the craw fishes, have fewer pairs of gills than the other representatives of the class.

Again, it may be, that to appreciate truly natural relations of this type of animals, it will be necessary to consider separately each of their minor divisions rather than the whole class as a unit; as we shall have to do also among the reptiles, where the peculiarities of the primary divisions overrule the influence of the media in which they are developed.

However obscure these relations may be among Crustacea, owing to the parasitism of some of their types, or the peculiar metamorphosis of others, if we now consider the insects proper we shall find here again a strict accordance with the results we have already derived from the investigation of the lower classes. Having acknowledged the superiority of the sucking insects over the chewing tribes, we cannot fail to perceive that the Neuroptera, which must be considered as the lowest, inasmuch as their body still preserves the elongated form of worms, are aquatic in their larval condition and have even external gills, as their respiratory organs during that period; next the Coleoptera, among which also we find aquatic larvæ, and a number of terrestrial types; and highest the Orthoptera, which undergo a less extensive, but entirely terrestrial development, whilst the Hymenoptera have a more diversified metamorphosis, and assume even in their larval condition in some of their types, the higher forms which characterize the larvæ of Lepidoptera.

Among the sucking insects we begin again with various aquatic types or aquatic larval forms,—next rise to the Diptera with other aquatic larval conditions but a constant aërial mode of life in the perfect state, and finally to the type Lepidoptera, in which all larvæ are terrestrial, and even highly organized in their earliest state in the higher groups; so that the class as a whole does not only rank above the Crustacea for its structure, but consists chiefly of aërial types in their perfect state of development, a large number of which are aquatic but fluviatile in their larval condition, and comparatively exceedingly few marine. So that if we compare the whole type of Articulata with either the Mollusca or Radiata, we see that in accordance with the higher development of its structure it has not only proportionally a larger number of terrestrial and aërial types, but an entire class is throughout aërial in its perfect state of development, and, though aquatic in the stages of growth, the larvæ are chiefly fluviatile and not marine; so that we may conclude from zoological evidence that the more intimate connection with the main land and aërial mode of existence indicate a higher degree of development than an aquatic mode of life; and between the animals living in water, that fluviatile types must rank higher than the marine.

These views are fully sustained by the order of succession of these great types of the animal kingdom throughout the earlier geological periods; for as it is already ascertained from zoological comparisons, that the earlier types in each class rank lower than their present living representatives, we have further evidence from the circumstances under which they live that they were all aquatic and marine in the earliest periods, and that fluviatile and terrestrial types have followed only at later periods. Without alluding to those classes in which the gradation of fossil types is less distinctly shown, let me only recall the Crinoids among Echinoderms, which for so long time prevailed to the almost entire exclusion of all other families among Acephala; the great prevalence of Brachiopoda in the oldest deposits and the first appearance of *Naiades* in tertiary beds; the large number of branchiate Gasteropoda up to the time of the tertiary period, when *Limnææ* and *Helices* made their first appearance; the earlier development of Crustacea with more uniform joints, and the appearance of insects of the tribe of Scorpions anterior to that of the winged families, among which the Neuroptera seem to be the first to increase in number, and the late occurrence of the sucking tribes in tertiary beds, and there will be no doubt left that the gradation of structure is intimately connected with the extension of continental lands, and that the present connection of animals with the surrounding media in which they live agrees also with their natural gradation. If we would study the natural relations between animals and the media in which they live, we could not begin with better prospect of success than by investigating minutely the different families of Vertebrata separately, rather than the whole classes of this great type. For though it is at once apparent that the class of Fishes as a whole is entirely aquatic, and stands at the same time lowest among Vertebrata, as soon as we pass to the investigation of the Reptiles we find aquatic and even marine types among Turtles, which rank much higher than the whole order of Batrachians, which are almost entirely fluviatile; and we find again marine and fluviatile types among Birds and Mammalia, the highest of all Vertebrata. These facts show most conclusively that an organization as high as that of the Vertebrata —introducing a mode of existence so independent of the changes of the seasons throughout the year, so durable as to last for numbers of years (whilst among Invertebrata, and especially among Insects, but also among many other animals of lower type, there exists the most intimate connection between their development and the course of the seasons); we say these facts show, that with such animals which are placed so far above the influence of physical conditions, their connection with the circumstances under which they live is much weaker, so much so that internal structure overrules greatly the foundation of those connections which are so intimate in lower animals, and reduces their limits to subordinate connections between members of the minor groups. While in the class of Fishes—the lowest—the whole type is organized in such a manner as to make it uniformly dependent upon one of the natural elements in which animals live, the three other classes present most diversified combinations, there being marine, fluviatile, and terrestrial or aërial types in these classes, under the development of as many structural types, differing almost in the same degree when contrasted with each other, and so much, that the aquatic Mammalia even in their marine types, or the marine Turtles, differ as much from each other or from Birds as they agree with their respective freshwater or terrestrial types. These discrepancies between the great types may be owing to other motives in the plan of creation than those to which they are here ascribed. The apparent anomalies between some of the articulated types may also be the results of combinations different from those with which they are connected above. But whether these views are correct or not, I have no doubt that the study of the phænomena which I am now contrasting, cannot fail to lead finally to a more correct appreciation of the natural relations which exist between animals and the media in which they live, than the vague views which have prevailed lately, from want of investigation of the subject rather than from an especial view taken of it. I am far from supposing that in every instance I have hit at the outset the true view; I shall be satisfied to have called forth direct investigation upon this question, and led the way in a field which promises such ample reward.

Before entering into a special investigation of the natural relations of Vertebrata and the surrounding media, it may not be out of place to call attention to some collateral facts which will appear particularly prominent in the type of Vertebrata, but which have already their value in the study of the lower types. I allude to the relative bulk of animals of the same type living in different media. We can derive no impression upon this point from the investigation of the Radiata, as they are all aquatic, and almost entirely marine. But the difference is already marked between the Mollusca if we contrast their marine and their fluviatile and terrestrial types within the limits of their natural secondary groups. Among the Acephala, if we consider the Lamellibranchiata, we cannot fail to observe that the marine representatives are as a whole, and taking into consideration the proportional number of their genera and species, of larger size and greater weight than the fluviatile. We have nowhere such gigantic, bulky and heavy freshwater bivalves, as are many of the marine shells, and we need only compare the large *Chamas* or *Tridacnas* and *Hippopus*, the gigantic *Pinna*, even with the largest of Anodonts; and again the numerous species of *Cyclas*, &c., with the smaller marine bivalves, among which we find but few species of so minute types. Again, among Gasteropoda how much larger are most of the Univalve marine shells, such as *Dolium*, *Strombus*, *Voluta* and others, than even the largest freshwater *Ampullariæ* and the whole lot of freshwater and terrestrial Pulmonata, among which latter we have absolutely the smallest of all Mollusca in the innumerable varieties of *Pupa* and other genera! We reckon in this type of Gasteropoda the minute species by hundreds, while there are exceedingly few of really small size among the marine ones, and the greater number are even universally above the medium size of the larger fluviatile and terrestrial types.

Among the Articulata the same rule obtains, and here we may compare classes with classes, even in their different stages of growth. Are not the Worms, taken as a whole, larger animals than the Caterpillars? Do we not find among marine Worms by far the largest types? We need only remember the gigantic *Eunice*, or even the parasitic Tape Worms, to be satisfied of the fact. Are not the Crustacea as a class composed of types exceeding far the largest of Insects even with their wings spread? Are not the marine Lobsters many times larger than the freshwater Crawfishes? A minute investigation of the details of this numerous class might lead to very interesting comparisons, which however would be out of the way in this general sketch.

I shall mention only a few facts to show that these comparisons might even be traced between the different stages of growth of these animals. It must be, for instance, a matter of surprise to see that the body of so many Insects is smaller in their perfect state of development than as a pupa; and that again this is smaller than that of the larva, though the larva be after all only the younger state of the pupa, and the pupa the younger state of the perfect Insect. But in the same ratio as we find so frequently throughout the animal kingdom that the lower condition of structure and development of a type is manifested in a more bulky body, so we find among Insects, that their earlier state of metamorphosis which is developed under inferior circumstances, reaches its final growth in a more bulky body than that of following periods during which their successive moultings and the transformations of the substance of the body take place; the greatest size which the larva acquires is first reduced in its transition into a chrysalis, and this again is reduced in its transition into a perfect insect,—the development of wings only leaving them seemingly of greater size when their surface is extended, though the bulk as a whole be reduced. Weighing these animals in these different states of development will satisfy the most incredulous of the reality of what is here stated, should the appearance have deceived him before. A Silkworm when it begins to spin is much heavier than the chrysalis, and this heavier than the perfect Moth. Without directly weighing these animals, we might be satisfied about this fact if we consider the amount of silk which is thrown out by the latter, and the amount of fluid which is discharged by the Moth even before it rids itself of its load of eggs and sperm to enjoy the last moments of its complete maturity.

If we now allude to the Vertebrata we shall find very similar facts, and perhaps in the animals to be mentioned, inducements for the discovery of curious unnoticed connections. And here again we should be cautious, for reasons alluded to already above, not to take the classes as such, but rather to consider their different types separately; for the class of Fishes as a whole cannot be said to contain the largest Vertebrates, nor even to afford any support to the view that aquatic animals in general are larger than terrestrial, for we find proportionably a much greater number of large species among Mammalia than among Fishes; we find a greater number of large terrestrial Reptiles than of aquatic ones. But if we review the classes separately, and consider their secondary groups by themselves, we find that the rule holds good, but bears, at the same time, most interesting reference to the order of succession in geological times, as the respective types of any given group are the larger in the present period, whether terrestrial or aquatic, for being representatives of families which had numerous representatives in older periods. Among Fishes, we find the largest in the family of Sharks and Skates, Sturgeons and Garpikes, the first of which are exclusively marine, the second marine and fluviatile, the third entirely fluviatile; but the three types are either exclusively representatives of families largely developed in former geological periods, or so connected with extinct types as to show that this connection has influenced their development.

Among Reptiles we find the largest in the family of Turtles among their marine representatives; among the Lizard-like in the fluviatile Crocodiles; among Batrachians in their aquatic families.

In Birds, the aquatic families, Pelicans, Geese, Ducks, &c. bear a much larger proportion of heavy bulky forms than any terrestrial families; and if the Ostrich should at once occur as a striking exception, let us not forget that the giants of this family are known in a fossil state, exceeding far their living representatives.

Among Mammalia, we have the Whales as the largest class; and if we should be reminded of the great size of terrestrial Pachyderms, let us not forget that Pachyderms were the prominent type of Mammalia during the tertiary period. In connection with these facts it might be shown that natural families throughout the animal kingdom are constructed within limits of size which do not admit of great differences. A comparison of Cetaceans with Rodents, of Ruminants with Bats, of Passerine with Gallinaceous Birds, of Sharks with Herrings, of Cod-fishes with Blennoids, of Cuttle-fishes with Pteropods, of Crabs with Entomostraca, &c., might easily satisfy the most sceptical that there are natural limits assigned to certain combinations of structure and the material bulk of the animals in which they are manifested.

After this digression let us return to our consideration of the natural connection of the secondary groups of Vertebrata with the elements in which they live.

Though the class of Fishes is entirely aquatic, we have among these animals a greater number of marine types, and some which are partly marine and partly fluviatile, or, at periods, marine, or, at periods, fluviatile; and others which are entirely fluviatile or almost so. And though, at present, it is not plain that fluviatile types on the whole are superior to the marine types, we should not lose sight of the circumstance, that the only living Sauroids, which have so many characters by which they may be connected with the class of Reptiles, and considered as the highest among Fishes, are entirely fluviatile; both *Lepidosteus* and *Palypterus* occur only in fresh waters; some of the *Lepidostei* only are known to reach the mouths of rivers emptying into the sea. And though the families of Sharks and Skates are chiefly marine, numbers of them, especially of those types of Skates which have numerous fossil representatives during the tertiary period, such as *Myliobatis,* are known to ascend freely the rivers in tropical regions. Among Cyclostomes, the lowest type, *Branchiostoma,* is marine, *Petrostoma* proper being both marine and fluviatile: the higher type of *Ammocœtes* (for we must consider *Ammocœtes* as higher, inasmuch as the division of the lips indicates a tendency towards a formation of a distinct upper and lower jaw) is exclusively fluviatile. The Goniodonts, which from their affinities to Sturgeons rank higher than the Siluridæ, are exclusively fluviatile, whilst there are some marine types among the latter. Among Percoids we find in fresh water a larger number of those in which the two dorsals are distinct, a character making them eminently superior to the forms with undivided fins. For the same reason we should consider the Sparoids inferior to the Percoids, their dorsals being not only generally undivided, but even covered with scales. Among the Eels, those destitute of all fins are exclusively marine, those without pectorals also exclusively marine, and we may fairly consider the freshwater Eels as the higher type of the family on this ground. If there is any natural connection, as I have attempted elsewhere to show that there is, between Scombroids and Scomberesoces, and Esoces proper, it becomes plain at once that the latter are the higher from the abdominal position of their ventrals, and they are a fluviatile family. Even taking the Cycloids as a whole, we find among them the lower families of Thoracici and Jugulares, as the families of Cod and Scombrides, chiefly marine, whilst the families of Salmonidæ and Cyprinidæ are chiefly fluviatile. Among the Gadoids we have those with many vertical fins, as the true Cod, marine, while those in which the dorsals and anals are reduced, such as the genus *Lota*, are fluviatile. Even among the Salmonidæ in the widest extension which this family had formerly, we find the Scopelidæ with the inferior structure of their jaws chiefly marine, while the Coracini and true Salmonidæ are chiefly fluviatile. Everywhere, in fact, in each minor group, the fluviatile representatives show characters indicating their superiority over their marine representatives. Whatever exceptions might be found to this law, which in the outset appears so general, I have no doubt will lead at some future time to the discovery of some other principle as yet unknown.

The class of Reptiles is one of the most interesting in the point of view under consideration, and each of their types exemplifies in itself the law of the intimate connection between animal types and the media in which they live in the most striking manner, inasmuch as here the gradation, which might be inferred from structural and embryological evidence, agrees most fully with the gradation of the elements in which they live. Among Batrachians we have chiefly fluviatile and terrestrial families. The Ichthyodes, or Batrachians with permanent branchiæ, are all aquatic, and acknowledged the lowest in the class. Some of their lowest representatives occur even in brackish swamps, and, as soon as attention is called to this subject, it cannot fail to be perceived that the Frogs with their more or less palmate fingers and their more aquatic habits, rank lower than the Toads with their divided fingers and terrestrial mode of life. Among Ophidians we have chiefly terrestrial families, and only a few marine and aquatic ones; but who can fail to perceive that the marine Serpents with their flattened tail are inferior to the terrestrial genera, and that among these it is a well-known fact there are some with rudimentary posterior extremities which assign them a superior rank? Some objections might be drawn from the consideration of the Saurians, among which the highest type, the Crocodiles, are chiefly fluviatile; but it has elsewhere been shown that Crocodiles are not truly Saurians of the same type with our Lizards, but modern representatives of a large family which was very numerous in former geological periods, when their first representatives were marine types provided with fins instead of distinct fingers; so that, far from being an exception, the Crocodiles of our days, which are either fluviatile or terrestrial, must be considered as the highest representatives of that almost extinct type of Reptiles, the earliest forms of which were marine, followed by freshwater. Finally, among Chelonians the gradation in connection with the natural elements in which they live is most striking, for the inferiority of marine Turtles is as plain as it can be, not only in the form of their organs of locomotion, but even in the peculiarity of many of their internal organs, especially of their ovaries, which contain eggs almost as numerous as those of Fishes. Next we place the freshwater Turtles with palmate fingers, and highest, terrestrial Testudines with their short undivided fingers. So that we have in this class, with its various marine and freshwater and terrestrial types, not only a full illustration of these laws, but so intimate a connection between gradation of structure and mode of living in various elements, as to lead to the conviction that the mere mode of living might in many instances be almost as safe a guide to ascertain the natural gradation of types, as the study of their internal structure.

Ever since the class of Birds has been the object of regular investigation, their aquatic types have been considered as inferior to the terrestrial ones, and among the former, those which live entirely an aquatic life are decidedly the lowest. They are so, not only on account of the more imperfect development of their legs, which preserve throughout their embryonic form, but also in the less extensive development of their wings, in the more scale-like form of their feathers, and the greater number of eggs they lay, and the less care they take of their young, which are hatched in a state of development in which they are already prepared to provide for their own food. The same is the case with the Gallinaceous and the Wading Birds, which, though more advanced in many respects, are still inferior to the climbing and Passerine Birds in this respect, having a heavier flight, if they fly at all, and living a more terrestrial, and even aquatic life; the Wading Birds coming nearer in this respect to those with palmate fingers, and the Gallinaceous Birds, as well as the Ostriches, having a more terrestrial mode of life; whilst the Passerine Birds rank higher in all these respects, feed their young, and take care of them for a longer time, and live almost exclusively an aërial life, few of them having aquatic habits, and those being in their respective families by their form as well as by their mode of life, decidedly inferior to their loftier relations.

The classification of Birds as a whole is still so imperfect, though their minor groups are well understood, that many important relations in these respects must necessarily be more or less concealed as long as their primary divisions are not better known; so that we may expect many interesting hints from further investigations in this view.

The class of Mammalia is not only the most varied in the forms of its members, but also in the diversity of their mode of life; nevertheless this diversity is connected by the most intimate relations of structure. The Whales are as much mammalian by their internal organization as the most exclusively terrestrial quadrupeds. True Cetaceans constitute a natural family, all the members of which are exclusively marine, and no one of them even fluviatile—for the Sirenidæ must be considered as entirely distinct from true Cetaceans; and these Cetaceans, at the same time that they are so exclusively marine, are also the lowest type of Mammalia, not only from the imperfection of their extremities, of which there is only one anterior pair, and from the want of hind-legs, but also from the extraordinary development and bulk of their muscular tail, and the development of a caudal fin, and sometimes even a fin-like fold of the skin upon the back. If it can be shown that the Sirenidæ are an aquatic type of a larger group embracing Pachyderms, the direct relation of their structure and mode of life will be at once obvious, since Sirenidæ are either marine or fluviatile, while true Pachyderms are terrestrial: and should we not be justified in considering the subaquatic Hippopotamus as inferior to its more terrestrial relatives of the genera Rhinoceros, Elephant and Horse? Are we not to consider the Ornithorhynchus, with its palmate hind-legs and spur, as inferior to *Echidna*? Are not the palmate Rodentia inferior to the terrestrial and arboreal types? Are not the aquatic Shrews inferior to the arboreal Insectivora? All these secondary questions will receive, in future, due attention, and will no doubt be satisfactorily settled. But there are families in which we can already see our way and arrive at precise conclusions. Among Carnivorous Mammalia we have three very distinct types: the Pinnipoda or Seals; the Plantigrada or Bears; and the Digitigrada, Dogs and Cats. Now even if objections were raised against the association of the Walrus with the common Seals, there can be no doubt of the inferiority of the latter when contrasted with Plantigrada and Digitigrada. Their short fin-like legs, their clumsy body in connection with their aquatic marine life, assign them a lower position, and the Plantigrada must be considered as intermediate between them and the Digitigrada. Now among Digitigrades, even if we take isolated genera, we are led to assign to the species with aquatic habits an inferior position among their nearest relatives. The Polar Bear comes decidedly nearer the Seals in all its habits than any other species of that genus, and on that ground should be considered as inferior to the terrestrial species. Again, the others, with their palmate fingers, rank lower than their terrestrial relatives: and we may even find that such considerations will hold good among the varieties of one and the same species; for we have varieties among the Digitigrade Dogs in which the fingers are palmate, a character which is derived from the imperfect development of their legs, preserving throughout life their embryonic form; and these varieties among Dogs are the most playful and at the same time most aquatic in their habits, preserving in their adult state characters of the young and habits of the lower types,—this playful disposition being universal even among the most ferocious of the Cat tribe. I shall abstain purposely from tracing these comparisons higher up among Monkeys, and in the human families, from fear of alluding to exciting topics; but leave it to the philosophic observer to consider how far the idea of an aquatic Monkey is compatible with the high position which these animals hold in the class of Mammalia; and how curious it is that in the human family there are races which differ so much in their natural dispositions, mode of life, habits, and adaptation to higher civilization; and how closely these natural dispositions are connected with apparently insignificant peculiarities of structure.

Upon reviewing the facts mentioned above, and the inferences derived from the facts, no impartial observer can in future deny the importance of the study of the natural relations between animals and the media in which they live; and the close connection which exists between them and the gradation of their structure. But this being the case, it must be a matter of surprise that the views so long entertained of the importance of this connection, which led earlier naturalists, generally, to the classification of animals according to the media in which they live, should have been so completely abandoned, and even considered of no value at all in systematic classification. For my own part I have no doubt that this negative result has arisen from the circumstance that all aquatic animals were brought together, in these earlier attempts, without reference to their structure or organic development, while we have found that structure is the ruling principle, and that natural connection with the element is the secondary motive by which these connections are influenced. Indeed, aquatic animals, though agreeing in many respects, and though provided with analogous apparatus to perform the same functions, have, in different types of the animal kingdom, a very different plan of structure, and very different organs to perform the same functions. I shall not enter into a detailed illustration of these differences, as I have alluded to these facts in other papers, but only recall here the great difference which exists in these connections between the different types.

Among the Radiata, which are all aquatic, we find even that the adaptation to the liquid element is introduced in a plan of structure which is widely different from the plan of structure prevailing in the Mollusca, though they also are chiefly aquatic; and that even the terrestrial types of Mollusca present, for adaptation to an aërial mode of life, only a modification of their aquatic types. The same may be said of Insects, in which the structure is mainly that of the Crustacea and Worms, which are permanently aquatic types, presenting simply a transformation of those peculiarities of structure which enable the lower classes to live under water, such as will enable them to rise in their adult state into an aërial condition of existence. Among the Vertebrata the case is very different. The type is constructed for a terrestrial and aërial mode of life; even their aquatic representatives have rudiments of the apparatus, which acquire the highest development in the complete terrestrial types, and most of their aquatic types are truly aërial animals living in water, just as Insects are aquatic types adapted to the air. Let us only contrast, in this respect, Cetacea with common Articulata. They have a pulmonary mode of life as much as man; they have the same mode of reproduction; only their form enables them to dive under water and to dwell permanently in the sea; but, for all their structure, they are truly aërial animals. And this is equally the case with Birds and Reptiles; and with the Fishes I am prepared to show that there is no difference in this respect. For though, in their perfect state, Fishes are exclusively aquatic, they are completely built upon the same plan with those aërial classes of Vertebrata. The difference here is only this, that the branchial apparatus, which exists simultaneously in Reptiles, Birds and Mammalia, in their imperfect condition, is developed to be a permanent organ of respiration, while it is reduced and disappears in the higher classes in proportion as the lungs acquire a greater development. In Fishes, on the contrary, the homologue of the lung remains functionally and organically in a rudimentary state, as an air-bladder. But all classes have both apparatus in an inverse state of development, and thus Fishes are as fully constructed on the plan of the higher Vertebrata, as the aërial Invertebrata are on the plan of their aquatic types. But the circumstances that Fishes have the double type of respiratory organs, and that the pulmonary one, which by no means exists in any Invertebrates, as I have shown elsewhere, but throughout the Vertebrata including Fishes, show that the whole type of the Fishes have to be viewed in the same light as Reptiles, Birds and Mammalia, and must therefore be only considered as a lower condition of these aërial types, and not the latter as a higher degree of the former. For tracheæ of Insects, and lungs of Spiders, are only modified branchiæ of the type of Articulata, just as much as lungs of Pulmonata are modified branchiæ of the type of Mollusca, while gills and lungs in Vertebrata are parallel systems both coexisting in all of them, and only acquiring respectively a different degree of development in each of their classes. These facts which I have traced in other papers through a special comparison of all the homologies of the different types of respiratory organs in Vertebrata, Articulata, Mollusca and Radiata, show plainly, that the aquatic, marine, or fluviatile, and terrestrial mode of life are introduced throughout the animal kingdom by special adaptations of peculiar different systems of organs performing analogous functions; and that the failure of introducing the consideration of the adaptation of animals to the media in which they live, in the plan of their classification, must be ascribed to the fact that these analogous structures were in the beginning considered as identical features in the organization. But taking in future into consideration all these peculiarities, we shall rapidly proceed towards the full understanding of all the relations between the gradation of animals and the media in which they live, as far as they are not yet fully understood.

An extensive review of the Vertebrata might long ago have led to such conclusions; but before they could be considered as a general law ruling the whole animal kingdom, it was necessary that they should be treated in a special manner through the innumerable types of Invertebrated animals; and we have seen that this agreement is as close and as complete throughout the types of Radiata, Mollusca and Articulata, as it is plain among Vertebrata; and the slight difficulties to which we have alluded, must probably be referred to the present state of our knowledge respecting some of them, rather than to a departure from this law in any of their types.

XV.—*On the genus* Habrothamnus. By John Miers, Esq., F.R.S., F.L.S.

Habrothamnus.

I take this opportunity of cancelling the suggestion made on a former occasion, in regard to the validity of this genus (Lond. Jo. Bot. v. 151; and Ill. So. Am. Pl. i. 75). From an examination of dried specimens, I could detect no difference in its floral structure from that of *Cestrum*, upon which a generic distinction could be drawn, and there seemed no other alternative, but to unite the whole group, as a separate section of *Cestrum*. I have, however, lately had an opportunity of examining a plant of this genus in a living state, and can here detect some slight differences, which are not distinguishable in dried specimens. In *Cestrum*, the æstivation of the corolla is induplicato-valvate, the edges of each lobe being partly turned in upon both margins, and closely applied and adherent to those of the contiguous lobes (see Lond. Journ. Bot. vii. 58; and Ill. South Amer. Plants, i. 126): but in *Habrothamnus*, each lobe has its margins completely turned in, so that they adhere, in a somewhat conduplicate form, firmly to one another, and are only connected with those of the adjoining lobes by apposition, not by adhesion; although the margins of the several lobes thus all converge towards the axis, each lobe is respectively free, and not valvately or induplicately connected with the adjoining lobes, as in *Cestrum*; this peculiar mode of æstivation, which is only a modification of the plicative or valvate, so peculiar a feature among the *Solanaceæ*, I propose to distinguish by the name of *implicative*; it is somewhat analogous to the volutive form of *Anthocercis*, a figure of which is shown in 'Ill. South Amer. Plants, i. 170,' but there the margins are respectively imbricated or overlapped, which is one of the principal distinguishing features of the *Atropaceæ* in the Solanal alliance. Another difference is observable in the structure of the stigma, which is not exactly that of *Cestrum*. In *Habrothamnus*, the style is a little thickened at its summit, and slightly infundibuliform, being terminated by a thin and distinct, almost entire margin, slightly bilobed; this orifice is closed by a large, spherical, and slightly bilobed green stigma, covered with numerous spiculate papillæ, with a hollow in the centre communicating with the channel of the style. In *Cestrum*, the style is terminated by two lamellar lobes, whose inner surfaces are covered with stigmatic glands, forming a somewhat bilobed capitate head. These differences in structure are small, and not to be discerned in the dried state, and therefore of themselves scarcely afford sufficient ground for a generic distinction; but combined with a very peculiar habit, easily distinguishable from that of *Cestrum,* they justify me in recalling the recommendation suggested, as above quoted, and in reinstating the genus, as proposed by Mr. Bentham, with the following amended character: not having seen the seed, I copy the description of it and the fruit wholly from that of Endlicher. 'Gen. Pl.' 3867. In coming to the above conclusion, it ought to be stated at the same time, that *H. tomentosus,* with its small calyx and the paucity and smallness of its bracts, does not sensibly differ in habit from many species of *Cestrum,* while on the contrary *C. bracteatum* and *C. organense* possess the large involucrating bracts that characterize most species of *Habrothamnus.* As the description and figure given by Kunth, of *Cestrum roseum,* correspond entirely with *Habrothamnus,* I have added it, as another species of this genus, and others may perhaps also be found to belong here.

Habrothamnus, Benth., (char. emend.).—*Calyx* tubulosus, coloratus, 5-dentatus, dentibus acutis. *Corolla* infundibuliformis, tubo imo angusto, summo inflato, ore contracto, limbo brevi, 5-partito, lobis acutis, reflexis, æstivatione implicativa*. *Stamina* 5, inclusa, æqualia; *filamenta* subulata, infra medium tubi inserta, apice subinflexa; *antheræ* ovatæ, 2-lobæ, spiculato-rugosæ, imo dorsi sine connectivo affixæ, utrinque longitudinaliter dehiscentes. *Ovarium* ovatum, apice umbilicatum, breviter stipitatum, stipite glandulo annulari instructo et cyatho (corollæ reliquo) circumdato, 2-loculare, dissepimento medio placentifero; *ovulis* paucis, spermadermis ligulatis suspensis. *Stylus* simplex, apice sub-incrassatus, infundibularis, ore integro sub-2-lobo. *Stigma* sphæricum glandulosum, subemarginatum, spiculoso-papillosum, medio cavum. *Bacca* calyce persistente cincta, 2-locularis. *Semina* pauca, angulata, umbilico ventrali. *Embryo* in axi albuminis carnosi rectus; *cotyledonibus* foliaceis, *radicula* tereti infera.—Frutices Mexicani et Ecuadorenses *sub-tomentoso-pubescentes, pilis articulatis*; folia *alterna, integerrima*; flores *inæqualiter cymosi, aut subfasciculati, bracteis magnis sæpius involucrati,* calycibus *corollis baccisque rubris.*

The species described are the following:—

1. *Habrothamnus fasciculatus,* Bth., Pl. Hartw. n. 369; Trans. Hort. Soc. iii. 1. tab. 1; Bot. Mag. tab. 4183. *H. elegans,* Schweid. *H. purpureus,* Lindl. Bot. Reg. n. s. 15. tab. 43. *Meyenia fasciculata,* Schl. Linn. viii. 251.

* Æstivatio implicativa, nempe lobis singulatim conduplicatis, hoc modo, marginibus sese æque cum contiguis induplicato-conniventibus, nec ut in *Cestro,* marginibus solummodo cum contiguis induplicato-valvatis.

2. *Habrothamnus tomentosus,* Bth. Pl. Hartw. n. 369.
3. *Habrothamnus corymbosus,* Endl. Bot. Mag. tab. 4201; Van Houtte, Flor. ii. tab. 10. *Meyenia corymbosa,* Schl. *loc. cit.* 252.
4. *Habrothamnus cyaneus,* Lindl. Bot. Reg. n. s. Misc. 72.
5. *Habrothamnus paniculatus,* Mart. & Gal., Bull. Acad. Brux. xii. 148.
6. *Habrothamnus roseus,* Mexico. *Cestrum roseum,* H. B. K. iii. 59. tab. 197.

XVI.—*On the effects produced by some Insects, &c. upon Plants.* By JAMES HARDY, Penmanshiel*.

I DO not intend in the present notices to offer any remarks on the general subject of the effects of the Annulosa upon vegetation; this is a theme too important to be disposed of cursorily, and to follow it out in detail would require a treatise. I design merely to make a few statements relative to some observations recently made on some points, where botany and entomology may be said to be conterminous and capable of affording mutual illustration.

1. *Vibrio Graminis.*

On the 28th of May I noticed that the leaves of the sheep's fescue grass (*Festuca ovina*), and if I recollect aright, of some other grasses, growing close upon the sea-coast, were affected with several purplish swellings, of which I brought away examples for examination. They only appear a little thicker than the leaf in whose substance they originate, and according to their length are squarish or oblong, slightly roughish, stiff and rounded like a piece of wire, and occupy either the entire breadth or are confined to the edges. At first, from finding in the interior only bluish or purplish granules, I felt disposed to attribute them to a fungus; till opening others more carefully, I observed several minute Annelides, coiled up in channels winding amongst the granules. These I subsequently found were *Vibriones,* of which one species, *Vibrio Tritici,* as is now well understood, produces the disease called "Ear Cockles," or "Burnt Corn" in wheat. Others of somewhat similar character swarm in decaying potatoes and turnips, and the "eel" of vinegar is an example familiar to microscopic amateurs. Some of the knots contained only a single occupant, but one of the more elongated ones had about half a dozen of various sizes. The worms are white, almost transparent, very minute and slender, just visible to the eye,

* Read before the Botanical Society of Edinburgh, July 11, 1850.

pointed at each end, the posterior tapered for a very considerable space, contracting as it were by three separate gradations till it terminates in a point; the head end is something like that of an eel, bluntish, and gradually widening out for a considerable way backwards, where there is a greenish annulus, formed perhaps by the commencement of the intestines, as behind this there is a cloudiness all along the middle. I could not perceive the oral opening, but behind the point there is a dusky spot connected by a line with the interior. The young ones are immaculate white, but the old contain a profusion of greenish granules, which may be either the eggs or the undigested food. Although not indicated externally, the body is evidently composed of a series of rings which separate the internal contents; as one in which the skin happened to be ruptured was emptied in a manner corresponding to this structure. The movement of the particles at the wound was a rapid rush, which extended itself by degrees upwards; but there were intervals where the current seemed to be impeded as if by constrictions, upon passing which it again flowed freely. The worms placed in moisture agitate themselves to and fro, but are usually rather inactive. The length is about 1 line. The species is probably new, and may be called *Vibrio Graminis.*

According to the observations of Mr. Bauer, *Vibrio Tritici* is originally introduced, in the young or egg state, into the germinating seed-corn, and after a succession of generations during the passage, is conducted by the propulsion of the circulating fluid up higher and higher, till it reaches the ear. Whether this be the means by which the present species gains access to the position which it occupies, I cannot determine. It is by no means uncommon, and as the parts affected by its presence dwarf the blade, interfere with the healthy flow of the sap, and will probably soon decay, it may be regarded as somewhat prejudicial to the coast pastures, which are principally composed of the grasses that it attacks. The granules with which the knots are filled give out a brown tincture when moistened.

2. *Cecidomyiæ of the Willow, Rose, and Rock-rose.*

It has recently been discovered by the German naturalists, that several of the galls which the Cynipides originate upon the leaves of trees produce two different forms of gall-fly; it has not however, so far as I am aware, been remarked, that the galls formed by the Dipterous *Cecidomyiæ* may in like manner be colonized at one and the same time by distinct species. The rose-gall upon the summits of willow shoots has attracted the attention of most observers, and DeGeer has briefly indicated the fly (*Cecidomyia salicina*), which he reared from the red larva which occasions it, as black with brown wings. During the present spring I met with one of these productions upon the *Salix cinerea*, tenanted by about eight or nine pupæ, which became flies on the 22nd of May, and these were at once seen to be not all of one species. The smallest and most numerous had the wings dusky and very pubescent, with the antennæ 17-jointed in the male and 16-jointed in the female, and were from $\frac{3}{4}$–1 line long, and the expanse of the wings 2 lines. The second, of which I only obtained a single male, was considerably larger, had the antennæ 22-jointed, the wings ample, clear, with only a few scattered hairs. Length $1\frac{1}{2}$ line, expanse of the wings 4 lines. I have not been able to identify these with any described species, and have named the first *C. saligna*, and the second *C. Cinerearum**. The *Cecidomyia salicina* of DeGeer, according to Macquart's account, has about twenty joints in the antennæ, and has the wings hairy and slightly obscure. Length 2 lines. The woody oblong gall of the willow likewise produces a *Cecidomyia*, which I venture to term *C. Gallarum-Salicis*. If I mistake not, from an examination of dried specimens, the antennæ are 20-jointed in the male and 19-jointed in the female, and the wings are slightly dusky and grayish pubescent. The length is $1\frac{1}{2}$ line, and the wings are 3 lines in expanse. Bouché, on the other hand, describes from this gall an insect which he likewise designates *Cecidomyia Salicina*, as 1 line long, with brown wings. There is thus a great confusion of synonyms on this topic, and it is possible from the observations which I have just recorded, that this may have arisen from insects really distinct having passed under the review of different observers. Mr. Westwood has recently brought forward another species found in the young twigs of *Salix viminalis* and *S. rubra*. This he names *C. viminalis*, and in it the antennæ are 17-jointed in both sexes, and the wings are colourless with the hinder margin strongly fringed.

I have also recently remarked an instance of two species of gall-midges acting in concert on roses. The leaflets of various wild species of these are tenanted in the centre by companies of larvæ which cause this part to thicken and blister on each side of the midrib, and the leaflet being thereby prevented from expanding, protects, as if in a pod, the little community. These larvæ have the characters of those of the *Cecidomyiæ*, viz. are spindle-shaped or subelliptical, only slightly convex, with distinct subcompressed lateral margins, the head end attenuated to a point, with a pair of horn-like bristles behind it, a dusky spot visible above and beneath, and a dagger-shaped polished mark

* *Cinereæ*, a sectional term applied by Mr. Borrer to the sallows.

on the fore-part of the breast; and the hinder end is subtruncate, slightly tuberculate. The most numerous is orange mottled with yellow; and the other is white, smoother, more minute, with the hinder apex trituberculate: both are sparingly bristled across the segments. The first is scarcely distinct from another yellowish grub often found on the underside of the leaves of garden roses affected with mildew, which appears to be engaged in devouring the minute fungi in which the disease consists. They descend into the soil to undergo their changes, and I doubt if I shall succeed in rearing them. About the time of their first appearance, however, I met with two species of *Cecidomyiæ* frequenting the infested rose-bushes, of which one, *C. Rosarum*, was occupied in depositing its eggs in the unopened leaflets. They are both undescribed species, and till the contrary is proved, I shall assume that they are the parents of the grubs in question.

To render these remarks more satisfactory, I shall append descriptions of the species to which they refer; which, except in the instance previously specified, are taken from fresh specimens.

1. *C. saligna*; nigro-cinerea; facie, verticeque sericeo-albis; occipite, oculisque nigris; scutello, lateribus, margineque posteriori thoracis subcarneis; pleuris et macula ante bases alarum argenteis; abdomine carneo, segmentis superne transversim nigricante fasciatis (♀); vel nigricante, marginibus posticis segmentorum vix carneis (♂); pedibus subelongatis, argenteo-cinereo-testaceis, tarsis fuscis; alis modice amplis, denigratis, dense griseo pubescentibus et fimbriatis, nervo costali nigro, angulo nervi furcati subrecto; antennis brevibus, cinereis, basi subtestaceis, 16-articulatis, articulis duobus primis cyathiformibus, ultimoque ovato exceptis, suboblongis, confertis, pilis verticillatis obsitis (♀); vel nigris, 17-articulatis, articulis, 1mo cyathiformi, 2ndo subrotundato, ultimoque subgloboso exceptis, pedicellato-oblongis, pilis longis fere biverticillatis obsitis (♂); halteribus albis, modice elongatis et clavatis. Long. corp. lin $\frac{3}{4}$–1; alar. exp. lin. 2.

2. *C. Cinerearum*; nigro-cinerea; facie grisea; oculis nigris; thoracis lateribus, nonnisi pleuris, maculaque ante bases alarum argenteis, concoloribus; dorso subelevato; abdominis dorso nitido piceo, lateribus obscurioribus; pedibus prælongis, pallide testaceis vel carneis, argenteo-micantibus; alis amplis, subhyalinis, sparse cinereo-pubescentibus et fimbriatis, nervis brunneis, subtenuibus, angulo nervi furcati subrecto; antennis nigris, 22-articulatis, articulis duobus primis crassioribus, subtransversis, reliquis, ultimo elongato-ovato excepto, pedicellato-subglobatis, introrsum longe, extrorsum breviter discreteque pilis verticillatis obsitis; halteribus elongatis albis, capitulo subdilatato vix fuscescente. Long. corp. lin. $1\frac{1}{2}$; alar. exp. lin. 4. ♂.

3. *C. Gallarum-Salicis*; nigro-cinerea; scutello piceo, concoloreve;

pleuris, ventre, lateribusque abdominis argenteis; pedibus elongatis cinereis, argenteo-micantibus; alis subamplis, subdenigratis, dense cinereo-fimbriatis, nervo costali crasso, obscuro, angulo nervi furcati rectiore; antennis nigris, 19?-articulatis, articulis confertis, dense setigeris, duobus primis, ultimoque exceptis, subcylindricis (♀); vel 20?-articulatis, duobus primis, ultimoque elongato oblongo-ovato exceptis, pedicellato-oblongo-subquadratis, confertim pilis verticillatis obsitis (♂); halteribus albis, capitulo dilatato. Corp. long. lin. $1\frac{1}{2}$; alar. exp. lin. 3.

4. *C. Rosarum*; nigricans, minuta, nitida, vix subcinereo micans; thoracis margine posteriori, alarum radicibus, scutelli apice, metathoraceque interdum carneis; abdomine carneo, segmentis ad bases nigricantibus; ventre notis nigris asperso; pedibus elongatis gracilibus, albo-argenteis, subcinereisque variantibus; alis mediocribus abdomine brevioribus, denigratis, crebriter atro-cinereo pubescentibus et fimbriatis, nervo costali, primoque longitudinali, subnigris, angulo nervi furcati subrecto; antennis brevibus, gracilibus, nigris, 14-articulatis, articulis subcrebre pilis longis verticillatis obsitis, 1mo cyathiformi, 2do rotundato, 3io ovato breviter pedicellato, succedentibus oblongo-ovatis, confertis, ultimo tamen breviter ovato; halteribus albis, modice elongatis et clavatis. Long. corp. lin. 1; alar. exp. lin. 2. ♀.

5. *C. rhodophila*; pallida, minuta, gracilis; capite atro; thoracis dorso fusco-cinereo, lineis tribus pilorum griseorum notato, margine posteriori, scutello, metathoraceque flavidis, subcarneisve; abdomine curtato pallide flavo; pedibus elongatis, gracilibus, subflavis, extrorsum cinerascentibus; alis sublatis, hyalinis, purpureo-iridiscentibus, subtiliter minus confertim pubescentibus et fimbriatis, nervo costali, primoque longitudinali distinctis, subdenigratis, angulo nervi furcati subacuto; antennis nigris, basi flavidis, gracilibus, 18-articulatis, articulis, 1mo et 2do brevioribus, crassioribusque, subcyathiformibus, succedentibus cylindricis, gradatim longitudine et latitudine decrescentibus, ultimo ovato, breviter discreteque pilis verticillatis obsitis; halteribus albis. Long. corp. lin. $\frac{1}{2}$; alar. exp. lin. $1\frac{1}{2}$. ♀.

Obs. Mas adhuc exilior evasit.

About the 2nd of July the leaves at the summits of the twigs of *Helianthemum vulgare*, in this vicinity, were collected into bunches, but not so firmly compacted as those of the sallow. At the bases of the leaves numbers of the larvæ of a *Cecidomyia* were congregated, to whose operation the deficient extension of the shoots was owing. The grubs were narrow, slightly orange, with the centre more dusky, somewhat truncate, and quadrituberculate behind; the attenuated anterior end with a pair of bristle-like horns and a dusky spot; a testaceous dagger-like line on the breast, and a few hairs on the segments, with five or six apical ones. Length 1 line. From these I reared a single specimen of the midge, which may be named,

6. *C. Helianthemi*; ochracea, minuta; oculis brunneis; thorace subflavo, atomis strigisque fuscis variegato; scutello carneo; facie, pedibus, antennisque flavis, his 14-articulatis, articulis, 1mo et 2ndo brevibus, ultimo subelongato, ceteris angustiore, reliquis pedicellato-subcylindricis, capitulis subcylindricis versus bases subcoarctatis, pilis longis biverticillatis obsitis; alis mediocribus, subalbido-flavidis, pallide nervosis, subcinereo-maculato-fasciatis, exitibus fasciarum maculas 7 cinereas marginales efficientibus, angulo nervi furcati subacuto; halteribus albis, capitulo modico. Long. corp. lin. $\frac{3}{4}$; alar. exp. lin. $1\frac{1}{2}$. ♂.

Obs. Habitu *C. bicoloris*, sed abunde differt; a *C. punctipenni*, Meig., numero articulorum antennarum minore, facile dignoscitur.

3. *Spotting of the leaves of Grasses, &c.*

I have often been unable to account for the suddenness with which the leaves of *Ranunculus repens*, and of many grasses (*Triticum repens* and *Alopecurus pratensis* being of the number) growing by the sides of walls, become whitened in minute specks and irregular lines all over the upper surface, as if the colour had been extracted from them, or had left some cells by a kind of elective preference for others. I have recently found this to be occasioned by a small dusky red-legged mite, which harbours under stones, but comes out in the sunshine in immense swarms to feast upon the foliage. Owing to the numerous mouths at work, large patches, especially in the grasses, are speedily drained of their sap and become quite dead or blighted. The mite is not described in any accessible work on the Arachnides. Dr. Johnston considers it to be a *Rhyncholophus*, but that the structure of the fore-legs indicates an affinity with *Bryobia*. From *Trombidium* it differs, he observes, in the eyes being sessile and on the shoulders. I have named it *R. haustor*, and the following specific character may serve to distinguish it:—

R. subovatus, atro-sanguineus, fronte, vitta dorsali, marginibus elevatis corporis plerumque, pedibusque coccineis; oculis, serieque marginali granulorum rufis; pedibus anticis gracilibus extensis posterioribus duplo longioribus. Long. corp. vix lin. $\frac{1}{4}$.

It occurs likewise upon the leaves of fruit-trees, but the dusky parts are then greener. In autumn it is much darker and more convex. It runs rapidly, agitates its fore-legs like antennæ, sloughs off its skin where it feeds, and leaves behind it an excrementitious deposit that glitters like honey-dew.

4. *Adelges Abietis.*

This insect forms the cone-like excrescences on the spruce-fir. The original matriarch lives outside the gall, remaining all winter in a dormant state at the root of the bud. As soon as the bud swells she revives likewise, and speedily becoming enlarged with the juice imbibed, she lays some hundreds of eggs about her. The bud meanwhile instead of growing in length becomes fleshy, and this fleshiness is communicated to the leaves. The result is an arrested bud, into the recesses of which, the young issuing from the cluster of ova on the outside of it beneath betake themselves, and become soon closed in during the growth consequent on the increased irritation occasioned by their presence in its interior.

From the statement of Linnæus one might infer that he was acquainted with the process of their formation: "Corpus Abietis in ipsis ramorum extremitatibus fragiforme, habet extus supra se et inter squamas foliaceas imbricatas, in sinu squamarum, plurima animalcula parva, e quorum ano quasi lana prominet. Juxta basin hujus corpusculi seu fragi observatur lana major in copia, in qua mater minorum, quæ caussat fragum."—*Faun. Suec.* p. 215. no. 700. edit. 1.

As to the alleged diversity of the species produced by the small rounded cones at the summit of twigs (*Chermes coccineus*, Ratz.), and those from the larger, more fleshy, and more oblong galls arising at the bases, or enveloped in the substance of shoots (*C. viridis*, Ratz.), the greater exposure to the sun is sufficient to give a deeper tint of colour as well as a more rapid evolution to the inclosed inmates. The difference assigned in the structure of the wing-veins quite eludes my detection.

Those arrested individuals that pass the winter on the branches are perhaps the progeny of winged females, which are oviparous. I observe, also, that winged females of two other species are in like manner oviparous, viz. those of *A. Laricis* and *A. corticalis*. M. Macquart had long since remarked this fact in regard to *A. Laricis*, and felt persuaded that it was only the second generation whose winged females are in this condition. He considered it to be a *Psylla*, and being anomalous proposed to form of it a new genus, which, not finding he had prefixed a name to, MM. Amyot and Serville, in attempting to supply the oversight, have called *Cnaphalodes* (Hemipt. 594, 595). The structure however of the larvæ of *Adelges*, as well as that of the mature insect, indicates that it follows the type of the *Coccidæ* rather than either that of the *Psyllidæ* or *Aphidæ*.

XVII.—*Remarks on some British species of* Carex. By W. O. Priestley, F.B.S.E.*

Having been engaged studying the British Carices for some time past, and having made some observations which may be

* Read before the Botanical Society of Edinburgh, June 13, 1850.

interesting, I have been induced to lay them in as brief a manner as possible before this Society. I have had my attention particularly directed to a mode of arranging them, by which they might be more correctly studied, and with greater ease. It is however by no means an easy matter to form divisions which will answer this purpose. The number of male and female spikelets, the arrangement of them on the stem, their being erect or pendulous, stalked or sessile, bracteated or ebracteated, are very variable characters, and a slight difference in situation may cause many and altered forms of the same plant. The most stable characters I believe will be found in the fruit,—in its form, nerves, and position on the spike, and I think so well marked are the differences, that a person familiar with these might recognise three-fourths of our Carices by the fruit alone. Still, this is not universal; there would be great difficulty for instance in distinguishing the fruit of *C. remota* from that of *C. axillaris*, and some of the intermediate forms between *cæspitosa* and *stricta*. Nature indeed appears as though she would be bound by no laws, and the same obstacles to accurate and stable arrangement which exist in every other branch of natural history are met with in many of the genera of plants. We must however have classification to assist us in the acquisition of every science, and if we cannot have a perfect one, we must be content to make exceptions.

Yet so important do I think the fruit as a means of diagnosis in Carices, that I think every one wishing to name them correctly should have authentic specimens, or at least correct drawings, for differences are not so easily described as they may be seen.

I have first to read a short description of a *Carex*, a living specimen of which is now before the Society, *C. montana*, and shall then notice two or three of our more obscure species.

C. montana.

Male spikelet terminal, clavate, fertile, 2–3 sessile, ovate, approximate, closely surrounding the barren spikelet. Bracts glume-like, membranous, terminating in a foliaceous scabrous apiculus, the lowest longer than its spikelet. Glumes purplish brown, the male obtuse, the fertile mucronate. Stigmas 3; style long, exserted. Fruit hairy, bluntly triquetrous, oblong obovate, acute below, emarginate at the apex, with the long beak of the nut protruded. A prominent line running down each anterior face. Colour pale, longer than the glumes when mature. Nut elliptical, attenuated below, with a rather long tapering beak. Stem 5–6 inches high, slender, triquetrous, with rough angles.

Leaves chiefly radical, confined to the base of the stem, narrow, linear, rough at the edges and keel. Root fibrous. Began to flower last month.

This *Carex* is described by Mr. Babington in the last edition of his 'Manual,' and said to have been found by Mr. W. Mitten near Tonbridge Wells. It is certainly a very rare *Carex* in Britain, and has been cultivated with success in the gardens here. As it has not previously been brought under the notice of this Society, I have taken the liberty of reading the description I made of the plant.

This appears to be the true *C. montana* of Linnæus. Dr. Goodenough, although perhaps our most correct writer on this genus of plants, thought it but a starved specimen of *C. pilulifera*, described as a second species by Linnæus, but it is essentially different either from *C. pilulifera* or *C. præcox*. In *C. pilulifera* the spikes when mature are rounded, the fruit spreading in all directions; whilst in *C. montana* they retain the ovate or elliptical form; again, the fruit and nut are both subglobose in *C. pilulifera*, while in *C. montana* they are both triquetrous. The habit and general appearance of the plant at once separate it from *C. præcox*.

I have next to notice the fructification of *C. intermedia*. In dissecting the fruit of this plant I at first found it invariably abortive, and became afraid I should not be able to procure the nut to add to my dissections, but fortunately having a considerable number of specimens, I noticed one in which the summits of the upper and lower spikelets were occupied by what I then thought immature florets; on examining these I found them to contain the nut perfectly developed, while the larger or inflated fruit, which is usually described by authors, was always abortive. I at once looked on the latter as a monstrosity, and the former as the true fruit, because it inclosed the nut. The abortive fruit is oblong lanceolate, inflated, with a swollen beak, slightly incurved, and is twice the length of its glume. The fertile fruit is ovate lanceolate, straight, very narrowly winged, and is scarcely longer than its glume. This abortive form is of very general occurrence in *C. intermedia*; a perfectly fertile spike appears comparatively rare; I cannot tell to what cause we must attribute this anomaly. It seems not to be a form of ergot, as I have some specimens of a *Carex* so diseased, and it is very different, being firm and solid, while that in *C. intermedia* is hollow. It appears to undergo some such change as the fruit of the common juniper found on the Pentland Hills. I saw a specimen of this *Carex* so changed, in the Museum of this Society, marked "infested with insects," but I am unable to say whether this be the cause of the monstrosity; or if so, why the insects should prefer this species to other individuals of the genus.

I have been somewhat particular in detailing this fact, as neither Hooker nor Babington distinctly notices it: the latter describes the abortive fruit without noticing the true one, and hence, if a perfect specimen were under examination, it might be believed to be another species.

Many opinions have been expressed, and much has been written, as to the identity of our British *C. Œderi* with *C. flava*. Sir W. J. Hooker scarcely knows how to distinguish one from the other, and Mr. Babington, at once decided, places it as a variety, but at the same time adds some new species equally hypothetical. If the arrangement of the spikes and habit of plant be regarded as characteristic, I really cannot tell where to mark the distinction. I met with both lately growing in the same tuft, and many intermediate varieties. The fruit in both is very much alike; it is the same shape, has a similar number of ribs, and the beak is often curved in the lower part of a spike of *C. Œderi,* while in specimens of *C. flava,* where the spikes are distant, and everything else is characteristic of *flava,* the beak is straight, or in short, the fruit has not been properly or quickly enough matured. The nut in each is identical. I have procured foreign specimens of *C. Œderi,* which agree with Schkuhr's description, and think it very probably may be a distinct species. The spikelets are very different from those of the same age in *flava*; the arrangement of them does not vary so much in the two, and it seems by no means a constant character that they should be approximated in *Œderi*; but the fruit is different in form. It can scarcely be said to be beaked, but is rather acuminate and cleft, while in *flava* the fruit in the youngest state is remarkable for the length of its beak.

Seeing then that our species does not correspond with the foreign *C. Œderi,* I have been led to believe that *C. Œderi* may be a distinct species, but that ours is nothing more than *flava* stunted in its growth, and so better adapted for the elevated and bleak situations where it is usually found.

It is very difficult to say whether the *Carex Bœnninghausiana* described by Mr. Babington, is a distinct species from *axillaris* or only a variety, and for the reason that mature specimens cannot be procured. It has been cultivated in the Botanic Garden of Edinburgh for some time, and Mr. M'Nab assures me that the fruit has never become matured, while both *remota* and *axillaris* have ripened fruit. All the specimens I have seen in the University herbarium and in Dr. Balfour's collection have unripe fruit, and Mr. Babington's description is evidently taken from one of these, as he is uncertain about the nut.

I think it highly necessary to see a plant in all its stages of growth, before we create it a new species, especially if it has a close affinity with others. Having the lowest spikelets composed of alternate spicula instead of crowded, is scarcely a sufficient distinction between this and *axillaris,* and I have a specimen in which there is an attempt to cluster in *Bœnninghausiana,* while it preserves its other characters. The fruit can scarcely be admitted as evidence when immature; it undergoes many changes in form before it ripens, and the young fruit in *axillaris* and *remota* is identical with it.

The roughness reaches below the middle, it is said, in the perigonium of *Bœnninghausiana*; so it does in *axillaris* when very young, and the thickening of the fruit and consequent forming of the beak appear to be from below upwards, where the embryo is first placed.

It may be a hybrid produced from the impregnation of *axillaris* by the pollen of another *Carex,* as *remota.* Be this as it may, it is very singular that it does not come to perfection, and this fact strengthens the idea that it may be a hybrid.

I think we are perfectly justified in regarding it as a variety of *axillaris,* unless, were it ever to mature, it should prove different.

The last *Carex* I shall notice is an alpine one placed by Mr. Babington as a distinct species under the name of *Carex Persoonii.* This too has evidently been examined in an immature state, as Mr. Babington is usually particular in mentioning the form of the nut, which he has omitted here. It turns out in fact to be identical with *Carex curta*; its spikelets as they ripen are becoming from oblong, roundish-elliptical, on account of the spreading of the fruit. The perigonium has become longer than the membranous glumes, and has taken the exact form of that in *curta,* the split beak having become an emarginate one, and the nut elliptical. This is an illustration of what I referred to before, and shows how necessary it is to have a mature plant before we write a description.

XVIII.—*Chronological Exposition of the Periods of Vegetation and the different Floras which have successively occupied the surface of the Earth.* By M. Adolphe Brongniart.

[Continued from p. 85.]

II. Kingdom of the Gymnosperms.

During the preceding periods, and especially during the carboniferous, the acrogenous Cryptogams predominated, and the gymnospermous Dicotyledons, less numerous, presented themselves chiefly in forms unusual and sometimes so anomalous, that it is a matter of hesitation whether to place them in this division or in the preceding; as for example the Asterophylliteæ. Subsequently, on the contrary, these anomalous and ambiguous forms, the classification of which is often obscure, disappeared; the acrogenous Cryptogams and the gymnospermous Dicotyledons become evidently referable to families still existing, from which they only differ as generic forms; the Ferns and Equisetaceæ which represent the Acrogens are less numerous; the Coniferæ and Cycadaceæ almost equal them in number, and ordinarily surpass them in frequency, more particularly in the second period. By their abundance and their dimensions they become the essential characteristic of all these formations. Finally, the angiospermous Dicotyledons are still wholly wanting, and the Monocotyledons are very few in number.

This kingdom of the gymnospermous Dicotyledons is divisible into two periods: the first, in which the Coniferæ predominate and the Cycadaceæ scarcely appear; the second, when the latter family becomes predominant by the number of species, their frequency, and the variety of the generic forms. The second period is divisible into several epochs having peculiar characters.

3. *Vosgesian Period.*

This period, which does not appear to have had long duration, and which only comprises the *grès bigarré,* properly so called, presents the following characters: 1. The existence of a tolerable number of Ferns of forms frequently anomalous, manifestly constituting genera now destroyed and occurring no more even in the most recent formations; such as the species of *Anomopteris* and *Crematopteris*; the stems of arborescent Ferns are more frequent than in the Jurassic period; true *Equiseta* are very rare; the *Calamites,* or perhaps rather the *Calamodendra,* are abundant. 2. The Gymnosperms are represented by the two Coniferous genera *Voltzia* and *Haidingeria,* the species and specimens of which are very numerous. On the other hand, the Cycadaceæ are very rare; M. Schimper only cites two species founded on two unique specimens, very imperfectly preserved, and the determination of which may even be doubtful.

This consideration appears to me completely to separate, in a botanical point of view, the period of the *grès bigarré* from the epoch of the *Keuper,* although both are placed by geologists in the triassic formation; for in the *Keuper* the Cycadaceæ become very abundant, perfectly characterized, and frequently analogous to those of the Jurassic period; while, on the other hand, the Coniferæ of the *grès bigarré* are absent in the latter formation.

Flora of the Grès bigarré of the Vosges.

Acrogenous Cryptogams.

Ferns.

Neuropteris grandifolia, *Schimp.*
—— imbricata, *Schimp.*
—— Voltzii, *Brong.*
—— intermedia, *Schimp.*
—— elegans, *Brong.*
Trichomanites myriophyllum, *Brong.*
Pecopteris Sultziana, *Brong.*
Anomopteris Mougeotii, *Brong.*
Crematopteris typica, *Schimp.*
Protopteris Mougeotii, *Brong.*
—— Lesangeana, *Schimp.*
—— micropeltis, *Schimp.*
—— Voltzii, *Schimp.*
Caulopteris? tessellata, *Schimp.*

Equisetaceæ.

Equisetites Brongniartii, *Schimp.*
Calamites? arenaceus, *Jäg.*
—— Mougeotii, *Brong.*

Gymnospermous Dicotyledons.

Asterophylliteæ?

Schizoneura paradoxa, *Schimp.*
Æthophyllum speciosum, *Schimp.*
—— stipulare, *Brong.*

Coniferæ.

Voltzia heterophylla, *Schimp.*
—— acutifolia, *Brong.*
Haidingeria latifolia, *Endl.*
—— elliptica, *Endl.*
—— Braunii, *Endl.*
—— speciosa, *Endl.*

Cycadaceæ.

Zamites vosgesiacus, *Schimp.*
Ctenis Hogardi, *Brong.* (Nilsonia Hogardi, *Schimp.*)

Doubtful Monocotyledons.

Yuccites vosgesiacus, *Schimp.*
Palæoxyris regularis, *Brong.*
Echinostachys oblonga, *Brong.*
—— cylindrica, *Schimp.*

I have not cited any locality for these plants of the *grès bigarré*, because they are all derived from the quarries worked on the two slopes of the Vosges, but particularly from that of Sultz-les-Bains, near Strasburg. *Anomopteris Mougeotii*, however, has been found in some localities in Baden. It is remarkable that these beds of fossil plants are thus limited to this region. But in comparing this flora with that of the slate quarries of Lodève, which have been regarded as of the same epoch, it will be seen that the two lists have nothing in common, and that it is by no means probable that these formations were contemporary.

4. *Jurassic Period.*

This period is one of the most extensive in regard to the formations it comprises and the variety of different special epochs of vegetation embraced in it, even though we are obliged to comprehend, under a common title, epochs during which frequently very analogous forms have succeeded to one another. It would comprise, thus, from the *Keuper* inclusively to the Wealden formations. In fact, the *Pterophyllum* of the *Keuper* reappears, with slight specific modifications, in the Wealden formations. The *Equisetites* of the *Keuper* extend as far as the middle oolitic formation; the *Baieræ* of the lias also reappear in the Wealden strata of the north of Germany; the genera *Sagenopteris* and *Camptopteris* are found equally in the *Keuper*, the lias and the oolite.

Nevertheless these common characters, which indicate a great analogy between the floras of each of these epochs of formation, do not prevent each from having its peculiar characters, and frequently a totality of species almost all peculiar to each particular epoch. We must therefore distinguish here these different subdivisions, the number of which will perhaps be multiplied hereafter, when the plants of each of the stages of the Jurassic formation are better known.

1. *Keupric Epoch.*

Amphigenous Cryptogams.

ALGÆ.

Confervites arenaceus, *Jäg.*—Stutgard.
Delesserites crispatus, *Brong.*

Acrogenous Cryptogams.

FERNS.

Odontopteris Cycadea, *Berg.*—Coburg.
Neuropteris? distans, *Sternb.*—Bamberg.
Sphænopteris Rässertiana, *Sternb.*—Bamberg.
—— pectinata, *Sternb.*—Bamberg.
—— clavata, *Sternb.*—Bamberg.
—— oppositifolia, *Sternb.*—Bamb.
Coniopteris Schönleiniana, *Br.* — Wurtemb.
—— Kirchneri, *Brong.*—Bamberg.
—— tricarpa, *Brong.*—Bamberg.
Hymenophyllites macrophyllus, *Br.* —Bamberg.
Tæniopteris marantacea, *Sternb.*—Wurtemb.
—— elongata, *Brong.*—St. Léger-sur-d'Heunes.
Pecopteris stutgardiensis, *Brong.*—Stutgard.
—— Meriani, *Brong.*—Basle.
—— taxiformis, *Sternb.*—Bamberg.
—— microphylla, *Sternb.*—Bamb.
Cladophlebis flexuosa, *Göppert.*—Bamberg.
—— Rässertii, *Sternb.*—Bamberg.
—— imbricata, *Sternb.*—Bamberg.
—— concinna, *Sternb.*—Bamberg.
—— obtusa, *Sternb.*—Bamberg.
Guttbiera angustifolia, *Presl.*—Bamberg.
Phlebopteris Landriotii, *Brong.*—St. Léger-sur-d'Heunes.
Camptopteris Munsteriana, *Sternb.*
Thaumatopteris? quercifolia, *Brong.* —Stutgard. (Pecopteris quercifolia, *Sternb.*)
Sagenopteris rhoifolia, *Sternb.* — Bamberg.
—— acuminata, *Sternb.*—Bamb.
—— semicordata, *Sternb.*—Baden.

EQUISETACEÆ.

Calamites arenaceus, *Brong.*—Stutg.
—— Jägeri, *Brong.*—Stutgard.
Equisetites columnaris, *Brong.* — Stutgard, Coburg.
—— cuspidatus, *Sternb.*—Stutgard, Baden.
—— elongatus, *Sternb.*—Stutgard.
—— Schönleinii, *Sternb.* — Würzburg.
—— conicus, *Sternb.*—Abschwind.
—— sinsheimicus, *Sternb.*—Baden.
Equisetum Meriani, *Brong.*—Basle.
—— Munsteri, *Sternb.*—Bamberg.
—— Höflianus, *Sternb.*—Waishof.
—— mondiformis, *Sternb.*—Bamb.

Gymnospermous Dicotyledons.

CYCADACEÆ.

Pterophyllum Jägeri, *Brong.*—Stutgard; Helibronn.
—— longifolium, *Brong.* — Basle; Austria.
—— Meriani, *Brong.*—Basle; Stutg.
Zamites? Munsteri, *Sternb.*—Bamb.
—— acuminatus, *Sternb.*—Bamb.
—— heterophyllus? *Sternb.*—Bamb.

CONIFERÆ.

Taxodites Munsterianus, *Sternb.*—Bamberg.
—— tenuifolius, *Sternb.*—Bamb.
Cunninghamites? dubius, *Sternb.*—Bamberg.
Peuce Keuperianus, *Unger.* (Pinites.)—Bamberg.

Doubtful Monocotyledons.

Palæoxyris Munsteri, *Sternb.*—Bamberg.
Preisleria antiqua, *Sternb.*—Bamb.

In comparing this flora with that of the *grès bigarré* of the Vosges, and with that of the lias, it is seen that it has nothing in common with the former except the *Palæoxyris,* which appears extremely near that of the *grès bigarré;* on the other hand, it resembles the flora of the lias or of the oolite in the Ferns, several of which are specifically identical or exceedingly near, and in the species of *Nilsonia* and *Pterophyllum,* which are also identical or very near species to those of the lias.

2. *Liassic Epoch.*

Amphigenous Cryptogams.

ALGÆ.

Caulerpites? Nilsonianus, *Sternb.*—Hög.
Sargassites septentrionalis, *Sternb.*—Hög.
Phymatoderma granulatum, *Brong.*—Boll.
—— Leymerianum, *Brong.*—Aube.
—— cretaceum, *Sternb.* (Chondrites.)—Boll.
Chondrites genuinus, *Sternb.*—Boll.
—— bollensis, *Kurr.*—Boll.

FUNGI.

Xylomites zamitæ, *Göpp.*—Bamb.
Uromycetites? concentricus, *F. Br.*—Bayreuth.

LICHENS.

Ramallinites lacerus, *Munst.*—Bayr.

Acrogenous Cryptogams.

FERNS.

Cyclopteris Brauniana, *Göpp.*—Bayreuth.
Odontopteris? cycadea, *Berg.*—Metz.
Neuropteris? trapeziphylla, *F. Br.*—Bayreuth.
——? alternans, *F. Br.*—Bayreuth.
—— pachyrachis, *Brong.* — Bamberg. (Cyclopteris pachyrachis, *Göpp.*)
Coniopteris Braunii, *Göpp.*—Bayr.
—— princeps, *Sternb.*—Bayreuth.
—— patentissima, *Göpp.*—Bayr.
Pecopteris Braunii, *Munst.*—Bayr.
—— Whitbiensis, *Brong.*—Bayr.
Cladophlebis Rässertii, *Brong.* — Bayreuth.
Tæniopteris Munsteri, *Göpp.*—Bayr.
—— vittata, *Brong.*—Hoer; Bayr.
Tæniopteris major, *Lindl. & Hutt.*—Bayreuth.
—— scitaminea, *Presl.*—Bayreuth.
—— obovata, *F. Br.*—Bayreuth.
Phyllopteris Nilsoniana, *Brong.*—Hoer.
Sagenopteris elongata, *Munst.*—Bayreuth.
Andriana baruthina, *F. Br.*—Bayr.
Laccopteris Braunii, *Göpp.*—Bayr.
—— germinans, *Göpp.*—Bayreuth.
Thaumatopteris Munsteri, *Göpp.*—Bayreuth.
Camptopteris crenata, *Presl.*—Bayreuth; Coburg.
—— Bergeri, *Presl.*—Coburg, Bayr.
—— Munsteri, *Presl.* — Bamberg, Bayreuth.
—— Nilsoni, *Presl.*—Hoer, Coburg.
Phlebopteris polypodioides, *Br.*—Heilbronn, Metz.
Clathropteris meniscioides, *Brong.*—Hoer, Metz, La Marche (H[te] Marne), Pouilly en Auxois.
—— platyphylla, *Brong.*—Halberstadt.
Diplodyctium obtusilobum, *F. Braun.*—Bayreuth.

MARSILEACEÆ.

Pilularites Braunii, *Göpp.*—Bayr.
Baiera dichotoma, *F. Braun.*—Bayr.

LYCOPODIACEÆ.

Psilotites? robustus, *F. Braun.*—Bayreuth.

EQUISETACEÆ.

Equisetum Munsteri, *Sternb.*—Bayr.

Gymnospermous Dicotyledons.

CYCADACEÆ.

Cycadites pectinatus, *Berg.*—Coburg, Metz.

Otozamites Bechii, *Brong.*—England.
—— Bucklandii, *Brong.*—England, Metz.
—— obtusus, *Brong.* (*L. & H.*)—England.
—— oblongifolius, *Kurr.*—Wurtemberg.
—— Mandelslohi, *Kurr.*—Wurtem.
—— acuminatus, *Fr. Braun.*—Bayr.
—— brevifolius, *Fr. Braun.*—Bayr.
—— Schmiedelii, *Fr. Braun.*—Bayr.
Zamites distans, *Sternb.*—Bamberg.
—— lanceolatus, *Lindl. & Hutt.*—Bayreuth.
—— Hartigianus, *Germ.*—Halberstadt.
—— heterophyllus, *Presl.*—Bayr.
—— crassinervis, *Germ.* — Halberstadt.
—— gracilis, *Kurr.*—Wurtemburg.
And several new species according to Fr. Braun.
Ctenis angusta, *Fr. Braun.*—Bayr.
—— abbreviata, *Fr. Braun.*—Bayr.
—— marginata, *Fr. Braun.*—Bayr.
—— ? inconstans, *Fr. Braun.*—Bayr.
Pterophyllum majus, *Brong.*—Hoer.
—— minus, *Brong.*—Hoer.
—— lunularifolium, *Göpp.*—Bayr.
—— dubium, *Brong.*—Hoer.
—— Zinckenianum, *Germ.* — Halberstadt.
Nilsonia contigua, *Fr. Braun.*—Bayr.
—— elegantissima, *Fr. Braun.* — Bayreuth.
—— intermedia, *Fr. Braun.*—Bayr.
Nilsonia speciosa, *Fr. Braun.*—Bayreuth.
—— brevis, *Brong.*—Hoer.
—— Sternbergii, *Göpp.* ?—Hoer.
—— elongata, *Brong.*—Hoer.
—— Bergeri, *Göpp.*—Coburg, Quedlinburg.
Cycadoidea pygmæa, *Lindl. & Hutt.* —Lyme-Regis.
—— cylindrica, *Ung.*—Lunéville.

Coniferæ.

Brachyphyllum peregrinum, *Br.*—England; Wurtemburg. (Arauc. peregrina, *Lindl. & Hutt.*)
—— mammillare ? *Brong.*—Bayr.
—— liasinum, *Br.* (*Kurr.*)—Wurtemburg.
Taxodites flabellatus, *Göpp.* ?
Palissya Braunii, *Endl.*—Bayreuth.
Pinites ? elongatus, *Endl.*—Engl.
Peuce Brauneana, *Ung.*—Bayreuth.
—— wurtemburgica, *Ung.* — Wurtemburg.
—— Lindleyana, *With.*—Whitby.
—— Huttonii, *With.*—Whitby.

Doubtful Monocotyledons.

Poacites Arundo, *Fr. Braun.*—Bayr.
—— Paspalum, *Fr. Braun.*—Bayr.
—— Nardus, *Fr. Braun.*—Bayr.
Cyperites scirpoides, *Fr. Braun.*—Bayreuth.
—— caricinus, *Fr. Braun.*—Bayr.
—— typhoides, *Fr. Braun.*—Bayr.

This list is founded upon that given by M. Braun of the fossil plants of the lias of the environs of Bayreuth (Münster, Beytr. zur Petrefact. fasc. vi. p. 11), only the species already named and described or figured being inserted; and to these are added: 1. those of the lias of Halberstadt and of Quedlinburg, described by Professor Germar, and those of the lias of Wurtemburg, by Professor Kurr; 2. those of the sand of the lias of Hoer in Scania; 3. those of certain parts of France, such as Hettange near Metz, La Marche (Haute-Marne), Pouilly (department of the Yonne); and 4. certain species of the lias of Lyme-Regis and Whitby in England.

But I have excluded the species of the oolitic beds of the neighbourhood of Scarborough and Whitby, which M. Unger has often included in this formation. If the species recently announced by M. Fr. Braun, but not even named, had been added to each genus in this list, it would have been increased by twenty-five species, and would thus have amounted to more than a hundred, comprising forty-seven Ferns and other acrogenous Cryptogams, and fifty gymnospermous Dicotyledons, thirty-nine of which are Cycadaceæ and eleven Conifers.

The essential characters of this epoch are therefore: 1. the great predominance of Cycadaceæ, already well established, and the presence of numerous genera in this family, especially of *Zamites* and *Nilsonia*; 2. the existence among the Ferns of many genera with reticulated nervation, which scarcely showed themselves, and only in forms varying little, in the more ancient formations, but some of which did nevertheless begin to appear in the epoch of the *Keuper*. The genera *Camptopteris* and *Thaumatopteris* are examples.

3. *Oolitic Epoch.*

Amphigenous Cryptogams.

ALGÆ.

Codites difformis, *Brong.*—Solenhofen. (Codites serpentinus et crassipes, *Sternb.*)
—— ? tortuosus, *Brong.*—Solenh. (Caulerpites tortuosus, *Sternb.*)
Corallinites arbuscula, *Ung.*—Austria.
—— halimeda, *Ung.*—Austria.
Chondrites laxus, *Sternb.*—Solenh.
—— lumbricarius, *Sternb.*—Solenh.
Sphærococcites cactiformis, *Sternb.*—Solenhofen.
—— varius, *Sternb.*—Solenhofen.
—— subarticulatus, *Sternb.*—Solenhofen.
—— secundus ? *Sternb.*—Solenh.
—— Schnitzleinii, *Sternb.*—Solenh.
—— cernuus, *Sternb.*—Solenhofen.
—— Stockii, *Brong.*—Solenhofen.
—— concatenatus, *Stern.*—Solenh.
—— ramulosus, *Stern.*—Stonesfield.
—— ciliatus, *Sternb.*—Solenhofen.
Munsteria clavata, *Sternb.*—Solenh.
—— vermicularis, *Sternb.*—Solenh.
—— ? lacunosa, *Sternb.*—Solenh.

Acrogenous Cryptogams.

FERNS.

Cyclopteris digitata, *Brong.*—Scarborough.
Sphenopteris cysteoides, *L. & H.*—Stonesfield.
—— arguta, *L. & H.*—Scarboro'.
—— crenulata, *Brong.*—Whitby.
—— denticulata, *Brong.* — Scarborough.
Sphenopteris hymenophylloides, *Brong.*—Whitby.
—— Williamsonis, *Brong.* — Scarborough.
Hymenophyllites macrophyllus, *Göpp.*—Stonesfield, Morestel.
Pachypteris ovata, *Brong.*—Whitby.
—— lanceolata, *Brong.*—Whitby.
—— microphylla, *Brong.*—Verdun.
Coniopteris athyrioides, *Brong.* — Whitby.
—— Murrayana, *Brong.* — Scarborough.
Pecopteris Moretiana, *Brong.*—Châtillon-sur-Seine.
—— Phillipsii, *Brong.*—Scarboro'.
—— denticulata, *Brong.*—Scarboro'.
—— arguta, *Brong.*—Scarborough.
—— serrata, *L. & H.*—Scarboro'.
—— Desnoyersii, *Brong.*—Mamers.
—— Reglei, *Brong.*—Mamers.
Cladophlebis tenuis, *Brong.* — Whitby.
—— Whitbiensis, *Brong.*—Whitby.
—— dentata, *Brong.*—Scarboro'.
—— ligata, *Brong.*—Scarborough.
—— Williamsonis, *Brong.*—Scarborough.
—— recentior, *Brong.*—Scarboro'.
—— haiburnensis, *Brong.*—Scarborough.
—— lobifolia, *Brong.*—Scarboro'.
—— undulata, *Brong.*—Scarboro'.
Tæniopteris vittata, *Brong.*—Scarborough, Hoer, Stonesfield.
—— latifolia, *Brong.*—Stonesfield, Scarborough.
Phyllopteris Phillipsii, *Brong.*—Scarborough.

Sagenopteris Huttoni, *Brong.*—Scarborough.
Polypodites Lindleyi, *Göpp.*—Scarborough.
—— crenifolia, *Göpp.*—Scarboro'.
—— undans, *Göpp.*—Scarborough.
Phlebopteris polypodioides, *Brong.* —Scarborough.
—— contigua, *L. & H.*—Scarboro'.
Camptopteris Phillipsii, *Brong.* — Scarborough.
Tympanophora simplex, *L. & H.*— Scarborough.
—— racemosa, *L. & H.*—Scarboro'.

MARSILEACEÆ.

Baiera Huttoni, *Fr. Braun.*—Scarborough.
——? furcata, *Fr. Braun.* — Scarborough.
Sphæreda paradoxa, *L. & H.*—Scarborough.

LYCOPODIACEÆ.

Lycopodites falcatus, *L. & H.*— Scarborough.
—— ? Meyeranus, *Göpp.*—Silesia.
Psilotites ? filiformis, *Munst.*—Monhaim.
Isoëtites crociformis, *Munst.*—Monhaim.
—— Murrayana, *L. & H.* — Scarborough.

EQUISETACEÆ.

Equisetites lateralis, *L. & H.*—Scarborough.
Calamites ? Lehmannianus, *Göpp.*— Silesia.
——? Hærensis, *Hising.*—Hoer.

Gymnospermous Dicotyledons.

CYCADACEÆ.

Otozamites Bucklandii, *Fr. Braun.*— Mamers, Valogne.
—— Bechii, *Fr. Braun.*—Mamers.
—— lagotis, *Brong.*—Mamers.
—— hastatus, *Brong.*—Mamers.
—— Beanii, *L. & H.*—Scarboro'.
—— latifolius, *Br.* — Orbagnoux (Ain).
—— microphyllus, *Br.*—Alençon.
—— acuminatus, *L. & H.*—Scarborough.
Otozamites lævis, *Brong.*—Scarborough.
—— Youngii, *Brong.*—Whitby.
—— acutus, *Brong.*—Whitby.
—— Goldiæi, *Brong.*—Whitby.
—— elegans, *Brong.*—Whitby.
Zamites pectinatus, *Brong.*—Scarborough.
—— distans, *Sternb.*—Stonesfield.
—— lanceolatus, *L. & H.*—Scarborough.
—— gigas, *L. & H.*—Scarborough. (Mantellii, *Br.*; falcatus, *Sternb.*; Whitbiensis, *Sternb.*)
—— undulatus, *Sternb.* ? — Scarborough.
—— longifolius, *Brong.*—Scarboro'.
—— Moreaui, *Brong.*—Verdun.
—— Feneonis, *Brong.*—Seissel, Morestel, Châteauroux.
—— patens, *Brong.*—Stonesfield.
—— taxinus, *L. & H.*—Stonesfield (an pectinatus, *Brong.*?).
—— pecten, *L. & H.*—Scarborough.
Pterophyllum Œynhausianum, *Göpp.* —Silesia.
—— carnallianum, *Göpp.*—Silesia.
—— propinquum, *Göpp.*—Silesia.
——? tenuicaule, *Morris.*—Scarborough.
—— minus, *Brong.*—Scarborough.
—— Nilsoni, *L. & H.*—Scarboro'.
Nilsonia compta, *Göpp.*—Scarboro'. (Pterophyllum Williamsonis, *Br. Prod.*)
Ctenis falcata, *L. & H.*—Scarboro'.
Cycadoidea squamosa, *Brong.* — Stonesfield. (Bucklandia squamosa, *Br. Prod.*)

CONIFERÆ.

Thuites divaricatus, *Sternb.*—Stonesfield, Solenhofen.
——? expansus, *Sternb.*—Stonesf.
Brachyphyllum mammillare, *Brong.* —Scarborough.
—— acutifolium, *Brong.*—Stonesf.
—— gracile, *Brong.* — Jura near Nantua.
—— Moreauanum, *Brong.* — Verdun.
—— majus, *Brong.* — Verdun, Whitby.
Palissya ? Williamsonis, *Brong.* — Scarborough. (Lycopodites Williamsonis, *Brong.*)

Palissya? patens, *Brong.* — Hoer. Lycopodites patens, *Brong.*)
Taxites podocarpoides, *Brong.* — Stonesfield.
Peuce Lindleyana, *With.*—Whitby.
—— eggensis, *With.*—Hebrides.
—— jurassica, *Endl.*—Poland.

Doubtful Monocotyledons.

Podocarya . . . . . , *Buckl.*—Charmouth, Dorset.
Carpolithes conica, *L. & H.*—Malton.
—— Bucklandii, *L. & H.*—Malton.

This list is chiefly based upon the very varied fossils collected on the coast of Yorkshire, near Whitby and Scarborough, in beds which are referable to different parts of the inferior oolite, and in particular to the great oolite. It also contains a small number of species found in the schistose limestone of Stonesfield, near Oxford, belonging to the same strata.

In France, the fossils of this formation have been collected chiefly in the neighbourhood of Morestel, near Lyons, by Dr. Lortet; at Orbagnoux and Abergemens near Nantua, in the department of Ain, by M. Itier; in the vicinity of Châteauroux, near Châtillon-sur-Seine, by Colonel Moret; at Mamers, department of the Sarthe, by M. Desnoyers; and lastly, in great quantity, by M. Moreau, in the beds of the very pure white oolitic limestone in the environs of Verdun and near Vaucouleurs. Some species have also been found at other points of the Jura, in Normandy, near Valogne, in the environs of Alençon, but in very small numbers in each of these localities. The majority of these species remain still without descriptions and figures, and they mostly differ, specifically, from those of England. The Ferns are usually less numerous and not so well preserved; an exception however must be made in the case of *Hymenophyllites macrophyllus*, found in a perfect condition at Morestel, and observed also at Stonesfield and in Germany. The Cycadaceæ, the species of which are not very varied, are referable to the genera *Otozamites* and *Zamites*; *Ctenis, Pterophyllum* and *Nilsonia* have not yet been observed there; finally, the Coniferæ of the genus *Brachyphyllum* are especially abundant there, and more frequent than in the other localities.

In Germany, these fossils have been principally observed in the schistoid limestone of Solenhofen, near Aichstädt, particularly those of the Algæ; M. Göppert also announces several Cycadaceæ in the Jurassic formation of Ludwigsdorf, near Kreuzberg, in Silesia.

But these very different localities belong to very different stages of the oolitic series, and will perhaps, when they are better known and more completely explored, constitute distinct epochs.

The distinctive characters of this epoch, comprehended in the whole extent that we have assigned to it, from the lias up to the

Wealden formation exclusively, are, among the Ferns, the rarity of the Ferns with reticulated nervation, so numerous in the lias; among the Cycadeæ, the frequency of the *Otozamites* and *Zamites*, properly so called, that is to say, of the Cycadaceæ most analogous to those now existing; and the diminution of *Ctenis*, *Pterophyllum* and *Nilsonia*, genera very far removed from living kinds; lastly, the greater frequency of the Conifers, *Brachyphyllum* and *Thuites*, much more rare in the lias.

4. *Wealden Epoch.*

Amphigenous Cryptogams.

ALGÆ.

Confervites fissus, *Dunk.*—Germany.

Acrogenous Cryptogams.

FERNS.

Pachypteris gracilis, *Brong.*—England, Beauvais. (Sphenopteris gracilis, *Fitt.*)
Sphenopteris Mantelli, *Brong.*—England, Germany.
—— Sillimani, *Mant.*—England.
—— Römeri, *Dunk.*—Germany.
—— tenera, *Dunk.*—Germany.
—— Phillipsii, *Mant.*—England.
—— Göpperti, *Dunk.*—Germany.
—— Hartlebeni, *Dunk.*—Germany.
—— longifolia, *Dunk.*—Germany.
Adiantites Mantelli, *Brong.*—Germ. (Cyclopteris Mantelli, *Dunk.*)
——? Klipsteinii, *Brong.* — Germ. (Cyclopt. Klipsteinii, *Dunk.*)
Cladophlebis Albertsii, *Brong.*—Germany. (Neuropteris Albertsii, *Dunk.*)
Pecopteris Huttoni, *Brong.*—Germ. (Neuropt. Huttoni, *Dunk.*)
—— Geinitzii, *Dunk.*—Germany.
—— Murchisoni, *Dunk.*—Germany.
—— Conybeari, *Dunk.*—Germany.
—— elegans, *Brong.*—Germany. (Alethopt. elegans, *Dunk.*)
—— polydactyla, *Dunk.*—Germany.
—— Ungeri, *Dunk.*—Germany.
—— gracilis, *Dunk.*—Germany.
—— Cordai, *Dunk.*—Germany.
—— Althausii, *Dunk.*—Germany.
—— Browniana, *Dunk.*—Germany.
——? linearis, *Sternb.* — Germany (non P. Reichiana, *Brong.*).
Lonchopteris Mantelli, *Brong.*—England, Beauvais.
——? Huttoni, *Presl.*—Germany.
Hausmannia dichotoma, *Dunk.* — Germany,
Protopteris? erosa, *Ung.*—England. (Endogenites erosa, *Mant.*)

MARSILEACEÆ.

Baiera Huttoni, *Brong.*—Germany. (Cyclopteris digitata, *L. & H.*, non *Brong.*)
—— Brauniana, *Dunk.*—Germany.
—— nervosa, *Dunk.*—Germany.

EQUISETACEÆ.

Equisetum Lyellii, *Mant.*—Engl.
—— Phillipsii, *Dunk.*—Germany.
—— Burchardi, *Dunk.*—Germany.

Gymnospermous Dicotyledons.

CYCADACEÆ.

Cycadites Brongniarti, *Röm.*—Germ.
—— Morrisianus, *Dunk.*—Germ.
Zamites æqualis, *Göpp.*—Germany.
—— abietinus (Pteroph., *Dunk.*).—Germany.
—— Dunkerianus (Pteroph., *Dunk.*).—Germany.
—— Lyellianus (Pteroph., *Dunk.*).—Germany.
—— Göppertianus (Pteroph., *Dunk.*).—Germany.
—— Humboldtianus (Pteroph., *Dunk.*).—Germany.
—— Fittonianus (Pteroph., *Dunk.*).—Germany.
—— Brongniarti (Cycad., *Mant.*).—England, Beauvais.
Pterophyllum Schaumburgense, *Dunk.*—Germany.
Zamiostrobus? crassus, *Göpp.*—England, Isle of Wight.
Cycadoidea megalophylla, *Buckl.*—Portland.
—— microphylla, *Buckl.*—Portland.
Clathraria Lyellii, *Mant.*—Sussex.

CONIFERÆ.

Brachyphyllum Germari, *Brong.*—Germany. (Thuites Germari, *Dunk.*)
—— ? Kurrianum, *Brong.* — Germ. (Thuites Kurrianus.)
—— imbricatum, *Brong.* — Germ. (Thuites imbricatus, *Röm.*)
—— Gravesii, *Brong.* — Beauvais. (Moreausia Gravesii, *Pomel.*)
Juniperites Sternbergianus, *Brong.*—Germany. (Muscites Sternbergianus, *Dunk.*)
Abietites Linkii, *Dunk.*

Plants of Doubtful Class.

Carpolithes Mantelli, *Stokes.*—England, Germany, Beauvais.
—— Lindleyanus, *Dunk.*—Germ.
—— cordatus, *Dunk.*—Germany.
—— Brongniarti, *Dunk.*—Germany.
—— Sertum, *Dunk.*—Germany.

This list is principally derived from discoveries made in recent years in the Wealden districts of the north of Germany, at Osterwald, Schaumburg, Buckeburg, Oberkirche, &c., the fossil plants of which were first described by M. Römer, and subsequently more completely by M. Dunker, in his monograph on these districts. To these species are added the less numerous and less varied formerly discovered in the *Wealden* of England, near Tilgate and Hastings Forests, in Sussex, and so well described by Dr. Mantell.

This same formation has been found in France, near Beauvais, by Mr. Graves, who observed in it *Lonchopteris Mantelli* and some other plants, of which I have not seen specimens, and which I have cited from his work on the geology of the department of the Oise.

The species, to the number of sixty-one enumerated above, appear to be all peculiar to this formation, with the exception perhaps of *Baiera Huttoni,* which seems identical with the species of the lias of Bayreuth and of the Scarborough oolite; but their generic forms are almost all the same as those of the lias and the oolitic formations. Nevertheless the Cycadeæ already appear less numerous in proportion to the Ferns.

It will further be remarked that this freshwater formation, which terminates, for us, the kingdom of the Gymnosperms, is allied by its total character to other epochs of the vegetation of the Jurassic period, and is distinguished from the cretaceous epoch which succeeds it, by the complete absence of every species which can be referred to the angiospermous Dicotyledons, in France and England as in the deposits of southern Germany, so rich in variety of species. On the other hand, in the lower chalk, the upper greensand, *Quadersandstein* or *Planerkalk* of Germany, we immediately find several kinds of leaves evidently belonging to the great division of angiospermous Dicotyledons, and some remains of Palms, of which, on the contrary, no trace appears in the Wealden deposits.

I have classed among the Cycadeæ the stems from Tilgate Forest, previously called by the name of *Clathraria Lyellii,* and which I have regarded as a stem allied to *Dracæna.* The totality of their characters, although the almost complete absence of preservation of their tissues does not allow of our anatomizing them, appears to me to render this reference more probable, and to indicate, in particular, the relations between this stem and those of *Zamites gigas,* found at Scarborough.

The abundance of *Lonchopteris Mantelli* is a character of the Wealden formations of the south of England and the department of the Oise, where this fossil seems to present itself, at all events in fragments, in the majority of the localities where the beds have been uncovered by the working of the potter's clays of this formation near Savignies. In Germany, on the contrary, this species is wanting, and *Abietites Linkii* appears to be the predominant plant. As to the species of *Brachyphyllum,* I have not yet been able to study them in nature, but the figures that have been given of them leave me little doubt of their analogy with those of the oolitic epoch.

The abundance of Cycadeæ also forms a distinctive character of the Wealden formations of Germany. However, there are, as is seen, several species common to both basins, and I will add that *Sphenopteris Göpperti,* Dunk., is probably identical with *Sphenopteris Phillipsii,* Mant.

I have not included in this list certain marine plants cited in the strata of this epoch: 1. because it appears to me doubtful whether they really belong to the Wealden epoch and not to the Glauconian; 2. because it seems to me still uncertain whether the species cited, *Chondrites æqualis* and *intricatus,* are really quite specifically identical with the species of this name of the upper fucoid sand of the chalk.

[To be continued.]

XIX.—*On the position of the Impressions of Footsteps in the Bunter Sandstone of Dumfries-shire.* By Robert Harkness, Esq.

The new red sandstone exists in Dumfries-shire in four separate patches. The one, which occurs in the north-west portion of the country, occupies the smallest area, and rests upon the lower parts of the representatives of the mountain limestone, which from their position and inclination appear to appertain to the carboniferous deposits of Ayrshire.

The new red sandstone which is met with in the lower portion of the Vale of the Nith, and also in the low country in Annandale, and which covers the greatest extent of surface, seems to lie unconformably upon the altered Silurian formation; the other portion of the county in which this deposit prevails is the south-east, where it abuts against the representatives of the mountain limestone formation as they occur in Dumfries-shire. Of the small isolated patch lying in the north-west we have no evidence to show that it affords any traces of footsteps, and its position with reference to the other two deposits cannot be distinctly made out. It is however probable that originally it existed as a part of the larger deposits which occur to the south, from which it has been detached by the eroding action of the waters of the river Nith.

It is in the district containing the largest area of sandstone that the footsteps are found in the greatest abundance. In the quarries of Corncockle and Templand village in the parish of Lochmaben, and also in those of Locherbriggs and Craigs in Dumfries, as well as at Green Mill in Caerlaverock, impressions occur more or less abundantly. At Corncockle they are more common, and in general more perfect than in any of the other quarries, and the tracks there are in some instances of such a character as to indicate that animals different in form traversed the sand, and that they bore little or no relation to those which impressed the strata in the other quarries. The more common footmarks are however to be obtained from all the different quarries.

The nature of the sandstone in the quarries which afford the tracks is to a great extent similar. The direction of the dip and also the inclination approach in localities where steps occur; and the position of the sandstone relative to the subjacent and surrounding Silurian is such as to show that the whole of the quarries owe their inclination to the same elevating cause. At Corncockle the sandstone consists of beds varying in thickness from one foot to four; and the beds are in some cases laminated; the laminæ occurring more frequently in the upper portion of the bed than in the lower. Sometimes the laminæ have a contorted appearance, and the brown and red layers which constitute these laminæ are the faces along which the stratum splits easily into flags. The texture of the rock is remarkably uniform, being fine and hard, with the red colour which prevails amongst the Bunter sandstones. In its bedding the rock is so regular as to be quarried along the planes of the strata with so much ease, that it is no rare occurrence to find an undisturbed perfectly smooth face of rock extending from the top to the bottom of the quarry, and almost from one side to the other. The faces of the beds are in some cases separated by very thin layers of fine clay, and when this is removed they have in some instances a burnished aspect. The dip of the beds here is towards the west at an angle of about 34°.

It is on the fine faces and also on the intervening fine red clays that we meet with the footsteps which have rendered this quarry so remarkable. The steps on the faces of the rock are more perfect than those which the clay affords; natural casts of these are obtained from the underside of the sandstone strata, and these partake of the imperfections of the impressions in the clay. The cause of this imperfection appears to have resulted in a great measure from the comparative thinness of the clay, which did not allow of a distinct impression before the foot pressed upon the less yielding sand.

A quarry is also wrought at Templand village, about half a mile south of Corncockle, and here impressions of two kinds of footsteps are also occasionally found. The sandstone at this locality differs considerably from the former, being of a coarser nature, the beds are of less thickness, and the position of the quarry with reference to that at Corncockle is such as to show that the sandstone of Templand village lies above that of Corncockle. The inclination of the beds here is towards the west at an angle of 30°.

At Locherbriggs, in the parish of Dumfries, four sandstone quarries occur in which footsteps have been found. The general character of the rock in these is similar; and the quarry lying furthest towards the south may be taken as a type of the deposits generally. In this the dip is at an angle of 35° W.S.W., and the rock consists of thin flags, under which lies a more compact stone. Beneath this compact rock two beds of thick flags occur, and under them the rock again becomes thin-bedded. The faces of these different beds present the same smooth and burnished appearance with those of Corncockle, with the exception of the faces which separate the two flags. These however are equally smooth and well developed, although devoid of the burnished aspect. On the upper face of this lower flag impressions of footsteps are found, and the lower face of the upper flag contains casts of these impressions, and to these two faces the occurrence of footsteps appears to be restricted.

The new red sandstone is likewise extensively wrought at Craigs quarry, also in the parish of Dumfries. Here the beds are of both a compact and flaggy nature, the former occurring in the higher portion of the quarry, and the latter below. It is on the faces of these flags and likewise in the interior of the beds, as shown when these are split along the laminæ, that footmarks are met with. Laminæ similar to those which are seen at Corncockle are also to be found in the flaggy beds here. The dip of the strata at Craigs is towards the west at an angle of about 30°.

At Green Mill in the parish of Caerlaverock, there is also a quarry of new red sandstone. The inclination of the rock here is at an angle of 32° W.S.W., and the beds are composed of laminæ similar to those of the quarry at Corncockle. Some of the beds are separated by thin layers of clay, and impressions occur both on these and likewise on the fine faces of the beds.

These are the localities from whence footmarks are obtained in that portion of the new red sandstone which occupies the greatest area in Dumfries-shire, and so great is the resemblance between the deposits at these different localities, that in any of them we have a representative of the beds containing impressions except at Templand, where the rock is of a coarse nature, and appears to occupy a higher position than at the other localities. A sandstone of a similar nature seems to overlie the flag rock at Green Mill, as seen on the high ground above the quarry.

Of the other area containing new red sandstone, and which lies on the south-east side of the county, we find that it offers on the whole characters which distinguish it from the new red sandstone of the southern portion of the Vale of the Nith and the district of Annandale.

The formation is wrought extensively to the east of the river Annan, and at the quarry of Corse Hill, about two miles from the town of Annan, we have a good example of its general nature. Here the dip is about 13° S.E., and the rock is composed of several series of sandstone beds interstratified with beds of red clay, some of which exceed 9 inches in thickness. The flags which lie upon these clay beds have their under surface marked in high relief with raised vermicular-like ridges, and these are derived from the upper surface of the clay beds, and appear to have resulted from the erosion of currents on the soft surface of the clay. Amongst these markings, casts of the footprints of the *Cheirotherium* are sometimes met with, and in some instances marks of desiccation occur. In the adjoining parish of Kirkpatrick Fleming, which lies eastward from Annan, the same beds of sandstone and shale are obtained; but here the red shales are more abundant, and at Cove quarry in the same parish the colour of the rock and the intercalated shales have undergone such an entire change as to place them in connection with the infra-gypseous clays of the Keuper sandstones.

In the district occupied by the largest area of sandstone, viz. the lower portion of the Vale of the Nith, and the more level parts of Annandale, we have other deposits besides the flaggy beds containing the impressions. These flaggy beds are succeeded by deposits of a coarser-grained sandstone which appears to exceed 100 yards in thickness. Above this sandstone a singular conglomerate of about the same thickness occurs; and on this conglomerate beds of fine soft sandstone repose, these latter being the highest which the new red sandstone of the Vale of the Nith affords us. The sandstone on the south-eastern parts of the county appears to be higher in position than this latter bed, and there is reason to conclude that 100 yards at least lie above the conglomerate, thus making the flags in which fossil steps abound, at least 300 yards below the infra-gypseous clays of the Keuper. The conglomerate, which is entirely a local deposit, and one which would accumulate much more rapidly than the common sandstones, renders it difficult to assign an exact position to the impressions; and the probability is that a comparison with localities where no conglomerate occurs would give us a thickness of Bunter sandstone not much exceeding the combined thickness of the higher and lower deposits exclusive of the conglomerate.

From this circumstance we find that, so far as the traces of footsteps are concerned, had we been led to infer their position in the Bunter sandstone generally, without taking the more rapid accumulation of the conglomerate as it occurs in Dumfries-shire into consideration, we should have placed them more than 300 yards below the Keuper, where it is probable that the real depth does not greatly exceed 200 yards from that deposit. With regard to the different kinds of tracks which are met with at Corncockle, two of these are also found in the quarries of the sandstone in the neighbourhood of Dumfries, viz. the impression which in front resembles the segment of a circle, and in which the sand is thrown backwards during the progression of the animal; and the other, the small impression in which toes and cushions of the foot are well marked. This latter footmark we find associated with the tracks of the *Rhynchosaurus* in the new red sandstone at Western Point near Runcorn in Cheshire. But no steps of this latter animal have hitherto been found in Dumfries-shire, and as ample opportunities would have occurred for discovering such steps had the animal which formed them existed in this locality during the deposition of that portion of the Bunter sandstone from which impressions are obtained, we may infer that either the conditions necessary for its existence did not prevail in Dumfries-shire, or that the animal was called into being after the sandstone of the district had been deposited. That this latter cause was most probably the reason why we have no traces of the *Rhynchosaurus* in the lower portion of the Bunter sandstone, we may infer from the circumstance, that three if not more types of animals, which were occupants of our earth during the more early portion of the period when the Bunter sandstone was being deposited, had ceased to exist, inasmuch as we find no traces of them in the higher beds of the sandstone.

That the small, toed animal which has been commonly considered as a tortoise, and the *Rhynchosaurus* coexisted, we have every reason to believe, but none of the impressions in Dumfries-shire show that circumstance, neither do we obtain in the district any of those worm-castings which are associated with the foot-marks at Western Point. This may probably be owing to the lowness of the beds in the Vale of the Nith and the district of Annandale, and to the deposits in the south-east of the county being above those from whence footsteps are procured in Cheshire.

It has been already mentioned that *Cheirotherium* footmarks have been met with in that portion of the new red sandstone which occurs in the south-eastern part of the county, and it has been stated that the general character of the beds here is such as to indicate that they approach near to the Keuper sandstone. We find both at Stourton quarry and also at Lymn that the footsteps of this animal occupy a high position in the Bunter sandstone. At Bemburg we find the *Labyrinthodon* also occurring in the higher beds of the Bunter; and Dr. Lloyd considers that the *Labyrinthodon bucklandi* belongs rather to the higher portion of this deposit than to the lower beds of the Keuper.

Considering the footsteps of the Bunter sandstone, we have first in the highest portion, the impressions of the *Cheirotherium*. Below these the footmarks of the *Rhynchosaurus* occur associated with what are termed the steps of a small tortoise; and at a depth exceeding 200 yards we have the tracks of several other animals, amongst which the small tortoise coexistent with the *Rhynchosaurus* also appears.

XX.—*Note to* Mr. Harkness's *paper on "The position of the Impressions of Footsteps in the Bunter Sandstone of Dumfriesshire."* By Sir W. Jardine, Bart.

Corncockle Muir is an elevated ridge of about a mile or little more in length, situate nearly in the centre of the valley of the Annan from east to west, and at about two-thirds of its length from its upper or northern end. At the northern extremity of this ridge the quarry of Corncockle is worked, and has supplied nearly the whole stone used in the neighbourhood for many generations. Further up the valley several attempts have been made to open quarries, but the rock becomes soft and inferior in quality, and no impressions of footmarks or traces of them have hitherto been met with northward of the above-mentioned locality.

So far as has yet been discovered, footprints of four distinct species of animals appear on the Corncockle beds. Of these two were described by the late Dr. Duncan, Minister of Ruthwell, in the Transactions of the Royal Society of Edinburgh, and have received the name of *Testudo duncani* from Professor Owen in his "Report on British Fossil Reptiles." A third was indicated as indistinct and having the impressions filled up; while the fourth does not appear to have been previously noticed, and is perhaps the most uncommon in the quarry. There has been no appearance of impressions of the *Cheirotherium*, which Mr. Harkness mentions as occurring in the sandstone of the lower basin.

For two of these impressions we would propose the generic title of *Chelichnus*, as little doubt will be entertained of their having been impressed by some animal of tortoise or chelonian form. These were the impressions originally noticed by Dr. Duncan and referred by Prof. Owen to *Testudo duncani*.

Chelichnus duncani, Owen, is the most frequently found, and tracks of it at the present time may be seen extending above 31 feet in length in a direction from west to east, not keeping a straight course, but zigzag and winding both to the north and south. Many of these impressions are very distinct, and exhibit a single sole or pad with slight undulations on its surface and five distinct claws which required the foot to be sunk to a considerable depth before their impress was left; these footprints are from 1 to 2 inches in diameter.

Chelichnus gigas, Jard., is the large footprint indicated by Dr. Duncan as indistinct. The general diameter is from 3 to 4 inches, frequently filled up, but when seen free they consist of a single raised pad or cushion with a circular ring, which appears in certain conditions to have protruded and concealed the claws. One impression of a walk of above 9 feet in length has been obtained, in which each footprint is 9 inches in diameter, and in one three toes are distinctly marked.

For the other two impressions, of which the direct alliance has not been ascertained, but which are certainly not tortoises, it was suggested that some more indefinite title would be preferable, and that of *Herpetichnus* has been applied.

Herpetichnus sauroplesius, Jard., is also one of the impressions noticed by Dr. Duncan; and one of the specimens presented by that gentleman to the museum of the Royal Society of Edinburgh, as well as one more lately procured, exhibit lengthened toes of unequal length, the second toe from the inside being the longest, the three exterior decreasing gradually. The impressions generally occur filled up, or present only a smooth hollow, as if the sand had been exceedingly moist, and the finer undulations of the sole had been obliterated on the removal of the foot. The length of the step or stride in these impressions, and the form of the foot in Dr. Duncan's specimen alluded to, incline us to consider this animal to have been of a more lacertine or saurian form than any of the others.

Herpetichnus bucklandi, Jard., has not been previously noticed; it is from a small animal, and the tracks generally appear raised or as a cast, but on one slab we have distinct impressions of at least three toes.

BIBLIOGRAPHICAL NOTICES.

A Sketch of the Physical Structure of Australia. By J. Beete Jukes, M.A., F.G.S. London: J. & W. Boone.

The author of this work, who accompanied as naturalist the exploring expedition of H. M. S. Fly, visited, during the voyage, considerable portions of the coasts of Australia for the purpose of geological investigation, and communicated an abstract of his researches to the British Association in 1846, and to the Geological Society in 1847. Subsequently availing himself of the various facts bearing on the subject collected during the laborious investigations of previous explorers, and to whom full credit is here given, Mr. Jukes has by his own personal examination been better enabled to study and understand the different published accounts of others, and by connecting the various observations together, having himself obtained a tolerably distinct notion of the structure of this region, has endeavoured to convey to the reader a general *résumé* of what is at present known respecting the geology and physical structure of Australia.

Considering the vast amount of still unexplored country, it might appear at first sight difficult to form any general conclusions as to the peculiar structure of the interior; but this is to some extent obviated by the great uniformity and monotony of those portions hitherto examined.

The geology of Australia (at present known) is somewhat remarkable; the principal mountain chains consisting chiefly of granitic and metamorphic rocks overlaid by a palæozoic formation with which are associated masses of porphyry, greenstone and basalt, frequently dislocating and altering portions of it: tertiary beds occupy considerable areas in the plains, as well as cover the hills to a certain height above the sea; and with these are associated still more recent igneous rocks. Deposits belonging to the secondary period (*i. e.* oölitic and cretaceous), which form so prominent a feature in the geology of portions of the northern hemisphere, have not yet been detected in Australia. "This circumstance inclines us to believe that the country may, most probably, have existed as dry land during the oölitic and cretaceous periods; if so, is it not possible that its present fauna and flora may be in some way the descendants and representatives of the fauna and flora that in the oölitic period were common to the whole earth?" Other points of equal interest are treated of in this volume, such as the peculiar character of the fossil vegetation associated with the Australian coal, as distinguished from that occurring in the carboniferous deposits of the northern hemisphere. This is a curious fact, inasmuch as, if both deposits are nearly synchronous, (and we quite agree with the author in referring the former to the palæozoic æra) Australia presents us at this early period with the antitype of a flora which became the characteristic one of the northern hemisphere during the secondary epoch: as, however, no deposits belonging to the latter occur throughout this vast continent, and inferentially no submergence of a large portion of the ancient land, until some part of the tertiary period, a question naturally arises as to the continuance and destruction of that early flora, and also as to the character of the vegetation during the tertiary æra; whether it did, like the present indigenous one, contain some forms representative of the earlier flora. Future researches may throw some light on this point. The subject matter is treated geographically under eight sections, and altogether the work is a very acceptable one, and will prove useful both to the scientific inquirer and the emigrant: the descriptions of the physical features, as dependent on the geological structure, are briefly but clearly stated. Much, however, remains to be effected; and we do not doubt that through the zealous and active labours of the Rev. W. B. Clarke, as well as in the appointment of a government geologist now proceeding on his mission, our knowledge of the peculiar structure, mineral riches and fossil character of the various rocks occurring in this important colony will be materially increased and elucidated.

Outlines of British Geology. Published for the Society for promoting Christian Knowledge. London, 1850.

This is a useful introduction to the study of British geology, embracing a general account of the principal formations occurring in England, with brief notices of those in Scotland and Ireland. In the descriptions of the range and extent of the more important strata, their physical and agricultural characters, the author has availed himself of some of the chief English works on the subject, although at the same time it is evident he has been an attentive observer of many of the described phænomena. The subject is treated in a very popular manner, devoid of all technicalities, and will form a good compendium to this science for the young student.

A copious glossary, explaining the terms which generally occur in geological works, and the nature and composition of the principal mineral substances, is appended to the volume, as well as a geological map and a few sections, illustrative of the sections of the strata traversed by the principal railways from London.

In the Press.

The Ichnology of Annandale, or Illustrations of Footmarks impressed on the New Red Sandstone of Corncockle Muir, Dumfries-shire. By Sir William Jardine, Bart., F.R.S.E., F.L.S. &c.

The illustrations now contemplated will consist of about Twelve Plates, lithographed from the "impressions on the sandstone." From the difficulty of properly representing these reduced, they will be figured of the size of the originals, and will be printed in colours so as to represent the precise appearance of the sandstone as nearly as possible. A few necessary and explanatory observations will accompany the plates.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

November 13, 1849.—William Yarrell, Esq., in the Chair.

ON THE SPECIES OF ANOMIADÆ. BY J. E. GRAY, ESQ., F.R.S.

The European species of *Anomiadæ* have been much multiplied, while on the other hand the exotic species have been almost entirely neglected.

The form, substance, surface and colour of the shell, which have been used to distinguish the species, were suspected by Montague to be dependent on the age of the specimens and the locality in which they happened to be found, and further researches have proved the accuracy of these observations.

There being in the British Museum considerable series of specimens of this family from different localities, I have attentively examined them, and believe that I have observed some characters by which they may be distinguished from each other, which are but little, if at all, modified by external circumstances or age.

Mr. Cuming has kindly allowed me to examine the original specimens of *Placunanomia,* described by Mr. Broderip, with some additional specimens which he has since received, and thus enabled me to identify the exotic species which have been described by that naturalist; and also the collection of *Anomiæ* contained in his cabinet, which has furnished me with several additional species.

The species may be divided into two very distinct genera :—

1. ANOMIA. Upper valve with three subcentral muscular scars; the anterior upper lobe of the notch separated from the cardinal edge ; the plug entirely shelly, and quite free from the edge of the notch.

2. PLACUNANOMIA. Upper valve with two subcentral muscular scars; the anterior upper lobe of the notch agglutinated to the cardinal edge; plug shelly at the top and near the body to which it is attached, and with horny longitudinal laminæ below and internally.

I. ANOMIA.

Upper valves with three subcentral muscular scars; byssal notch distinct; the upper part of the anterior lobe of the notch separate from and often partially overlapping the front of the cardinal edge; the plug thick, elongate, entirely shelly, and quite free from the edge of the notch.

Syn. Anomia, *Müller*, 1776; *Retzius*, 1788; *Lamk.* 1801; *Megerle*, 1811; *Schum.* 1817.

Anomia, pars, *Linn. S. N.*

Anomia, A. *Schumach. Essai*, 1817.

Echion and Echinoderma, sp. *Poli, Mol. Sicil.*

Fenestrella, *Bolten*, 1798.

Lampades, pars, *Gevers*, 1787.

" Ænigma, *Koch,*" according to the cabinet of Mr. Cuming.

I am by no means certain that all the species here indicated are distinct, or are to be distinguished by the characters here assigned to them, unassisted by the country which they inhabit; but they seem distinct, and it appears to be desirable that they should be distinguished until we have the means of more completely investigating them, and of examining and comparing the animals which form them.

* *The upper scar in dorsal valve large; two lower scars smaller, and nearly under the upper one. Shell suborbicular.* ANOMIA.

† *European.*

1. ANOMIA EPHIPPIUM.

Shell white, yellow, rosy or red-brown; upper valve radiated; internally pearly. The upper scar large, oblong, the two others rather smaller, subequal, one above the other; the lowest of the two rather more behind. Plug large, broad, short; the sinus in lower valve large.

Anomia Ephippium, *Linn. S. N.* 1150; *Chemn.* viii. 82. t. 76. f. 692, 693; *Mont. T. B.* 155; *Lamk. Syst.* 138; *Dillw. R. S.* i. 286; *Poli, Test.* ii. 186. t. 20. f. 9, 10; *Lamk. Hist.* vi. 226, ed. 2. vii. 273. n. 1.

Anomia Tunica Cepa, *Dacosta, B. Conch.* 165. t. 11. f. 3.

Anomia cepa, *Linn. S. N.* 1151; *Chemn.* viii. 85. t. 76. f. 694, 695; *Dillw. R. S.* i. 287; *Poli, Test.* ii. 182. t. 30. f. 1–8; *Lamk. H.* v. 227, ed. 2. vii. 274. n. 3.

Anomia violacea, *Brug. Enc. Méth.* 71.

Anomia plicata, *Brocch. Conch.* 665. t. 16. f. 9.

Anomia scabrella, *Philippi, Sicil.* i. 92. ii. 65. t. 18. f. 1.

Anomia polymorpha, *Philippi, Sicil.* i. 92. ii. 65.

Anomia costata, *Brocchi,* 463. t. 10. f. 9.

Anomia sulcata, *Poli, Test. Sicil.* t. 30. f. 12; *Brocch.* t. 10. f. 2.

Anomia radiata, *Brocchi,* t. 10. f. 10.

Anomia pectiniformis, *Poli, Sicil.* t. 30. f. 13, on a *Pecten*; *Philippi, Sicil.* ii. 63. t. 18. f. 3.

Anomia margaritacea, *Poli, Sicil.* t. 30. f. 11; *Philippi, Sicil.* ii. 63.

Anomia electrica, *Linn. S. N.* 1151; *Chemn. Conch.* viii. t. 76. f. 691; *Lamk. Hist.* vi. 227, ed. 2. vii. 274. n. 4.

Anomia squamula, *Linn. S. N.* 1151; *Chemn. Conch.* viii. 86. t. 76. f. 696; *Lamk. Hist.* vi. 228, ed. 2. vii. 275. n. 8.

Anomia punctata, *Chemn. Conch.* viii. 88. t. 77. f. 698; *Dillw. R. S.* ii. 288.

Anomia aculeata, *Müller, Z. D. Prod.* 249; *Chemn.* viii. 92. t. 77. f. 702; *Mont. T. B.* 157. t. 4. f. 5; *Dillw. R. S.* i. 288.

Anomia scabra, *Solander MSS.* fide *Dillwyn.*

Anomia lens, *Lamarck, Hist.* vi. 228, ed. 2. vii. 276. n. 9.

? Anomia aspera, *Philippi, Sicil.* ii. 65. t. 18. f. 4.

Anomia elegans, *Philippi, Sicil.* ii. 65. t. 18. f. 2.

Anomia patelliformis, *Chemn. C.* viii. 89. t. 77. f. 700; *Dillw. R. S.* i. 290.

Anomia striatula, *Bruguière, Enc. Méth.* 74.

? Anomia bifida, *Chemn. Conch.* viii. 79. t. 76. f. 689, 690; *Dillw. R. S.* 290.

Anomia cylindrica, *Gmelin, S. N.* 3349; *Dillw. R. S.* i. 291.

Anomia cymbiformis, *Maton & Racket, Linn. Trans.* viii. 104. t. 3. f. 6; *Mont. Supp.* 64.

Anomia coronata, *Bean, Mag. N. Hist.*

Anomia patellaris, *Lamk. Hist.* ed. 2. vii. 273. n. 2; *Deles. Recueil*, t. 17. f. 3.

Anomia pyriformis, *Lamk. Hist.* vi. 227, ed. 2. vii. 275. n. 5; *Deles. Rec.* t. 17. f. 4.

Anomia fornicata, *Lamk. Hist.* vi. 228, ed. 2. vii. 275. n. 6 = *Enc. M.* t. 170. f. 45.

? Anomia membranacea, *Lamk. Hist.* vi. 228, ed. 2. vii. 275. n. 7 = *Enc. Meth.* t. 170. f. 1–3?

? Anomia cucullata, *Bruguière, E. M.* 70.

Hab. European Seas.

Coast of Africa; Capt. Edward Owen. B. M.

†† *Asiatic.*

2. Anomia amabæus.

Flat, white, smooth; internally pearly, with a very thin disk.

Upper scar moderate; lower scars 2, rather large (nearly as large as the upper one), confluent into a broad oblong scar.

Hab. Philippines, Island Buraas (Jackass Island); on stones, sand, ten fathoms.

3. Anomia cytæum.

Shell suborbicular, smooth; internally reddish.

Upper muscular scar very large, subcordate; lower 2, suborbicular, smaller, nearly equal-sized; the upper in the notch of the upper one; the lower hinder close to lower hinder edge of the upper one; sinus in lower valve large.

Hab. China, River Zangtze Keang; *Fortune.* Mus. Cuming; two specimens.

4. Anomia dryas.

Suborbicular, flat, white; upper valve internally and radiately lined.

Upper scar large, oblong; lower scars 2, small, circular, nearly confluent, placed side by side nearly on the same line.

Hab. Singapore; on dead shells, ten fathoms, in coarse sand and gravel. Mus. Cuming; one small specimen.

5. Anomia achæus.

Shell purplish, smooth; umbo rather acute; upper valve generally convex; inside purplish white.

Upper muscular scar large, lower edge slightly arched; lower scars 2, small, nearly equal-sized; the hinder rather lower than the other.

Hab. Indian Ocean, Kurachee, mouth of the Indus. Brit. Mus. and Mus. Cuming.

Major Baker has kindly sent to the Museum a very large series of the dorsal valves of this species, collected at *Kurachee.* They are extremely variable in form, surface, colour and thickness, and they also offer considerable variety in the disposition of the muscular scar. In all the upper scar is largest, but variable in shape from round to broad cordate. In most the two lower scars are close together, but separate, and nearly on the same line. In others the lower scar is rather lower than the middle one, and in a few (four) specimens, which are mostly produced posteriorly, the lower scar is much lower; that is to say, in some the upper edge is parallel with the lower edge of the middle one. In one specimen the two lower scars are on the same line, and are confluent together, forming a scar about the same size as the upper scar, yet showing that the lower scar is formed by two muscles; so that this valve cannot be confounded with a *Placunanomia*.

The examination of this series of specimens from the same locality I think shows, that though the comparative size and disposition of the scars may furnish good characters for the distinction of the species, yet they are not to be implicitly relied on.

6. Anomia belesis.

White or red; the upper part of the centre of the dorsal valve white, externally radiately striated; apex acute, at some distance from the dorsal edge.

Upper valve with three separate scars, the upper one very large, oblong, and rather transverse; two lower ones very small, nearly equal-sized, and nearly on the same line.

Hab. Indian Ocean? *General Hardwicke.* Brit. Mus.

††† *American.*

7. Anomia acontes.

Yellowish white, suborbicular, flat, smooth; disk pearly.

Upper scar moderate, subcircular; lower scars smaller, distant, circular, subequal, the lower one nearly on a line with the lower edge of the middle one.

Hab. Jamaica; *Gosse.* Mus. Cuming; one small specimen.

8. Anomia fidenas.

White, pearly, thin, flat, smooth externally, pearly within, with a thick white disk.

Upper scar large, elongate, arched below; lower scars 2, small, circular, far apart, the lower one considerably below the other.

Hab. America, west coast. Panama; on *Pinna* at low water. Mus. Cuming, No. 2; three specimens.

9. Anomia adamas.

Red, thick, with numerous indistinct radiating ribs, most distinct on the edge of the lamina; internally red, pearly, with a small white disk.

Upper muscular scar oblong, arched below; lower scars subequal, separate, but close together, and nearly on the same line.

Hab. Galapagos; Lord Hood's Island, attached to *Avicula margaritifera* at nine fathoms. Mus. Cuming, No. 5; three specimens.

10. Anomia pacilus.

Red, with distinct radiating ribs; internally reddish pearly, with a thick white disk.

Upper muscular scar oblong, broad, lower edge arched; lower scars 2, rather smaller, nearly similar in size, rather close together but separate, the hinder one rather lower than the other.

Hab. Peru; Tambaz; dredged from five fathoms in soft mud. Mus. Cuming, No. 9.

11. Anomia larbas.

Shell white, smooth, lower valve pale green.

Upper muscular scar large; lower scars 2, nearly as large as, and close to, the upper one, nearly equal, and nearly in a line.

Hab. Coast of Peru, Payta. Mus. Cuming.

12. Anomia alectus.

Irregular, upper valves convex, reddish, internally pearly; lower valve green, internally green.

Upper scar large, oblong; lower scars 2, large, rather smaller than the upper one, close together, but not confluent; the lowest one the largest.

Hab. Peru, Bay of Guayaquil; *Hinds.* Mus. Brit., and Mus. Cuming, No. 7.

13. Anomia hamillus.

Reddish, thin, sinuous. Dorsal valve with a triangular, white, porcellanous disk.

Upper scar large, roundish; lower scars 2, separate, close together, nearly equal-sized, small, and nearly on the same line.

Hab. West Columbia, Bay of Cañes. Mus. Cuming, No. 6.

14. Anomia lampe.

Shell yellowish green, radiately costated; internally green.

Upper muscular scar large, squareish; lower two rather smaller, subequal, near together and to the upper scar, and nearly on the same line; sinus in lower valve very large.

Hab. California; *Lady Katherine Wigram,* Mus. Brit. Mus. Cuming; three specimens.

15. Anomia tenuistriata.

Shell very variable in shape, regularly radiately striated; sinus of lower valve very large, ovate.

Dorsal valve with three nearly equal muscular scars very close together; the two lower small, placed close together side by side, just on the lower margin of the upper scar, the hinder one being rather behind the hinder edge of the upper one.

Ostrea anomialis, *Lamk. Hist. A. s. V.* vi. 220.

Anomia Ephippium, *Defrance, Dict. Sci. Nat.* ii.

Anomia striatula, *Desh. Coq. Foss. Paris,* t. 65. f. 7, 11.

Anomia tenuistriata, *Desh. Coq. Foss. Paris,* i. 377, *in Lamk. Hist.* vii.

Fossil, Grignon.

The very characteristic scars of the dorsal valve are well shown in M. Deshayes' plate above referred to, but not mentioned in the description.

** *Upper scar of dorsal valves large; two lower scars smaller, far behind the upper one. Shell oblong, transverse.* ÆNIGMA, *Koch.*

16. ANOMIA ÆNIGMATICA.

Shell elongate, transverse, oblong, purple or yellowish, with a purplish disk; apex acute, considerably within the dorsal edge.

The upper scar large; suborbicular, subcentral; lower scars 2, much more posterior, small, equal-sized, and nearly confluent.

Tellina ænigmatica, *Chemn. Conch.* xi. t. 199. f. 1949, 1950.

Anomia rosea, *Gray, Ann. Philos.* 1825, 5.

Anomia ænigmatica, *Alton in Wiegmann Arch.* 1837, *Verz.* 21; *Reeve, Nomen. Conch.*

Hab. Indian Ocean.

Var. 1. Elongate, purplish brown, smooth, flat. *Chemn. l. c.* f. 1949, 1950.

Hab. Indian Ocean, on the surface of flat wooden piles, &c.

Var. 2. Like former, but more elongated, and the sides folded together.

Anomia naviformis, *Jonas*; fide *Mus. Cuming.*

Ænigma, sp. *Koch*; fide *Mus. Cuming.*

Hab. Manilla. Mus. Cuming.

Var. 3. Flat, smooth; like *Var.* 1, but yellow, with a dark purple-brown transverse ray.

Hab. Philippines. Mus. Cuming.

Var. 4. Flat, purple; like *Var.* 1, but often more ovate, and with a few radiating ribs, ending in projections, making the edge sinuous.

Hab. Singapore; on piles of wood forming the wharves. Borneo. Mus. Cuming.

*** *Two upper scars small; lower one large. Shell suborbicular; sinus small.* PATRO.

17. ANOMIA ELYROS.

White, lamellar, closely radiately striated.

The disk of the upper valve with three separate subcircular scars; the two upper scars small, subequal, one under the other; the lower one large, nearly circular, subcentral. Notch in lower valve very small. Plug small, elongate, subcylindrical; the notch small, with reflexed edges.

Hab. Port Essington; *Earl of Derby.* Depuch Island; *Capt. Sir Everard Home, Bart.* British Museum.

Var. 1.? Shell very thin. Mus. Cuming.

Var. 2. Very thick; disk white, very thick. Mus. Cuming.

The small size of the upper scars in this species probably depends on the small size and elongated form of the plug. The other species, which have the upper scar the largest, have at the same time a larger notch and a broader plug.

II. PLACUNANOMIA.

Upper or dorsal valve with two subcentral muscular scars; the upper scar radiately veined. Byssal notch distinct, converted into a hole by the upper part of the anterior lobe of the notch being soldered to and forming part of the cardinal edge: the plug triangular, gradually enlarging in size; the apex and outer surface next to the body to which it is attached, calcareous, longitudinally striated; the inner surface covered with horny, longitudinal, parallel laminæ, and more or less agglutinated to the edge of the notch.

Syn. Placunanomia, *Broderip, Proc. Zool. Soc.* 1832, 29; *Müller, Syn.* 176; *Desh. in Lamk. Hist.* vii. 269.

Anomia, *β, Schumacher, Essai,* 1817.

Anomia, pars, *Blainv. Man. Moll.*; *Montague*; *Forbes & Hanley.*

Ostrea, sp. *Da Costa*; *Montague.*

Placunonomïa, *D'Orb. Amér. Mérid.*

Placunomia, *Swains. Malac.* 39, 1840.

Pododesmus, *Philippi, Wiegmann Arch.* i. 385, 1837.

Mr. Broderip, who established this genus, does not observe the character furnished by the muscular impressions, or the lobe of the notch: he merely says, "Impressio muscularis in utrâque valvâ subcentralis. In valvâ superiore organi adhesionis impressio superaddita." And further, that "the organ of adhesion, which in its bony character (for it is more bone than shell) resembles that of *Anomia,* does not perforate the lower valve directly, but is inserted between the laminæ of the internal surface of the lower valve, above the muscular impression and below the hinge, and passes out into an external, irregular, somewhat longitudinal, superficial fissure or *cicatrix,* which is narrowest at the hinge margin, and which it entirely fills to a level with the surrounding surface."

This form is produced by the gradual increase of the size of the plug and the simultaneous increase of the size of the shell.

Some have considered the "plug" or "stopper" of *Anomia* to be a third valve, which is evidently a mistake. Philippi (*Moll. Sicil.* i. 92) considers it as the ossification of the tendon of the adductor muscle.

Mr. Broderip, in the passage quoted, regards it as a *bone.* In Dr. Dieffenbach's Travels I have remarked: "The plug is evidently only a modification of the kind of laminar beard formed by the end of the foot of the Arcs (*Arcæ*); for, like it, it is formed of numerous parallel, erect, longitudinal horny laminæ, placed side by side, extending from the apex to the margin, and it is on these plates that the calcareous matter is deposited when the attachment assumes its shelly substance. The same structure is to be observed in the plug of the European *Anomia Ephippium* (*striata*)."—*Voy. New Zealand,* ii. 261.

Messrs. Forbes and Hanley compare it to the byssus of *Pecten,* and venture to predict that when the very young Anomiæ have been observed, they will be found to be attached by threads like that genus (*Brit. Moll.*). I have examined a very small specimen of the genus, and found it laminar, like that of the adult shell.

M. Philippi, when describing *Pododesmus,* appears to have observed only the upper of the two muscular scars, for he gives as the generic character, "*Impressio muscularis unica, ovata,*" and he only figures the larger upper one on the plate.

The upper scar, which is usually of a larger size, and has its surface covered with radiating veins, while the lower is generally punctated, appears to be the one which gives rise to the muscle that is attached to the inner surface of the plug.

* *Shell plicately folded. Perforation of lower valve small, firmly embracing the plug.* PLACUNANOMIA.

1. PLACUNANOMIA CUMINGII.

Shell depressed; edge of the valves with three or four large angular folds.

Placunanomia Cumingii, *Broderip, Proc. Zool. Soc.* 1832, 29; *Sow. Genera,* t. ; *Manual,* t. . f. .

Hab. Central America; Gulf of Dulce, Province of Costa Rico.

** *Shell ovate, radiately ribbed; edge not plicated. Perforation of lower valve moderate, firmly embracing and inclosing the plug.* PODODESMUS.

† *American.*

2. PLACUNANOMIA RUDIS.

White; disk brown; smooth laminæ.

Upper valve with two rounded separate scars of nearly equal size, the hinder one rather more transverse.

Placunanomia rudis, *Broderip, Proc. Zool. Soc.* 1834, 2.

Pododesmus decipiens, *Philippi, Wiegmann Arch.* i. 1837, 387. t. 9. f. 1 (one scar left out).

Hab. East Indies? *Broderip.* Havana; *Philippi.* West Indies; *Brit. Mus.*

3. PLACUNANOMIA FOLIATA.

White, smooth laminæ, with very slight, distant, radiated ribs; disk purple brown.

Upper valve with two nearly united scars; the upper largest, and rather elongated; lower small, rounded.

Placunanomia foliata, *Broderip, Proc. Zool. Soc.* 1834, 2.

P. echinata, *Broderip, Proc. Zool. Soc.* 1834, 2.

"P. pectinata, *Brod.*" in *Mus. Cuming.*

Hab. Eastern Columbia, Bay of Guayaquil. Isle of Muerte; *Broderip.* Martinique, n. 6, and Brazils, n. 7; Mus. Cuming. Jamaica (upper valve of young only); *Rev. L. Guilding*; Brit. Mus.

The specimen of *Placunanomia echinata,* from the island of Nevis, in Mr. Cuming's collection, appears to be only an imperfect specimen of this species. Mr. Broderip doubted if this might not be the case, when he described it.

4. PLACUNANOMIA ABNORMALIS.

White, radiated, ribbed.

Upper valve with two scars, confluent on the lower hinder edge; the upper one rather the largest.

"Placunomia abnormalis, *Sow.*" in *Brit. Mus.*

Hab. West Indies.

These three species are very nearly related to each other, and if it were not for the difference in the position of the scars, might be taken for one. The first is white, and the two last have a brown blotch on the internal surface of the dorsal valve.

*** *Shell ovate, not plicated; radiately ribbed. Perforation of lower valve large, only slightly embracing the large thin plug.* MONIA.

5. PLACUNANOMIA MACROCHISMA.

Upper valve with two scars, partly confluent on the lower hinder edge; the upper scar largest. Lower valve with an oval oblique scar, narrowed behind, rather in front of the plug.

Anomia macrochisma, *Deshayes, Rev. Soc. Cuvier.* 1839, 359; *Mag. de Zool.* 1841, t. 34.

Placunanomia Broderipii, *Gray, B. M.* 1842, and *Mus. Cuming.*

Hab. Kamtschatka; *Deshayes.* "Onalaski," Mus. Cuming. "Cagayan, Lucon," fide "*G. B. Sowerby,*" in Brit. Mus.

M. Deshayes observes: "On sait que dans le plus grand nombre des Anomies la perforation se reduit ordinairement en un simple échancrure, parce que les deux parties du bord supérieur ne se rejoignent jamais. Ici au contraire le trou est complète, et la valve est réellement perforée." This character is common to all the species of *Placunanomia.* M. Deshayes does not figure nor describe the plug. I think the habitat assigned to this species by Mr. G. B. Sowerby must be a mistake. It is the specimen referred to by Mr. Broderip in the observations on the genus in the Proceedings of the Zoological Society.

6. PLACUNANOMIA CEPIO.

Scars 2, far apart; upper very large, ovate, longitudinal, central; lower smaller, oblong, oblique, rather behind the upper.

Plug large, flat, broad. Notch large, wide.

Hab. California; *Lady Katherine Wigram;* Brit. Mus.

7. PLACUNANOMIA ALOPE.

Upper valve flat, smooth, radiately striated. Scars two, well separated, rounded, equal-sized.

Hab. California; *Lady Katherine Wigram.*

Two upper valves in British Museum.

†† *European.*

8. PLACUNANOMIA PATELLIFORMIS.

Shell suborbicular, convex or quite flat, radiately striated; inner disk greenish. Apex rather within the dorsal margin.

The upper muscular scar of the dorsal valve very large, oblong; the lower one small, roundish, on the lower part of the hinder margin of the upper one.

The peduncle of the cartilage with a triangular cavity in front, under the tip, and continued in an oblong rib-like ridge towards the centre of the shell.

Anomia patelliformis, *Linn. S. N.* 1152; *Nov. Act. Upsal.* 1773, i. 42. t. 5. f. 6, 7; *Retzius, Nov. Gen. Test.* ii.; *Sars,* fide *Mus. Cu-*

ming; *Loven, Moll. Scand.* 30; *Forbes & Hanley, Brit. Moll.* 334. t. 56; *Wood, Index Test.* t. 10. f. 10, not *Chemn.*

Squama Magna, *Chemn. Conch.* vii. 87. t. 77. f. 697.

Anomia Squama, *Gmelin, S. N.*; *Schumacher, Essai.*

Ostreum striatum, *Da Costa, Brit. Conch.* 162. t. 11. f. 4.

Anomia undulatim striata, &c., *Chemn. Conch.* viii. 8. t. 77. f. 699.

Anomia undulata, *Gmelin, Syst. Nat.* i. 3346; *Mont. Test. Brit.* 157. t. 4. f. 6; *Maton & Racket, Trans. Linn. Soc.* viii. 103; *Turton, Conch. Dict.* 4. *Bivalves,* 230. t. 18. f. 8, 9; *Dillw. R. S.* i. 289; *Wood, Index Test.* t. 11. f. 9.

Ostrea striata, *Pulteney in Hist. Dorset,* 36; *Donovan, B. Shells,* ii. t. 45; *Mont. T. B.* 153, 580.

Anomia striata, *Loven, Index Moll. Scand.* 29; *Forbes & Hanley, Brit. Moll.* 336. t. 55. f. 1, 6. t. 53. f. 6.

Hab. Coast of Europe. British Seas, *Lister.* North Sea, *Sars,* fide *Mus. Cuming,* n. 51.

This species is easily known from the other European species by being generally thicker and regularly radiately ribbed, and greenish; but the number and position of the muscular scars at once separate it from all the multiform varieties of that species. Some authors, overlooking the latter character, have been inclined to regard it as a mere variety.

I may remark, that the large series of this species which I have examined has shown that the position of the two muscles is liable to a slight variation; in by far the larger number of specimens the small lower muscle is quite close to and confluent with the scar of the upper larger muscle, but in a few specimens it is separated from the upper larger one by a small interval or space. This has induced me to believe that probably the three West Indian species of the genus may prove, when a larger series of specimens have been collected and compared, only varieties of the same species.

††† *Australian.*

9. Placunanomia zealandica.

Suborbicular, white, smooth; upper valve with distant radiating grooves; internally dark green.

Upper valve with two confluent scars; upper oblong, longitudinal, lower rather small and more transverse.

Anomia Zealandica, *Gray, in Dieffenbach's New Zealand,* ii. 261, 1843.

Hab. New Zealand; on the inside of mussel shells.

10. Placunanomia ione.

Shell white, laminar; edge of the laminæ with small, slender, elongated processes; internally green.

Lower muscular scars small, round, on the lower hinder edge of the larger one; sinus or perforations large.

Hab. Australia, Sydney; on rocks, *Mr. Strange.*

Mus. Cuming; three specimens. ? Van Diemen's Land.

Dr. Sinclair, Brit. Mus., a single dorsal valve.

11. Placunanomia colon.

Shell (upper valve) flat, with rather irregular, flat, radiating ribs; white, lower spotted; upper valve with two separate scars; the upper one oblong, longitudinal, the lower much smaller, circular.

Hab. ——?

Mr. Cuming's Collection (no. 10). Mr. Humphrey's Collection; a single upper valve of a rather young shell.

Here may be added the description of a new genus, intermediate between this family and *Placunidæ.*

III. Hemiplacuna.

Shell free; valves orbicular, flat, external surface minutely laminar and radiately striated, especially on the edge of the plates; muscular scar in each valve single, nearly central, circular; the right valve flat, with a large oblong, elevated transverse process for the cartilage, having a very small concavity in the inner surface in front of the cartilaged process representing the sinus in *Anomia*; the left valve rather more convex, with an oblong transverse pit for the internal cartilage under the umbo.

Hemiplacuna, *G. B. Sowerby, MSS.*

This shell has all the external characters of the flat species of *Placuna,* and has the same muscular impression; but instead of having the two linear diverging ridges and grooves to give attachment to the cardinal cartilage, it has an oblong elevated process in the right valve, and an oblong cavity in the left, exactly similar to those found in the genus *Anomia*; and on the inner surface of the right valve, just in front of the base of the process which supports the cartilages, there is a small shallow roundish pit with a short furrow towards the centre of the shell, which is evidently a rudimentary representation of the sinus found in the genus *Anomia.* This sinus is not visible on the outer surface of the shell.

This shell forms a most excellent passage between the genus *Anomia,* or rather *Placunanomia,* and *Placuna.* It shows the gradual change which takes place between the three genera. In *Anomia* there are two muscles for the purpose of attaching itself to marine bodies, which form a plug which is free from the sinus of the shell.

In *Placunanomia* there is only a single muscle to perform the same office, but in the more typical species of this genus the plug itself is affixed into the surface of the shell, forming, as it were, part of its substance. In *Hemiplacuna* and *Placuna* there is no muscle or plug for attachment, and the shells are free; but in *Hemiplacuna* there is a rudimentary development of the sinus through which the plug is emitted, and the ligament which connects the shell is of the same form as that found in the genera *Anomia* and *Placunanomia.*

Mr. George B. Sowerby kindly showed me this shell, which he purchased with a number of other fossil shells brought from the Red Sea. He informed me that he intends to describe it at length, and give it the name which I have with his permission here used. The specimen now forms part of the British Museum collection. I immediately recognized in it the species of *Placuna* figured by M. Rozière in his plates of the fossils of the Red Sea, engraved in Napoleon's large work on Egypt.

The name for the genus is not consistent with the Linnæan canon; but I use it rather than attempt to form a less objectionable one, and thus burthen the genus with two names.

HEMIPLACUNA ROZIERI.
Placuna, sp., *Rozière, Description d'Egypte, Minéralogie*, t.11. f.6.
Hemiplacuna Rozieri, *G. B. Sow. MSS.*
Anomia? or Placuna? *Desh. in Lamk. Hist.* vii. 270, *note.*
Fossil. Shore of the Red Sea; Vallée de l'Egarement.

November 27.—R. H. Solly, Esq., in the Chair.

The following paper was read:—

1. ON THE LORINE GENUS OF PARROTS, ECLECTUS, WITH THE DESCRIPTION OF A NEW SPECIES, ECLECTUS CORNELIA. BY CHARLES LUCIAN, PRINCE BONAPARTE, F.M.L., F.Z.S. ETC. ETC. ETC.

The richness, good scientific order and proper management of the well-kept Zoological Garden of Amsterdam, as well as the courtesy and liberality of its able director, Mr. Westerman, will strike every naturalist, even though coming, as I did myself, from England. The establishment has been lately illustrated by the pen of H. Schlegel, equally superior when it removes the boundaries of science for professed zoologists, or renders it useful and popular to ladies and children. With or without his valuable book, a visit to this attractive spot would be fully repaid by the inspection alone of the gigantic Salamander, *Sieboldia maxima*, Bonap., which has grown more than a foot in length since I gave it that generic name; not to speak of the beautiful collection of living *Fringillidæ* and *Parrots*. Among the rarest and most splendid species of these latter birds, collected from every quarter of the globe, I will only mention, from America, a magnificent *Macrocercus hyacinthinus*, Vieill., with the bill still larger than usual; from Africa, the Congo Jack, *Pionus gulielmi*, established a few weeks ago by Sir William Jardine; and from Malasia the *Lorine*, which I now introduce to the Zoological Society, sure of their receiving with forbearance my compendious account of its relations.

The genus *Eclectus* of Wagler holds a conspicuous place in the family of *Lorine Parrots*, and is eminently natural if kept within the proper boundaries assigned to it by its founder, including his two only species, and, as a third, my new one, all from the Moluccan islands, and similar in form, having a large stature, the plumage loose, red, with more or less blue, a powerful black bill with scarcely a cere, a smooth simple tongue, and a shortish square tail.

1. ECLECTUS PUNICEUS. *E. coccineus, dorso, alis, caudâque purpureo-fuscescentibus; margine alarum, tectricibus inferioribus, remigibus, annulo ophthalmico, fasciâ abdominali et torque interscapulari, pulchrè cyaneis; crisso, et caudæ apice, rubris.*

Synonyms.

Psittacus puniceus, *Gm.* (exclus. specimin. rostro rubro.)

Lorius amboinensis? *Briss. Orn.* iv. p. 231. sp. 19.

Psittacus cardinalis? *Bodd.* ex Lory d'Amboine, *Buff. Pl. Enl.* 518.

Domicella! punicea? *Wagl. Mon. Psitt. in Act. Monac.* p. 569. gen. xiii. sp. 3.

Eclectus Linnæi, *Wagl. Mon. Ps.* p. 571. gen. xiv. sp. 1; *Gray, Gen.* tab. 103. f. 1.

Lorius cardinalis? *G. Gray, nec Hombr. et Jacq. Voy. Astrolabe et Zélée.*

Hab. New Guinea, where it has been killed often on the west coast near Lobo, by M. Sal. Muller.

The iris in this species is black.

Misled by Wagler, and judging by the plate of Buffon, which certainly gives the idea of a true *Lorius*, Mr. G. R. Gray has, by double employment, considered the *puniceus* as one of these birds in his 'Genera.' Should he have seen the Parrot, he would have perceived it to be identical with his *Eclectus Linnæi*, and consequently that *puniceus*, which Kuhl only went a little too far in confounding with *B. grandis*, far from being generically distinct, is, even as a species, very nearly allied to it.

2. Eclectus grandis. *E. coccineus, dorso, alis, caudâque, purpureo-fuscescentibus; margine alarum, tectricibus inferioribus, remigibusque, apice cyaneis; abdomine, et torque interscapulari, subviolaceis; crisso, et caudæ apice, luteis.*

Synonyms.

Psittacus grandis, *Gm. Lath. Kuhl* (who unites the preceding with it).

Psittacus ceylonensis, *Bodd.* ex Lory de la Nouvelle Guinée, *Buff. Pl. Enl.* 683; *Brown, Ill.* tab. 6; *Levaillant, Perr.* tab. 126 adult, 127 junior, 128 juv.

Eclectus grandis, *Wagl. Mon. Psitt. in Act. Monac.* 1832, p. 573. gen. xiv. sp. 2.

Eclectus ceylonensis, *G. Gray, Genera of Birds.*

Hab. In Insulis Moluccis.

Often brought from Amboina, but the native place is not well ascertained. Doctor Forsten (too often confounded with Forster), one of the scientific victims of climate, sent it to Holland from the island of Gilolo.

The iris in this species is golden yellow.

3. Eclectus Cornelia. *E. coccineus, dorso, alis, caudâque, purpureo-fuscescentibus; margine alarum remigibusque apice cyaneis; tectricibus inferioribus rubro cyaneoque variis; abdomine, crisso, et caudæ apice, rubris concoloribus.*

I have named this beautiful bird after H. Schlegel's virtuous and talented wife, whose quick eye detected the species before professed ornithologists themselves, who relied on their possessing it among the unnumbered treasures of the as yet uncatalogued Leyden Museum *; and I dedicate it to that lady with additional pleasure, as a small testimony of gratitude for the happy hours spent, and the useful information collected, under the hospitable roof of the zoologist,

* The superiority of the Leyden Museum over any other is unquestionable, not perhaps so much on account of its containing a greater number of species than those of London, Paris, Philadelphia and Berlin, but for the freshness and perfection of the specimens, for the quantity of skeletons, and above all for the never-sufficiently-praised series of individuals of the various species of both sexes, in different ages, and from different localities and countries, which facilitate one's judgement, and show at once in most cases, especially with *Mammalia*, what is or is not a good species. For this and many other reasons, a detailed Catalogue of this splendid collection is a necessity of our days. We can hardly conceive how the many treasures accumulated in that National establishment by the indefatigable zeal of its so well-known director, Temminck, seconded by M. Schlegel and their subordinates (whose industry may be appreciated in England by those acquainted with M. Frank the Amsterdam merchant, so useful to science and naturalists of every country), are still allowed to remain unknown and undescribed; the Museum itself, with its numerous new species, being left *uncatalogued*, and that in the year 1850! The discoveries made by Dutchmen in far-distant lands, to the peril of their lives, and with their own or their government's capital, are thus daily exposed to be anticipated by other nations, and monopolized by the ever-increasing struggles of English industry; whilst a scientific Catalogue published on the plan long since advocated by Professor Is. Geoffroy St. Hilaire for the museum of the great French Nation, that is, with descriptions and figures of all new or not sufficiently-known species, would be an imperishable monument for science and for the Dutch Nation. And the greater benefit have we the right to expect for science from the execution of this noble enterprise, inasmuch as M. Schlegel, who would certainly be the head and arm of the publication, combines the knowledge for which he has long been celebrated all over the world, with the skill of a firstrate draftsman. His paper on Iconography applied to Natural History (Mem. Taylerian Soc. Haarlem), in which beautiful drawings of his own are produced as examples, after he has critically reviewed the standard works of every nation, and while giving sound precepts to artists devoted to our science, ought to be known everywhere, and at least translated into the English language. Under such circumstances, no book on Natural History, we shall never enough repeat it, would prove more effectual to the progress of science, more creditable to the nation, to the government, and to the able individuals willing to accomplish the labour, than the Catalogue of the Leyden Museum on the enlightened plan above-mentioned, which such a naturalist as Schlegel certainly could not fail to improve in the course of elaboration.

In order to prove our assertion, it is enough to remark, how much by the desired publication would be improved our knowledge of the Malasian fauna, since, of the productions of the island of Gilolo alone, all those collected at the mere landing of the Dutch naturalists, upon a surface of a square mile, proved to be new, and many of them very important additions to science; to indicate the number of undescribed objects received from Ashantee; and to point out the advantages arising from the facility of placing henceforth beyond the possibility of doubt the existence of remarkable species unaccountably rejected or misplaced, as *Gavialis Schlegeli* and *Testudo emys*. But to justify fully our insisting on these facts, I will select a few animals which I shall have perhaps the honour thus first to introduce to the English naturalist, and these examples I shall take out of each of the different classes, saying of the animals just as much as is necessary to excite, not to satisfy scientific curiosity. Among the new Mammalia, some of which will constitute new genera, I shall choose a third living species of Elephant.

Elephas sumatranus, Temm., based upon four skeletons which I admired in company with my learned friend and colleague, Prof. Is. Geoffroy St. Hilaire of Paris. This species is perfectly intermediate between the Indian and African, especially in the shape of the skull, and will certainly put an end to the distinction between *Elephas* and *Loxodon* with those who admit that anatomical genus; since although the crowns of the teeth of *E. sumatranus* are more like the Asiatic who possesses the deepest knowledge of each and every class of vertebrate animals, and whose literary and *truly philosophical* attainments are only equaled by his practical and thorough acquaintance with species, the only solid base of our science.

Hab. In Insulis Moluccis; most probably from Ceram.

The total length of this Parrot is 1 English foot 2 inches, the wings measuring $8\frac{3}{4}$ inches, and its tail $5\frac{1}{2}$ inches. The bill is black, as in the other Noble-Lories (*Eclecti*), and the small portion of the cere that remains uncovered by the red feathers of the front is greyish; the red colour on the head is brighter than on the rest of the plumage, and somewhat lighter than in the other species; the naked ring around the eye is very narrow and grey, without the small blue feathers that surround it in *Eclectus puniceus* only; the iris is stramineous and exteriorly of a reddish colour; the pupil, excessively dilatable, is blue-black. The feet are grey, with the granular little scales blackish; the nails black. The quills are greenish internally, reddish externally, but with their point of a shining blue; on the under surface they are entirely blackish; the under wing-coverts are red, intermixed with blue. The tail-feathers are of a dull red, with black shafts, and internally somewhat greenish. The bottom of the whole plumage is lead-colour.

The absence of blue on the back and abdomen at once distinguishes

animal, still the less numerous undulated ribbons of enamel are nearly quite as wide as those forming the losanges of the African. The number of pairs of false ribs (which alone vary, the true ones being always 6) is 14, one less than in the *africanus*, one more than in the *indicus*; and so it is with the dorsal vertebræ, which are 20 (21 and 19 in the others), whilst the new species agrees with *africanus* in the number of sacral vertebræ (4), and with *indicus* in that of the caudal ones (34).

Of the Birds I shall only mention *Agelastes meleagrides*, Temm., a lesser Talegalla, furnished with a strong spur, very rounded wings, and a flat tail. The head and neck are naked; a very broad white collar; all the rest of the plumage black, finely undulated with white.

In the Reptiles a new *Viperine* may be spoken of with great interest, constituting certainly an independent genus (*Chloroechis*, Schlegel), and showing that Nature takes pleasure in hiding under the similarity of tints the snares of a detestable animal, as the innocence of the females of showy birds affords them protection against the tyrants of the air. The green colour of this poisonous Serpent from Ashantee, as well as its forms, recall the *Dendrophidinæ*, and make it, though a true *Viperine*, lead an arboreal life, and conceal its perfidious power among the foliage of the trees.

From the Amphibians a dozen of undescribed *Hyladinæ* will prove Africa not so deficient of these elegant Frogs as it has been supposed to be; whilst another small *Batrachian* from New Holland (*Myiobatrachus paradoxus*, Schlegel) has the general appearance of a *Bombinator*, but with the body rounded and the legs and toes shortish, somewhat connected or at least entangled by the marginal skin of the flanks. It is rendered remarkable in the whole class of Amphibia by two long curved canine teeth situated towards the end of the superior jaw, and much resembling fangs.

Among the Fishes I have particularly admired a *Percine* from the Cape, allied to the *Anthias buphthalmos* of my 'Fauna Italica,' and called by Schlegel *Anthias gibbiceps* . . . . But what, if hundreds of new species of that class (and I am still dazzled by the sight of many and many even of my favourite *Pleuronectidæ*) would by their being well known greatly benefit our science, and alone give convincing proof of the propriety, nay, I may add, of the urgent necessity, of the publication?

our new Parrot from both its congeneric species, the red colour prevailing so much on its plumage that even the under wing-coverts are variegated with that colour, and not pure blue as in the others. Our *Ecl. Cornelia* stands therefore with *puniceus* and *grandis* precisely in the same relation that *Lorius unicolor*, Bechst. (Levaill. pl. 125) does to *Lorius tricolor*, Steph. (*Ps. lory*, L., figured in Levaillant's plates 123 and 124), both being almost entirely red, and wanting the blue tinges on the so-called scapular. From that analogous variety of a red-billed species, however, the black bill will tell it at once, even to those superficial observers who only look to colours; and as to another *cardinalis* (besides the *puniceus*, so called by Gray, through reverence to the heterodox Boddaert), that of the Astrolabe and Zélée's voyage, the generic difference is still more strongly declared in that species of French naturalists, since it has a greater nudity round the eye, a wedge-shaped tail, and more slender and elegant forms.

This is not the place to enter into a discussion about geographical species, local races, or varieties. Our *Eclectus Cornelia*, notwithstanding its identity of forms and similarity of colours with *E. puniceus* and *grandis*, which might induce a philosophical mind to consider the three as forming but one and the same species, differs more from either of the two than they do from each other, although they have been placed in different genera. It is impossible at all events that the three should not be kept distinct by those naturalists who wish to represent Nature as it is, not as they would have it; and consistency forbids to consider them otherwise than species as long as we admit as such the *Lagopus scoticus*, and the different kinds of Sparrows of Europe; and they certainly deserve that title more than the inconstant geographical modifications of *Falco peregrinus*, admitted as species by those who slight over the much more important and at least constant differences of the Vulturines. *Habent sua sidera . . . species!* That is all we have to say on so important a subject for the present.

It is impossible to imagine a bird of milder and more gentle disposition than our *Eclectus*. The specimen figured allowed itself not only to be handled in every manner, but placed free, out of its cage, would allow every measurement to be taken, its wings pulled, its tail spread, and every feather to be counted and described. Even when its patience was at an end, and it resorted to its bill, it was gently; and it would only use the powerful weapon in seizing the intruding finger without inflicting any kind of injury. It uttered a low note, resembling that of the coot (*Fulica atra*, L.) when heard at a distance.

MISCELLANEOUS.

On the Visual Organ of the Annelida. By M. A. de Quatrefages.

An interesting question, and one which has not yet been completely solved, is—whether the organs of the senses exist in the lower animals. In this memoir M. Quatrefages has engaged in the investigation of the sense of sight in the Annelida, the organ of which should be more easily discovered than that of the other senses, for it is always characterized, even in its most rudimentary state of organization, by the crystalline lens (taken in its most general sense), and by a retina.

Among the Annelida, *Torrea vitrea* presents very perfect eyes; their size is somewhat considerable (0·001 millim.); they have a crystalline lens, a choroid coat, a vitreous humour, a transparent cornea, &c.; some others also have a visual apparatus as perfect or very nearly so.

In the *Hermellæ*, the *Sabellæ*, and the *Terebellæ*, the question is more difficult of solution, for the eyes are very small and sunk beneath the integuments; hence they are not easily detected; they must undoubtedly be compared with the stemmata of insects.

Some Annelida have other eyes besides those on the head. M. Quatrefages believes that he has discovered them upon the branchiæ of the *Sabellæ*, and he has no doubt that the red points which we find upon the sides of each ring in several Annelida of the genus *Nais* are true eyes; there is however nothing surprising in this, when we recollect the very great independence existing between the various rings of which the body of these animals consists. Again, some acephalous mollusca, as *Pecten*, also present, upon the borders of their mantle, eyes, the nerves of which are not derived from the cerebral ganglion.—*Comptes Rendus*, Dec. 31, 1849.

NEW CLASSIFICATION OF TRILOBITES.

To the Editors of the Annals of Natural History.

Edinburgh, August 9th, 1850.

Gentlemen,—I beg you to insert in your first number of the 'Annals of Natural History' the inclosed new classification of Trilobites prepared by my friend M. Barrande of Prague in Bohemia, which I recommend to the consideration of naturalists for its simplicity and clearness. It forms part of the very important work in three volumes, imperial quarto, which that very meritorious person is about to publish, and the first volume of which will be ready in the autumn.

At the Meeting of the British Association for the Advancement of Science recently held at this place, I pointed out to the Geological Section the beauty of the plates of Trilobites already completed, and indicating the very high value of the work geologically and zoologically, I endeavoured to show that it would throw a more condensed and clear light upon the distribution of all classes of animal life in the older palæozoic world, than any publication which had yet appeared.

M. Barrande's 45 genera of Trilobites, as named herein, are divided by him into 250 species. His plates of chambered shells, mollusks, &c. are equally beautiful, and I earnestly solicit naturalists as well as geologists to subscribe to a work, which published in the French language, has been carried on by the author at a very great cost of time and labour, and in which he has shown the utmost ability. The high opinion which Professor Edward Forbes entertains of this work of M. Barrande was declared in the warmest terms by him in the proceedings of our Section.

Your very obedient servant,

RODERICK I. MURCHISON.

Essai de Classification des Trilobites.

Section I. Conformation de la tête très-distincte de celle du pygidium.

Familles.	1ere Série.	Plèvre à sillon.		Familles.	2me Série.	Plèvre à bourrelet.
I.	1.	Harpes .... *Goldf.*		XII.	32.	Acidaspis ...... *Murch.*
II.	2.	Remopleurides . *Portl.*				
	3.	Paradoxides ... *Brong.*				
	4.	Hydrocephalus . *Barr.*				
	5.	Sao .... *Barr.*				
	6.	Arionellus ...... *Barr.*				
III.	7.	Ellipsocephalus *Zenk.*	Pygidium minimum. Thorax maximum.			
	8*.	Olenus .... *Dalm.*				
	9*.	Peltura .... *M. Edw.*				
	10*.	Triarthrus ...... *Green.*				
	11.	Conocephalites . *Zenk.*				
	12.	Prœtus .... *Stein.*			33.	Cheirurus ...... *Beyr.*
	13.	Phillipsia ...... *Portl.*			34.	Placoparia ...... *Cord.*
IV.	14*.	Griffithides ... *Portl.*		XIII.	35.	Sphærexochus . *Beyr.*
	15.	Cyphaspis ...... *Burm.*			36.	Staurocephalus *Barr.*
	16.	Arethusina ...... *Barr.*			37.	Deiphon ...... *Barr.*
	17*.	Harpides ...... *Beyr.*		XIV.	38*.	Zethus .... *Pand.*
V.	18.	Phacops .... *Emmr.*			39.	Dindymene ... *Cord.*
	19.	Dalmania ...... *Emmr.*			40*.	Amphion ...... *Pand.*
VI.	20.	Calymene ...... *Brong.*		XV.	41*.	Encrinurus ... *Emmr.*
	21*.	Homalonotus . . *Kön.*			42.	Cromus .... *Barr.*
VII.	22.	Lichas .... *Dalm.*				
	23.	Trinucleus ...... *Lhwyd.*				
VIII.	24.	Ampyx .... *Dalm.*				
	25.	Dionide .... *Barr.*				
	26.	Asaphus .... *Brong.*				
IX.	27*.	Symphysurus... *Goldf.*				
	28*.	Ogygia .... *Brong.*				
		Axe tronqué.	Pygidium maximum. Thorax minimum.			*Axe tronqué.*
X.	29.	Æglina .... *Barr.*		XVI.	43.	Bronteus ...... *Goldf.*
		Groupe de passage.				
XI.	30.	Illænus .... *Dalm.*				
	31*.	Niteus .... *Dalm.*				

44. Telephus ... *Barr.* (plèvre inconnue).

Section II. Conformation de la tête peu distincte de celle du pygidium.

XVII. 45. Agnostus...... *Brong.* .... ?

Nta. les genres qui manquent en B.

THE NEPAUL BEAR, URSUS BABELLA, HORSFIELD.

The Nepaul bear having been found to vary greatly in colour, and in some states very nearly to resemble the European brown bear, some zoologists have been inclined to regard it and the European bear as the same species. There is a fine specimen of the Nepaul bear now living in the Gardens of the Zoological Society, and the comparison of it with the European bear, nearly of the same size, shows that the Nepaul animal is a very distinct species. Its most distinguishing character is the shortness of the hind-feet; the ears are very large, prominent, and covered with bushy hair. The head is broader, and the muzzle shorter and covered with shorter and more adpressed hair than its European congener; indeed the head and feet have the appearance of being almost one-quarter shorter in proportion to the size of the animal than that species. The claws are elongate, arched, compressed, and with a sharp cutting edge beneath.—J. E. GRAY.

Description of a new species of the genus Thracia. By Dr. JONAS.

THRACIA MAGNIFICA, Jonas. *Th. testâ ovato-oblongâ, transversâ, inæquivalvi, lacteâ; utrinque rotundatâ; lateribus hiante; valvâ dextrâ ventricosiore et majore quam sinistrâ; latere antico flexuoso, posteriore brevi, obliquè carinato, transversim corrugato-plicatâ, plicis subdistantibus concentricis longitudinaliter radiatim granulato-striatâ, margine neutrali arcuato anticè subsinuato.*

Hab. ——?

From the Proceedings of the Zoological Society for Dec. 11, 1850.

Remark on the genus Nocticula *of J. V. Thompson.* By J. D. DANA.

The genus *Nocticula*, established by Thompson in his 'Zoological Researches,' No. 2. p. 52. and pl. 5 (Cork, 1829), is closely related to the *Euphausidæ*. The general form of the animal, its thoracic and abdominal appendages, and the antennæ, eyes, and short beak, are as in *Thysanopoda* and *Euphausia*; and the last abdominal segment has the acuminate character with the naked barb on either side near the apex, which occurs in this family*. The legs are not however represented as bifid, the outer branch and branchial appendages having been overlooked (and in the suggestion of this error we make the "*due allowance* for drawings made at sea of such minute objects" which Thompson asks of his readers). The number of thoracic legs is stated at sixteen, but this includes, as the drawing shows, a pair of maxillipeds. Excluding these, there will then be seven pairs, which is the number in *Thysanopoda*; and it seems probable that *Nocticula* and *Thysanopoda* are identical, and if so, the former name has the precedence.

The species described and figured by Thompson was taken in the

* Milne-Edwards alludes to this character in the name of his *Thysanopoda, T. tricuspidata* (Ann. des Sci. Nat. xix. 1830, 454, note).—The genus *Nocticula* is not referred to by Edwards, either in his Memoir, or in his 'Hist. Nat. des Crustacés.'

Atlantic, between latitudes 5° 25′ S. and 29° 30′ N., and longitude 17° 18′ W. and 32° 55′ W., on the 6th, 12th and 25th of September. It was brilliantly phosphorescent. It is called the *Nocticula Banksii*, as it is supposed by Thompson, and with apparent good reason, to be identical with the *Cancer fulgens* of Sir Joseph Banks, a species observed between Madeira and Brazil, and published with a drawing by Macartney in the Philosophical Transactions for 1810. This drawing Thompson has copied, and in it seven pairs of thoracic legs are represented.—*From Silliman's American Journal for July* 1850.

METEOROLOGICAL OBSERVATIONS FOR JULY 1850.

Chiswick.—July 1. Cloudy : clear. 2. Fine. 3. Rain : cloudy and boisterous. 4. Heavy rain. 5. Fine : clear. 6. Fine : overcast. 7. Rain. 8. Very fine. 9. Cloudy : showery. 10, 11. Very fine. 12. Foggy : overcast. 13, 14. Overcast and fine. 15. Very fine : sultry : clear. 16. Very fine : cloudy. 17. Slight haze : very fine : overcast : rain. 18. Heavy rain : sultry : cloudy and mild. 19. Rain. 20. Overcast. 21. Cloudy and fine. 22, 23. Very fine. 24. Cloudy : rain at night. 25. Heavy showers. 26. Fine : windy : cloudy : rain. 27. Rain : showery. 28. Slight showers. 29. Cloudy : very fine : quite clear. 30. Cloudy : clear at night. 31. Slight haze : fine.

Mean temperature of the month	61°·91
Mean temperature of July 1849	62 ·29
Mean temperature of July for the last twenty-three years .	63 ·23
Average amount of rain in July	2·38 inches.

Boston.—July 1. Cloudy : rain P.M. 2. Fine. 3. Cloudy. 4. Cloudy : rain with thunder and lightning P.M. 5. Cloudy. 6. Cloudy : rain A.M. and P.M. 7. Rain. 8. Fine. 9. Cloudy : rain P.M. 10—12. Cloudy. 13—15. Fine. 16. Fine : rain A.M. and P.M. 17. Fine. 18. Calm : rain P.M. 19. Rain : rain A.M. and P.M. 20, 21. Cloudy. 22, 23. Fine. 24. Cloudy : rain early A.M. 25, 26. Cloudy : rain A.M. and P.M. 27. Rain : rain A.M. and P.M. 28. Cloudy : rain A.M. and P.M. 29, 30. Cloudy. 31. Fine : rain A.M. and P.M.

Applegarth Manse, Dumfries-shire.—July 1. Heavy rain at night : showers. 2. Showers all day and wind. 3. Showers : fair P.M. : wind. 4. Showers : cleared P.M. 5. Heavy showers : fine P.M. 6. Rain all day. 7. Fine A.M. : a few drops P.M. 8. Very fine all day. 9. Showers nearly all day. 10. Very fine all day. 11. Very warm : slight drizzle. 12. Very warm : thunder. 13. Very warm : oppressive. 14. Very warm : close. 15. Very warm : bright. 16. Very warm : slight showers : thunder. 17. Very warm : thunder. 18. Warm : dull : hazy : thunder. 19. Warm : shower early. 20. Warm still and pleasant. 21. Warm and fine : cloudy P.M. 22. Warm : a few drops of rain. 23. Warm : sultry : thunder. 24. Heavy rain. 25. Fair A.M. : wet all rest of the day. 26. Showery all day. 27. Very slight drizzle. 28. Fair : warm. 29. Fair and very fine. 30. Fair and warm. 31. Shower early : fair P.M.

Mean temperature of the month	59°·4
Mean temperature of July 1849	57 ·0
Mean temperature of July for the last twenty-eight years ...	58 ·1
Average rain in July for twenty years	3·91 inches.

Sandwick Manse, Orkney.—July 1. Showers. 2. Clear : drops. 3. Rain. 4. Fine : clear. 5. Cloudy : clear. 6. Clear : fine. 7. Clear : showers. 8. Showers : hail. 9. Bright : clear. 10. Cloudy : fine. 11. Fog : rain. 12. Cloudy. 13. Cloudy : fine. 14, 15. Fine : very fine. 16. Fine : very fine : hot. 17. Drops : showers : fog. 18. Cloudy : fine. 19. Cloudy : fine : cloudy. 20. Cloudy : fine : fog. 21. Bright : hazy. 22. Hazy : fine. 23. Bright : fine. 24. Clear : fine. 25. Clear : fine : hot : fog. 26. Cloudy : hot : drizzle. 27. Fog : damp. 28. Cloudy : fog. 29, 30. Cloudy. 31. Bright : clear.

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

Days of Month. 1850. July.	Barometer. Chiswick. Max.	Barometer. Chiswick. Min.	Barometer. Boston. 8½ a.m.	Barometer. Dumfries-shire. 9 a.m.	Barometer. Dumfries-shire. 9 p.m.	Barometer. Orkney, Sandwick. 9½ a.m.	Barometer. Orkney, Sandwick. 8½ p.m.	Thermometer. Chiswick. Max.	Thermometer. Chiswick. Min.	Thermometer. Boston. 8½ a.m.	Thermometer. Dumfries-shire. Max.	Thermometer. Dumfries-shire. Min.	Thermometer. Orkney, Sandwick. 9½ a.m.	Thermometer. Orkney, Sandwick. 8½ p.m.	Wind. Chiswick. 1 p.m.	Wind. Boston.	Wind. Dumfries-shire.	Wind. Orkney, Sandwick.	Rain. Chiswick.	Rain. Boston.	Rain. Dumfries-shire.	Rain. Orkney, Sandwick.
1.	29·881	29·808	29·28	29·52	29·46	29·41	29·41	70	46	59·5	60	54	55	51	sw.	sw.	ssw.	sw.	......	......	......	·15
☾ 2.	29·913	29·851	29·32	29·57	29·56	29·44	29·52	71	52	62·5	60	48½	53	51½	sw.	w.	w.	s.	......	·05	......	·05
3.	29·915	29·751	29·12	29·19	29·60	29·17	29·40	73	53	65	59	49	52	47	sw.	ssw.	w.	w.	·25	......	......	·13
4.	29·913	29·753	29·30	29·58	29·64	29·55	29·67	68	44	61	57	48½	54	51	sw.	s.	sw.	nw.	·33	......	......	·09
5.	30·148	30·052	29·52	29·79	30·00	29·81	30·01	70	40	60	61	46½	54	50½	w.	w.	w.	wnw.	......	·40	......	......
6.	30·151	29·922	29·66	29·97	29·77	30·03	29·96	71	53	62	53½	42	53½	51	sw.	s.	sw.-e.	sw.	·09	......	......	·05
7.	30·955	29·658	29·34	29·83	29·87	29·92	29·87	63	43	58	62	49	51½	46	n.	sse.	nw.	nw.	·34	·65	......	......
8.	30·040	29·991	29·54	29·90	29·91	29·94	29·97	68	39	56	62	45	49	46	w.	nw.	w.	nw.	......	......	1·65	·30
● 9.	30·016	29·955	29·54	29·90	29·94	29·95	30·02	67	41	59	60	45½	50	47	w.	nnw.	w.	nnw.	·15	......	......	·06
10.	30·064	30·044	29·62	29·95	29·93	30·01	30·00	69	43	55	66	43	52	52	sw.	nw.	w.	calm	......	·33	......	......
11.	30·091	30·068	29·59	29·95	30·00	29·95	30·01	70	47	63	65	54	57	54	nw.	nw.	sw.	se.	......	......	......	......
12.	30·108	30·025	29·62	30·02	30·00	30·00	30·02	68	48	67	68	57½	65½	57½	e.	sse.	s.	w.	......	......	......	·16
13.	30·026	30·015	29·59	30·00	30·02	30·10	30·13	75	49	60	71	58½	58	60	e.	ne.	e.	sse.	......	......	......	......
14.	30·053	30·008	29·60	30·07	30·05	30·15	30·15	74	54	69	72½	52	61	58	se.	ene.	e.	ese.	......	......	......	......
15.	29·974	29·926	29·50	30·00	29·97	30·10	30·05	85	60	66	72½	55½	61	62	e.	ne.	se.	se.	·01	......	......	......
☽ 16.	29·920	29·888	29·42	29·92	29·90	30·00	30·00	89	57	70	72	56	66	62	sw.	ene.	ene.	ese.	·04	......	0·10	......
17.	29·865	29·849	29·37	29·88	29·84	29·95	29·95	80	54	69	76	55	66	56½	n.	ene.	ne–n.	w.	·34	·02	......	......
18.	29·991	29·921	29·40	29·87	29·88	29·95	29·98	76	59	68	68	55½	60½	54	sw.	nw.	s.	w.	·37	......	......	·10
19.	29·941	29·921	29·39	29·89	29·89	29·98	29·98	67	54	60	70	55	59	55½	w.	n.	nnw.	se.	·02	1·28	......	......
20.	29·943	29·933	29·45	29·89	29·84	29·94	29·91	66	56	65	69	52	58½	56½	e.	e.	sw.	se.	......	·03	......	·05
21.	29·946	29·938	29·45	29·82	29·79	29·83	29·80	78	50	67	71	49	60½	57½	se.	s.	sw.	sse.	......	......	......	......
22.	29·943	29·911	29·40	29·83	29·84	29·89	29·96	85	60	67	74	60	62	57	s.	se.	se.	se.	......	......	......	......
23.	29·901	29·809	29·25	29·83	29·75	30·01	29·99	88	55	70	76	59½	61	58	se.	e.	se.	ese.	·15	......	0·20	......
○ 24.	29·925	29·909	29·30	29·72	29·79	29·96	29·95	76	49	61	66	55½	63½	59½	s.	w.	sw.	e.	·15	·10	......	......
25.	29·813	29·628	29·30	29·74	29·60	29·85	29·82	65	50	63	65	48½	67	62	s.	s.	s.	e.	·10	......	......	......
26.	29·716	29·666	29·05	29·59	29·61	29·76	29·82	69	54	59·5	62	53½	62	57	w.	wnw.	n–ne.	nne.	·06	·44	......	......
27.	29·807	29·729	29·16	29·70	29·91	29·95	30·06	63	54	57	67	56	55½	52	w.	w.	n.	nw.	·26	·22	......	·02
28.	29·989	29·904	29·48	29·96	30·08	30·09	30·18	65	54	58	67½	52	55	53	n.	n.	ne.	nw.	·01	·50	......	......
29.	30·109	30·066	29·60	30·12	30·10	30·18	30·16	72	52	63	69	53	57	57	ne.	n.	e.	wsw.	......	·08	......	......
30.	30·197	30·150	29·68	30·13	30·08	30·14	29·95	74	54	66	71	54	61	60½	ne.	calm	sw.	s.	......	......	1·00	......
31.	30·144	30·106	29·54	30·03	30·13	30·09	30·20	78	62	66	68	57½	56½	55	w.	wnw.	w.–e.	w.	·01	......	......	......
Mean.	30·009	29·908	29·43	29·843	29·862	29·906	29·932	72·67	51·16	62·9	66·4	52·2	57·98	54·75					2·68	4·10	2·95	1·16

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 34. OCTOBER 1850.

XXI.—*On the Hedge Plants of India, and the conditions which adapt them for special purposes and particular localities.* By Dr. Hugh F. C. Cleghorn, Hon. E.I.C.S.*

It is my purpose to notice the hedge-plants observed in the Peninsula, as well as a few indigenous species of frequent occurrence, from the employment of which advantages may be derived. My intention is to glance at them under their botanical and agricultural characters, and to allude to some which deserve to be generally diffused with a view to their œconomical properties and practical utility.

Since my admission on the Madras establishment in 1842, I have traversed a considerable portion of that Presidency in the execution of duty, including the Southern Division, the territories of Mysore, with parts of Canara, and the Southern Mahratta country. Along the line of march, and in the course of botanical rambles, I made rough camp notes as to the vegetation and general appearance of the country. From want of leisure, these were unavoidably very imperfect, yet they may serve to attract attention to a subject which seems to me of no small importance; and I trust some little advantage may be derived from my observations.

The system of Indian husbandry continues much in the rude state our fathers found it a century ago. In the day of rapid progress at home, agriculture in Hindostan evinces few signs of improvement. The farming utensils are simple and wretched; the most abject utilitarianism characterizes field operations. With the Ryot no motive seems to exist beyond providing the means of immediate subsistence: he scratches the soil with his black-wood plough, tipped with iron, and made light with the pole of bamboo, so as to be carried on the shoulder; he drops

* Read to the British Association, August 1, 1850. An abstract was previously laid before the Botanical Society of Edinburgh.

the seed upon the furrow, drags a log of wood,—hollowed like a trough but open at the ends,—to break the clods and smoothen the surface, or draws a few thorny branches of Acacia over the field, which may be termed the brush-harrow of the Hindoo: nature has been bountiful—man is indolent, and gives himself no concern about his crop, trusting for the anticipated harvest to the immense productiveness of the soil, which yields, in many parts thrice a year, such abundant crops under the favouring rays of a tropical sun, that the cultivator is not stimulated to farther exertion. The Ryot, however, understands irrigation and the succession of seasons, but knows little regarding the biennial or triennial rotation of crops. The sites of tanks are invariably well chosen, being selected where one or more *nullahs* or water-courses naturally meet in a convenient locality for embankment. Manure is never employed on the cotton plains, although usually in sugar-cane fields, and to a great extent in Sooparee gardens, as well as to the root of grape vines and pine-apples. The manure used generally consists of rotted leaves, cow-dung, wood ashes, blood, dead fish, &c.; and indeed the dunghills of Betel plantations are so valued as occasionally to become the subjects of litigation. I would simply mention the fact that œconomy is not practised in the employment of animal manures. In 1846–47 large quantities of bones of animals that had died of disease and drought, were scattered over the plains, in the Mysore territories. I had a portion collected in heaps, ground to fragments in a Chunam mill, and then sparingly applied to a potato field: the result showed the fertilizing effect.

There is no spring of activity among the aborigines of these unhappy lands; hence it becomes the especial duty of the Agri-horticultural Societies at the different Presidencies, of the Chambers of Commerce, and of every enlightened and liberal member of the community, to aid and encourage the regeneration of the agricultural system.

Whilst deploring that past exertions have been retarded by the indisposition of the natives to adopt the improvements of science and the suggestions of practical men*, "which they foolishly conceive to be unprofitable innovations," there is ground for consolation in observing that the results of "*persuasion, patience* and *perseverance*" are visible in the improved face of the country over large tracts, as Mysore, the Ceded districts and Southern provinces, which have been longest under our rule, and in which a cessation from war has enabled our resources to be devoted more assiduously to *the triumphs of peace*.

This altered aspect has been brought about by the bridging

* Madras Athenæum, May 9th, 1843.

of rivers and nullahs; the formation of Ghauts, by which the inland traffic reaches the coast; the abolition of transit duties; the extension of made roads; the increased number and better construction of labour-carts, arising from increased facilities of intercourse; and the completion of other public works, as Moosaffir-Khanahs, Choultries, Travellers' Bungalows, &c. Let us hope that as the various impediments are successively removed, in process of time our modes and systems will be better understood and appreciated; the lands will be more generally manured, the fields enclosed, and the roadsides fenced; additional tracts cultivated, and English improvements gradually introduced into Hindostan,—giving an impetus to commerce throughout the country.

As the *climate* widely varies in different parts of the Peninsula, so the *aspect* of the country, the soils and productions of the districts, the modes of cultivation, and the facilities of traffic differ in an extraordinary degree, and those cultivators accustomed to one method of agriculture can seldom manage any other.

The arid sands of Madras, the undulating plateau of Mysore, the extensive plains of the Deccan, the primæval forests of Coorg and Malabar, the jungles of Hydrabad and Nuggur, present botanical and geological features strikingly dissimilar*. There is as much variety in the surface of the ground as there is in different parts of Europe: indeed so complete is the contrast between the extreme sterility of some tracts of the Carnatic plains, which exhibit a painfully barren picture of desolation from the total absence of wood, and the luxuriant arboreous vegetation of the Neilgherry slopes, which the researches of Wight prove to possess one of the richest floras in the world, that no two countries in Europe display more opposite characteristics. The climate of the former is remarkable for excessive drought, so that European furniture invariably cracks and warps, whereas in the vicinity of the Malabar Ghauts the south-west monsoon is felt in full force, and the fall of rain exceeds 120 inches in the season, producing an atmosphere so charged with humidity that the lancet in my pocket has been covered with rust in a few days. It must be clear, therefore, that in suggesting as worthy of trial any vegetable products calculated to enrich and improve the country, great attention must be paid to the question of local applicability. The effects of moisture greatly favour the growth of most species, while a very dry state of the air is incompatible with the life of others.

* Hence the importance of specific habitats being given to every specimen in our Indian herbaria; not such a vague one as "*India Orientalis*" or "*Montes Hindostaniæ.*"

The *Cacti*, *Agaveæ* and *Euphorbiæ* are adapted to the arid districts, their structure enabling them to exist, when refreshed with only occasional showers; the *Mimoseæ* and *Cæsalpineæ* seem to enjoy the somewhat more cold and moist climate of the Balaghaut districts; while the *Bambuseæ* and *Pandaneæ* luxuriate in the rich loamy soil of the Mulnad (*i. e.* Rain country). Hence, were a railway* to cross the Peninsula, the fences ought to differ as the line is continued through various districts, in accordance with the conditions under which particular plants thrive best between certain limits of temperature and moisture. The great prevalence of spiny shrubs and prickly bushes all over India is remarkable to every one; they are a continual source of annoyance to the traveller, and a fruitful cause of admission into hospital, as every regimental surgeon can testify.

Scutia indica (Brong.), *Zizyphus* (four species), *Solanum indicum* (L.) and *trilobatum* (L.), *Toddalea aculeata* (Pers.), *Pterolobium lacerans* (R. Br.), *Carissa carandas* (L.), *C. diffusa* (Rox.), *Azima tetracantha* (Lam.), *Smilax ovalifolia* (Rox.), *Acacia*†, *Mimosa*, many species, and other armed climbing plants, are widely diffused. These often grow interlaced in thickets, or surround the clumps of jungle like a fringe—presenting a rampart which is almost impenetrable, especially when forest conflagrations have occurred and a dense tangled underwood has succeeded. The long flexuous stems of several species of *Calamus* are particularly troublesome, obstructing all passage through the unfrequented forests of the Malabar Ghauts, and even when the path has been cleared with a bill-hook, the graceful tendrils unobserved frequently trip the most cautious traveller, and the recurved prickles are with difficulty unhooked from his clothes.

Again on the open ground the traveller's progress is impeded by *Echinops echinatus* (Rox.) with its globular spinous heads, *Tribulus lanuginosus* (L.) with its hairy pointed fruit, *Solanum Jacquini* (Willd.), completely armed with prickles, *Barleria prionitis* (L.) and *buxifolia* (Rox.), spreading everywhere in Mysore, *Asteracantha longifolia* (Nees) on the margins of ditches and tanks, which has six to eight spines at each verticil, *Lepidagathis* (two species), with spinous pointed leaves.

The prickles and spines of these plants wound the barefooted pilgrim, especially during the hot months, when the leaves having

* Whilst writing these pages, Dr. Royle, the E.I. Company's botanist, informed me that an official reference had been made to him concerning the plants best adapted for hedging the Indian railways, now in progress.

† One of the most remarkable is *Acacia latronum*, W.; common in the barren tracts, armed with large white stipulary thorns united at the base. Linnæus designated it "Frutex horridissimus, ramosissimus:" it is entitled to this distinction.

dropped off, the thorns are left bare and exposed, which renders travelling extremely difficult in some parts, as the spines are so strong as to pierce a shoe or sandal of dressed leather; and if the weary traveller seek to rest himself, he must beware as much of thorns, as of red ants, tarantulæ, and other biting insects which infest the soil. Innumerable climbers festoon the Euphorbiaceous hedges, enveloping them with their umbrageous leaves, and showing off their elegant and many-tinted blossoms to the best advantage on these nearly leafless shrubs.

The rich inflorescence bursts forth towards the close of the rains. All do not unfold their flowers at once—a continuous succession of blossom is presented throughout the year in the subalpine districts, which are under the influence of the S.W. monsoon. These strong climbing plants, consisting chiefly of *Convolvulaceæ, Cucurbitaceæ, Apocynaceæ* and *Asclepiaceæ*, delight the eye and often diffuse an agreeable fragrance, but by their rank luxuriance prove very destructive to enclosures. Some of those most frequently met with are as follows:—

Cucurbitaceæ.

Mukia scabrella, Bryonia laciniosa, epigæa and *mysorensis, Coccinia indica, Trichosanthes Cucumerina* and *palmata.*

Convolvulaceæ.

Ipomæa sepiaria and *vitifolia, Pharbitis nil, Quamoclit pinnatum* and *phœniceum, Argyreia aggregata* and *bracteata, Calonyction speciosum* (Ch.).

Asclepiaceæ.

Oxystelma esculentum, Dœmia extensa, Holostemma Rheedii, Pergularia odoratissima.

Apocynaceæ.

Ichnocarpus frutescens (R. Br.), *Carissa carandas* (L.), *C. diffusa* (Rox.), *Vallaris pergularia* (Burm.).

The herbaceous plants generally met with, enjoying the shelter of the hedges by the roadsides, are suffruticose *Malvaceæ, Mirabilis Jalapa, Plumbago zeylanica, Deeringia celosoides, Asystasia coromandeliana* (N. E.), *Peristrophe bicalyculata, Boerhaavia* (two species), *Basella alba, Cardiospermum Heliocacabum* with balloon-like capsules, *Abrus precatorius, Mucuna prurita, Canavallia virosa, Clitorea ternatea,* a blue and white creeper of great beauty. The cyan hue of the *Clitorea,* with the yellow petals of *Abutilon,* and the pure white of *Coccinia indica*—found in every hedge—offers a truly splendid appearance.

After these preliminary notes, as to the abundant provision in nature for the extensive diffusion of hedges, let us see to what extent the plants adapted for live fences have been made subservient to that use in the œconomy of agriculture. Supplied with such materials for hedge-making as few countries possess, we have wretched enclosures,—in many parts none at all, and cultivators go on in the old way of their ancestors, whose footsteps they follow with the utmost devotion and reverence. Some carefully tie the necks of the sheep and donkeys to their fore-legs to prevent their straying over the plains: other villagers by general agreement drive away the cattle at the beginning of the monsoon, and again permit them to roam unherded as soon as the rains are over.

If the traveller stations himself on one of the detached conical hills or droogs, which form a peculiar feature of Southern India, for the purpose of obtaining a bird's-eye view of the surrounding country, he probably finds during the rainy and cold season, a fine sheet of cultivation, comprising a great variety of cereal, leguminous and oleaginous plants, sown with regularity and spreading round the scattered mud-built villages to a great extent: the fields in full flower look beautiful and give an appearance of prosperity. During the hot season the scene is very different; few are the traces of vegetation,—an arid plain then stretches around you; the sun acts so powerfully as to produce fissures and cracks all over the ground. "The surface of the plain presents a monotonous and almost treeless extent of arenaceous waste, bounded by the horizon, and unbroken save by a few rocky elevations that stand forth abruptly from the sheet of black soil like rocks from the ocean."

"Sir Thomas Munro might well observe that these (the Ceded) districts are more destitute of trees than any part of Scotland he ever saw, and that the traveller scarcely meets with one in twenty miles, and nowhere with a clump of fifty*."

Since the time of that enlightened governor, much has been done to improve the physical aspect of the country, by the plantation of numerous topes of *Bassia latifolia* (Mahwa) and avenues of *Ficus indica* and *religiosa* (banyan and peepul), which being planted on both sides of the trunk-roads afford a pleasant shade.

The custom generally is to separate the patches of arable land when dependent on irrigation by low mounds of earth; when dry by slight fences of dead thorns (*Vachellia Farnesiana*), or by leaving between them uncultivated strips or spaces from 3 to 15 feet wide, sometimes broader (according to the value of the

* Capt. Newbold in 'Madras Journal of Science,' vol. x. p. 113. Since writing the above we have heard of the lamented death of this able and distinguished geologist, at a time too when diligently employed in publishing his researches.

land). These are overrun with spinous plants, studded with dwarf Mimosas, or at certain seasons thickly covered with long grass: these interspaces add to the beauty of the country, and contribute in some measure to the fertility of the soil by preserving a little moisture; but their irregularity presents a very slovenly appearance, and the brush is often inhabited by wild hogs and antelopes which greatly damage the crops. Fences as in England are few and rarely to be seen. Some of the fields are surrounded by hedges; but these are not kept in such repair as to resist the pressure of cattle: they are frequently meant only to distinguish the lands appertaining to particular castes or classes of the villagers.

The hedges observed in our wanderings generally consisted of *Opuntia Dillenii* (Haw.), *Euphorbia Tirucalli* and *antiquorum*, with *Agave americana* (L.). When the ground is sown, the gaps are filled up with branches of *Vachellia Farnesiana*, a small tree which grows in many fields.

It is only in the neighbourhood of large towns, encircling the smaller villages, military cantonments, missionary settlements, or the dwelling-houses of intelligent foreigners, that we find ornamental or even regular enclosures. A few very fine hedges demonstrate how well they would thrive, and show the practicability of agricultural improvement, if the will and energy existed among the natives. The hedges of the country in general, even when kept up as fences round temples, are in a very slovenly condition, and are ruined by being overgrown with rank climbing plants, such as those previously enumerated.

Opuntia Dillenii, Haw.

Cactus indicus, Rox.

Hedge Prickly Pear.

Nag phena, *Hindustani*. Naga-kulli, *Canarese*.

Probably introduced from South America, though so long domesticated all over India, that many consider it a native.

Commonly used as a hedge-plant about cantonments, forming an impenetrable fence, 4 to 6 feet high; but excludes the air, and harbours destructive vermin and venomous reptiles. Cultivators object to it, because it spreads, cannot be kept within bounds, and impoverishes the land.

The hotter the district the more luxuriant this plant: it flowers at all seasons, and grows in the most sterile ground—in sand—in the rocky beds of rivers—in the fissures of mud walls. It is easily propagated by planting leaves in the earth half buried; they seldom fail to strike root and prosper; it is difficult to eradicate; the figs are eaten sparingly in times of scarcity. Spines one to three together in a tuft.

Sir Hans Sloane mentions in his 'History of Jamaica' that, "In the Island of St. Cristopher, when it was to be divided between English and French, it was ordered by the consent of the two nations that there should be planted three rows of the *Opuntia tuna* as a boundary, thinking these the strongest fortification to hinder the attempts of one another in cases of war." The Grecian traveller, Clarke, has suggested that in some latitudes it might serve as an outwork for fortifications; since, as he says, "artillery has no effect upon it; pioneers cannot approach it; fire will not act upon it; and neither infantry nor cavalry can traverse it."

In fact in the Spanish colonies in America this plant is considered as a very important means of military defence, and is propagated constantly around fortifications with that intent. Desfontaines in his 'Flora Atlantica' remarks of *O. tuna*: "Munimentum hortorum et domorum impenetrabile."

We object to the prickly pear from its unsightly appearance, "the enormous area it covers, and the harbourage of every variety of filth and vermin." It should only be employed when none of the plants aftermentioned will grow. The cantonments of Hurryhur and French Rocks have been greatly improved by the substitution of neatly kept milk-hedges for the prickly pear, which formerly deformed them. The bandicoot rat (*Mus malabaricus*, Shaw, *M. giganteus*, Hardwicke), a most destructive animal, is partial to hedges of the *Opuntia* and *Agave*, burrows under them to a great depth, and roots up the seeds of garden plants sown near its haunts.

Pereskia aculeata (Haw.), the West Indian gooseberry, grows readily, and seems likewise well adapted for hedges.

Agave americana, L.

A. Cantula, Rox.

Fourcroya Cantula, Haw.

[Figured in Lindley's Vegetable Kingdom, 2nd ed.]

The American Agave. Native name: *Wilaeete Ananas*, i. e. English Pine Apple. Sans. *Kantula*.

Introduced from America.

In some parts the hedges are formed almost exclusively of this stately aloe-looking plant, which is both ornamental and useful. The flower-stalks rise to the height of 15 to 30 feet, when ten or twelve years old, and are employed in roofing. It flowers in the rains.

The long sheathing leaves are sometimes macerated for the fibres, which are separated by beating on stones, and form excellent cordage. The lower decayed leaves are used as fuel in the absence of wood, and the terminal spines sometimes serve instead of pins and nails. The Agave juice is not collected in India, vinous beverages being formed from the date and cocoa-nut palms, which flourish in the same localities. These latter trees, with the *Agave, Opuntia,* and Bamboo, give a character to the landscapes in Southern India. This species is propagated by suckers, and young plants are in great request. There are hedges of this plant in Spain, Portugal, Sicily, Calabria, West Indies, South America, Mauritius, Cape Town. Native gardens are often surrounded by mud walls, armed with Agave leaves, the spines being made to project at both sides.

Euphorbia Tirucalli, L.

Ossifraga lactea, Rumph. Herb. Amb. vii. t. 29.

Milk Bush.

Lunka-sij, *Beng.* Tiru-kalli, *Tam.* Doodu-kalli, *Can.*

Probably introduced from Africa.

This, with *E. antiquorum,* is common all over the Madras Presidency, growing abundantly anywhere on the rough and rocky parts of the Deccan, though doubtfully indigenous. It is much used as a hedge-plant, and though unarmed makes an excellent fence. It grows to 20 feet high; but should be annually clipped, as it becomes open at the roots. It is customary to plant *E. antiquorum,* L. (Nar-sij) in these openings, which grows well under the shade of its congener. Both united constitute a most serviceable enclosure, which has the advantage of occupying *little space* and being *touched by no animal*: the tenacious acrid juice quickly causes sneezing or produces ophthalmia.

At the beginning of the rainy season a trench is dug to the depth of two feet where the fence is intended to grow. The cuttings take root in any soil; and in one year it becomes a tolerable fence (Buchanan's Journey, i. 36). The villagers are prejudiced against this as a fence, and cut it down in seasons of pestilence, supposing that it exerts a baneful influence. The juice is often employed instead of a wafer for closing despatches, and is a very effectual blister in rheumatic affections. Cattle will not break through, nor vermin live under it. The trunk of old trees affords a yellow close-grained wood, 8 or 10 inches in diameter, which is valued for gun-stocks, &c.

These four plants thrive in the most arid soil: when the ground seems much parched they retain their greenness, and improve the scenery, giving an appearance of verdure when all else is withered and lifeless.

Euphorbia nivulia, Buch.

E. neriifolia, Hort. Beng.

Ela Calli, Hort. Malab. ii. t. 43.

Sij, *Hind.* Ela Calli, *Can.*

A poor-looking tree, grows abundantly in the rocky parts of the Deccan, and forms a common hedge, delighting in the arid districts. "Habitat ubique in Indiæ sepibus."—*Buch.* It has a whitish dead appearance, resembling a bundle of dry sticks, and unless for a short period during the rains, when it puts forth a few leaves, rather takes from than adds to the appearance of the landscape (*Graham*). The branches being as thick as the stem, their accumulated weight often breaks it, and the plant falls to the ground.

Cæsalpinia sepiaria, Rox.

Mysore Thorn. Hyder ka Jar, *Hind.*, i. e. Hyder's Plant.

A showy scandent shrub, armed with short strong recurved prickles. This plant is invested with historical interest, Hyder Ally having employed it much as a protecting hedge around his strongholds. The fences are handsome, and almost impenetrable. The village fortifications in the Mysore territories have in a great measure fallen to pieces; but the remaining mud walls are still encircled by stout hedges of this and *Pterolobium lacerans,* as are also the dwellings of the Pariahs who are not permitted to build within the village walls. It is generally used as a fence in the Baghyat lands of the Deccan. Indigenous in the subalpine districts, and has been domesticated at Madras and in Bengal, where it is now nearly as common as in Mysore. Hyder's plant possesses the advantages of beauty and durability, is easily raised from seed in rows wherever the fence is to be established, and seems to grow vigorously both above and below the Ghauts in almost every climate. The hedge requires little care beyond shortening the side branches by occasional pruning. The base is generally substantial, so as effectually to resist the pressure of cattle and to prevent the ingress of destructive vermin.

Cæsalpinia Sappan, L.

Sappan Wood.

Patanga-mara, *Can.*

An armed climbing shrub planted in garden or other fences; it is easily reared from seeds in almost any soil, if the plants are watered during the dry weather. After ten or twelve years the wood of the plant becomes valuable for its red dye, and is exported extensively from the western coast*.

* Mad. Top. Report, i. p. 495.

Pterolobium lacerans, R. Br.

Cæsalpinia lacerans, Buch (Journey, i. 37).

A common jungle shrub in wooded districts, aptly designated *lacerans* by Roxburgh, for it is *completely armed,* and as dreadful as the Kantuffa of Bruce*, which belongs to the same genus. The legume is curious, ending in a membranous knife-shaped wing. When associated with *C. sepiaria* it makes an excellent fence; singly it is rather diffuse.

Guilandina Bonduc or *Bonducella,* L.

Nicker Tree.

Nata, *Bengal.* Kad Gajaga, *Can.*

A handsome well-armed shrub common in hedges of Mysore and Canara: forms an impenetrable fence. Seeds solitary, like marbles, and are a favourite remedy in catarrh and ephemeral fever.

Parkinsonia aculeata, L.

Prickly Parkinsonia or Jerusalem Thorn.

A handsome low-sized tree, not unlike the laburnum, planted for fences, which are very beautiful, from the bright green and feathery foliage, and pretty yellow flowers in loose pendulous racemes. It seems well adapted for hedges, and is naturalized in many districts. Observed at Cairo by Hooker, and in Jamaica by Macfadyen, at Bellary by Newbold, and about Bombay by Graham.

Poinciana pulcherrima, L.

Gool Mohur. "Peacock's Pride."

A common armed shrub in every garden, reared more for the beauty of its flowers than as a serviceable fence. *P. elata,* L., is a more showy plant, not so frequently met with, and unarmed. "In Barbadoes *P. pulcherrima* is planted for a fence, and to distinguish fields from one another, both for its use and ornament. I thought I never saw anything finer than a hedge of this †."

Mimosa rubicaulis, Lam.

A large climbing shrub, well armed; common in Mysore; rather straggling, but capable of forming an elegant fence; conspicuous from the purple flowers changing to white. I am not aware that this species has been tried.

Inga dulcis, Willd.

Koorka poolly, *Teling.*

A handsome tree, introduced from the Philippine Islands according to Roxburgh, and there probably from America, of which

* Travels in Abyssinia, vol. v.

† Sloane's Jamaica, p. 50.

it is a native. It is now frequently met with, being much employed as a fence, particularly below the Ghauts. I have observed a thriving hedge at Shemogah, which was an excellent substitute for prickly pear in enclosing a compound. I have seen Inga hedges at Bangalore and in Capetown. The pulp of the curiously twisted seeds is sweet and nutritious; hence the specific name.

Acacia arabica, Willd.

Babool, *Hind.* Karijalee, *Can.*

The most common indigenous tree, known to all travellers—often the only visible tree, thriving in every soil. Seeds and pods of great value to the shepherd in the hot season as food for his flock. Dr. Gibson suggested some years ago that the waste parts of the Deccan should be planted with this tree, as it grows rapidly, and requires no water. The timber is used for tools and tent-pegs, the bark for tanning, and the gum as a substitute for wafers in the public offices. When covered with its globose heads of yellow flowers it gives a smiling aspect to the arenaceous waste; and Moore aptly introduces it in an Arabian scene:—

"Our rocks are rough, but smiling there
The Acacia waves her yellow hair
Lonely and sweet, nor loved the less
For flowering in a wilderness."

Acacia concinna, DC.

Mimosa saponaria, Rox.

Shigai or Shikakai, *Can.*

A large climbing plant with numerous aculei. Some villages and coffee gardens are surrounded with strong hedges of this plant, which are rented annually in Nuggur, the thick saponaceous legumes being articles of trade, and sold at the rate of three for a pice; used as soap for washing the hair, &c. (Buchanan, i. 38.)

Vachellia Farnesiana, W. & A.

Kalee Kikur, *Hind.*

A small tree common everywhere in hedges and fields. The branches are lopped off for fuel, and for repairing the fences. This is a most useful tree, affording timber for ploughs, bandies, and other agricultural implements.

All these *Mimoseæ* and *Cæsalpineæ* are of easy culture. Cuttings of them root freely.

Bambusa arundinacea, Willd.

Arundo Bambos, Linn.

The Common Bamboo.

Bans, *Beng.*

This arborescent grass is capable of forming an excellent fence, and is used extensively for gardens and fields in Coorg, the Southern Mahratta country, and Guzerat, where it grows in the greatest abundance, delighting in the rich soil along the edge of mountain streams. It requires a much more humid climate than the prickly pear or milk bush. These abound in the Carnatic plains, while the bamboo flourishes everywhere beside the water-courses of the Western Ghauts: "omnium vulgatissima." (*Buch.*) It forms a dense and graceful underwood: when luxuriant it occupies too much space and harbours vermin. To obviate this, the young thick shoots should be removed frequently and carefully, and the lateral branches only allowed to remain. From its singularly rapid growth it exhausts the soil where it grows, and deprives the ground of its nourishment, instead of preserving its moisture. "Bamboo fences are peculiarly adapted to pasture land, the cattle browsing on the young shoots keeping down their growth, so that very little additional care is required *."

Buchanan (Journey, i. 5) mentions with commendation that Mr. Place, a collector, of Arcot, "caused each village to be surrounded by a hedge of bamboo: by this measure a large quantity of that most valuable plant will in time be raised," which is applied to a great variety of œconomical purposes. In times of scarcity the seeds are eaten by the poorer classes of Mysoreans, mixed with honey. The inflorescence I have only observed in rich moist situations, and in these its favourite haunts the thorns are sometimes absent.

There are several species of bamboo. *B. spinosa*, by the number and strength of the spines and branches, is said by Roxburgh to form the most impenetrable jungle of India. *B. nana* (Rox.), introduced from China to the Botanic Garden, Calcutta, makes beautiful close hedges; and the *Behoor Bans* of the Bengallees, a variety of *B. Tulda* (Rox.), (*Dendrocalamus Tulda*, Nees), being small, solid, bent to one side, and armed with numerous strong thorns, is very fit for hedges.

Pandanus odoratissimus, L.

Fragrant Screw Pine.

Mundige; also Kaythege-mara, *Can.*

A large spreading ramous shrub, 6 to 10 feet high, having the habit of a gigantic *Bromelia*. Very common in Coorg and Nuggur, and known on the coast of Coromandel as the Kaldera Bush. The patches of hill rice are often fringed with belts of this shrub, forming a natural enclosure. It is sometimes planted for the purpose of hedging. The leaves are 3 to 5 feet long, drooping,

* Macfadyen (Hook. Bot. Misc. iii. p. 83), who gives an excellent account of the hedge plants of Jamaica.

armed on the back and sides with strong spines. Avenues of *Pandanus* are seen in China and Cochin-China, and in the Mauritius (*Loureiro* and *Hardwicke*). It answers well for hedgerows, but requires too much room: it grows well from branches. Often forms impenetrable thickets, which I have been told by hog-hunters are a favourite resort of these animals. The sweet-scented flowers are much prized, and often sell in the bazaars at two annas a piece.

Capparis sepiaria, L.

A much-branched shrub of low size, with very strong and sharp recurved prickles, very common in the uncultivated tracts of Mysore. This and *C. incanescens*, W. & A., form whole jungles at the foot of the Bababooden Hills, and in the South Mahratta country. It is an excellent plant for hedges: we have admired some fine village hedges in the Shikarpoor talook. "Habitat ubique in Indiæ dumetis, solo aridiore."—*Buch.*

C. horrida, L., *C. aphylla*, Rox., *C. Roxburghii*, Wight, and *C. incanescens*, W. & A., are worthy of trial, though more straggling than *C. sepiaria*. The first is very common in Mysore, likewise the second, much sought for its berries, which are pickled. The latter grows everywhere in Scinde and Guzerat.

Balsamodendron Berryi, Arn. Ann. Nat. Hist. iii. 85.

Protium Gileadense, W. & A. Exc. Syn.

Amyris Gileadensis, Rox. Exc. Syn.

A most common spinescent plant in some parts of the country, and constantly used for making fences. (*Wight.*)

Toddalea aculeata, Pers.

Scopolia aculeata, Sm.

Paullinia asiatica, L.

Toddali, *Can.*

A prickly shrub, with trifoliate leaves, common in the hotter parts. It is usually of a very ramous character, and might be employed in the formation of hedges. We observed it in many parts of Mysore and the South Mahratta country, and have experienced infinite difficulty in attempting to make our way between the bushes. The flavour of the black seeds is pungent, resembling pepper. The berries make an excellent pickle.

Pisonea aculeata, Rox.

A very common large straggling shrub, armed with strong axillary recurved thorns. It makes excellent impenetrable fences, and when fairly caught in it, it is no easy matter to be extricated, the prickles being so numerous, crooked and sharp.

Both Kœnig and Roxburgh were so situated amongst the Vendalore Hills, near Madras; hence the former named it *Tragularia horrida,* not at that time suspecting it to be *P. aculeata.* (Rox. ii. 217.)

Hemecyclia sepiaria, W. & A. in Edin. New Phil. Journ. xiv. 297; Wight, Cat. 940.

This Euphorbiaceous plant forms a rigid densely interwoven shrub rising to 8 or 10 feet, of rather frequent occurrence. The leaves are extremely hard, and resemble those of *Celastrus emarginatus.*

Epicarpurus orientalis, Blume.

Trophis aspera, Retz.

Streblus asper, Lour.

Suna Gargathee-mara, *Can.*

A rigid milky tree of small size, with numerously interwoven branchlets, common everywhere in India. Leaves scabrous, employed for polishing ivory and furniture. Wood used for fuel; berries eaten by birds. Much used as a fence, for which it is well fitted by its very ramous rigid character: though unarmed, it affords good protection by the closeness of its branches. Detached plants form low trees with bushy heads.

The scarp of Fort William is strengthened by an impenetrable hedge of *Trophis aspera.* (Hook. Misc. iii. 29.)

Jatropha Curcas, L.

Angular-leaved Physic Nut

Mara harulu, *Can.*

Domesticated all over India. A most common bush, seen growing round the little native gardens throughout Mysore. It is of speedy growth, attaining the height of 6 or 8 feet; but forms a bare, scraggy, useless enclosure. The leaves are deciduous; the seeds are purgative; the stems are soft and spongy, and will not even burn. "Colitur ubique in Indiæ sepibus."—*Buch.*

Rhamnus circumscissus, L.

Scutia indica, Brong., Wight Ill. t. 73.

A straggling shrub armed with recurved prickles overrunning the country, particularly towards the Ghauts. It would, from its sharp aculei and numerous diverging branches, form an excellent hedge-plant.

Azima tetracantha, Lam.

Monetia barlerioides, Rox.

Trikanta-jatee, *Hind.*

A common thorny bush, frequently associated with *Scutia indica.* It somewhat resembles in habit the English furze. It grows freely in every soil, giving off many opposite branches, spreading in every direction. The spines are quatern, axillary, sometimes 2 inches long. The white berries are eaten by men and birds.

Gmelina asiatica, L.

A pretty shrub, of a very ramous character, common in the Peninsula, bearing large yellow flowers, and opposite thorns in the axils of the branches. It forms an elegant and excellent fence in the gardens of Bombay. (*Graham.*)

Rumphius wrote of this plant, "Frutex stipitosus qui sese sursum explicat in longos et flagellosos ramos."

There are many ornamental plants which we often observe arranged in straight lines, forming inner fences or shady avenues in Eastern gardens. These are the *Lawsonia inermis*, the Hennah plant of Egypt (*Mendi*), resembling the English privet. The *Lonicera ligustrina*, Wall. (privet-like honeysuckle), is much used at Ootacamund, and answers well, forming a very compact fence about gardens. (*Wight.*)

The lime, mulberry and pomegranate are suitable, and have been long in use; likewise the *Hibiscus rosa sinensis*, L. (shoe-flower), *Adhatoda vasica* and *Betonica*, Nees, *Gardenia florida* (*Gundha raj*), *Allamanda cathartica*, &c.

Phyllanthus reticulata, Poir. (*P. Vitis-Idæa*, Rox.), "found wild in every part of India, and seems to thrive well in all soils and situations. It is frequently employed for ornamental hedges in gardens, for which end it is well chosen, as its thick evergreen foliage and constant succession of beautiful red berries give it a pretty appearance*." I am not familiar with this in southern India, except as a small jungle tree.

Pedilanthus tithymaloides, Poit. (the slipper plant) is much planted as a border for gardens, taking the place of box. Neither goats nor cows will touch it. The following are also used for garden borders:—

Graptophyllum hortense (*Justicia picta*) with its variegated leaves; *Vinca rosea*, Willd., common all over India; *Heliotropium curassavicum*, L., domesticated at Bangalore; *Rosa indica*, L.; *R. semperflorens*, Curtis.

The above are the hedge-plants most frequently noticed in the

* Roxburgh's Fl. Ind. ii. p. 665.

Peninsula. The number is a large one, to which I could have added many more, indigenous in the jungles, which have not been tried. We have confined our remarks to quick hedges "vivæ sepes," because they are obviously preferable to every other mode of protecting agricultural produce in a climate like that of India. Ditches are particularly unsuitable, rapidly filling up with rank vegetation, and their sides often giving way under the violence of the monsoon. Stone walls are rarely seen, being expensive and always badly constructed. Wire fences, coated with dammer, were introduced at Bombay by the energetic Dr. Buist in 1843; these unquestionably form a light and elegant enclosure for oriental compounds, but are too expensive to come into use among native cultivators.

The subject is truly important. Large tracts consisting of many acres together, wholly or partially uncultivated, and the frequent occurrence of seasons of scarcity, attest the still neglected state of Indian agriculture, while the remains of quickset hedges, decayed terraces and ruined wells in many parts convey the impression that irrigation and husbandry *in remote ages* had been practised more assiduously than by the present generation.

One of the obstacles to improvement we believe to be, that from the time the grain appears above ground till the harvest is gathered in, the ryot has to watch his field; but as many wild hogs and other animals infest the neighbouring jungle, this watching is difficult and often ineffectual, and hinders the farmer from extending his operations *. We know too from the official return on cotton culture in India (pp. 444, 489, 490), and from the testimony of many collectors and other observers†, that great devastation takes place annually from herds of antelopes and thousands of heads of cattle which migrate or are driven from place to place in particular seasons. The wild animals are being destroyed in large numbers, and as cultivation extends will find no shelter, while the damage occasioned by stray bullocks could be prevented by encouraging a more general system of field enclosures.

"The frequent fearful occurrences of famine in India remind us of the almost forgotten period when they were of as frequent occurrence in Europe, and the inference follows, that when the light of European science has extended to India the same bene-

* Asiatic Researches (Carey), x. 34.

† Dr. Gibson, Superintendent of the Botanical Gardens at Dapooree, states with reference to an experiment (sowing of upland cotton), that it was one on which a general conclusion could not be based, inasmuch as the field enjoyed the shelter of a hedge on one side and tree plantations on other two sides—few of those appliances are to be found in nine-tenths of the villages of the Deccan.—Bom. Hort. Trans. no. 2. p. 49.

ficial consequences may follow, and that foresight may eventually prepare for, and knowledge obviate many of the evils which now fall without alleviation on the naked head of the native sufferers. The loftiest ambition of the most enlarged mind, when dwelling upon hopes of the most extended usefulness, could hardly imagine a wider range of benevolence." Thus wrote Dr. Kennedy, Physician General, Bombay, whose extensive information and long acquaintance with Western India give his opinion a peculiar value. A season of peace and tranquillity has in providence succeeded to times of anarchy and confusion, and it behoves us to use every effort for developing the resources of those vast countries, and securing the best interests of the many millions committed to our care for higher and nobler ends than our own aggrandizement.

1. *Hedge Plants.*

Opuntia Dillenii, *Haw.*
Agave americana, *L.*
Euphorbia Tirucalli, *L.*
—— antiquorum, *L.*
—— nivulia, *Buch.*
Cæsalpinia sepiaria, *Rox.*
—— Sappan, *L.*
Pterolobium lacerans, *R. Br.*
Guilandina Bonduc, *L.*
Parkinsonia aculeata, *L.*
Poinciana pulcherrima, *L.*
Mimosa rubicaulis, *Lam.*
Inga dulcis, *Willd.*
Acacia arabica, *Willd.*
—— concinna, *D.C.*
Vachellia Farnesiana. *W. & A.*
Hemicyclia sepiaria, *W. & A.*
Epicarpurus orientalis, *Blume.*
Jatropha Curcas, *L.*
Pisonea aculeata, *Rox.*
Capparis sepiaria, *L.*
—— aphylla, *Rox.*
Scutia indica, *Brong.*
Azima tetracantha, *Lam.*
Gmelina asiatica, *L.*
Balsamodendron Berryi, *Arn.*
Toddalea aculeata, *Pers.*
Bambusa arundinacea, *Willd.*
—— spinosa, *Rox.*
—— nana, *Rox.*
Dendrocalamus tulda, *Nees.*
Pandanus odoratissimus, *L.*

II. *Ornamental Plants forming inner fences.*

Lawsonia inermis, *L.*
Lonicera ligustrina, *Wall.*
Citrus Limetta, *Riss.*
Morus indica, *L.*
Punica granatum, *L.*
Phyllanthus reticulata, *Poir.*
Hibiscus rosa sinensis, *L.*
Adhatoda vasica, *Nees.*
—— Betonica, *Nees.*
Graptophyllum hortense, *Nees.*
Gendarussa vulgaris, *Nees.*
Gardenia florida, *L.*
Allamanda cathartica, *L.*

III. *Plants used for edging garden walks.*

Pedilanthus tithymaloides, *Poit.*
Vinca rosea, *Willd.*
Heliotropium curassavicum, *L.*
Rosa indica, *L.*
—— semperflorens, *Curtis.*

XXII.—*Characters of new species of* Helix *from India, Mauritius and the Cape of Good Hope; also of a new Mauritian* Tornatellina, *with remarks on the habits of a Cape* Succinea. By W. H. Benson, Esq.

1. *Helix Baconi*, nobis, n. s.

Testa anguste perforata, depresso-turbinata, tenuissima, pellucida, pallide cornea, supra nitidiuscula, eleganter decussatim corrugato-striata, subtus polita, radiato-striata; spira elevatiuscula, lente crescente; apice obtuso, fuscato; sutura impressa; anfractibus 5 subconvexis, superioribus supra fascia rufo-fusca angusta, demum obsoleta marginatis, ultimo subcarinato, subtus convexo; apertura subverticali subquadrato-lunari; peristomate acuto, margine columellari verticali cum basali angulum rotundatum efformante, supra brevissime reflexo.

Diam. major 14, minor 13, axis 7 mill.

Hab. rarissime in agris Rohillanis, prope urbem Moradabad Indiæ Septentrionalis.

This beautifully sculptured shell is unapproached in character by any of the *Naninæ* or the nearly allied Helices of North-Western India. The sculpture reminds the observer of that of *H. ligulata*, Fér., and the narrow band below the suture adds strength to the idea; but the form of the shell, its substance, and the number of whorls in relation to the diameter, forbid any suspicion of its being the young of that shell, which, moreover, has never been found in Rohilkhund nor in any neighbouring district, and does not approach the province nearer than 200 miles to the southward.

A single specimen was taken alive, during the rains of 1843, in a bush on the bank of the Gungun River, near Moradabad, by my friend Dr. J. F. Bacon, and was kindly ceded by him to me, from whom he had first imbibed his taste for conchology. No other specimen occurred in the various entomological and conchological excursions made in the vicinity, and the shell has not hitherto been met with in any other quarter. I dedicate it to its zealous and active discoverer.

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

Testa vix perforata, conico-globosa, cornea, translucente, scabra, oblique irregulariter costulato-striatissima; apice obtuso; anfractibus $3\frac{1}{2}$ convexis, ultimo rotundato, sutura profunda; apertura obliqua rotundata spiram vix æquante; peristomate tenui acuto, margine columellari reflexo, perforationem semitegente.

Diam. 2, axis 2 mill.

Hab. in agro Bengalensi et Baharico, necnon versus occidentem usque ad ripas fluvii Goomty.

This interesting little shell, which calls to mind *Helix harpa*, Say, of North America (referred to *Bulimus* by Pfeiffer and Reeve) as well as our own indigenous *H. aculeata*, was first discovered in July 1836, and sent to me by the late Lieut. Burkinyoung of the 5th Bengal N. I., who fell in the disastrous retreat from Cabul. He was a zealous student of natural history, and one of the small Indian band whose attention I had the good fortune to direct to the land and freshwater testacea of the Bengal Presidency. He found the species in a mango grove, distant a day's march from Jounpore, and on the road thence to Benares, creeping on the trunks of trees, during very heavy rain. In 1847 Dr. J. F. Bacon rediscovered the shell at Dinapore, near Patna, and has since ascertained that it inhabits the mango groves on the whole route from Barrackpore, in Bengal, to the borders of Sikkim, and thence to Chuprah in Bahar. Jounpore is its most westerly limit known, and lies on the line which appears to separate the moister subtropical climate of the eastern from the more arid tracts of the western provinces;—a circumstance also indicated by the fauna of the Goomty which waters the district, and in which the more tropical forms *Melania variabilis*, nobis, and *M. lirata*, nobis (*M. lineata*, Troschel), first appear in proceeding from the west; while, on the other hand, *M. tuberculata*, Müll., and *M. spinulosa*, Lamk., enjoying with them a joint occupancy of the waters to the eastward, have a wide range to the west, extending even into Affghanistan.

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

Testa minute perforata, parvula, depresso-turbinata, cornea, scabra, rude oblique leviterque striata; spira conoidea, apice obtuso; anfractibus 5, lentius convolutis, convexis, ultimo subtus convexo, nitidulo, versus umbilicum excavato, medio leviter carinato, carina antice evanescente; sutura leviter impressa, marginata; apertura late lunata vix obliqua, peristomate tenui acuto, margine columellari brevi, reflexiusculo.

Diam. major 4, axis 2, long. apert. 1 mill., lat. vix $2\frac{1}{2}$ mill.

Hab. infrequens sub lapidibus in collibus Mokæ, apud insulam Mauritii.

I discovered this neat little *Helix* under stones in February 1847, on the grounds of Sir David W. Barclay at Moka. Its companions here were *H. similaris*, and on the surrounding hedges *Cyclostoma rubens*, and a delicate little *Tornatellina*. In a neighbouring ravine I found it associated with *Bulimus clavulinus*, P. and M., *Helix rufa*, Lesson, *H. inversicolor*, Fér. (*Carocolla bicolor*, Lamk.) in all stages from the youngest to the adult, and with the young heliciform and adult examples of *Pupa clavulata*, *fusus*, *modiolus*, &c. I mention these forms particularly, to show that the species cannot be confounded with the young of any of its associates. *H. inversicolor,* when possessing only three whorls, is double the diameter of *H. Barclayi,* is acutely carinated, and distinguished by its dark colour. The young pupæ are umbilicate, not perforate, are more conoidal, and are characterized by the bold sculpture which obtains in all the Mauritian species of that genus.

Having been the unwilling cause of the erasure of a nominal species bearing the name of *Barclayana,* Pfr., from the catalogue of Helices *, I have much pleasure in dedicating the present shell to the old friend and successful conchological collector on whose grounds I detected it, and who, occupied with the richer and more obvious forms which the island presented to him, had not then directed his attention to the minuter land species.

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

Testa perforata subgloboso-depressa, tenui, striatula, opaciter albida, punctis translucentibus fasciisque strigisve purpureo-fuscis ornata; spira elevatiuscula, fusco-rubente, apice obtuso, fusco; anfractibus 5–$5\frac{1}{2}$ subarcte convolutis, convexis, ultimo inflato, toto interdum, fere versus aperturam duntaxat purpureo-fusco; apertura rotundato-lunari, intus fusca, peristomate simplici, acuto, margine columellari dilatato, reflexo.

Diam. major $5\frac{1}{3}$ mill., minor 5 mill., axis $3\frac{1}{2}$.

Hab. in palude prope Baszaarm's Kraal, inter Diep Rivier et Muysenberg Prom. Bon. Spei, in floribus Zantedeschiæ Æthiopicæ, et ad marginem paludis humidum, cum Succineæ specie reptans.

This little species, which is allied to, but very distinct from *H. Capensis,* Pfr., and *H. Uitenhagensis,* Krauss, I found on the 1st of September 1846, in tolerable abundance on the border of a marsh between the 12th and 13th milestones, on the road from Cape Town to Simonstown. It was chiefly on the wet ground bordering the marsh, the centre of which was then flaming with broad tracts of a gorgeous scarlet-flowered *Tritomanthe;* a few specimens were in the throat of the corolla of *Zantedeschia Æthiopica,* or Pig-lily of the colonists. Although this plant was abundant in every ditch near the Cape at that season, the shell appeared to be confined to the marsh in question. On the 24th of October, when I went to procure a larger supply, very few specimens were to be found.

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

Testa aperte et profunde umbilicata depressa, tenui, rugoso-plicatula, translucente, nitidiuscula, cerea, virenti-cornea; spira vix elevata,

* 'Ann. and Mag. Nat. Hist.' for September 1848. Pfeiffer has adopted this view, 'Zeitschrift für Malak.' 1849, p. 71. "No. 305, *H. Barclayana,* Pfr., ist ganz zu streichen, da es nach Benson's Mittheilungen der Jugendzustand von *Pupa Pagoda* ist."

apice obtuso; anfractibus 4 subplanatis, rapide crescentibus, ultimo antice majori, non descendente; apertura obliqua rotundato-lunata, peristomate tenui margine dextro superne arcuato, columellari breviter reflexiusculo.

Diam. major 7, minor $5\frac{1}{2}$, axis 3 mill. (spec. nostr.).

Hab. sub monte Capitis Leonis prope Camp's Bay, Prom. Bon. Spei.

I found a single specimen of this delicate shell under trees and fallen leaves in the ravine between the Lion's Head and Table Mountain, near Camp's Bay. A single larger specimen unnamed, but with the locality "Table Mountain" affixed to it, is in the British Museum.

The following shell described by Pfeiffer at page 71. no. 5. of the 'Zeitschrift für Malak.' for 1849, under my manuscript name, from specimens received from me by Mr. Cuming, I had delayed publishing, with the view of instituting a comparison with the allied species *H. rivularis,* Krauss, which is also a denizen of South Africa. I cannot do better than copy the characters given by Pfeiffer.

6. (249 *a*) *Helix rariplicata,* Benson.

"Testa umbilicata depressa, tenuis, cornea, plicis arcuatis subdistantibus munita; spira parum elevata; sutura profunda; anfractus 4 convexi, ultimus teres, non descendens; umbilicus angustus, pervius; apertura parum obliqua, lunato-subcircularis; peristoma simplex, rectum, marginibus conniventibus.

"Diam. maj. $4\frac{1}{2}$, min. $3\frac{1}{2}$, alt. 2 mill."

Hab. in Prom. Bon. Spei.

This shell I found in several places about Green Point from April to November 1846. In the latter month it was alive in great abundance clustering under loose stones in a barren tract near the greater Light-House. During the winter season this tract was inundated to a great extent by shallow fresh water.

Near the great Light-House Green Point, at the Round Battery, Simonstown, and in Hottentot's Holland, I procured dead specimens of a shell which appears to me to correspond with *Helix vernicosa,* Krauss, taken by Wahlberg at Natal, but I have not been able to make a comparison of specimens. I may here note that I have not yet exhausted my new species of *Helix* from the environs of Cape Town, and that three (if not four) new species of *Physa* and an *Ancylus* inhabit the waters at the base of Table Mountain.

Genus Tornatellina, *Beck.*

1. *Tornatellina Cernica,* nobis, n. s.

Testa globoso-conica, tenui, striatula, striis exilissimis spiralibus obsolete decussata, pallide cornea, pellucida, nitida; spira conica, apice obtuso, rubente; anfractibus 4 convexis; apertura elliptico-ovata, spiram superante, plicis duabus coarctata; plica 1 lamelliformi parietali, intrante, hyalina, 2nda columellari dentiformi, ad angulum columellæ truncatæ posita; columella lata, verticali, hyalina, oblique lateque truncata, margine dextro simplici, acuto.

Long. 3 mill., diam. 2–2¼ mill.

Hab. in sepibus apud Moka Insulæ Mauritii.

I discovered this interesting little species in February 1847 in the grounds of Sir D. Barclay at Moka, creeping in showery weather on the leaves of Niccioli hedges. The animal was Heliciform, and I noted it at first in my journal as an *Achatina*, with reference to the truncation of the columella, until the retraction of the animal admitted a view of the parietal plica which winds into the interior of the shell. In form this species much resembles *Torn. globosa*, Petit, but differs in its thinness, sculpture (when viewed under the lens), and in the plaits of the aperture, &c. In its short, twisted, abruptly truncated columella, and in the winding callous ridge on the parietes, the Bolivian *Achatina concentrica*, Reeve, 'Conch. Icon.' pl. 19. f. 106, is related to *T. Cernica*, and will perhaps form another species of the genus. *T. Cernica* affords the only example of this genus known to inhabit the isles of the Indian Ocean; the species recorded by Pfeiffer, Petit, and others being confined to the Pacific Ocean, the West Indies and South America. I took only two specimens, but Sir D. Barclay writes that he has since been more successful in its capture. I have named the species from "Cerne," one of the appellations of the beautiful island which produces it, and which, with reference to its extent, is so prolific in the land mollusca.

It is further worthy of note that *Helix unidentata* and *H. Cepoides*, gigantic in their genus, seem to indicate a transition from this form, through *H. Studeriana*, to the more regular forms of *Helix*; and that among these, *H. unidentata* and *H. Studeriana* inhabit the neighbouring island group of the Seychelles.

The *Succinea* which accompanied *Helix paludicola* at the Cape, and which may be *S. Chiloënsis*, Pfr. (*S. elongata* var. γ, Fér.) is decidedly amphibious, notwithstanding the opinion of some authors. Dropped into water, it, at first, crept out of it, but presently I observed it descending, of its own accord, below the margin of the liquid, and twice, within the space of a few minutes, I saw it take to the water, and swim resupinate at the surface like a *Lymnæa*, and ascend the opposite side of the glass vessel in which I had placed it. I was particular in the examination of the animal, with reference to this singular action, and found the upper tentacula short and thick, with the eyes or percipient points at their apex, the lower pair being very short; the animal within the shell was blackish brown, the foot livid, and rayed on the upper side with the darker colour. No species of *Lymnæa* occurred to me at the Cape, though I took near Cape Town an *Ancylus* and several species of *Physa* distinct from those discovered by Krauss and Wahlberg in the eastern part of the colony. My first specimens of *Physa* were taken nearly three months after the observation of *Succinea*.

In addition to the above circumstances, I may here note that, in 1832, I took *Succineæ* creeping on stones under water in company with *Lymnæa stagnalis*, *peregra* and *auricularia*, *Planorbis marginatus* and *vortex*, *Bithynia impura* and *Physa fontinalis*, in Lough Carrigan, county Cavan, Ireland, which fact I entered carefully in my conchological journal. It militates against the opinion of some authors, and indeed against my own observations on the habitation generally selected by the animal of *Succinea*, which I have had occasion to remark elsewhere in Great Britain, India, Mauritius and Germany. Moreover *Succinea crassiuscula*, nobis, an inhabitant of the whole of Gangetic India, is so independent of the presence of standing or running water, that it frequents the walls of ravines and precipitous banks where no water ever lodges, and where it can receive no moisture but that derived from dews or from the fall of the periodical rains.

Aix la Chapelle, July 30th, 1850.

XXIII.—*Sketch of the Geology of the neighbourhood of Grantham, Lincolnshire; and a comparison of the Stonesfield Slate at Collyweston in Northamptonshire with that in the Cotswold Hills.* By the Rev. P. B. Brodie, M.A., F.G.S.*

The object of the present paper is to give a short account of the geology of a portion of the county of Lincolnshire, especially in the neighbourhood of Grantham and Stamford, and to point out its identity in many respects with certain parts of Gloucestershire. The formations observable in the district above mentioned are the Great Oolite, Stonesfield Slate, and Lias. The Great Oolite (and some of the superior overlying groups, including in places the cornbrash) may be traced with considerable regularity from Minchinhampton in this county in a north-easterly direction to Stamford, whence it pursues a more northern course into Yorkshire. The Great Oolite is extensively quarried at Ketton and other places near Stamford, and affords a good building-stone, more or less full of fossils; one bed, in which I found

* Read at the Meeting of the Cotswold Naturalists' Club, June 18, 1850, and with slight alterations at the last Meeting of the British Association for the Advancement of Science, August 1850.

Patella rugosa, consisting of a coarse-grained oolitic freestone lithologically resembling the shelly freestone in the Inferior Oolite at Leckhampton Hill. I was unfortunately so much hurried that I had no time here to make sections, or to examine the quarries more accurately. In a beautiful old Norman church lately restored, at Tickencote in Rutlandshire, I noticed blocks of this stone made up of minute shells in a good state of preservation, similar to some on Minchinhampton Common. Crossing the narrow lias valley to the opposite hill at Collyweston, which commands an extensive view over the surrounding country, the Stonesfield slate is largely quarried, and, as in the Cotswolds, occupies the highest ground in the district. The following is a section of one of the deepest quarries in descending order :—

	ft.	in.
1. Rubble, consisting chiefly of broken slate	5	0
2. Sand, a few inches.		
3. Hard slate (ragstone)	4	0
4. Yellow sand	3	0
5. Slate	1	0
6. Yellow sand	1	0
7. Bluestone, with traces of vegetable matter in fragments	1	6
8. Slate	3	0
	18	6

Further on some inferior strata are visible, viz. :—

	ft.	in.
9. Sand	4	0
10. Ferruginous oolite	14	0
11. Clay		
Total	36	6

The beds seem to be nearly horizontal.

The best slate splits into thin laminæ, and forms a beautiful and useful material for roofing, preferable even in some respects to that of the Cotswolds, being finer-grained and more micaceous; but the average thickness of the whole is about the same. There is however a sufficient lithological resemblance to identify this formation in Northamptonshire with that of Gloucestershire and Oxfordshire; and even the minor details are more nearly alike than the distance of one deposit from the other would lead us to suppose. The formation, however, near Stamford is by no means so extensive in its geographical range, being, as far as I am aware, limited to a few localities in that neighbourhood. I was unable to trace the junction of the slate with either the Great Oolite above, or the Inferior Oolite below, but it may be observed (according to Mr. Morris) in one or two places in this district. I cannot state positively whether it is as closely connected with the Great Oolite as it is in the Cotswolds, where my friend Professor Buckman and myself (in a joint paper on the Stonesfield Slate of Gloucestershire*) conceive it to be not sufficiently distinguishable from it to entitle it to rank as an independent formation. But from the facts and sections given in Mr. Morris's paper, they seem to be as closely intermingled; indeed he distinctly states that the slate is *not* independent of the Great Oolite, and thus confirms our views respecting its characters in Gloucestershire. The bed of clay, which we suppose to be the representative of the 'Bradford clay,' does not occur at Collyweston overlying the slate, though it may have been previously denuded.

Fossils generally are not very abundant in the Collyweston slate, and these consist almost entirely of marine shells, among which *Trigonia impressa* (a highly characteristic shell), *Gervillia acuta* (a gregarious species, lying grouped together on the slabs, but not common in the Cotswolds), *Cardium, Pinna, Pecten,* and a small *Natica,* are the most frequent, though a few others are mentioned by Mr. Morris. He also notices numerous fragments of *Pecopteris polypodioides,* a species of fern abundant in the oolitic shales of Yorkshire, which seems to identify the slate with them. Plants however, as far as my observation went, are comparatively rare at Collyweston, and very imperfect. I walked over tons of slate laid out for weathering, as in Gloucestershire, and I could not observe even a trace of vegetable matter, the slate being in most cases particularly unfossiliferous, and on this account much better adapted for œconomical purposes. Two genera of plants only are mentioned by Mr. Morris, *Pecopteris* and *Zamites,* and these in patches and fragmentary, scattered through certain portions of the beds overlying the slate. But these must be limited to particular spots, for in the four quarries I visited on Collyweston Hill I saw scarcely a trace of any, and I was struck by their apparent rarity in that district, compared with their abundance in certain divisions of the slate at Sevenhampton and other localities near Cheltenham. The absence of the varied flora so characteristic of the slate near Cheltenham and Oxford, is not more remarkable than is that of the other interesting terrestrial and marine remains which it there contains. I saw no teeth or bones of reptiles and fish, nor elytra of beetles, nor could I learn that the workmen had ever observed any; and hence *zoologically* the Collyweston slate differs more from its south-western equivalents than it does in its internal *mineralogical* structure. These facts lead to the inference that it was deposited beneath a deeper sea, and at a greater distance from land, whence we should expect to find few evidences of neighbouring coasts, and a larger assemblage of marine exuviæ, the denizens of deeper water, though the genera would not be very numerous.

* See Quarterly Journal of the Geological Society, No. II. p. 220.

On the whole, the Great Oolite and its associated beds in their extension northwards, bear a closer resemblance to the Yorkshire than to the Bath and Minchinhampton series, except a portion of the upper beds at Ketton and Casterton.

For further details I may refer to the "Notice of the Geology of the neighbourhood of Stamford and Peterborough," by Captain Ibbetson and Mr. Morris, published in the Transactions of the Meeting for the Advancement of Science, 1847. When I visited Lincolnshire I had not seen this interesting paper, and it appears that we had independently arrived at the same conclusions.

Great Oolite (continued) *North of Grantham.*

There are some large and valuable quarries of Great Oolite at Ancaster, eight miles north-east of Grantham, which have long been famous for their beautiful building-stone. The following section will explain its general character in descending order:—

	ft.	in.
1. Blue clay, in which I could detect no fossils; perhaps the representative of the Bradford clay, which in Wilts immediately overlies the Great Oolite, and often separates the minor subdivisions. Near the top it is traversed by a thin dingy-white kind of marl, with a few imperfect impressions of plants	12	0
2. Ragstone—coarse, shelly, hard oolite	5	0
3. Sandy, soft (rarely shelly) oolitic freestone, variously coloured, yellow, pink and white, which often gives it, from its variegated wavy hues, a beautiful appearance. This forms the famous building-stone, and yields very large blocks	17	6
4. Hard, shelly oolite, generally of a blue colour. Not worked ..	16	0
5. Soft white stone below, depth uncertain.		
Total	50	6

Near the above is another quarry, in which the strata above the freestone are thicker, the blue clay no. 1 amounting to a thickness of 20 feet, and resting upon a hard blue stone containing many shells, especially a large species of *Avicula*, and broken fragments of carbonized plants, but too imperfect to determine. There is a soft, yellow, sandy band at its base also full of similar vegetable remains;—the total thickness of the two beds does not exceed 2 feet. The white rag, equivalent to no. 2 in the previous section, is only 1 ft. 3 in. thick, and reposes on the freestone.

The fossils in the ragstone and freestone are small and not numerous, and as I could obtain only two genera, *Arca* and *Cardita*, the shells of which were much waterworn, no comparison can be instituted between them and the equivalent series at Bath and Minchinhampton. The abundant remains of plants, and their rarity in Gloucestershire and Somerset in the *Great* Oolite, seem to indicate a closer affinity, zoologically, with the Yorkshire oolites; and I am informed by my friend Mr. Lycett that he and Mr. Morris could identify very few of the Great Oolite fossils of the north with those of the south of England. The building freestone is perhaps softer, as a mass, than that near Stroud and Bath, while it is remarkably distinguished by its waved, purple and pink colours, which give it the appearance of certain portions of the new and old red sandstones, and add greatly to the beauty of the material for architectural purposes.

Inferior Oolite.

The Inferior Oolite takes a less regular course in its extension on the north-east of the Cotswold chain of hills. It is bounded on the east by the Great Oolite, and on the west by the lias; but as it has been subject to great denudation in the counties of Northampton, Rutland and Lincoln, the escarpments generally are less bold and rugged, and the hills comparatively low. In Lincolnshire it forms a bleak, open country like the Wolds of Gloucestershire, and it is well adapted for turnips. The stone frequently lies close to the surface, so that the soil is very stony, like the cornbrash in Wiltshire, and this probably is mainly attributable to the amount of aqueous action to which it has been subject. In parts of Rutlandshire the soil is of a deep red colour (which distinguishes the upper beds in the Cotswolds), and much better wooded than in the neighbourhood of Grantham; but in no case does it afford that romantic and beautiful scenery which especially characterizes the Lower Oolites in Gloucestershire. The village of Denton four miles south-west of Grantham is certainly a pretty spot, and there the Inferior Oolite bears a close lithological resemblance to a portion of the series at Leckhampton, Crickley and elsewhere. The following is a section (in descending order) of Green's quarry on the summit of the hill:—

	ft.
1. Rubble, about	2
2. Oolite marl	4 or 5.
3. Soft, shelly, white and yellow, though sometimes brown oolite, not quarried deep.	

The oolite marl is nearly identical with that near Cheltenham, though rather darker in colour, and much reduced in thickness. It is loaded with corals as at Crickley, many of which, as far as I could judge, appear to belong to the same species as those in Gloucestershire. Some parts of the bed are softer and full of shells, among which I procured several species of *Cerithium*, *Nerinæa*, *Natica*, and other genera. *Natica macrostoma*? is abundant, and a species of *Rostellaria* also occurs, though rarely; the edges of the beds have been much waterworn, probably by currents, and the shells are exposed in relief, and are much weathered in consequence. I sent a small collection to our colleague Mr. Lycett, and he states that although the greater number were new to him, yet the tendency of the others is towards the Inferior Oolite, and agree specifically with some in our district. Such for instance as the *Natica adducta* (an oolite marl shell), but also found in the Great and Inferior Oolite of Yorkshire; *Trigonia striata,* from the Roestone and Gryphite grit; while at the same time there is a new species of *Acteonina, Monodonta,* &c. At so great a distance we must expect this to be the case, and the identity of a stratum (where the order of superposition is clearly defined) may be sufficiently proved if we can find a few distinctive species in both localities, and among these the *Natica macrostoma*?* is certainly one, a fine series being preserved in the Grantham Museum. It is to be hoped that a larger collection will soon be made, and a careful comparison instituted between the Inferior Oolite fossils of Gloucestershire and Lincolnshire. Much has yet to be done in the Oolites generally in England, and with the exception of the standard and invaluable work, 'The Geology of England and Wales,' by Conybeare and Phillips, and a few local papers, very little is known of the oolitic districts N.E. of the Cotswolds, especially in Lincolnshire, Rutlandshire and Northamptonshire; and a wide field is open for the research of an active and intelligent geologist in that quarter; and as our science is strictly a progressive one, inexhaustible and as yet hidden treasures, rich in their way as the gold of California, may be in store for us. In our Inferior Oolite, corals are more or less distributed throughout the whole; but no one stratum contains them in greater abundance than the oolite marl, the upper division of which at Crickley has been correctly denominated the "coral bed," and evidently formed an extensive coral reef beneath the ocean; but with the exception of the pisolite, we have no further evidence of suchr eefs in any of the other superior or inferior beds. Hence the abundance of corals in the oolite marl near Grantham, coupled with other facts, such as the frequency of *Nerinææ,* which are usually found associated with corals, and are believed to have inhabited shallow seas, tends to support the probability that the marl in Lincolnshire was deposited under similar conditions to the marl in Gloucestershire, although many of the shells may be distinct, a very little geographical distance in a sea-bottom being often sufficient to produce a corresponding increase or decrease in the number and variety of species.

I observed the marl occupying a similar position nearer Gran-

* With respect to this species, Mr. Lycett is of opinion that it cannot be referred to any known species, and he proposes to call it *Natica Leckhamptonensis.* It appears to be confined to the oolite marl, as many others are, and I have never yet seen it in any of the superior or inferior beds.

tham, where it is harder, whiter, and extensively used for roads, and contains many small shells and corals. The soft, white and yellow oolite (no. 3, p. 260) affords many small shells, and forms a tolerable building-stone; but as it is never quarried deep, I could not ascertain its thickness, nor the nature of the lower strata; but there must be a considerable mass of oolite probably intervening between it and the subjacent lias. One of the numerous trial-borings on Harrowby Hill near Grantham gives the following section:—

	ft.	in.
Soil	0	6
Rubble.............................	6	0
Inferior oolite	40	6
Lias (blue bind) continued downwards ..	10	0

by which it appears that thereabouts the total thickness of the Inferior Oolite does not exceed 41 feet. As a portion of no. 3 is a friable freestone, it may be considered as the representative of the shelly freestone underlying the 'oolite marl' at Leckhampton. Nearer Grantham also there is a fragmentary, shelly oolite on the side of Ponton Hill, which is possibly a continuation of the same bed; but a more accurate investigation is required before this can be positively determined. There are so few natural or artificial sections in the country that it is extremely difficult to obtain correct information; and although two lines of railway are now being constructed, the engineers employed know nothing of geology, and are therefore incapable of rendering any assistance.

In the Institution at Grantham there is a very tolerable collection of Inferior Oolite fossils, chiefly from Denton, among which were several Clypei and other shells common to Crickley and Leckhampton.

There can be no doubt that the beds above the oolite marl once existed in Lincolnshire, as the gravel near Grantham, to which I shall presently allude, contains numerous fragments of oolite, and I recognized in them certain shells which are characteristic of some of the strata which overlie the marl at Leckhampton. There may be some spots in that and the adjoining counties where these higher bands exist still *in situ*, but from the general appearance of the country I am led to infer that the degradation to which, from various causes, they have been exposed, has removed a considerable portion of the upper division of the Inferior Oolite. While moreover the Great Oolite bears a closer resemblance in some respects to the Yorkshire series, the Inferior Oolite in the districts under review would seem to be more nearly allied to the more enlarged and coæval system in Gloucestershire. Still nothing decisive can be stated upon this point at present, until the strata and their organic contents have been more accurately investigated, and a careful comparison instituted by competent persons between the Lower Oolites in the northern, midland, and south-western portion of England *.

Upper and Lower Lias.

The Lias in its north-eastern course runs nearly parallel to the *lower* division of the Oolites, from the Cornbrash to the Inferior Oolite inclusive; but while the latter *diminish in breadth* towards the Humber, the former occupies a considerable area from E. to W., though less expanded thereabouts than it is in some of the midland counties, and in its course thence in a south-westerly direction. Although, like other formations in different and distant localities, this varies in *extent and thickness*, it preserves, on the whole, a greater persistency and uniformity of character throughout the whole world than any other deposit; so that groups of fossils and detailed sections, either from Germany or Asia (the Himalayas for instance), are found to correspond very closely with those in our own country. In a collection of lias fossils from the Cape of Good Hope, exhibited at the Geological Society in December last, I was struck with the close resemblance which they bore to certain species with which I was familiarly acquainted in this vale, although there were some, as might be expected, which were new to me.

The junction of the Inferior Oolite and Upper Lias shales may be observed near Stamford, and many of the characteristic fossils have been noticed. It also crops out at the base of some of the numerous longitudinal valleys which traverse the oolitic district round Grantham, and it may cap some of the hills on the north of the town. In a short visit I was unable to examine this part of the series more closely, but as these seem to be mainly composed of the ferruginous beds underlying the marlstone, it is probably of limited extent and thickness. These hills overlook a low and extensive flat, occupied almost exclusively by the *middle beds* of the Lower Lias, so largely developed at the Leigh and other spots throughout the Vale of Gloucester, and in no respects differing from them. The soil is cold and wet, like all clay soils, but the general aspect of the tract is most uninteresting, and by no means equal to the rich and often picturesque valley through which the Severn flows. The Vale of Belvoir, however, more to the west, is a richer country, and the castle, which stands on oolitic, well-wooded hills, commands a fine view over the lias and new red sandstone in Nottinghamshire. In this neighbourhood the

* Perhaps there is no locality in England where the Inferior Oolite may be so well studied in detail, or where it is so extensively developed, as in the outer escarpments of the Cotswolds.

marlstone abounding in fossils is largely developed, and also in the descent from Denton Hill into the valley in which Grantham stands. It there occupies the same relative position, and presents the same geographical features as it does in Gloucestershire, Warwickshire and Somersetshire.

A railway cutting through Gonnerby Hill close to Grantham has exposed the top beds of the Lower Lias, undistinguishable either lithologically or zoologically from their equivalents at Hewlett's and Robinswood Hills near Cheltenham and Gloucester. The ochraceous and laminated lias of Professor Buckman, with their characteristic fossils, are well seen in a deep cutting, in the latter of which, nodules and layers of ironstone are extensively distributed. The specimens which I procured, and the collections I saw from this part of the series, agree precisely with those obtained in similar strata in Gloucestershire. This division of the Lias constitutes comparatively low hills N.W. of Grantham, not capped by oolite, which takes a more northern course towards Lincoln. A considerable portion of the former town stands upon sand and gravel, but the lower division of the Lias has been penetrated for wells to the depth, as I was informed, of ninety feet; but from the difficulty I had in obtaining sections in any of the inferior strata, I am unable to say whether it agrees exactly in this respect with those in the Vale of Gloucester. The Lower Lias generally may be best studied N.W. and W. of Grantham, on the S. and S.E. of which the oolitic Wolds rise and rarely display the Upper Lias at their base. West of the town towards Nottingham the junction of the red marl and lias is probably visible, though I did not myself see it; at all events the '*Insect Limestone*' occurs at Granby between Denton and Nottingham, for in the Grantham Museum there is a beautifully perfect fish, apparently a *Dapedium*, from this stratum; the structure of this limestone being so peculiar, that in the absence even of insect remains, I had no difficulty in recognizing it. In this case, this is the furthest point *northwards* in which it has been hitherto detected; and as it is largely quarried at Barrow on Soar near Mount Sorrel in Leicestershire, its course may in all probability be traced southwards with tolerable regularity into Warwickshire, Worcestershire and Gloucestershire; and it may extend, and very likely accompanies the red marl in its range still further to the *north*, perhaps even to the north-eastern coast of Yorkshire.

The Gravel.

The gravel in places near Grantham, especially at Ponton Hill, two miles south of the town, is extremely interesting, and there of some extent and thickness. It is mainly composed of the debris of the inferior oolite, chalk flints, and other older primitive rocks, such as granite, mica schist, porphyry, hard quartzose sandstone, trap, and slate. I also observed boulders of mountain limestone and Caradoc sandstone with characteristic fossils. None of these boulders are very large. The gravel is evidently derivative, and belongs to the period of the great northern erratic drift, so extensively distributed over the counties of Northamptonshire, Buckinghamshire, Cambridgeshire and Essex. Near Cambridge a similar gravel may be observed, but the fragments of which it is composed are much smaller, being at a greater distance from their source. The gravel on Ponton Hill is thirty feet thick: animal remains, so abundant in some localities in England, seem to be extremely scarce, for the labourer who had worked there for years stated that he had never found anything except a portion of a stag's horn, about ten feet from the surface. At Bottisford, however, west of Grantham, there is a bed of clay probably of a different age to the gravel abovementioned, containing bones of elephants, ox, deer, &c.

Conclusion.

Allow me, Mr. President, in conclusion (while we may justly congratulate ourselves on the prosperity of our Society), to express a hope that each of our members will in his turn contribute his share to the stock of general knowledge and new facts which it is the object of our scientific meetings to promote. A good dinner certainly is not a bad thing, and frequent reunions of scientific friends are extremely delightful; but our aim must be a higher one, and we must endeavour to advance as much as possible those nobler and more enduring pursuits which enlarge the mind and benefit our fellow-creatures. Every one, however limited his acquaintance with science in general, has it in his power even in his daily walks to observe the structure and nature of the animate and inanimate world. Beautiful and varied too as the wide field of nature is, it seems almost culpable to pass by unnoticed the many wonders which it contains, though the choicest are often hidden from the unobservant eye. Yet there are flowers rich and rare, and gems of costly price, the tempting rewards of meritorious zeal and diligent research. A new flower, a new insect, a habit or an instinct in the higher animals not before noticed, may be discovered by a mere beginner, and *one recorded fact* is worth a thousand hasty generalizations founded on mere negative evidence, or theoretical deductions. There is much yet to be done, not only in geology, but in every other branch of knowledge; and truth is best elicited, and false reasonings most satisfactorily overthrown, by an earnest, patient and laborious search into the novelties and beauties of God's creation, not studied in the closet alone, but amidst the plains and rocks, the woods and streams, and even in the recesses of the "vasty deep."

In this way, such master-minds as Sedgwick, Murchison, Owen, Lyell, Forbes and others, have read the pages of the book of nature, and have shown us how to unravel its mysteries, and to study and appreciate the glorious handiwork of an Omnipotent Creator.

XXIV.—*Description of a new British Alga belonging to the genus* Schizosiphon, *Kütz.* By Robert Caspary, Ph.D. &c.

[With a Plate.]

Schizosiphon Warreniæ, Casp.

Char. Gen. Kützing, Phyc. Gen. p. 233; Spec. Alg. p. 327.

Char. Spec. Fastigatim ramoso, infimâ cellula ramorum latiori, hemispherica, laterali, ochreis obscuris, fibris sæpe spiralibus, apicibus ramorum longe attenuatis.

Locality. Near Mainporth, Falmouth, highest water-mark. Fragments also in a specimen of *Schizothrix Creswellii*, Harv., collected by the Rev. R. Creswell near Sidmouth. Plymouth.

The plant forms a solid crust over the horizontal rock to the extent of many square feet in larger or smaller patches from $\frac{1}{4}$–$\frac{1}{2}''$ in thickness, throwing up on the surface little spherical elevations of different diameter and height. It grows particularly vigorous where fresh water runs down the cliff. The colour is in the fresh state a dark, dull, blackish green, in the decayed a tan-brown, and on the rocks the greater part of the plant is of the latter colour. It feels slimy and slippery.

If we apply a small power to a thin vertical section of the plant, we have the view represented in Pl. VIII. fig. 9. Thin stems of a light green colour branch repeatedly dichotomously in the upper part, the branches being all parallel, and each drawn out into a thin, hair-like apex. Fig. 2 represents one branch, magnified 700 times. The stem and the branches consist of one row of cells, the relative proportion of breadth to length of which is $=1:\frac{1}{2}$–2, the length being 0·0024; 0·0013; 0·0016; 0·0018; 0·0025; 0·0026; 0·0023 of a duodecimal French line. Fig. 6 and 8 represent such cells; they are square, and rounded at the corners, and as two often lie together as if they were still one, *i. e.* not separated from each other, as in fig. 8, it is evident the increase of cells is effected by a division-wall growing in the middle of the lengthened cells; therefore two together are often as long as one neighbouring, not yet divided cell. The cells of the apex are often longer than those in the middle and much thinner; their length is 0·0028‴; 0·0038‴. Fig. 4 represents the point of a branch, 1300 times magnified. The cells are often scarcely distinguishable, particularly in the under part of the stem. The contents of the cells are light green, fine grains, coloured by iodine dark brown, but not affected by muriatic acid and spirits of wine. In the middle of the cell is often one larger, apparently colourless globule (see fig. 8), breaking the light stronger than the surrounding contents of the cell. I could not observe that this globule had any connection with the formation of the cells. The hair-like apices contain, besides a colourless fluid, only a few granules of chlorophyll. The undermost cell of each branch is hemispherical, broader than the other cells of the branch, has a very visible wall, which I never saw in the other cells, and mostly, as in fig. 6 *a*, a little hemispherical elevation on the inner side of the upper wall, as if this was a nucleus attached to the wall. The contents consist of a light brownish, transparent fluid, without grains. But the most peculiar circumstance is, that the undermost cell of the branch does not cohere with the cells of the stem, being considerably removed from it to one side, as shown in fig. 6. The branch is only connected with the stem by a sheath of slime, enveloping both. The cells in the main stem, or those immediately over the basal cell of a branch, frequently acquire somewhat the character of the basal cell. Fig. 1 and 3 represent such cells. They are more or less cylindrical, often very much prolonged, elliptical, or the dimension of their breadth is by far greater than that of their length, and the granular contents have disappeared, the cells representing one brownish, semitransparent mass, of which I cannot say if it is solid or not. The walls between such cells are very visible, or are rather not distinguishable from the substance of the sheath. The length of some of these cells was 0·0019‴; 0·0039‴.

The stem and the branches are, with the exception of the apices, enveloped in a sheath of brownish green jelly. This sheath is composed of many funnel-shaped gelatine tubes, succeeding each other at little distances; the upper part with its thinner end in the wider of the lower, and surrounding the stem in such a way that this seems almost to be covered with a solid gelatinous mass. The upper margin of each tube is split in a great many hair-like threads of very minute diameter, which frequently curl about in an irregular manner, but often represent a phænomenon very rarely found amongst Algæ, that they form a real spiral round the gelatinous cover of one or two branches or stems.

Fig. 7 represents a part of the base of a stem; in the middle is the thread of cells covered with the gelatinous mass. E is the upper, F the under end of the stem. A, B, C, D are the funnel-shaped tubes of gelatine, but the margin of B, C, D, together with its very short fringes, is by a fortunate accident in cutting turned downwards, and so shows the nature of its construction, which is very rarely observable on branches which have the fringes in their regular position turned upwards.

Fig. 2 A shows a spiral. Fig. 5, 10 and 11 represent three others, of very different diameter. By scraping an old plant with a razor I got the spirals, represented fig. 10 and 11, clear out of connection with their stems, lying quite separated from the rest. I found these spirals, the windings of which are difficult to perceive, as they are so very close, wound both ways, to the right and the left. Either one thread alone is spirally twisted, as in fig. 5 and 11, or several together, as in fig. 10.

I have watched the plant from the end of February to the beginning of May without having found any fruit, or having perceived any alteration in its structure.

The dried plant does not show the hair-like apices of the branches and stems, nor the nucleus in the cells. Young plants of $\frac{1}{2}'''$ or $1'''$ in height show scarcely any branches, spirals, or hair-like drawn-out apices.

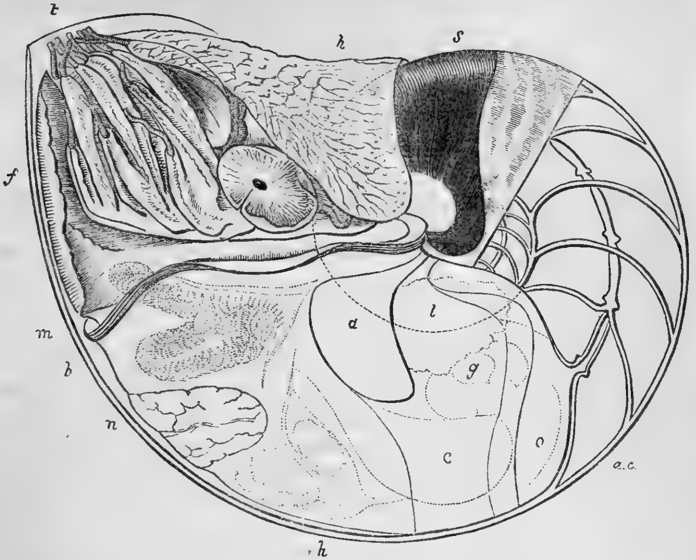
Iodine and spirits of wine do not affect the sheath, but *muriatic acid* deprives it of its colour, and brings the green strings of the cells in the branches and stems well out in view.

The plant is named after Miss Warren, of Flushing, Cornwall.

XXV.—*On the Animal of* Nautilus. By J. E. Gray, F.R.S.

The British Museum two or three years ago procured from the Leyden Museum a specimen of the animal of *Nautilus Pompilius* contained in its shell. The specimen has been recently mounted so as to display the animal in its natural position in its shell, for which purpose one side of the outer whorl of the shell has been removed.

As this specimen differs considerably from the figure of the animal given by Prof. Owen in his admirable memoir on the Pearly Nautilus, and from that in M. Valenciennes' excellent paper in the 'Archives du Muséum,' vol. ii. p. 257, I have thought that a figure of it, engraved by Miss Ann Waterhouse from a most accurate drawing made by Mr. S. P. Woodward, might be interesting to your readers. The figure exhibits the organs in their natural situation—those of the body as they are seen through the mantle.



t. Tentacles. *h.* Hood or "disk." *f.* Funnel.
m. Margin of the mantle. *n.* Nidamental gland.
a. Adductor muscle. *a c.* Air-chambers and siphon.
s. A portion of the outer wall of the shell, left to show the form and extent of the black layer.

Internal organs, indicated by dotted lines:—
b. Branchiæ originating from the inner surface of the mantle and passing forwards into the funnel.
h. Heart and arterial glands.
c. The crop. *g.* Gizzard. *l.* Liver. *o.* Ovary.

The specimen is interesting as showing the large proportion which the body of the animal (and the last chamber of the shell) bears to the air-chambers. The mantle, as in the Gasteropodous Mollusca, is of the same size and form as the mouth of the shell; its edge is entire and quite separate from the body, except at the hinder part near the involute spire. The funnel is large and quite separate from the mantle, which covers it partially, as is the case with all other Cephalopods. Its lower part is continuous like the free margin of the mantle, forming a ridge along the side of the body under the eyes, and dilated behind into a half-ovate flap, which lines the concavity of the disk, between it and the posterior lobe of the mantle. This flap is well represented by M. Valenciennes, t. 11. f. 3 A.

If Dr. Lovén's theory is correct, which I am inclined to believe, and the funnel represents the foot of the Gasteropods, then its lateral extension above described will represent the lobes on the sides of the body, and the hinder half-ovate flap the operculigerous lobe.

The black mark on the involute spire of the shell is evidently deposited by and shows the limits of the hinder edge of the disk when in its living state.

XXVI.—*On some new genera and species of Silurian Radiata in the Collection of the University of Cambridge.* By Frederick M'Coy, Professor of Geology and Mineralogy in Queen's College, Belfast.

ZOOPHYTA.

Fam. Graptolitidæ (M'Coy).

Stem simple or branched, thin, usually linear, horny, unrooted; polype-cells sessile in one or two rows; each cell divided at bottom by a transverse diaphragm.

In the form of the thin horny polypidom and polype-cells the *Graptolitidæ* agree with the *Sertulariadæ*, but differ in not being rooted. I have never found any trace of ovarian vesicles; others may find them, however, by examining great numbers of specimens, or by some fortunate accident; or, like the closely allied *Corymorpha* (which agrees with the *Graptolites* in having a free polypidom), the ova may have been developed in naked sacs attached to the base of the tentacles of the polypes, and would not leave any trace in the fossil state.

On the same grounds that the allied recent genera *Plumularia* and *Sertularia* are separated, I propose to restrict the term *Graptolites* to those which, like the original typical species, have the cell-denticles only on one side, and for those having them on both sides I propose the generic name *Diplograpsis*. Prof. Nilsson and Col. Portlock have published nearly similar views, the latter with great clearness.

Graptolites lobiferus (M'Coy).

Sp. Char. Several inches long, straight; axis capillary, undivided portion of the stem about one-third of a line wide; cells forming large, obtusely rounded lobes, uniformly convex on the upper and outer margin; a notch on the outer edge separates the rounded extremity from the oblique descending margin; four cell-lobes in 3 lines; width from axis to end of cell-lobe slightly less than 1 line.

The rounded lobe-like form of the cells and their size render this one of the most distinctly marked species of the genus. Fragments are often beautifully iridescent.

Common in the black shale of Lockerby.

Graptolites millipeda (M'Coy).

Sp. Char. Length unknown : occurs in short, curved or spirally inrolled fragments; cell-denticles on the outer side, each broad at the base and abruptly contracted to a small mucro, deflected or strongly curved backwards, both the upper and lower margins being sigmoidally curved; the denticles touch each other (when fully preserved) at their bases; five or six denticles in the space of 2 lines; width from axis to end of cell-denticles slightly more than half a line.

The much closer, shorter and wider cell-denticles with their abruptly recurved points, easily separate this species from the *G. convolutus* (His.), the inrolled form of which agrees with it. I only provisionally characterize the species, as there is a possibility that if the *G. convolutus* be only the top of *G. Sedgwickii,* this might ultimately form the corresponding portion of the *G. lobiferus,* a supposition which at present however is not supported by any evidence, there not being the same amount of resemblance between the two latter as between the two former species, the difference in size and structure of the cells being much greater.

Not uncommon in the black shale of Lockerby.

Diplograpsis rectangularis (M'Coy).

Sp. Char. Straight, simple, usually from 1 to 1½ inch long, 1 line wide, gradually tapering to the base, which is a fine simple point; axis fine capillary; cells perfectly at right angles to the axis, forming square denticles to the margin, distinctly separated by rather wide parallel-sided notches reaching two-thirds of the way to the axis, five in the space of 2 lines.

This species is more distinct and constant in its characters than most of the allied forms; in general appearance it approaches the *D. pristis* (His. sp.), but is easily distinguished by the short square cells, *set at right angles to the axis,* instead of the narrow very oblique ones of that species. The only Graptolite making any approach in the form and direction of the denticles is the *bicornis* of Hall, which however is distinguished by the strong lunate process to the base, from which it derives its name; the base of the present species being a simple point as in the *D. pristis*; there is also in most of Mrs. Hall's figures a perceptible obliquity in the denticles, which so admirable an artist could not have designed for this species: the bicarinate base (so commonly preserved in the *D. bicornis*) certainly does not appear in ours.

Both this and the *D. pristis* being of considerable thickness are occasionally liable to be compressed in a plane at right angles to that usually seen, the two rows of cells being pressed flat against each other, and so producing the form figured and described by Hisinger, Portlock, Hall, &c. under the name of *Graptolites scalaris*; and as the numerous specimens under my examination show every stage of the accident, I do not hesitate to recommend the suppression of that species.

Abounding in the black shale of Lockerby.

Fam. GORGONIADÆ.

To this family I provisionally refer the two following new genera, from the relations of their nearest living analogues.

Protovirgularia (M'Coy), n. g.

Etym. *πρῶτος, primus,* and *virgularia.*

Gen. Char. Stem capillary, dichotomously branching, closely set on each side with short, alternately placed pinnules, either contracted close up to the axis in a doubly oblique alternating series, or extended with a gentle upward and outward curve, each pinnule transversely ridged with about five parallel cylindrical cells placed at right angles to its length.

This is a most interesting type, as in the form of its axis and the structure of the transversely ridged celluliferous pinnæ, both in the curved extended, and in the straight contracted states, it perfectly resembles the recent *Virgularia mirabilis,* while by its branching it approximates to the *Hydroida,* thus completing the passage between that great group and the eight-rayed corals by the present genus on the one hand and the free *Hydroid Graptolites* on the other. I know but one species which resembles at first sight the *Graptolites ramosus* of Hall, but that species has only simple denticles, on one side of the branches, while this differs from it and all other *Graptolites* by its two alternating rows of moveable pinnules, transversely furrowed, apparently to contain each a number of polypes, as in the recent group to which I have approximated it. I have little doubt the so-called *Graptolites amplexicaule* figured by Hall (t. 26. f. 11) may ultimately be referred to the same group, though the characteristic cell-furrows at right angles to the upper edge of the pinnules have not yet been noticed.

Protovirgularia dichotoma (M'Coy).

One specimen about $2\frac{1}{2}$ inches long, branching twice at an angle of about 30°, and shows all the pinnules extended at right angles to the capillary axis with a gentle upward curvature like the living *Virgularia* in the same state; another simple fragment about the same length has them half-expanded, being nearly straight and oblique to the axis; a third fragment has them quite contracted, resembling a bit of narrow braid, exactly like the contracted state of the recent *Virgularia mirabilis*; this one shows very plainly the transverse cell-ridging, rather less than 1 line wide; four pinnæ in the space of 2 lines.

In the slate at Lockerby.

Pyritonema fasciculus (M'Coy).

I propose the above name for a singular fragment of a fossil from the dark limestone of Tre Gil, nearly straight, about $2\frac{1}{2}$ inches long, 4 lines wide, and $1\frac{1}{2}$ line thick, and marked longitudinally with coarse, thread-like ridges about the third of a line in diameter, occasionally cut by small sharp transverse wrinkles, the whole having some resemblance to an *Ichthyodorulite* (*Onchus* or *Ctenacanthus*), with which I believe it was confounded by previous observers. On first seeing the specimen, I doubted this reference, from observing that the ridges, instead of being merely superficial, thicker and more numerous at one end, as they should be on this view, seemed equally thick at each end, and clearly not in one plane, but those at the surface of one part plunging into the mass and giving place to others emerging from it. Owing to the skill and kindness of Mr. Anthony, of Caius College, two sections for the microscope were prepared, which proved that the whole mass was really a bundle of thread-like rods of silica, corresponding exactly in diameter with the external ridges, the sections of which exactly correspond with the others in the interior; the siliceous fibres are solid, cylindrical, with slight occasional transverse rugosities; they are less than their own diameter apart; and the interstices show no organization under a magnifying power of 330 diameters, the limestone being of a finer texture and lighter colour than that of the matrix, as if there had been originally a soft animal matter in the spaces between, which kept out the coarser calcareous mud, but which became filled with finer material by percolation on its decomposition. I am therefore rather inclined to compare the fossil in question with the *Hyalonema* of Gray, of which a short notice was published in the Geol. Proceedings 1835, being, according to that naturalist, a recent marine zoophyte allied to *Gorgonia*, called "Glass plant" by the English at Canton. It has a long, thick, rope-like axis, formed of a bundle of very long slightly twisted threads of pure silica, held together by a little animal matter, the whole having an external animal pulpy layer in which the polypes were lodged, and which falls away at their death, leaving the siliceous axis of glass-like fibres exposed*. The analogy between those seems to me very strong, and I know of nothing else in nature like the fossil. I have named the genus from πυρίτης, *silex*, and νῆμα, *filum*. Lest the specimen might be supposed to resemble a bundle of certain *Serpulæ*, I may mention that the rods of silica are not tubes, and have no walls.

Strombodes Wenlockensis (M'Coy).

Sp. Char. Corallum forming large irregular masses of polygonal stems, the mouths of which vary usually from 8 to 10 lines in diameter; boundary-walls strong, prominent, vertically sulcated on the inside; star depressed round the margin of the walls, forming a large circular convexity nearer the centre, within which is a concavity, from which rises the thick prominent compound axis; radiating lamellæ twenty-four to twenty-nine, strongest and most prominent on the circular convexity of the star, where an equal number of small alternate ones disappear: *vertical section* shows the thick central axis composed of irregularly twisted plates, inner area a little narrower than the outer area, from which it is separated by a solid vertical wall, crossed by loose vesicular structure curving upwards and outwards, one or rarely two vesicular plates reaching across the area on each side, vesicular plates of the outer area more curved, slightly smaller, the rows inclining slightly upward and outward, scarcely three cells in a row. A star 9 lines in diameter has the prominent circular portion 7 lines in diameter, and the prominent axis rather more than 1 line in diameter.

To judge from the figure in the 'Silurian System,' that marked t. 16. f. 8 *a* (not the 8 *b*), of Mr. Lonsdale's *Acervularia Baltica* (Schw.), would seem to belong to this species, but according to Phillips that has far more than thirty-six lamellæ (Pal. Foss.); the species represented by the latter figure has neither axis nor divisional walls to the stars, and is certainly generically distinct from *Strombodes*; the true *A. Baltica* of Schweigger, according to his reference to the 'Amœnitates Academicæ,' has no axis and cannot belong to the present genus, of which this species is the only one I am acquainted with in Silurian strata. The fracture as usual passes through, and not between the columns, and the buds are developed in the corners of the old stars.

Not uncommon in the Wenlock limestone near Wenlock.

* I believe M. Edwards considers this recent form to belong to the *Amorphozoa*, and that the observed polypes were parasites. From the axis of *Antipathes* being siliceous, I adopt for the present Mr. Gray's opinion.

Strephodes Craigensis (M'Coy).

Sp. Char. Corallum forming irregular, slightly flexuous, slowly tapering, obscurely nodulose subcylindrical stems, averaging 7 or 8 lines in diameter when old, but both at that size and at 3 to 4 lines in diameter, tapering at the rate of 1 line in 1 inch; outer wall thick, marked with longitudinal fine lamellar sulci (ten in 3 lines); terminal cup shallow, lined by the radiating lamellæ, which are strongest a little within the circumference, and are obscurely complicated at the centre; connected at the sides by distinct transverse vesicular plates: *horizontal section*, outer solid wall thick, sixty-five to sixty-eight slightly flexuous, radiating lamellæ, one half of which extend about half-way to the centre, the other half slightly thickening, uniting in groups of two or three and complicated at the centre; transverse vesicular plates few, most numerous towards the circumference: *vertical section* shows a thick external wall on each side, from which rows of depressed elongated irregular cells curve gradually under the centre, the plates being thickest and nearly horizontal in the middle half of the diameter.

In the greater thickness, size, and approximately horizontal disposition of the vesicular plates in the middle of the corallum, there is an approach to *Cyathophyllum*, but in the cup and horizontal section the radiating lamellæ are clearly seen to unite in bundles and reach the centre—characters totally at variance with those of *Cyathophyllum*. On some of the slender stems obscure signs apparently of lateral buds appear, but I cannot be certain of their true nature. It tapers more slowly than any other species I know.

Common in the limestone of Craig Head.

Strephodes vermiculoides (M'Coy).

Sp. Char. Corallum of closely grouped, round columns of exceedingly irregular diameter from frequent intermittence of growth, producing very unequal annular swellings and funnel-shaped rings; external wall thin, marked by lamellar sulci (six in 3 lines at a diameter of 1 inch, or about twenty all round, indistinct at the more usual diameter of 8 or 9 lines); cup deep, lined with alternating large and smaller vertical lamellæ irregularly uniting about the centre, their edges and sides papillose and perforated, the union of which papillæ forms a dense broad granular margin to the cup obscuring the lamellæ: *horizontal section*, about twenty slightly and irregularly curved, flexuous, radiating lamellæ, extremely thin, indistinct and equal in the dense, nearly solid or granular outer area, where they are connected by very close, minute, curved, vesicular plates; one half of the lamellæ scarcely extend beyond the outer zone, the other half suddenly increase in thickness and proceed towards the centre, where they are irregularly united, connected by few large, curved, vesicular plates, forming nearly transverse rows of irregular cells: *vertical section,* outer third on each side very dense, of extremely small rounded vesicular plates nearly united, inner half of diameter composed of much larger, thin, irregular vesicular plates.

This coral may be distinguished from the *Cystiphyllum cylindricum* (Lonsd.) by the distinct radiating lamellæ towards the centre, and the small size of the vesicular structure towards the circumference, forming an almost solid white granular structure. The Devonian *Cyathophyllum vermiculare* of Goldfuss (also a *Strephodes*) is almost identical in external appearance, but has the radiating lamellæ thickest in the outer area, straighter and alternately of very unequal thickness, and wants the remarkable dense, almost unradiated outer zone. The lamellæ as usual are less numerous in young tubes of smaller diameter.

As far as I can judge from the figure alone, I should think the coral figured by Lonsdale as the *Cyathophyllum cæspitosum* of Goldfuss (S. S. t. 16. f. 10) from the Wenlock rocks might be probably referred to this species, which, in general size, form and mode of grouping of the branches, it resembles; it is quite certain that it has no relation to the true Eifel species of Goldfuss, which is common in the Devonian limestone of Newton Bushel, Torquay, Plymouth, &c., which has slender, even, dichotomous branches and broad transverse diaphragms, &c.

Wenlock limestone of Wenlock and near Aymestry.

Cystiphyllum brevilamellatum (M'Coy).

Sp. Char. Corallum elongate, subcylindrical, preserving for several inches a diameter of little more than an inch, slightly tortuous, and with obscure, irregular swellings of intermittent growth; outer wall extremely thin, strongly ribbed with alternately larger and smaller vertical lamellar sulci, about four large and three smaller in the space of 3 lines, at the diameter of 1 inch (or eighty-four all round); terminal cup with a circular depressed centre, equaling rather less than half the diameter, surrounded by an inclined outer area composed of twenty-four radiating lamellæ (corresponding to the stronger external sulci) extending from the walls about one-fifth of the diameter, connected by close numerous transverse vesicular plates, having at the margin an equal number of extremely short lamellæ (corresponding with the smaller external ridges); internal area broad, formed of large vesicular plates irregularly arranged: *vertical section* composed of arched, irregular, vesicular plates, curving gradually from the walls under the centre, small and numerous at the sides, considerably larger in the middle.

It is possible that Mr. Lonsdale's second figure of *Cystiphyllum Siluriense,* t. 16 bis, f. 2, may be a young group of this species, as this figure by its narrow form, radiated cups, &c. seems totally distinct from his fig. 1, which is the true type of his species;—a new specific name would be required for it in any case.

Wenlock limestone of Wenlock.

Caninia lata (M'Coy).

Sp. Char. Young corallum very widely conic, attaining the adult diameter of 3 inches at a height of about 2 inches, after which it remains cylindrical for a height of several inches, marked with irregular concentric obtuse undulations and small fimbriated lines of growth; in the young the radiating lamellæ are alternately longer and shorter, but before reaching the adult diameter, they are all thin and nearly equal, four or five in a space of 3 lines at a diameter of 2 inches 9 lines (or 110 to 116 all round), connected by numerous transverse curved vesicular plates; inner area formed of broad horizontal simple diaphragms, which at a diameter of an inch extend almost across the corallum to the exclusion of the outer vesicular and radiated layer; at a diameter of $2\frac{1}{2}$ to 3 inches they maintain a diameter of about an inch, the outer lamellated and vesicular zone having proportionately increased; each of the diaphragms is strongly bent downwards at one point of the circumference, forming a distinct siphon; outer wall extremely thin, forming a few root-like tubercles on the conical young; terminal cup with a depressed flattened centre and very convex outer area.

In the Wenlock limestone of Wenlock.

Clisiophyllum vortex (M'Coy).

Sp. Char. Corallum simple, conic, slightly curved, enlarging at the rate of 1 inch 8 lines in 3 inches from the apex; outer wall thin, faintly marked with subequal longitudinal lamellar striæ (five or six in the space of 3 lines at a diameter of 1 inch) and small concentric wrinkles; at a diameter of 1 inch the horizontal section shows an outer area of about sixty thick, equal, radiating lamellæ barely reaching one-fourth of the diameter towards the centre, connected by small irregular transverse vesicular plates; a few of the pairs have a very thin, short, marginal lamella between each of the larger ones, and where this occurs, the vesicular transverse plates become much more numerous; inner area rather more than half the diameter, forming a circular mass of confused vesicular tissue crossed by a few arched radiating delicate lamellæ: *vertical section* having the narrow outer area on each side (corresponding to the lamelliferous zone) of arched vesicular plates, forming large unequal horizontal or slightly inclined cells, one or two extending across the width of the area; wide inner area composed of small oval cells arranged in much-curved transverse rows, the convexity of the curve upwards.

Wenlock limestone, Wenlock.

Arachnophyllum typus (M'Coy).

Syn. & Ref. *Acervularia Baltica* (Schw.), Lonsd. pars S. S. t. 16. f. 8 *a* (not of Schweigger).

Sp. Char. Corallum forming thick, irregular, enveloping masses; upper surface undulated, covered with large shallow polygonal stars, defined by very obtusely angular ridges; the centres averaging 7 or 8 lines apart, circular, depressed, rather more than one-third the diameter of the star, radiated with about thirty-eight strong granulose subalternate lamellæ, half of which reach the flattened centre, where they are irregularly united and slightly twisted; on the outer inclined area of each star, each of the lamellæ becomes much thinner and more faintly marked, branching di- or tri-chotomously once or twice, and often waving in a variable manner before reaching the boundary, over which they frequently pass into the adjoining stars: *vertical section* showing a few delicate vertical striæ under the centres of the stars (edges of the twisted vertical lamellæ), and a nearly uniform small vesicular tissue, the cells of irregularly unequal size, passing from star to star, with a few irregular dense bands nearly coinciding in curvature with the form of the cells; average of larger cells two to three in 1 line; no divisional walls between the stars.

That this is *one* of the fossils figured by Mr. Lonsdale in the 'Silurian System' as the *Acervularia Baltica* of Schweigger I have little doubt, but neither the particular figure to which I refer, nor the others which that writer has given under the same name in that work, have any specific relation to the *Acervularia Baltica* of Schweigger, who avows that name to be only a synonym of the *A. ananas* (Linn. sp.), referring to the original figure, &c. in the 'Amœnitates Academicæ' of Linnæus, representing a coral which has a distinct walled tubular centre, from which the groups of young are developed, solid walls between the cells, &c. The lateral disk buds are often seen in this curious coral.

Wenlock limestone near Aymestry.

Petraia æquisulcata (M'Coy).

Sp. Char. Conical, slightly curved, oblique, with a few broad, obtuse, undefined concentric swellings of growth; regularly increasing from the apex to a diameter of $1\frac{1}{2}$ inch at $2\frac{1}{2}$ inches from the base; external wall very thin, it and the cast regularly marked with equal obtuse ribs, about eighty-five in the adult diameter of $1\frac{1}{2}$ inch (six in 3 lines), eighty at 1 inch (eight in 3 lines), seventy-five at 9 lines and forty-six at 4 or 5 lines (ten in 3 lines), separated by thin, equal, equidistant slits representing lamellæ, each alternate one of which is merely marginal, the others occasionally and regularly uniting before reaching the centre, round which they are twisted to form a spirally conical central area; no connecting vesicular plates.

The regularity and equality of size of the lamellar ribs both on the exterior and on the cast, as well as their large number, give a peculiar aspect to this species. In parts of some specimens the lamellar sulci are bent in a zigzag manner, but it is an unusual appearance, for which I cannot account. By carefully removing part of the outer wall, each of the lamellæ is seen to be split near the exterior (not visible on casts), and each to be perforated by tubuli, as in Mr. Lonsdale's supposed genus *Tryplasma*; these punctures leave no trace on the equal, obtuse, smooth ridges of the cast. I have usually seen this coral ticketed in collections as *Cyathophyllum turbinatum*, to which it bears some superficial resemblance, but has no real specific or even generic relation.

Very abundant in the Coniston limestone of Coniston; in the calcareous flags of Applethwaite Common; fine Caradoc sandstone of Mulock quarry, Dalquorhan; flags of High Haume; slates of Llansaintfraid.

Petraia subduplicata (M'Coy).

Sp. Char. Regularly conic, slightly oblique and curved at the tip; outer wall thick, marked with one or two small interruptions of growth, and with fine, longitudinal, distant impressed equal striæ (seven in 2 lines, at a diameter of 5 or 6 lines); average length 9 lines, of which the 3 lines nearest the apex are filled with solid calcareous deposit; width 7 lines. Casts regularly conic, subtruncate at small end; length and width about equal, regularly sulcated by twenty-seven to twenty-eight strong, straight, primary lamellar sulci extending to the centre, where they are irregularly complicated into a large cellular mass; between the large slits are an equal number of finer ones, extending about three-fourths the length of the cast from the wide edge of the cup (representing the secondary lamellæ), which extend only a short way towards the centre.

Var. *a. crenulata.*

This beautiful variety differs from the ordinary type in the primary and secondary lamellar sulci, particularly towards the edge of the cup, being bent with numerous small angular zigzag flexures (perhaps from alternating projections on their sides). I might have supposed this to have been a small form of the *P. elongata* (Phill. sp.), if it was not for his reference to Lonsdale's figure (S. S. t. 16 bis, f. 6), which represents a distinct species which I have frequently seen; the lamellæ of the present species are also finer, the size smaller, and the form more regular, and the lamellar ridges of the cast never pitted. On the cast the lamellar sulci are regularly alternate in size, except at the strong simple odd one, on each side of which are two or three short ones.

Very abundant in the fine greenish Caradoc sandstone of Mulock quarry, Dalquorhan; in the schists of Cyrn y Brain, greenish schists of Llansaintfraid.

Petraia uniserialis (M'Coy).

Sp. Char. Corallum rapidly and regularly expanding, oblique, averaging 5 lines in height and width, radiated with about forty-five or fifty lamellar sulci; average internal casts nearly 5 lines wide and 2 lines high, radiated by the deep slits of twenty-five strong primary lamellæ (six or seven in 3 lines at the margin) extending to the centre, where they are united and irregularly complicated; between each pair of these slits is a row of small, close, irregular, numerous pits (representing papillæ of the secondary lamellæ), about three in a space equaling the distance of the lamellar slits apart.

I frequently find this common species confounded with the *P. bina* (Lonsd.), which in form and size it resembles, but from which it differs completely in the primary lamellæ being simple plates extending to the complicated centre, leaving deep slits in the cast, which therefore has but one set of rows of pits instead of two; while in *P. bina* these lamellæ are replaced by a row of large papillæ, leaving a row of large pits in the cast, extending but a little way towards the centre. The secondary row of lamellar papillæ (and pits on the cast between the slits) is much smaller, closer and less regular in the present species than in the *P. bina*. Some of the casts present a depression in the smaller end, into which a process of the solid part of the apex must have penetrated. Between the lamellar sulci in some damaged specimens, obscure traces of cells seem doubtfully visible under the lens;—if these should prove to be vesicular plates, the species should be transferred to the genus *Strephodes*, thus removing it still further from *P. bina*, in which there is nothing of the kind.

Var. *a. gracilis.*

Certain casts a little longer and of a much more elongate form than the above, being about as high as wide, and having about thirty to thirty-six primary lamellar slits at a diameter of 6 or 7 lines, and an equal number of rows of close, small puncta, require separate mention, though I do not see that they differ in other respects.

Common in the schists of Pen lar Llandovery; Mathyrafal; Llansaintfraid and Castel Craig; fine Caradoc sandstone of Alt y Anker.

Cyathaxonia Siluriensis (M'Coy).

Sp. Char. Corallum elongate conic, about 5 lines long and 2 lines in diameter at that height from the base; strong central axis nearly one-third of the diameter; sixteen or seventeen strong radiating lamellæ, each extending from the axis to the outer wall, before reaching which it bifurcates, leaving a triangular interlamellar space about equal in width to the distance between the adjoining lamellæ; surface coarsely ridged longitudinally; the sulci corresponding to the divided edges of the lamellæ, leaving one of the equal intervening ridges to correspond with each of the spaces between the individual lamellæ, and between their divided edges.

This is the only species of the genus I am aware of in the Silurian rocks.

Rare in the Upper Ludlow rock of Underbarrow, Kendal.

Spongarium æquistriatum (M'Coy).

Sp. Char. Elliptical, depressed, proportion of width to length varying from 85 or 90 to 100; marked with sharp, rugged concentric wrinkles; entire disk closely and evenly radiated by coarse rounded very approximate ridges, averaging five in 1 line. Long diameter from 8 lines to 1 inch.

This species is perfectly distinguished from its congeners by the coarse, close, equal striation of the entire disk, giving it a peculiarly harsh aspect; the ridges are much less than their thickness apart.

Rather rare in the quartzose Upper Ludlow rock of Benson Knot, Kendal.

Spongarium interlineatum (M'Coy).

Sp. Char. Broad oval, usual proportion of width to length as

35 to 100, marked with very strong concentric undulations; radiating ridges very numerous, straight, slender, simple, of unequal lengths, averaging with considerable regularity half a line apart; intervening spaces finely striated radiatingly; long diameter varying from 7 lines to 1 inch 3 lines.

This species is easily distinguished from the *S. Edwardsi* (Murch.) by having considerably more than double the number of radiating ridges; they have never been seen to dichotomize, but retain their comparatively near approximation by the intercalation of similar, straight, shorter ridges towards the circumference; the substance also appears stronger and is more strongly wrinkled concentrically; the small radiating striæ between the larger ridges are very characteristic.

One very obscure specimen, apparently of this species, measures 2 inches in its long diameter; the distance between the main ridges is about four times their thickness.

Abundant in the green micaceous quartzite of the Upper Ludlow at Benson Knot, Brigsteer and Scalthwaiterigg, Kendal.

Spongarium interruptum (M'Coy).

Sp. Char. Elliptical, proportion of width to length about 85 to 100, convex below or externally, concave above or internally; interior smooth, or marked with faint concentric wrinkles; exterior rugged with coarse concentric undulations, entire outer surface marked with sharp, subalternate, thread-like striæ, five or six in one line; some of which rise at irregular intervals into short, very thick, subangular, radiating ridges interrupted by the concentric wrinkles and not regularly resumed. Average length 1 inch.

The sharp alternately large and small striæ, and the short irregular interrupted ridges or elongate tubercles produced by the irregular prominence of some of the ridges, distinguish this species readily from the others. Two of the specimens are of great interest, one showing the attachment of the base half round a bit apparently of an *Orthoceratite*; the other showing for the first time the thickness of the substance to be about one-sixth of a line, and exhibiting the unradiated inner concave surface, and the impression of a part of the peculiarly radiated exterior.

Rare in the green micaceous quartzite (Upper Ludlow) of Spital, Kendal.

Nebulipora (M'Coy), n. g.

Gen. Char. Corallum incrusting or forming lenticular masses, with a concentrically wrinkled epitheca below; composed of small prismatic tubes perpendicular or nearly so to the upper surface on which they open; among the small tubes are irregularly arranged clusters of similar tubes of rather larger size; tubes in contact, traversed by horizontal diaphragms at regular distances (walls apparently perforated by rows of small foramina).

The *Favosites favulosa* (Phill.), Mem. Geol. Surv. vol. ii., is the only published species I know of this genus, which differs from *Favosites* in the clusters of enlarged tube-cells at subregular intervals; and from *Stromatopora* by the tubules being regularly prismatic, with diaphragms (? and connecting pores).

Nebulipora explanata (M'Coy).

Sp. Char. Corallum forming very thin, irregularly expanded laminæ, upwards of 2 inches long, covered with nearly regular quincuncially arranged nebular clusters of large tubes, flat or slightly depressed, about $1\frac{1}{2}$ line in diameter, and rather less than twice their diameter apart (about twelve or fourteen cells between one centre and the next); smaller intermediate tubes about six in one line.

To the naked eye the whole of the tubular structure of this coral is manifestly coarser than in the *N. lens*, from which it differs in its large irregular foliaceous expansions of growth; it also seems that the proportion (150 to an inch) of small cells in a given space was also greater in the *F.* (*Nebulipora*) *favosa* (Phill. sp.), to which I should have otherwise referred it.

Coniston limestone, Coniston.

Nebulipora lens (M'Coy).

Sp. Char. Corallum forming lenticular masses averaging 10 lines in diameter and $1\frac{1}{2}$ line thick in the middle, gradually thinning to the edge; base slightly concave, with small concentric wrinkles; upper surface evenly convex; clusters of large cells rounded, flat or slightly concave, about 1 line in diameter and usually a little more than their diameter apart (averaging from sixteen to twenty cells between one centre and another); smaller tubes averaging eight in one line, larger tubes of the clusters averaging four or five in one line; two interdiaphragmal spaces equal the diameter of the tube; apparently two irregular, close rows of connecting pores on each face of each tube.

When imperfectly developed or rubbed, it is difficult to recognize the imperfect star-like clusters or nebulæ of the larger tubes. The structure not being composed of concentric layers round a central nucleus, and the appearance of the mouths of the tubes on the upper surface, easily distinguish this fossil from the *Stromatopora nummulitisimilis* (Lonsd.).

Owing to the minuteness and imperfect mode of preservation it is difficult to be satisfied about the connecting pores, but from the appearance under a high power of several specimens, I have little doubt they are as in the above notice.

In great abundance clustered like *Nummulites* in some parts of the fine Caradoc sandstone of Horderly West; more rare in the schists of Moel Uchlas?; Pont y Glyn, Diffwys; Cwm of the Cymmerig.

Nebulipora papillata (M'Coy).

Sp. Char. Corallum forming very thin layers (usually coating *Orthoceratites*); clusters of large cells elevated into conical papillæ, about ten in each cluster; the papillæ a little wider than high, usually about twice their diameter apart, quincuncially arranged; thickness of corallum usually less than half a line, diameter of papillæ about half a line, distance apart about one line; of the smaller cells about nine or ten occupy one line.

Not very uncommon coating *Orthoceratites* in the Upper Ludlow rock of Brigsteer, and Coniston flags of Coniston, also at Firbank.

Favosites crassa (M'Coy).

Sp. Char. Corallum forming large, subcylindrical, curved branches, composed of long, slightly diverging, remarkably regular and equal prismatic tubes, opening as thin-walled polygonal cells on the surface, with a nearly uniform diameter of half a line; two rows of pores on each face of the prismatic tubes, diaphragms either slightly more or less than the diameter of the tubes apart; interpolated young tubes few.

In the general characters of the tubes and connecting foramina this species nearly agrees with *F. Gothlandica*, from which species it is distinguished by the elongate branch-like form of the general mass, the tubes averaging rather less than half the diameter, and being far more uniform in size than in that species, from the small number of interpolated young tubes, connected probably with the shape of the corallum, which is elongated instead of forming low wide masses as in *F. Gothlandica*. I suspect this to be the coral occasionally quoted as the Devonian *F. polymorpha* in Silurian rocks, a species which is very distinct from the present, and which I have never seen in Silurian strata, nor seen any recognizable figure of a Silurian specimen. As the essential characters are neither described nor figured, I do not like to refer to the figure (t. 15. f. 2) of the so-called *F. polymorpha* given by Mr. Lonsdale in the 'Sil. Syst.,' placed in the genus *Alveolites* by M. D'Orbigny under the name (without definition) of *A. Lonsdalii*, although the size of the tubes coincides.

Masses 2 inches in diameter and 6 inches long in the Coniston limestone, Coniston Water.

Palæopora ? favosa (M'Coy).

Sp. Char. Corallum forming irregular rounded masses formed of prismatic tubes, opening as polygonal shallow cells on the surface (averaging $1\frac{1}{2}$ line in diameter in limestone, and about 1 line in sandstone); the dense narrow interspace or thick boundary-wall of the cells formed of one, or in places two rows of small cells; concave bottom of the stars very obscurely radiated with twelve irregular, rugged, nearly obsolete lamellar projections, scarcely distinguishable from a few intermediate granules, a small papillary axis in the centre: *vertical section,* clear open space of the tube, 1 to $1\frac{1}{2}$ line in diameter, separated by thick vertical walls (or very narrow dense interspaces of one or two rows of cells), traversed by strong distant horizontal, or slightly concave diaphragms, varying from the diameter to little more than half the diameter of the tubes apart.

It is very probable that this coral should form the type of a particular genus; the polygonal cells very narrow, dense interspaces, apparent absence of the circular tube of the cells, and small central axis, distinguish it from the other species of *Palæopora.* The large masses preserved in limestone are singularly like *Favosites Gothlandica,* the surface showing apparently the same sized and shaped polygonal hollow cells, with strong divisional walls, and the rough vertical section showing apparently prismatic tubes with distant diaphragms; a sharp eye or a lens however will detect the cellular structure of the divisional walls, and careful search will show the radiation, &c. of the cells; this is most distinct in a polished horizontal section. Specimens preserved in the fine sandstone present a very different appearance, forming small fig-shaped masses covered with hexagonal nearly smooth or very minutely granular convex or concave casts of the cells, with a distinct axal puncture in the centre of each. I have however connected them satisfactorily, though with difficulty, with the more perfectly preserved limestone examples.

Extremely abundant in the calcareous schists and limestone of Craig Head; Girvan; and in the fine Caradoc sandstone of Mulock quarry, Dalquorhan.

Fistulipora decipiens (M'Coy).

Sp. Char. Corallum forming hemispherical or subcylindrical masses 3 or 4 inches in diameter, concentrically wrinkled at base; cell-tubes straight, subparallel, with moderately thick walls, leaving clearly defined circular *smooth-edged* cells in the transverse section, very regular in size and disposition, usually slightly less than half a line in diameter, and averaging rather less than their diameter in the shortest line between adjacent cells, in which line there are usually two, or more rarely three, of the intermediate vesicular cellules; about eighteen of the intermediate or polygonal cellules in the space of 2 lines; diaphragms in the small tubes slightly more or less than their diameter apart, two interdiaphragmal spaces in the large tubes slightly exceeding the diameter.

So exactly does this resemble the *Palæopora interstincta* (Wahl.), that I have little doubt it has often been confounded with it, although an attentive examination will show that the distinctly walled tubes are smooth within and perfectly destitute of lamellæ. I have seen this coral also in large masses in the Upper Silurian limestone of Gothland. It may be distinguished from the very nearly allied *Manon* (*Fistulipora*) *cribrosa* (Gold. sp.), by the smaller size of the cell-tubes and their greater number in a given space, their *proportionate* distance being pretty nearly the same. In both the British and foreign specimens the cells are so beautifully distinct, that it would be impossible to overlook the notches or rudimentary lamellæ if they existed.

Forming large masses not uncommonly in the Wenlock limestone near Aymestry.

Berenicea heterogyra (M'Coy).

Sp. Char. Parasitic, often on *Orthoceratites*, covering spaces of upwards of 2 inches square; cells disposed in irregular radiating, or divaricating, circular, or fan-shaped lines, ten or eleven occupying the space of 1 line (measured across their length), and about three in the same space in the direction of their length, each cell slightly more than the third of a line long, very narrow, fusiform, about four times longer than wide, and separated by a space, varying from their greatest width to less than one half their width or nearly in contact; upper convex surface of each cell with four or five large tubercles when well preserved.

The cells of this remarkable species are almost invisible to the naked eye, but it occurs forming patches of considerable size; the small size of the cells and their very elongate slender form distinguish this species from the *B. irregularis* of Lonsdale.

Coniston limestone of Coniston.

POLYZOA.

Ptilodictya explanata (M'Coy).

Sp. Char. Corallum forming large funnel-shaped foliaceous flexible expansions upwards of 2 inches wide; axis semimembranous, very thin, marked with small, close, concentric or forward-curved undulating wrinkles; tube-cells pyriform oblique, three or four times longer than wide, narrowed posteriorly, anterior ends of the adjacent cells convex rhomboidal, with a round perforation nearest the anterior edge; cells separated by depressed lines, which (when finely preserved) show one or two alternating rows of small cellules, about seven or eight cells in a space of 2 lines.

The broad foliaceous expansions of this species readily distinguish it from any of those described by Mr. Hall, as well as the very narrow depressed spaces between the cells on the surface, and the broad rhomboidal, convex portion of the cells surrounding the aperture. Finely preserved casts of the surface show the strong granules on the ridges corresponding to the intercellular depressions of the true surface. Old specimens often show a few thick irregular branching ridges on the surface as in *Neuropora*. One young specimen is flat and oval, like the base of Say's *Favosites* (*Stenopora*) *Lycoperdon*, with which it might be confounded if the posterior tapering of the cell-tubes was not noticed; others are more elongate, conical; and the greater number of specimens are irregularly undulated fragments, parts of large expansions. The large, expanded, undulated and wrinkled axis when the cells are rubbed off, resembles species of *Stromatopora*; a careful search will usually show some remaining cells, or by rubbing down the thin axis some of the cells of the under side will be brought into view, when their comparatively greater size and oblique ovate form will identify them.

Very common in the slates of Mynydd Fron Frys; five miles west of Chirk; Llansaintfraid; Llanfyllin; Blain y Cwm; Cyrn y Brain; Coniston limestone of Coniston; limestone of Mathyrafal; schists north end of Pen y Craig, above Glyn.

Ptilodictya costellata (M'Coy).

Sp. Char. Corallum frequently dichotomizing at an acute angle; average width about $1\frac{1}{2}$ line; surfaces gently convex, section acutely elliptical, edges acute, with a rather broad lateral margin, having a minutely granular non-celluliferous surface, each face averaging from seven to ten longitudinal rows of oblong or nearly oval cells, arranged in alternating lines (six to eight rows in the space of 1 line, about four or five cells in the same space in each row); cells about a third longer than wide and half their length between the rows, and about half their width between the cells of each row, giving the casts the appearance of being regularly marked with longitudinal sulci; intercellular spaces very minutely granulose.

The sulcated appearance of the cast and the linear arrangement of the cells easily distinguish this species from the *Stictopora* (*Ptilodictya*) *acuta* (Hall. sp.) By grinding down a fragment I have ascertained with certainty the presence of the flat internal axis, which is however of great delicacy, and not to be seen in the shale or sandstone specimens.

Not uncommon in the slates of Llansaintfraid; calcareous schists of Mathyrafal, and limestone of Girvan.

Ptilodictya fucoides (M'Coy).

Sp. Char. Corallum forming very thin, flat, submembranous, foliaceous, linear expansions, averaging $1\frac{1}{2}$ to 2 lines wide, frequently dichotomizing at an acute angle, branches very rarely, but occasionally anastomosing; cells extremely small (eight in the space of 1 line), about eighteen rows in the width of the frond, very close quincuncially arranged, without perceptible linear disposition; internal axis smooth, nearly membranous.

The extreme minuteness, number and close disposition of the cells easily distinguish this species from the *P. acuta* or *costulata*, and often give the specimens a resemblance to some fucoid.

Not uncommon in the schists of Llansaintfraid; schists of Gelli Grin, Bala; and schists of Corwen.

Fenestella patula (M'Coy).

Sp. Char. Corallum forming small semicircular expansions about half an inch in diameter; interstices broad, strongly carinate, slightly flexuous, and dichotomizing very frequently (usually at rather less than every line in height), about seven in the space of 2 lines; fenestrules about one-third wider than the interstices, of very irregular shape, but nearly equal in length; dissepiments strong, about half a line apart; pores large, very prominent (about three to the length of an interstice).

This species is more nearly allied to the *Retepora* (*Fenestella*) *antiqua* of Goldfuss, than the Silurian species referred to it by Lonsdale (*F. subantiqua*, D'Orb.); from the latter species it is easily distinguished by its thick, widely divaricating and frequently branched interstices, the irregular shape of the fenestrules, and the much fewer and more prominent pores.

Not uncommon in the Wenlock limestone of Dudley.

Fenestella rigidula (M'Coy).

Sp. Char. Corallum formed of very slender ridged straight interstices, branching seldom (at distances of about every 10 lines), several interstices often branching at the same height, at a very acute angle, about ten interstices in the space of 2 lines; mesial keel very strong, with a row of small pores; fenestrules very regular in size and shape, quadrangular, slightly longer than wide, their width about equaling that of the interstice; usually three large thick-edged pores to the length of a fenestrule and one larger at the end of each dissepiment.

In size, mode of branching, and rigid straightness of the interstices, this is not unlike the *F. subantiqua,* but is completely distinguished by its closer dissepiments, forming shorter fenestrules, and its much fewer and larger pores. From the row of pores on the keel, this would enter M. D'Orbigny's subgenus *Fenestellina.* I suspect, from some specimens I have seen, that it is possible some of the figures given by Lonsdale in the 'Silurian System' as the *Fenestella prisca* (Gold. sp.), may be coarse, inaccurate representations of this species; if this should even prove so, the name I propose should be retained, as it has no affinity with the large Devonian coral of Goldfuss, with which I am well acquainted.

Not uncommon in the Wenlock limestone of Dudley.

ECHINODERMATA.

Taxocrinus? Orbignii (M'Coy).

Sp. Char. Column cylindrical, about 2 lines in diameter at an inch from the pelvis, and not varying materially in character within 2 inches from the pelvis; joints finely granulated, uniform, two in the space of 1 line; pentagonal *pelvic plates* 1 line high, alternating with which are the pentagonal or obscurely heptagonal scapulæ, nearly $1\frac{1}{3}$ line long; arms of two quadrangular and one cuneiform joint each 1 line long, and $1\frac{1}{3}$ line wide, the latter giving off two hands of five joints, the last being cuneiform, and giving origin to two fingers; from pelvis to end of fingers 1 inch 3 lines.

I have not distinctly made out the interbrachial plates, but as there seems a notch between the upper adjacent edges of the scapulæ, I have little doubt they existed; besides their presence, the species is easily distinguished from the *Ichthyocrinus pyriformis* (Phill. sp.), by the greater number of joints in the arms and hands, the much thicker column, and the nearly unvarying character of the joints as they approach the pelvis.

In the "Asterias" bed of the Upper Ludlow at High Thorns, Underbarrow.

Glyptocrinus basalis (M'Coy).

Sp. Char. Cup subpyriform, pelvic plates hexagonal, slightly exceeding the costals in length and supporting the intercostals on their upper truncated edge; all the plates marked with thick radiating ridges, one to each side, except in the pelvic plates, which have them only in the three upper sides, the lateral pair being the forked ends of the strong vertical ridge of the costal or radial rows; average length of cup from pelvis to base of rays, 1 inch 6 lines; width the same; length of pelvic plates $3\frac{1}{2}$ lines, pentagonal first costal 3 lines, hexagonal second costal $2\frac{1}{2}$ lines, heptagonal scapular plate 3 lines, hexagonal first arm plate $2\frac{1}{2}$ lines, second arm plate 2 lines.

This fine species differs from the *Glyptocrinus decadactylus* (Hall), of the Hudson River group of New York, by the great size of the pelvic plates, and their being hexagonal instead of pentagonal, and their bearing the intercostal plates directly on their truncated upper edge, the intercostals in the American species being supported on the sides of the laterally united *first costals,* which latter plates in this species are completely separated. The first arm-plates are laterally united without the intervention of an interbrachial plate, which exists however between the second arm-joints, nearly equaling them in size. In one of the most distinctly preserved intercostal spaces, three interscapular plates are seen to rest on the upper half of the octagonal intercostal, the lateral ones being pentagonal, and the middle longer one hexagonal. All the plates seem to have been thin, and allow considerable variety in form of the cup from slight pressure.

Not uncommon in the calcareous schists of Alt y Anker.

XXVII.—*Supplementary Notices regarding the Dodo and its Kindred.* No. 9. By H. E. Strickland, M.A., F.G.S.

[Continued from vol. iv. Ser. 2. p. 339.]

9. *Discovery of a* third *example of a Dodo's head.*

I have much pleasure in communicating the following extract of a letter addressed to me by P. L. Sclater, Esq., of Corpus Christi College, Oxford, who has just returned from the continent. It affords another instance of the interesting discoveries that may be made by searching the *penetralia* of old established museums, especially in towns not often visited by scientific travellers.

"What I wished to tell you was that at Prague, in the *Böhmischen Museum,* there is a veritable skull of the Dodo;—that is, all the frontal portion, just as much as we should leave in preparing a skin,—which I believe you are not aware of. They have also casts of the heads at Oxford and at Copenhagen. M. Max. Dormitzer, Assistent am Böhmischen Museum, Prag. no. $\frac{738}{1}$, would be very happy to give you any information on the subject. He told me that he found the above-mentioned skull among some rubbish, and that it was a long time before they made out what it was."

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

November 13, 1849.—William Yarrell, Esq., in the Chair.

Description of a new species of Cytherea. By Lovell Reeve, F.L.S., F.Z.S. etc.

Cytherea nobilis. *Cyth. testâ orbiculari-cordatâ, crassâ, transversim concentricè liratâ, liris rudibus, obtusis, subplanulatis, numerosis, crebris, valdè irregularibus, hic illic intermissis, non parallelis; lacteâ, epidermide tenui corneâ, translucidâ, indutâ.*

Long. $4\frac{1}{4}$ in.; lat. $2\frac{1}{2}$ in.; alt. 4 in.

Hab. ——?

This fine species, from the collection of A. L. Gubba, Esq., is distinguished by a peculiarity in the form and arrangement of the concentric ribs with which it is sculptured. They are very numerous, flattened, close-set, and extremely irregular, now narrow, now broad, each one varying irregularly in width and now and then suddenly intermitted. It is of a pure cream-colour, covered with a thin, horny, transparent epidermis. Mr. Gubba obtained it from a vessel in Havre-de-grace, but could not ascertain its locality.

Descriptions of twenty-four new species of Helicea, from the Collection of H. Cuming, Esq. By Dr. L. Pfeiffer.

1. Streptaxis glabra, Pfr. *Str. testâ umbilicatâ, depressè ovatâ, tenui, pellucidâ, virescenti-albidâ, omnino glabrâ; spirâ laterali, acutiusculâ; suturâ albo-marginatâ; anfractibus* 6 *convexiusculis, penultimo inflato, ultimo antrorsum deviante; umbilico angusto, non pervio; aperturâ perobliquâ, semicirculari, dente minuto parietis aperturalis munitâ; peristomate albo, subincrassato, breviter reflexo.*

Diam. maj. 8, min. 6, alt. 5 mill.

Hab. Demerara.

2. Streptaxis Cumingiana, Pfr. *Str. testâ perforatâ, depresso-globosâ, solidulâ, glabrâ, virenti-albidâ; spirâ sublaterali, conoideâ; anfractibus* 7 *angustissimis, subplanis, penultimo prominulo, ultimo antrorsum deviante; aperturâ perobliquâ, auriformi, lamellâ intrante parietis aperturalis coarctatâ; peristomate simplice, breviter expanso, marginibus callo tenui junctis, dextro arcuato, infernè dente* 1 *acuto munito, basali*

stricto, dente 1 *transversè elongato instructo, columellari brevissimo, ad perforationem non perviam subreflexo.*
Diam. maj. $6\frac{2}{3}$, min. $5\frac{1}{3}$, alt. 4 mill.
Locality unknown.

3. Helix Monssoni, Pfr. *H. testâ perforatâ, turbinatâ, tenui, levi, carinatâ, striis incrementi et lineis confertissimis impressis, obliquè antrorsum descendentibus subtilissimè decussatâ, diaphanâ, albidâ, rubro-unicingulatâ; spirâ conoideâ, apice obtusiusculâ; suturâ submarginatâ; anfractibus* 6 *subplanulatis, ultimo magno, infra cingulum carinato (carinâ anticè obsoletâ), basi convexiusculo; aperturâ obliquâ, subangulato-lunari; peristomate simplice, recto, margine columellari supra perforationem breviter reflexo.*
Diam. maj. 38, min. 33, alt. 23 mill.
Locality unknown.

4. Helix albicans, Pfr. *H. testâ perforatâ, depressâ, striatulâ, sublævigatâ, nitidâ, hyalino-albidâ; spirâ vix elevatâ; suturâ impressâ, marginatâ; anfractibus* 5 *planiusculis, lentè accrescentibus, ultimo non descendente, subrotundato, circa perforationem impresso; aperturâ verticali, latè lunari; peristomate simplice, acuto, margine columellari brevissimè reflexo.*
Diam. maj. 8, min. 7, alt. 4 mill.
Hab. in insulâ Jamaica.

5. Helix phlogophora, Pfr. *H. testâ subperforatâ, depressulâ, tenuissimâ, striatulâ, pellucidâ, nitidâ, fulvo-luteâ, flammulis angulatis et serrulatis rufis confertis pictâ; spirâ parum elevatâ, apice subpapillatâ; anfractibus* $3\frac{1}{2}$ *convexis, rapidè accrescentibus, ultimo depresso, basi planiusculo; aperturâ perobliquâ, rotundato-lunari; peristomate simplice, recto, margine columellari subreflexo.*
Diam. maj. $6\frac{1}{2}$, min. $5\frac{1}{2}$, alt. 3 mill.
Locality unknown.

6. Helix sericatula, Pfr. *H. testâ perforatâ, depressâ, discoideâ, subtiliter et confertim costulatâ, striatâ, subsericâ, griseo-corneâ, lineis brunneis irregularibus radiatâ; spirâ planâ; anfractibus* $4\frac{1}{2}$ *vix convexiusculis, ultimo subrotundato, juxta perforationem subimpresso; aperturâ subverticali, latè lunari; peristomate simplice, recto, obtusiusculo, margine basali declivi, supernè reflexo, perforationem ferè occultante.*
Diam. maj. $4\frac{1}{2}$, min. 4, alt. $2\frac{1}{3}$ mill.
Hab. ad Port Jackson (Mr. Strange).

7. Helix nobilis, Pfr. *H. testâ angustè umbilicatâ, subturbinato-depressâ, solidâ, striatâ, lineis impressis concentricis et obliquis subtiliter decussatâ, fulvâ; spirâ parum elevatâ, subturbinatâ; anfractibus* 6 *parum convexis, ultimo medio circulo elevato, obtuso cincto, infra eum fasciâ saturatè castaneâ, deorsum dilutâ, ornato, circa umbilicum pallido; aperturâ amplâ, parum obliquâ, latè lunari, intus margaritaceâ; peristomate*

simplice, recto, margine columellari ad umbilicum in laminam brevem, triangularem reflexo.

Diam. maj. 53, min. 45, alt. 30 mill.

Hab. in insulâ Borneo, var. pallida in insulis Philippinis.

8. Helix borneensis, Pfr. *H. testâ obliquè perforatâ, depressâ, tenuiusculâ, striis incrementi distinctis et lineis obliquis, impressis, crebris decussatâ, saturatè fulvâ; spirâ vix elevatâ, obtusâ; anfractibus 4 parum convexis, celeriter accrescentibus, ultimo medio zonâ nigricante, deorsum dilutâ, ornato; suturâ lineâ impressâ marginatâ; aperturâ obliquâ, amplâ, transversè lunari-ovali, intus margaritaceâ, fasciâ pellucente; peristomate simplice, acuto, margine columellari in laminam brevem, triangularem, umbilicum semitegentem, reflexo.*

Diam. maj. 52, min. 42, alt. 25 mill.

Hab. in insulâ Borneo.

9. Helix africana, Pfr. *H. testâ perforatâ, depressâ, tenui, nitidâ, minutissimè striatulâ, lineis confertis, concentricis, impressis sub lente minutissimè decussatâ, rufo-fuscâ vel pallidè corneâ; spirâ brevissimè conoideâ, apice subelevato; suturâ submarginatâ; anfractibus 7 vix convexiusculis, sensim accrescentibus, ultimo carinato (carinâ anticè obsoletâ), non descendente, basi paulo convexiore; aperturâ depressâ, latâ, lunari; peristomate simplice, recto, acuto, margine columellari supra perforationem brevissimè reflexo.*

Diam. maj. 26, min. 23, alt. 13 mill.

Hab. ad Axim in littore occidentali Africæ.

10. Helix sandvicensis, Pfr. *H. testâ umbilicatâ, discoideâ, striatâ, nitidulâ, luteo-corneâ; spirâ planâ; suturâ impressâ; anfractibus 5–6 lentè accrescentibus, ultimo depresso, basi vix convexiore; umbilico lato, dimidium ferè diametri occupante; aperturâ parum obliquâ, lunari-rotundatâ; peristomate simplice, recto, tenui, marginibus conniventibus.*

Diam. maj. 18, min. 15, alt. 5 mill.

Hab. in insulis Sandwich.

11. Helix Jacquinoti, Pfr. *H. testâ umbilicatâ, fornicato-conoideâ, solidulâ, acutè carinatâ, confertim arcuato-costatâ, albo et fusco variegatâ; spirâ conoideâ, obtusâ; anfractibus 8 angustis, omnibus carinatis (carinâ exsertâ, compressâ, costis decurrentibus denticulatâ), ultimo basi vix convexiusculo, radiatim striato; umbilico extus laminâ horizontali coarctato, intus lato; aperturâ depressâ, securiformi, lamellis 6 intrantibus munitâ; 2 in pariete aperturali elongatis, 1 columellari et 3 in margine basali profundis, vix conspicuis; peristomate simplice, recto, acuto, margine basali in lamellam umbilici introitum circumclaudentem continuato.*

Diam. maj. 9, min. $8\frac{1}{2}$, alt. 5 mill.

Hab. in insulâ Tahiti, et in insulis Marquesas.

12. Helix coarctata, Pfr. *H. testâ umbilicatâ, depressâ,*

distanter arcuato-costatâ et sub lente minutissimè spiraliter striatâ, fusculâ, brunneo-tessellatâ; spirâ fornicatâ, supernè depressâ; anfractibus $8\frac{1}{2}$ *angustis, carinatis, ultimo infra penultimum recedente, tertiam paginæ inferæ penultimi partem liberam relinquente, basi vix convexiusculo, obsoletè radiatim costato, distinctius concentricè striato; umbilico lato, extus laminâ horizontali coarctato; aperturâ depressâ, securiformi, lamellis* 6 *intrantibus munitâ:* 2 *in pariete aperturali,* 2 *in margine basali,* 1 *in supero,* 1 *dentiformi in columellâ; peristomate simplice, recto, acuto, margine basali retrorsum in laminam, umbilicum coarctantem, continuatâ.*

Diam. $6\frac{1}{3}$, alt. $3\frac{1}{2}$ mill.

Hab. in insulâ Tahiti.

13. Helix nympha, Pfr. *H. testâ imperforatâ, globoso-depressâ, tenui, obliquè striatulâ, nitidâ, diaphanâ, virenti-albidâ; spirâ brevissimâ, apice obtusâ; suturâ albo-filosâ; anfractibus* 4 *subplanis, rapidè accrescentibus, ultimo subdepresso, basi convexo; columellâ intrante, subverticali, compressâ, albâ; aperturâ obliquâ, latè lunari; peristomate simplice, tenui, castaneo-limbato, margine supero recto, basali breviter reflexo, cum columellâ angulum obtusum formante.*

Diam. maj. 32, min. 26, alt. 18 mill.

Hab. in insulis Philippinis.

14. Helix tricolor, Pfr. *H. testâ lenticulari-conoideâ, tenui, carinatâ, undique confertim concentricè striatâ, hyalinâ, supernè lineis albis et ad suturam fasciâ albâ, castaneo-punctatâ ornatâ; spirâ brevi, conoideâ, apice obtusâ; anfractibus* 4 *planiusculis, ultimo carinâ albâ, lineis castaneis marginatâ et articulatâ munito, supernè et ad carinam subitò deflexo, basi juxta columellam subgibbo; aperturâ angustâ, perobliquâ, subquadrangulari; peristomate simplice, castaneo-limbato, margine dextro recto, basali breviter reflexo, columellari perdeclivi, introrsum dilatato, excavato, saturatè castaneo.*

Diam. maj. 34, min. 29, alt. 17 mill.

Hab. St. Christoval, ins. Salomonis.

15. Helix recedens, Pfr. *H. testâ imperforatâ, subsemiglobosâ, solidâ, carinatâ, supernè confertim costulato-striatâ, pallide carneâ; spirâ fornicatâ; suturâ vix impressâ; anfractibus* 6 *planiusculis, lentè accrescentibus, ultimo a medio infra penultimum recedente, basi planiusculo, striato; carinâ rufo-lineatâ; aperturâ obliquâ, angulato-lunari; peristomate subsimplice, margine dextro recto, basali subincrassato, columellari brevissimè reflexo.*

Diam. 12, alt. 7 mill.

Locality unknown.

16. Helix Salleana, Pfr. *H. testâ imperforatâ, conicâ, tenuiusculâ, striatulâ et impressionibus obsoletis rugosulâ, parum nitidâ, diaphanâ, cinereo-lutescente, ad peripheriam fasciis* 2 *fusco-viridibus, punctisque castaneis ornatâ; spirâ conicâ, acu-*

tiusculâ; anfractibus 5 convexiusculis, ultimo lineis concentricis impressis notato, subangulato, basi parum convexo; aperturâ parum obliquâ, lunari-ovali, intus nitidâ, concolore, fasciis nigricantibus; peristomate tenui, rectangulè expanso et reflexiusculo, albo, margine columellari supernè dilatato, calloso.

Diam. maj. 30, min. 24, alt. 24 mill.

Hab. in ripis fluvii St. Johan. Guatemalæ (Sallé).

17. Helix platystyla, Pfr. *H. testâ imperforatâ, conicâ, solidâ, costulato-striatâ, albidâ, lineâ rufâ ad suturam ornatâ; spirâ conicâ, acutiusculâ; anfractibus 6 convexiusculis, sensim accrescentibus, ultimo obsoletè angulato, basi subplano; aperturâ obliquâ, latè lunari; peristomate simplice, marginibus subparallelis, dextro breviter expanso, columellari supernè perdilatato, calloso.*

Diam. maj. 22, min. 19, alt. 19 mill.

Hab. in insulis Moluccis?

18. Helix brevipila, Pfr. *H. testâ umbilicatâ, globoso-depressâ, pilis brevissimis, rigidis, quincuncialiter dispositis asperâ, haud nitidâ, saturatè brunneâ; spirâ parum elevatâ, obtusâ; anfractibus vix 5 convexiusculis, ultimo rotundato, anticè subdeflexo, circa umbilicum angustum subcompresso; aperturâ obliquâ, rotundato-lunari, intus nitidâ; peristomate tenui, brunneo-carneo, breviter expanso, marginibus conniventibus, columellari subdilatato-reflexo.*

Diam. maj. 12, min. 10, alt. $6\frac{1}{2}$ mill.

Hab. in orâ orientali Novæ Hollandiæ (Mr. Strange).

19. Helix Baskervillei, Pfr. *H. testâ umbilicatâ, globoso-depressâ, solidâ, striis incrementi rugulosis, lineisque spiralibus impressis subgranulatâ, olivaceo-fuscâ, parum nitidâ; spirâ subconoideo-elevatâ, apice obtusiusculâ; suturâ impressâ, crenulatâ; anfractibus $6\frac{1}{2}$ angustis, convexiusculis, ultimo rotundato, anticè vix descendente; aperturâ parum obliquâ, lunari, dente linguæformi albo parietis aperturalis, obliquè intrante, coarctatâ; peristomate validè carneo-labiato, margine dextro arcuato et basali subhorizontali, latè subdentato latè expansis et reflexis, columellari brevi, perdilatato, umbilicum angustum semitegente.*

Diam. maj. 24, min. 19, alt. 14 mill.

Hab. Vancouver's Island (Lieut. Baskerville).

20. Helix connivens, Pfr. *H. testâ angustè umbilicatâ, depressâ, solidâ, striis incrementi distinctis, lineisque subtilibus concentricis sub lentè decussatâ, corneo-stramineâ, nitidulâ; spirâ parum elevatâ; suturâ impressâ; anfractibus 6 parum convexis, ultimo anticè non descendente, peripheriâ subangulato, basi convexiore; aperturâ obliquâ, latè lunari, intus albidâ; peristomate intus valide albo-labiato, marginibus conniventibus, dextro acuto, parum expanso, basali breviter reflexo, columellari supernè dilatato, patente.*

Diam. maj. 26, min. 22, alt. 14 mill.

Hab. Liew-Kiew.

21. Helix galactostoma, Pfr. *H. testâ umbilicatâ, convexo-orbiculatâ, solidâ, striatâ, sub lente granulatâ, fulvâ; spirâ brevi, fornicatâ, obtusâ; anfractibus $4\frac{1}{2}$ convexiusculis, sensim accrescentibus, penultimo angulato, ultimo subdepresso, anticè deflexo, basi subangulatim in umbilicum, mediocrem, pervium, $\frac{1}{5}$ diametri vix superantem descendente; aperturâ perobliquâ, lunari-ovali, intus lacteâ; peristomate simplice, fusculo-limbato, marginibus conniventibus, callo junctis, dextro brevissimè expanso, basali subreflexo, columellari albo, supra umbilicum dilatato-reflexo.*
Diam. maj. 36, min. 31, alt. 18 mill.
Hab. in insulâ Madagascar.

22. Helix rosarium, Pfr. *H. testâ umbilicatâ, depressâ, tenui, supernè subtilissimè granulatâ, diaphanâ, pallide fulvâ, flammis a suturâ exeuntibus, cingulisque 3 interruptis, moniliformibus rufis ornatâ; spirâ planâ; anfractibus vix 5 convexis, ultimo subdepresso, anticè non descendente, basi radiatim striatulo et lineis impressis spiralibus distantibus notato, circa umbilicum mediocrem, infundibuliformem subcompresso; aperturâ parum obliquâ, lunato-subtriangulari; peristomate albo-labiato, breviter reflexo, margine supero ab insertione primum ascendente, tum sinuato, basali strictiusculo, repando, columellari brevi, triangulatim patente.*
Diam. maj. 21, min. 17, alt. 9 mill.
Locality unknown.

23. Bulimus (Partula) decussatulus, Pfr. *B. testâ perforatâ, ovato-conicâ, tenui, striis incrementi lineisque spiralibus minutissimè decussatulâ, vix nitidulâ, fulvescenti-albidâ, diaphanâ; spirâ brevi, conicâ, obtusiusculâ; suturâ mediocri; anfractibus $4\frac{1}{2}$ convexis, ultimo $\frac{5}{9}$ longitudinis æquante, rotundatâ; columellâ subplicatâ, recedente; aperturâ angulato-ovali; peristomate simplice, tenui, marginibus conniventibus, dextro campanulatim expanso, columellari super perforationem reflexo.*
Long. 15, diam. $8\frac{2}{3}$ mill.; ap. 9 mill. longa, $6\frac{1}{2}$ lata.
Hab. in insulâ Navigatorum.

24. Bulimus (Partula) navigatorius, Pfr. *B. testâ dextrorsâ, perforatâ, oblongo-ovatâ, solidâ, obsoletè granulato-striatâ, nitidulâ, fulvâ, lineis confertis saturatioribus signatâ; spirâ conicâ, acutiusculâ; suturâ levi, albo-marginatâ; anfractibus 5 planiusculis, ultimo spiram superante; aperturâ oblongâ, angustâ, intus albidâ, dente calloso parvulo profundo in ventre anfractûs penultimi munitâ; peristomate subincrassato, intus valide albo-labiato, marginibus parallelis, dextro breviter expanso, medio subdentato, columellari dilatato, plano, reflexo.*
Long. 23, diam. 11 mill.; ap. (c. perist.) 13 mill. longa, 8 lata.
Hab. in insulâ Navigatorum.

Descriptions of twelve new species of Vitrina and Succinea, from the Collection of H. Cuming, Esq. By Dr. L. Pfeiffer.

1. Vitrina luzonica, Pfr. *V. testâ depressâ, tenui, lævigatâ, nitidâ, pellucidâ, aureâ; spirâ planiusculâ; suturâ simplice, vix impressâ; anfractibus 3 sensim accrescentibus, ultimo subdepresso, peripheriâ rotundato, basi lato; aperturâ obliquâ, lunari-ovali; peristomate tenui, margine supero antrorsum subarcuato, columellari tenuissimo, declivi.*

Diam. maj. $7\frac{1}{2}$, min. $5\frac{2}{3}$, alt. 4 mill.

Hab. Sorsogon, insulæ Luzon (H. Cuming).

2. Vitrina Verreauxii, Pfr. *V. testâ depressâ, striatulâ, tenui, diaphanâ, parum nitente, olivaceo-fulvâ; spirâ subplanulatâ; suturâ impressâ, marginatâ; anfractibus $3\frac{1}{2}$ rapidè accrescentibus, ultimo depresso, basi angusto, planiusculo; aperturâ perobliquâ, amplâ, lunari-ovali; peristomate simplice, acuto, marginibus approximatis, dextro antrorsum arcuato, columellari breviter recedente, leviter arcuato.*

Diam. maj. 13, min. 10, alt. 6 mill.

Hab. in Australiâ (Verreaux).

3. Vitrina Strangei, Pfr. *V. testâ depressâ, tenuissimâ, lævigatâ, nitidâ, fusco- vel virenti-corneâ; spirâ parvâ, vix convexiusculâ, vertice subtili, laterali; suturâ impressâ, submarginatâ; anfractibus 3 vix convexiusculis, rapidè accrescentibus, ultimo supernè depresso, peripheriâ rotundato, basi convexiore; aperturâ obliquâ, amplâ, lunari-subcirculari; peristomate simplice, obtusulo, marginibus approximatis, dextro antrorsum dilatato, columellari recedente, perarcuato, angustissimè membranaceo-marginato.*

Diam. maj. 10, min. $7\frac{1}{2}$, alt. 5 mill.

Hab. Brisbane, in orâ orientali Novæ Hollandiæ (Strange).

4. Succinea acuta, Pfr. *S. testâ oblongâ, subfusiformi, tenui, distinctè striatâ et minutè malleatâ, nitidissimâ, pellucidâ, roseâ, epidermide deciduâ fulvâ munitâ; spirâ subelongatâ, conicâ, acutâ; suturâ profundâ; anfractibus 4 convexis, ultimo $\frac{3}{5}$ longitudinis vix æquante, basi attenuato; columellâ subcallosâ, substrictè recedente; aperturâ axi ferè parallelâ, oblongo-ovali, supernè angulatâ; peristomate simplice, tenui, margine dextro leviter arcuato.*

Long. 20, diam. $9\frac{1}{2}$, alt. 7 mill.; ap. 12 mill. longa, medio 7 lata.

Hab. in Britanniâ, prope Scarborough.

It is impossible to join this beautiful shell to any of the varieties of *S. putris*, from which it differs by its colour, by the elongated and sharply-pointed spire, whorls more convex, nearly straight columella, and oblong-ovate aperture.

5. Succinea subgranosa, Pfr. *S. testâ elliptico-ovatâ, tenui, subgranulato-striatâ, diaphanâ, parum nitidâ, pallide corneâ; spirâ brevi, obtusiusculâ; anfractibus vix 3 convexis, ultimo*

basi attenuato; columellâ substrictè recedente, supernè leviter callosâ; aperturâ parum obliquâ, subangulato-ovali, intus nitidissimâ; peristomate simplice, acuto, margine dextro mediocriter arcuato.

Long. $8\frac{1}{2}$, diam. 5, alt. ferè 4 mill.; ap. 6 mill. longa, 4 lata.

Hab. Kurmant, Indiæ, varietas ventrosior, albida prope Calcutta.

6. Succinea indica, Pfr. *S. testâ depressè oblongâ, tenuissimâ, longitudinaliter plicatulâ, pellucidâ, pallide corneâ; spirâ brevi, obtusiusculâ; anfractibus vix 3, penultimo convexiusculo, ultimo $\frac{2}{3}$ longitudinis æquante; columellâ substrictè ferè ad basin recedente, supernè calloso-marginatâ; aperturâ axi ferè parallelâ, basi recedente, ovali-oblongâ, angulatâ, intus nitidissimâ; peristomate acuto, margine dextro leviter arcuato.*

Long. 17, diam. $7\frac{1}{2}$, alt. 6 mill.; ap. 12 mill. longa, infra medium 7 lata.

Hab. Bleensal, Indiæ.

7. Succinea Bensoni, Pfr. *S. testâ ovato-conicâ, tenui, regulariter confertim striatâ, pellucidâ, sericinâ, luteo-corneâ; spirâ conicâ, acutiusculâ; anfractibus 3, penultimo convexiusculo, ultimo $\frac{2}{3}$ longitudinis æquante; columellâ callo tenui indutâ, vix arcuatâ, recedente; aperturâ ovali; peristomate tenui, margine dextro mediocriter arcuato.*

Long. 8, diam. 5, alt. $3\frac{1}{2}$ mill.; ap. 5 mill. longa, 3 lata.

Hab. Moradabad, Indiæ (Mr. Benson).

8. Succinea picta, Pfr. *S. testâ semiovatâ, tenuissimâ, longitudinaliter striatulâ et irregulariter plicatâ, pellucidâ, nitidissimâ, rubenti-fulvâ, roseo-albido strigatâ; spirâ minimâ, papillatâ; suturâ levi; anfractibus $2\frac{1}{2}$, ultimo inflato, anticè lineis impressis spiralibus notato; columellâ supernè subcallosâ, recedente, leviter arcuatâ; aperturâ amplâ, parum obliquâ, angulato-ovali, intus rubenti-fulvâ; peristomate simplice, ad insertionem subinflexo.*

Long. 17, diam. 11, alt. 7 mill.; ap. 15 mill. longa, medio 9 lata.

Hab. Diana Peak, insulæ St. Helenæ. (On the leaves of cabbage-trees.)

9. Succinea Salleana, Pfr. *S. testâ depressè ovatâ, tenuissimâ, striatulâ, lineis spiralibus impressis irregulariter notatâ, pellucidâ, nitidâ, corneo-albidâ; spirâ brevissimâ, subpapillatâ; anfractibus $2\frac{1}{2}$, penultimo convexo, ultimo $\frac{3}{4}$ longitudinis superante; columellâ subcallosâ, strictè recedente; aperturâ axi subparallelâ, angulato-ovali; peristomate submarginato, margine dextro vix arcuato.*

Long. 19, diam. 10, alt. 7 mill.; ap. 16 mill. longa, infra medium 9 lata.

Hab. New Orleans (Mr. Sallé).

10. Succinea pusilla, Pfr. *S. testâ ovatâ, tenui, striatulâ, sub lente obsoletè decussatâ, diaphanâ, parum nitidâ, pallide corneâ; spirâ brevi, acutiusculâ; anfractibus $2\frac{1}{2}$, penultimo*

convexo, ultimo $\frac{2}{3}$ longitudinis æquante; columellâ vix arcuatâ, recedente; aperturâ obliquâ, ovali; peristomate simplice, margine dextro supernè subincurvato, tum strictiusculo.

Long. $4\frac{2}{3}$, diam. 3 mill.; ap. $3\frac{1}{4}$ mill. longa, 2 lata.

Hab. Ceara, in Americâ meridionali.

11. Succinea rubicunda, Pfr. *S. testâ ovatâ, tenui, striatulâ, sub lente obsoletè granulosâ, diaphanâ, parum nitidâ, luteo-rubescente; spirâ brevi, sanguineâ, subpapillatâ; anfractibus $2\frac{1}{2}$ convexis, ultimo inflato; columellâ callosâ, substrictè recedente; aperturâ parum obliquâ, angulato-ovali, intus nitidissimâ; peristomate simplice, margine dextro regulariter arcuato.*

Long. 14, diam. 8, alt. 5 mill.; ap. $10\frac{1}{2}$ mill. longa, medio 6 lata.

Hab. in insulâ Masafuera (Cuming).

12. Succinea solidula, Pfr. *S. testâ depressè ovatâ, solidulâ, longitudinaliter subplicatâ, sub lente minutissimè granulatâ, vix diaphanâ, parum nitidulâ, fulvâ; spirâ brevi, scalari, apice papillatâ, rubicundâ; anfractibus $2\frac{1}{2}$ convexis, ultimo inflato, $\frac{3}{5}$ longitudinis æquante; columellâ substrictè descendente, callosâ; aperturâ oblongâ, intus submargaritaceâ; peristomate submarginato, marginibus callo tenui junctis, dextro supernè arcuato, tum strictiore.*

Long. 12, diam. 7, alt. $5\frac{1}{2}$ mill.; ap. $8\frac{1}{2}$ mill. longa, 5 lata.

Locality unknown.

The form of this shell is most nearly approaching to *Succinea campestris.*

On a new genus of Pholadidæ, with notices of several new species and of a remarkable specimen of Pholas calva in Mr. Cuming's Collection. By G. B. Sowerby, Jun., F.L.S.

Among the species of *Pholades* there are various modifications of structure, particularly with regard to the form, position and number of the accessory valves, and the test enclosing the anterior hiatus of the shell in some species, which are very interesting and important, and have given rise to various proposals for the division of the species into distinct genera. The propriety or otherwise of such divisions it is scarcely worth while to argue about, as it is after all a mere question of convenience, whether such modifications should be expressed by arranging the species in so many genera of a family, or so many subdivisions of a genus. It will be sufficient for my present purpose to remark, that there is one character in which the *Pholades*, whether open or closed, with or without accessory valves, cup-bearing or tube-forming, all agree, and that is, in the curved processes commencing under the hinges inside the shell. In the genus now to be described these are wanting, and this fact removes the hesitation which might have been felt in attempting to establish a generic distinction from the other characters, however well-marked and interesting.

Genus Triomphalia*.

Char. Gen.—Molluscum acephalum terebrans. Testa bivalvis, ætate juniore hians, ætate maturâ clausa. Valvæ inæquales; utraque anticè laminâ testaceâ inflatâ ad marginem ventralem affixâ, internè cardine unidentato, sine processu subcardinali. Valva dextra posticè alteram longitudine superans. Valva sinistra alteram involvens, ad dorsum nucleo quasi-umbonali incipiens.

The shells of this genus, when mature, have the ventral hiatus closed by an expanded test fixed to the edge of each valve; that of the left valve commences at the back, in a nucleus resembling an extra umbo, and in front overwrapping that of the other. The right valve, on the other hand, materially exceeds in length, at the posterior extremity, the other valve, which terminates very abruptly. The hinge is without sub-umbonal processes, but has an obtuse tooth on the hinge in each valve.

The name is taken from the nucleus of the covering-test in the right valve, which forms, as it were, a third umbo. The typical species is the *Pholas globosa* of Quoy.

Triomphalia globosa. (Pholas globosa, Quoy.) *Tr. testâ subovali, posticè subattenuatâ, anticè globosâ; valvis transversè dimidiatis, parte posticâ concentricè lyratâ; in medio costâ imbricatâ unicâ, parte anticâ lyratâ, radiatim costis acutè imbricatis ornatâ: valvâ dextrâ productâ sublinguiformi, dentibus acutis recurvis serratâ: nucleo laminæ terminalis valvæ sinistræ triangulari, striatâ, subcomplanatâ.*

Found in soft stone, at half-tide. Island of Leyte; Cuming.

Triomphalia pulcherrima. *Tr. testâ subovali ventricosâ, anticè globosâ, corrugatâ, anticè subattenuatâ; valvis transversè dimidiatis, parte posticâ costis distantibus concentricè lyratâ, parte anticâ lineis lyratâ, margine dentibus acutis crispatis serratâ: nucleo laminæ terminalis valvæ sinistræ subtriangulari, rotundo, lineis elevatis lyrato.*

This species is much larger than *Tr. globosa*, the ventral covering much more rough and inflated, the concentric ribs on the posterior part of the valves more strongly defined, and not crossed by the oblique row of raised points which is seen in the former species.

Found in soft stone at low water at West Colombia; Cuming.

Triomphalia Cumingii. *Tr. testâ rotundâ, crassâ; valvis posticè canali divisis, concentricè lineis elevatis lyratis, anticè costis minutis serratis radiatis; parte posticâ concentricè laminatâ; valvâ dextrâ posticè in lingulam triangularem margine triplicatam productâ; valvâ sinistrâ posticè brevissimâ margine terminali circulari.*

This shell would be completely spherical but for the linguiform extension of the right valve. The left valve terminates in a circular margin, where the rounded part of the right valve meets it.

* Τρεῖς, *tres*; ὀμφαλὸς, *umbo*.

Found in coral rock at low water. Isle of Zebu, Philippines; Cuming.

The following new species of *Pholas* will be figured and described in the forthcoming number of my 'Thesaurus Conchyliorum':—

1. Pholas laqueata. 2. Ph. Manillæ. 3. Ph. fragilis. 4. Ph. constricta.

5. Ph. terediniformis. *Ph. testâ globosâ, apertâ, in medio divisâ; anticè margine ventrali subangulatâ, costis laqueatis concentricis ornatâ; posticè brevi, lævigatâ; laminâ dorsali unâ subquadratâ super marginem reflexam testæ positâ.*

Although short, and with an angular opening, like the species of the genus *Xylophaga*, this species and the following have the curved subcardinal processes which are characteristic of the true *Pholades*, and are not found in *Xylophagæ*.

Found in cakes of floating wax on the coast of Cuba.

6. Ph. aperta.

7. Ph. Incii. This differs from the great Californian species in the characters of the dorsal side of the anterior part, which is finely striated in both directions; in the epidermidal laminæ, which are beautifully serrated; and in the integumental covering of the dorsal edge, which is divided into four parts.

Collected by Capt. Ince, R.N., in coral rocks at Rain Island, Torres Straits.

8. Ph. multistriata.

9. Ph. latissima. *Ph. testâ subquadratâ, subcompressâ, apertâ, anticè angulatâ posticè truncatâ; costis moniliferis radiatis et lineis concentricis cancellatâ; umbonibus subcentralibus margine dorsali reflexo.*

A wide, rather flat shell, widely gaping in front, and truncated at the posterior extremity, with radiating ribs forming knots on the raised lines of growth. It appears to be without accessory valves.

Taken in Manilla Bay; Cuming.

10. Ph. spathulata. *Ph. testâ elongatâ, clausâ, obliquè divisâ; parte anticâ radiatim costatâ subangulatâ; parte posticâ concentricè leviter striatâ, subtruncatâ, ad margines integumento protectâ, ad terminos in cyatho corneo, lateribus spathuliformibus, productâ: ad umbones laminis duabus æqualibus posticè bilobatis, anticè elongatis.*

From New Zealand.

Pholas Calva (Sowerby, Proc. Zool. Soc. 1834).

I wish to call the attention of the Meeting to a remarkable specimen of *Ph. calva in situ*, which may be considered as bearing, in some degree, upon the boring question in a manner somewhat unfavourable to the '*rasping*' theory. In this specimen the animal has lined the anterior narrow end of its hole with a thick laminated tube, formed not of shelly matter, as in the case of *Pholas tubifer*, of which I figure a specimen *in situ*, but of the same material as the stone in which it has burrowed, and bearing every appearance of a reformation of its substance by precipitation, after having been dissolved by a chemical agent. The structure is far too fine to have been formed from any *débris* which could be the result of merely mechanical action.

The specimen of *Ph. tubifer*, in my father's collection, shows in a remarkable manner the fitting of the hole to the shape of the shell, which is not symmetrical, and could not turn in the slightest degree.

BOTANICAL SOCIETY OF EDINBURGH.

July 11, 1850.—Professor Fleming, President, in the Chair.

The following communications were made :—

1. Dr. Cleghorn, H.E.I.C.S., directed attention to the culture of cotton in Mysore. He read extracts from a letter of Captain Onslow, Superintendent of Nuggur Division of Mysore, in reference to the culture of American cotton at Cuddoor. In spite of an unfavourable season the experiment had proved satisfactory. The seeds were supplied from Dr. Wight's government plantation, at Coimbatore—"the natives pay in kind, and the produce is bought, if they like to sell at the market rates." When traversing the Peninsula in the execution of duty, Dr. Cleghorn had given some attention to the culture of cotton in India, a question of such importance in its commercial and agricultural bearings : his observations enabled him to express an opinion, that in the extensive cotton tracts above the Ghats, large quantities of cotton might be supplied of an improved quality. In the present state of ignorance and poverty amongst the ryots, it is manifestly unreasonable to expect *rapid* progress in the agriculture of Hindostan. The aiming at new improvements are so many deviations from the practice of their ancestors, whose footsteps they follow with the utmost devotion and reverence : hence progress must be slow, but it is not imperceptible. The face of the country is much improved in the districts longest under our rule, and where good roads exist : the next essential for developing the cotton trade is the presence of enterprising inland traders. Dr. Cleghorn mentioned that he had examined and compared all the species of *Gossypium* in the Herbarium of the Botanical Society (comprising the collections of Hamilton Buchanan, and Lady Dalhousie, with contributions from Wight, Campbell, &c.), and also those in the Herbarium of Professor Balfour, with a view to ascertain the specific characters by which to discriminate them from one another : he considered the entire series remarkable, as showing the striking differences which soil, climate and culture produce in species, and which may appear in nature, giving rise to a multiplication of species. The unimportant discrepancies of foliage and pubescence are good for nothing. The whole group of so-called species seems referable to *G. herbaceum*, L., *G. arboreum*, L., *G. barbadense*, L., and *G. acuminatum*, Rox. Dr. Cleghorn looked anxiously for the work of Dr. Royle, which is expected to contain the fullest information on the entire subject of Indian cotton and its culture.

2. "On the occurrence of *Eleocharis uniglumis*, Link., near Blackness Castle, Linlithgowshire," by Mr. J. T. Syme. He gave the

characters which distinguish *E. uniglumis* from *E. palustris* and *E. multicaulis.* He noticed particularly the narrowness of the membranous margin of the glumes in *E. uniglumis,* and the fact that the lowest glume surrounds the spike entirely. (See p. 145.)

3. "On the effects of Insects on Plants," by Mr. James Hardy. In this paper Mr. Hardy alluded particularly to the effects produced by *Vibrio graminis,* a new species, *V. Tritici, Cecidomyia salicina,* and *Rhyncholophus haustor.* (See p. 182.)

4. Dr. Balfour gave an account of a botanical trip to Aberdeen. He stated that on the 29th of June, he left at 5 A.M. by rail, with 100 pupils; reached Aberdeen about 11, and after botanizing in the neighbourhood, returned to Edinburgh late in the evening. He noticed and exhibited some of the rarer plants gathered, among which were *Goodyera, Linnæa, Trientalis, Utricularia, Drosera anglica, Carex incurva,* &c.

Dr. Cleghorn exhibited a jacket of the Grass-cloth of commerce, manufactured from the fibres of the *Bœhmeria nivea* of botanists, the *Urtica tenacissima* of Roxburgh (Fl. Indica, iii. 590).

5. Dr. Balfour read a letter from Dr. Campbell of Demerara, accompanying some seeds of *Victoria Regia.* Dr. Campbell says, "I enclose in this a dozen seeds of *Victoria Regia,* brought from the Essequibo a few days ago by an itinerant collector, who seems to know their value, as he charges a dollar (4*s.* 2*d.*) a dozen for them. I am afraid they will not germinate after their voyage across the Atlantic; but this at least you must bear in mind, if you intend to try the experiment, that the plant will not live in an atmosphere within the influence of the sea breeze, nor grow in soil or water where there is the slightest saline principle existing. Such at least is the result of experiments tried here. I visited the locality of the plant in the Essequibo, above 100 miles from the sea, in 1846, and it appeared to me a small lagoon, rather than a lake, over which the river flows in the rainy season. It is surrounded on all sides with a dense 'bush' (natural forest), through which we had great difficulty in dragging a small corial (wood-skin boat) in which we embarked on the lagoon, which is a most gloomy spot, the favourite resort of caymans, where the sun can scarcely penetrate even at noon, and with an atmosphere oppressively damp and hot. So far as I could judge by sounding and examining the stems of the plant, it appears to grow at a depth of 12 or 14 feet, in an oozy, slimy, muddy sort of compound, with which I presume sand must be mixed; for higher up the river there are immense tracts of loose sand in the bed of the river, which must be swept along with the torrent every rainy season."

Mr. G. Lawson showed a specimen of *Lathyrus Nissolia* from the Den of Mains, near Dundee, where he believed it was first found last year by some local botanists. Mr. Lawson thought it probable that the plant was only naturalized; but it was interesting to notice its occurrence so far north, as Mr. Watson in the 'Cybele Britannica' (i. 323) gave its northern limit in Derbyshire, doubting its existence at "the glass houses at Dent's Hole, Newcastle, where it grew in the time of Lawson."

MISCELLANEOUS.

CAPTURE OF CENTROLOPHUS POMPILUS.

To the Editors of the Annals of Natural History.

Falmouth, August 29, 1850.

Gentlemen,—A fine specimen of the Black fish, *Centrolophus pompilus*, Cuv. et Val., was caught by the teeth in a drift net, August 27, 1850, in this neighbourhood. An accurate representation (woodcut) of the fifth Cornish fish will be found in Mr. Yarrell's 'British Fishes,' vol. i. p. 179, 2nd ed. This rare fish is in the possession of A. Fox, Esq., to whom I am indebted for an examination.

I am, Gentlemen, your obedient servant,

W. P. Cock.

Description.—Body elongate, broad, compressed, covered with minute thin scales. Colour bluish black; fins black, dark steel-gray where the scales had been rubbed off. Lateral line crooked. Head obtuse, rounded in front. Eyes large, $\frac{7}{8}$ths of an inch in diameter. Sclerotic coat firm, grayish white; a black line encircled the cornea at its junction with the sclerotica. Cornea $\frac{5}{8}$ths of an inch in diameter. Irides as bright as burnished silver; pupils large and dark. Skin (palpebræ) surrounding the eyes channeled transversely. Nostrils double, oval, open, the one nearest the eye $\frac{3}{8}$ths, the other $\frac{1}{8}$th of an inch in diameter. Edge of aperture strengthened by a doubling of the membrane. Teeth numerous in each jaw, very minute, palate free. Mouth small, $1\frac{1}{8}$ inch from the angle to the centre of lip; from angle of mouth to root of pectoral fin $3\frac{1}{8}$ inches. The free edge of the preoperculum serrated. Gill-rays five. Gills flaccid, of a dirty pale yellowish flesh-colour, and covered with purulent matter. The fish, although fresh, had a very peculiar and powerful odour.

Length from tip of nose to root of caudal fin	17 inches.
Length of caudal fin	$3\frac{1}{2}$
Depth of body (fins not included)	$4\frac{1}{2}$
Thickness	$2\frac{1}{2}$
Length of dorsal fin	$9\frac{1}{2}$
Depth	$1\frac{1}{2}$
Length of pectoral fin	$2\frac{1}{2}$
Length of abdominal fin	$1\frac{1}{2}$
Length of ventral fin	$5\frac{1}{8}$

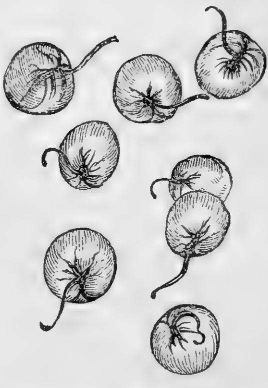
The lower jaw was fractured, and the gill-rays on the right side lacerated, supposed to have been caused by the violent efforts made by the fish to clear itself from the meshes of the net.

Notices of Acalephæ *found at Lowestoft, August* 1850. By T. Brightwell, F.L.S.

1. Great numbers of the genus *Cydippe* occur, cast up on the shore, and in the recently constructed harbour at Lowestoft. They differ much in size and form, some being more elongate and much larger than others, but all of the same species. In the stomach of one of the larger ones a small shrimp was discernible. In calm weather these animals come in great abundance to the top of the water.

2. *Beroë Cucumis* (*Forskallii* of Milne-Edwards) was found in the same locality in considerable numbers. My friend, Mr. Brooks, found specimens in the month of June of a larger size and more fully developed than those taken by myself in August. Those I found were only 9 lines long and 6 broad—sack-shaped—the upper or broad end having thick lobed lips, closing in a transverse line upon the mouth or upper surface: eight strong vertical bands run from the broad end to the opposite extremity. These bands were without cilia half way down, but from thence they were strongly ciliated to the end; at the narrow end there is a little bunch of minute, short, arborescent appendages, slightly knobbed at their extremities. The ridge round the broad end was tinctured reddish purple, and the ciliated lobes had a faint line of the same colour. These lobes under the microscope showed a very complex organization, and small globular bodies were observed floating in them. The rest of the body was of crystal clearness, and the texture of the animal much more tender and fragile than that of the *Cydippe*. In the dark these animals, when irritated, gave out a most brilliant and beautiful emerald-green light, illuminating their whole surface, and far exceeding in phosphorescent brilliancy any other I have seen.

3. *Noctiluca miliaris*. This minute zoophyte is now pretty well known to naturalists, though it has not at present found its proper niche in our zoological classifications. It is one of the "Hydrostatic Acalephæ," consisting of a small air-bag supporting a very minute flexible active tentacle. A century ago, Mr. Sparshall, of Wells, in this county, figured this animal, and wrote a good paper on it* which he communicated to Baker, who has given part of it in his book, entitled 'Employment for the Microscope,' p. 402. Occasional notices of this zoophyte have since appeared in our zoological journals and elsewhere, but the fullest details respecting it are to be found in a paper by M. Suriray, which is given at length in Lesson's volume on the Acalephæ, forming part of the 'Suites à Buffon'—see p. 145 of that vol. This little animal we have had abundant opportunities of observing upon our eastern coast, for thirty years past. It occurs floating on the surface of the ocean, and is doubtless one of those animals which most contribute, in these parts, to the luminous appearance of the sea by night†. It abounds on the shores and in the harbour of Lowestoft, and we believe on every part of this coast.



Magnified view of *Noctiluca miliaris*.

* I possess a copy of this paper and figure, given to me by the late Mr. Sparshall of Norwich, a relative of the author.

† An excellent paper on this interesting subject by Dr. Pring, of Weston-super-Mare, appeared in the 'Philosophical Magazine' for Dec. 1849, from which we have borrowed the above woodcut.—Ed.

Gemmules, or round bodies, are sometimes observed in them. The tentacle or tail appears, when very highly magnified, rather flat than round, and marked with delicate transverse striæ down its centre. The *Noctiluca* appears more nearly allied to the *Physaliæ* than any other family of the Acalephæ, and to the genus *Alophota* of Brandt. Only one species of this genus is known.—*A. Olfersii,* described by Brandt as "a white bladder or air-vessel the size of a pea, oblong oval, having two tentacula." (See Lesson's Acalephæ, p. 559.)

4. *Thaumantias hemisphærica* (see Forbes's naked-eyed Medusæ, p. 49). Of this beautiful little animal we captured many specimens in the harbour of Lowestoft. They agreed precisely with the description given by Professor Forbes, except that we found many specimens with fewer than twenty ocelli and tentacles; and in all the specimens we examined, there were two or three minute lobes on the margin of the umbrella, between each tentacle.

We also found three or four other smaller species of *Thaumantias* in the same locality; some having the umbrella shaped like a Chinese hat;—we noted these, with some doubt however as to our correctness, as *T. pileata, T. sarnica, T. punctata, T. inconspicua,* and *T. Thompsoni,* of Professor Forbes.

5. Of the larger Medusæ, *Chrysaora hyoscella* occurred in great variety during two days of very calm, warm weather. From their beautiful markings, viz. light brown bistre colour, with diverging and branching radii, proceeding from a circular line round the centre, and large dark spots round the circumference, they appeared like the tops of so many small balloons, floating in the ocean, and attracted general observation. They varied greatly in size, colour, and markings. *Rhizostoma undulata*?, *Medusa aurita*?, and others of this family, were seen at the same time, but the study of this race of animals is from their nature, and especially from our having no good work respecting them, beset with difficulties.

6. We also captured what appeared at first to be a very minute star-fish, but which on examination proved to be one of the young states of a Medusa, as described by Sars. It was about 2 lines in diameter, and swam freely in the salt water.

7. With the smaller Medusæ we also took two specimens of the young state of a Crab, the *Zoe pelagica* of the older naturalists. These little animals are very active swimmers, and from their transparency, their large eyes, and arborescent vessels, running especially about the head, they are very beautiful objects in the microscope.

8. On the stem of an Alga, growing by the side of the Lock at Lowestoft, we found *Bowerbankia densa,* the only specimen we have found on our coast.

ON THE GENUS HYALONEMA. BY J. E. GRAY, ESQ.

M. Milne-Edwards, in his work on British Fossil Corals, observes, "The genus *Hyalonema* established by Mr. Gray (Proceed. of the Zool. Soc. 1835, 63) is also referred by some zoologists to the tribe of *Gorgoninæ*, but the recent observations of M. Valenciennes tend to establish, that the fasciculus of siliceous threads which constitute the axis of this singular production belongs to the class of *Spongidæ*, and the polypi which we have observed in a dried state on different parts of the axis appear to be parasites belonging to the order of *Zoantharia*." (p. 81.)

I have not seen M. Valenciennes's paper in which this theory is propounded, or the ground on which it is supported, but I have seen the specimen in the Paris Museum on which the observations I suppose have been made. It is a very imperfect one, and I suspect that its imperfect condition has been the cause of this theory.

Besides the Paris specimen, we have in the British Museum two; I have in my own collection one; and in the Dutch collections I have seen five or six specimens of this coral. They have all the same form and structure, and are all more or less covered with a similar bark, scattered with tubercles from which the polypes are emitted.

The spicula agree in their formation with the axis of *Gorgoniæ*, being formed of numerous very thin concentric layers. Each of them is surrounded and separated from its neighbour by a layer of fleshy substance exactly like the bark which covers the whole of them in consistence and formation, and it is this layer which doubtless secretes the thin concentric lamina of which the spicula are formed. They are nearly of the same length, forming a twisted rope-like axis, consisting of parallel, nearly equal, lengthened, elongated fibres, without any oblique or transverse interlacing fibres or spicula. They are of very different thickness, appearing as if new ones were formed, and the older ones gradually increased in diameter as the coral grows. Indeed the only difference that I see between this coral and *Gorgonia* is, that instead of having a single axis, it has many twisted into the form of a rope, and instead of the axis being dilated at the base so as to form a kind of root, the coral lives imbedded in a sponge.

If the fibres belong to a sponge, it is very remarkable that they should never be found without the investing bark or presumed parasite. I am not aware of any sponge which consists simply of parallel fibres without any anastomosing or transverse filaments, nor of any spicula of a sponge which are of different diameters gradually increasing in thickness, and formed of numerous concentric layers, like the axis of a *Gorgonia*.

It appears to me to be much more consistent with probability that *Hyalonema* should be a coral, than that it should be a sponge of a structure never before observed, covered with a parasite also peculiar in organization and new to science.

Notice of a Hybrid Crowned Pigeon. By D. W. Mitchell, Sec. Z.S.

The habits of so singular a form as the Crowned Pigeon possess an interest, which will, I believe, be a sufficient apology for my desire to make some record of the first instance of its successful nidification in confinement. And I make the record of this particular instance with greater confidence, because the previous experience of the Society's Menagerie affords proof that the bird discovered by M. Steurs in Gillolo, and described in the Proceedings of 1844 under the name of *Goura Victoriæ*, by Mr. L. Fraser, is not the female of *Goura coronata*, as has been suggested, but a true and distinct species.

The number of Crowned Pigeons in possession of the Society having been reduced to a single female of *Goura Victoriæ*, and a male of *Goura coronata*, they were placed, by my direction, in the same division of the old Aviary. In the beginning of June last it was observed that they had paired. About two months afterwards they began to make attempts at the construction of a nest. In the open part of the Aviary there was a large branch of a tree fixed transversely, as a perch, about six feet from the ground. They commenced their work by carrying up twigs and pieces of stick which had been purposely placed within their reach, to the extremity of the perch, and vainly endeavoured to fabricate a platform on this slippery and insufficient foundation. The careful keeper watched their difficulty, and supplied them with the necessary support by fixing there a flat piece of basket-work.

They now began in earnest, and on the 15th of August they ceased from their labour, during which the male had generally carried up the materials and the female disposed of them. On this eventful day it is supposed the single egg was laid, but it was so constantly covered by one or other of the birds, that the keeper did not get sight of it for some time afterwards. The nest was within a few feet of the front of the Aviary, which during the period of incubation was passed by many thousands of visitors: still so adroitly did the birds watch their opportunity, that I heard of no instance, except that in which the keeper saw the egg, in which they were discovered in the act of relieving each other. The exposed situation of the nest, which was very slightly protected by the thin foliage of a climbing rose, rendered me apprehensive of the effects of the weather on the young bird, which was hatched on the 13th of September. It was covered with constant assiduity by one or other of the parents, who fed it while beneath them. Whether from excess of care or from accident I know not, but it was found dead in the nest on the morning of the 17th, the mother still sitting there with unmoved constancy, and overshadowing the dead corpse with her warm breast, as if incredulous of her bereavement.

On the 24th of October another egg was produced, but, having been dropped from a perch in the house, was found broken on the ground. These birds are still in admirable health, and I have hope that if they breed at an earlier period in the approaching season, they will have better fortune, and succeed in bringing their produce to maturity.

While upon this subject, I may perhaps not inappropriately advert to another Columbine hybrid, of which two specimens exist in the Collection, the produce of *Ectopistes migratorius* ♂ and *Turtur risorius* ♀. They have neither the tail of *Ectopistes* nor the collar of *risorius*, and to any one who was ignorant of their origin, would present indubitable indications of at least specific distinction.

And I may also notice in this place a hybrid of an entirely different kind, which was deposited during the earlier part of this year in the Society's Menagerie, and has become the property of the Earl of Derby. This animal was imported from India some four years ago, and appears to be the produce of a *Zebu* mother and a *Yak* sire, although I have been altogether unable to trace its actual history.—*Proc. of Zool. Soc.*, Dec. 11, 1849.

SPHÆRONEMA DEFORMANS.

Some time since our attention was called to a curious case of hypertrophy in a crop of peas observed by Dr. Dickie, in the county of Aberdeen, and a somewhat similar case occurred last year in the great conservatory at Kew, on the leaves of more than one species of *Pleroma*. In the former case bodies, probably due to incipient fermentation, resembling the yeast fungus, were present; in the latter no such bodies were observed. But in an eruptive disease on the leaves of *Eranthemum pulchellum*, lately transmitted by one of our correspondents, where the external appearance is almost identical, the presence of a well-formed fungus is beyond all doubt. The under side of the leaves is spotted with little pale dirty white, or fawn-coloured pustules, which exhibit at first a cellular structure, and appear to be in that state a mere exuberant growth of the cellular tissue of the leaf, containing no trace of filaments, or anything like fructification. It is not, however, clear, when the further history of these pustules is taken into consideration, that they are really an altered state of the cells, and not a cellular tissue proper to the parasite; because not only is the stroma of many *Sphæriæ* distinctly and closely cellular, but even where no visible stroma exists, as for instance, in *Sphæria herbarum*, the early stage of growth before any fructification is formed, exhibits simply a mass of cells, and as it approaches maturity the central cells are absorbed, while asci are developed from those near the walls. In a very curious genus, lately communicated by Dr. Montagne, after the absorption of the central cells, the basal cells are transformed into spores, as in some Algæ.

In the production before us, the whole pustule is at first shapeless, and confused with the tissue of the matrix. After a time however the surface is rough, with a greater or less number of points, reduced rarely to one or two, which are the ostioles of so many perithecia. There are no asci, but myriads of very minute subelliptic spores are produced on short delicate sporophores, without any trace of asci. The fungus is therefore a *Sphæronema*, taking the genus in a certain degree of latitude; and it is very possible that at a certain stage of growth the spores ooze out, forming a globule or cirrhus at the tip of the ostiole, a circumstance dependent entirely on the degree to which the perithecia are susceptible of collapsion. Not having seen specimens in their place of growth, we cannot state positively that the case is so. For the same reason it is impossible to affirm what is the predisposing cause of the production of the parasite—which not only disfigures the leaves, but makes the flowers droop and turn brown before they are well expanded—or to suggest any remedy. The only parties capable of doing so are those who can watch its growth; and when once the real nature of the substance is ascertained, their observations, if made with care and tolerable acuteness, will be worth a thousand times more than any speculations in the closet. It is a cheering fact that the cultivator's eye is turned to every anomalous appearance, because it shows an increase of intelligence, and the very act of inquiry and expectation of a reply keeps the faculties on the alert, and stimulates to further observation. We would, however, strongly urge the wisdom of not leaning entirely upon others, but trusting a little as well to native powers of observation. It is well to know whether any anomalous appearance is due to a fungus or insect, or whether it is some diseased affection produced by outward conditions, or by innate constitutional weakness. But these points being ascertained, it is to the first observer of the affection that we may justly look for available information.

The species being undescribed may be characterized as follows: *Sphæronema deformans*; parasitic on living leaves; perithecia oblong, growing several together from a pallid pustule, which is rough with the free ostioles; spores minute subelliptic.—M. J. B.—*Gardeners' Chronicle*, Sept. 7, 1850.

On the Names of the Victoria Water Lily. By J. De C. Sowerby, F.L.S., Secretary to the Royal Botanic Society.

The observations of Mr. Gray, in the last number of the 'Annals,' p. 146, seem to call for the following remarks.

From the various printed accounts of this splendid plant, the six names below may be collected:—

Euryale Amazonica, Poeppig, 1832.
Nymphæa Victoria, Schomburgk, 1837.
Victoria Regina, Gray, 1837.
Victoria Regalis, ib.?, 1837.
Victoria Regia, Lindley, 1837, Hooker, 1846.
Victoria Cruziana, D'Orbigny, 1840.

It is clear that the oldest of these names is *Euryale Amazonica* (and unless it be thought proper to accept the provincial names, one of them must be employed); now therefore that it is found that the plant does not belong to the genus *Euryale*, and that it forms the type of a new genus, the specific name *Amazonica* ought to be retained, or rather, it ought never to have been altered. As for the "permission of Her Majesty," our loyalty need not to be alarmed, for it appears most probable that the "permission" only applied to the name Victoria along with the generic name *Nymphæa* in Sir R. Schomburgk's letter before it was revised, *Regina* being an afterthought. Her Majesty will not be offended by that name being adopted which is most in accordance with accepted rules. I would therefore call it *Victoria Amazonica*. The *Victoria Cruziana* of D'Orbigny is supposed to be only a variety.

CAPTURE OF TETRODON PENNANTII.

To the Editors of the Annals of Natural History.

Gentlemen,—I beg leave to communicate to you the fact that a fine specimen of the *Tetrodon Pennantii* (?) was lately washed up ashore on the coast of the co. Wexford. The length is 18 inches. As it was skinned when it arrived in Dublin, Mr. Glennon, who stuffed it, could not say whether it was male or female.

I remain Gentlemen, yours most obedient,

Dublin, Sept. 18, 1850. H. W. Hopkins.

METEOROLOGICAL OBSERVATIONS FOR AUG. 1850.

Chiswick.—August 1. Hazy. 2. Densely overcast: slight haze: clear. 3, 4. Fine. 5, 6. Very fine. 7. Very fine: rain at night. 8. Cloudy: slight rain. 9. Fine. 10. Fine: drizzly. 11. Fine. 12. Fine: thunder: clear at night. 13. Heavy clouds: very fine: lightning at night. 14. Cloudy: very fine. 15. Slight rain: cloudy: clear. 16. Very fine. 17, 18. Cloudy and fine. 19. Boisterous, with dry air: clear. 20. Fine. 21. Overcast: heavy rain: frosty at night. 22. Clear and fine. 23, 24. Cloudy: fine: clear. 25. Overcast: drizzly. 26. Slight rain. 27. Fine. 28. Very fine. 29. Clear and fine. 30. Very fine. 31. Overcast.

Mean temperature of the month	59°·38
Mean temperature of Aug. 1849	62 ·91
Mean temperature of Aug. for the last twenty-four years ...	62 ·18
Average amount of rain in Aug.	2·41 inches.

Boston.—Aug. 1, 2. Cloudy. 3. Fine. 4. Cloudy. 5—7. Fine. 8. Fine: rain with thunder and lightning P.M. 9. Cloudy: rain A.M. and P.M. 10. Cloudy. 11. Fine. 12. Fine: rain P.M. 13. Cloudy: rain A.M. and P.M. 14. Fine. 15. Cloudy. 16. Fine. 17. Cloudy. 18. Fine. 19. Cloudy: stormy. 20. Fine: stormy. 21. Fine. 22. Fine: rain P.M. 23, 24. Fine. 25. Cloudy: rain P.M. 26. Fine. 27. Cloudy: rain P.M. 28—30. Fine. 31. Cloudy.

Applegarth Manse, Dumfries-shire.—Aug. 1. Slight shower at night: fine day. 2. Slight drizzle: fine day. 3. Fair and fine, though cool. 4. Heavy rain and high wind. 5. Fine A.M.: rain P.M. 6. Fair and fine A.M.: shower P.M. 7. Fair and fine: rain P.M. 8. Rain A.M.: cleared: rain P.M. 9. Rain: cleared P.M. 10. Rain P.M. 11. Rain. 12. Rain: fine P.M. 13. Fair and fine. 14. Fair: sultry. 15. Warm: sultry. 16. Fair: slight drizzle. 17. Fine: slight drizzle. 18. Wet nearly all day. 19. Shower: stormy. 20. Showers short and frequent. 21. Fine harvest day. 22. Showery: hail: cool. 23. Fair till 5 P.M.: rain heavy. 24. Frequent showers: hail. 25. Wet day: cleared P.M. 26. Fine harvest day: slight shower. 27. Heavy rain all day: flood. 28. Fine harvest morning: one shower. 29. Fine harvest morning: fair all day. 30. Fine harvest morning. 31. Slight drizzle A.M.: cleared.

Mean temperature of the month	55°·1
Mean temperature of Aug. 1849	56 ·7
Mean temperature of Aug. for twenty-eight years	57 ·0
Rain (average) for twenty-three years in Aug.	3·60 inches.

Sandwick Manse, Orkney.—Aug. 1. Clear: cloudy. 2. Bright: cloudy. 3. Showers: cloudy. 4. Rain: clear. 5. Cloudy: clear. 6. Clear. 7. Clear: fine: cloudy. 8. Rain: thunder-showers. 9. Cloudy: rain. 10. Fog: fine. 11. Rain: cloudy. 12. Fine: hot: fine. 13. Fine. 14. Fine: cloudy: fine. 15 Damp: cloudy: fine. 16. Cloudy. 17. Bright: cloudy. 18. Showers: cloudy. 19, 20. Showers. 21. Bright: clear. 22. Bright: rain and thunder. 23, 24. Showers. 25. Rain: drizzle. 26. Showers: drizzle: showers. 27. Damp: rain. 28. Showers: rain. 29. Showers. 30. Cloudy: rain. 31. Showers.

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

Days of Month.	Barometer.							Thermometer.								Wind.				Rain.			
	Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1850. Aug.	Max.	Min.	8¾ a.m.	9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.	8¾ a.m.	Max.	Min.	9¼ a.m.	8¾ p.m.								
1.	30·171	30·119	29·65	30·12	30·05	30·15	29·94	70	57	65	70	47	58	58	e.	e.	e.	s.	·01	·08	......	·09
2.	30·096	30·028	29·52	29·94	29·92	29·84	29·86	69	55	68	66½	48	59	55	sw.	calm	sw.	w.	......	......	......	......
3.	30·046	29·980	29·50	29·91	29·85	29·80	29·80	79	53	64	62½	51½	57	55	e.	w.	wsw.	sw.	......	......	......	·08
4.	29·941	29·812	29·26	29·53	29·50	29·45	29·40	77	52	70	62	51½	54½	57½	sw.	sw.	ssw.	w.	......	......	......	·27
5.	29·750	29·659	29·18	29·58	29·58	29·42	29·62	82	56	71	61½	52½	57	51½	sw.	ssw.	sw.	wnw.	·02	......	......	......
6.	29·733	29·720	29·20	29·59	29·68	29·63	29·74	74	49	62	65	48	55½	51½	ne.	nnw.	w.	w.	......	......	......	......
● 7.	29·871	29·863	29·33	29·73	29·57	29·80	29·73	77	58	60	66½	40½	58	56½	sw.	nw.	e.	se.	·08	......	......	......
8.	29·733	29·659	29·14	29·48	29·40	29·49	29·47	75	51	72	66	55½	56½	57	sw.	ssw.	sw.	e.	·02	......	0·65	·07
9.	29·740	29·700	29·06	29·30	29·43	29·38	29·43	71	51	62	66	53	60½	56	sw.	sw.	wsw.	n.	......	·19	......	·12
10.	29·875	29·838	29·26	29·62	29·60	29·61	29·61	75	58	64	66	54	56	55	sw.	w.	sw.	se.	·02	·06	......	·44
11.	29·823	29·722	29·22	29·52	29·48	29·48	29·65	74	50	63	66	52	56	54½	sw.	sw.	nw.	ssw.	·04	......	......	·21
12.	29·821	29·693	29·24	29·65	29·82	29·88	29·96	71	46	63	65	53	57	55	se.	ssw.	ne.	calm	·10	......	......	·05
13.	29·901	29·855	29·35	29·85	29·83	29·91	29·89	75	47	61	69	45½	59½	57½	nw.	nnw.	w.	calm	......	·87	......	......
☽ 14.	30·014	29·994	29·52	30·00	30·02	30·02	30·08	72	55	63·5	66½	49½	58½	59	ne.	wnw.	sw.	calm	......	·40	......	......
15.	30·011	29·961	29·54	30·04	30·00	30·04	30·05	70	52	63·5	73½	46½	60½	55½	n.	n.	w.	w.	·01	......	......	......
16.	29·972	29·944	29·46	29·96	29·90	30·02	29·98	78	53	63	69½	56	59½	55	ne.	n.	sw.	w.	......	......	0·56	......
17.	30·003	29·966	29·40	29·87	29·90	29·96	29·96	76	49	68	64	55	55	52	w.	nw.	e.	calm	......	......	......	·06
18.	29·996	29·767	29·30	29·63	29·46	29·29	29·07	76	49	63	63	52	54½	55	sw.	w.	se.	......	......	......	......	·24
19.	29·795	29·753	29·17	29·35	29·40	28·99	29·32	68	45	60	59	48	56	49½	w.	w.	se.	nnw.	......	......	......	·21
20.	29·718	29·706	29·17	29·45	29·48	29·38	29·50	68	43	55	57	44	51½	45½	sw.	w.	w.	nnw.	·01	......	......	·18
21.	29·646	29·612	29·22	29·48	29·49	29·50	29·53	62	32	50	59	39½	57½	42	s.	s.	wnw.	calm	·45	......	......	·27
○ 22.	29·837	29·799	29·34	29·43	29·52	29·49	29·46	66	39	50·5	58	36	52	50	sw.	ssw.	sw.	sw.	......	......	......	......
23.	29·985	29·882	29·46	29·68	29·73	29·44	29·70	66	39	51·5	58	39	51	49	sw.	w.	sw.	sw.	......	·13	0·25	·32
24.	30·040	29·729	29·56	29·80	29·83	29·82	29·77	72	40	53	58	46	52	51	s.	sw.	sw.	wsw.	·10	......	......	·19
25.	30·068	29·899	29·44	29·51	29·45	29·30	29·14	67	54	60	62	48½	51	54½	sw.	sw.	sw.	wsw.	·10	......	......	·19
26.	30·153	29·799	29·28	29·59	29·98	29·42	29·85	71	36	60	59½	50	49	48	nw.	wnw.	w–nw	nw.	·01	·10	......	·25
27.	30·213	29·908	29·70	29·88	29·67	29·86	29·76	72	49	56	58	38	52	46	sw.	s.	w–nw	n.	......	......	......	·03
28.	30·114	30·064	29·56	29·89	29·94	29·73	29·68	67	40	53·5	56½	43	50	51	n.	wnw.	nw.	wnw.	......	·07	......	·42
29.	30·153	30·141	29·66	29·98	30·02	29·87	30·02	67	32	52	57	45	49	48	w.	w.	wnw.	wnw.	......	......	......	·53
☾ 30.	30·253	30·221	29·80	30·10	30·13	30·05	30·04	68	33	50	57½	35	53	52	n.	w.	w.	nw.	......	......	2·45	·20
31.	30·300	30·292	29·83	30·10	30·12	30·01	30·11	62	42	52	61½	49	55	51	w.	wnw.	w.	w.	......	......	......	·19
Mean.	29·960	29·873	29·39	29·747	29·763	29·678	29·713	71·51	47·26	60·3	62·9	47·5	55·20	52·70					0·97	1·90	3·91	4·61

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 35. NOVEMBER 1850.

XXVIII.—*On the* Pholadidæ. By WILLIAM CLARK, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN, Norfolk Crescent, Bath, June 26, 1850.

I BEG to lay before you descriptions of the animals of the *Pholadidæ,* including the anatomies of *Pholas dactylus* and *Teredo megotara,* which, with my notes on *P. papyracea* and on the terebrating mollusca that have already appeared in the January 'Annals' for 1850, will form a complete monograph on this tribe, with the exception of the animal of *P. crispata,* that does not occur on the southern coasts, and that of *Xylophaga dorsalis,* which though met with alive many years ago was not then observed.

Pholas, Teredo, and *Xylophaga* constitute the British genera of this family. I have just submitted the *Pholades* and the *Teredo megotara* to a rigorous examination, not only of the external organs, but I have entered into detailed observations on their anatomical structure. Grave errors exist in our records relative to this family, both as regards the shells and the functions of the soft parts.

It is really strange that in so celebrated and ancient a genus as *Pholas,* so often the theme of discussion, so many doubts and contradictory accounts should still prevail respecting the hinge, cartilage, ligament and adductor muscles of the animal. Though there may be errors of minutiæ, I think that malacologists will find, in this account, some rectifications, obscure points explained, a variety of new matter, and that the observations on the structure of *P. dactylus* and *Teredo megotara* will assist not only to illustrate this family, but, *mutatis mutandis,* give a general view of the material points of the organization of the animals of the Acephala.

As I have, in the accounts below, entered so largely into the incidents of this group, I shall at once plunge "in medias res."

Pholas dactylus, Linnæus.

Animal conically elongated; body pale bluish white; mantle tinged with yellow, very thick ventrally, posteally, and around the gape; the other portions are of the thinnest texture, closed throughout except anteriorly a large oval aperture for the passage of the foot, and having the posterior end produced into a long retractile sheath of a milk-white colour when denuded of the epidermis, inclosing the branchial and anal siphons, which are just separated at their termini, the former with 12–16 long cirrhi, usually furnished on one side, sometimes on both, with 3–7 fimbriæ, besides one or two intermediate shorter cirrhi, which are ciliated on both sides; the anal tube is plain and slightly escalloped, but in some states it appears to have a number of short blunt cirrhi, which are not real, but occasioned by the doubling of the points of the scallops on contraction; their colour is brown, interspersed with a few white blotches, producing a pepper-and-salt appearance; the sheath for a short distance from the terminus is studded with subcircular whitish squamous papillæ. The foot is plain, hyaline, bluish white, suboval, pointed before and behind, truncate basally, rather obliquely fixed to the body by a long cylindrical, thick, fleshy white pedicle. The sheath can be extended to double the length of the shell, and the branchial portion is often distended with water to three times the usual size; its diameter greatly exceeds the anal one. There are on each side the body a pair of long narrow symmetrical branchiæ; these are nearly of similar size, reaching fully to the anterior end, from which they taper gradually posteally, and lie, not free, but fixed throughout their extent to within half an inch of the branchial compartment; they are pale brown; the branchial vessels are transverse, large, but not crowded, and present the aspect of coarse pectinations. There are two triangular elongated pointed palpi on each side in connection with each other and the branchiæ by narrow flat ribbons running above and below around the mouth; the structure and position of these palpi are so unlike each other, that one can hardly admit the appellation of palpum to be applied to the external one, which, instead of being fixed to the body like its fellow, is glued by one side to the *mantle* nearly its whole length, the point only being free, the upper part forming with the upper portion of the one on the other side an attenuated striated narrow band or fillet around the upper part of the mouth; these external palpi have the aspect of very long irregular triangles, which, instead of being thick like the ones on the body, are thin and laminar, and have more the appearance of branchial plates than of ordinary palpi. Notwithstanding these peculiarities they have not the disposition of the blood-vessels of the regular branchiæ, being quite smooth on the side next the mantle, and on the other closely striated; in these respects they are like their discordant fellow-palpi, which are smooth on the side next the body, and striated on the other; the striated surfaces partially lap on each other; the external mantellar palpi are very much longer than those on the body. These appendages are usually considered to be of a tentacular nature, to conduct the aliment into the mouth: that may be; but they have also branchial functions, as they are connected with each other by a very visible artery that coalesces with that of one of the main branchiæ, and I have not a doubt that leading branchial veins form a similar union with those of the regular branchiæ. The liver is anterior, of ample volume, granular, and yellowish green.

Pholas parva, Pennant.

Animal thick, subcylindrical, less elongated than its congeners; body milk-white; mantle pale bluish white, when deprived of the fugacious light-red epidermis, which, at the closure of the valves, forms a line resembling a suture of a red sandy colour: this division of the body causes each side of it to appear banded. The mantle is closed except an aperture for the foot, and being prolonged into a long retractile sheath covered with a thick red-brown epidermis, which is aspersed with thickset sand-like red eminences, or minute papillæ, that become larger and more intense at the termini of the orifices, where its margin is irregularly encircled with a fine light brown fringe or rather pile; within the periphery of this fringe are the siphonal apertures, the branchial one being rather the longest, without cirrhi, but sinuated or escalloped, and marked with a dozen brown and white alternate lines running into the tube; these at half-contraction have the appearance of short blunt cirrhi, occasioned by the doubling of the brown and white points of the scallops, the two nearest the anal tube being the longest in appearance, with a single one exactly opposite the two; these however are only deceptions, and vanish entirely when the tube is fully expanded; the anal cylinder is pale brown and perfectly simple; both siphons are destitute of cilia, having only the margins of the sheath finely pilose; none of the other Pholades are without cirrhi on the branchial orifice. The foot, when at rest, is nearly an oval, but in action it becomes pointed behind and rounded in front; it is truncate at the base, and fixed to the body by a long round cylindrical fleshy pedicle of pale bluish white. The branchiæ and the palpi on each side are so nearly similar to those of *P. dactylus* as to require no observation; the siphonal sheath when extended is double the length of the shell. The liver is darker than in the last species.

Pholas candida, Linnæus.

Animal conically elongated from the anterior end to the posterior axis of the cone. The body, sheath and mantle are a pale red-brown, but when divested of the epidermis, of the palest hyaline tinged with brown. The mantle as usual is closed, except the aperture for the foot, and being produced into a sheath that is proportionately shorter than in its congeners; the siphons are of the same length, and both are cirrhated at their orifices, the only example in this respect that we know of amongst the Pholades; the branchial with about twelve whitish brown rays, of deeper tint towards the base, and between some of them one or two smaller, but not fimbriated; the anal has about eight short pale rays. Some authors describe papillæ on the tubes; our specimens only showed minute sand-like points, which we think are due to the epidermis. The foot is much narrower, more elongated and pointed than in any of its congeners, and fixed to the body by a compressed pedicle, of a pale hyaline in some animals, and flaky bluish white in others. All the other organs exhibit no particular variation from those of *P. dactylus*.

I have so fully entered on the boring qualities of the Pholades in the January Number of the 'Annals' for 1850 as to require no remarks. The Pholades are generally excavators and inhabitants of rocks, chiefly the red sandstone on the South Devon coast, but the *P. dactylus* and *P. candida* often burrow and pass their existence in pure sand at the back of the Warren and Cockle Sands at Exmouth, where the finest and most delicately sculptured individuals are found, surpassing in beauty the rock specimens. Having concluded my remarks on the external organs of the Pholades, I shall now consider the anatomy of the *P. dactylus*, connecting with it the parts of the shell that relate to the hinge, cartilage, ligament, curved subumbonal apophyses, and other accessories: for reference, and to prevent confusion, I have distributed the matters to be considered into distinct sections.

The Hinge.

The hinge of the Pholades appears not to be well understood, and has not received the investigation that has been so liberally bestowed on the terebrating powers of the animal; it is extraordinary even in late malacological works to find it described as obscure and rudimental, and M. Deshayes, in his comment on *Pholas* in the last edition of Lamarck, mentions the hinge as scarcely existing, and not being a 'véritable ligament'—how different from the fact! And I will observe, that if there is a genus better provided than any other of the bivalves with ligamental appendages, it is *Pholas*.

The hinge of *Pholas dactylus* has very slight traces of denticular assistance; it nevertheless works, *en charnière,* in a circumscribed space, to which it is confined by powerful ligaments, and though somewhat different in its component parts from the usual configuration, it does not in its functions materially differ from those of the ordinary bivalves; it has a strictly internal cartilage, which is laminar, of small volume, oval shape, and light yellow colour; it is fixed on the internal portion of the convexity of the valves, termed the hinge, which articulates, imbedded in the thin plates of the cartilage. The ligament succeeds; it consists of two parallel plates, between which is a considerable interspace of strong, close-set, white elastic transverse threads, the one fixed more externally to the inner side of the reflected dorsal cellular excrescence; the other, below it, to the internal commissure of the two valves, thus forming a powerful ligament that allows them the usual movement of the ordinary hinge: on this is added a third ligamental apparatus, which may be termed accessorial, to increase the strength of the hinge, and is formed by the reflection of the tough end of the mantle issuing between the anterior points of the valves in an elongated oval form, and covers the transverse threads of the outer layer of the ligament; it is firmly secured by throwing out filaments which enter the dorsal cells of each valve; this production of the mantle is further fortified by two thin, flexible, suboval testaceous plates, supported by a subtriangular rest; these appendages are exudations from the reflexed mantle. The posterior part of the valves, as is usual in elongated shells, has the common continuous membranous ligament produced by the protrusion of the edge of the mantle, with the addition, in this species, of a long thin linear testaceous plate; the use of this posterior ligament is to assist in maintaining the valves from sliding out of their natural position. It appears then that *Pholas* is iron-bound as to ligament, which, in it, is far more powerful in securing the valves than in the shells of any other group of the *Acephala* of similar fragility and tenuity.

The Muscular System.

It will now be convenient to notice the muscular system, and in the first place, that part of it connected with the shell. In this group of bivalves, the curved spatulate apophyses springing under the umbones have long excited the attention of naturalists, and the uses assigned to them as supports of the body, we believe to a certain extent to be correct; but they have other important functions that have not attracted sufficient notice. Before they are mentioned, it will facilitate their illustration if it is now stated, that though an anterior adductor muscle is spoken of by authors, there is not a trace of one in *Pholas dactylus,* and I believe all its congeners are also deprived of this organ.

There is only one adductor muscle in *Pholas,* not posteriorly situated, but very slightly post-medial: the fact of the absence of this organ anteriorly, I think I have ascertained beyond doubt: no muscle passes through the animal or embraces the mantle anteally, the tough and thickened margins of which are supported on both sides the shell and around the gape by long thin strap-shaped fillets thrown off from the medial adductor muscle, which, with that of the foot, may be considered as the great points of departure of all the principal muscles of the body.

Some authors contend that what I call the ligament, under the dorsally reflected mantle, is the anterior adductor: this idea cannot be supported, as independent of this strange position for an adductor muscle, the two layers of filaments are fixed, the one, external to the other, with a space between them, to the *shell,* and not to the animal; therefore they are ligamental, and their action and reaction have the same effect as in the ordinary bivalve ligament.

The important functions of the crotchets under the beaks claim particular notice, as much error has existed with respect to them: their utility originates from the two very strong muscular bands given off from the foot, which are fixed to their spatulate roughened terminations, and serve as *points d'appui* for its action in the work of excavation, without endangering or distressing the body. We have here a beautiful illustration of the resources of nature to accomplish what is necessary for the well-being of her creations; for if the foot was attached to the body as in the ordinary bivalves, without aid, the severe action of excavation would probably paralyse the animal and tear it from its natural position, which result is prevented by this admirable contrivance, and the body lies securely supported in the curvature of these appendages, whilst the movement of the foot is altogether maintained by working from the crotchets.

Nature has not given this animal an anterior adductor, because it is unnecessary, as it rarely expands the large gape by a separation of the valves; and when it does, the medial adductor and the limited action of the ligament suffice: the permanent gape is the equivalent for what in ordinary bivalves is effected by the opening and closing of the shell by the adductor muscles. The apophysary and pedal apparatus are not the substitutes for an anterior adductor muscle; for if they did act as such, their muscular powers must remain in quietude from the necessary contraction, and the excavating action would be destroyed: the two actions are completely antagonistic. The posterior part of the valves is only opened slightly to allow the issue of the basal portion of the branchial sheath, to assist by attrition in the enlargement of the posterior part of the chamber whilst the foot is operating in front.

The foot and pedicle, which in a living state appear almost hyaline, when they have become exsiccated, will be found to consist of a mass of longitudinal elastic fibres, the principal portion of which centre on the umbonal excrescences, and the remainder supply muscular threads to the anterior part of the body: the basal area of the foot is by far the most coriaceous portion.

Lamarck's Dimyal arrangement is almost untenable, as the Pholades having only a medial adductor are removed therefrom, and many of his Monomyæ having two muscles renders the position still more doubtful. The medial adductor of the Pholades is a most influential organ; it is fixed to and is an integral component of the mantle at that point where it becomes the origin of the siphonal sheath, and adheres by its large subcircular flaps to each side of the valves, showing when removed two well-marked cicatrices: this muscle extends its influence to each extremity of the animal, as from it the mantellar marginal supports emanate; it also supplies the siphons with powerful retractors, and furnishes the tube into which the rectum discharges with a sphincter; it is the main support and connection of the animal with the posterior part of the shell; it likewise supplies the posteal parts of the body with the minor muscular threads; and finally it is the organ of a limited relaxation to allow the valves to be opened in concert with the cartilage and ligament for the issue of the basal portion of the branchial sheath, when it is required to assist in excavation, and of their closure to expel the water from the respiratory sac.

The whole mass of the branchial and anal tubes is a tissue of coriaceous muscles which are composed of layers of strong close-set longitudinal fibrous cords, crossed at right angles by minor ones, and at the posterior extremities they throw off the special annulated retractors of the terminal cirrhi of the branchial orifice, which appear each to have a minute sheath, and they also provide for the retraction of the anal orifice.—We have next to examine the nervous influences.

The Nervous Influences.

The powerful and diffusely distributed muscles of this species would lead us to expect that the medullary masses would be of corresponding importance; this is not the case, as in *Pholas dactylus* I can only find two inconsiderable ganglia; the anterior one is the largest, consisting of a white pulpy mass, situated on the centre of the œsophagus just above the buccal aperture; from it two distinctly visible threads curve anteriorly, the one giving filaments to the right, the other to the left palpum, from whence additional ramifications proceed to the anterior parts of the body, besides supplying the muscles of the foot. The posterior ganglion is situated between the heart and the anus, and is connected with the anterior one by two close, parallel, dorsal, very minute longitudinal threads that are seen without difficulty, and cannot well be mistaken for veins; the minor mass furnishes threads to the adductor muscle, and sends to the ovarium and muscles of the belly appropriate filaments. This is all that I have been able to observe of the nervous system, and collect from it, that however insignificant the ganglionic masses may appear, their effects on the muscles prove that the potentiality of their influences is not impaired by the minuteness of the hair-like threads which are the conductors of the subtle fluid that excites their action.

The Digestive Organs.

We commence with the mouth, situate immediately above the connecting labium of the palpi; it is rather a large transverse orifice, and leads directly into the simple œsophagus, which proceeds with a portion of the liver on each side of it through the anterior part of the dorsal range into a small oval stomach, the base of which is enveloped by the light green granular liver which pours the bile into its ridged coat by several ducts; its cavity is almost filled up with a folded plate, which I call the gizzard or stomachal attritor, and authors the tricuspid membrane, which is erroneously, as I think, considered by some malacologists an agent to regulate the entrance of the bile from the liver. I think this idea cannot be sustained, as besides the stomach being provided with bile ducts, one of the axes of the tricuspid corneous plate is fixed at the cardiac orifice of the stomach, and receives the animalculæ as they descend the œsophagus; and after trituration by the gizzard, which is worked by the elastic hyaline stylet, they pass through the other axis of the tricuspid membrane, which is inserted in the pyloric orifice into the intestine. I have preparations showing the gizzard in the stomach with its posterior end united to the intestine, and attached by the middle to the hyaline stylet.

This singular organ, so well known to exist, I believe, in all bivalves, has caused some difference of opinion as to its use; but

I think when all the incidents attached to it have been mentioned, they, in conjunction with the position in the stomach of the tricuspid organ, can lead to no other conclusion than that the apparatus is a gizzard worked by the foot and elastic stylet to comminute the food, and is analogous to the gizzard in many of the Gasteropoda. The stylet is for the basal half cylindrical, and tapers from thence to the stomach, where it makes a loop, and is fixed by a filamentary muscle to the gizzard or tricuspid membrane; its colour is hyaline milk-white, and in certain lights reflects the metallic hues; the working point of support is the centre of the basal part of the foot, through the pedicle of which it proceeds obliquely to the stomach, guarded by a sheath which appears to secrete a lubricating fluid, probably having its source from the liver, through the centre of which it passes to its junction with the corneous attritor; it is eminently elastic, formed of a suite of circular lines; it is impervious. I have submitted it to every sectional form, but the only departure from homogeneity are the fine circular elastic fibres; in the species we now describe it is fixed by a short muscle to the bottom of the foot; in *P. parva* it appears to rest, free. At one time I thought the stylet might be the vehicle of a solvent fluid from the stomach, but its impermeability negatives this idea; and if there is a connection with the foot from the stomach, it must be by the sides of the walls of its sheath; in that case a solvent would neutralize the lubricity so necessary to its action, as a spring for the gizzard; besides, the most careful examination of the external and internal surfaces of the foot shows no connection between them, or orifice for the issue of a solvent. No adjuvant powers of sight have enabled me, in this species, to discover the pore which is said to admit water to the foot of many of the bivalves, or to expel it if received from the stomach.

I now return to the intestine, which we left united to the posterior end of the tricuspid membrane; as soon as it is clear of the pylorus, it makes a double and plunges deeply into the body, nearly to the foot, through the folds of the liver, and then ascends to the dorsal region, to near the point from whence it commenced the circumvolution; it then proceeds under the peritoneum or membrane enveloping the liver and stomach to the pericardium, which it pierces, and passes in a straight line, embraced by the ventricle and auricles, to its termination in the anal tube.

The Circulation and the Respiratory Organs.

The circulation is complete; that is, there is an aortic action, and a venous reflux of the blood for aëration to the pulmonary apparatus. The respiration is effected by a pair of very long membranous narrow symmetrical laminæ on each side of the body, composed of a vascular network, fixed under the mantle to the dorsal range, accompanied also on each side by a pair of palpi: on leaving the body the four branchiæ without an intermediate substance run together tapering to their termination at about half an inch from the extremity of the branchial orifice; they are firmly fixed the whole length by their bases from the point they leave the body to the membrane which separates the anal from the branchial cavity, cutting off all communication between the two siphons; consequently the water must be received and ejected through the branchial siphon, or by the pedal orifice, in the bivalves with closed mantles, as is the case with the Pholades, and probably with other families of the same structure in which the branchial and anal tubes are separated their entire length by a divisional membrane.

The discovery of this circumstance is so important as regards the disputed point, how the branchiæ receive the ambient element, that I have used every means to test it, by dissection, by all the modifications of experiment, and particularly by mercurial injections; this last mode I have used very successfully, as the following operations will show. First, I threw into the anal siphon a column of mercury that completely filled the cavity, and on applying further pressure regurgitation ensued, but not a particle of the mineral found a passage to the branchial vault; this result occurred in many specimens, and though the pressure was often considerable before regurgitation was allowed to take place, still the branchial division of the mantle remained free from the quicksilver. In one experiment the fluid appeared in the lateral tissues; this condition I attribute to a lesion of the dorsal lateral membranes. 2ndly, I found that if there is the slightest solution of continuity in the fine membrane on which the branchial vessels are fixed on one side, and the interweavings and traceries on the other, which form the roof of the anal siphon, the application of the mercury to that tube gradually filled the whole range of the branchial vessels, which exhibited a very elegant appearance, but no fluid escaped from them into the branchial sac. 3rdly, I repeated many times the first experiment with the view of endeavouring to find a passage through the rectum, and intestine on the dorsal range that is embraced by the heart, but without success; if I had succeeded, it would have been impossible to arrive at the stomach and mouth, as the intestine plunges into the body coasting the foot, at which point it is of larger diameter, and always filled with a compacted mass of sand which effectually stops up the passage: this part of the intestine around the foot, from its difficulty and the hardness of the fæcal matters, seems analogous to the ascending portion of the colon in man.

In all these attempts either regurgitation ensued, or the continual pressure of the mercurial column caused lesions.

This impossibility to pass anything into the rectum probably arises from its sphincter, or one in the anal tube, as the stoppage always occurred at that point where it empties into it.

4thly, On applying the mercury through the mouth and œsophagus the stomach was readily filled; but as soon as the pylorus was passed, a stoppage not to be removed occurred, from the duodenum being, like the colon in the last case, filled with sand; we may therefore conclude that water can never enter the stomach of bivalves from the anal tube.

The spaces lining the roof of the anal siphon consist of four longitudinal rows; the two middle ones are the largest, and form transverse parallelogramic figures, whilst the other two, one on each side, are smaller subquadrangular areas. I can conceive no other use for these crypts, in such families as have them, than as depositaries for the ova; if so, the oviducts of course communicate with them, and the ova probably remain there some time after fecundation, and the final ejection, in bivalves of this structure, can only take place from the anal tube. It is probable that the principal use of the anal conduit in the bivalves, in which the branchial cavity is completely cut off from the anal one, is to receive the rejectamenta, supply water to the ova during their maturation, and ultimately to eject them.

It is necessary to state that these experiments require much patience and attention, and some delicacy of manipulation, to arrive at sound results; it is very material not to use specimens with accidental lesions, or those made in removing the animal from the shell, which operation, from the obstruction of the crotchets, cannot be effected without some practice and dexterity.

The result of the 1st and 3rd experiments would appear to demonstrate the non-communication between the branchial and anal siphons in the Pholades; this fact being established, they will not be the exceptions; but it is probable that the *Myadæ, Solenidæ, Lutrariæ,* &c. have a similar configuration of the branchial apparatus; and though the *Veneres, Cardia,* and other open-mantle bivalves, have the character of their branchial sacs different from those of the Pholades, in not having the siphons completely separated, but more or less confluent, the possibility of branchial currents must be admitted. Still, as it has been shown that in the Pholades the water cannot be received and discharged otherwise than through the branchial aperture, or from the pedal orifice, it is clear that regular separate currents by cilia cannot exist between the two siphons, so as to make one the inhalant, and the other the exhalant canal; and if there is any truth in analogy, every presumption authorizes us to conclude, that the same action of the reception and discharge of the water through the branchial siphon and pedal or ventral opening prevails in the open-mantle bivalves, the *Veneres, Cardia,* &c., wherein the branchial sac is posteriorly divided into two, not separated, but confluent siphons at their bases, being only more or less divided towards their terminal portions by an internal septum, so that they must be considered in conjunction, and as one siphon, for branchial purposes.

If therefore it be established beyond all reasonable doubt, that there is no communication between the anal and branchial siphons in *Pholas,* there is an end to the doctrine of separate branchial currents by cilia; for if this is impossible in one family of the same class, we have a right analogically, and agreeably to the axiom, "ex uno disce omnes," to consider that all are in a similar category as to the mode of admission of the water to the branchiæ, whatever may be the differences in certain classes in the disposition and structure of the siphonal apparatus.

Having arrived at this conclusion, I will, though it is almost unnecessary in corroboration of it, make a few additional remarks. It is well known that muscles are often hung up high in the crevices of rocks, some of them above the level of the ordinary tides, where my dredger says that they remain suspended throughout the year, and can only for a few days in each month, at spring tides, receive the water: this condition may occur for about two hours in 75 days out of the 365; yet when any of these animals are opened, the cilia under the microscope will always be seen in action, beating, subdividing, and eliminating the air from the moisture. In this case, for near three-quarters of the year, the creation of branchial currents is impossible; they cannot be produced from nothing.

It appears then, whether the cilia be within the possibility of assisting in the creation of branchial currents or not, their action never ceases whilst moisture remains in the shells, and I think it must be considered as settled, that there is no community between the cilia and what are called branchial currents. I have at Exmouth repeated all the experiments with the mercury on fresh flexible animals; the first were performed with rigid specimens from spirit; the results are most satisfactory, and I think entitle me to state with confidence, that in *Pholas* there is no communication between the branchial and anal siphons.

I have now to offer a most important communication, which I have only been in a condition to make since the above observations were written. I am enabled to state, after a prolonged and anxious examination of fifty of the living Pholades, under all the phases of experiment, that nine-tenths, if not all the water to bathe the branchiæ is admitted at the *pedal* gape, and ejected *only* by the *branchial siphon*; the anal one *alone inhales* water and discharges it; and in the close-mantle *Solenidæ, Myadæ, Lutrariæ,* &c., as well as in the open-mantle *Veneres, Cardia,* &c., the water is only admitted into the branchial vault at the pedal or ventral aperture by the simple opening of the valves, and ejected according to the structure of their respective sacs, either by the branchial issue alone, as in the Pholades, &c., or as in the *Veneres, Cardia,* &c., by the two confluent orifices, which are in fact but one branchial conduit.

This discovery and attendant results will finally I hope dispose of the complicated scheme of some authors, of the reception and discharge of the water for branchial purposes by cilia and separate siphonal ducts, as it shows what I have always advocated, that nature gives access to the water for the respiratory apparatus by the simple opening of the valves, and causes it to be discharged, when effete, by their closure at the posterior siphonal issue, as well as by the pedal opening and ventral scissions of the mantle. It is therefore I think satisfactorily proved, that the doctrine of separate currents by cilia, and that the inhalant is always kept distinct from the exhalant current, and admitted by a separate aperture from that by which the latter is expelled, or in other words, that the water is imbibed by the branchial siphon and discharged from the anal, is absolutely untenable.

The important discovery I have just related was made manifest in the simplest manner. On taking up an animal, the siphons of which were largely inflated, I observed that the great mass of water was poured out from the branchial tube, and only a small quantity from the anal one; on replacing the animal in water, I was surprised, instead of seeing, as I expected, the water flow up the branchial canal, to observe a powerful column, through the tenuity of the membrane, pass rapidly from the pedal opening, in consequence of the relaxation of the mantle around the pedal gape, and fill the branchial vault. This very decisive proof how the water reaches the branchiæ induced me to vary the experiment. I placed the animal with the tubes entirely in the water and the pedal gape out of it; very little fluid entered the branchial sac, the anal siphon alone imbibed a portion; and on holding the animal with the siphons downward, scarcely any water issued from the branchial one, and only a little from the anal; but as soon as I suffered the pedal gape to reach the water, a column was instantly seen to fill it as before.

I do not mean to say that if the pedal aperture is kept out of the water, some fluid may not be imbibed by the branchial tube; nature will supply its wants by other channels if deprived of the accustomed ones. I only insist on the position that the usual canal for the entry of the main body of water for the use of the branchiæ in all bivalves is by the pedal and ventral apertures, and that the exit is by both the branchial and pedal fissures of the mantle, and that these actions are accomplished agreeably to the wants and will of the animal at uncertain intervals by the simple opening and closure of the valves, and that what are called currents by cilia do not exist. I cannot help again observing on this simple solution of a disputed point;—I may call it as simple a one as that of Columbus, when he showed how the egg may be made to stand on its apices; and yet it is quite decisive of the desired point, how the water is admitted to the branchiæ.

The Secretory Organs.

Under this head, as I propose to offer at a future time some observations on the anatomy of the Lamellibranchiata, I will only at present mention the veins and glands which I think produce the cartilage and ligament. On carefully opening the lateral cavities on each side the anterior dorsal range, a fasciculus of veins may be seen deposited therein, some of which I have traced to the liver; and it is probable that the inspissated fluid thrown off by them is specially applicable to the formation of the cartilage and internal portion of the ligament, as I have found their excretory ducts to be spongy masses that send forth the viscous humour distilled from the veins on the internal convex circular areas in which the valves articulate; and a proof of one at least of the true uses of the excretory apparatus is, that in *Pholas dactylus* the fluid is of a light brown or drab, and it produces two thin cartilaginous plates of those colours, whilst in *P. parva* the colour is as dark as tar, and the plates of the cartilage correspond with it. It is probable the coarser parts of this secretion are separated from the concentrated cartilaginous matter, and form the interior layers of the ligament, the mantle only producing the external skin. It is reasonable to suppose that all bivalves have these secreting organs; and it will be desirable to ascertain if such shells as the *Mactræ, Myæ, Lutrariæ*, &c., which have internal cartilages of considerable volume, have the excretory and secretory organs correspondently developed as in the Pholades; and if in those genera that have external cartilages, there is any variation of structure.

The Reproductive Organs.

The Acephala are hermaphrodites without congression, and as it is termed, they suffice for themselves; but this fact must not be understood ideally, as these animals have distinct visible organs, the union of which, within themselves, produces the male and female influences. I hesitate to concur in the statement of some authors, that the sexes are distinct in the bivalves. I think it is probable that this idea has arisen from the animals being examined at different periods of the year. In the genial months, the ovaria, and the virile membranous pouches, are distended and fully developed; but in the winter season, when all nature flags, and takes repose after the exhaustions of the summer, and when even the influences of the "Æneadum Genetrix" are softened down, then the ovaria and the pyriform virile membranes become obsolete: these two very different states may have contributed to produce erroneous conclusions. We must, as I have elsewhere observed, not forget the precept,

"Ætheris et terræ genitabile quærere tempus."

I do not mention that I have quoted this line a second time, as an apology for the repetition; on the contrary, I mean to mark the great importance in which it was held by the illustrious author, who has in his work repeatedly used it or its equivalent.

The ovarium of *P. dactylus* is a conical organ, amalgamated with the lower part of the body, having a pointed apex. Though I applied the quicksilver, I did not satisfactorily make out the oviducts; they do not appear to be at the apex of the ovarium, and I am inclined to think that they are situate at the junction of the body with that organ. In many bivalves it is considered that the ova, on issuing from their receptacles, are at once committed to the protection of nature. I almost think this idea is not correct, and that the ova, after fecundation and exclusion from the ovarium, are for some time committed to the protection of the parent before final ejection. In some bivalves, as in *Anodon* and the *Mytili*, the ova are transferred to the interspaces of the branchial laminæ for maturation. In this species and its congeners we believe the ova pass from the ovarium into the crypts, traceries and interweavings of the roof of the anal vault, and remain there separated from the ovarium, and undergo, *mutatis mutandis*, precisely in the different seasons, the same phases and aspects as I have mentioned concerning the ova in the ovaria of the *Dentalia*, in my paper on that genus in the 'Annals,' the animals of which are strict hermaphrodites, as are the *Chitons* and *Patellæ*; and thus we see the propriety of placing those Gasteropods as immediate sequences to the bivalves, in respect of natural order.

Teredo, Adanson.

I submit for the consideration of malacologists a description of the animal of one of the rarest of the *Teredines* and its anatomy. I infer that this genus is still in great obscurity from the serious mistakes that exist in the accounts of it: this is the more remarkable, as it has attracted the greatest attention for the last 200 years in consequence of its devastations, which have been so alarming, that various governments have called in the aid of the learned and scientific to examine into their nature, and suggest the best means of preventing its destructive ravages.

Some authors, amongst them Sir Everard Home, call the external veins the ducts of the testicles, and say the heart is situated near the head. More modern accounts state that there is no true hinge; that the ligament is obsolete and the foot rudimentary or absent; the branchiæ are described as long brown fleshy cords; the elastic stylet is mentioned as a club-shaped body peculiar to *Teredo*, and the animal is said to be furnished with two stomachs. Some observers say, that the anterior adductor muscle is well marked, but the posterior one slightly; others affirm the branchiæ to be the ovaria, and that the protective tube of *Teredo megotara* is destitute of the posterior circular laminæ. I propose to show that not one of these statements is correct. I am informed that M. Deshayes has produced anatomical details on one or more of the Teredines in his work on the 'Mollusques d'Algérie,' which I have had no opportunity of consulting; I must therefore abide by my own views.

The origin of this account is the receipt from Exmouth of a pine stake, which has doubtless served as a water-mark in one of the channels of the estuaries, and being destroyed by the perforations of these creatures, was taken floating in the offing at that place. I received the mass enveloped in sea-weed, accompanied by bottles of sea-water. The log contained fifty living specimens of this rare species unmixed with any other, many of which were apparently full-grown and 10 inches in length; some I examined alive and dissected fresh, and many others from spirits. These facilities have I think almost put it in my power to produce a tolerably general idea of the animal, though it may not be a complete anatomical detail. Under the circumstances I have stated, I am inclined to think that the following notes may afford malacologists some information, and enable them to compare my humble attempt with the anatomies of *Teredo* by the great masters in this branch of science. Agreeably to my usual method I commence with the external description of the animal, and then proceed to its anatomy.

Teredo megotara, Brit. Moll.

Animal vermicular, pale bluish white, inclosed in a subcylindrical elongated tubular mantle, not of very thin texture, only open anteally and posteally. The specimen examined measured 8 inches from the front valves to the terminal pallets, and when the siphons are extended, an inch longer. The anterior part of the animal is inclosed in a pair of hemispherical shining white valves, with a large angular gape in front, and rounded behind into auricles, which in this species are much larger than in its congeners; the body and mantle are fixed to them, and proceed under the protection of a testaceous tube to the terminal pallets, which are also encased within the tube.

It will here be convenient to observe, to be spoken of more in detail hereafter, that the calcareous tube through which the body passes, has hitherto been considered as one of mere protection; but I shall show that though the globular valves in front work free in the tube, it is as much a part of the animal as the shell of the Pholades, inasmuch as it is fixed to it posteriorly by a very strong muscle.

The branchiæ are invisible until the mantle is opened. There is what appears to be a purple dull red labium on each side the mouth, connected by a thin membrane; these have been termed salivary glands, and may perhaps be such. The oral aperture is subtriangular. The foot in the living animal appears bluish hyaline, but when the moisture is absorbed it is muscular and coriaceous, attached to the body by a thick powerful cylindrical pedicle, and in its centre the terminus of the hyaline stylet is visible; the form of its basal area is that of the anterior gape, which is of a diamond figure, with its angles placed vertically and transversely, but the transverse axes are longer than the vertical. A pair of yellowish white spatulate appendages are fixed to the posterior extremity of the body. In this animal, besides the anterior and posterior apertures of the shell, there is a rather extensive oval orifice on the dorsal surface of the shell, which is covered by a thick subcircular tough skin, springing from the internal part of the anterior end of the mantle, which appears to have the valvular function of closing the orifice; but it will be mentioned again.

These are the only features of the animal which are visible without dissection. A bivalve animal consists of the shell, soft parts, and the hinge, which latter organ has caused some misconceptions, which I will endeavour to remove. It is nearly similar to that of *Pholas*; the valves articulate on a thin genuine cartilage, which is a secretion from glands; on each side the anterior dorso-lateral part of the body the denticular appliances are wanting in one valve, and in the other there is only a short blunt tooth; the ligament is a united production of the glands just mentioned, and the mantle; it may be considered to be more external than internal, and only differs from *Pholas* in having one, the upper, instead of two layers of transverse fibres, strengthened and covered as in that genus by the anterior end of the mantle being reflected on it, but it is not fortified by testaceous plates. We have here all but the hinge of *Pholas*, and taking the shell as far as its circumscribed volume extends, we find it nearly similar in having the curved subumbonal internal apophyses, the single post-medial adductor, and the long tubular mantle fixed to the auricles; but instead of the viscera and branchiæ being inclosed in the usual bivalve portion, they are placed in that part of the mantle which is external to the shell; nevertheless they are protected by the tubular case, which, as I have stated, is an integral portion of the hard parts of the animal, not merely protective or accessorial. We have thus a complete equivalent for the bivalve shells of the Pholades, in which the siphonal apparatus commences at the posterior end of the shell, deriving their retractors from offsprings of the medial adductor; whereas in *Teredo* the retractors have their source from a particular muscular sphincter at the posterior end of the tubular mantle in which the pallets are inserted, and have nothing of the nature of an adductor muscle, as the tube to which they are fixed is a perfect cylinder.

The next point to engage attention is the muscular structure, which, with slight exceptions, scarcely differs from *Pholas*. The two principal masses of muscles are those of the foot and the adductor; the latter is a powerful fibrous mass of bright red filaments, as Sir Everard Home states was the colour of the species he examined; it embraces the hinder part of the mantle within the hemispherical valves, being post-medial and fixed in the internal hollows of the auricles, showing therein when removed well-marked cicatrices: this muscle throws off elastic ribbons, which proceed on the lateral parts of the mantle to that point of the tubular mantle where the sphincteroidal muscle is fixed, and of which it is probably the origin: this last muscle is a most important one; by being permanently fixed to the animal and posterior end of the protective tube, by the oval-shaped fillets springing from the sphincter muscle, it is the point of support for the retractors of the comparatively short siphons, and also the fulcrum for the pallets that are firmly fixed laterally therein, and undoubtedly serve to compress and relax the siphons. It is necessary to observe, that if the very long mantellar tube was not firmly attached, the *points d'appui* of the pallets and retractors would be lost, and the long, linear branchiæ drawn together in the tube in such a mass as to impede the passage of the water and other functions. The posterior sphincter in *Dentalium* is analogous in its uses; and though the hemispherical valves of *Teredo* play loose in the anterior part of the tube, they are kept in proper position by the powerful operation and suction of the foot, and do not require permanent fixation like the smaller pallet end of the animal.

I will briefly explain the operation of the posterior spatulate appendages in compressing and relaxing the siphons. The very great length of the branchiæ, which are $4\frac{1}{2}$ inches long, out of a total of 8 or 9, together with the extent of the tubular cylindrical mantle, requires an aid to facilitate the flow of water through the long canal; these pallets act as a sort of force-pump, and operate thus:—When the branchiæ require water their siphon is filled, and its inflation acted on by the spatulate valves being brought together; the sphincter is simultaneously relaxed, and the water forced into the branchial cavity, after which it is again closed by the separation of the pallets, and as I have ascertained that there is no communication between the branchial and anal tubes, it follows that the effete water is expelled by the same canal as it entered, by the action of the pallets on the sphincter. This is precisely the operation of the sphincter in *Dentalium*; and in case a communication did exist between the two siphons, the anal, from its very inferior calibre, could not discharge the mass of water received by the branchial siphon into the tubular branchial compartment of the mantle; it must either be poured forth by the anterior gape or branchial siphon—I believe indiscriminately from both. I think the anal canal is strictly applicable to discharge the water taken in by its own siphon, for rejectamental uses, and in many cases for the emission of ova.

The siphons, though short, form a muscular texture of strong elastic threads, crossed by others at right angles; the branchial orifice is usually white, sometimes pale red with eight or ten short terminal cirrhi, which are furnished with minute retractors springing obliquely near their extremities from the muscular tissue; the anal orifice is plain. The foot is a strong muscular mass; it sends forth two very strong fillets that are fixed to the spatulate ends of the internal crotchets, which support the body, in lieu of the ordinary adductor muscle of bivalves, which is here, as in *Pholas*, wanting, to the remarks on which we particularly refer.

I close these observations by stating, that the masses of the foot, medial adductor, and posterior sphincter supply their respective parts of the body with the minor muscular threads.

It is time to inquire about the nervous agencies that stimulate the action of these powerful muscular organs, and we find their volume, as in *Pholas*, not to be apparently in accordance with them. There are just above the mouth two minute ganglia so nearly confluent, that they may be considered as one; from them, two very slender threads descend to the roof of the anal aperture, distributing numerous ramifications to the proper stomach and foot, whilst the main cords pass into the base of that portion of the tubular mantle which contains the liver, ovarium and pericardium, in a distinct independent membrane that may be called a peritoneum, and in their passage under these organs they furnish them with filaments, and then piercing the fundus of the peritoneum enter the pericardium, and form a junction with a second larger ganglion that is fixed in that cavity in some measure enveloped by the heart and auricles, and is only visible when the pericardium is cleared of them: this mass supplies the terminal part of the ovarium, the entire branchiæ, and all the posterior parts of the body with nervous threads.

The digestive organs next present themselves. Authors have said there are two distinct stomachs; this is not so: they have mistaken the peritoneal cavity containing the liver, ovarium and pericardium, for one: the true and only stomach is within the hemispherical valves, in immediate contact with the greenish brown liver that pours the bile into it from above; it is very small; the walls are simple; and the elastic stylet and gizzard, which some naturalists denominate the tricuspid membrane, work within it as a gizzard and attritor.

I have carefully dissected the apparatus of the present species, and have it on a card in a united state, showing the hard horny parts of the rubbing portion. Some authors say that this machine is not to be found in all bivalves. Which? I am inclined to think that none are without it.

The mouth is a triangular V-shaped aperture placed immediately above the foot; on each side there is a palpar or salivary mass, which from its wavy streamlets appears to be of the latter quality; they have a glandular aspect, and may perhaps combine tentacular uses. The mouth opens into a short œsophagus which descends into a small stomach, the contents of which under the microscope appeared to be wood reduced to a pulpy mass, that after having undergone the action of the gizzard is discharged into the intestine, which, as soon as it springs from the pylorus, mounts to the integuments that divide the dorsal aperture from the peritoneal cavity, passing through them and showing from without a tubular inflation that has been mistaken for the œsophagus of the second stomach, but is undoubtedly an intestine, which I have traced and opened throughout its length; it proceeds in a straight line through the liver to about the centre of the ovarium for 1 inch $\frac{7}{10}$ths, when, by a sudden short turn, it retraces its steps for $\frac{9}{10}$ths of an inch, when it again turns and makes an oblique reach of about $\frac{1}{2}$ an inch, and then makes a further gyration, and forms a complete but small sigmoid flexure, and pursues its course for 1 inch $\frac{3}{10}$ths to the anterior part of the body, which it descends, coasting for $\frac{6}{10}$ths of an inch the foot to the external pyloric point of the stomach, and becoming a short rectum, opens into the tubular mantellar canal at some distance from the anal siphon; the whole of the circumvolution is about 5 inches, far exceeding that of the Pholades. The valvular dorsal flap I have before mentioned covers the aperture under it, assisted by a fine membrane perforated to correspond with the oval aperture, which appears to be in aid of the external valve for preventing the ingress or egress of water, except at the minute perforation, in unison with the true mouth. I can conceive no other use for this valve than to admit water to the mouth, œsophagus and stomach when the foot is engaged in excavation, and in consequence perhaps the anterior gape is hermetically closed.

It would appear that the animal swallows the excavated wood, and does not eject it by currents of water. I infer this, as not only the stomach but the intestine is always filled with a pulp, which under the microscope has the aspect of ligneous debris. The *Patellæ* operate in like manner.

The circulation is venous, arterial and branchial, and consequently complete. The respiratory apparatus has been strangely misunderstood; it has been described to consist of four fleshy cords, portions of which Sir Everard Home pronounced to be the testes, and others the ovaria; these views are erroneous. But we will first mention the heart and auricles, which are placed at the base of the ovarium in the peritoneal cavity within the mantle, but in a distinct pericardium; the heart is an elongated, very pale bluish white opake ventricle, accompanied by two symmetrical fusiform slender auricles that are also opake, somewhat posterior to it, which appear to pour the aërated blood into it by lateral valvular ducts; on opening the ventricle its walls did not exhibit any particular muscularity; we were not successful in detecting the valves of the auricles. There is at the posterior part of the auricles a white, suboval, subglobular, fine granular mass, touching and partly surrounding them; we are unable to state its nature; it is not part of the ovarium, which terminates before the pericardium commences, and in such a situation it cannot be the organ to animalize the ova: I am inclined to consider it a gland that distils a liquor for the use of the heart and auricles.

At the base of these organs the four cords that have created such difference of opinion as to their uses come into view, but they do not appear to be either the branchiæ, arteries, veins, testes or ovaria; still they have a sort of connection with the branchiæ; the two longer and larger brown lines have their origin on each side the hemispherical valves, and proceed, attached to each latero-dorsal range of the mantle, to the posterior siphons; they appear to be composed of red brown granular points; within these two lines, but not until the branchiæ commence, two others of smaller size and nearly similar composition run parallel, and terminate with the larger ones at the siphons; the addition of the two shorter and smaller cords springing from the larger at the point where the branchiæ begin, appears to show a connection of these appendages with them, whatever their nature may be. We will now consider the structure of the branchiæ, and the surmises on the nature of the four brown cords that accompany them.

The branchial apparatus is composed of only two narrow laminæ running horizontally from their origin, where they are the broadest, attached to the dorsal region of the mantle and tapering gradually to the siphons; but before they approach them, for an inch or two, they become more fleshy and linear, and are what Sir Everard Home terms "the strong substance for the support of the weakest part of the body of the animal;" they do not enter the siphon, as in *Pholas*, being cut off therefrom by the posterior sphincter; their colour is reddish brown, and the blood, as seen by the microscope, very pale pink; their length in a nine-inch animal is from 4 to $4\frac{1}{2}$ inches. The branchiæ, when not in natural *situ* and opened for dissection, appear as a plane, but in the living animal are doubled together and hang on each other, but without the intervention of any substance between them, and in this respect similar to the branchiæ of the Pholades when they have cleared the body and become linear; but in *Teredo* they are altogether posterior to the body; the branchial artery of each lamina runs as is usual parallel, and just under their junction with the body, in the closest connection with the granular cords in question; but each branchial vein runs parallel and decidedly within the granular cords, and shows no connection with them like the arteries. What then is the nature of these appendages, particularly of the longer ones? I am inclined to consider them glandular bodies, which perhaps serve either as emunctories, to carry off injurious matters from the blood, or as absorbents of what is beneficial: I am quite at a loss to say which of these very opposite views is most probable. I state another surmise: they may be an aid to extract additional quantities of air to invigorate the branchiæ in the production of the utmost vitality for the blood, to support the animal in the arduous labours of excavation: in this view they may be considered as rudimentary branchiæ; but after all is said, their true functions are doubtful.

With respect to the secretions, all that I know of them has been mentioned under the heads of the organs I have described, except those of the ovary, which will be noticed in the next section. These animals, like all the bivalves, are strict hermaphrodites. The ovarium is a white glandular body entwined with the liver, but as it approaches the pericardium it becomes a distinct mass; and what is unusual at this time of the year, 20th January, in several of the ovaria the contents had begun to assume the appearance of ova, but with the utmost power of the microscope I could not perceive any trace of the membranous pyriform bodies containing a fluid which I have observed in the genial months in many of the ovaries of the strict hermaphrodite bivalves and Gasteropoda, which I consider to be the male influences; nor could I discover any other organ that had the slightest pretension to be regarded of a similar nature. I failed to verify the oviduct, but from the position of the ovarium I have little doubt that it passes at and under that portion of the peritoneal cavity which contains the terminus of the ovary, into the anal compartment of the mantellar tube, about $1\frac{1}{2}$ inch above the siphon, and that the ova are there discharged. I do not think the branchiæ in this species serve as receptacles for the ova; their structure is not calculated for such purpose.

I have now to make a few observations on the camerated structure of the posterior part of the protective tube, which has caused malacologists much speculation on the uses of it; some, myself amongst them, thought the laminar spaces might be for a time to protect the pulli until ultimate exclusion.

These ideas were dispelled by the discovery of the fixture of the posterior part of the animal by the strong oval muscles springing from the sphincter, which induced me to examine this portion of the tube with care, and in a fine full-grown specimen I discovered the principal object, if not the precise animal œconomy, of the laminæ. I perceived in the centre of each plate a decided muscular impression, which, on comparison with the last-formed one of the sphincter muscle, proved to be identical in shape; this fact made it evident, that the animal, either when full-grown, or when growing, if its longitudinal increase is not correspondent with the boring progress, must, by being posteriorly fixed, either suspend excavation, rupture the mantle, or have the power of advancing the muscle of attachment. This advancement of the muscle is not a new fact; it has been observed in the *Spondyli* and *Ostreæ*; and it cannot be doubted that nature has conferred on the present species the power of detaching and advancing the muscle of attachment, and that each hoop-shaped lamina, thrown out for some point of the animal œconomy, marks the periodic removal of the muscle. The laminæ are always more numerous in the longer and older animals; in very young specimens there are only 1–3, and in the older ones 20–40.

When authors have stated that this species has the tube without concamerations, we presume they have only had opportunities of examining very young or imperfect specimens; in all the specimens I have seen, many of which were 10 inches long, they were present, and I believe that no species of *Teredo* is without them.

The plugging up of the terminal volutions in *Aporrhaïs* and other Gasteropoda, and the consequent withdrawal of the posterior parts of the animal, are analogous to this operation in *Teredo*; the same principle excites the action in both cases, self-preservation.

It will be observed that the alliance of *Teredo* with *Pholas*, through the apophysary processes, is more decisive than between any two other bivalve families. I trust that I shall not be considered fanciful if I venture to remark, that there are points of analogy between *Teredo* and *Dentalium* so striking as almost to give some weight to the idea that it forms the passage to the Gasteropoda; in support of these views I beg malacologists to observe the similar vermiform character of the animals, the attachment of their posterior parts to the shells by sphincteroid muscles, the peculiar plan of the admission of the water by short siphons in conjunction with the sphincter, the single branchial dorsal lamina on each side, their separation from the body, and other minor analogies. These concordances almost make me think my hypothetical surmises have some foundation, and that the transfer of *Pholas* and *Teredo*, &c., from the bottom to the top of the scale of the bivalves, would not be an injudicious procedure.

I conclude by apologizing for the unreasonable draught I have made on the valuable pages of the 'Annals.'

I am, Gentlemen, your most obedient servant,

WILLIAM CLARK.

XXIX.—*Descriptions of some newly discovered Species and Characters of a new genus of* Araneidea. By JOHN BLACKWALL, F.L.S.

Tribe OCTONOCULINA.

Family SALTICIDÆ.

Genus *Salticus*, Latr.

1. *Salticus obscurus*.

Length of the male $\frac{1}{8}$th of an inch; length of the cephalothorax $\frac{1}{16}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{16}$; length of a posterior leg $\frac{1}{9}$; length of a leg of the third pair $\frac{1}{12}$.

Cephalo-thorax large and nearly quadrilateral, projecting a little beyond the base of the falces*, which are small, conical

* The organs of spiders improperly denominated mandibles, as they are situated above the labrum, and, consequently, form no part of the oral apparatus, I have proposed to name *falces*.

and vertical: maxillæ short, powerful, straight, enlarged and rounded at the extremity: lip oval, obtuse at the apex: sternum oval. These parts are of a dark reddish brown colour, the cephalo-thorax being sparingly clad with white hairs. The intermediate eyes of the anterior row are greatly larger and the intermediate eye of each lateral row is much smaller than the rest. Legs short, robust, of a reddish brown colour, the metatarsi and tarsi being the palest; the fourth pair is rather the longest, then the first, and the third pair is the shortest; the femora, genua and tibiæ of the anterior pair of legs are remarkably powerful, the first being very convex on the upper part, and the last densely covered with hairs on their inferior surface. Each tarsus is terminated by two curved claws, below which is a small scopula or brush. Palpi short, and similar in colour to the legs; the radial joint is smaller than the cubital; the digital joint is large, oval, convex and hairy externally, concave within, comprising the palpal organs, which are highly developed, very prominent at the base, provided with a black spine curved into a circular form at their extremity, on the outer side, and are of a red-brown colour. Abdomen oviform, convex above, projecting a little over the base of the cephalo-thorax; it is of a very dark reddish brown colour, having a few white hairs distributed over its upper surface, and on each side of the medial line, at its anterior extremity, there is a short longitudinal streak composed of white hairs, which is not very conspicuous.

I have described this spider from a specimen in the cabinet of Francis Walker, Esq., of Arno's Grove, Southgate, Middlesex, in which locality it was taken in May 1848.

Family Thomisidæ.

Genus *Thomisus*, Walck.

2. *Thomisus formosus.*

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 $\frac{1}{10}$; length of an anterior leg $\frac{7}{20}$; length of a leg of the third pair $\frac{3}{16}$.

Eyes disposed on the anterior part of the cephalo-thorax in two transverse curved rows, forming a crescent whose convexity is directed forwards; the lateral eyes of both rows, which are seated on tubercles, are larger than the rest, those of the anterior row being the largest of the eight. Cephalo-thorax large, slightly compressed before, broadly truncated in front, convex and glossy: falces short, cuneiform, vertical: maxillæ convex near the base, pointed at the extremity, and inclined towards the lip, which is rather long and triangular: sternum heart-shaped: the first and second pairs of legs, which are much longer and more powerful than the third and fourth pairs, are nearly equal in length, the first pair being rather the longer, and are provided on the under side of the tibiæ and metatarsi with two parallel rows of strong spines; the legs of the third pair are the shortest: the palpi are short, and have a curved pectinated claw at their extremity. These parts, which are of a pale green colour in immature females, are greenish yellow in adults. The tarsi are terminated by two curved deeply pectinated claws. Abdomen oviform, sparingly supplied with hairs, convex above, projecting over the base of the cephalo-thorax; the upper part is of a bright red colour, paler in the medial region, and has a few obscure transverse lines of a lighter hue above the spinners; the sides are yellowish white, and the under part is pale red mottled with yellowish white spots. Sexual organs brownish black.

The male, though rather smaller and slenderer than the female, resembles her in colour, with the exception of the cephalo-thorax and its appendages which are red; the legs also have the same relative length, but their absolute length is greater, an anterior one measuring $\frac{23}{48}$ths of an inch. The radial joint of the palpi, which is rather stronger than the cubital, projects a large pointed apophysis from its extremity, on the outer side; the digital joint is oval, pointed at its termination, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, not very complicated in structure, and are of a red colour. The concavity of the digital joint does not extend to its extremity, which is compact.

An adult male and female of this handsome species, captured at Southgate in 1848, the former in May and the latter in June, are in Mr. Walker's cabinet.

Genus *Philodromus*, Walck.

3. *Philodromus Clarkii.*

Length of the male $\frac{1}{7}$th of an inch; length of the cephalo-thorax $\frac{1}{16}$; breadth $\frac{1}{18}$; breadth of the abdomen $\frac{1}{16}$; length of a leg of the second pair $\frac{3}{8}$; length of a leg of the fourth pair $\frac{1}{4}$.

Cephalo-thorax nearly circular, slightly compressed before, convex, with a small indentation in the medial line of the posterior region: falces small, conical, vertical: maxillæ gibbous near the base, inclined towards the lip, and convergent at the extremities: lip triangular: sternum heart-shaped: legs long and slender, provided with hairs and spines; the second pair is the longest, then the first, and the fourth pair is the shortest. These parts are of a red-brown colour freckled with minute spots of a deeper hue. Each tarsus is terminated by two curved pectinated claws, below which is a small scopula. The palpi are short and resemble the legs in colour; the radial joint is smaller than the cubital, and projects a large and somewhat pointed apophysis from its extremity, on the outer side; the digital joint is of an irregular oval figure, being convex at the base and depressed near the middle; it is hairy externally, concave within, comprising the palpal organs, which are moderately developed and not very complicated in structure; a long, slender, black spine, prominent at its origin on the inner side, is curved round their extremity, and they are of a red-brown colour. The concavity of the digital joint does not extend to its termination, which is compact. Eyes disposed on yellowish white spots on the anterior part of the cephalo-thorax in two curved transverse rows, forming a crescent whose convexity is directed forwards; the lateral eyes of each row are seated on small but distinct prominences. Abdomen oviform, sparingly clad with hairs, convex above, projecting a little over the base of the cephalo-thorax; its colour is red-brown, palest on the sides, freckled with minute spots of a darker hue; on the upper part a series of oblique, not very distinct, yellowish white spots occurs on each side of the medial line; these series are slightly curved, and, as their extremities meet, describe a long narrow oval.

In connecting the name of the Rev. Hamlet Clark with this species, I pay a just tribute to the merits of a zealous and intelligent naturalist, and, at the same time, gratify my feelings of friendship and esteem for a relative to whom I am obliged for numerous specimens of spiders, and also for an opportunity of inspecting Mr. Walker's highly interesting collection of British *Arachnida*.

A specimen of *Philodromus Clarkii*, taken at Southgate in June 1849, is in the cabinet of Mr. Walker.

Family Linyphiidæ.

Genus *Neriëne*, Blackw.

4. *Neriëne apicata.*

Length of the male $\frac{1}{12}$th of an inch; length of the cephalo-thorax $\frac{1}{24}$; breadth $\frac{1}{30}$; breadth of the abdomen $\frac{1}{24}$; length of a posterior leg $\frac{3}{20}$; length of a leg of the third pair $\frac{1}{9}$.

Cephalo-thorax oval, convex, glossy, with an indentation in the medial line of the posterior region; an obtuse conical prominence, surmounted by a tuft of short hairs, occurs immediately behind the eyes, near the base of which, on each side, is a small cavity: falces conical, vertical, somewhat divergent at their extremities, and armed with teeth on the inner surface: maxillæ enlarged where the palpi are inserted, obliquely truncated at the extremity, on the outer side, and inclined towards the lip, which is semicircular and prominent at the apex: sternum heart-shaped, broad, convex and glossy. These parts are of a very dark reddish brown colour. Eyes disposed on the anterior part of the cephalo-thorax; the four intermediate ones describe a trapezoid whose anterior side is the shortest, and those of each lateral pair are seated obliquely on a tubercle, and are contiguous; the anterior eyes of the trapezoid are the smallest of the eight. Legs moderately long, provided with hairs; the fourth pair is the longest, then the first, and the third pair is the shortest; they are of a reddish brown colour, the femora being the reddest. 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 resemble the legs in colour, but are rather paler; the humeral joint is somewhat curved towards the cephalo-thorax; the cubital joint is clavate, and the radial, which is short, has two curved, pointed, black apophyses at its extremity, in front, the superior one being the larger and more prominent; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs, which are moderately developed, complicated in structure, and of a reddish brown colour. The abdomen is oviform, sparingly clad with hairs, convex above, projecting over the base of the cephalo-thorax, and is of a brownish black colour. The branchial opercula are brown.

A male of this species, having the palpal organs completely developed, was found on a rail at Oakland in February 1850.

Genus *Walckenaëra*, Blackw.

5. *Walckenaëra Hardii.*

Length of the male $\frac{1}{6}$th of an inch; length of the cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{16}$; breadth of the abdomen $\frac{1}{16}$; length of an anterior leg $\frac{1}{4}$; length of a leg of the third pair $\frac{1}{5}$.

This species, which is nearly allied to *Walckenaëra cuspidata*, has the cephalo-thorax oval, convex, glossy, prominent before, with an obtuse conical protuberance situated in the space surrounded by the eyes, a little in advance of the posterior pair, immediately behind which is a small tuft of hair: falces powerful, conical, divergent at the extremities, armed with teeth on the inner surface, and inclined towards the sternum, which is heart-shaped: maxillæ moderately strong, obliquely truncated at the extremity, on the outer side, and inclined towards the lip, which is semicircular and prominent at the apex: legs provided with hairs; the anterior and posterior pairs, which are the longest, are equal in length, and the third pair is the shortest. These parts are red-brown, the lip being much the darkest, and the legs the lightest coloured. Each tarsus is terminated by three claws; the two superior ones are curved and minutely pectinated, and the inferior one is inflected near its base. Eyes disposed on the anterior part of the cephalo-thorax; those of the posterior pair are wide apart, and form with those of the anterior pair, which are the smallest and near to each other, a trapezoid whose anterior side is much the shortest; the eyes of each lateral pair are placed obliquely, and are the largest of the eight. Palpi red-brown, the radial and digital joints being much the darkest; the humeral joint is curved towards the cephalo-thorax, and the cubital and radial joints are clavate, the latter, which is the stronger, projecting two apophyses from its extremity, the larger situated in front, and the smaller on the under side; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are moderately developed, complicated in structure, with a small curved spine, enveloped in membrane, at their extremity, and are of a dark reddish brown colour. The abdomen is oviform, sparingly clad with hairs, and brownish black. The branchial opercula are yellowish brown.

I have named this spider in compliment to James Hardy, Esq., of Penmanshiel, Berwickshire, North Britain, whose various contributions to entomology are duly appreciated by zoologists. It was sent to me by Mr. Hardy in December 1848, with other specimens of *Araneidea* captured by him in Berwickshire.

Family Epëiridæ.

Genus *Epëira*, Walck.

6. *Epëira signata.*

Length of an immature male $\frac{3}{16}$ths of an inch; length of the cephalo-thorax $\frac{1}{12}$; breadth $\frac{1}{14}$; breadth of the abdomen $\frac{1}{10}$; length of an anterior leg $\frac{7}{24}$; length of a leg of the third pair $\frac{3}{20}$.

Eyes disposed in two transverse rows on the anterior part of the cephalo-thorax; the four intermediate ones form a square, and each lateral pair is seated obliquely on a small prominence. Cephalo-thorax convex, rounded on the sides, compressed before, with an indentation in the medial line of the posterior region; it is well supplied with white hairs, particularly on the anterior part, and is of a dark red-brown colour, which is most intense on the sides; a conspicuous yellowish white spot occurs in the angle formed by the furrows which serve to distinguish the head from the thorax. Falces conical, vertical, and armed with two rows of teeth on the inner surface; they are of a red-brown colour, and are darkest at the base, in front. Maxillæ short, straight, enlarged and rounded at the extremity: lip nearly semicircular, but somewhat pointed. Sternum heart-shaped.

These parts are of a dark red-brown colour, with the exception of the extremities of the maxillæ and lip, which are much paler. Legs robust, provided with hairs and spines; they are of a pale reddish brown colour, with streaks, spots and annuli of a deeper hue. The palpi are short and resemble the legs in colour. The specimen from which the description was made had the digital joint of the palpi very tumid, but the palpal organs were not developed, demonstrating that it had to undergo its final change of integument before it arrived at maturity. The tarsi are terminated by the customary number of claws of the usual structure. Abdomen short, broad, sparingly clad with hairs, convex above, projecting over the base of the cephalo-thorax; the upper part is of a dark red-brown colour freckled with numerous minute spots of a lighter hue; near the anterior extremity, on each side of the medial line, is a large, conspicuous, yellowish white spot; the sides are paler than the back, and along the middle of the under part a broad, dark, reddish brown band extends, which comprises two curved, yellowish white lines whose concavities are directed towards each other. The branchial opercula are of a dark reddish brown colour.

This distinctly marked spider, which was captured at Broadstairs in Kent, in the month of September, occupies a place in Mr. Walker's cabinet.

7. *Epëira ornata.*

Length of the female $\frac{1}{4}$th of an inch; length of the cephalo-thorax $\frac{1}{9}$; breadth $\frac{1}{10}$; breadth of the abdomen $\frac{1}{8}$; length of an anterior leg $\frac{5}{16}$; length of a leg of the third pair $\frac{5}{24}$.

Cephalo-thorax somewhat oval, slightly compressed before, glossy, convex, with an indentation in the medial line of the posterior region: falces powerful, conical, vertical, armed with two rows of teeth on the inner surface: maxillæ short, strong, straight, and greatly enlarged and rounded at the extremity: lip nearly semicircular, but rather pointed: legs robust, provided with hairs and spines: palpi short, with a curved pectinated claw at their extremity. These parts are of a dull yellow colour tinged with red, the extremities of the maxillæ and lip being much the palest. Sternum heart-shaped, dull yellow marbled with red. Eyes disposed in two transverse rows on the anterior part of the cephalo-thorax; the four intermediate ones form a square nearly, the posterior side being rather the shortest; the eyes of each lateral pair, which are contiguous, and those of the anterior intermediate pair are seated on small prominences. Abdomen oviform, thinly clad with hairs, convex above, projecting over the base of the cephalo-thorax; it is of a fine bright red colour, palest on the sides and under part; a series of minute indentations of a light yellow hue extends along the upper part, on each side of the medial line. The branchial opercula are yellow, and a long pale process connected with the sexual organs is directed backwards.

A specimen of this showy *Epëira* is in Mr. Walker's cabinet. It was taken in April 1848, but in what locality is not stated.

Tribe SENOCULINA.

Family Dysderidæ.

Genus *Schœnobates*, Blackw.

Eyes six, disposed on the anterior part of the cephalo-thorax; four, situated near the frontal margin, describe a transverse curved row whose convexity is directed backwards, and behind each lateral eye another is placed.

Maxillæ very powerful, short, broad, gibbous near the base, somewhat enlarged and rounded at the extremity, and slightly inclined towards the lip.

Lip large, triangular.

Legs moderately long and robust; the anterior and posterior pairs, which are the longest, are equal in length, and the third pair is the shortest.

8. *Schœnobates Walkeri.*

Length of the male $\frac{1}{8}$th of an inch; length of the cephalo-thorax $\frac{1}{16}$; breadth $\frac{1}{20}$; breadth of the abdomen $\frac{1}{20}$; length of an anterior leg $\frac{3}{16}$; length of a leg of the third pair $\frac{1}{8}$.

Legs moderately robust, provided with hairs and a few spines; they are of a yellowish brown colour, with the exception of the femora of the first and second pairs, which are dark brown. Each tarsus is terminated by two small curved claws. Cephalo-thorax oval, convex, with an indentation in the medial line of the posterior region; it is of a red-brown colour, somewhat darker on the margins, and has several rows of white, iridescent, scale-like hairs on the sides, which converge towards the centre. Falces subconical, without teeth on the inner surface: sternum heart-shaped. These parts, with the maxillæ and lip, are of a red-brown colour. The humeral joint of the palpi is dark brown, the cubital yellowish brown, and the radial, which has a small pointed apophysis at its extremity, in front, is reddish brown; the digital joint is oval, convex and hairy externally, concave within, comprising the palpal organs; they are highly developed, prominent, not very complicated in structure, and are of a reddish brown colour. Abdomen oviform, convex above, projecting a little over the base of the cephalo-thorax; its colour is dark brown mingled with yellowish brown; white, iridescent, scale-like hairs are distributed over its surface, and a spot composed of dense white hairs occurs immediately above the spinners.

The spider from which the foregoing description was made is preserved in Canada balsam, and has suffered from compression; consequently, my account of it is not so complete as it would have been could I have examined it more perfectly. After a most careful and prolonged inspection under the microscope I could not ascertain that it had more than six eyes, which are arranged in the order stated above; but even should it ultimately be found to possess eight of those organs, it must still, by its other essential characters, constitute a new genus.

I feel sincere pleasure in dedicating this remarkable species to Francis Walker, Esq., F.L.S., a distinguished naturalist, well-known to the entomological readers of the 'Annals and Magazine of Natural History' by his valuable papers on *Aphides*; and I gladly avail myself of this opportunity to express my thanks to Mr. Walker for his liberality in permitting me to publish descriptions of any *Araneidea* contained in his cabinet which I suspected to be unknown to arachnologists.

Schœnobates Walkeri was taken at Broadstairs in Kent in the month of September, and is in Mr. Walker's collection of *Arachnida*.

XXX.—*Descriptions of a new genus and six new species of Saurian Reptiles.* By P. H. Gosse, A.L.S.

Family Iguanadæ.

1. *Anolis iodurus.* The Purple-tailed Anolis. Crest on the nape prominent: ventral scales smooth, roundish; those of the back small, many-sided, keeled; those of the sides granular: tail rather compressed, slightly crested. ♂. Length of body 2 inches; of tail 3 inches; total 5 inches. Glaucous green, marked with irregular waved lines of a darker shade; upper surface of the head marked with pale dots, confluent: sides yellow-green, sometimes brassy: basal portion of the tail brilliant light purple; the terminal two-thirds pale brown: under parts of the body and limbs pale glaucous: goitre bright orange.

The colour changes under the excitement of fear or anger to sooty brown, usually paler on the part which before was purple; the legs appear banded with transverse pale lines: under parts brownish gray, obscurely spotted with brown.

Sometimes the general colour is a chaste gray, tinged with reddish violet on the neck and shoulders; the purple of the tail bright.

The brown hue increases in intensity, I believe with anger, and sometimes extends over the belly, paled along the mesial line; at other times the belly retains the ordinary glaucous hue. The goitre is not susceptible of any change of colour.

♀. Length of body $1\frac{1}{2}$ inch; of tail $2\frac{1}{4}$ inches; total $3\frac{3}{4}$ inches. Upper parts wood-brown, crossed by three broad transverse bands of black, the first in the middle of the trunk, the third immediately over the thighs, the second intermediate; each band is edged anteriorly and posteriorly with white, and a narrow white line runs along the mesial line of the loins, dividing the second and third band: tail crossed by four or five pale lozenge-shaped marks; outer surface of limbs crossed by several darker transverse bands. Under parts both of body and limbs yellowish white.

The females in this genus seem to have the faculty of changing their colour in much less perfection than the male; and I have reason to believe that the power of stretching the goitre is very little, *if at all,* possessed by this sex.

Hab. Jamaica. Very common about houses in the lowlands. Specimens in Brit. Mus.

The trivial name is formed from *ἰώδης, violet-coloured,* and *οὐρὰ, the tail.*

In spirits this resembles *A. punctatus,* a Brazilian species, but differs from it in the tail being much longer, more slender, and more compressed; and in the white dots on the head being much more obscure, and more confluent.

2. *Anolis opalinus.* The Pearly-bellied Anolis. Nuchal crest inconspicuous: tail roundish, slightly compressed; indistinctly crested; strongly keeled beneath, the keels forming about six continuous ridges. ♂. Length about the same as that of *A. iodurus.* Drab, or pale wood-brown, thickly studded with dark brown spots, irregularly confluent, so as to form a rude netted pattern; the mesial line of the back is slightly paler than the ground colour, and, being crossed by undefined bands of dark brown, displays a series of pale areas along the dorsal surface; the alternate pale and dark bands are most conspicuous and most regular on the tail. A stripe of dark brown, still reticulated, proceeds from the muzzle through the eye, and along the side to the thigh, where it is lost; below it runs a pale stripe parallel to it. The external surface of the limbs is reticulated and banded like the body. The under parts pale yellowish, speckled at the sides with brown. The scales of the belly are iridescent in both this and the preceding species, but chiefly in this, the belly of which, when the angle formed by the incident ray and the reflected one is very wide, glows with a ruddy golden hue, exceedingly beautiful and opaline.

Its change is to a nearly uniform brownish black, in which the markings are but just distinguishable by a slight difference of shade; sometimes, however, the whitish areas of the back are more than usually conspicuous, especially one upon the rump of a hastate form.

Hab. Jamaica. In the same situations as the preceding species. Very common. Specimens in Brit. Mus.

3. *Draconura catenata.* The Chain-marked Anolis. Three or four series of keeled scales run down the back, slightly larger than those of the sides, but diminishing gradually towards them. Muzzle clothed with irregular, subequal, polygonal scales, two- or three-keeled. Ears linear, perpendicular. Tail slightly compressed. ♂. Length of body $1\frac{8}{10}$ inch; of tail 3 inches; total $4\frac{8}{10}$ inches. Pale dusky or drab, divided by two paler bands running down each side and one down the middle of the back. Along the dark band on each side of the mesial line, a series of irregular-oval spots of blackish hue runs from the shoulders to the extremity of the tail; a band of the same hue passes diagonally from a point between the eye and ear, meeting at the nape. Legs and upper parts tinged with fawn colour; thighs and legs obscurely banded with black. Lips mottled with blackish. Goitre rich crimson. Under parts whitish with an opaline lustre.

Its change is from a state in which the hue is pale, and the spots only just visible, to a much darker hue, the spots nearly black, the sides and belly mottled with blackish. The only specimen I ever met with was a male, apparently adult, the testes large.

Hab. Bluefields, in Jamaica. Rare. Brit. Mus.

Genus Placopsis (πλάξ, *a broad plate,* and ὄψις, *the face*).

Nostril superior, above the eye-ridge, subapical. Toes dilated, unequal. Femoral pores none. Head lengthened, covered from the interparietal to the muzzle with large, angular, smooth plates, without any small scales: rostral plate erect; jaws even; rounded. Ventral scales imbricate, flat. Back and sides covered with smooth, oval, flat scales, not imbricate, separated by minute grains. Scales on each side of the goitre long-oval, loosely imbricate. Tail compressed, with a dentelated crest above; keels forming ridges beneath.

4. *Placopsis ocellata.* The Plate-headed Anolis. Head four-sided, flattened. Interparietal oblong, rounded behind, square in front. Ears small. Goitre very large. Nape slightly crested, only in adult. ♂. Length of body 3 inches, of tail $3\frac{3}{4}$ inches; total $6\frac{3}{4}$ inches. Ground colour delicate greenish white, crossed by interrupted and irregular bands of black, of which about four are situated on the body, and about eight on the tail; the latter

the more conspicuous and well-defined. Belly crossed by zigzag lines of reddish brown. Goitre dark crimson, with few white scales.

♀. The bands or spots are smaller and more irregular.

In the ♂, about an hour after the specimen was in my possession, the bands on the tail, which before were very vivid, had paled so as to be scarcely distinguishable. The ♀ in about the same time changed to a pale umber-brown, in which however the markings were still distinct.

Hab. St. Elizabeth's, and Westmoreland, in Jamaica. Rather rare. Brit. Mus.

Family Geckotidæ.

5. *Sphærodactylus Argus.* The Eyed Pallette-tip. Length $2\frac{1}{4}$ inches. Upper parts purplish brown, marked with dark ocelli, which have pale disks. On the head the ocelli have white disks, and are lengthened, so as to form about six longitudinal interrupted bands, reaching from the nose to behind the fore-legs: thence the spots are more obscure, irregularly scattered, and interspersed with black dots. Under parts grayish yellow, unspotted. Tail reddish brown above, with the ocelli in some specimens large and indistinct, in others small and beautifully clear, and in others almost obsolete: the under surface of the tail brick-red, unspotted. The scales are well-defined, and form a beautiful and regular network pattern, all over the body.

Hab. Jamaica. Common in houses, in corners, and crevices. Specimens in Brit. Mus.

This species bears a considerable resemblance to *S. punctatissimus* from Martinique; but that species is of a paler hue, has the lines on the head more numerous, and both these and the pale spots are simple, or destitute of dark outlines.

It appears to be *Salamandra minima, fusca, maculis albis notata* of Sloane (tab. 273. figs. 7, 8), but he calls it Wood-slave, a term which (in the leeward parts of the island at least) is appropriated to *Mabouya agilis,* and gives *Mabouya* as a synonym. And then, to make the confusion worse, he describes, somewhat indistinctly, indeed, the habits of *Thecadactylus lævis.*

6. *Sphærodactylus oxyrhinus.* The Sharp-nosed Pallette-tip. Head narrow, muzzle lengthened, nose sharper than in the preceding. Length ——? (about the same size as the preceding, but the specimen, being mutilated, could not be measured). Pale wood-brown above, uniformly covered with dark specks, generally confluent, so as to present a sinuous pattern. Under parts pale yellowish, lightly speckled on the throat and sides. Tail ——? (this was wanting in the only specimen I ever obtained).

Hab. St. Elizabeth's, in Jamaica. Rare. Taken in a house. Brit. Mus.

This is a very distinct species. The description of *S. nigro-punctatus* in Mr. Gray's 'Synopsis of the Reptiles in the British Museum,' might be applied to this, but a comparison of the specimens shows that they are not at all alike; *nigro-punctatus* being much larger, of a deeper brown, with the specks scarcely discernible.

The trivial name is formed from ὀξὺς, *sharp*, and ῥὶν, *the nose*.

XXXI.—*Chronological Exposition of the Periods of Vegetation and the different Floras which have successively occupied the surface of the Earth.* By M. Adolphe Brongniart.

[Concluded from p. 203.]

III. Kingdom of the Angiosperms.

The predominant character of this last transformation of the vegetation of the globe is the appearance of the angiospermous Dicotyledons, of those plants which at the present time constitute more than three-quarters of the vegetable creation of our epoch, and which appear to date their predominance from the origin of the tertiary formations. For a long time I imagined that these plants had not begun to present themselves until posterior to the chalk, with the first beds of the tertiary formations; but more recent researches have shown that the beds belonging to the cretaceous formation already present certain very positive examples.

The plants even extend back to the commencement of the cretaceous epoch; for it is certain that several well-determined species exist in the *Quadersandstein* and the *Planerkalk* of Germany, which appear to correspond to the *grès vert* of France or greensand of English geologists, although this formation has never displayed any of them in France and England, and presents only a few examples of Cycadeæ, Coniferæ and marine plants; but in the south of Sweden, at Kopingue in Scania, a few specimens of dicotyledonous leaves present themselves also associated with a species of Cycadea in beds which have been referred to the cretaceous glauconia or greensand; so that the cretaceous formation, taken as a whole, appears to constitute a first period of the reign of the Angiosperms, forming, so to speak, the transition between the vegetation of the secondary formations and that of the tertiaries, presenting, like the former, still a few Cycadeæ, like the latter, already a few angiospermous Dicotyledons, and thus preluding the considerable development of the latter plants in the following period. This period is, moreover, characterized by several Coniferæ peculiar to it, which appear very distinct from those of the Wealden formations and those of the eocene epoch of the tertiary formations; such, especially, are the *Cunninghamites.*

We may distinguish then, in this reign of the Angiosperms, two great periods:—

1. The cretaceous, a kind of transition period.

2. The tertiary period, presenting all the characteristics resulting from the predominance of the angiospermous Dicotyledons and Monocotyledons, and divisible into several epochs, the characters of which will not be well established until all the doubts have been removed as to the concordance of the different local series of the tertiary formations.

5. *Cretaceous Period.*

The cretaceous period properly so styled perhaps comprises several distinct epochs; but the beds in which fossil plants have been observed not having been always classed with precision in the different subdivisions of this formation, it is impossible to establish its chronology with certainty. Still, an epoch should be distinguished which appears to have immediately preceded this formation, as also one which follows it and yet differs from the eocene epoch.

We are acquainted with the fossil plants of the cretaceous period:—

1. In the marine subcretaceous lignites of the Isle of Aix near La Rochelle, and of Pialpinson in the department of Dordogne; these would be the oldest beds of the cretaceous formation or the latest of the Jurassic. In these have been found only marine plants and the wood and branches of the Coniferæ.

2. In the chloritic chalk or greensand of the south of England, of the environs of Beauvais and the environs of Mans; in these only Cycadeæ, Coniferæ, or marine plants have been observed.

3. In the same formation in Scania, in which M. Nilsson has observed dicotyledonous leaves mingled with the leaves of Cycadites.

4. At Niederschöna, near Freyberg, in Saxony, beds analogous to the greensand or to the *Quadersandstein,* containing a tolerable variety of fossils, Cycadeæ, Coniferæ, and Dicotyledons, particularly species of *Credneria.*

5. In the *Quadersandstein* of Bohemia and Silesia, at Blankenburg, Tiefenfurth, Teschen, &c., where this sand is characterized by the presence of dicotyledonous leaves of the genus *Credneria,* and especially by the considerable variety of Coniferæ described by M. Corda in the work of Reuss upon the chalk of Bohemia.

6. In France, in the ferruginous sands depending on the

greensands near Grandpré, department of Ardennes, where M. Buvignier has found two very remarkable fossil plants, a stem of an arborescent fern and a cone already observed in England in the same formation.

But in other places and in beds of certainly different epochs, this period has presented solely marine plants; such in particular are the fucoid sands or *macigno*, characterized by *Chondrites Targionii, æqualis, intricatus*, &c., now designated by the name of fucoid sands, *grès à fucoides* or *flysch*, the geological epoch of which has long been problematical, but which all appear to agree in considering as a distinct formation, superior to the chalk and inferior to the most ancient beds of the tertiary formations.

These fucoid sands form a very distinct epoch, which appears up to the present time characterized solely by marine vegetables, and which, at least in the botanical point of view, would form the line of demarcation between the cretaceous and the tertiary formations; for it is remarkable that the Fuci which occur in it in such great number, have few relations to those of the chalk properly so called, and none at all with those of the most ancient beds of the tertiary formations, such as those of Monte Bolca.

The study and comparison of these fossils coming from such varied sources, enables us to divide the cretaceous period into three epochs, the middle one being the true cretaceous epoch; the others, characterized almost entirely by marine plants, are doubtful enough as to their true geological position; one, more ancient than the chalk, comprises only the subcretaceous lignites of the environs of La Rochelle and of the department of Dordogne; the other, above the chalk, corresponds to the fucoid sands.

1. *Subcretaceous Epoch.*

Algæ.

Cystoseirites Partschii, *Sternb.*—Transylvania.
—— filiformis, *Sternb.*—Ibid.
Laminarites? tuberculatus, *Sternb.*—Isle of Aix.
Rhodomelites strictus, *Sternb.*—Ib.

Naiadeæ.

Zosterites Orbigniana, *Brong.*—Isle of Aix.
Zosterites Bellovisiana, *Brong.*—Isle of Aix.
—— elongata, *Brong.*—Ibid.
—— lineata, *Brong.*—Ibid.

Coniferæ.

Brachyphyllum Orbignianum, *Brong.*—Isle of Aix.
—— Berardianum, *Brong.*—Pialpinson.

This little flora is almost entirely based upon the fossil plants collected in the marine lignites of the Isle of Aix, near La Rochelle, long since described by M. Fleurian of Bellevue.

The difference of the plants seems to forbid the union of this flora with that of the lower chalk or greensand, but it will be requisite to study it more completely under the double relation of its precise geological epoch and the totality of vegetable species it comprehends. The most abundant and most characteristic of these species is the *Rhodomelites strictus,* the branches of which, interlaced and mixed with *Zosterites,* constitute the mass of these lignites, with the wood of Coniferæ, which have not yet been studied, and the little, very rare, branches of *Brachyphyllum Orbignianum.*

I have inserted in this epoch the two species of *Cystoseirites* described by M. de Sternberg, and indicated by him as found in beds between the Jurassic schists and the chalk in Transylvania. Does this fossil flora correspond to a formation almost entirely marine, but contemporaneous with the Wealden epoch ? This can only be decided by new investigations, but the analogy of the *Brachyphylla* of the two epochs leads to such a supposition.

2. *Cretaceous Epoch.*

Amphigenous Cryptogams.

ALGÆ.

Confervites fasciculata, *Br.*—Bornh., England.
—— ægragropiloides, *Br.*—Bornh.
—— Woodwardii, *Mant.*—England, Norfolk.
Sargassites Lyngbyanus, *Br.* — Bornh.
Halyserites Reichii, *Sternb.*—Niederschöna.
Chondrites furcellatus, *Röm.*—Saxony, Beauvais.
—— Mantelli, *Röm.*—Saxony.
—— Targionii, *Brong.*—Beauvais.
—— cylindricus, *Sternb.*—Teschen ; Bohemia.

Doubtful Algæ.

Fucoides Brongniartii, *Mant.*—Sussex.
Cylindrites, of *Göppert,* 3 species.

Acrogenous Cryptogams.

FERNS.

Protopteris Singeri, *Presl.*—Silesia.
—— Buvignieri, *Br.*—Grandpré.
Pecopteris Reichiana, *Br.*—Niederschöna.
—— striata, *Sternb.*—Sahla.
—— bohemica, *Corda.*—Bohemia.
—— Zippei, *Corda.*—Bohemia.
—— lobifolia, *Corda.*—Bohemia.
And two new species from Niederschöna.

Monocotyledons.

PALMS.

Flabellaria chamæropifolia, *Göpp.*—Silesia.
Palmacites varians, *Corda.*—Boh.

Gymnospermous Dicotyledons.

CYCADEÆ.

Cycadites Nilssonianus, *Br.*—Scania.
Zamites cretacea, *Br.*—N. Schöna. (Pteroph. cretaceum, *Rossm.*)
Microzamia gibba, *Corda.*—Boh.
Zamiostrobus ovatus, *Göpp.* — England.
—— familiaris (male cone). — Bohemia. (Zamites familiaris, *Corda.*)
—— Guerangeri (male cone).—Le Mans.

CONIFERÆ.

* Cupressineæ.

Widdringtonites fastigiatus, *Endl.*—Bohemia.
Cryptomeria primæva, *Corda.*—Boh.

** Abietineæ.

Abietites Benstedi.—*Göpp.*
——oblongus, *Lindl.*—Lyme-Regis, Grandpré.
—— exogyrus, *Corda.*—Bohemia.
Pinites Reussii, *Corda.*—Bohemia.

Pinites macrocephalus, *Brong.** — England. (Zamia macrocephala, *L. & H.*)
—— sussexiensis, *Brong.* — Engl. (Zamia sussexiensis, *Mant.*)
Cunninghamites oxycedrus, *Sternb.* —N. Schöna.
—— elegans, *Corda.*—Bohemia.
—— planifolius, *Corda.*—Bohemia.
Dammarites albens, *Göpp.*—Boh.
—— crassipes, *Göpp.*—Silesia.
Araucarites acutifolius, *Corda.* — Bohemia.
—— crassifolius, *Corda.*—Bohemia.
Eleoxylon cretaceum, *Brong.*—Boh. (Pinus cretacea, *Corda.*)

Angiospermous Dicotyledons.

MYRICEÆ.

Comptonites? antiquus, *Nilss.*—Scania.

BETULACEÆ.

Alnites? Friesii, *Nilss.*—Scania.

CUPULIFERÆ.

Carpinites arenaceus, *Göpp.*—Siles.

SALICINEÆ.

Salicites? Wahlbergii, *Nilss.*—Scania.
—— Petzeldianus, *Göpp.*—Silesia.
—— fragiliformis, *Zenk.*—Blankenb.

ACERINEÆ.

Acerites cretaceus, *Nilss.*—Scania.

JUGLANDEÆ.

Juglandites elegans, *Göpp.*—Silesia.

Dicotyledons of uncertain Family.

Credneria integerrima, *Zenk.*
—— denticulata, *Zenk.*— Blankenb.
—— biloba, *Zenk.*—Blankenb.
—— subtriloba, *Zenk.*—Blankenb.
—— Sternbergii, *Brong.*—Teschen; Bohemia.
—— cuneifolia, *Brong.*—N. Schöna.
—— expansa, *Brong.*—N. Schöna.
—— tremulæfolia, *Brong.*—Niederschöna.

Besides these should be noticed at least ten or twelve species of undetermined and often imperfect dicotyledonous leaves, figured by Geinitz, Reuss, Corda and Göppert, or existing in collections.

This flora, which now comprises about sixty or seventy known species, is, as is seen, remarkable from the gymnospermous Dicotyledons almost equaling the angiospermous, and for the existence of still a rather large number of well-characterized Cycadeæ, which cease to show themselves at the eocene epoch of the tertiary formations.

The genus *Credneria*, comprehending dicotyledonous leaves with a very peculiar nervation, but the affinities of which are doubtful, is also one of the characteristic forms of this epoch, in a tolerably large number of localities. With regard to the species of dicotyledonous leaves referred to determinate families, I must remark that these determinations, founded on very imperfect specimens, few in number, are still very uncertain, and cannot furnish a basis for any comparison with other floras, or any certain conclusion.

* A specimen of this fruit, which has just been communicated to me by Mr. Wetherell, establishes in a very positive manner that it is not the fruit of a *Zamia*, but the cone of a *Pinus*, having all the characters of this genus, relatively to the form and direction of the scales and the position of the geminate seeds at their bases. As to *Z. sussexiensis*, its analogy with the preceding seems to me evident.

3. *Fucoidean Epoch.*

This epoch, which seems to me to form the most natural limit between the cretaceous and tertiary periods, is characterized by those deposits, so rich in Algæ of a very special form, which have been called fucoid sands or *macignos*, or the *flysch* of Switzerland, a formation widely distributed, especially in Southern Europe, from the Pyrenees to the environs of Vienna, and even as far as the Crimea.

At present no terrestrial plants have ever been found intermixed with these marine plants. I do not think that even fossil woods have been met with.

Almost all these Algæ appear to belong to the same group, to the genus *Chondrites*, and although the species are tolerably numerous, they pass into one another by almost insensible shades. The Algæ of the environs of Vienna, placed in the genus *Munsteria*, are very badly characterized, and perhaps are not congeneric with those of the Jurassic limestone of Solenhofen; but they seem to me to have been found in the same formation, designated by the name of the gray calcareous schist, of the sand of Vienna, as the *Chondrites* of the same country.

FLORA OF THE EPOCH OF THE FUCOID SAND.

ALGÆ.

Chondrites intricatus, *Brong.*
—— æqualis, *Brong.*
—— difformis, *Brong.*
—— Targionii, *Brong.*
—— furcatus, *Brong.*
Chondrites recurvus, *Brong.*
—— Huotii, *Brong.*
—— affinis, *Sternb.* (Sphærococcites.)
—— inclinatus, *Sternb.* (Sphærococcites.)
Munsteria Hässii, *Sternb.*
—— flagellaris, *Sternb.*
—— geniculata, *Sternb.*

The remarkable points about this series of species are, that they have nothing in common either with the Algæ of the subcretaceous epoch, or with those of the eocene epoch, especially of Monte Bolca, with which this flora would be almost contemporaneous, according to many geologists; and, again, the identity of these species of Algæ in so many localities situated at great distances, localities so numerous for most of these species that I have not been able to cite them.

Chondrites Targionii, or perhaps a distinct, but very nearly approaching species, is the only one presented in another formation, in the greensand and gault of the Isle of Wight, in England, according to Dr. Fitton, and in the same formation in the department of the Oise, according to Mr. Graves.

M. Kurr has also described and figured under the name of *Chondrites Bollensis*, a *Fucus* of the lias, the very varied forms of which are almost identical with *Chondrites Targionii*, *æqualis* and *difformis*.

6. *Tertiary Period.*

The collective nature of the plants of this period, contemporaneous with all the tertiary deposits and surviving even yet in the vegetation clothing the present surface of the earth, is one of the most characteristic. The abundance of angiospermous Dicotyledons, of Monocotyledons of various families, but especially of Palms, during at least a portion of this period, distinguishes it at once from the more ancient. The observations made upon the cretaceous epoch, however, have established a kind of transition between the forms of the secondary epochs and those of the tertiaries, which some years ago was not supposed to have existed. But while in that epoch the Angiosperms appeared almost to equal the Gymnosperms, they exceed them much in the tertiary period; while in the cretaceous epoch there still existed Cycadaceæ and Coniferæ allied to the genera inhabiting tropical regions, the Cycadaceæ appear to be wholly wanting in Europe, and the Coniferæ belong to genera of temperate regions during the tertiary period.

In spite of this *ensemble* of characters common to the whole tertiary period, there are evidently notable differences in the generic and specific forms, and in the predominance of certain families at different epochs of this long period. But we here frequently experience grave difficulties in establishing the synchronism of the numerous local formations which constitute the different tertiary rocks. In this attribution of the different localities, where fossil plants have been observed, to the principal divisions of the tertiary series, I have not followed exactly the bases received by M. Unger in his 'Synopsis'; I have approached very near to the distribution adopted by M. Raulin in his memoir on the transformations of the flora of central Europe during the tertiary period (Ann. des Sc. Nat. x. 193, Oct. 1848), which refers to the pliocene or most recent epoch, several of the formations classed by M. Unger in the middle or miocene division. Nevertheless, on the advice of M. Élie de Beaumont, I have not placed all the beds of the lignite of Germany in the pliocene division, as M. Raulin did, nor all in the miocene, like M. Unger; but, in agreement with the old opinion of my father, I have left the lignites of the shores of the Baltic, containing amber, in the inferior divisions of the old basins of Paris, London and Brussels, regarding them as contemporary with the Soissonnese lignites; the lignites of the banks of the Rhine, of Wetterau and Westphalia, are arranged in the middle or miocene division; those, on the contrary, of Styria and of a portion of Bohemia, among the recent or pliocene beds.

This distribution agrees generally well enough with the nature of the plants contained in the beds. One important point alone leaves me in doubt: viz. the lignites of the environs of Frankfort, of the Wetterau, the plants of which are pretty generally analogous to those of Œningen and of Parschlug in Styria, although their geological position seems to require their reference to a more ancient formation.

It is probable that a more complete acquaintance with these different beds would lead to a division into a greater number of distinct epochs; but I believe that the division into three principal epochs, which I shall term, with the majority of geologists, eocene, miocene and pliocene, is sufficient for the comparison of the successive changes of the vegetable kingdom. I shall indicate for each, the localities which I have considered it necessary to comprise under these different designations.

With regard to the general characters which result from the comparative examination of these floras, we see in the first place that the numbers of species of the great divisions of the vegetable kingdom are distributed in the following way in these floras:—

	Eocene epoch.		Miocene epoch.		Pliocene epoch.	
Cryptogamia	33	......	10	......	13	
Amphigenous	......	16	......	6	......	6
Acrogenous	......	17	......	4	......	7
Phanerogamia.						
Monocotyledons ...	33	33	26	26	4	4
Dicotyledons	143	......	97	......	195	
Gymnosperms ...	......	40	......	19	......	31
Angiosperms ...	......	103	......	78	......	164
Total	209	......	133	......	212	

It is merely necessary to observe, that in the first column or eocene formation, the fossil fruits of the Isle of Sheppey, a part only of which have as yet been described by Mr. Bowerbank, have a great influence on the figures of the different divisions of the Phanerogamia, and that this locality however appears altogether exceptional, and perhaps presents us with an example of the results of currents bringing exotic fruits from distant climates to accumulate upon a point of the coast of Europe.

Under this point of view, the enumeration of the plants of this first epoch is not in any way capable of being compared with those of the other epochs, in which I have even avoided introducing the small number of fossil plants of the tertiary beds of the equatorial regions which are known, confining myself to the comparison of the tertiary floras of Europe.

As to the characters drawn from the vegetable forms during these three epochs, the most remarkable appear to me to be:

1. For the eocene epoch, the presence, but the rarity of Palms, confined to a small number of species. The predominance of Algæ and marine Monocotyledons, which must be attributed to the great extent of marine formations during this epoch.

The existence of a great number of extra-European forms, resulting however from the presence of the fossil fruits of Sheppey.

2. For the miocene epoch, the abundance of Palms in the majority of the localities incontestably belonging to this epoch; the existence of a tolerably large number of non-European forms, and particularly of the genus *Steinhauera*, which appears to me to be a Rubiaceous plant allied to the *Morindæ*, found in several localities of these formations.

3. For the pliocene epoch, the great predominance and the variety of the Dicotyledons, the rarity of the Monocotyledons, and, especially, the absence of Palms; lastly, the general analogy of the forms of these plants with those of the temperate regions of Europe, North America and Japan.

A remarkable character of the floras of these three epochs, but one which becomes still more striking in the last, in which Dicotyledonous plants are more numerous, is the absence of the most numerous and most characteristic families of the Gamopetalæ. Thus, in all the numerous impressions of Parschlug, Œningen, Höring, Radoboj, &c., nothing announces the existence of Compositæ, Campanulaceæ, Personatæ, Labiatæ, Solanaceæ, Boraginaceæ, &c.

The only Monopetalæ cited in large numbers are the Ericaceæ, the Ilicineæ, with some Sapotaceæ and Styraceæ, families which contain almost as many dialypetalous as gamopetalous plants.

In the miocene flora alone, several Apocynaceæ have been indicated, and the Rubiaceous genus I have cited above.

1. *Eocene Epoch.*

This epoch, in its most precise limits, comprehends the plastic clay with its lignites, the Parisian marine limestone (calcaire grossier), and the gypsum above it in this same basin; but I have not considered it necessary to separate from it, for the present, certain formations, which, according to the researches of modern geologists, are placed between the cretaceous formation and the inferior portions of the beds which we have just indicated: such are the nummulitic beds of the district of Vicenza, including the celebrated deposits of Monte Bolca, and probably certain neighbouring localities, such as Salcedo, in the district of Vicenza. I have also joined to this flora of the eocene formations a very remarkable locality of the Paris basin, the relations of which with the tertiary strata are not yet perfectly determined: viz. the layers of the kind of ancient travertine which, near Sézanne, contain numerous fossil vegetables still undescribed, and of which I shall here notice the most remarkable. At the same time it should be observed, that these plants are very peculiar, and probably belong to a special flora, unless these differences depend upon a diversity of station.

Besides the different members of the eocene properly so called, of the Paris basin, I include in this flora the fossils of the same formation in England, in the Isle of Wight and the Isle of Sheppey, in the London basin. These last fossils, consisting almost entirely of fruits transformed into pyrites, constitute a collection which has no analogue at other points of the tertiary basins of Europe, not merely on account of the number and diversity of these fruits, but of the wholly special characters, which remove them far from the plants of which the leaves are found in the other strata of the same geological epoch. Everything therefore leads us to think that these fruits, although belonging to plants contemporaneous with the eocene deposits of Europe, have been brought from distant countries by marine currents, as fruits are still brought from the equatorial regions of America on to the coasts of Ireland or Norway by the great current of the Atlantic. The deposit of the Isle of Sheppey therefore appears an accidental case in the eocene deposits, and the Paris basin does not present any of these fossils.

The tertiary basin of Belgium, which follows that of London, has presented, near Brussels, some fossil fruits, very few in number, but apparently identical with one of the genera most abundant in Sheppey. These are the *Nipadites,* at first regarded as a species of *Cocos,* under the name of *Cocos Burtini.*

Lastly, by the advice of my learned colleague M. Élie de Beaumont, I have included in this same flora the plants contained in the lignites of the shores of the Baltic and of Pomerania, so rich in amber, in which the plants have frequently been preserved. To M. Göppert is owing our acquaintance with these plants, represented most frequently by very small fragments, the relations of which he has determined with much sagacity and exactitude.

With the materials collected from these various localities, but most of which are still unpublished, we shall be able to construct the flora of the eocene epoch, of which the following list, comprising only the species described or at least determined, is but a sketch.

Flora of the Eocene Epoch.

Amphigenous Cryptogams.

ALGÆ.

Confervites thoræformis, *Brong.*—Bolca.

Caulerpites Agardhiana, *Brong.*—Bolca.

—— pinnatifida, *Brong.*—Bolca.

Zonarites flabellaris, *Sternb.*—Bolca.

Zonarites multifidus, *Sternb.*—Salcedo, Vic.
Gigartinites obtusus, *Brong.*—Bolca.
Sphærococcites Beaumontianus, *Br.* —Paris. (Fucoides Beaumontianus, *Pomel.*)
Chondrites Dufresnoyi, *Pomel.* — Paris.
Delesserites Lamourouxii, *St.* — Bolca.
—— spathulatus, *Sternb.*—Bolca.
—— Bertrandi, *Sternb.*—Bolca.
—— Gazolanus, *Sternb.*—Bolca.
Corallinites Pomelii, *Brong.*—Paris.

Fungi.

Sporotrichites heterospermus, *Göpp.* —Amber.
Pezizites candidus, *Göpp.*—Amber.
Hysterites opegraphoides, *Göpp.*— Amber.

Acrogenous Cryptogams.

Hepaticæ.

Marchantites sezannensis, *Br.* — Sézanne.
Jungermannites Neesianus, *Göpp.*— Amber.
—— transversus, *Göpp.*—Amber.
—— contortus, *Göpp.*—Amber.

Musci.

Muscites serratus, *Göpp.*—Amber.
—— apiculatus, *Göpp.*—Amber.
—— confertus, *Göpp.*—Amber.
—— dubius, *Göpp.*—Amber.
—— hirsutissimus, *Göpp.*—Amber.

Filices.

Pecopteris Humboldtiana, *Göpp.*— Amber.
—— Pomelii, *Br.*—Sézanne.
Tæniopteris Bertrandi, *Brong.*—Vicenza.
Asplenium Wiegmanni, *Brong.* — Sézanne.
Polypodites thelypteroides, *Brong.* —Sézanne.

Equisetaceæ.

Equisetum stellare, *Pomel.*—Oise.

Characeæ.

Chara helicteres, *Brong.*—Paris.
Chara tuberculosa, *Lyell.* — Isle of Wight.
—— Lemani, *Brong.*—Paris.

Monocotyledons.

Naiadeæ.

Caulinites parisiensis, *Brong.*—Paris.
—— grandis, *Pomel.*—Paris.
—— Brongniartii, *Pomel.*—Paris.
—— nodosus, *Ung.*—Paris.
—— ambiguus, *Ung.*—Paris.
—— cymodoceites, *Pomel.*—Paris.
—— herbaceus, *Pomel.*—Paris.
—— zosteroides, *Pomel.*—Paris.
Zosterites tæniæformis, *Brong.* — Vicent.
—— enervis, *Brong.*—Paris.
Halochloris cymadocæoides, *Ung.*— Bolca.
Potamogeton tritonis, *Ung.*—Bolca.
—— naiadum, *Ung.*—Bolca.
—— multinervis, *Brong.*—Paris.
Carpolithes Websteri, *Brong.*—Isle of Wight. (Carp. thalictroides, var. *a*, *Br.*)

Nipaceæ.

Nipadites, *Bowerb.*—13 species from the Isle of Sheppey, 2 of which occur also in the tertiary beds of Brussels.

Palmaceæ.

Flabellaria parisiensis, *Brong.* — Paris.
—— rhapifolia, *Sternb.*—Vinacourt, Som.
—— maxima, *Ung.*—Oise, Grisolle.
Palmacites echinatus, *Brong.*—Soissons.
—— annulatus, *Brong.*—Paris.

Gymnospermous Dicotyledons.

Coniferæ.

* Cupressineæ.

Juniperites Hartmannianus, *Göpp.*— Amber.
Thuytes Klinsmannianus, *Göpp.*— Amber.
—— Mengeanus, *Göpp.*—Amber.
—— Breynianus, *Göpp.*—Amber.
—— Kleynianus, *Göpp.*—Amber.
—— Ungerianus, *Göpp.*—Amber.
Cupressites Brongniartiana, *Göpp.*— Amber.

Cupressites Linkianus, *Göpp.*—Amber.
—— Bockianus, *Göpp.*—Amber.
Callitrites Brongniartii, *Endl.* —Paris.
—— curtus, *Endl.*—Sheppey.
—— Comptoni, *Endl.*—Sheppey.
—— thuioides, *Endl.*—Sheppey.
—— crassus, *Endl.*—Sheppey.
Frenelites recurvatus, *Endl.*—Sheppey.
—— subfusiformis, *Endl.*—Sheppey.
—— globosus, *Brong.*—Sheppey.
—— elongatus, *Brong.*—Sheppey.
Solenostrobus subangulatus, *Endl.* —Sheppey.
—— corrugatus, *Endl.*—Sheppey.
—— sulcatus, *Endl.*—Sheppey.
—— semiplotus, *Endl.*—Sheppey.
—— tessellatus, *Brong.*—Sheppey.

** Abietineæ.

Abietites obtusifolius, *Göpp.*—Amber.
—— geanthracis, *Göpp.*—Lignite, Silesia.
—— Wredanus, *Göpp.*—Amber.
—— Reichianus, *Göpp.*—Amber.
Pinites Defrancii, *Brong.*—Paris.
—— macrolepis, *Brong.*—Paris.
—— rigidus, *Göpp.*—Amber.
—— lignitum, *Göpp.*—Lign., Saxe.
—— ovoideus, *Göpp.*—Silesia.
—— Thomassianus, *Göpp.* — Lignite.
—— brachylepis, *Göpp.*—Lignite.
Peuce succinifera, *Endl.*—Amber.

*** Taxineæ.

Taxites acicularis, *Brong.*—Lignite, Cassel.
—— Langsdorffii, *Brong.*—Lignite, Wetterau.
—— diversifolius, *Brong.*—Lignite, Cassel.
—— affinis, *Göpp.*—Lignite.
Taxoxylon Ayckei, *Ung.*— Lignite, Silesia.

**** Gnetaceæ.

Ephedrites Jonianus, *Göpp.*—Amber.

Angiospermous Dicotyledons.

BETULACEÆ.

Alnus succineus, *Göpp.*—Amber.
Betulinium parisiense, *Endl.*—Paris.

CUPULIFERÆ.

Quercus Meyerianus, *Göpp.*—Amber.
Carpinites dubius, *Göpp.*—Lignite.

JUGLANDEÆ.

Juglans ventricosa, *Brong.*—Lignite, Pomerania.
—— Schweiggeri, *Göpp.*— Lignite, Prussia.
—— Hagenianus, *Göpp.* — Lignite, Prussia.

ULMACEÆ.

Ulmus Brongniartii, *Pomel.*—Paris.

PROTEACEÆ.

Petrophylloides, *Bowerb.*—7 species from the Isle of Sheppey.

LEGUMINOSÆ.

Leguminosites, 18, Xylinoprionites, 2, Faboidea, 25, } species of fruits from the Isle of Sheppey.

ŒNOTHEREÆ.

Trapa Arethusæ, *Ung.*—Bolca.

CUCURBITACEÆ.

Cucumites variabilis, *Bow.*—Sheppey.

SAPINDACEÆ.

Cupanioides, *Bow.*—8 species from Sheppey.

MALVACEÆ.

Hightea, *Bowerb.*—10 species from Sheppey.

ERICACEÆ?

Dermatophyllites, *Göpp.*—9 species in amber.

Families doubtful.

Phyllites, 10 species.
Antholithes, 4 species.
Carpolithes, 8 species.

The most remarkable characters of this flora are: 1. the great quantity of Algæ and marine Naiadeæ, a character related to the extent and magnitude of the marine formations of this epoch.

2. The great number of Conifers, belonging mostly to genera still existing, but among which the *Cupressineæ* seem to predo-

minate, especially if we admit, as positively belonging to this family, the various fruits of the Isle of Sheppey which Mr. Bowerbank has described under the name of *Cupressinites*, and of which M. Endlicher has formed the genera *Callitrites, Frenelites*, and *Solenostrobus*. If these fruits really belonged to the European vegetation, they indicate very peculiar generic forms, which are probably entirely destroyed.

3. The existence of several large species of Palms, equally demonstrated by the presence of their leaves and their stems.

2. *Miocene Epoch.*

This middle epoch of the tertiary formations appears to me to comprise the following localities among those which have furnished materials for the study of the vegetation of the tertiary period :—

1. In the environs of Paris, the upper or Fontainebleau sands, and the millstones (Meul. Par.) which crown our hills; 2. the sands with impressions, in the environs of Mans and Angers, and probably those of Bergerac, department of Dordogne; 3. a portion of the tertiary formations of Auvergne, and particularly those of the mountain of Gergovia, beds which, from their impressions, appear more ancient than those of Menat, but which perhaps all belong to different stages of the pliocene epoch; 4. the freshwater formations of Armissan, near Narbonne, the gypsum of Aix in Provence, the lignites of Provence, the fossil plants of which are scarcely known; lastly the lacustrine formations, rich in the wood of Palms and fasciculated stems of Monocotyledons, of Upper Provence, near Apt and Castellane; 5. a portion of the tertiary beds of Italy, and particularly those of Superga, near Turin; 6. the *molasse* of Switzerland with its lignites, at Lausanne, Köpfnac and Horgen, containing the remains of Palms.

7. The lignites of the banks of the Rhine, near Cologne and Bonn, at Friesdorf, Liblar, &c., sometimes containing the wood of Palms, and those of the Wetterau at Nidda, near Frankfort, and in other places; as well as those of Meisner, near Cassel, which appear of the same epoch, although those of the Wetterau seem more to approach the pliocene flora, by the abundance of certain genera of Dicotyledons, such as *Juglans* and *Acer*, and even by several cases of specific identity.

8. A portion of the lignites of Bohemia, and particularly those of Altsattel, the fossils of which, described by M. Sternberg and M. Rossmässler, agree generally with those of the other localities already cited. Other lignites of Bohemia, those of Bilin and Comothau especially, pass completely into the pliocene flora.

9. Höring in Tyrol, and Radoboj in Croatia, the numerous

impressions from whence M. Unger has so well made known in his 'Chloris protogæa,' and which have become almost the type of the pliocene flora.

With the exception of the lignite beds of the environs of Cassel and Frankfort, the species of which often have numerous relations with those of Œningen and Parschlug, and which perhaps belong rather to the pliocene flora, the different localities which I have just cited have many relations in respect to their fossil plants. Thus the *Nymphæa Arethusæ* occurs in the millstones of Paris and in the marls of Armissan; the *Flabellaria rhapifolia* and *maxima* occur at Höring in Tyrol, at Radoboj in Croatia, and in the upper sands of the environs of Angers and Perigueux. The *Callitrites Brongniartii*, Endl., occurs equally in the beds of Armissan, of Aix in Provence, of Höring, and of Radoboj.

Lastly, the *Steinhauera globosa* of the lignites of Altsattel in Bohemia, occurs also in the sands of the environs of Mans, and the *Platanus Hercules* of Radoboj in Croatia has been sent to me from Armissan, by M. Tournal.

These facts will probably be multiplied by a more attentive study of the different localities, but they already leave little doubt about the synchronism of the majority of these local formations.

Flora of the Miocene Formations.

Amphigenous Cryptogamia.

Algæ.

Cystoseirites communis, *Ung.*—Radoboj.
—— gracilis, *Ung.*—Radoboj.
—— Helii, *Ung.*—Radoboj.
Sphærococcites cartilagineus, *Ung.*—Radoboj.
Xylomites umbilicatus, *Ung.*—Radoboj.

Acrogenous Cryptogams.

Musci.

Muscites Tournalii, *Brong.*—Armissan.

Filices.

Filicites polybotrya, *Brong.*—Armissan.

Characeæ.

Chara medicaginula, *Brong.*—Meul. Par.
—— prisca, *Ung.*—Radoboj.

Monocotyledons.

Naiadeæ.

Zosterites marina, *Ung.*—Radoboj.
Caulinites Radobojensis, *Ung.*—Radoboj.
—— nodosus, *Ung.*—Radoboj.
Ruppia pannonica, *Ung.*—Radoboj.
Carpolithes thalictroides, *Brong.*—M. Paris.

Graminaceæ.

Culmites anomalus, *Brong.*—Meul. Par.
—— Göppertii, *Munst.*—Bohemia.
Bambusium sepultum, *Ung.*—Radoboj.

Liliaceæ.

Smilacites hastata, *Brong.*—Armissan.
—— grandifolia, *Ung.*—Radoboj.

Palmaceæ.

Flabellaria latania, *Rossm.*—Bohemia.
—— rhapifolia, *Sternb.*—Höring, Switz.
—— oxyrachis, *Ung.*—Höring.
—— verrucosa, *Ung.*—Höring.
—— crassipes, *Ung.*—Höring.
—— Martii, *Ung.*—Höring.
—— major, *Ung.*—Höring.

Flabellaria hœringiana, *Ung.*—Höring.
—— maxima, *Ung.*—Radoboj.
—— Lemanonis, *Brong.*—Aix.
Phœnicites pumila? *Brong.*—Le Puy.
—— spectabilis, *Ung.*—Radoboj.
—— salicifolius, *Ung.*—Bohemia.
—— angustifolius, *Ung.*—Bohemia.
Endogenites didymosolen, *Spreng.* —Paris.
—— perfossus, *Ung.*—Bohemia.

Gymnospermous Dicotyledons.

CONIFERÆ.

Callitrites salicornioides, *Brong.*—Radoboj. (Thuites salicornioides, *Ung.*)
—— Brongniartii, *Endl.*—Aix, Armissan, Höring, Radoboj.
Sequoites taxiformis, *Brong.*—Arm., Höring. (Cupressites taxiformis, *Ung.*, tab. ix.)
Glyptostrobites Ungeri, *Brong.* — Höring. (Cupressites taxiformis, *Ung.*, tab. viii.)
—— parisiensis, *Brong.*—Meul. Par. (Muscites squamosus, *Brong. Prod.*)
Abietites lanceolatus, *Ung.* (Eleate). —Radoboj.
—— Ungeri, *Endl.* (Pinites).—Radoboj. (Palæocedrus extinctus, *Ung.*)
—— hordeaceus, *Göpp.* (Pinites).—Bohemia.
—— austriaca, *Ung.* (Eleate).—Bohemia.
Pinites pseudostrobus, *Brong.*—Armissan.
—— Saturni, *Ung.*—Radoboj.
—— oviformis, *Endl.*—Bohemia.
—— ovatus, *Presl.*—Bohemia.
Araucarites ? Göppertii, *Presl.* — Höring.
Elæoxylon acerosum, *Brong.*—Bohemia.
——Hœdlianum, *Brong.*—Bohemia.
Taxites Tournalii, *Brong.*—Armissan.
—— Langsdorffii, *Brong.*—Lignite, Wetterau.
Podocarpus macrophylla, *Lindl.*—Aix.

Angiospermous Dicotyledons.

MYRICEÆ.

Comptonia grandifolia, *Ung.*—Radoboj.
Comptonia breviloba, *Brong.*—Höring.
——? dryandræfolia, *Brong.*—Armissan.
Myrica quercina, *Ung.*—Radoboj.
—— inundata, *Ung.*—Radoboj.
—— banksiæfolia, *Ung.*—Höring.
—— hœringiana, *Ung.*—Höring.
—— acuminata, *Ung.*—Höring.
——? longifolia, *Ung.*—Carniolia.

BETULINEÆ.

Betula dryadum, *Brong.*—Armiss., Radoboj.
—— salzhausenensis, *Göpp.*—Lignite, Wetterau.
Betulinium tenerum, *Ung.*—Austria.
Alnus Kefersteinii, *Göpp.*—Lignite, Wetterau.

CUPULIFERÆ.

Quercus palæococcus, *Ung.*—Radoboj.
—— furcinervis, *Ung.*—Bohemia.
—— cuspidata, *Ung.*—Bohemia.
Fagus atlantica, *Ung.*—Radoboj.
Carpinus macroptera, *Brong.* — Arm., Rad.
—— grandis, *Ung.*—Radoboj.
—— betuloides, *Ung.*—Gergovia.

ULMACEÆ.

Ulmus bicornis, *Ung.*—Radoboj.
—— prisca, *Ung.*—Radoboj.
—— Lamothii, *Pomel.*—Gergovia.

MOREÆ.

Ficus hyperborea, *Ung.*—Radoboj.

PLATANEÆ.

Platanus ? grandifolia, *Ung.*—Radoboj.
—— digitata, *Ung.*—Radoboj.
—— jatrophæfolia, *Ung.*—Radoboj.
—— Hercules, *Ung.*—Radoboj, Armissan.

SALICINEÆ.

Populus crenata, *Ung.*—Radoboj.
—— Leuce, *Ung.*—Bohemia.

LAURINEÆ.

Daphnogene cinnamomeifolia, *Ung.* —Rad., Bohemia.
—— paradisiaca, *Ung.*—Radoboj.
—— relicta, *Ung.*—Radoboj.
Laurus camphora? *Crois.*—Gergovia.
—— dulcis ? *Lindl.*—Aix.

UMBELLIFERÆ.

Pimpinellites Zizioides, *Ung.*—Radoboj.

HALORAGEÆ.

Myriophyllites capilliformis, *Ung.*—Radoboj.

COMBRETACEÆ.

Getonia petreæformis, *Ung.*—Radoboj.
Terminalia radobojensis, *Ung.*—Radoboj.
—— miocenica, *Ung.*—Radoboj.

CALYCANTHEÆ.

Calycanthus Braunii, *Brong.*—Lignite, Wetterau.

LEGUMINOSÆ.

Phaseolites cassiæfolia, *Ung.*—Radoboj.
Desmodophyllum adoptivum, *Ung.*—Radoboj.
—— viticinoides, *Ung.*—Radoboj.
Dolichites europæus, *Ung.*—Radoboj.
—— maximus, *Ung.*—Radoboj.
Erythrina sepulta, *Ung.*—Radoboj.
Adelocercis radobojana, *Ung.*—Radoboj.
Bauhinia destructa, *Ung.*—Radoboj.
Mimosites borealis, *Ung.*—Höring.
Acacia disperma, *Ung.*—Radoboj.

ANACARDIEÆ.

Rhus stygia, *Ung.*—Radoboj.
—— Pyrrhæ, *Ung.*—Radoboj.
—— Rhadamanti, *Ung.*—Radoboj.

ZANTHOXYLEÆ.

Zanthoxylon europæum, *Ung.*—Radoboj.

JUGLANDEÆ.

Juglans nux-taurensis, *Brong.* — Turin.
Juglans ventricosa, *Brong.* — Lignite, Wetterau.
—— acuminata, *A. Braun.* — Lignite, Wetterau.
—— lævigata, *Brong.* — Lignite, Wetterau.
—— costata, *Sternb.*—Bohemia.
—— minor, *Sternb.*—Bohemia.

RHAMNEÆ.

Rhamnus deperditus, *Ung.*—Radoboj.
Ceanothus polymorphus, *Ung.* — Radoboj.

ACERINEÆ.

Acer campylopteryx, *Ung.*—Radoboj.
—— eupterygium, *Ung.*—Radoboj.
—— pegasinum, *Ung.*—Radoboj.
—— megalopteryx, *Ung.*—Radoboj.
—— tricuspidatum, *A. Braun.* — Lignite, Wetterau.

NYMPHÆACEÆ.

Nymphæa Arethusæ, *Brong.* — Armissan, Meul., Paris.

APOCYNEÆ.

Echitonium superstes, *Ung.*—Radoboj.
—— microspermum, *Ung.*—Radoboj.
Neritinium dubium, *Ung.*—Radoboj.
—— longifolium, *Ung.*—Radoboj.
Plumieria flos-saturni, *Ung.*—Radoboj.
Apocynophyllum sessile, *Ung.*—Radoboj.
—— lanceolatum, *Ung.*—Radoboj.

RUBIACEÆ.

Steinhauera subglobosa, *Sternb.* — Bohemia, Mans sands.
—— oblonga, *Sternb.*—Bohemia.

The most striking characters of this epoch consist in the mixture of exotic forms now peculiar to hotter regions than Europe, with plants generally growing in temperate countries, such as the Palms, a species of Bamboo, Laurineæ, Combretaceæ, Leguminosæ of warm climates, Apocyneæ analogous, according to M. Unger, to the genera of the equatorial regions, a Rubiaceous plant wholly tropical,—united with Maples, Walnuts, Birches, Elms, Oaks, Hornbeams, &c.—genera peculiar to temperate or cold regions. The presence of equatorial forms, especially of Palms, appears to me to distinguish this essentially from the following epoch. Finally, the very small number of plants with a monopetalous corolla will be remarked, confined to species referred by Unger to the Apocyneæ, and the genus *Steinhauera* founded on a fruit which is closely related to that of the *Morindæ* among the Rubiaceæ.

3. *Pliocene Epoch.*

This epoch, embracing all the tertiary beds superior to the shell-marls of Touraine, comprehends a considerable number of localities, rich in fossil plants, and which have their position determined as much even by the *ensemble* of the vegetation they contain as by their other geological characters. The tertiary basins which it appears to me should form the basis of this flora, both from their identity and the numerous well-studied plants they contain, are:—That of Œningen near Schaffhausen (Œn.), the species of which were long ago studied and determined by M. Alex. Braun, whose labours, although unpublished, have been communicated to several scientific men, in particular to M. Unger; that of Parschlug in Styria (Parschl.), the numerous impressions of which have been combined, studied and determined by M. Unger, published in part in his 'Chloris protogæa,' and presented as a whole in a special enumeration of these species lately published under the title of 'Flora of Parschlug.' In this locality alone M. Unger has recognized and classed 110 different species; it is the most numerous local fossil flora known, and the identity of a great number of species with those of Œningen indicates the synchronism of these two local formations. Some other points in Styria also seem to be of the same epoch, as well as several localities in Hungary, very rich in silicified wood. In Bohemia the tripoli schists of Bilin and Comothau, which contain a rather large number of plants, described by M. Sternberg, are doubtless referable to this epoch, from the nature of the plants; lastly, the tertiary hills, called the subapennine hills of the Placentian district, of Tuscany and a portion of Piedmont, as well as the gypseous formation of Stradella, near Pavia, so rich in impressions of leaves, form part of this epoch; but, with the exception of this last point, these beds generally contain but few plants.

In France the pliocene epoch probably comprehends a portion of the freshwater deposits of Auvergne and Ardèche. Thus the schists of Menat and those of Rochesauve appear to me to present a flora very analogous to that of Œningen and of Parschlug. As to the marls of Gergovia and Merdogne near Clermont, I have considered it best to class them rather in the miocene epoch;

but this question can only be solved by a more attentive determination of the species they contain. The following flora, which includes all that has been described or named from these beds, is nevertheless based, as may be seen from the indications of the localities, on the two basins of Parschlug and Œningen.

Flora of the Pliocene Formations.

Amphigenous Cryptogams.

Algæ.

Confervites bilinicus, *Ung.*—Bilin.
Sphærococcites? striolatus, *Sternb.*—Italy.

Fungi.

Xylomites maculatus, *Ung.* — Parschlug.
—— tuberculatus, *Ung.*—Parschl.
Sphærites punctiformis, *Ung.*—Parschlug.
—— disciformis, *Ung.*—Parschl.

Acrogenous Cryptogams.

Musci.

Muscites Schimperi, *Ung.*—Parschl.

Filices.

Adiantum renatum, *Ung.*—Parschl.
Pteris parschlugiana, *Ung.* — Parschlug.
Goniopterites stiriacus, *Brong.* — Arnfels.
Tæniopteris dentata, *Göpp.* — Töppl., Bohemia.

Lycopodiaceæ.

Isoëtites Braunii, *Ung.*—Œn., Parschlug.

Equisetaceæ.

Equisetum Braunii, *Ung.* — Œn., Parschl.

Monocotyledons.

Naiadeæ.

Potamogeton geniculatus, *Braun.*—Œningen.

Gramineæ.

Culmites arundinaceus, *Ung.*—Parschlug.

Cyperaceæ.

Cyperites tertiarius, *Ung.*—Parschl.

Liliaceæ.

Smilacites sagittata, *Ung.*—Parschl.

Gymnospermous Dicotyledons.

Coniferæ.

* Cupressineæ.

Callitrites Brongniartii, *Endl.*—Parschlug.
—— gracilis, *Brong.*—Comothau.
Widdringtonites Ungeri, *Endl.*—Parschlug.
Taxodites europæus, *Brongniart.*—Greece, Bilin.
—— œningensis, *Ung.*—Œningen, Parschl.
—— dubius, *Presl.*—Bilin.
Thuioxylon juniperinum, *Ung.*—Styria, Austria.
—— ambiguum, *Ung.*—Styria.
—— peucinum, *Ung.*—Lesbos.

** Abietineæ.

Abietites Oceanines, *Ung.*—Parschl.
—— balsamodes, *Ung.*—Parschl.
—— leuce, *Ung.*—Parschl.
Pinites gothianus, *Ung.*—Parschl.
—— furcatus, *Ung.*—Parschl.
—— hepios, *Ung.*—Parschl.
—— centrotos, *Ung.*—Parschl.
—— æquimontanus, *Göpp.*—Styria.
—— Haidingeri, *Ung.*—Styria.
—— Hampeanus, *Ung.*—Styria.
—— Cortesii, *Brong.* — Placentian district.
—— canariensis, *Lindl.*—Spain.
Peuce lesbia, *Ung.*—I. of Lesbos.
Eleoxylon acerosum, *Brongniart.*—Styria.
—— pannonicum, *Brong.*—Hungary.
—— Hödlianum, *Brong.*—Styria.
—— regulare, *Brong.*—Hungary.

*** Taxineæ.

Taxites tenuifolius, *Brong.*—Comothau.

Taxites carbonarius, *Munst.*—Lignite, Bavaria.
—— Rhosthornii, *Ung.*—Lignite, Carinthia.
Taxoxylum Göppertii, *Ung.*—Hungary.
—— priscum, *Ung.*—Styria, Hungary.
Salisburia adiantoides, *Ung.*—Italy.

Angiospermous Dicotyledons.

MYRICEÆ.

Comptonia acutiloba, *Brong.*—Bilin.
—— œningensis, *A. Braun.*—Œn., Parschl.
—— ulmifolia, *Ung.*—Parschl.
—— laciniata, *Ung.*—Parschl.
Myrica deperdita, *Ung.*—Parschl.

BETULACEÆ.

Betula Dryadum, *Brong.*—Parschl.
—— macroptera, *Ung.*—Bilin.
Alnus Kefersteinii, *Göpp.*—Bilin.
—— gracilis, *Ung.*—Bilin.
—— suaveolens, *Viv.*—Stradella.
—— nostratum, *Ung.*—Styria.

CUPULIFERÆ.

Quercus bilinica, *Ung.*—Bilin.
—— serra, *Ung.*—Parschl.
—— lignitum, *Ung.*—Parschl.
—— aspera, *Ung.*—Parschl.
—— Hamadryadum, *Ung.*—Parschl.
—— chlorophylla, *Ung.*—Parschl.
—— Daphnes, *Ung.*—Parschl.
—— elæna, *Ung.*—Parschl.
—— Drymeia, *Ung.*—Parschl., Stradella.
—— mediterranea, *Ung.*—Parschl.
—— Zoroastri, *Ung.*—Parschl.
—— cyclophylla, *Ung.*—Parschl.
—— myrtilloides, *Ung.*—Parschl.
Quercinium sabulosum, *Ung.*—Austria, Hungary, Silesia, France, Moulins.
—— austriacum, *Ung.*—Austria.
—— transylvanicum, *Ung.*—Transylvania.
Fagus castaneæfolia, *Ung.*—Styria.
—— Feroniæ, *Ung.*—Bilin.
—— Deucalionis, *Ung.*—Bohemia.
Fegonium vasculosum, *Ung.*—Austria, Styria.
Carpinus macroptera, *Brongniart.*—Parschl.
—— oblonga, *Ung.*—Parschl.

ULMACEÆ.

Ulmus quercifolia, *Ung.*—Parschl.
—— plurinervia, *Ung.*—Parschl.
—— zelkovæfolia, *Ung.*—Parschl.
—— parvifolia, *A. Braun.*—Parsch., Œn.
—— Bronnii, *Ung.*—Parschl., Bilin, Comothau.
—— prælonga, *Ung.*—Parschl.
—— longifolia, *Ung.*—Bilin.
Ulminium diluviale, *Ung.*—Bohemia.
Celtis Japeti, *Ung.*—Parschl.

BALSAMIFLUEÆ.

Liquidambar europæum, *A. Braun.*—Œn., Parschl.
—— acerifolium, *Ung.*—Parschl.
—— protensum, *Ung.*—Parschl.

SALICINEÆ.

Populus gigas, *Ung.*—Parschl.
—— Æoli, *Ung.*—Œn., Parschl.
—— latior, *A. Br.*—Œn., Parschl.
—— ovalifolia, *A. Br.*—Œningen, Parschl.
—— Phaëtonis, *Viv.*—Stradella.
Salix angustissima, *A. Br.*—Œningen, Parschlug, Bilin.
—— neriifolia, *A. Br.*—Œningen.
—— tenera, *A. Br.*—Œningen.
—— lancifolia, *A. Br.*—Œningen.
—— capreæfolia, *A. Br.*—Œn.

LAURINEÆ.

Daphnogene cinnamomeifolia, *Ung.*—Parschlug.

THYMELEÆ.

Hauera styriaca, *Ung.*—Styria.

SANTALACEÆ.

Nyssa europæa, *Ung.*—Styria.

CORNEÆ.

Cornus ferox, *Ung.*—Parschlug.

MYRTACEÆ.

Myrtus miocenica, *Ung.*—Parschl.

CALYCANTHEÆ.

Calycanthus Braunii, *Brong.*—Œn.

POMACEÆ.

Pyrus Theobroma, *Ung.*—Parschl.
—— Euphemes, *Ung.*—Parschl.

Pyrus minor, *Ung.*—Parschl.
Cratægus Oreonis, *Ung.*—Parschl.
Cotoneaster Andromedæ, *Ung.*—Parschlug.

ROSACEÆ.

Rosa Penelopes, *Ung.*—Parschl.
Spiræa Zephyri, *Ung.*—Parschl.

AMYGDALEÆ.

Prunus paradisiaca, *Ung.*—Parschl.
—— Euri, *Ung.*—Parschl.
—— theodisca, *Ung.*—Parschl.
—— atlantica, *Ung.*—Parschl.
Amygdalus querculus, *Ung.*—Parsch.
—— pereger, *Ung.*—Parschl.

LEGUMINOSÆ.

Robinia Hesperidium, *Ung.*—Parsch.
Cytisus? œningensis, *A. Braun.* — Œningen.
—— Dionysii, *Ung.*—Parschl.
Amorpha styriaca, *Ung.*—Parschl.
Glycirrhiza Blandusiæ, *Ung.*—Pars.
Phaseolithes orbicularis, *Ung.*—Pars.
—— serrata, *Ung.*—Parschl.
—— physolobium, *Ung.*—Parschl.
—— securidaca, *Ung.*—Parschl.
Gleditschia podocarpa, *A. Braun.*—Œn., Parschl.
Bauhinia parschlugiana, *Ung.*—Parschlug.
Cassia ambigua, *Ung.*—Parschl.
—— hyperborea, *Ung.*—Parschl.
—— petiolata, *Ung.*—Parschl.
—— Memnonis, *Ung.*—Parschl.
Acacia parschlugiana, *Ung.*—Parschl.
Mimosites palæogæa, *Ung.*—Parschl.

ANACARDIEÆ.

Rhus punctatum, *Al. Braun.*—Œn.
—— cuneolata, *Ung.*—Parschl.
—— nitida, *Ung.*—Parschl.
—— triphylla, *Ung.*—Parschl.
—— elæodendroides, *Ung.*—Parsch.
—— zanthoxyloides, *Ung.*—Parschl.
—— Herthæ, *Ung.*—Parschl.
—— Napæarum, *Ung.*—Parschl.

JUGLANDEÆ.

Juglans acuminata, *A. Braun.* — Œn., Parschl.
—— falcifolia, *A. Braun.* — Œn., Parschl.
—— melæna, *Ung.*—Parschl.
—— quercina, *Ung.*—Parschl.
Juglans elænoides, *Ung.*—Parschl.
—— hydrophila, *Ung.*—Parschl.
—— cinerea fossilis, *Brong.*—Tuscany.

RHAMNEÆ.

Karwinskia multinervis, *A. Br.* — Œningen, Styria.
Rhamnus terminalis, *A. Br.*—Œn.
—— aizoon, *Ung.*—Parschl.
—— aizoides, *Ung.*—Parschl.
—— degener, *Ung.*—Parschl.
—— pygmæus, *Ung.*—Parschl.
—— bilinicus, *Ung.*—Bilin.
Ziziphus tremula, *Ung.*—Parschl.
—— protolotus, *Ung.*—Parschl.
Paliurus Favonii, *Ung.*—Parschl.
Ceanothus subrotundus, *Al. Br.*—Œningen, Parschl.
—— europæus, *Ung.*—Parschl.
—— tiliæfolius, *Ung.*—Bilin, Œn.
—— bilinicus, *Ung.*—Bilin.
—— polymorphus, *Ung.*—Œningen.

CELASTRINEÆ.

Celastrus europæus, *Ung.*—Parschl.
—— cassinefolius, *Ung.*—Parschl.
—— cuneifolius, *Ung.*—Parschl.
Euonymus Latonus, *Ung.*—Parschl.

SAPINDACEÆ.

Sapindus Pythii, *Ung.*—Parschl.

ACERINEÆ.

Acer lignitum, *Ung.*—Bilin.
—— pseudo-monspessulanum, *Ung.*—Parschl.
—— obtusilobum, *Ung.*—Styria.
—— pseudo-campestre, *Ung.*—Œn., Parschl.
—— trilobatum, *A. Br.*—Œningen, Parschl., Bilin.
—— productum, *A. Br.*—Œningen, Parschl., Bilin.
—— tricuspidatum, *A. Br.*—Œn.
—— trifoliatum, *A. Br.*—Œn., Bilin.
—— radiatum, *A. Br.*—Œningen.
—— vitifolium, *A. Br.*—Œningen.
—— parschlugianum, *Ung.*—Parsch.
—— ficifolium, *Viv.*—Styria, Stradella.
—— elongatum, *Viv.*—Styria, Stradella.
—— integerrimum, *Viv.* — Styria, Stradella.
Acerinium danubiale, *Ung.*—Upper Austria.

TILIACEÆ.

Tilia prisca, *A. Braun.*—Œn.

MAGNOLIACEÆ.

Liriodendron Procaccinii, *Ung.* — Sinigaglia.

CAPPARIDEÆ.

Capparis ogygia, *Ung.*—Parschl.

SAPOTEÆ.

Sideroxylon hepios, *Ung.*—Parschl.
Achras lycobroma, *Ung.*—Parschl.

STYRACEÆ.

Symplocos dubius, *Ung.*—Parschl.
Styrax borealis, *Ung.*—Parschl.

OLEACEÆ.

Fraxinus primigenia, *Ung.*—Parschl.

EBENACEÆ.

Diospyros brachysepala, *Al. Br.*—Œningen.

ILICINEÆ.

Ilex sphenophylla, *Ung.*—Parschl.
—— stenophylla, *Ung.*—Parschl.
—— parschlugiana, *Ung.*—Parschl.
—— ambigua, *Ung.*—Parschl.
—— cyclophylla, *Ung.*—Parschl.
Prinos europæus, *Ung.*—Parschl.
Nemopanthes angustifolius, *Ung.*—Parschl.

ERICACEÆ.

Rhododendron flos-Saturni, *Ung.*—Parschl.
Azalea hyperborea, *Ung.*—Parschl.
Andromeda glauca, *Ung.*—Parschl.
Vaccinium vitis-Japeti, *Ung.*—Pars.
—— icmadophilum, *Ung.*—Parschl.
—— myrsinites, *Ung.*—Parschl.
Ledum limnophilum.—Parschl.

The pliocene epoch, examined in Europe,—for I have intentionally excluded from the preceding list some fossils from the Antilles which are referred to these formations,—presents as its peculiar character, extreme analogy with the existing flora of temperate regions of the northern hemisphere,—I do not say of Europe, for this pliocene flora comprehends several genera foreign to our existing flora, but peculiar to the vegetation of America or temperate Asia. There are, taking for granted the correctness of the generic relations established by the botanists to whom these determinations are due, *Taxodium, Salisburia, Comptonia, Liquidambar, Nyssa, Robinia, Gleditschia, Bauhinia, Cassia, Acacia, Rhus, Juglans, Ceanothus, Celastrus, Sapindus, Liriodendron, Capparis, Sideroxylon, Achras* and *Symplocos,* all genera foreign to temperate Europe, in which they have been found in a fossil condition, but which are, for the most part, still met with in the temperate regions of other parts of the globe.

Of other genera still existing in Europe, but now only containing a small number of species there, we find many more in the fossil condition : for example the Maples, fourteen species of which are enumerated in this flora of the pliocene epoch, and the Oaks, which amount to thirteen. It should be remarked that these species come from two or three narrowly circumscribed localities, which, at the present time, probably do not present more than three or four species of these genera in a radius of several leagues. Lastly, another character to which I have already drawn attention, and which renders this flora still more different from that of our epoch, is the absence or at least the small number and the nature of the plants with gamopetalous corollas.

Thus, there are in this flora only twenty plants arranged in the families of that division; all these belong to the group of hypogynous gamopetalæ which I have called isogynous, which in the general organization of their flowers approach nearest to the dialypetalæ.

Is this absence of anisogynous gamopetalæ, or gamopetalæ with irregular ovaries, the result of chance? or of the fact that most of these plants, especially among the species of temperate regions, are herbaceous, these herbaceous plants being generally in conditions less favourable for passing into the fossil condition? Or lastly, were not these families, which some botanists have been led to consider as the most elevated in the scale of vegetable organization, at that time yet created? This cannot now be established positively.

But it should be observed that in the miocene epoch these plants were still less numerous, yet belonged to other families, and that in the eocene epoch none have been cited by the authors who have made out the relations between the fossil and living plants, without having at the same time preconceived ideas on the subject.

Another fact to be noted, but which also probably depends on the herbaceous nature of these plants and their leaves not being caducous, is the almost complete absence of Monocotyledons, Ferns and Mosses, which establishes, in reference to these families, a very great difference between the pliocene flora and the existing one of Europe. A no less important difference distinguishes this flora from those of older epochs, viz. the absence throughout these beds of the family of Palms, which formed, on the contrary, the prominent character of the miocene epoch. No trace of them is known in Europe in the pliocene formations I have enumerated, while the woods of this family are very abundant in the formations of the Antilles, which are regarded as belonging to an epoch at least as recent as the pliocene formations,—which appears to indicate that the zones of vegetation were distributed at that epoch almost in the same manner as at the present time.

Indeed, in these modern formations of the Antilles, among the fossil woods, the only parts of vegetables hitherto collected, are found specimens which indicate the existence not only of numerous and varied Palms, but of several other families of the equatorial zone, such as Lianes allied to the Bauhinias, Menispermeæ, Pisonias, &c. Thus the vegetation of the Antilles had the characters of the equatorial zone at that epoch, as the flora of Europe had at the same time those of the temperate zone.

Finally, to conclude our observations on this flora of the last geological epoch, preceding the existing one, we will direct attention to the fact, that in spite of the general analogies which exist between the plants of these formations and those which at present live in the temperate regions, not one species appears to be identical, at least with any plant now growing in Europe; and if, in some rare cases, complete identities appear to exist, it is between these fossil plants and American species. Thus the flora of Europe, even in the most recent geological epoch, was very different from the existing European flora.

XXXII.—*On the Reciprocal Relation of the Vital and Physical Forces.* By George Newport, F.R.S., F.L.S.*

The published Report of the Meeting of the British Association for the Advancement of Science, held at Birmingham in September 1849, contains an abstract of a paper by Dr. Fowler, F.R.S., with the following title: "*If Vitality be a Force having correlations with the Forces, Chemical Affinities, Motion, Heat, Light, Electricity, Magnetism, Gravity, so ably shown by Professor Grove to be modifications of one and the same force?*"

From this abstract it appears that Dr. Fowler regards the vital forces as having not only reciprocal relations among themselves, but also with the physical forces;—that the vital forces are, in the expressive term employed by Mr. Grove with regard to the physical forces, "*mutually correlated,*" and are convertible the one into the other. Dr. Fowler gives the following illustrations in support of the view:—"The change of temperature to which the infant is necessarily exposed at its birth, the heat going rapidly out of it, excites the motion necessary for inspiration. This gives the oxygen of the air access to the carbon of the blood by endosmosis. This again to animal heat. From that electricity may be obtained, and from electricity, by an appropriate coil, magnetism. Gravity the infant acquires by its growth, and can counteract by its muscular contractility. It may be said that an infant affords no evidence of the production of the forces, light, electricity, and magnetism, but the experiments of Dr. Faraday have demonstrated that all these may be produced by the vitality of the Gymnotus, and rendered palpable to our sight and feeling." Dr. Fowler then further instances the production of light by fire-flies, glow-worms, and some marine animals, and afterwards remarks:—"That mind and vitality reciprocally excite and depress each other must be obvious to all who are attentive to their daily feelings; and all conversant with surgical practice must be aware of the difference in healing of wounds in a

* Read at a Meeting of the British Association, August 1850.

healthy or exhausted subject." (Report Brit. Assoc. 1849, p. 77, 78.)

A view similar to this was printed anonymously in the 'British and Foreign Medico-Chirurgical Review' for January 1848. Still more recently, on the 20th of June 1850, since the publication of Dr. Fowler's abstract, a paper was announced at the last Meeting of the Royal Society, by Dr. Carpenter, "*On the Mutual Relation of the Vital and Physical Forces.*" But as neither that paper nor the abstract of it has yet been printed, I can only allude to the fact in connexion with that of the publication of Dr. Fowler's remarks, as showing that views like to one which I announced some years ago are now beginning to be disseminated.

The view by myself had for its foundation the opinion that *vital force* is derived *from without*; that its *degrees*, or *kinds*, have a close relation with the *physical forces*; and that, like vital force, the *instinctive power*, or *force*, in animals, is an "evolution, or change of form," of these forces, in, or through, the organization of nervous structure;—and by which the entire body is impelled to acts of definite character in proportion as the force evolved is determined more or less centrifugally to definite structures or regions; and further, that this determination to particular regions may be regulated either by the vegetative powers of organization inherent in the body itself, or by accessions of force from without, as by motion, light, heat, food, contact, &c.

This view, in so far as relates to the connexion of the vital and instinctive forces with the physical, was publicly announced in a paper read to the Linnæan Society on the 18th of November 1845, "*On the Natural History, Anatomy, and Development of the Oil Beetle, Meloë.*"

The force referred to in that paper in illustration of the view was *light*; my attention being then particularly drawn to the effects of this influence on the instincts of the young animal. I had already published, in the 'Philosophical Transactions' for 1837, the results of observations on the influence of light on the Hive Bee, during the occurrence of the annular eclipse of the sun in May 1836; and also had pointed out in the 'Transactions' for 1841 the marked effect of light on the instinct of a newly born Myriapod. It may thus be seen that immediately it was shown that "an intimate relation exists between electricity, magnetism and light, and that these are convertible the one into the other*," —the observations I had made on the effects of light on animals would quickly induce the conception that a similar relation exists between the physical and the vital and instinctive powers,

* Faraday, "On the Magnetization of Light," &c. (Athenæum, Dec. 6, 1845.)

the connexion being traced through the *nervous force* on the one hand, and *light* and *electricity* on the other. This conception, or idea of relation, was expressed in the following words in my paper on *Meloë*, after some experiments on the effects of light on the instincts of the animal had been detailed :—

"Thus the unerring influence of a great physical cause, which arouses the instinct of the newly developed being, seems to be clearly indicated in the effects of light upon these Meloës. These effects I may perhaps be allowed to designate *the polarization of instinct*. The facts I have now detailed lead me, in conformity with the discovery by Faraday of the analogy of light with heat, magnetism and electricity, to regard light as the primary source of all vital and instinctive power, the degrees and variations of which may, perhaps, be referred to modifications of this influence on the special organization of each animal body. Matteucci already has shown that electricity and nervous function are closely related; and now that Professor Faraday has proved that light and electricity are the same principle, we seem to have approached closer to a knowledge of the origin of life. The throes of parturition in the pregnant female,—the electrical shock of the Torpedo,—and doubtless also the ejection of poison by stinging insects,—the impressions of sensation, and the act of contraction in muscular fibre,—all seem to be concomitant with the maturation, evolution, change of form or of nature of some material constituent of organic life,—and directly connected with, or influenced by, the hitherto regarded imponderable agent, nervous function; a too intense, or too frequent diffluence (exhaustion) of which seems to hasten the dissolution of the whole body, and diminish the intensity of those affinities by which its primary constituents are held together, and the cessation of which constitutes death."

This enunciation of view respecting the relations of the *vital*, *instinctive* and *physical forces*, the Council of the Linnæan Society did not permit me to retain in my paper printed in their 'Transactions,' so that only the first two sentences I have quoted are there published, and I was compelled, but not without reluctance and remonstrance, to submit to the omission of the remainder. But a portion of the omitted paragraph, sufficient perhaps to establish the fact of the view having been announced, had already been published in the Report of the Proceedings of the Society, first in the Gardeners' Chronicle for November 22nd, and, more explicitly, in the Athenæum for December 6, 1845, in the following words:—

"In the course of the paper the author pointed out some remarkable effects of light on the development and instincts of the young larva, as shown by experiments which he detailed; and then stated that he had been led by these and other facts, in conformity with the great discovery by Professor Faraday of the analogy of light with magnetism and electricity, to consider light as the primary source of all vital and instinctive power, the degrees and variations of which, he suggested, may, perhaps, be referred to modifications of this influence on the special organization of each animal body. The close relation which Mr. Faraday has now shown to subsist between light and electricity, and by Matteucci between electricity and nervous power, and the known dependence of most of the functions of the body on the latter, were remarked on as leading to the above conclusion."

A further report of the same views, but somewhat more detailed, was afterwards published in the 'Proceedings' of the Linnæan Society (vol. i. p. 271), and in the 'Annals and Magazine of Natural History' for May 1846 (vol. xvii. p. 352).

Thus the connexion of the *vital* and *physical forces* through *light, heat, electricity* and *nervous function* was pointed out by myself in November 1845.

The masterly views by Mr. Grove respecting the *correlation of the physical forces* had then already been published in a report of his Lectures in the Literary Gazette for January 1844, but with them I was entirely unacquainted. No allusion however is made in that report to the *vital forces*, or to any connexion of these with the *physical*. Mr. Grove afterwards published a summary of his views in a separate form in August 1846, and it is interesting to find near the end of his essay the following passage:—

"I believe that the same mode of reasoning as I have adopted in this essay might be applied to the organic as well as to the inorganic world, and that muscular force, animal and vegetable heat, &c., might, and at some time will be shown to have similar definite correlations; but I purposely avoided the subject as pertaining to a department of science to which I have not devoted my attention."

Thus the *idea* of a close relation between the *vital and physical forces* by myself in 1845, and of *a correlation of the vital forces* by Mr. Grove in 1846, precede the remarks in the 'British and Foreign Medico-Chirurgical Review' for January 1848, and also Dr. Fowler's communication to the British Association in September 1849.

But what until lately has been merely a *view* or *idea*, or at most an imperfect theory deduced from a comparison of well-known circumstances, is now, in some respects, confirmed by experimental facts recently communicated by Matteucci to the Royal Society and printed in the 'Transactions' (Part 1. 1850). In that communication electricity is shown by direct experiment to develope *nervous force*, as nervous force had already been shown by Faraday and Matteucci to develope electricity through the agency of the organs of the electrical fishes. Thus the mutual convertibility of these forces, the one into the other, in organic structure, appears now to be established, and the *proof* afforded of the correctness of the *view* or *idea* is due to Matteucci. Now what is true of electricity in this respect may fairly be held to be correct of the other forces, seeing that these have been correlated as *physical influences*, electricity with heat, heat with light, &c.

It may be unnecessary, therefore, to re-state now, in support of the doctrine that the *vital forces* have a reciprocal relation with the *physical*, those circumstances which have already been mentioned in the communications referred to. I shall merely add to these a very few remarks, with facts derived chiefly from the Invertebrata, and which either are new, or have not yet been applied to this inquiry, or have been directly observed by myself.

It may be received as an admitted principle that it is necessary, in addition to the previous communion of the sexes, and in order to render continuous the changes then commenced, that the ovum should either be maintained at the temperature in which it is produced, or in one which is more or less increased, or in alternations of degrees of heat; since, when the ovum is retained in a medium of low temperature, the amount of which is more and more diminished, the changes commenced are at first retarded, then arrested, and with this arrestation vital force is proportionately diminished instead of being increased.

The amount of heat force derived from without, and required for the evolution of life, varies, as we know, between wide extremes in different animals. Among insects there are some *Culicidæ*, even in this climate, which come forth during the depth of winter and continuance of frost, if merely slight changes are induced in the temperature of the air by solar rays. In the colder region of Canada at that season there are other species amongst the *Perlidæ* which undergo their transformations, and even pair, preparatory to depositing their ova, at similar low temperatures. One species, *Capnia vernalis*, as I learn from my friend Mr. Barnston, who has watched its habits, comes forth at the end of winter, when the thick ice begins to crack, and changes from the nymph to the perfect state in the crevices, leaving its slough there, even when the temperature of the air has again sunk to freezing. Another species of the same tribe, *Brachyptera glacialis*, also makes its appearance at the same time, undergoes its changes, and even pairs in the crevices of decaying ice*. As these insects are short-lived in their perfect state, and as their larvæ

* See a paper by myself on "*Pteronarcys regalis*" in Trans. Linn. Soc. vol. xx. pp. 451, 452.

are aquatic, it is clear that although pairing takes place at but little above the temperature of freezing, the ova are deposited at a time when diurnal warmth is increasing, because accessions of force from without are necessary to evolve vital force within them, and induce the formation of structure; and, further, because without these accessions the ova have not within themselves the amount of force required and evolved by—and which promotes and sustains—the organization of the parent.

This then appears to be true with regard to all the ovipara: that the ova require increments and alternations of heat-force from without to promote the development of the embryo, although the increment required by some may be slight. The force thus derived from the inorganic world induces changes in the constituents of the ovum, the result of which is the production of *vital power*. From these constituents, originally an aggregation of nucleated cells, a layer of cells is separated on the surface of the mass, and this becomes the foundation of the future being. The cells of which it is composed are very similar in appearance to others which form the common mass, and it is through changes in these that the embryo is formed. I have watched these changes in many Articulata. The ova of one species, the common earwig, *Forficula*, are well fitted to illustrate the view under consideration; and are in fact, with the ova of *Meloë*, those from which my view was originally in part deduced. The *Forficula* rarely deposits her eggs at a temperature below 43° F. or 44° F., and, as naturalists are well aware through DeGeer, and as I have constantly observed, the female attends to and incubates them during the whole period of their development, turning and removing them from place to place according as the locality may happen to be of the required warmth or degree of moisture. The cells in the embryo or foundation layer of the impregnated egg grow and expand by accessions of heat and moisture, and some of these acquire *gravity* through the chemical changes promoted by heat, and by endosmosis and assimilation of substance through the shell in a fluid condition, as well as by assimilation of materials from other cells, which, having arrived at maturity are in decadence. The cells of the layer then divide, each into two, and these again enlarge in like manner, and thus mutually promote the growth and enlargement of the whole, as well as the enlargement of the entire ovum by their individual expansion and increase. These changes are accompanied by an evolution of vital force, as *motion*, in the forming tissue. Heat thus promoting organization through *chemical affinity* and *gravity* results as *motive force*. Motion among individual cells is the invariable accompaniment of their growth and subdivision, and the reaction of the cells on each other during their changes is the commencement of motion in separate regions or portions of the whole tissue, and ultimately in the entire body of the embryo when formed. In this way the first movements of organs in the interior of the embryo are commenced. Thus motion is generated in individual cells during the earlier stages of formation through *heat force* derived from without, and becomes a fixed and inherent power in one structure, while the same force may be evolved as *light* in another. In the union of the cells, as centres of force to form *muscular tissue*, a power of contractility is produced. Thus muscular force is derived from *heat, chemical change*, and *gravity*. These principles of formation of structure apply to every period of change in the animal. I have mentioned in a paper on the Circulatory Organs *, that "two modes of development are in operation in the same animal: first that of *growth* or simple extension or enlargement of each individual part; next that of *aggregation* of two or more parts to form particular divisions or regions of the body;" and I have elsewhere † carried out these views more in detail. Now, what is true with regard to the compound parts of the already-formed embryo is equally true with reference to the simple constituent structures through which it is originated, and to the changes in one species as in another. In the egg of the glow-worm, *Lampyris*, the cells in a portion of the foundation layer, instead of uniting to form muscular or nervous tissue, retain to a great extent their primary individuality, and assuming somewhat of the condition of secretory organs, evolve their vital force as *light*. Thus through heat supplied to the ovum from without, light becomes a product in the organization of the embryo. I have seen light emitted from the luminous organs at the moment the embryo is escaping from the egg-shell. It may perhaps be urged that this light is simply that of combustion, or is assimilated rather to the purely vegetative processes of organization, than is due to, or is a form of *vital force*. But this objection seems to be answered by the fact that the light of the glow-worm is excited to greater vividness not only by higher temperature of the surrounding medium, and an acceleration of the respiratory and circulatory processes, as well as by immersion in oxygen, but also by mechanical irritation of the animal, and consequent excitement of *nervous force*. In this respect, then, the production of light by the glow-worm seems to bear analogy with the evolution of electricity through mechanical or other modes of exciting nervous force in the electrical fishes; and if this be the fact, we then have force derived from without, in the form of *heat*, converted through organization into *vital force*, and evolved as *muscular contractility, light, electricity* or *nervous power*.

* Phil. Trans. 1843, part 2. p. 244. † Linn. Trans. vol. xix. part 3.

XXXIII.—*Descriptions of three new Devonian Zoophytes.* By Frederick M'Coy, Professor of Geology and Mineralogy in Queen's College, Belfast.

Stromatopora (*Caunopora*) *verticillata* (M'Coy).

Sp. Char. Corallum forming slender, cylindrical, vermiform branches 1 or 2 lines in diameter, each with a distinct central canal one-fourth to one-third of a line in diameter; surrounding sclerenchyme nearly solid, traversed by verticillate whorls of simple, nearly straight canals, averaging about one-third the diameter of the central canal in most of their length, extending obliquely upwards and outwards from the inner channel (whose walls they perforate with regular, rounded, quincuncially arranged openings) to the surface, where they form slightly elongate quincuncially arranged pores, four in the space of 1 line, separated by solid interspaces thicker than their diameter.

This species by its narrow cylindrical branches and distinct central channel resembles the *C. ramosa* (Brassart sp.), but instead of having a minute vermicular subequal reticulated structure, as in that species, the general structure is nearly solid, and regularly traversed from the centre to the surface by large, oblique, nearly straight verticillate canaliculi, giving a plumose appearance to the longitudinal section.

Not uncommon in some parts of the Devonian limestone of Teignmouth.

(*Col.* University of Cambridge.)

Alveolites vermicularis (M'Coy).

Sp. Char. Corallum forming polymorphous masses of obscurely defined concentric layers, of short, irregularly and obtusely polygonal, vermicular, flexuous tubuli, traversed by regular horizontal diaphragms slightly more or less than the diameter of the tubes apart; cavity of the tubes in vertical and horizontal sections separated by at least their diameter of sclerenchyme; about six tubes in the space of 1 line.

I believe this species has been confounded with the very distinct *Favosites* (*Alveolites*) *spongites* of the Eifel, in which however the tubes are half a line in diameter (only two openings in the space of 1 line); and in which they are also straight instead of vermicular or minutely flexuous, and have the sclerenchyme much thinner in proportion to the size of the tubes, presenting all the characters (as I find from examination of authentic specimens) represented with great fidelity in Goldfuss's figures, t. 28.

f. 1 *a* to 1 *e* of the 'Petrefacta Germaniæ.' The branched varieties, which become hollowed by age, are extremely liable to be confounded with large specimens of the *Caunopora ramosa*, but the structure is coarser, the tubules, though flexuous, are far straighter and more tube-like, and finally the transverse diaphragms can always be made out by a little rubbing down of the surface, while they certainly do not exist in the smaller and far more irregular sponge-like tissue of the *Caunopora*. I have noticed in some specimens preserved in slates that the oblique cell-openings on the surface are rhomboidal with the lower angle very prominent and spinose.

Common in the Devonian limestone of Teignmouth; Devonian shale of Newquay, and slates of Bedruthen Steps, St. Eval.

(*Col.* University of Cambridge.)

Strephodes gracilis (M'Coy).

Sp. Char. Corallum simple, very gradually tapering, irregularly twisted, averaging 3 inches long and 8 lines in adult diameter; *horizontal section*, outer wall very thick, solid; radiating lamellæ at the above diameter about fifty-six, very thin, extending in a slight irregular manner towards a large central space, which the primary ones fill with their irregular complicated extremities; secondary lamellæ as thick as the primary, of irregular lengths, but seldom extending one-fourth the distance to the centre; transverse vesicular plates extremely delicate, rather few, irregular: *vertical section* showing in the middle a few irregular flexuous delicate longitudinal lines (edges of the complicated ends of the vertical radiating lamellæ); sides occupied by very open vesicular tissue, composed of large, curved, delicate, oblique plates, forming about two rows of great cells on each side; outer wall very thick, forming a nearly smooth surface; when decorticated the lamellar sulci average five in 2 lines; terminal cup deep, strongly radiated to the flattened centre.

This little species is extremely remarkable for the looseness of the vesicular tissue in the vertical section, or great size and consequent smaller number of the cells. Decorticated fragments bear some external resemblance to the *Cyathophyllum cæspitosum* of the same beds when in the same condition, but a vertical fracture with the hammer, wetted or polished, will easily distinguish them by showing the broad transverse diaphragms of the latter.

Not uncommon in the Devonian limestone of Newton Bushel.

(*Col.* University of Cambridge.)

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The British Flora, comprising the Phænogamous or Flowering Plants and the Ferns. The 6th edition, with additions and corrections, &c. By Sir WILLIAM JACKSON HOOKER, K.H., LL.D. &c. &c., and GEORGE A. WALKER-ARNOTT, LL.D. &c. &c. London, Longman and Co., 1850. Pp. 604.

THE appearance of this new edition of the 'British Flora' has been expected with considerable interest. Since the last edition was published, British botany has advanced at a much greater pace than during the preceding years: the vast number of new species, real and supposed, which have been added to our lists, sufficiently indicates the increased activity with which the science has been pursued; and a greater attention to sound scientific principles as well as to minute accuracy of investigation has been displayed, along with a more hearty disposition to recognise and profit by the labours of foreign botanists. It is no wonder then that many have been anxious to see how such able and distinguished men as Sir W. J. Hooker and Dr. Walker-Arnott would deal with this great accumulation of new matter, especially as they have written scarcely anything bearing on British botany since the former edition, although more works than one similar to the present have been published by others. Our list of editors includes the name of the author of one of these publications, and some persons may perhaps think it strange for us to notice what may be considered a rival book in other than general terms. We might indeed feel some such delicacy if the difference between the two works consisted merely in discrepancy of personal opinion respecting this or that plant: but, as the case now stands, we feel none, since they are written on totally different principles, and we are able to merge the authors in the theories which they respectively adopt. We would on no account stir up personal contention between three friends of science and of each other: but we do not shrink from taking up the gauntlet in an amicable controversy, and inviting the botanical public to listen to the arguments on both sides, and to give their support to whoever shall seem to them to bear the greatest weight of reason. This 6th edition of the 'British Flora' is unquestionably very superior to its predecessors. The volume has been reduced in bulk, and made more portable and compact, though still rather thick for field use. This is effected partly by the employment of a smaller type, and partly by a judicious pruning of the more wordy and irrelevant remarks at the end of the account of each species. The descriptions themselves however have been shortened in very few instances, and very frequently they have been lengthened. This is especially observable in the case of the Natural Orders: and there are numerous traces of the attention which Dr. Arnott is well known to bestow upon this branch of botany. We have been especially gratified by noticing the great increase of accuracy and precision throughout the whole work, so far as regards the distinction of those species which the Authors * fully recognize as such. No one moreover can fail to perceive how assiduously they have examined specimens received from foreign countries, and observed in a living state many plants of the Scottish mountains. Again, great facility has been afforded for the identification of the genus to which a plant belongs, by the insertion of a "Conspectus of the Orders" at the beginning of each Subclass, and a Conspectus of the Genera at the beginning of each Order. These tables, being formed on purely artificial arrangements, are obviously intended for the convenience of beginners and collectors: but with some singular exceptions, a really scientific tone and manner of treatment is discernible everywhere. The nomenclature is considerably improved, by being brought into at least some conformity with the views of contemporary botanists: this is especially to be seen in the subdivision of several genera. It may be well to mention some of the changes in respect to both species and genera, and remarks bearing upon them, which have struck us as especially worthy of attention. *Nasturtium amphibium* is removed to *Armoracia*, the Horse-radish being at the same time no longer considered to be a *Cochlearia*. There is an excellent note on the difficulty of dividing *Brassica, Sinapis*, &c.: the Authors protest very justly against an arrangement which separates *Sinapis nigra* † from the Mustards and joins it to the Kails, on account of the purely artificial character drawn from the nerves of the pod: it is a pity they have not had courage to combine the two genera, which have but little real distinctness: probably all the British species of *Brassiceæ* might safely be thrown in. The stipulate species of *Arenaria* form the genus *Spergularia*; but their artificial removal, along with *Spergula*, into *Paronychiaceæ*, is more than questionable. Plausible reasons are given for treating *Stellaria scapigera* (Willd.) as a mere variety of *S. graminea*. *Prunus spinosa, insititia*, and *domestica* are made to form one species, the *P. communis* of Hudson: of late nearly every one has wished for this change, but no one has dared to make it. *Epilobium lanceolatum* (Seb. and Maur.) is admitted on Mr. Borrer's authority. The British *Sedum purpureum* is taken as a mere form of *S. Telephium*: surely our plant cannot be identical with Tausch's? *Daucus maritimus* (With.) is very properly suspected: probably it would long ago have been rejected, were not plants exactly resembling the inland *D. Carota* constantly found by the sea. *Pyrethrum* is judiciously merged in *Matricaria*: there is no natural character to separate them, and we have not found the cavity of the receptacle in *M. Chamomilla* absolutely constant. The inflorescence of *Parietaria* is shown to be a contracted cyme furnished with bracts, the union of

* The conjunction of names on the title-page compels us to speak of "the Authors," but we believe it is sufficiently known that Dr. Arnott alone is really responsible for nearly all the additions and alterations in this edition.

† We do not quite understand the scientific purport of the advertisement of the mustard "originally prepared by Mrs. Clements of Durham."

which forms the segments of the involucre: the identity of the two alleged species is easily understood from this explanation. The species of *Convallaria,* which have flowers jointed with the pedicel, form the genus *Polygonatum* after Tournefort. *Carex saxatilis* of British botanists is combined with *C. Grahami* (Boott): the Authors remark that Dr. Boott considers his *C. Grahami* as Fries's var. *alpigena* of *C. vesicaria,* but that Wahlenberg ascribes to the latter three stigmas: these perplexities have been now removed by Anderson, who (see Bot. Gaz. ii. 253–262) has traced *C. vesicaria* passing through its var. *alpigena* into *C. pulla* (our *C. saxatilis*) as it ascends from the low swamps to the alps of Lapland: it may be added that Fries had previously spoken of *C. saxatilis* as having either two or three stigmas; and of *C. vesicaria* var. *alpigena* as closely resembling it, but passing imperceptibly into the typical *C. vesicaria*. There are many other improvements which we have not mentioned, some because they had been anticipated by Mr. Babington, and others because they are comparatively trivial.

It now becomes necessary to speak of what appear to us to be the chief defects of the book. The principal of these belong to the distinction of species: "the Authors" (see pp. ix–xi) "are not inclined to believe that any one of the tests,"—that is, of difference of habit, however indefinable, or of microscopic difference accompanying identity of habit, or of permanence under cultivation,—"is sufficient:" they think that "a thousand years' cultivation cannot prove two supposed species distinct;" that "there appears to be less violence done to Nature's laws by combining too much, than by subdivision, unless where there is an anatomical or physiological distinction." Linnæus is asserted to have taken "nearly all his specific characters from conspicuous parts, especially from the stem and foliage," which are said to be "therefore natural": and prophetic hints are given of a time "when what are now called genera or subgenera will alone be considered species": finally, the Authors refuse to partake in the so-called "neomania" for splitting, due to "the too-refined ingenuity of the German, Swiss, and modern Swedish botanists." In these and the accompanying remarks, there appears to be a confusion between the actual distinctness of species in Nature, and the outward differences by which we apprehend that distinctness: it is most true that a species "can neither for convenience be united with others, nor be split into several": we should certainly seek, not convenience, but the very truth: but how are we to arrive at the truth? When we speak of one plant as distinct from another, we mean that it is distinct as a whole, not as a mere collection of distinct parts: the characters do not *constitute* the difference; they do but manifest it to our sight. No test can therefore be *à priori* declared sufficient: all may sometimes fail, and yet the plants may be really distinct. Science in such cases is not, as it might seem, impossible; for frequent observations under different circumstances by laborious and sagacious observers, aided by cultivation, will doubtless finally ascertain the truth. Of course many mistakes will be made; but we know of no other method which can really secure science from the rashness or vanity of species-mongers, and at the same time ensure its sound and permanent progress. "At the beginning of our studies," says Fries, "we are always hoping to circumscribe nature with absolute characters and limits, as if our hands held her in their grasp; but when we gain experience, we come to see the emptiness of our hopes and the futility of our efforts. For nature lives in integrity: and when we cannot take her in under this her true character, we tear her in pieces to adapt her to our own perceptions, and then patch her up again in any way we can." But to return to our Authors: they virtually assume that no species are distinct, until they are proved so, and carry out this principle so far as it is possible: the old orthodox species afford the principal limits to its extension. Hence those plants which have been lately considered to have a reasonable claim to separation are mostly retained as mere varieties; and unluckily the Authors' contempt for characters drawn from the reproductive organs causes them to pass over in silence the very points on which most stress should be laid. They are also too fond of getting rid of troublesome plants by calling them hybrids; and this theory is brought to bear so heavily upon the *Rubi*, that only one true species is allowed between *R. idæus* and *saxatilis*: but we are glad to see that Wimmer's recent application of it to the *Salices* has not been followed. Some examples must in justice be given to substantiate these assertions.

The var. β. of *Thalictrum minus* with "segments of the leaflets much acuminated" is called *T. nutans* (Desf.), to which Grenier, who has seen authentic specimens, ascribes "folioles larges." *Ranunculus circinatus* the Authors "cannot believe to be distinct from" *R. aquatilis*, because the latter must be abnormal, when its leaf-segments are not in one plane: what of *Carum verticillatum* and scores of others? Nothing is said of the styles, stigmas, or habit of *R. tripartitus*, which is suspected. *R. cœnosus* is said to vary in the position of the style; but as it was apparently not seen alive, the opinion is worth next to nothing: it is reluctantly separated from *R. hederaceus*. *Thlaspi virens* (Jord.) is not even noticed. *Helianthemum Breweri* (Planch.) is merged in *H. guttatum*, without mention of the disposition or shape of the leaves: *H. polifolium* (Pers.) is called "probably a mere variety of *H. vulgare*"! The *Violæ* are given chiefly according to Mr. H. C. Watson's characters. the true *V. canina*, of which Smith's *V. flavicornis* is a dwarf form, is called *V. pumila* (Vill.): but Villars' plant is really quite different, having rather the leaves of *V. stagnina* (Kit.), and remarkably large conspicuous stipules which are inciso-dentate, not laciniated: it is also stoloniferous according to Fries, who places it in a different section: perhaps the name *canina* should be dropped altogether: *V. sylvatica* has certainly an inferior claim to it; and the mere fact of its being taken from Gerard proves little. We cannot understand the additional note on Mr. Babington's recent paper; "the *V. lactea*" (Sm.) is there opposed to "what we (Hooker and Arnott) and most others call *V. lactea*;" whereas in the text Smith's name is given to their plant: the anther-spurs, which are spoken of as if they alone exhibited a difference, of course afford only an artificial character to assist those who do not know the really distinct plants. Don's *Potentilla opaca* is shown not to be the plant of Linnæus, but the *P. intermedia* of Nestler, which is suspected to be "the luxuriant or cultivated form" of the former: it grows wild however in the South of France and of Switzerland: the name *opaca* is still retained for the supposed Scottish plant. The scepticism respecting *Potentilla reptans* and *P. Tormentilla* is needless; they are well distinguished by the carpels: *P. mixta* is now allowed by Nolte himself to be a hybrid; and probably similar English hybrids have seemed to connect the two species. *Pyrus pinnatifida* and *Aria* var. *intermedia* are suspected to be hybrids of *P. Aria*, the former with *P. aucuparia*, the latter with *P. torminalis*: but Fries says that *P. intermedia* (his *Sorbus scandica*), of which he regards Smith's *pinnatifida* as a var., grows in Gottland, Norway, Sweden, &c., where *P. torminalis* is not found; and that the true *Sorbus hybrida* (L. fil.) (his *S. fennica*, Kalm) differs by having acid fruit, resembling in appearance those of *P. aucuparia*. *Saxifraga pedatifida* (Sm.) is referred to *S. geranioides* (L.), and marked as not native: we are told that the form *pedatifida* is never wild: but Grenier describes a plant as *S. pedatifida* (Sm.) which grows in several places in the Cevennes, *but not in the Pyrenees*: it differs from *S. geranioides* (of which he makes *S. ladanifera* a resinous variety) by having oval not cordate-orbicular leaves with many-nerved not one-nerved petioles. *Sonchus asper* is called "quite similar to *S. oleraceus* in general appearance," and so suspected: we thought that most botanists could distinguish them at a distance of ten yards. Some of Fries's new *Hieracia* are introduced timidly and inconsistently; but all the British plants are virtually referred to seven species. No allusion is made to *Achillæa tanacetifolia* (All.). The genus *Calystegia* is needlessly separated from *Convolvulus*. *Rhinanthus major* ("Ehrh.") and *angustifolius* ("Gmel.") (*major*, Sm.) are separated, the former being marked as introduced; but both considered as mere varieties: the former is identified with *R. villosus* (Pers.) and *hirsutus* (Lam.): from these synonyms and the description it seems to be *R. alectorolophus* ("Pollich") of Koch, who is doubtful about Smith's plant, which he identifies with *R.* (*Alectorolophus*) *Reichenbachii* (Drey.), Mr. Babington's *R. major var.* γ. *Primula scotica* is strangely stated not to be foreign: where but in Scandinavia should we look for a plant so boreal with ourselves? and accordingly we find Fries saying (Summa, 199), "In alpibus Norvegiæ frequens in Lapponiam usque, etiam in Succia boreali:" he adds that Blytt's observations confirm his belief of its distinctness. *Beta maritima* is called *vulgaris* on Moquin-Tandon's authority, without allusion to the number of stems from one root or the shape of the stigma. *Thesium humile* (Vahl) the Authors think cannot be native, as being an African plant: but it grows in Lower Austria, and our other species grows no further northwards in Germany than Vienna. *Callitriche platycarpa* is joined to *C. verna* without allusion to the size of the fruit: we do not believe the direction of the styles in this genus to be really variable; but a well-practised eye is requisite to disregard deviations from extrinsic causes. *Ceratophyllum platyacanthum* (Cham.) is given as a var., although not seen in Britain: is the true plant meant? our Authors call theirs common in Germany, but Koch gives only Berlin for Chamisso's plant: further, no mention is made of the wing to the *whole* striated fruit and the different insertion and direction of the spines. *Sisyrinchium anceps* is rejected as not possibly European; yet there is every reason to believe it native in Ireland; and the same theory would affect *Spiranthes cernua* and (scarcely less) *Spartina alterniflora. Luzula multiflora* is joined to *L. campestris*; but the remark is precisely the old one on the var. *congesta*: probably each species has such a variety. We suspect there would be less confusion respecting the fruits of Potamogetons if they were dried more carefully: a greater or less degree of pressure changes them greatly, and sometimes creates false ridges. There is no allusion to *Carex brizoides,* the occurrence of which in Yorkshire was recorded some time ago in our pages. *C. stricta* is still called *C. cæspitosa,* and Fries's character of *his C. cæspitosa* added: it is apparently taken from Mr. Babington's Manual with a change of terms: at least two independent writers could scarcely both translate "fructibus obtusis" by "fruit acute": we may add that Fries's plant has the basal sheaths terete, not keeled, and the fruit-bearing stems flaccid, not rigid, and is altogether much slenderer than *C. stricta.* Our Authors further doubt whether the Clova *C. aquatilis* be the plant of Wahlenberg, and are inclined to refer it to Fries's *C. cæspitosa*: but, first, Hooker and Arnott themselves speak of "fruit broader than glumes," and Babington of "glumes always narrower than fruit," just as Fries does; Fries also says that Wahlenberg's plant varies from 1½ to 6 feet high: secondly, our *C. aquatilis* cannot be *C. cæspitosa* ("L." Fr.), for the former has sheaths always leafy, the latter sheaths never leafy: they are placed in different sections by Fries. *Poa (Sclerochloa) Borreri* cannot be a hybrid between *P. distans* and *procumbens*; for it occurs in Norway, Sweden and Lapland, where *P. procumbens* is not found. Neither is there reason for doubting Mitten's *Triticum biflorum* to be Brignoli's plant. We cannot at all understand what the Authors mean by the first two vars. of *Aspidium spinulosum*: and with regard to *L. Fœnisecii,* the possibility of Mr. Lowe having given Dr. Lemann wrong specimens cannot invalidate the testimony of those of Dr. Lippold or the worth of the known plant as a species.

We have by this time said enough to show that this new edition of the 'British Flora' has many recommendations and many drawbacks. It would be unreasonable to expect a work of this nature to be totally free from errors; and where there is so much really laudable and valuable, we would on no account dwell heavily on blemishes which it is yet impossible not to see. It is scarcely necessary to add, in speaking of a book bearing Sir W. J. Hooker's name, that nothing can exceed the forbearance, gentleness, and courtesy of tone and language displayed towards all botanists, however they may differ in opinion.

Dr. Jacob Sturm's *Deutschlands Flora.* Fortgesetzt von Johann Wilhelm Sturm, M.A. Heft 93 and 94. Nürnberg, 1849.

Icones Floræ Germanicæ et Helveticæ, auctore Ludovicö Reichenbach. Vol. xii. Lipsiæ, 1850.

Bryologia Europæa, auctoribus Buch, Schimper et Gümbel. Fasc. 43. Stuttgardtiæ, 1850.

Genera Plantarum Floræ Germanicæ iconibus et descriptionibus illustrata. Opus a beato Nees ab Esenbeck *incoatum, continuatum nunc conjunctis studiis plurium auctorum persecutum.* Fasc. 25, *auctore* Schnizlein. Fasc. 26, *auctore* Bischoff. Bonnæ, 1849.

Thesaurus Literaturæ Botanicæ; curavit G. A. Pritzel. Fasc. 5. Lipsiæ, 1850.

We have recently received the above continuations of well-known works, all of which are highly deserving of the attention of British botanists. Dr. Sturm's valuable series of plates of the plants of Germany well merits to be better known in this country. These two Parts, which fully support the character for excellence which the work bears, are from the pen and pencil of the son of the original author.

The 12th volume of Reichenbach's well-known 'Icones' contains the species of *Amentaceæ, Betulaceæ, Cupuliferæ, Urticaceæ, Aristolochiaceæ, Laurineæ, Dipsaceæ* and *Valerianeæ.* It does not require any recommendation from us, as it is allowed to be essential to all who desire an acquaintance with the European species allied to those of Britain.

The new fasciculus of the 'Bryologia' contains a revised account of the *Phascaceæ,* the *Archidiaceæ* and *Weisiaceæ,* and some supplementary plates.

The receipt of two numbers in continuation of the 'Genera Plantarum' of the late Nees von Esenbeck has pleased us greatly, as we, in common probably with most botanists, had feared that the series of misfortunes which have attended the work had brought it abruptly to an end. This is so cheap and so excellent a book that it needs to be seen only to recommend itself, but we may state that these parts are quite equal to their predecessors; and that Fasc. xxv. contains genera of *Dipsaceæ, Stellatæ, Gentianeæ,* and some other orders; and Fasc. xxvi. is occupied by the first twenty plates of the *Umbelliferæ.*

The continuation of the 'Thesaurus' concludes the alphabetical arrangement of books under their authors' names, and includes the "Opera anonyma." Then commences the "Pars systematica."

It is highly satisfactory to have so good a proof that the botanical writers of Germany are now again turning their attention to science, having doubtless long been tired of revolution, and that their publishers also find themselves in a condition to continue the publication of scientific works.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

Nov. 13, 1849.—William Yarrell, Esq., in the Chair.

Descriptions of thirty new species of Tornatellina, Cylindrella, and Clausilia, from the Collection of H. Cuming, Esq. By Dr. L. Pfeiffer.

1. Tornatellina Cumingiana, Pfr. *T. testâ ovato-oblongâ, solidâ, striatulâ, epidermide olivaceo-lutescente indutâ; spirâ elongato-conicâ, apice acutâ; anfractibus $5\frac{1}{2}$ vix convexiusculis, ultimo $\frac{3}{7}$ longitudinis subæquante; columellâ subarcuatâ, distinctè et obliquè truncatâ; pariete aperturali lamellâ magnâ, horizontaliter intrante munito; aperturâ semiovali, intus callosâ; peristomate simplice, acuto.*

Long. 8, diam. $3\frac{2}{3}$ mill.; ap. $3\frac{2}{3}$ mill. longa, medio $1\frac{2}{3}$ lata.
Hab. in Real Llejos (H. Cuming).

2. Cylindrella sericea, Pfr. *C. testâ profundè rimatâ, subcylindraceâ, truncatâ, solidulâ, subtilissimè striatulâ, diaphanâ, hyalino-albidâ, supernè fuscescente; suturâ albo-filosâ; anfractibus 9 angustis, subæqualibus, vix convexiusculis, ultimo non protracto, basi carinâ funiformi munito; aperturâ subobliquâ, ferè circulari, basi canaliculatâ; peristomate albo, expanso, reflexiusculo, supernè affixo.*

Long. 26, diam. $8\frac{2}{3}$ mill.; ap. c. perist. $6\frac{1}{2}$ mill. longa, 7 lata.
Hab. in insulâ Haiti.

3. Clausilia cyclostoma, Pfr. *Cl. testâ non rimatâ, fusiformi, gracili, solidâ, sub lente subtilissimè et confertissimè undulato-striatâ, non nitente, purpurascenti-nigricante; spirâ regulariter attenuatâ, sursum pallidiore, apice obtusiusculâ, purpureâ, nitidâ; suturâ filari, supernè papilliferâ; anfractibus 9 planiusculis, ultimo deorsum soluto, basi bicristato; aperturâ circulari, intus nigrâ; lamellis approximatis, superâ compressâ, acutâ, inferâ minore; lunellâ nullâ; plicis palatalibus 2–3 profundis, vix conspicuis, subcolumellari immersâ; peristomate continuo, supernè subemarginato, albo, latè expanso.*

Long. 21, diam. medio 5 mill.; ap. $4\frac{2}{3}$ mill. longa, $4\frac{1}{3}$ lata.
Hab. in Archipelago Koreano (Sir Edw. Belcher).

4. Clausilia claviformis, Pfr. *Cl. testâ vix rimatâ, subclaviformi, tenui, lævigatâ, nitidâ, luteo-corneâ, albo-variegatâ; spirâ turritâ, apice acutâ; anfractibus 9 convexiusculis, ultimo basi rotundato; aperturâ elliptico-pyriformi; lamellis tenuibus, inferâ profundâ, subtransversâ; lunellâ nullâ; plicis palatalibus 2, superâ suturæ parallelâ, breviusculâ, inferâ brevissimâ, subcolumellari usque ad marginem porrectâ; peristomate continuo, vix soluto, tenui, breviter expanso.*

Long. 12, diam. $3\frac{1}{2}$ mill.; ap. 3 mill. longa, $2\frac{1}{4}$ lata.
Hab. in Archipelago Koreano (Belcher).

5. Clausilia Belcheri, Pfr. *Cl. testâ subrimatâ, fusiformi-subulatâ, solidulâ, lævigatâ, pellucidâ, luteo-corneâ, albo-variegatâ; spirâ gracillimâ, apice acutâ; anfractibus* 13 *convexis, ultimo basi tumidulo; aperturâ pyriformi; lamellis mediocribus, conniventibus; lunellâ nullâ; plicis palatalibus* 2 *suturæ parallelis, superâ longiore, alterâ brevi, subcolumellari inconspicuâ; peristomate continuo, breviter soluto, labiato, breviter reflexo.*

Long. 12–13; diam. 3 mill.; ap. 3 mill. longa, $2\frac{1}{4}$ lata.
Hab. in Archipelago Koreano (Sir Edward Belcher).

6. Clausilia turrita, Pfr. *Cl. testâ subrimatâ, fusiformi-turritâ, solidâ, longitudinaliter subarcuatim striatâ, albâ, punctis cinereis conspersâ, nitidulâ; spirâ elongatâ, gracili, apice corneâ, acutâ; anfractibus* 14 *planis, ultimo anticè corrugato, basi subcompresso; aperturâ obliquâ, pyriformi-ovali, intus fuscâ; lamellis parvulis, superâ ferè obsoletâ, inferâ profundâ, obliquâ; lunellâ inconspicuâ; plicâ palatali* 1 *superâ, subcolumellari immersâ; peristomate continuo, soluto, tenui, expanso.*

Long. $21\frac{1}{2}$, diam. $4\frac{1}{2}$ mill.; ap. $4\frac{1}{3}$ mill. longa, $3\frac{1}{4}$ lata.
Hab. in insulis Candiâ et Siphanto (Spratt).

7. Clausilia candida, Pfr. *Cl. testâ rimatâ, cylindraceo-fusiformi, solidâ, medio sublævigatâ, candidâ, punctis corneis irregulariter aspersâ, haud nitente; spirâ sensim attenuatâ, apice corneâ; anfractibus* 10–11 *planulis, summis et ultimis costulato-striatis, ultimo anticè rugoso, juxta periomphalum latiusculum arcuato-cristato; aperturâ amplâ, pyriformi-rotundatâ, intus fusculâ; lamellis conniventibus, inferâ subfurcatâ; lunellâ indistinctâ; plicâ palatali* 1 *superâ, subcolumellari immersâ; peristomate continuo, soluto, tenui, undique expanso.*

Long. 21, diam. $4\frac{2}{3}$ mill.; ap. 5 mill. longa, 4 lata.
Hab. in insulâ Candiâ (Spratt).

8. Clausilia puella, Pfr. *Cl. testâ rimatâ, fusiformi, solidâ, lævigatâ, nitidâ, candidâ; spirâ gracili, apice corneâ, acutiusculâ; suturâ mediocri; anfractibus* 11, *primis* 8 *convexis (quarto ad sextum costulato-striatis),* 2 *penultimis planioribus, ultimo costulato, basi arcuato-cristato; aperturâ angustâ, oblongâ; lamellis tenuibus, subparallelis; lunellâ inconspicuâ; plicis palatalibus* 2 *profundis, brevibus, subcolumellari inconspicuâ; peristomate continuo, libero, breviter expanso.*

Long. $13\frac{1}{2}$, diam. 3 mill.; ap. 3 mill. longa, 2 lata.
Hab. in Græciâ (Spratt).

9. Clausilia Milleri, Pfr. *Cl. testâ non rimatâ, fusiformi, gracili, solidulâ, longitudinaliter confertissimè et subarcuatim costulatâ, albidâ, punctis raris corneis adspersâ; spirâ regulariter turritâ, apice nigricante, nitidâ; anfractibus* 11–12 *planiusculis, ultimo anticè ramoso-rugato, basi arcuato-cristato; aperturâ oblongo-pyriformi, intus fusculâ; lamellâ superâ tenui,*

marginali, inferâ profundâ, obliquâ; lunellâ indistinctâ; plicâ palatali 1 *superâ; subcolumellari inconspicuâ; peristomate soluto, continuo, breviter expanso.*
Long. 18–19, diam. $4\frac{1}{2}$ mill.; ap. 4 mill. longa, $2\frac{3}{4}$ lata.
Hab. in insulâ Paros (Miller).

10. Clausilia strigata, Pfr. *Cl. testâ non rimatâ, fusiformi, ventrosulâ, solidulâ, longitudinaliter confertim costulato-striatâ, albâ; spirâ supernè attenuatâ, nigricanti-striatâ, apice acuto, nigro; suturâ marginatâ; anfractibus* 11 *planiusculis, ultimo anticè vix validius costulato, basi obtusè bicristato; aperturâ oblongo-pyriformi, intus pallidè fusculâ; lamellis mediocribus, inferâ introrsum furcatâ; lunellâ vix conspicuâ; plicâ palatali* 1 *superâ, subcolumellari immersâ; peristomate continuo, soluto, tenui, undique expanso.*
Long. 18, diam. $4\frac{1}{3}$ mill.; ap. 4 mill. longa, 3 lata.
Hab. in insulâ Candiâ (Spratt).

11. Clausilia compressa, Pfr. *Cl. testâ subrimatâ, fusiformi, solidulâ, confertim costulato-striatâ, cærulescenti-albâ, punctis et strigis corneis marmoratâ, parum nitidâ; spirâ gracili, apice corneâ, acutiusculâ; suturâ impressâ, submarginatâ; anfractibus* 12 *planiusculis, ultimo latere compresso, basi bicristato; cristis conniventibus, basi contiguis, alterâ juxta periomphalum subarcuatâ, compressâ, alterâ breviore; aperturâ pyriformi-oblonga, intus fusculâ; lamellis conniventibus, minutis, inferâ sursum furcatâ; lunellâ inconspicuâ; plicâ palatali* 1 *superâ, subcolumellari immersâ; peristomate continuo, soluto, tenui, expanso, albo.*
Long. 17, diam. 4 mill.; ap. 4 mill. longa, $2\frac{2}{3}$ lata.
Hab. in insulâ Cerigo (Spratt).

12. Clausilia græca, Pfr. *Cl. testâ rimatâ, fusiformi, solidâ, confertissimè costulatâ, cinereo-albidâ, non nitente; spirâ regulariter attenuatâ, apice corneâ, acutiusculâ; suturâ subcrenulatâ; anfractibus* 10 *convexiusculis, ultimo infra suturam compresso, anticè rugoso-costulato, basi breviter cristato; aperturâ oblongâ, intus albâ; lamellis parvulis, conniventibus; lunellâ inconspicuâ; plicâ palatali* 1 *superâ, subcolumellari immersâ; peristomate continuo, soluto, tenui, breviter expanso.*
Long. 13, diam. $3\frac{1}{3}$ mill.; ap. 3 mill. longa, 2 lata.
Hab. in Moreâ (Spratt).

13. Clausilia scalaris, Pfr. *Cl. testâ vix rimatâ, ventroso-fusiformi, truncatâ, confertim et acutè lamellatâ, haud nitente, fuscescenti-albidâ; suturâ profundâ, lamellis prominentibus denticulatâ; anfractibus (spec. trunc.)* 7 *scalaribus (margine supero ampliato, supra suturam prominente), ultimo latere impresso, basi subbicristato: cristâ rimali obsoletâ, alterâ distinctâ; aperturâ amplâ, pyriformi; lamellis exiguis, approximatis; lunellâ inconspicuâ; plicâ palatali* 1, *subcolumellari*

emersâ; peristomate continuo, soluto, tenui, campanulato-expanso.

Long. 13, diam. $4\frac{1}{2}$ mill.; ap. 4 mill. longa, $3\frac{1}{3}$ lata.

Hab. in insulâ Melitâ (Spratt).

14. Clausilia canaliculata, Pfr. *Cl. testâ subrimatâ, fusiformi, solidulâ, striatulâ, purpureo-brunneâ, vix nitidulâ; spirâ gracili, apice acutâ; suturâ subalbofilosâ; anfractibus* 10 *planulatis, ultimo costulato, latere impresso, basi æqualiter bicristato; aperturâ rotundato-pyriformi, basi canaliculatâ, intus fusculâ; lamellis approximatis, superâ marginali, parvâ, inferâ altâ, flexuosâ; lunellâ imperfectâ, interruptâ; plicâ palatali* 1, *suturæ parallelâ, lunellam utrinque transgrediente, subcolumellari inconspicuâ; peristomate continuo, soluto, tenui, expanso, basi regulariter rotundato.*

Long. 13, diam. 3 mill.; ap. $3\frac{1}{4}$ mill. longa, 3 lata.

β. *Clavato-fusiformis, anfractibus* 9, *peristomate carneo-labiato.*

Hab. in Eubœâ. Var. β. in Monte Delphi, 6500 ped. supra mare.

15. Clausilia homalorhaphe, Pfr. *Cl. testâ rimatâ, cylindraceo-fusiformi, solidâ, longitudinaliter striatâ, cærulescenti-albâ, vix nitidulâ; spirâ sursum attenuatâ, apice corneâ, tum saturatè cæruleâ; suturâ planâ, marginatâ; anfractibus* 11 *planis, ultimo subcompresso, anticè rugoso-striato, basi obtusè bigibboso; aperturâ ovali, intus carneâ; lamellis conniventibus, inferâ ferè transversâ; lunellâ distinctâ; plicis palatalibus* 2, *alterâ superâ, alterâ inferâ, juxta subcolumellarem emersâ; peristomate continuo, breviter soluto, reflexiusculo-expanso.*

Long. 20, diam. 4 mill.; ap. 5 mill. longa, $3\frac{1}{2}$ lata.

Hab. in insulâ Candiâ (Spratt).

16. Clausilia Hedenborgi, Pfr. *Cl. testâ subrimatâ, fusiformi, turritâ, solidulâ, longitudinaliter subremotè plicatâ, interstitiis striatâ, parum nitidâ, cinereo-albidâ; spirâ gracili, apice lutescente, acutiusculâ; anfractibus* 12 *planiusculis, ultimo basi validè cristato; periomphalo latiusculo; aperturâ ovali, intus albâ; lamellis tenuibus, inferâ subtransversâ; lunellâ vix distinctâ; plicâ palatali* 1 *superâ, subcolumellari immersâ; peristomate continuo, soluto, tenui, breviter expanso.*

Long. 18, diam. 4 mill.; ap. 4 mill. longa, 3 lata.

Hab. in Syriâ, inter Nahr et Kelb. (Road of Antoninus: Hedenborg.)

17. Clausilia striata, Pfr. *Cl. testâ non rimatâ, fusiformi, confertissimè striatâ, opacâ, albidâ, punctis corneis conspersâ; spirâ turritâ, apice acutiusculâ, corneâ, nitidâ; suturâ levi, marginatâ; anfractibus* 11 *planis, ultimo anticè undulato-costulato, basi obtusè cristato; aperturâ ovali, intus fusculâ; lamellis tenuibus, conniventibus, interstitio biplicatulo; lunellâ parum conspicuâ; plicâ palatali* 1 *superâ,* 1 *inferâ, juxta subcolumellarem emersâ; peristomate continuo, soluto, tenui, undique mediocriter expanso.*

Long. 19, diam. $4\frac{1}{2}$ mill.; ap. $4\frac{1}{2}$ mill. longa, $3\frac{1}{2}$ lata.

Hab. in insulâ Candiâ (Spratt).

18. Clausilia flammulata, Pfr. *Cl. testâ profundè arcuato-rimatâ, fusiformi, solidulâ, lævigatâ, nitidulâ, cretaceâ, flammulis longitudinalibus corneis pictâ; spirâ sursum attenuatâ, apice pallidè corneâ, obtusiusculâ; anfractibus* 10, *superis costulato-striatis, sequentibus subplanis, penultimo infra crenulato, ultimo anticè costulato-striato, juxta periomphalum compressè cristato; aperturâ oblongo-ovali; lamellâ superâ mediocri, inferâ profundâ, subramosâ; lunellâ validâ; plicâ palatali* 1 *superâ, elongatâ, subcolumellari immersâ; peristomate continuo, soluto, albo, expanso, margine extero repando.*

Long. 16, diam. 4 mill.; ap. 4 mill. longa, 3 lata.

Hab. in Moreâ (Spratt).

19. Clausilia tetragonostoma, Pfr. *Cl. testâ subrimatâ, clavato-fusiformi, tenui, læviusculâ, castaneâ, pellucidâ, sericinâ; spirâ sursum attenuatâ, apice nigrâ, acutiusculâ; anfractibus* 11, *mediis vix convexiusculis, ultimo anticè capillaceo-striato, latere valdè compresso, basi bicristato; cristis parallelis, alterâ periomphalum cingente brevi, alterâ valdè elatâ, compressâ, crenulatâ; aperturâ subtetragonâ, intus fuscâ; lamellis approximatis, superâ tenui, marginali, inferâ validâ, transversâ; lunellâ angustâ, arcuatâ, cum plicâ palatali unicâ crucis formam exhibente; plicâ subcolumellari inconspicuâ; peristomate continuo, soluto, tenui, expanso.*

Long. 15, diam. 4 mill.; ap. 4 mill. longa, 3 lata.

Hab. in Eubœâ (Spratt).

20. Clausilia lunellaris, Pfr. *Cl. testâ subrimatâ, fusiformi, solidulâ, striatulâ, corneo-fuscâ, sursum deorsumque pallidiore, nitidulâ; spirâ apice acutiusculâ; suturâ anfractibus superiorum lineâ impressâ marginatâ, inferiorum subpapillatâ; anfractibus* 9 *vix convexiusculis, ultimo paulo distinctius striato, basi leviter bigibboso; aperturâ ovali-rotundatâ; lamellis conniventibus, superâ exiguâ, inferâ flexuosâ; lunellâ magnâ, suturam attingente; plicis palatalibus* 2, *alterâ superâ, breviusculâ, alterâ brevissimâ, subcolumellari emersâ; peristomate continuo, supernè appresso, sublabiato, breviter expanso.*

Long. 14, diam. 4 mill.; ap. $3\frac{2}{3}$ mill. longa, 3 lata.

Hab. in Eubœâ (Spratt).

21. Clausilia negropontina, Pfr. *Cl. testâ subrimatâ, ventroso-fusiformi, solidâ, longitudinaliter confertim striatâ, purpureo-brunneâ, haud nitente; spirâ apice corneâ, obtusâ; suturâ subcrenulatâ, papillis albis striæformibus ornatâ; anfractibus* 8 *subplanis, ultimo basi tumido, sulco levi bigibboso; aperturâ subrotundâ, supernè subangulatâ; lamellâ superâ minutissimâ, inferâ altâ, transversâ; lunellâ magnâ, callosâ, à suturâ ad basin elongatâ; plicâ palatali* 1 *superâ, subcolumellari inconspicuâ; peristomate continuo, supernè appresso, reflexiusculo, margine externo subdentato, fusculo.*

Long. 13, diam. vix 4 mill.; ap. $3\frac{2}{3}$ mill. longa, 3 lata.

Hab. in Eubœâ (Spratt).

22. Clausilia Hanleyana, Pfr. *Cl. testâ vix rimatâ, subclavatâ, longitudinaliter striatulâ, tenui, vix nitidulâ, corneo-fuscescente; spirâ subcylindricâ, sursum attenuatâ, pallidiore, apice obtusâ; suturâ marginatâ, irregulariter papilliferâ; anfractibus $8\frac{1}{2}$ vix convexiusculis, ultimo basi tumido, juxta rimam obsoletè gibboso; aperturâ amplâ, subcirculari; lamellis approximatis, superâ parvulâ, inferâ magnâ, compressâ, transversâ, basi ramosâ; lunellâ parum arcuatâ; plicâ palatali 1 superâ, subcolumellari immersâ; peristomate continuo, vix soluto, albo, expanso.*
Long. 13, diam. 3 mill.; ap. $3\frac{1}{2}$ mill. longa, 3 lata.
Hab. in Eubœâ (Spratt).

23. Clausilia Thermopylarum, Pfr. *Cl. testâ subrimatâ, cylindraceo-fusiformi, solidulâ, subtiliter striatulâ, griseo-carneâ, parum nitente; spirâ supernè attenuatâ, apice corneâ, obtusiusculâ; suturâ marginatâ; anfractibus 9–10 vix convexiusculis, ultimo distinctius striato, basi breviter et obsoletè bicristato; aperturâ ovali-pyriformi; lamellis mediocribus, conniventibus; lunellâ validâ; plicâ palatali 1 superâ, subcolumellari emersâ; peristomate continuo, breviter soluto, albo-labiato, reflexiusculo-expanso.*
Long. 17, diam. 4 mill.; ap. 4 mill. longa, $3\frac{1}{3}$ lata.
Hab. prope Thermopylas (Spratt).

24. Clausilia sericata, Pfr. *Cl. testâ subrimatâ, fusiformi, tenui, confertim costulatâ, sericinâ, fuscâ; spirâ apice pallidè corneâ, obtusiusculâ; suturâ albo-marginatâ; anfractibus 10 convexiusculis, ultimo basi breviter cristato; aperturâ amplâ, subrotundâ, supernè angulatâ, intus hepaticâ; lamellâ superâ parvulâ, inferâ flexuosâ; lunellâ validâ, arcuatâ; plicis palatalibus 2 elongatis, superis, 1 inferâ emersâ, medianis pluribus irregularibus, callosis, subcolumellari immersâ; peristomate continuo, breviter soluto, tenui, expanso.*
Long. 19, diam. $4\frac{1}{2}$ mill.; ap. $4\frac{1}{2}$ mill. longa, $4\frac{1}{4}$ lata.
Hab. in Eubœâ (Spratt).

25. Clausilia Charpentieri, Pfr. *Cl. testâ vix rimatâ, cylindraceo-fusiformi, tenui, longitudinaliter confertissimè costulato-striatâ, pallidè fuscâ, diaphanâ, vix nitidulâ; spirâ supernè attenuatâ, apice glabrâ, luteâ, obtusâ; suturâ submarginatâ, costulis crenulatâ; anfractibus 9, prioribus 6 convexis, sequentibus 2 planulatis, ultimo basi tumido, obsoletissimè bigibboso; aperturâ latè ovali; lamellâ superâ exiguâ, inferâ magnâ, compressâ, transversâ, basi ramosâ; lunellâ leviter arcuatâ; plicâ palatali 1 superâ, subcolumellari inconspicuâ; peristomate continuo, supernè appresso, albo-labiato, expanso, margine externo subdentato.*
Long. 14, diam. 4 mill.; ap. 4 mill. longa, $3\frac{1}{3}$ lata.
Hab. in Eubœâ (Spratt).

26. Clausilia Reeveana, Pfr. *Cl. testâ vix rimatâ, fusiformi, tenui, longitudinaliter confertissimè costulato-striatâ; vix seri-*

cinâ, cinerascenti-fuscâ; spirâ apice corneâ, obtusulâ; suturâ submarginatâ, crenulatâ; anfractibus 9, summis convexis, reliquis vix convexiusculis, ultimo latere impresso, basi subcristato; aperturâ pyriformi-ovali, intus fusculâ; lamellis tenuibus, approximatis; lunellâ filari, leviter arcuatâ; plicâ palatali 1 superâ (nonnullisque obsoletis supra eam), subcolumellari immersâ; peristomate continuo, breviter soluto, tenui, expanso.

Long. $13\frac{1}{2}$, diam. 4 mill.; ap. $3\frac{2}{3}$ mill. longa, 3 lata.

Hab. in Græciâ (Spratt).

27. Clausilia idæa, Pfr. *Cl. testâ breviter arcuato-rimatâ, fusiformi, solidulâ, haud nitente, saturatè cinereâ, costis filiformibus, rectis, albis, confertis munitâ; spirâ sensim attenuatâ, apice acutâ; suturâ vix impressâ, albo-filosâ; anfractibus 13 planis, ultimo fortius rugato, basi cristâ brevi, arcuatâ juxta periomphalum latiusculum, et gibbere obtuso munito; aperturâ ovali, intus fusculâ; lamellâ superâ parvâ, inferâ obliquâ, profundè furcatâ; lunellâ extus conspicuâ; plicâ palatali 1 superâ, subcolumellari immersâ; peristomate continuo, soluto, carneo, labiato, expanso.*

Long. 22, diam. 5 mill.; ap. 5 mill. longa, 4 lata.

Hab. in Monte Idâ, 5500 ped. supra mare (Spratt).

28. Clausilia Dunkeri, Pfr. *Cl. testâ rimatâ, ventroso-fusiformi, tenui, confertim costulatâ, diaphanâ, fuscescenti-albidâ; spirâ à medio attenuatâ, apice obtusiusculâ; anfractibus $10\frac{1}{2}$ vix convexiusculis, ultimo latere compresso, basi validè bicristato; carinis conniventibus, æqualibus; aperturâ pyriformi-ovali, intus albâ; lamellâ superâ parvâ, inferâ transversâ; lunellâ distinctâ inter cristarum originem; plicâ palatali 1 superâ, subcolumellari immersâ; peristomate continuo, soluto, albo-sublabiato, undique latè expanso.*

Long. 19, diam. $4\frac{2}{3}$ mill.; ap. $4\frac{2}{3}$ mill. longa, 4 lata.

Hab. ad "Caunus," Asiæ Minoris.

29. Clausilia Sowerbyana, Pfr. *Cl. testâ breviter rimatâ, ventroso-fusiformi, truncatâ, longitudinaliter costulato-striatâ, diaphanâ, fuscâ; suturâ albo-marginatâ; anfractibus (superstit.) $6\frac{1}{2}$ planiusculis, ultimo latere excavato, basi validè bicristato; cristis parallelis, alterâ arcuatâ, periomphalum latiusculum cingente, alterâ sursum furcatâ; aperturâ subrhombeâ, basi leviter canaliculatâ; lamellis mediocribus, conniventibus, inferâ profundâ, vix flexuosâ; lunellâ validâ; plicis palatalibus 2 brevibus supra lunellam, subcolumellari vix emersâ; peristomate continuo, breviter soluto, albo, reflexiusculo-expanso.*

Long. (trunc.) 16, diam. 5 mill.; ap. $4\frac{2}{3}$ mill. longa, $4\frac{1}{3}$ lata.

Hab. in Pamphyliâ (Spratt).

30. Clausilia semidenticulata, Pfr. *Cl. testâ rimatâ, fusiformi, solidulâ, longitudinaliter confertim costatâ, brunneâ, albido-striolatâ; spirâ supernè attenuatâ, obtusiusculâ; anfractibus 13 angustis, convexiusculis, ultimo rugoso-costato, basi*

tumido, juxta rimum compresso-cristato; aperturâ pyriformi-ovali, basi canaliculatâ; lamellâ superâ marginali, inferâ utrinque ramosâ; lunellâ parvulâ; plicis palatalibus 2, superâ 1, alterâ inferâ, breviter emersâ, subcolumellari subocculta; peristomate continuo, soluto, intus albo-labiato, reflexiusculo, margine sinistro extrorsum confertim denticulato.

Long. 15, diam. $3\frac{3}{4}$ mill.; ap. $3\frac{1}{3}$ mill. longa, $2\frac{2}{3}$ lata.

Hab. prope Bujukderé ad Bosporum.

LINNÆAN SOCIETY.

January 15, 1850.—R. Brown, Esq., President, in the Chair.

Read a Paper "On the Economy of a new species of Saw-fly." By John Curtis, Esq., F.L.S. &c. &c.

This species, which belongs to the genus *Selandria*, was taken by Lord Goderich in his father's garden at Putney, where its larvæ were first observed in July 1846, on the Solomon's Seal (*Convallaria multiflora*, L.?). When first noticed, Lord Goderich states, they had almost consumed the entire membrane of the leaves, and many of them were feeding on the stalks; and in a short time after they had eaten the plant nearly to the ground, leaving only the stronger branches, but not destroying the plant itself. The number on one small plant was full a hundred; and the next year, and again in 1848, they reappeared in equal numbers. In 1849 their numbers were fewer. Mr. Curtis gives a detailed description of the caterpillar, which on the 28th of June (when many of them had cast their last skins, which remained sticking to the leaves) were nearly $\frac{3}{4}$ of an inch in length. They disappeared in succession, burying themselves from 2 to 4 inches deep in the earth, where they formed small oval cocoons like a coating of glue, but often perforated in different places. On the 30th of April in the last year, Mr. Curtis succeeded in breeding a male fly; another male and two females were hatched on the 3rd of May; and these were succeeded by several more of the latter sex. They were as black as ink, and appear to be allied to *Selandria fuliginosa*, Schrank, but the male antennæ approach those of *Cladius*. A full description of both sexes is given, and the species is named by Mr. Curtis after its discoverer, *Selandria Robinsoni*.

The paper was accompanied by drawings, illustrating the structure of the insect; and was concluded by some remarks on the characters and affinities of the genus *Selandria*. Although the elongated antennæ of the species described resemble those of *Nematus*, and still more those of *Cladius*, it is not only distinguished from those genera by its divided marginal cell, but the heavy habit of the females especially and the characters of its trophi, which are intermediate between *Athelia* and *Tenthredo*, indicate the groups to which it is naturally allied. The author regards the number of discoidal cells in the inferior wings as furnishing good characters for the distinction of the genus *Selandria* into sections as follows:—

1. With two discoidal cells, the marginal cell receiving one transverse nervure.—Example *S. serva*, Fabr.

2. With both transverse nervures united with the marginal one.—Example *S. stramineipes*, Klug.

3. With one discoidal cell.—Example *S. Robinsoni.*

4. With no discoidal cell.—Example *S. fuliginosa*, Schrank.

And he further observes that the variations in the position of the nervures, and in the magnitude of the cells, will also be found very useful in identifying the species.

February 5.—William Yarrell, Esq., V.P., in the Chair.

Read the conclusion of Mr. Huxley's paper " On the Anatomy of *Diphyes*, and on the Unity of Composition of the *Diphyidæ* and *Physophoridæ*," &c.

Mr. Huxley, whose communication was written at sea, commences his memoir by a brief abstract of previous investigations of the family of *Diphyidæ*, chiefly derived from the works of Lesson and Will, in the absence of other books of reference. Of all the authors referred to, he observes, there is not one except Will, who has given any but a very superficial account of the family. So far even as the natatorial organs are concerned, it is but rarely that a description is sufficiently detailed and accurate not to fit two or three species with equal ease, while the minute internal organs have fared still worse. By all, the important fact of the gemmiparous generation of these animals is overlooked; by all, except Will, the demonstration of the generative organs is omitted, and even he mentions with some doubt the male sac only; and lastly there is no attempt made by any of them to trace the various organs through their development, or to establish on the ground of anatomy the natural affinities of the group. To these latter points, Mr. Huxley states, that his attention has been chiefly directed during a voyage of some months through the South Atlantic and Indian Oceans, in the course of which he has examined several genera both of *Diphyidæ* and *Physophoridæ*, with as much care and attention as the inconveniences of ship-board would permit. The results are given under the following sectional divisions, viz.: 1. a description of the different species examined; 2. their anatomy; and 3. a comparison of *Diphyidæ* and *Physophoridæ*. Under the first head Mr. Huxley describes four species of *Diphyes*, one of *Calpe*, one of *Eudoxia*, one of *Aglaisma* ?, and one of *Rosacea*. He then enters at length into the anatomy of the different parts of the body, under the several heads of the common tube; the natatorial organs and the duct connecting their cavities with the common tube; the nuclear piece or bract and its sacculus; and the polypoids, each consisting of a stomachal sac, a prehensile organ and a generative organ. Although generative sacs were found by the author in all the genera examined by him, it was only in *Eudoxia* and *Aglaisma* (?) that he procured unequivocal evidence, by the presence of ova, of their real nature. No unequivocal male organs were observed, although the so-called " entozoa " of Will were frequently seen swimming about in the cavity of the young generative organs. But they were not more abundant in these situations than in the stomachal sacs, common tube, &c., and their dissimilarity to true spermatozoa is too great for any conclusions to be founded on their presence. The total absence of male sacs, and the rarity of ova in the females, may, Mr. Huxley thinks, be accounted for by the season during which his investigations were carried on, the months of March, April, May and June being the winter of the Southern Hemisphere. Lastly, the author enters on the comparative anatomy of various species of *Physophoridæ*, by means of which he believes it to be satisfactorily demonstrated that there exists a unity of organization between the two families of *Diphyidæ* and *Physophoridæ*; and concludes by stating his opinion that *at least* two other families, the Hydriform and Sertularian Polypes, should be arranged with them in one natural group. The structural coincidences in these families he enumerates as follows: 1. body composed of two membranes, out of which the organs are modeled; 2. thread-cells universally (?) present; 3. gemmiparous generation; 4. sexual generation, spermatozoa and ova being formed in vase-like external sacs.

The paper was accompanied with a series of illustrative drawings.

March 5.—William Yarrell, Esq., V.P., in the Chair.

Dr. Wallich, V.P.L.S., read the following extract of a letter from Prof. Lehmann, dated Hamburgh, 14th December, 1849:—"I write to inform you that a work has just appeared, namely Proceedings of the Fifth Meeting of Scandinavian Naturalists held at Copenhagen 1847. Copenhagen, 1849. 8vo. There is in it a very remarkable paper by Liebmann, entitled 'A few words concerning the Impregnation of *Cycadeæ*,' p. 501 *seq*. It appears, according to this paper, that in that family ripe and vegetative fruits may be produced, without the process of impregnation. A female plant in the Botanic Garden at Copenhagen (males do not exist in Europe) produced seeds which have germinated! Liebmann made the same observation in Mexico."

Read also a paper entitled, "Further observations on the habits of *Monodontomerus*, with some account of a new *Acarus*, *Heteropus ventricosus*, a parasite in the nests of *Anthophora retusa*." By George Newport, Esq., F.R.S., F.L.S. &c. &c.

Mr. Newport remarked that as some of the details of a paper on "certain *Chalcididæ* and *Ichneumonidæ*" read to the Linnean Society in March 1849 had drawn forth at that time the dissent of some entomologists, he had repeated his observations during the past summer, and on one occasion had obtained as many as *two hundred and forty-seven* larvæ of *Monodontomeri* from the nests of *Anthophora*. In every instance these parasites had fed on the bee larva *from without*, and had drained it of its contents in the same way that the larva of *Paniscus* drains that of the body of a caterpillar, thus proving the correctness of his original statement, that the *Monodontomeri* are *external* and not *internal* feeding parasites. He had originally been led to this view, *not*, as erroneously stated by Mr. Westwood in the printed Proceedings of the Linnean Society for May 1849, p. 37 (Annals and Mag. Nat. History, Oct. 1849, p. 288), from the simple fact that the author had found the bodies of these parasites covered with an armature of hairs, but as he had explicitly stated in his former paper, from the circumstance that he had never found hairs on the bodies of *internal* feeding parasites. Mr. Newport also found, as he formerly mentioned, some remains of the destroyed bee larva in each cell, but no "yellow dust or granules," as stated by another observer. Thus his more recent observations have confirmed those which he formerly communicated to the Society on the *Monodontomeri.*

Having however collected a quantity of these larvæ for further observation, he was surprised to find at the end of a few days that their bodies were covered with multitudes of what at first appeared like microscopic drops of fluid, which each day increased in size, until at length he found, on careful examination, that those supposed drops were the bodies of multitudes of gravid parasites, which infested and ultimately destroyed the larvæ of *Monodontomerus,* as these had done that of the bee. The œconomy of this microscopic parasite was then traced to some extent, and the fact of their having attained a mature state proved in the circumstance that at the end of about three weeks many of them produced multitudes of extremely minute young, which differed from their parents only in the smaller size, and in having no enlargement of the abdominal portion of the body. These young were smaller even than the young of *Stylops,* as each measured only *sixteen thousandths* of an inch in length. The author stated other facts connected with the œconomy of this singular parasite, and mentioned that he is still engaged in its investigation. The following are the characters and description of this new *Acarus.*

Class ACARI.

Family Sarcoptides, Koch.

Genus *Heteropus,* Newp.

Corpus elongatum, subarticulatum. *Caput* mobile. *Thorax* a trunco distinctus, ad latera corpusculis clavatis munitus. *Pedes anteriores* palpiformes ; *reliqui* (parium trium posteriorum) æquales, arcuati, attenuati, tarsis gracilibus 4-articulatis, articulo terminali lato vesiculari.

H. ventricosus, pallidè ferrugineus, capite saturatiore, prothorace paribus 2 pilorum longorum, pedibus subrobustis ; articulis omnibus longè pilosis : tibiæ articulo apicali corporis dimidium æquante.—Long. $\frac{1}{6}$–$\frac{1}{8}$ lin.

♀ gravidæ abdomine magnoperè inflato vesiculari.

Hab. In postibus intra nidos *Anthophoræ retusæ,* apud Gravesend, in Comitatu Kent.

MISCELLANEOUS.

NOTES ON THE SYNGNATHI.

To the Editors of the Annals of Natural History.

Gentlemen, The Willows, Swansea, Oct. 5, 1850.

I wish to record in your valuable periodical the following notes, which may assist towards determining the time at which the transfer of the ova from the female to the male in *Syngnathus acus* and *S. lumbriciformis* takes place ; their vivification, &c.

May 14, Langland Bay. *Syngnathus lumbriciformis* with pouch on the *anterior* portion of the belly, *empty.*

June 10, Langland Bay. *S. lumbriciformis,* pouch *full of roe.*

June 6, Swansea Bay. *S. acus,* pouch on the *posterior* portion of the belly, *full.*

July 8, Swansea Bay. *S. acus,* young alive and obvious to the unassisted eye: some still within the ova, some partially, and others wholly liberated. All the above specimens are preserved in the Royal Institution of South Wales. They were all taken above low water mark.

In *S. lumbriciformis* the pouch is on the *anterior* instead of the *posterior* portion of the belly as in *S. acus*; and the membrane running round the edges of the pouch is not so fully developed.

I am, Gentlemen, your obedient servant,

Matthew Moggridge.

On the Resuscitation of Frozen Fish. By Prof. O. P. Hubbard.

For a number of years, during my residence in New Hampshire, I have received from numerous sources, the statement that fish taken in the cold of winter from our ponds and thrown out upon the ice and freezing quite hard, have been restored to their usual activity when thrown again into cold water.

That they would ever have moved again if left alone is incredible; and how far and for what time a fish may be frozen and yet be restored is not shown by experiment. I have good reasons, from the character of my informers, for believing that the facts are as stated, though when repeated they are hardly credible to others; and I am much gratified in obtaining for publication the following authentic account of a satisfactory instance.

Persons who have had similar experience are requested to communicate the facts in detail to the writer.

"Some time in the winter of 1838 or 1839—living near a stream abounding with fish, which emptied into a pond near by,—I was in the habit, daily, of catching them, (as they pass down stream,) by means of an eel-pot. This was so constructed as to receive and retain them without injury, if taken out soon, and on one occasion, the pot having remained longer than usual, so many were caught as nearly to fill the pot, and numbers perished from pressure or want of air.

"It was the custom to examine the pot in the morning. On one occasion, a severe cold morning, in January I think, I took up the pot and found a considerable number were taken. These I emptied upon the snow, which was deep and so crusted with ice as nearly or quite to bear me up.

"I then replaced the eel-pot in its proper bed for another draught, which took me about twenty minutes, and then gathered up my fish, exposed on the snow, into a pail or basket, and found them frozen as stiff as icicles.

"I carried them home to the shop, where they remained frozen, according to my recollection, for the space of an hour and a half longer, and so stiff and inflexible that they could not be bent without cracking, as did some of their tails and fins in pulling them apart when they were congealed together. I then put them into a tub of water drawn from the well, to thaw them for dressing, and I think added a small quantity of warm water that stood upon the stove, but am not certain whether it was before or after scaling them.

"After some little time, how long I cannot now say, I examined them to see if they were thawed sufficiently for dressing, and to my surprise, I found some of them as lively as when sporting in their native brooks. I called on others to view them, who had seen them while they were frozen. To them also it appeared almost incredible, but we were constrained to believe our own eyes and senses.

"I think those fish were *perch* that came to life after (I cannot say death, but) freezing.

"In the spring, I remark, we set the eel-pot with its mouth down stream, as then the fish are running from the pond up stream.—*Silliman's American Journal for July* 1850.

"Yours respectfully, PARACLETE SKINNER."

Woodstock, Conn., Dec. 1849.

NEW BIRD FROM NEW ZEALAND.

Dr. Mantell has just received from his eldest son, Mr. Walter Mantell, of New Zealand, the skin of a bird hitherto supposed both by the natives and European colonists to be extinct. It is a large species of Rail or *Porphyrio*, called "*Moho*" and "*Tákehé*" by the New Zealanders, who state that it was formerly abundant and contemporaneous with the Moa, but as not an individual had been seen for many years, the race was thought to have been extirpated by the wild cats and dogs. A skull and other bones discovered by Mr. Walter Mantell with the remains of the Dinornis, &c. in the bone-bed at Waingongoro, and described by Professor Owen as *Notornis Mantelli* (Zool. Trans. vol. iii.), belong to this species. This bird is about 2 feet high, of a rich dark purple colour, with red beaks and legs. It was caught by dogs, its trail having been observed on the snow, in a gully behind Resolution Island, at the south-western extremity of the Middle Island of New Zealand. This unique example of a bird, perhaps the last of its race, is alike interesting to the ornithologist and palæontologist; Dr. Mantell has placed it in the hands of our eminent ornithologist Mr. Gould to figure and describe. A fine specimen of that very rare bird the *Apteryx Owenii*, and of other rapidly diminishing forms, together with some highly interesting recent and fossil shells, accompanied this valuable addition to the fauna of our Antipodes. Mr. Walter Mantell, when the "Woodstock" left Wellington, was about to depart on another exploration of the bone-deposits, in the hope of discovering other and more perfect skulls of the Moa than have hitherto been obtained.

ON THE ANIMAL OF GEOMELANIA. BY A. ADAMS, F.L.S.

An examination of the animal of *Geomelania Jamaicensis*, Pfeiffer (which the kindness of Mr. Cuming has allowed me to make), shows it to belong to the family of Looping-Snails, *Truncatellidæ* of Gray; in fact, it differs in no respect from the animal of *Truncatella*.

The tentacles are short, conical and depressed, with the eyes large, black, and sessile on the middle of the upper surface of their base; the head terminates anteriorly in a broad, flattened bilobate proboscis, as long as the tentacles; and the foot is short, depressed, and divided by a deep groove from the head, bearing on its upper hind surface a horny, simple, thin, oval operculum, with the apex slightly spiral, and the nucleus subterminal. The order, which consists of the genera *Truncatella, Skenea, Geomelania*, and possibly *Acicula* and *Assiminea*, differs from the *Cyclostomidæ* in the position of the eyes and the short depressed tentacles; and would seem to be placed most naturally between *Auriculidæ* and *Cyclostomidæ*. By means of *Rissoa* and *Hydrobia* it has also relations with *Littorinidæ; Truncatella* resembling the former and *Assiminea* the latter genus. In habits they are amphibious.—*Proc. of Zool. Soc.* Dec. 11, 1850.

METEOROLOGICAL OBSERVATIONS FOR SEPT. 1850.

Chiswick.—September 1. Drizzly. 2—5. Very fine. 6. Clear and fine. 7. Frosty: very fine. 8. Cloudy. 9. Overcast. 10. Overcast: clear. 11. Foggy: very fine. 12. Foggy: fine: clear. 13. Slight fog: fine: clear. 14. Foggy: fine: clear. 15. Slight fog: cloudy. 16. Overcast: cloudy. 17. Clear and fine. 18. Fine: overcast. 19. Foggy: overcast: rain. 20. Cloudy: rain. 21. Boisterous: heavy rain at night. 22. Heavy rain. 23. Rain: lightning in the evening. 24. Cloudy: very fine. 25. Dense fog: very fine. 26. Overcast: constant heavy rain. 27. Fine: thunder and heavy rain in afternoon. 28. Clear: fine: clear. 29. Fine: rain. 30. Rain: rather boisterous: overcast.

Mean temperature of the month	54°·23
Mean temperature of Sept. 1849	57 ·76
Mean temperature of Sept. for the last twenty-four years	57 ·23
Average amount of rain in Sept.	2·61 inches.

Boston.—Sept. 1. Cloudy. 2. Fine. 3. Cloudy: rain P.M. 4—6. Fine. 7. Cloudy: rain P.M. 8—12. Cloudy. 13—15. Fine. 16, 17. Cloudy. 18. Fine. 19. Cloudy. 20. Fine: rain P.M. 21. Cloudy: rain early A.M. 22. Fine. 23. Cloudy: rain P.M. 24. Cloudy. 25. Foggy. 26. Rain: rain early A.M. 27. Fine: rain early A.M. 28, 29. Fine: rain P.M. 30. Cloudy: rain A.M.

Applegarth Manse, Dumfries-shire.—Sept. 1. Fine harvest day. 2. Fair, but cloudy: threatening P.M. 3. Very fine: frost rime in the morning. 4. Frost rime A.M.: one slight shower. 5, 6. Fair and fine. 7. Fair and fine, though chill. 8. Fair and fine: milder. 9. Fair and fine: smelling of frost. 10. Fair and fine: cloudy. 11. Fair and fine: cloudy: very warm A.M. 12. Fair and fine: heavy dew: white rime. 13. Fair and fine: fine harvest weather. 14. Still fair and fine. 15. Dull A.M., but cleared, and was fine. 16. Fine, but colder. 17. Fine, but colder: mercury falling. 18. Fine, but colder: moon wading. 19. Fair, but threatening change. 20. Rain A.M.: rain also P.M. 21. Heavy showers all day. 22. Heavy showers A.M.: cleared, but moist. 23. Very fine, after showers in the night. 24. Fine harvest day. 25. Fair, but cloudy: cleared P.M. 26. Rain during night and morning: cleared. 27. Succession of heavy showers: flood. 28. Heavy rain during night: ditto day. 29. Rain and hail P.M. 30. Showers.

Mean temperature of the month	51°·65
Mean temperature of Sept. 1849	53 ·5
Mean temperature of Sept. for the last twenty-eight years	53 ·17
Average rain in Sept. for twenty-three years	3·13 inches.

Sandwick Manse, Orkney.—Sept. 1. Drizzle: showers. 2. Rain. 3. Clear: cloudy. 4. Showers: damp. 5. Showers. 6. Fine. 7. Fine: aurora. 8. Fine: cloudy. 9. Fine: cloudy. 10. Cloudy: aurora. 11. Fine: fog. 12. Fine: cloudy: clear: aurora. 13. Fine: cloudy. 14. Clear: aurora. 15. Hazy: aurora. 16. Fine: hazy: fine. 17. Fine. 18. Fine: cloudy. 19. Cloudy. 20. Cloudy: drops. 21. Cloudy: rain. 22. Bright: rain. 23. Showers: cloudy. 24. Cloudy: clear. 25. Bright: clear. 26. Hazy: clear. 27. Bright: clear. 28. Rain: showers: aurora. 29. Bright: showers: clear: aurora. 30. Showers: aurora.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* CHISWICK, *near London; by* Mr. Veall, *at* BOSTON; *by the* Rev. W. Dunbar, *at Applegarth Manse,* DUMFRIES-SHIRE; *and by the* Rev. C. Clouston, *at Sandwick Manse,* ORKNEY.

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1850. Sept.	Max.	Min.	8½ a.m.	9 a.m.	9 p.m.	9½ a.m.	8½ p.m.	Max.	Min.	8½ a.m.	Max.	Min.	9½ a.m.	8½ p.m.								
1.	30·348	30·333	29·83	30·19	30·24	30·11	30·17	72	46	63	67	54½	55	55	nw.	wnw.	nw.	w.	·01	......	......	·06
2.	30·385	30·292	29·86	30·23	30·18	30·09	30·09	72	41	60	63	53½	52	46	w.	nw.	w.	e.	......	......	......	·65
3.	30·238	30·190	29·70	30·09	30·18	30·22	30·43	64	51	60	61½	53½	51	40	sw.	nw.	w-ne.	nw.	......	......	......	·93
4.	30·322	30·274	29·86	30·28	30·27	30·55	30·55	66	30	53·5	59	39½	47	49	ne.	nnw.	e.	w.	......	·02	......	·03
5.	30·377	30·277	29·90	30·23	30·25	30·53	30·56	66	37	50·5	67	37½	50	48	ne.	nw.	ne.	nw.	......	......	......	......
● 6.	30·343	30·285	29·87	30·33	30·35	30·60	30·67	64	30	52	57	41½	53	49	ne.	n.	ne.	nw.	......	......	......	·07
7.	30·401	30·357	30·00	30·40	30·40	30·47	30·51	67	33	52	56	43	53	48	e.	nw.	ne.	calm	......	......	......	......
8.	30·446	30·388	30·03	30·42	30·37	30·49	30·45	60	36	52	59	40	52	49	n.	n.	ne.	n.	......	·03	0·03	......
9.	30·367	30·297	29·95	30·30	30·25	30·38	30·34	61	47	52·5	61½	35	52	48½	ne.	nw.	ne-se.	se.	......	......	......	......
10.	30·318	30·288	29·86	30·23	30·20	30·29	30·25	65	35	55·5	58	39	52	50	e.	calm	sw.	se.	......	......	......	......
11.	30·272	30·230	29·80	30·28	30·15	30·20	30·20	69	37	60	64	41	53½	52	e.	e.	se.ssw	s.	......	......	......	......
12.	30·250	30·219	29·83	30·20	30·19	30·22	30·23	70	32	60·5	65½	40	46	40	e.	se.	se-sw.	se.	......	......	......	......
☽ 13.	30·266	30·241	29·86	30·25	30·22	30·26	30·32	68	32	53	65	43½	53	54	e.	e.	se.	se.	......	......	......	......
14.	30·239	30·221	29·80	30·25	30·25	30·33	30·32	59	40	55·5	59	38½	54	48	e.	e.	se.	se.	......	......	......	·01
15.	30·252	30·247	29·86	30·29	30·29	30·33	30·38	65	52	59	58½	47	52½	49	e.	ene.	ne.	calm	......	......	......	......
16.	30·284	30·251	29·88	30·32	30·30	30·38	30·37	67	51	59·5	58	41	53½	49	e.	e.	ne.	se.	......	......	0·00	......
17.	30·290	30·197	29·88	30·28	30·17	30·31	30·19	69	39	56	61	35	55½	51	e.	ene.	ne-sw	se.	......	......	......	......
18.	30·073	29·888	29·62	29·98	29·80	29·92	29·78	69	46	59	60	44	53½	54	e.	e.	sw.	sse.	......	......	......	......
19.	29·808	29·700	29·34	29·70	29·64	29·78	29·78	70	53	61	62	46	54½	53	se.	sw.	ese.	se.	·02	......	......	......
20.	29·632	29·463	29·18	29·54	29·52	29·75	29·72	66	53	62	58	52	55	54½	s.	e.	se.	se.	·10	......	......	·05
○ 21.	29·813	29·531	28·97	29·18	29·48	29·60	29·33	69	41	59	62	51½	54½	54	sw.	ssw.	se.–s.	ese.	·50	·21	......	·07
22.	29·889	29·834	29·40	29·65	29·77	29·53	29·62	71	46	55	59	49½	55	53½	s.	ssw.	s.	s.	·06	......	......	·23
23.	29·803	29·753	29·37	29·80	29·75	29·75	29·82	71	51	60	56	51	54½	53	e.	ene.	s.	wnw.	·04	......	0·70	·54
24.	29·724	29·715	29·26	29·70	29·66	29·79	29·75	67	45	62	55	43	55	51	sw.	ne.	sw.	ese.	·12	·12	......	·05
25.	29·803	29·682	29·27	29·64	29·53	29·66	29·61	68	48	56	60	39	54	52	sw.	w.	se.	se.	......	......	......	......
26.	29·870	29·860	29·29	29·51	29·51	29·52	29·55	60	44	57	60	49½	55	53	s.	s.	s.	se.	·72	·02	......	·03
27.	29·802	29·690	29·29	29·48	29·35	29·52	29·34	67	48	53	56	50	55	53	sw.	sw.	sw.	se.	·49	·10	......	......
☾ 28.	29·867	29·782	29·23	29·38	29·50	29·09	29·29	63	42	52·5	57	45½	50½	50	w.	wsw.	w.	wsw.	......	·35	......	1·15
29.	29·846	29·380	29·32	29·50	29·23	29·33	29·34	62	42	51	56	44	50	44	sw.	s.	s.	s.	·29	·03	......	·14
30.	29·359	29·266	28·80	29·17	29·09	29·28	29·37	59	40	49	54½	41½	49	48½	w.	wsw.	wsw.	ne.	·01	1·34	1·70	·04
Mean.	30·089	30·004	29·60	29·960	29·936	30·009	30·011	66·20	42·26	56·3	59·8	44·3	52·68	49·96					2·36	2·22	2·43	4·05

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 36. DECEMBER 1850.

XXXIV.—*Tabular view of Fossil Shells from the middle division of the Inferior Oolite in Gloucestershire.* By John Lycett, Esq.*

[With a Plate.]

The term middle division of the Inferior Oolite has been adopted from an arrangement of this formation made by Sir R. Murchison in 1834, and which, with some slight modification, will be found to be a convenient one for the zoological as well as for the mineral character of the divisions. The following comparison of fossil testacea from the middle division of the formation at Leckhampton and Crickley Hills with others from a similar geological position near Minchinhampton, and of both collections with Great Oolite shells of the latter place, has been undertaken for the following reasons. The Leckhampton shells constitute a numerous assemblage, have only recently been procured or investigated, and present a striking contrast with those of the upper and lower divisions of the same formation which are well known, and have for the most part hitherto supplied the numerous Inferior Oolite fossils to be found in museums and illustrated works. The person to whom the merit is due of having first drawn attention to this assemblage is undoubtedly Mr. Buckman, who having procured a few species was immediately struck with the similarity of aspect, and even specific identity, which they presented to certain Great Oolite shells which had previously been believed were peculiar to that formation: as the number of species increased the same general similarity of aspect was remarked, until at length an opinion was entertained by some of our Cotswold geologists, that a large proportion, perhaps even a majority of these shells, were identical with Great Oolite species. That the Leckhampton shells should not previously have been procured will excite no surprise, when it is stated that they are not to be *picked up*, nor do they immediately arrest the eye of the observer like many other Inferior Oolite fossils; they are

* Read to the Cotswold Naturalists' Club, July 30, 1850.

usually small, even minute, and are disengaged from the investing stone only by great labour and perseverance. For the means of making this comparison I am indebted to the kindness and liberality of the Rev. P. B. Brodie, who has placed at my disposal his numerous collection, and to whom, as votaries of natural history, our thanks are due for the indomitable perseverance with which he has followed up the investigation of this very characteristic assemblage of shells. In the mean time having procured a considerable number of species from the same division of the Inferior Oolite near Minchinhampton, and been accustomed to compare them with Great Oolite shells of the same vicinity, I became desirous of making the following comparison, with the view of testing how far the two collections placed upon the same geological parallel, but fifteen miles asunder, resembled each other, what proportion of either and of both passed upward into the Great Oolite, and lastly, what amount had previously been figured and described; tables accompanied by notes, if carefully prepared, would obviously to a great extent supply this desideratum; and although the number of species procured from each locality probably falls far short of what will ultimately be obtained, the tables it is hoped will not be destitute of utility even in another point of view—they can be placed in comparison with collections from the Ragstones of the Inferior Oolite, and the zoological resemblance or difference between them ascertained. By following out this plan I am precluded from interfering with the labours of those who have recently investigated the geology of the Cotswolds, of Messrs. Buckman, Strickland and Brodie, to whom so much of our present amount of knowledge respecting these hills is due.

It would indeed have been desirable had the tables been made more comprehensive, so as to include the fossils of the upper and lower divisions of the Inferior Oolite; but a little reflection convinced me that by doing so I should be arrogating an amount of knowledge which I am very far from possessing; inasmuch as the information to be gathered from the literature of the science would scarcely be available for such a purpose, the general term Inferior Oolite with a locality attached being usually the amount of information of the position of a shell in this formation.

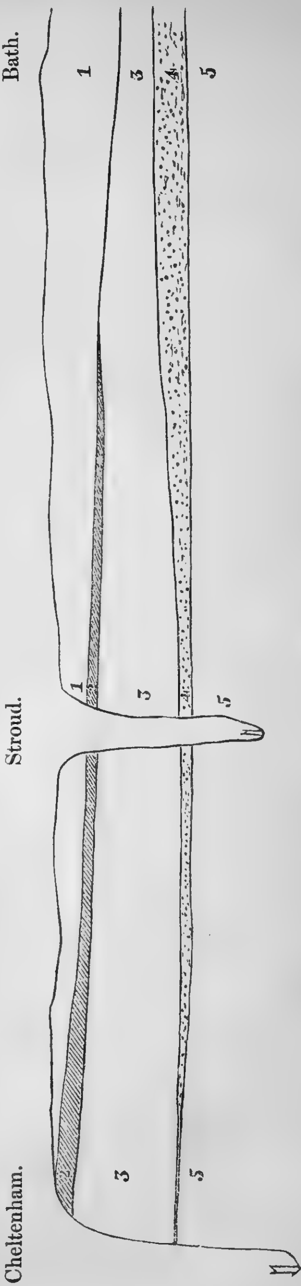
The Inferior Oolite in the vicinity of Cheltenham exhibits two very distinct assemblages of organic remains; the difference between these is so obvious, even to the uninstructed observer, that a glance at any well-arranged collection is sufficient to establish conviction of this fact. The upper of these assemblages is contained in the several beds called Upper Ragstones, numbered 1, 2, 3 and 4 in Mr. Strickland's valuable section of Leckhampton Hill* which is about to be pub-

* See Quart. Journ. Geol. Soc. 1850, p. 249.

lished, where the united thickness assigned to them is 38 feet; the whole of the formation beneath, with the exception of about $2\frac{1}{2}$ feet, or about 189 feet of rock, belongs to the second zoological assemblage, which it is the especial object of this comparison to elucidate. The Inferior Oolite has long been known to geologists for the great profusion which it possesses both in species and individuals of the two great tribes of Ammonites and Belemnites; some few of these pertain to the first or uppermost of our assemblages, but the great mass of these tribes, together with a large and characteristic series of other shells, are absent in the neighbourhood of Cheltenham; these constitute a third and still lower zoological series, to examine which, *in situ*, we must visit the escarpment of the Cotswolds, some miles to the southward of Leckhampton, and from thence we shall find this assemblage to be persistent in gradually increasing importance to the neighbourhood of Bath, and to extend throughout the whole course of the formation in Somerset and Dorset to the English Channel. In the two last-mentioned counties the localities of Dundry, Sherborne and Bridport have become celebrated for the profusion of their fossils, and until very recently museums and collections have been supplied almost exclusively from those sources, and the fossils of this third and lowest assemblage have been held to represent those of the Inferior Oolite generally. In the middle portion of the Cotswolds, or from Stroud to Wotton-under-Edge, the three subdivisions of the Inferior Oolite are exhibited by the various sections; but a little to the southward of the latter place, the uppermost division and upper portion of the middle division thin out and are lost; at the same time the Fuller's earth above attains a much greater importance, its thickness, together with that of the Inferior Oolite, amounting to a little more than the aggregate thickness of the two formations about Cheltenham. The following imaginary section from Cheltenham to Bath will make the subject more clearly understood. Thus the Fuller's earth 148 feet thick at Bath has diminished to 70 feet at Stroud, and in the vicinity of Cheltenham to a very inconsiderable band of clay. The lower division of the Inferior Oolite (No. 4 in the section), consisting of several Ammonitiferous beds with brown sands beneath, altogether 70 feet thick, has diminished to 40 feet at Stroud, and at Leckhampton is represented by the lowest bed 2 feet thick, charged in the usual characteristic manner with Belemnites, beneath which are 6 inches of chocolate-coloured sands reposing upon the blue marls of the Lias. The upper division or Ragstones (No. 2 in the section) about 40 feet thick near Cheltenham is reduced to 20 at Stroud, and is ultimately lost to the south of Wotton as before mentioned.

The middle division, nearly 190 feet thick at Leckhampton, is somewhat diminished at Stroud, and loses the greater portion of its volume, including the Oolite marl and all the upper beds before it reaches Bath, where it is represented by 60 feet of freestone. The Bath section is taken from a valuable paper by Mr. Lonsdale in the Geological Transactions. The shells of the middle division are for the most part distributed in beds of no great thickness; the great mass of the deposit being nearly destitute of organic remains, or containing only minute shelly detritus.

The numerical results obtained from the Tables of comparison are as follow:—255 species have been examined from the middle division of the Inferior Oolite, 181 being from Leckhampton, and 145 from Minchinhampton; of these 73 are common to the two localities and 64 pass upwards into the Great Oolite, or 28 per cent. Of the Leckhampton shells alone 59, *i. e.* 33 per cent., and of the Minchinhampton Inferior Oolite suite 43, *i. e.* 31 per cent., pass upwards. Thus, from each of the localities, a larger per-centage of shells pass upwards than is obtained when the entire number of species are reckoned; an instance of the cautious reliance which should be placed upon estimates derived from a limited number of species or from shells of a single locality, where the object is to draw wide and general inferences. It should also be stated that about 40 species in addition to these were not sufficiently perfect to be determined, nearly or quite the whole of which are unknown to the Great



1. Fuller's earth. 2. Upper Ragstones. 3. Freestones, &c. 4. Lower rags and sands. 5. Lias.

Oolite; this addition would still further reduce the per-centage of those which pass upward to the latter formation.

For remarks on particular species the notes which accompany the Tables should be consulted, but some further observations upon the several families of shells may here be given. The Leckhampton shells as a whole are remarkable for their diminutive size: this remark is not only applicable to those species which are likewise found in the lower and upper divisions of the same formation, but to those also which are found in the same formations at Minchinhampton. Upon the whole it may be stated that there is a nearer approximation between the Great Oolite and Leckhampton shells than between those of the two formations at Minchinhampton. As compared with the upper and lower assemblages, the middle is characterized by an entire absence of the Pholadomyas, the Homomyas, the Gresslyas, and I had almost said of Ammonites, Belemnites and Nautili, genera which constitute so large a proportion of the other assemblages, in this respect presenting a striking accordance with the contents of the shelly beds of the Great Oolite. Again, the large number of *Nerineæ* and *Cerithia,* though differing specifically from those of the Great Oolite, tend much to separate it zoologically from the upper and lower assemblages, where they are few and rare. Mr. Brodie's collection has a single Nautilus and Belemnite; my own has four Ammonites of one species, and a single Nautilus; their presence under such circumstances is a sufficient indication of the solitary and perhaps accidental nature of their occurrence, a proof in fact that they did not live and propagate in the middle division. The *Rostellariæ,* though few in number and differing specifically from those of the Great Oolite, serve also to mark the separation of the assemblage from other Inferior Oolite groups, and its approximation to the conditions of sea-bottom under which the Great Oolite shelly beds were deposited; but the most striking circumstance which tends to the same conclusion is the occurrence of a great diversity of forms in the family of the *Patelloidea,* which appears to be altogether absent in the upper and lower series; of the fourteen species it will be observed, that no less than six are specifically identical with Great Oolite forms; and what renders this fact the more worthy of notice is, that the entire family are absent in the Inferior Oolite contemporaneous beds at Minchinhampton. The *Terebratulæ,* which usually are of much importance in the determination of particular groups of rocks, are abundant in this division only in the bed of Oolite marl; but in localities where the marl is consolidated into a cream-coloured mudstone, or where a considerable number of other genera of shells are present, the *Terebratulæ* are comparatively scarce; the genus however is one which conduces much to impress an individual or distinctive character upon the assemblage, or to isolate it from other shelly deposits; it will be observed that of the twelve species two only of them appear to have been continued to the period of the Great Oolite; the other species do not even seem to be found in the other divisions of the same formation, each of which has its distinctive *Terebratulæ*.

The vertical range of the several species throughout the middle division is considerable, for with the exception of certain small and very rare species, the same *Terebratulæ* may be found to occur at intervals through a vertical thickness of 140 feet of rock. The genera which may be pointed out as most eminently to characterize this division are the *Cerithia*, the *Nerineæ*, the *Trochi*, the *Solaria*, the *Cylindrites*, the *Melaniæ*, the *Rostellariæ*, the *Trochotomæ*, the *Tancrediæ*, and the *Terebratulæ*; of these tribes all but two belong to the Gasteropoda; they constitute the great bulk of the univalves, and contain in all fifty-two species, not one of which is found in the Great Oolite. Other genera might be mentioned whose species equally belong to this series, but such have been selected as acquire importance either by the number of their species or by that of the individuals of such species. It may perhaps place the subject in a more striking point of view when it is stated, that of the 108 Gasteropods only 20 are continued to the Great Oolite. The smaller per-centage obtained from the total number of species when compared with a single locality is caused by a large proportion of the shells which are common to the two localities being likewise those which pass upwards into the Great Oolite, thus illustrating the fact, that species which occur in considerable number and have a wide range horizontally, are those which we should expect to find through a considerable range of beds vertically.

I would define the limits of the middle or freestone division of the Inferior Oolite as including all that portion of the formation situated between the upper ragstone beds (1, 2, 3 and 4 of Mr. Strickland's section), and the Ammonitiferous beds or upper portion of the lower division.

Lastly, the general conclusion may be stated to which this comparison has led, that these testacea constitute a zoological assemblage distinguished from those of the other portions of the Inferior Oolite by features as well-marked as those which distinguish the fossils of the other great groups (proximate in sequence), which are termed formations, from each other, and that these features, varying in detail, will probably be found to occur, like some other shelly deposits of the oolitic formations, at intervals and over small areas wherever the freestones of the Inferior Oolite are extensively developed.

On Tancredia, *a fossil genus of Lamellibranchiate Conchifera.* Plate XI. figs. 8, 9, 10.

Gen. Char. Shell thin, equivalve, inequilateral, smooth, flattened, subtrigonal or transverse, somewhat gaping at the posterior extremity, which is produced and attenuated; anterior side with a longitudinal angle passing from the umbo to the antero-ventral border. Hinge with two cardinal teeth in each valve, the anterior one the larger, and a wide and deep, rather irregular fossa between them; lateral teeth distant, one or two in each valve (usually two); ligament probably partially internal and contained in the cardinal pit.

The figure of the cardinal pit varies in the different species; in one it is triangular, one of the angles being at the umbo, in others it is wider and more irregular, but there is not any raised edge bordering it, as in *Mesodesma* and the *Lutrariæ*; the figure and size of the cardinal teeth likewise vary; occasionally the posterior cardinal tooth can hardly be distinguished; strictly speaking, the anterior cardinal tooth is immediately beneath the umbo, the pit and other tooth being posterior to it; the posterior lateral tooth is sometimes wanting altogether; the internal margins of the valves are smooth; the valves are thin and delicate, but such as have had their internal surface exposed showed no traces of the muscular impressions. This genus may be classed as one of the *Mactracea,* and placed near to *Mesodesma* and *Amphidesma*; the external figure is donaciform; the character of the dentition approaches near to, but is really distinct from, *Mesodesma,* from which latter genus the gaping posterior extremity tends to separate it; the shell is likewise thinner and more delicate than in either of the genera with which it has been compared; with *Donax* it has nothing more in common than the external form.

This genus of small bivalves is eminently characteristic of the lower members of the oolitic system of rocks; the Great Oolite has three species, and the freestone beds of the Inferior Oolite have two other species; neither of these are common to the two formations, nor have they been found in the upper or lower divisions of the Inferior Oolite. The diffusion of this generic form is worthy of notice; it may without exaggeration be said, that certain layers in the shelly portion of the Great Oolite were merely so many colonies in which they propagated almost exclusively in countless numbers, but the great mass of these are of one species; the freestone beds of the Inferior Oolite contain likewise a great number of another species. A knowledge of these five species is of importance in the recognition and distinction of the shelly beds in the two formations, as from the numbers of two or three species they may be expected to occur over large areas; already they are known in the lower oolitic system of Normandy.

The generic appellation is derived from the name of Sir Thos. Tancred, Bart., the founder of the Cotswold Naturalists' Club.

The descriptions of two species will be found in the notes to the tables of Inferior Oolite shells; those of the Great Oolite are deferred to the monograph upon that subject.

Note on No. 199, *Ptychomya*? *Agassizii.*

At pl. 11. f. 3, 4 of the 'Etudes critiques sur les Mollusques fossiles,' by M. L. Agassiz, is an imperfect impression of an oblong flattened bivalve shell to which is affixed the new generic appellation *Ptychomya,* but no account is given of the locality or geological formation to which it belongs; the figure is founded upon a single impression. M. Agassiz has not ventured to define the genus, and in his introduction mentions that M. D'Orbigny considers it to be a *Crassatella,* to which genus M. Agassiz remarks it has no external resemblance.

Having long possessed specimens of a small shell which exhibits the external characters of *Ptychomya,* and as two of the specimens are in a condition nearly perfect, I have ventured to record the little information thus acquired with the impression, that although meagre and imperfect, it should not be withheld when the object of investigation is obscure or unknown; nevertheless the present note would not have appeared but for the necessity of affixing a generic name in my Tables to the little shell in question. The high degree of critical acumen displayed by the talented author of the 'Études,' together with the just confidence which he shows in the accuracy of his own observations and deductions when controverted by others, rendered it probable that the generic value which he had claimed for this obscure form would eventually be found to be justified; the present species therefore became an object of interest upon the discovery that it could scarcely with propriety be assigned to any other known genus.

Ptychomya? *Agassizii.* Pl. XI. fig. 6.

Figure suborbicular and flattened; umbones straight, small, pointed and mesial; the substance of the shell thick; the lunule indistinct or very slightly excavated; the hinge-line posteriorly straight or slightly curved and sloping obliquely; the ventral border rounded, the surface with about fourteen rounded, broad but depressed costæ, which are curved upwards and meet the costæ of the opposite side upon the middle of the shell forming an angle, the points of junction of the several costæ being upon a line passing obliquely from the umbo to the antero-ventral border; the costæ are crossed by very fine, closely arranged encircling striæ or lines; the hinge is without teeth. Height 3 lines, breadth 3 lines.

The impression figured by M. Agassiz has a much more oblong or transverse figure, being much lengthened posteriorly; it is also rather imperfect or truncated at that extremity; the angle of the costæ is placed much more anteriorly than in our species, but inclines like the latter to the antero-ventral border; the costæ are likewise more narrow and numerous. Considering the flatness of the valves and their thickness, it would appear that the mollusk was shielded rather than inclosed by them; the valves would appear to have been open all round except at the ligament; the character of this latter organ must for the present remain doubtful, as no trace of a lamina for its attachment is visible. Our present imperfect definition of the genus *Ptychomya* therefore will be as follows:—Shell equivalve, suborbicular or oblong and transverse, flattened, thick; umbones small, straight, flattened; hinge-line posteriorly straight or slightly curved; valves open all round; surface with numerous curved ribs meeting at an angle, whose apex is directed towards the umbo; the costæ are covered with numerous, closely arranged, concentric striæ or lines. Hinge edentulous.

Of the fossil *Myadæ*, *Goniomya* is the only one which resembles it, but in that genus the costæ meet at an angle inclined in an opposite direction to *Ptychomya*; the surface has similar fine concentric lines, but here the resemblance appears to cease.

The true position of our genus in the molluscous tribes must therefore remain in abeyance; the smallness of the object and hardness of the investing stone are formidable obstacles in the way of further information to be obtained from it.

EXPLANATION OF PLATE XI.

Fig. 1. *Turbo elaboratus.*
— 2. *Solarium Cotswoldiæ.*
— 2 *a.* The same magnified.
— 3. *Chemnitzia gracilis.*
— 4. *Gervillia aurita.*
— 5. *Opis gibbosus.*
— 5 *a.* The same magnified.
— 6. *Ptychomya Agassizii.*
— 6 *a.* The same magnified.
— 7. *Corbis aspera.*
— 8. *Tancredia donaciformis.*
— 9. *Tancredia extensa.*
— 9 *a.* Interior of the same.
— 9 *b.* Magnified view of the hinge.
— 10. *Tancredia truncata.*

The two latter species pertain exclusively to the Great Oolite.

Tabular List of Fossils.

Genus.	Species.	Authority.	Inf. Ool. Leckhampton.	Inf. Ool. Minchinhampton.	Gr. Ool. Minchinhampton.
1. Patella ...	rugosa	Sow. Min. Con. ...	*	...	*
3. ——	nitida	Deslongchamps ...	*		
2. ——	inornata	new sp.	*	...	*
4. ——	retifera	new sp.	*		
7. Emarginula	planicostula ...	Deslongchamps ...	*		
8. ——	scalaris	Sow. Min. Con. ...	*	...	*
9. ——	alta	new sp.	*	...	*
10. ——	granulata	new sp.	*		
11. ——	Leckhamptonensis.	new sp.	*		
6. Fissurella ...	acuta	Deslongchamps ...	*	...	*
5. ——	Brodiei	new sp.	*		
12. Rimula ...	clathrata	Sow. Min. Con. ... (Emarginula)	*	...	*
12*. ——	Blotii	Deslongchamps ...	*	...	*
13. ——	tricarinata	Emarginula, Sow. Min. Con.	*	...	*
13*. ——	minutissima ...	new sp.	*		
14. Pileolus ...	lævis	Sow. Min. Con. ...	*	*	*
15. ——	plicatus	Sow. Min. Con. ...	...	*	*
16. Nerita	costata	Phil. Geol. York. .	*	*	
18. —— ...	{ pulla .... / minuta .... }	Roemer .... / Sow. Min. Con.... }	*	...	*
19. ——	tumidula	Natica, Phil. Geol. York.	...	*	
17. ——	cassidiformis ...	new sp.	*		
43. ——	lineata	new sp.	*		
20. Naticella ...	decussata	Natica, Goldfuss...	*	*	
50. Natica	adducta	Phil. Geol. York. .	*	*	
52. ——	macrostoma ? ...	Roemer and Goldfuss.	*	*	
53. ——	Leckhamptonen- [sis.	new sp.	*		
127. ——	Gomondii	new sp.	*		
21. Monodonta .	sulcosa	Nerita, Archiac ...	*	*	*
22. ——	Lyellii	Nerita, Archiac ...	*	*	*
23. ——	heliciformis	new sp.	*	*	*
27. ——	lævigata	Nerita, Sow. Min. Con.	*	*	*
24. Delphinula .	funata	Goldfuss	*	*	
26. ——	quaterno-cingil-lata.	new sp.	...	*	*
35. ——	lineata	new sp.	*		
25. Littorina ...	nana	new sp.	*		
30. Turbo	elaboratus	new sp.	...	*	
28. ——	capitaneus	Goldfuss	*	*	*
29. ——	princeps	Roemer	*	*	
33. ——	Cheltensis	new sp.	*		
34. ——	varicosus	new sp.	*		
31. Cirrus	nodosus	Sow. Min. Con. ...	*	*	

Genus.	Species.	Authority.	Inf. Ool. Leckhampton.	Inf. Ool. Minchinhampton.	Gr. Ool. Minchinhampton.
36. Trochus......	monilitectus ...	Phil. Geol. York. ..	*	*	
37. ——	bi-cingendus ...	new sp.	*	*	
38. ——	alternans	new sp.	*		
39. ——	gemmatus	new sp.	*	*	
40. ——	cingillato - serratus.	new sp.	*		
41. ——	pileus	new sp.	*	*	
42. ——	infundibuliformis	new sp.	...	*	
44. Pleurotomaria	funata	new sp.	...	*	
45. ——	lævigata	new sp.	...	*	
48. Trochotoma	calix	Solarium, Phillips; T. affinis, Deslongchamps.	...	*	
46. ——	carinata	new sp.	*	*	
47. ——	depressiuscula ...	new sp.	...	*	
49. ——	funata	new sp.	...	*	
51. Natica	canaliculata	new sp.	...	*	*
54. Phasianella .	acutiuscula	new sp.	...	*	
55. ——	turbiniformis ...	new sp.	*	*	
55*. ——	subangulata ...	new sp.	...	*	
56. Acteonina ...	tumidula	new sp.	...	*	
57. ——	ovata	new sp.	...	*	
58. ——	glabra	Acteon, Phillips ...	...	*	
59. Cylindrites .	attenuatus	new sp.	*	*	
60. ——	gradus	new sp.	...	*	
61. ——	mamillaris	new sp.	*		
62. ——	tabulatus	new sp.	...	*	
63. ——	bulbiformis	new sp.	...	*	
64. Chemnitzia .	nitida	new sp.	*		
65. ——	elegans...........	new sp.	*		
98. ——	procera?	Melania, Deslongchamps.	...	*	
99. ——	gracilis............	new sp.	...	*	
66. Ceritella, n.g.	sculpta............	new sp.	*		
99*. Chemnitzia	turris	Melania, Deslongchamps.	...	*	
67. Ceritella ...	tumidula	new sp.	*		
69. Scalaria	pygmea	new sp.	*		
70. Solarium ...	Cotswoldiæ	new sp.	*	*	
71. ——	diadema	new sp.	*		
72. ——	....	new sp.	*		
73. ——	....	new sp.	*		
74. Eulima	parvula............	new sp.	*		
75. Rissoa	lævis...............	Sow. Min. Con. ...	*	...	*
76. Rissoina......	obliquata	Rissoa, Sow. Min. C.	*	...	*
76*. ——	obtusa	new sp.	*		
77. Cerithium ...	....	new sp.	...	*	
78. ——	....	new sp.	...	*	
79. ——	....	new sp.	*		
80. ——	....	new sp.	*		
81. ——	....	new sp.	*		

Genus.	Species.	Authority.	Inf. Ool. Leck-hampton.	Inf. Ool. Minchin-hampton.	Gr. Ool. Minchin-hampton.
82. Cerithium..	....	new sp.	*	*	
83. ——	....	new sp.	*		
84. ——	....	new sp.	...	*	
85. ——	....	new sp.	*	*	
86. ——	....	new sp.	*		
87. ——	....	new sp.	*		
88. ——	....	new sp.	*		
89. ——	....	new sp.	*		
90. Nerinæa ...	Bruntrutana? ...	Archiac?	*	*	
91. ——	acicula?	Archiac	...	*	
92. ——	....	new sp.	...	*	
93. ——	....	new sp.	...	*	
94. ——	....	new sp.	...	*	
95. ——	....	new sp.	...	*	
96. ——	....	new sp.	*	*	
97. ——	....	new sp.	*		
100. Fusus? ...	carinatus	Roemer	*		
101. ——	obliquatus	new sp.	...	*	
101*. ——	carino-crenatus .	new sp.	...	*	
102. Rostellaria .	unicornis	new sp.	...	*	
103. ——	simplex	new sp.	...	*	
104. ——	spinigera	new sp.	...	*	
105. ——	solida	new sp.	*	*	
106. ——	gracilis	new sp.	*		
107. Serpula ...	lævigata	new sp.	*		
108. ——	Undetermined...	....	*		
108*. ——	socialis	Buckman............	*	*	
109*. Belemnites	Undetermined...	....	*		
109. Nautilus ...	lineatus	Sow. Min. Con. ...	*	*	
110. Ammonites	Undetermined...	....	...	*	
111. Echinus ...	germinans	Phil. Geol. York...	*		
112. Pygaster ...	patelliformis ...	Agassiz	*	...	*
113. Cidaris......	subangularis ...	Goldfuss	*	...	*
114. ——	Undetermined...	....	*		
115. ——	coronatus	Goldfuss	*	...	*
116. Acrosalenia	Hoffmanni	Goldfuss	*	...	*
117. Cidarites ...	crenularis	Goldfuss	*		
118. ——	Undetermined...	....	*		
119. Nucleolites	clunicularis	Goldfuss	...	*	*
121. Lima	punctata	Goldfuss	*	*	*
122. ——	duplicata	Sow. Min. Con. ...	*	...	*
124. ——	notata	Goldfuss	...	*	*
128. ——	lunularis	Deshayes	*	*	*
129. ——	læviuscula	Goldfuss	*	...	*
123. ——	squamicosta......	Buvignier	*	*	
125. ——	plicata	new sp.	...	*	
126. ——	alata	new sp.	...	*	
130. ——	punctatilla	new sp.	*	...	*
130*. ——	minutissima......	new sp.	*		
134. Pecten......	clathratus	Roemer	*	*	*
134*. ——	variety? of the above.	....	*		

Genus.	Species.	Authority.	Inf. Ool. Leck-hampton.	Inf. Ool. Minchin-hampton.	Gr. Ool. Minchin-hampton.
135. Pecten	lens	Sow. Min. Con. ...	*	*	*
131. ——	vimineus	Sow. Min. Con. ...	*		
130**. Lima ...	ovalis	Plagiostoma, Sow. Min. Con.	*	...	*
136. Pecten	Undetermined...	....	*		
137. ——	lineolatus.........	new sp.	*		
138. Hinnites ...	sepultus	new sp.	*		
139. ——	comptus	Spondylus, Goldfuss.	*	*	
140. ——	velatus	Spondylus, Goldf.	...	*	*
139*. ——	tuberculatus (left valve).	Spondylus, Goldf.	...	*	
141. Plicatula ...	elongata	new sp.	...	*	
142. Placuna?...	jurensis	Roemer	*	*	*
143. ——?	armata	Plicatula, Goldfuss	*	...	*
144. ——?	complicata	new sp.	*		
145. Mytilus ...	pectinatus	Sow. Min. Con. ...	*	*	*
146. ——	striatulus	Goldfuss	*		
147. ——	pulcher............	Goldfuss	*	...	*
149. ——	cuneatus	Modiola, Sow. Min. Con.	*	*	*
148. ——	subrectus.........	new sp.	*	...	*
150. ——	crenatus	new sp.	*		
151. Dreissena...	lunularis	new sp.	*	*	
152. Gervillia ...	tortuosa	Gastrochæna, Phill.	*	*	
153. ——	lata	Phillips	...	*	
154. ——	aurita	new sp.	...	*	
155. ——	costatula	Deslongchamps ...	*	*	*
156. ——	lævigata	new sp.	*	...	*
157. Perna	mytiloides	Goldfuss	*	...	*
158. Gervillia ...	ovata	Avicula, Sow. Min. Con.	*	...	*
158*. ——	complicata	Buckman............	*		
159. Pteroperna	gibbosa............	new genus and sp.	...	*	
160. Pinna	cuneata	Phillips	*		
161. ——	hastata	new sp.	...	*	
164. Hiatella ...	interlineata	new sp.	*	*	
166. Myoconcha	crassa	Sow. Min. Con. ...	*	*	*
163. Ostrea	costata	Sow. Min. Con. ...	...	*	*
163*. ——	Undetermined...	....	*		
168. Opis.........	Moreausius	Buvignier	*	*	
169. ——	angustatus	new sp.	...	*	
170. ——	elongatus	new sp.	...	*	
171. ——	gibbosus	new sp.	*	*	
172. Trigonia ...	clavo-costata ...	new sp.	...	*	
173. ——	lineolata	Agassiz	*	*	
174. ——	angulata	Sow. Min. Con. ...	...	*	
175. ——	striata	Sow. Min. Con. ...	...	*	
176. ——	costatula	new sp.	*	*	
177. ——	v. costata	new sp.	...	*	
177*. ——	tuberculosa	new sp.	*		
178. Corburella .	curtansata	Corbula, Phillips...	*	...	*

Genus.	Species.	Authority.	Inf. Ool. Leckhampton.	Inf. Ool. Minchinhampton.	Gr. Ool. Minchinhampton.
181. Corbula	involuta	Goldfuss, striata, Buckman.	*	...	*
179. ——	imbricata	new sp.	*		
180. ——	depressa	Phillips	*		
183. Cypricardia	cordiformis	Deshayes	*	*	*
183. ——	siliqua	new sp.	...	*	*
186. Cardium	cordiforme	new sp.	*		
187. ——	lævigatum	new sp.	*		
188. ——	cognatum	Phil. Geol. York.	*		
189. ——	punctato - striatum.	new sp.	*		
190. ——	granulatum	new sp.	*		
184. ——	semicostatum	new sp.	*	*	
191. Sphæra	Madridi	Cardium, D'Arch.; Cardium incertum, Phillips.	*	*	*
192. Venus	trapeziformis	Roemer	*	*	*
193. ——	curvirostris	new sp.	*	*	
194. ——	Suevica	Goldfuss	...	*	*
195. Cytherea	picta	new sp.	*	*	
196. Astarte	excavata	Sow. Min. Con.	...	*	
197. ——	quadrata	new sp.	*	*	*
198. ——	bullata	new sp.	...	*	
199. Ptychomya	Agassizii	new sp.	...	*	
200. ——	depressa sulcato-striata	Goldfuss Roemer	*	*	
201. ——	Menkei	Unio, Dunker	...	*	*
202. ——	detrita	Goldfuss	...	*	
203. ——	formosa	new sp.	...	*	
215. ——	orbicularis	Sow. Min. Con.	*	...	*
204. Lucina	lyrata	Phillips	*	*	*
208. ——	despecta	Phillips	*	*	*
205. Corbis	aspera	new sp.	...	*	
206. ——	ovalis	Phil. Geol. York.	...	*	
207. ——	lævigatus	new sp.	*		
209. Psammobia	lævigata	Phil. Geol. York.	*		
210. Mactromya	globosa	Agassiz	*	*	*
211. Panopæa?	delicatissima	new sp.	*		
212. Tancredia	donaciformis	new sp.	*	*	
213. ——	sulcata	new sp.	*		
214. Nucula	variabilis	Sow. Min. Con.	*	...	*
216. Ceromya	concentrica	Isocardia, Sow. Min. Con.	...	*	*
217. ——	striata	Cardita, Sow. Min. Con.	...	*	
218. Macrodon	Hirsonensis	Cucullæa, D'Arch.	...	*	*
219. Goniomya	literata	Mya, Sow. Min. Con.	...	*	
220. Arcomya	oblonga	Sanguinolaria, Buckman.	*	*	
221. Myopsis	punctata	Sanguinolaria, Buckman.	*	*	

Genus.	Species.	Authority.	Inf. Ool. Leckhampton.	Inf. Ool. Minchinhampton.	Gr. Ool. Minchinhampton.
222. Myopsis ...	dilata	Mya, Phill.; Sanguinolaria, Buckman.	*	*	*
223. Arca	pulchra	Sow. Min. Con. ...	*	*	*
225. ——	lata	Dunker	*	*	
232. ——	trisulcata	Goldfuss	*		
224. ——	rudiuscula	new sp.	*		
250. Modiolarca	ovata	Arca ovata, Buckm.	*		
226. Cucullæa...	elongata	Sow. Min. Con., not Phillips.	*		
227. ——	dense granulata .	new sp.	...	*	
228. ——	amœna...........	new sp.	*	...	*
229. ——	cucullata	Arca, Goldfuss ...	*	*	*
230. ——	elongata	Phil. Geol. York. .	...	*	
231. ——	triangularis? ...	Phil. Geol. York..	...	*	
233. ——	nana	new sp.	*		
249. ——	bipartita	new sp.	*		
248. ——	funiculosa?	Arca, Goldfuss ...	*		
248*. ——	obliqua	new sp.	*	*	
234. Lithodomus	attenuatus	new sp.	*		
235. Trichites ...	nodosus	Lycett, Ann. Nat. Hist. 1850.	...	*	*
236. Terebratula	simplex	Buckman...........	*	*	
237. ——	plicata	Buckman...........	*	*	
238. ——	fimbria	Sow. Min. Con. ...	*	*	
239. ——	resupinata?	Sow. Min. Con. ...	*	*	
240. ——	ornithocephala?	Sow. Min. Con. ...	*	*	
241. ——	....	new sp.	*	*	
241*. ——	....	new sp.	*	*	*
242. ——	....	new sp.	*	*	*
243. ——	....	new sp.	*	*	
244. ——	....	new sp.	*		
246. ——	....	new sp.	*		

Notes and Descriptions of New Species.

2. *Patella inornata*; ovate, smooth; apex pointed, moderately elevated, subcentrical, but posterior and inclined slightly forwards. The Great Oolite shells are rather more elevated and pointed.

4. *P. retifera*; ovate, costated and cancellated; costæ numerous and unequal, crossed by numerous encircling lines; apex moderately elevated, posterior, but inclined forwards.

10. *Emarginula granulata*; ovately globose; apex curved posteriorly; costæ numerous, very fine, with others still more delicate alternating, and rendered granular by transverse encircling lines.

11. *E. Leckhamptonensis*; oval, depressed; apex posterior; costæ large, rounded and tuberculated where crossed by encircling lines; costæ twenty-six in number.

5. *Fissurella Brodiei*; figure a lengthened oval, rather depressed;

apex subcentral; costæ about forty-two, large, nearly equal, crossed by numerous encircling lines.

13*. *Rimula minutissima*; almost microscopic, conical; apex curved; ribs radiating, rounded, numerous, closely arranged, indented by encircling striæ; under surface nearly orbicular.

17. *Nerita cassidiformis*; subhemispherical, angulated; spire discoidal; an elevated smooth encircling carina divides the body-whorl into two portions, the upper of which is flat and has a few fine encircling lines; on the lower portion the lines are larger, rounded and closely arranged.

43. *N. lineata*; very oblique; spire of several whorls, not elevated and nearly concealed; surface with numerous very fine longitudinal radiating lines.

53. *Natica Leckhamptonensis*; spire elevated, whorls convex, the last enormously expanded, upper surface of the whorls rounded and sulcated; aperture very effuse, orbicular. Only casts known. A gigantic species.

23 & 27. *Monodonta heliciformis* and *M. lævigata*; these shells are smooth and depressed; they have the tooth of *Monodonta*, but are without any basal sulcus or umbilicus; they will appear in the Great Oolite monograph under the new generic name *Alostoma*.

26. *Delphinula quaterno-cingillata*; subglobose; spire of several whorls, angulated; longitudinal costæ large, elevated, rather angular, impressed by numerous transverse lines; umbilicus costated; aperture orbicular.

25. *Littorina nana*; small, smooth, thick; spire elevated; whorls few, convex, narrow; aperture rather small.

9. *Emarginula alta*; shell much elevated, compressed laterally; apex curved posteriorly, the convex side beneath the apex having narrow, simple, smooth elevated ribs, of which the middle one is the most prominent; there are also slight traces of smaller costæ upon the flattened sides of the shell; the height exceeds the length of the aperture: rare.

30. *Turbo elaboratus*; ovate; spire elevated, whorls five, slightly convex and angulated; surface above the angle smooth, horizontal, or even slightly concave, encircling ribs numerous, elevated, crossing numerous longitudinal elevations or costæ, which are indistinct upon the last volution; aperture oval, its length rather more than half of the entire shell. Axis 11 lines: rare.

33. *Turbo Cheltensis*; small; spire elevated, whorls five, convex, nodulated, nodules in four rows, about sixteen in a volution, the nodules of each row connected by an encircling line; nodules large, diminishing in size upwards in each successive row; length $\frac{1}{6}$th of an inch.

34. *Turbo varicosus*; turreted, whorls six, convex, each with four encircling, rounded and smooth costæ crossing about eight large longitudinal elevations, which pass rather obliquely from left to right. Axis 2 lines.

37. *Trochus bi-cingendus*; elevated, whorls rather concave, with

two encircling nodose ribs, one at each margin of the whorl, and three mesial circles of nodules.

38. *Trochus alternans*; moderately elevated and costated, three nodulated costæ upon each whorl, the middle one the smallest.

40. *Trochus cingillato-serratus*; whorls few, bicarinated, the lower carina much the larger, the intermediate space concave with small serrated circles of ribs; the carinæ are longitudinally serrated.

41. *Trochus pileus*; very elevated; whorls few, concave, with longitudinal elevations united at the base, and overwrapping the upper portion of the succeeding whorl, base discoidal.

42. *Trochus infundibuliformis*; figure a low cone above, discoidal beneath; whorls three or four, flattened, with numerous obscure longitudinal wrinkled lines.

41 & 42. These two remarkable species are placed provisionally in the genus *Trochus*; it is probable however that they will ultimately be erected into a new genus.

44. *Pleurotomaria funata*; elevated; whorls five or six, convex above, but rather flattened at the sides, with numerous equal, closely arranged angular encircling ribs decussated by fine longitudinal lines. Fascia of the sinus broad, striated longitudinally, with an encircling elevated line bounding it upon each side.

45. *Pleurotomaria lævigata*; discoidal; whorls five, smooth, slightly convex; fascia of the sinus narrow, forming a slightly convex band; base smooth and discoidal.

46. *Trochotoma carinata*; moderately elevated, acuminated; whorls narrow, numerous, angulated, rendered concave both above and below by an elevated and acute carina; the first three or four whorls have closely arranged encircling striæ crossed by others longitudinal, but the larger whorls are perfectly smooth, or have only the oblique lines of growth; the carina is formed by two parallel lines; the base is widely and deeply excavated; height $\frac{5}{6}$ths of the basal diameter: rare.

47. *Trochotoma depressiuscula*; depressed; whorls five, narrow and angulated; ribs below the angle three, above more numerous; upper surface of the whorls concave, lower flattened; base striated, excavation large, not deep; height half the basal diameter: rare.

49. *Trochotoma funata*; elevated, acuminated, nearly smooth; whorls convex, their lower portions flattened, with numerous encircling granulated ribs, faintly traced, basal excavation contracted. Height about equal to the basal diameter.

51. *Natica canaliculata*; ventricose; spire elevated; whorls five, acute, flattened at their sides, their upper surfaces deeply channeled, the angle of the whorls slightly tumid; aperture obliquely ovate; axis imperforate, last whorl very large and tumid; axial diameter 1 inch 4 lines, transverse 1 inch.

54. *Phasianella acutiuscula*; ovate; spire small, acute, with four very narrow rather convex whorls, whose upper borders are disunited from the preceding whorls; body-whorl much expanded and globose; aperture large, $\frac{2}{3}$rds the axial length; axis 5 lines, transverse diameter 4 lines.

55. *Phasianella turbiniformis*; ovate, acute; whorls five to six, convex, narrow, last whorl large, ventricose; aperture large, oval, oblique, its length a little exceeding half of the axial and $\frac{4}{5}$ths of the transverse diameter.

55*. *Phasianella subangulata*; ovate, lengthened; spire pointed; whorls rather convex, few, body-whorl large, ovate, subangulated in the middle; aperture elongated and oblique, its length equal to the transverse and $\frac{3}{5}$ths that of the axial diameter of the shell.

57. *Acteonina ovata*; ovate; spire of moderate elevation, consisting of four flattened whorls, last whorl subcylindrical, large; aperture lengthened, oblique; axis 11 lines, breadth 6 lines.

56. *Acteonina tumidula*; spire small; body-whorl very large and tumid; aperture expanded anteriorly; axis 6 lines, breadth 4 lines.

59. *Cylindrites attenuatus*; conico-cylindrical; spire short, acute, of six whorls, which are very narrow and acute at their upper borders; body-whorl flattened and attenuated towards the base; length 8 lines, breadth 4 lines.

60. *Cylindrites gradus*; cylindrical, elongated; spire elevated; whorls five to six, step-like, but slightly rounded at the angles, the lower portions of the whorls perfectly flat.

The above-named two species of *Cylindrites* have elevated spires; those which follow have sunk spires, but exposed, the upper edges of the whorls being visible; the apex, which usually comprises the first two or three volutions, forms a kind of mamillary tubercle elevated above the depressed edges of the other whorls except the last. They constitute two very distinct sections.

62. *Cylindrites tabulatus*; conico-cylindrical, vertex large, but little depressed; whorls numerous, centre slightly mamillated and elevated; the figure is tuberose and the vertex unusually large.

61. *Cylindrites mamillaris*; conico-cylindrical, elongated; sides of the body-whorl flat, its upper edge acute; the inner whorls have their upper flat surfaces visible, the first two or three of which are elevated into a rounded or mamillary process. This nearly resembles a Great Oolite species, but it is less elongated, and the vertex is more depressed.

63. *Cylindrites bulbiformis*; very short or tun-shaped, the upper surface wide and flattened, but the apex rises a little; axis 4 lines, transverse diameter 5 lines.

64. *Chemnitzia nitida*; small, smooth; whorls five to six, convex, body-whorl large, oval, aperture oblique; length $\frac{1}{2}$ inch.

65. *Chemnitzia elegans*; subcylindrical, smooth; whorls numerous, convex, but short, their breadth exceeding their length; the body-whorl is symmetrical and not enlarged; apex unknown; length of fragment $3\frac{3}{4}$ inches, in which only the four last whorls are preserved.

99. *Chemnitzia gracilis*; spire excessively lengthened and acuminated; whorls very numerous, flattened or very slightly convex, longer than wide, sutures marked, aperture ovately elongated, pointed anteriorly; length 7 inches, diameter of last whorl 6 lines.

Ceritella, a genus related to *Cerithium*, which will be illustrated in a forthcoming monograph on the Testacea of the Great Oolite.

66. *Ceritella sculpta* ; small, turreted ; whorls few, long, nearly flat, each with three encircling striæ, equidistant ; the body-whorl has six striæ besides numerous others closely arranged at the base.

67. *Ceritella tumidula* ; small, smooth, much lengthened ; whorls flattened, but slightly tumid at their upper junctions, body-whorl symmetrical ; length $\frac{3}{5}$ inch.

69. *Scalaria pygmea* ; shell minute ; whorls seven, globose, the last whorl much enlarged ; costæ eight in a volution.

70. *Solarium Cotswaldiæ* ; depressed, both upper and under surfaces nearly equally concave ; sides rather flattened, but with the borders rounded and furnished with numerous longitudinal elevations or nodules, twenty-eight upon the lower and twenty upon the upper border of the last volution ; the entire surface has numerous narrow, crenated, encircling costæ, crossed by very fine longitudinal lines not always distinct ; costæ upon the sides of the last whorl about fourteen.

74. *Eulima parvula* ; minute ; whorls five, convex, body-whorl rather large ; apex obtuse.

76*. *Rissoina obtusa* ; spire obtuse ; whorls slightly convex, six ; outer lip moderately large ; costæ numerous, closely arranged, slightly curved from right to left.

77 to 89 inclusive. *Cerithium* ; the descriptions of the species of this genus are omitted for the reasons given under the genus *Solarium*, as are likewise of *Nerinæa* 93 to 97 inclusive.

101. *Fusus obliquatus* ; small, subconical, acuminated, longitudinal ; costæ about nine in a volution, passing obliquely from left to right ; base with several large encircling striæ, but the costæ are not continued to this part.

102. *Rostellaria unicornis* ; spire lengthened, composed of many whorls, whorls costated, the costæ terminating in knobs on their upper portions ; costæ ten in a volution, indented by five encircling striæ ; last whorl smooth, with a single prominent carina, having an acute and elevated spire at one quarter of the circumference posteriorly from the outer lip ; the wing single, rounded, curved, slender and produced ; caudal extremity moderately long.

103. *Rostellaria simplex* ; smooth ; whorls long, few, convex ; the spire moderately elevated ; body-whorl with two carinæ, the upper one the larger, and forming two angles in its course ; caudal extremity short. Only casts have been procured, but they are well characterized.

104. *Rostellaria spinigera* ; spire elevated, acute ; whorls few, each with seven prominent spines or spinous ribs ; body-whorl spined above, grooved beneath ; wing not digitated and but moderately expanded ; caudal extremity straight and moderately long.

105. *Rostellaria solida* ; spire turreted ; whorls five, angulated by a circle of elevated longitudinal spinous ribs crossed by lines ; body-whorl with a single carina, beneath which are several deep encircling grooves ; wing simple, small, proceeding from the carina ; caudal extremity short.

106. *Rostellaria gracilis* ; spire lengthened, smooth ; whorls six, lengthened, angulated, the angle being in the middle of the whorl forming an acute and crenulated carina ; body-whorl smooth, with two

carinæ and large digital processes; caudal extremity slender and lengthened; the slender form, crenulated carina and smooth surface distinguish it from *R. trifida.* Portions and casts of two other species of *Rostellariæ* have been obtained, but not sufficiently perfect to admit of being described.

107. *Serpula lævigata*; a simple, round, smooth spiral tube, the tube being rather thick.

101*. *Fusus? carino-crenatus*; shell small, fusiform; spire of four volutions, keeled and striated; an elevated carina encircles the middle of each whorl, its edge undulated or crenulated; encircling striæ cover the whole surface of the shell, and there is an indistinct circle of nodules upon the upper portion of each whorl near to the junction.

127. *Natica Gomondii*; small, globose; spire small; whorls convex, narrow, their upper margins cinctured with a narrow, flat, horizontal area, the outer edge of which is acute: rare.

125. *Lima plicata*; elongated, narrow; costæ nine, very large and elevated, rounded and imbricated.

126. *Lima alata*; auricles very large, the length of the hinge-line being equal to that of the longitudinal diameter; anterior auricle much folded; ribs numerous, narrow, regular and imbricated.

130. *Lima punctatilla*; shell minute, gibbose, nearly straight; costæ about twenty, rounded, large; interstitial spaces narrow; surface of the costæ punctated where they are crossed by very fine lines.

134*. Possibly a variety of *Pecten clathratus* with large, elevated encircling ribs.

130*. *Lima minutissima*; oblique, broad, convex; costæ fourteen, rounded, smooth, wider than the interstitial spaces, nearly evanescent upon the anterior side.

137. *Pecten lineolatus*; auricles large, striated; shell ovate, slightly convex; costæ very minute, numerous, waved and granulated, degenerating into very fine lines towards the ventral border, and crossed by encircling lines, very fine, and arranged in the closest possible order.

138. *Hinnites sepultus*; suborbicular, rather irregular, convex; auricles unequal; costæ ten, equal, radiating, waved, small and crenulated, degenerating towards the ventral border into mere lines; interstitial spaces wide, each having one or two longitudinal lines; length $\frac{1}{4}$ inch.

141. *Plicatula elongata*; elongated, rather oblique; costæ longitudinal, waved, very fine, closely arranged, rounded and scabrous, terminating towards the tubular border in a few tubular spines.

143. *Placuna armata*; the normal form is that of curved radiating lines of tubular spines little elevated, but the general aspect is that of irregular elevated confused tubercles. This species is placed under *Placuna* merely to indicate that generically it agrees with the shell called *Placuna jurensis*, but which certainly is neither a *Placuna* nor yet an *Anomia*, to which latter genus it has sometimes been assigned; its true place must remain for the present in abeyance.

144. *Placuna? complicata*; surface covered with clusters of tubular spines, depressed and confused, producing a most irregular and uneven surface.

148. *Mytilus subrectus*; elongated, smooth, slightly oblique, anterior border straight, the two extremities of the shell attenuated; hinge-line lengthened, straight.

150. *Mytilus crenatus*; thick, oblique, convex; length less than twice the width; striæ regular, concentric, deeply grooved upon the back; a single depression or fold (its edge acute) passes obliquely from the umbo to the antero-ventral border; hinge straight, moderately long.

151. *Dreissena lunularis*; smooth, anterior border straight or slightly concave, posterior side curved, umbones pointed, terminal, longitudinal ridge acute, anterior diameter through both valves equal to the breadth.

152. *Gervillia tortuosa*; this shell, the *Gastrochæna tortuosa* of Phillips, belongs to a very remarkable section of the *Gervilliæ*, of which *G. Hartmanni* and *G. Monotis* are likewise examples; they are tortuous, very inequivalve, the right valve being more or less concave, its borders fitting closely to the undulations of the convex valve.

154. *Gervillia aurita*; equivalve, smooth, very oblique, both the auricles very much extended and acuminated, the entire figure being very slender.

156. *Gervillia lævigata*; smooth, very oblique; anterior auricle produced and rather pointed, posterior moderately large; left valve convex, right nearly flat. This shell is more oblique than *G. costatula*, and wants the ribs of that species.

159. *Pteroperna*; a group of shells proposed to be separated from the *Gervilliæ* and *Pernæ*, to both of which genera they possess affinities, combined with the external form of *Avicula*. A species very nearly allied to our *P. gibbosa* is abundant in the Great Oolite; our shell however is more convex and oblique.

161. *Pinna hastata*; spear-shaped, compressed, lines of growth waved and strongly marked; lines longitudinal, delicate, waved and closely arranged, crossed by others more distinct.

164. *Hiatella interlineata*; subquadrate; anterior side rounded, posterior straight and truncated; costæ transverse, large, few, elevated, forming an angle upon the back of the shell; the interstitial spaces have numerous encircling very fine lines.

169. *Opis angustatus*; narrow, elongated, extremely convex, fornicated; lunule large, posterior depression cordate, large and deep, with a wide longitudinal sulcus posterior to the carina; ribs concentric, closely arranged, posterior side with densely arranged fine transverse lines; carina moderately elevated and impressed by the costæ; umbones narrow and incurved.

171. *Opis gibbosus*; subtrigonal or cordate, convex, anterior side and base nearly straight; umbones large, dorsal carina obtuse and scarcely elevated; costæ large, both upon the anterior and posterior side; lunule cordate and deep, inner margin toothed. The nearly globose form, nearly obsolete carina, and ribs upon the posterior side, separate it from contemporaneous species. The size does not usually exceed that of a pea; with increase of growth it becomes more trigonal.

176. *Trigonia costatula*; transversely oblong, anterior side trun-

cated, flattened, with two obscure longitudinal ridges crossed by numerous lines; dorsal ridge nodulated, but little elevated; dorsal costæ disunited from the carina, numerous, regular, narrow and curved. With advance of growth the anterior transverse lines become indistinct; the dorsal ribs are broken in their anterior portions and displaced, forming irregular nodules; this change commenced when twelve ribs had been perfected, but the Leckhampton specimens not having that number, do not exhibit it.

177. *Trigonia* v.- *costata*; semiorbicular, anterior side slightly concave, with a single deep longitudinal groove and numerous transverse prominent lines, prominent near the umbo, but becoming fine and indistinct afterwards; area lanceolate; dorsal carina narrow, smooth, but little elevated; dorsal costæ numerous, closely arranged, angular and narrow, partially broken in the middle, and forming an acute angle with their anterior portions; at the middle they also become slightly nodulated.

178. *Corburella,* new genus.

Gen. Char. Equivalve, inequilateral, transverse, thin, smooth; umbones small, approximate, posterior side attenuated and slightly gaping, anterior side more convex and rounded; hinge with a small depressed subconical cardinal tooth in each valve, and an extended slightly thickened laminar plate forming a kind of anterior lateral tooth or process; muscular impressions faintly marked, scarcely visible.

This genus differs from *Corbula* in being equivalve, and in the character of the hinge, the teeth are much smaller and not hollowed to receive the ligament; the substance of the test is thinner, and the muscular impressions much more faintly marked. The *Corbula curtansata* of Phillips is the type of this genus.

179. *Corbula imbricata*; shell suborbicular, small, slightly longer than wide, imbricated by a few elevated concentric ridges rising over each other; lunule cordate, excavated; umbones incurved: the largest specimens attained the size of a small pea.

177. *Trigonia tuberculosa*; ovately trigonal, depressed, fornicated; anterior side flattened, transversely striated; carina acute, elevated and crenated; ribs regular, curved and tuberculated, tubercles elevated, obtuse, very closely arranged, their upper surfaces flattened.

184. *Cardium semicostatum*; ovately convex, rather longer than wide; umbones prominent, mesial, incurved, posterior side ribbed longitudinally; ribs smooth, rounded, closely arranged, occupying about one-fourth of the surface; the remainder smooth in the adult state, but young individuals have very fine, closely arranged, concentric striæ.

183*. *Cypricardia siliqua*; transversely elongated; umbones small, anterior; hinge-line very long, posterior side extended and attenuated, ventral border straight, lines of growth few.

187. *Cardium lævigatum*; suborbicular, smooth, transverse, moderately convex; umbones mesial, incurved, anterior side rounded, posterior slightly truncated, ventral border rounded, lines of growth few and obscure.

189. *Cardium punctato-striatum*; oblong, transverse; umbones anterior; anterior side short, rounded, posterior lengthened and obliquely truncated, ventral border curved; striæ longitudinal, numerous and closely punctated, crossed by obscure numerous encircling lines giving the surface almost a scabrous aspect; there is likewise an obscure oblique posterior longitudinal keel, posteriorly to which the surface is much more depressed.

195. *Cytherea picta*; suborbicular, rather longer than wide, smooth, moderately convex; umbones mesial, slightly curved forwards; hinge-margin oblique, curved; ventral border rounded; surface with several broad zones of colours at irregular intervals, the bands being white upon a chocolate-coloured ground; length $\frac{1}{2}$ inch: rare.

197. *Astarte quadrata*; quadrate, transverse, thick, rugose, lines of growth irregular and strongly marked, forming an angle somewhat rounded upon the posterior side of the shell; umbones anterior, lunule excavated, cordate.

198. *Astarte bullata*; small, subglobose; umbones mesial, curved forwards; lunule excavated, cordate; costæ elevated, broad, rather distant, usually, but not always, regular; size that of duck shot.

199. *Ptychomya Agassizii*; new genus indicated, but not described, by M. Agassiz: see a notice of this genus at page 408.

201. *Astarte Menkei*; our specimens do not exhibit the wrinkled surface near to the umbones described by Dunker, but this probably is an inconstant character.

203. *Astarte formosa*; rather depressed, transversely ovate; umbones pointed, mesial, inclined forwards; lunule large, slightly excavated; hinge-line lengthened, oblique; anterior border rounded, posterior rather produced and slightly angulated; encircling ribs very closely arranged, irregular, small, and little elevated; length equal to $\frac{3}{4}$ths of the breadth.

205. *Corbis aspera*; transversely oval, gibbose; umbones large, mesial; lunule small, cordate; hinge-line straight, sloping, borders rounded, inner margin toothed; encircling costæ narrow, elevated, rather distant; interstitial spaces with fine encircling striæ. This species approaches near to *Corbis Lajoyei*, D'Archiac, but the ribs are more elevated and distant, the umbones are larger, and the hinge-line is not so nearly horizontal.

207. *Corbis lævigatus*; small, transverse, moderately convex; umbones mesial, lunule small; hinge-line straight, nearly horizontal; costæ few, widely separated, elevated, the interstitial spaces smooth; length $\frac{1}{4}$ inch, breadth $\frac{1}{4}$th more.

211. *Panopæa delicatissima*; small, transverse, oblong, convex; umbones large, mesial; hinge-line rather straight; ventral border lengthened, rather straight; costæ concentric, regular, closely arranged, delicate; length $\frac{1}{6}$ inch: breadth $\frac{1}{4}$ inch; the hinge has not been seen.

204. *Lucina lyrata*; the abundance of this species, its wide diffusion and great variety of aspect demand something more than a mere notice of its occurrence. The two extreme varieties are as follows:—

Var. '*a.*' shell orbicular, moderately convex; hinge-line oblique, short and curved. Var. '*b.*' shell transversely ovate, rather flattened; hinge-line straight, lengthened and nearly horizontal; the character of the surface, though variable, has nothing peculiar to either variety of figure; the encircling costæ are narrow, elevated, widely separated and never quite regular; the interstitial spaces have numerous encircling lines, which are serrated or indented, forming a finely granulated surface; there is also occasionally an obscure rib to be traced within them; the posterior side has an oblique longitudinal fold, posterior to which the shell is more compressed, and the costæ curve nearly at right angles to the other surface; the posterior border is likewise slightly truncated and angulated at its junction with the ventral border.

217. *Ceromya striata*, syn. *Cardita striata*, Sow. Min. Con. t. 89. f. 1, but not *Isocardia striata*, Roemer, t. 7. f. 1, which is likewise a *Ceromya*, and of which latter shell *Ceromya inflata*, Agassiz, is a synonym. The present or Sowerby's species has the striæ longitudinal, in the other they are transverse.

212. *Tancredia donaciformis*; transverse, subtrigonal, smooth, moderately convex; umbones mesial; posterior border slightly concave, posterior extremity rather pointed, anterior border straight, obliquely sloping, ventral border rounded; length $\frac{3}{5}$ths the breadth.

113. *Tancredia sulcata*; small, transverse, subtrigonal or donaciform; umbones mesial, surface very finely striated concentrically with an anterior dorsal longitudinal ridge grooved at the angle; the striæ anterior to the sulcus rise at a right angle with the others.

228. *Cucullæa amœna*; rhomboidal, fornicated; umbones large, mesial, distant, both extremities of the hinge-line angulated; posterior dorsal ridge acute, the surface posterior to it concave; there are also several irregular longitudinal ribs upon each side of the shell; the middle portion of the surface has only encircling striæ.

224. *Arca rudiuscula*; transversely elongated; width $2\frac{1}{2}$ times the length; borders elliptically curved; a wide longitudinal mesial depression; longitudinal costæ irregular and rugose, nearly evanescent upon the middle portion.

250. *Modiolarca ovata*, syn. *Arca ovata* (Buckman); oblong, ovate, very gibbose; umbones anterior, very large, touching each other; hinge-line curved, its extremities rounded; ventral border sinuated by a wide mesial depression, but which does not reach the umbones; surface imbricated with longitudinal closely arranged waved and flattened costæ, crossed by densely imbricated transverse lines; lines of growth few and strongly marked. The diameter through the umbones is equal to that of the shell longitudinally. The general figure is nearly that of a very gibbose *Modiola*, but the character of the surface agrees with that of the *Arcacea*.

231. *Cucullæa triangularis* (Phillips?); subtrigonal, rather flattened; hinge very oblique to the ventral border, and nearly at right angles to the posterior border, which is straight and elongated; anterior border much shorter, rounded; umbones oblique, nearly mesial; surface with exceedingly fine decussating striæ producing a finely gra-

nular surface. The figure agrees with the shell figured by Phillips; the greater number of specimens do not exhibit any markings upon the surface.

233. *Cucullæa nana*; minute, rather compressed, suborbicular; umbones mesial, touching; hinge-line short, rounded at the extremities; surface with extremely fine decussating lines, two or three of which upon the posterior side are more elevated.

249. *Cucullæa bipartita*; small, rhomboidal; umbones large, mesial; hinge-line angulated at its extremities; a longitudinal oblique keel upon the posterior side, and a wide and deep depression extending from the umbo to the ventral border; surface with lines longitudinal, closely arranged, crossed by a few lines of growth.

234. *Lithodomus attenuatus*; elongated, smooth, posteriorly attenuated; umbones small, near to the anterior extremity; width $\frac{3}{4}$ths of an inch, which is thrice the length.

248*. *Cucullæa obliqua*; depressed, oblique, subtrigonal; umbones touching, small, mesial; hinge very oblique to the ventral border; anterior side short, rounded; posterior produced, flattened and angulated at the base; surface with extremely fine lines, both longitudinal and transverse, the latter very densely arranged. There may sometimes be difficulty in distinguishing this from *Cucullæa cucullata*, but the present shell is more flattened and oblique, the umbones are much smaller, the hinge-line shorter, and the posterior border more lengthened.

172. *Trigonia clavo-costata*; shell elevated, anterior border rounded; costæ regular, some tuberculated, others smooth; tubercles large, closely arranged, the first three or four and the last one or two elevated, but without tubercles; cardinal area broad, flattened, with oblique carinæ; posterior extremity short and truncated. This shell has usually been confounded with *T. clavellata*, but the figure is much more truncated or shortened posteriorly, the costæ are perfectly regular, and the tubercles are very large and closely arranged, the few first and last costæ being simple; these several features separate it from the Oxford clay species. It approaches near to *T. Bronnii*, Agassiz, in form, but the character of the costæ as above described are different.

XXXV.—*Observations on the Luminosity of the Sea, with descriptions of several of the objects which cause it, some new to the British Coast.* By Charles William Peach, Associate of the Royal Institution of Cornwall*.

[With three Plates.]

The Report of the Royal Institution of Cornwall for 1846 contained some remarks of mine on the luminosity of the sea; since that time I have taken every opportunity of extending my ob-

* Read November 2nd, 1849, and abridged from the Report of the Institution.

servations whenever I was so fortunate as to witness that beautiful phænomenon; these have been frequent, and I trust it will be found that I have not been altogether idle, when I could spare time to examine minutely. I have thought that it would be better to give the observations in a journal-like form, though I have only given *some of the times* when the most remarkable or interesting things were noted, not only of the luminosity, but of other unusual appearances which occurred at or about the time; with a table showing, for four years, the objects noticed in those months when observations were made, and another to show how often in each year the weather changed from fine to coarse after these displays, and how often it continued fine. This is done with the hope that, by a long-continued series carried on in different places, by different observers, something satisfactory may be arrived at.

The subject has been taken up afresh in different places, and as the British Association for the Advancement of Science has requested all information possible on the subject, it appears there is still great interest connected with it. On one point nearly all are agreed, *i. e.* that whenever the sea is luminous, animals and their exuviæ are invariably present, as well as occasionally vegetable productions; that these are the spangles which illumine the water and not any property in the water itself, but that the animals have not the power to give out their light unless irritated or moved.

I shall call attention to a long list of objects, some of which I am assured are new to the British coasts: these I purpose to describe as well as I can, but shall leave the naming to those who are more intimately versed in such matters.

1846.	Sea.	Animals, &c.	Weather.
June 11, 10 P.M.	Very luminous ...	Beroë abundant; Sarsia prolifera, with others, rare.	Exceedingly hot weather.
1847.			
April 19.	Very luminous ...	Lizzia octopunctata, skins of Barnacles, and small Crustaceans.	Very unsettled weather and dull: torrents of rain.
May 3.	Very luminous ...	Steenstrupia rubra, Beroë, &c. &c.	Very fine weather; 5th and for some time after unsettled, cold and wet.
July 22.	Very luminous, sheet-like.	Volvox innumerable, rolling about in all directions.	Very hot with heavy showers, and heavy dews about this time.
Nov. 9.	Very luminous, in large spots, at times in masses.	Skins of Barnacles, small Acalephæ, and Beroë in thousands.	The two days before stormy strong weather, wind S.E.; splendid weather for some time after.

1847.	SEA.	ANIMALS, &c.	WEATHER.
Dec. 24.	Very luminous indeed.	Various objects, but mostly Crustaceans.	Very unsettled and stormy with gales S.W.
1848.			
Mar. 18.	Slightly luminous.	....	Fine weather; 19th, showery, very cold: total eclipse of the moon.
June 9, 1 A.M.	Very luminous and sheet-like.	Objects large, shining as they rested on the blades of the oars; small and large Crustaceans.	Moon just set, rather cold; before daylight terrific rain and a heavy gale to the S.W.
Aug. 1, 11 30 P.M.	Luminous.	Volvox most abundant, exceedingly active.	Weather fine, night cloudy: A.M. few drops of rain. 2nd, rain in torrents and very unsettled for a few days.
Sept. 4.	Very luminous, in large spots.	....	Strong S.E. wind and moonlight. Observed a large star drop in the eastern part of the heavens; it left a luminous streak behind, and burst like a rocket; a shower of sparks fell from it. We fancied we could hear the report: the moon was shining bright, otherwise it would have completely illuminated the heavens; as it was, it caused a great light, and made my men start. 5th, very foggy, and heavy rain at times.
Oct. 25, 1 15 A.M.	Very luminous indeed.	....	Aurora borealis most splendid: a few days fine weather before with gentle showers. 27th, gale of wind S.W. with torrents of rain.
Dec. 13.	Very luminous in large spots thrown up by the curling waves.	Opossum shrimps very abundant.	Fine weather. 15th, a terrific gale with lashing rain.
1849.			
Feb. 12.	Bright flashes which continued for some time.	Crustaceans darting about with great rapidity, as if irritated.	Weather unsettled with a damp atmosphere.
Mar. 27.	Very luminous; water very clear.	Nidi of Acalephæ, skins of Balanoides most abundant, a small swimming Annelide.	For a few days before weather very fine; this afternoon set in wet and stormy.

1849.	Sea.	Animals, &c.	Weather.
April 26, 11 P.M.	Very luminous indeed.	Thaumantias inconspicua, and other Acalephæ, Beroë, Polyphemi, &c., &c., very plentiful and most active.	Splendid and calm. 27th, a gale of wind with lashing, cold rain.
July 1.	Very luminous.	Sarsia prolifera, Lizzia octopunctata, Beroë, &c., &c., Diphydiæ for the first time. See Plates XII. and XIII., new ones.	Day fine, night bright moonlight; 2nd, thick fog; 3rd, strong wind S.W., thick rain.
July 20, 10 P.M. & 1 45 A.M.	A glorious display.	Diphydiæ by thousands, Acalephæ abundant,—those figured in Pl. XIV. from 1 to 8 and 11 and 12 equally so. So sheet-like (caused by the very small ones), that when the larger ones dashed through them they left a meteor-like train behind.	Showery, but warm and fine seasonable weather; 22nd, gale of wind; hundreds of porpoises in the harbour making a great noise.
Sept. 9.	Luminous.	Cyclops, &c., &c., with Nos. 1 and 3, Pl. XIV. plentiful.	Before for several days weather fine: porpoises plentiful in the harbour after the great shoals of mackerel: strong out wind commenced, with dull weather and showery.
Nov. 3.	Very luminous.	So abundant were several of the Acalephæ, Beroës, &c., but more especially the minute Crustaceans, that the water was like sheets of fire.	Mild, calm and clear. 5th, cold with heavy lashing rain and very unsettled weather.

Objects observed in each month for Four Years.

	1846.	1847.	1848.	1849.
Jan.	——	——	——	——
Feb.	——	——	——	Small Crustaceans, and some Opossum shrimps.
March.	——	——	——	Nidi of Acalephæ, skins of Balani, and exuviæ of Crustaceans, small Annelides.

	1846.	1847.	1848.	1849.
April.	——	Acalephæ, exuviæ of Balani and Crustaceans.	——	Acalephæ, Beroë, small Crustaceans such as Polyphemi, &c.
May.	——	Acalephæ, Beroë, &c. &c.	——	Acalephæ, Beroë, Zoea, Polyphemi abundant, and other minute Crustaceans.
June.	Acalephæ, Beroë, &c.	——	——	——
July.	——	Volvox abundant.	——	Acalephæ, Diphydiæ, Cyclops, Volvox, &c., most abundant.
Aug.	——	Minute Annelides, Gemmæ of Polyps.	Volvox abundant.	Crustaceans, Annelides, Acalephæ, &c., of various kinds, abundant.
Sept.	——	——	——	Gemmæ of Polyps and Cyclops abundant.
Oct.	——	Exuviæ of Balani abundant.	——	Crustaceans of various kinds abundant. Diphydiæ, Acalephæ, &c. &c., plentiful.
Nov.	——	Ditto with minute Acalephæ, Beroë, &c., abundant.	——	All as above with others.
Dec.	——	Crustaceans not uncommon.	Opossum shrimps abundant.	——

Number of times when the weather has changed suddenly from fine to wet with gales of wind, heavy surf, and at times tempestuous with thunder and lightning after unusually luminous displays :—

1846, 1; 1847, 9; 1848, 13; 1849, 19:

when it continued fine :—

1847, 2; 1848, 4; 1849, 3.

List of objects observed.

Gasteropoda ...... Young of Eolis.
Tunicata .... Tadpole of a Cynthia.
Cirrhopoda .... Exuviæ, and young of.
Crustacea .... Opossum shrimp, Zoea, Oniscus cœruleus, Polyphemus, Cyclops, Cypris, &c.
Annelidæ .... Two varieties of small swimming ones.
Zoophyta .... Probably Gemmæ of Laomedea and Campanularia.
Acalephæ .... Willsia stellata, Saphenia dinema, Sarsia prolifera, Thaumantias octona, Thaumantias inconspicua, Thaumantias lucifera, Bougainvillia nigritella, Lizzia blondina, Lizzia octopunctata, Steenstrupia rubra; Beroë, two varieties; a number of other forms, the young of the above; Diphydiæ, new to the British coasts, two varieties.
Volvox .... Two varieties;
and minute jointed Algæ.

Although at present I am unable to state the nature of the luminous matter, this I well know, that animals and animal matter, with probably small jointed algæ, are always present when the sea is luminous; and that when it is at its greatest intensity, a peculiar state of the atmosphere may be noticed, damp, soft, and close: a gentle rippling movement is also necessary to disturb them, otherwise no light is emitted. I have noticed, that should lightning and tempest follow unusual displays, and this is frequently the case, all trace of them is lost for some time, as if the electric discharge proved fatal. It is remarkable that the light of the glow-worm is most brilliant at those times when the luminosity of the sea is the greatest, thus showing that probably the luminous matter is of the same kind. There is still another interesting fact connected with this peculiar state of the atmosphere, for porpoises, also fish, such as pilchards, mackerel, &c., which visit our coasts in shoals, are dashing and jumping about, and sporting just before, or at the time when these luminous displays take place, as if acted upon by the same exciting cause.

When broad flashes are given out, myriads of minute crustaceans are present; frequently the Volvox plays a prominent part, and is so abundant at times that the water is cloudy with them, and often thought to be muddy. It is interesting to view the minute Acalephæ with a magnifying glass as they lie in the landing net, to notice the luminosity of the ocelli and reproductive organs—they are like so many brilliant lamps on gala nights. I have watched them for seconds: to the naked eye the light appears one, but the lens reveals their beauty, and shows the multiplicity of their lights. After the light dies away, it may be revived by plunging the object into fresh water; it then flickers brilliantly, being a beautiful blue at the centre, but gradually ceases, and is lost, not again to be revived. I have seen luminosity at all seasons of the year, and at all hours of the night, and in bright moonlight. I have observed it until daylight both in summer and winter, and even until overpowered by strong daylight. Very young fish are probably luminous, and I understand that the monk-fish or angler is like a lighted lanthorn when in the water. I fancy that the luminosity of it and other fishes may arise from gelatinous and other objects which stick to them, rather than from any luminosity they possess of their own; of course I do not now speak of dead fish.

I could have given many more instances which I have observed, but from fear lest I should extend them too far, I pause, hoping to renew the subject at some future time.

I will now give a description of the objects figured.

Plate XII. Figs. 1 to 9, 13 & 14, *Diphydiæ*; the bell part of the most brilliant glass-like appearance, assuming very many forms, but all more or less bell-shaped: on the mantle are pointed parts, but never assuming the appearance of tentacula; they are of a rather bluish colour, dart about with great rapidity, and are very restless; when moving they contract and dilate the umbrella part, very much like the small medusæ, and can draw in or stretch out their ovarian appendages, which may be seen in various stages of growth: the first were collected on the 20th July, and thence to 5th August; figs. 13 & 14, later.

It will be seen that in all, when the appendages are so far advanced as to become elongated beyond the umbrella, they have grape-like clusters with larger ones making up separate groups; and generally associated with these are small yellow comb-like objects, tipped on the lower edge with very minute grains. These comb-like appendages vary in number, frequently three to each group, at times altogether wanting; this is a very rare case; at other times extremely abundant; they are attached to fine rough thread-like strings which are very jelly-like. I have seen them break into innumerable specks, and have, I think, observed signs of life in them after being thus broken up, though on this head, from their extreme delicacy and smallness, I would not speak positively.

The tube which is inserted in the umbrella, and from which the ova are suspended, is generally near one side; in the upper part of this, as in all well advanced (see fig. 14 *b*), I observed a coloured globule, at times red, occasionally dull green; this moves a little sometimes. I observed also other globules of similar colours passing down the tube from the top, amongst and into the ova, traversing the whole length of the bunches; and when two of these globules touched each other, they did not amalgamate as water would, but passed round one another, and each held on its own course.

Surrounding the speck at fig. 14 *b*, I noticed exceedingly minute comma-like cilia in rapid motion; they were not numerous: these I have seen in many specimens. From the great transparency of the whole of these objects, even when one passed behind the other, all may be seen clearly, provided a little darker shade is over it; they can only be seen in certain positions; practice tells the best method of managing them. Although my description has extended to such a length, I have still an interesting part to notice: hitherto figs. 10, 11 and 12 have been unnoticed; I was observing fig. 9, attentively, when all at once the centre appendage left the jelly-like umbrella, and assumed the shape of fig. 10; in a short time it formed like fig. 11, and then changed to fig. 12. There was a rupture in the upper part at *a*, where I observed an abundance of delicate cilia in active motion, so delicate that they would have escaped observation had not the motion of the water attracted my notice; the forsaken umbrella jerked about—the deserter luxuriated in his liberty and appeared to make good use of it. I watched it for a long time, till the "wee short hour ayont the twal," told me a tale, and I unwillingly left it well supplied with water; but when I rose in the morning, it had only "left a wreck behind" of small granules inactive and dead. The size of these objects never exceeded the sixth part of an inch; they were generally smaller; some were specks. At times the above were most abundant, but invariably vanishing after strong gales, especially when accompanied by lashing rain or thunder.

Fig. 13 will be seen to have its ova in an inverted position, the tube being below the umbrella instead of in it; fig. 14 had two jelly-like appendages (umbrella- or bell-shaped) and was extremely active. I have seen three or four specimens something like the latter.

These departures from general form may have arisen from ruptures by injuries, and although their activity was not destroyed, their known tenacity under injuries will account for their vivacity.

Plate XIII. Figs. 1 to 4, *Diphydiæ*. It will be seen that the appendages are much more developed in figs. 1, 2, 3. Fig. 4 appears to have thrown off many of the grape-like parts, and by some means the bell part has become inverted, and the comb-like appendages are all upon one long filament, showing that in all probability there is a continuous connexion between these even when the tail is laden with the clusters, and that the filamentary thread is concealed amongst them, and is of sufficient tenacity to resist the tearing off of the clusters. An examination of the more highly magnified figs. 2 *a*, 3 *a*, shows part of the tails of figs. 2 and 3; and there are between the clusters of ova connected with these, bars which may be seen on each side, also bent and needle-like objects sharp at both ends. The stem of fig. 3 *a* is wrinkled like the windpipe; on each side of it a double line passes, stouter and more strongly marked than the internal part. The larger parts of the ovarian appendages (and these assume two or three different shapes) have a hyaline appearance, and that beautiful cloud-like arrangement which may be seen in opal when light is reflected through it, and as if made up of countless granules.

Fig. 2 has the comb-like appendages altogether wanting.

Fig. 3 shows them very abundant.

Fig. 4, with them left when nearly all the ovarian parts are gone and the umbrella inverted.

Fig. 3 *b*, the back part of one of the comb-like objects.

Fig. 3 *c*, side view of the same.

Plate XIV. Figs. 1 & 1 *a*. play a conspicuous part *very often* in the luminosity of the sea, being present in swarms. They differ from the naked-eyed medusæ in having the stomach external on the upper part of the umbrella. They are brilliant fellows, and flap and snap their cilia about, and at times throw them up as at fig. 1 *a*; this position appears to be a state of rest. Fig. 1 *b*. shows the stomach highly magnified; fig. 1 *c*, ditto with the lips turned down; 1 *d*, the arrangement of the tentacula; 3 *a*, the stomach of fig. 3: this sort is not so common, and has the stomach also on the upper side of the umbrella; I fancy they *may be* the gemmæ of Corallines.

I now pass to fig. 4, another of the class *Diphydiæ*, but of a different shape; these occurred several times; the outer part is glass-like, shaped like a wine-glass without a foot, the internal part granular and yellow, the widest part surrounded by pointed delicate cilia, by which it moved in the most rapid manner, darting about, across and up and down; at times it would rest on the sharp point, and turn round like a boy's top when it makes the last gyrations before falling, the upper part describing wide circles; this it would continue for some time, then fall down, withdraw its cilia and lie on its side as if to rest; all at once it would rise and dart off on its gambols again. It very much resembles the *Cubiodes vitreus*, fig. 3892, page 421, of Knight's 'Museum of Animated Nature,' also figured in the 'Penny Cyclopædia,' found in the Straits of Gibraltar, where it appears to have a case and live in groups. These had no case and were solitary; in every other respect they were like the one from Gibraltar. Fig. 5 is a much smaller specimen; it is wholly granular, still yellow, and the mouth surrounded with cilia, moves quickly, generally with the cilia downwards; it greatly resembled the seed of the sweet scabious, and probably may be the young of the other. Minute as it was, the "interjections," though represented so large at fig. 6, were parasitical upon the former; these put down their disk-like foot, then turned over their rounded head, and threw a summerset, recovered themselves and repeated it again and again; and upon *these parasites* I observed *their parasites*, fig. 7, minute indeed, and which I believe were *Cypris* in various stages of growth.

Fig. 8 is a strange thing, evidently one in a state of transition, lies on its side, and runs round by jerks like the seconds hand of a clock when the pendulum is taken off. When tired, it closes up and assumes the form of fig. 8 *a*. The head part is dark and granular, the wing-like appendages glassy and brilliant.

Fig. 9, no doubt one of the same kind, found a few days after, further advanced.

Fig. 10, the tadpole of one of the *Botrylli*, probably *Cynthia*; it was beautiful, and appeared to be moored by a very delicate gelatinous thread to a minute alga; was active and appeared to enjoy itself, and was very shining.

Fig. 11, two varieties of *Volvox*, the merest specks; they moved by an undulatory zigzag motion, opening the points, and shutting them at pleasure; the lower ones generally carried the point forward. Specks as they were, I saw one burst, when hundreds of young ones came out, and off they rolled as the parent did before them: this I have seen in two or three instances.

The last I have to describe, fig. 12, was a jointed Alga, minute indeed, transparent, generally present in abundance in summer when the water is very luminous.

All the figures are taken from specimens collected in Fowey Harbour, and just outside of it. The whole of them minute—some so small that I can adopt no sign, nor use any word to tell how small.

[We regret that our severe duty as Editors compels us to curtail this paper by the omission of many passages which evince our Friend's well-known zeal, and the delight which the study of nature affords him.—Ed.]

XXXVI.—*Descriptions of some new species of Butterflies.* By William C. Hewitson, Esq.

[With two Plates.]

Fam. Nymphalidæ.

Genus Ectima, Diurnal Lepidoptera.

Nymphalis, Godart.

Ectima Iona, Hewitson MSS., Diurnal Lep. pl. 42. fig. 4.

Upper side dark brown, tinged with purple, except at the base of the posterior wings, and marked with numerous lines and spots of black.

Anterior wings with an irregular band of white formed of four distinct oval spots reaching from a little beyond the middle of the costal nervure to the middle of the outer margin.

Posterior wings with two scarcely visible ocelli.

Under side of a light yellowish brown with the same marking as above.

The female differs from the male in having the white band much larger and not divided into distinct spots. Exp. $1\frac{1}{2}$ inch.

In my own collection. From the river Amazon.

This species, though nearly allied to *E. Liria* (*Nymphalis Lirissa*, Godart), is very easily distinguished from it by the purple colour of the wings, the very different form of the white band, and the absence of numerous ocelli.

Genus Heterochroa, *Boisduval.*

Heterochroa Zea. Pl. IX. figs. 1 & 2.

Heterochroa Zea, Hewitson MSS., Diurnal Lepidoptera, p. 278.

Upper side dark brown, with a central band of white common to both, which, commencing at the median nervure of the anterior wing in the form of a distinct triangular spot, curves slightly inwards and extends to the anal angle of the posterior wing, where it is followed by an irregular patch of orange.

On the anterior wing, between the commencement of the white band, the costa and the apex, is a triangular patch of orange, cut into four by nervures, convex on its outer margin, and nearly touching the white band with its acute angle. Parallel to the margins of both wings are the usual black lines.

Under side of a glossy silver, divided into three broad irregular bands—each bordered by deep black—by two narrow belts of crimson, the middle band occupying rather more space than the white band and the orange spot of the upper sides together; the marginal band, which is obscured in the middle of the anterior wing, is again divided longitudinally by a black line, and also perpendicularly by the nervures. In the cell of the anterior wing is a square silver spot, cut into three triangles by a curved black line, and outside of this two silver spots, one minute. Exp. $2\frac{3}{10}$ inches.

In my own collection. From Rio de Janeiro.

This beautiful species, though very nearly allied to *H. Iphicla* of Cramer (*H. Serpa,* Boisduval), is abundantly distinct.

Heterochroa Zeba. Pl. IX. figs. 3 & 4.

Heterochroa Zeba, Hewitson MSS., Diurnal Lepidoptera, p. 278.

Upper side deep brown, with a common central band of white pointed at each end, commencing at the median nervure of the anterior wing in a *minute oval spot,* and extending to the usual rufous patch at the anal angle of the posterior wings; between the commencement of this band, the costal nervure and the apex of the anterior wing, is a triangular patch of orange not divided by nervures, the acute angle of which, though nearly approaching the white band, is separated from it by a broad line of black.

Under side ferruginous—lightest under the orange patch; the central band pure white, and prolonged upwards to the extreme costal margin of the anterior wing by a line of silver; two silvery belts cross the cell of the same wing and extend beyond it, that nearest the base being common to both wings; these belts are all bordered with black; a less distinct silvery line runs along the margin of both wings; the abdominal fold is gray. Exp. $1\frac{8}{10}$ inch.

In my own collection. From Rio de Janeiro.

On the upper side this species nearly resembles *H. Syma*, on the under side it is like *H. Cytherea*. It is also nearly allied to *H. Mythra* of Godart.

Heterochroa Abia. Pl. IX. fig. 5.

Upper side dark brown, with a narrow central common band of white commencing at the median nervure of the anterior wing and extending to near the ferruginous spot at the anal angle of the posterior wing, where it is narrow and pointed, straight on the anterior wing, curved inwards on the posterior. Between the commencement of the white band—which it touches—the costal margin and the apex of the anterior wing, is an irregular somewhat triangular large patch of orange. Both wings have the usual submarginal lines of black.

Under side indistinct; the white band as above, but prolonged at the anal angle to the margin of the wing. Inside the band almost white, the cells of both wings crossed by two ferruginous belts margined with black; outside the band claret colour. Exp. 2 inches.

In my own collection. From Rio de Janeiro.

This species is easily known from all the others by the pointed anal angle of the posterior wings.

Heterochroa Thoasa. Pl. IX. fig. 6.

Heterochroa Thoasa, Hewitson MSS., Diurnal Lepidoptera, p. 278.

Upper side light brown, with a very broad central band of white, rounded at both ends, commencing at the median nervure of the anterior wings and ending near a small rufous spot at the anal angle of the posterior wings; between its commencement and the costal nervure of the anterior wing is a spot of white, and between it and the apex of the wing a small lunular patch of orange. The usual submarginal lines border both wings.

Under side rufous, with the broad band and spot of white as above, a silvery belt of white near the base of both wings, and a short one across the cell of the anterior; on the anterior wing between the submarginal lines are several obscure spots of lilac, and near the margin of the posterior wing between two of these lines a belt of white; the abdominal fold is also white. Exp. $1\frac{7}{10}$ inch.

In the British Museum and my own collection. From the river Amazon.

Heterochroa Abyla. Pl. IX. fig. 7.

Anterior wings long and protruded at the apex. Posterior wings deeply dentated.

Upper side deep purplish brown, with a broad common band of white, rounded at both ends, indented at the crossing of the nervures, widest on the posterior wing, commencing at the median nervure of the anterior wing and ending near a large orange patch at the anal angle of the posterior wing; obliquely across the apex of the anterior wing is an irregular oblong patch of orange. The usual black lines run parallel to the margins of both wings.

Under side as above, but rufous, of many tints. Between the black marginal lines of both wings are several broken lines of white tinged with purple, and near the bases of the wings many similar lines of a yellowish colour. Exp. $2\frac{2}{10}$ inches.

In the British Museum and my own collection. From Jamaica.

This beautiful species scarcely differs except in form from *P. Iphicla* of Linnæus.

Heterochroa Lara. Pl. IX. fig. 8.

Upper side deep brown, apex of anterior wing black. Anterior wing crossed by a broad beautiful band of crimson, irregular on its outer margin, commencing at the middle of the costa and ending at the outer margin considerably below the middle.

Under side chocolate-colour, with the nervures, lines between them and a submarginal line, black. The band of the anterior wings almost white, slightly tinged with crimson, chiefly at its extremities. In the middle of the cell is a spot of ochre nearly cut in halves by two black spots, each with a blue point in its centre; a black line also bounds the inner side of the central band, and this is dotted with blue. The base of the wing on the costa is crimson as well as that of the posterior wing, which is also belted with five black lines inclosing a patch of ochre; the under side of the abdomen is yellow, and the abdominal fold rufous. Exp. $2\frac{1}{2}$ inches.

In my own collection. From Venezuela.

This species differs greatly in appearance from those described above; it has longer palpi, but is nearly allied to *H. Isis* and *H. Mesentina.*

Fam. Satyridæ.

Genus Corades, Doubleday.

Corades Enyo, Hewitson, Proc. Zool. Soc., Annulosa, pl. 4.

Corades Iduna, Hewitson MSS., Diurnal Lepidop. pl. 63. fig. 1.

Upper side. Anterior wings deep brown, with three spots of white, one triangular beyond the end of the cell at the costa, the second between it and the apex, the third larger, midway between the cell and the outer margin, curved and divided by a nervule.

Posterior wing tailed, chocolate-brown, with a large rufous patch between the end of the cell and the outer margin.

Under side. Anterior wing deep brown, the apex ashy brown.

Posterior wing silvery ash, with two indistinct bands of brown, one from the costa across and beyond the cell, the other from the costa to the tail, and outside the band are some indistinct points of white. Exp. $2\frac{1}{2}$ inches.

In the Museum and my own collection. From Bolivia.

Corades Pannonia. Pl. X. figs. 1 & 2.

Upper side deep brown, almost black, posterior wings tailed.

Under side. Anterior wing brown, the apex and a small spot on the costa near it lighter, the former undulated with silver. Halfway between the middle of the wing and the posterior margin and parallel with it are three round rufous spots.

Posterior wing brown, beautifully undulated with silver striæ of a purple hue, except on the margin of a band of yellow, which crosses the wing in a straight line, commencing near the middle of the costa and ending at the tail, distinctly defined on the inner margin, on the outer indistinct, losing itself in the silver striæ; there is also a slight indication of a belt of silver across the cell. Exp. $2\frac{8}{10}$ inches.

In the British Museum and my own collection. From Venezuela.

Fig. 2 is probably only the female of the preceding; it differs from it however more than can be seen by an uncoloured plate. Its upper side is of a much lighter brown. On the under side instead of the straight band of yellow, there is a much narrower one of silver, curved outwards. The scarcely seen belt of silver across the cell in the above is here distinct and silvery.

Corades Ulema. Pl. X. fig. 3.

Upper side brown.

Under side light brown, anterior wing with the apex lighter, with five yellowish spots, two upon the costa near the apex, the outer one the largest and undulated with silver, three in a row between the middle of the wing and the outer margin.

Posterior wing tailed, crossed by two bands, which, having their origin at the costa, almost unite at the anal angle; the inner one narrow, of equal breadth, silvery white, curved inwards, crosses the middle of the cell. The outer triangular, broad at the costa and gradually becoming narrower to the tail, the inner side silvery white and concave, the rest undulated with silver and rufous striæ, with three black oval spots; the rest of the wing undulated with silver, except between the bands, where it is of an uniform brown with a white lunular spot. Exp. $2\frac{2}{10}$ inches.

In the British Museum and my own collection. From Bolivia.

Corades Medeba. Pl. X. fig. 4.

Upper side brown.

Under side. Anterior wings dark brown, apex lighter, part of it and a small triangular spot near it on the costa undulated with silvery white. In the cell is an oblong triangular rufous spot, and between it and the outer margin of the wing five oval spots of the same colour, four of them in a row parallel to the margin.

Posterior wing tailed, light brown, undulated with darker striæ slightly silvered in patches, chiefly on the costa; a waved line commencing on the costa crosses the cell and ends there in a triangular yellow spot, a second very crooked line having its origin at the same place passes outside the cell and ends at the anal angle. Between this line and the posterior margin are six dots of white, the middle ones scarcely visible. Exp. $2\frac{2}{10}$ inches.

In the British Museum and my own collection. From Bolivia.

I have a variety of this species in which the red spots on the anterior wing are nearly absent, and almost the whole of the posterior wing is silvery.

Corades Sareba. Pl. X. fig. 5.

Upper side brown.

Under side. Anterior wing with the basal half rufous, the middle brown, with three rufous irregular spots, two united, and a broad triangular space at the apex and adjoining spot upon the costa ash-colour, undulated with brown.

Posterior wing tailed, light ash-brown, undulated with brown. From the costa crossing the cell and beyond it is an indistinct belt of brown, and on the middle of the wing beginning at the costa and passing just outside the cell and ending at the anal angle a distinct crooked band of brown, and between it and the posterior margin some indistinct points of white. Exp. $3\frac{3}{10}$ inches.

In the British Museum. From Bolivia.

The six species which I have indicated or described in this paper constitute the whole of the genus; they are all of recent discovery.

Genus Euptychia, Hubner.

Euptychia gera, Hewitson MSS., Diurnal Lepid. pl. 63. fig. 4. ♀.

Upper side dirty white, anterior wing broadly brown on the costal and outer margins. Posterior wing marked before the middle by two parallel lines of brown and two indistinct eyes with darker centres, both wings with two submarginal lines of brown.

Under side as above, except that the anterior wing is crossed before the middle by two lines of brown, and that the eyes on the posterior wing are rufous with deep black centres dotted with white, that there are besides two smaller ocelli, outside of these, and between them two oval spots with a line of silver in their centres.

The female differs from the male in having the upper side brown, tinged with purple near the base, crossed in the middle by a common band of white, commencing on the anterior wing below the costa and divided at the inner margin from the band on the posterior wing. *Under side* ashy brown with the white central band as above. Exp. $1\frac{6}{10}$ inch.

In my own collection. From the river Amazon.

Euptychia tricolor, Hewitson MSS., Diurnal Lepid. pl. 65. fig. 5.

Upper side. Anterior wing brown, with the costal margin rufous, and a line of bright blue parallel to the lower part of the outer margin.

Posterior wing black, with the upper edge broadly margined with orange, the outer and inner edges with brilliant blue.

Under side. Anterior wing ash-colour, with the costal nervure, three equidistant oblique bands and two lines parallel to the posterior margin brown; at the apex an orange ocellum with black centre.

Posterior wing: basal half ash-colour, with the base and two bands brown, outer half brown, with two large eyes of deep black margined with orange and bipupiled with white; between them two oblong orange spots centred with silver, and on the costa a minute ocellum; below these two submarginal brown lines. Exp. $1\frac{6}{10}$ inch.

In my own collection. From the river Amazon.

XXXVII.—*Notice of a Tridactylous Footmark from the Bunter Sandstone of Weston Point, Cheshire.* By R. Harkness, Esq.

The quarry of Weston Point is situated on the south side of the Mersey, about a mile and a half west from Runcorn; and here some of the most perfect impressions of footmarks are obtained. The rock consists of the usual red, fine-grained sandstone which is characteristic of the Bunter formation; and in one part of the quarry a thin bed of fine clay occurs separating two of the sandstone strata. It is on the face of this clay bed that the footsteps are met with; the lower face of the overlying sandstone having natural casts thereof in fine relief. This clay bed is in general so fragile, and intersected to such an extent with fissures, caused by desiccation, previous to the deposition of the overlying beds, that it is in a great measure incapable of being removed in pieces of any size. It is therefore on the sandstone which rests upon the clay bed that we have the impressions in their most perfect state. The footmarks which are found in the greatest abundance are those of the *Rhynchosaurus*. The impressions of a small tortoise, having curved claws of considerable size, are also numerous; and a few steps of the *Cheirotherium* are likewise to be met with. Amongst these there occur impressions of a tridactylous character, and the position which these assume is such as to indicate that they bear relation to the footprints of a bipedal animal.

These markings, which are about three-quarters of an inch in length, show three well-developed toes, the centre one being about twice the size of the other two; and the general appearance of the impressions has great similitude to the *Ornithichnites diversus* of Hitchcock, and also to the footmark of the present *Grallæ*. The length of the stride is about 7 inches; but as only two impressions are found on the slab, this can only be taken as an instance of a single stride; and as the interval between each step varies in accordance with the rate of progression, the length of the individual stride can give merely a general idea as to the development of the legs.

This I believe is the first instance of the occurrence of a tridactylous footprint bearing resemblance to the step of a biped in the new red sandstone of the Old World. But as Prof. Hitchcock some years ago, in 'Silliman's Journal,' made known their existence amongst the representatives of this formation in America, in great quantities, we might reasonably conclude that the same kind of impressions would be met with amongst the Bunter sandstones of Europe.

The conditions which prevailed during the deposition of the sandstone at Weston Point were such as would afford the usual requirements for the habitat of littoral birds; and the occurrence of vermicular markings, on the sandstone and clay, indicates that the food which is commonly required for the support of such birds as the stilt-plovers, prevailed in considerable quantities, and the nature of the step and the length of the stride are such as to sanction the opinion as to the relationship between the animals which formed the impressions at Weston Point and the present existing *Scolopacidæ*. The extensive geographical range of this family of birds would also appear to justify the conclusion as to impressions having some connection with them, inasmuch as we have in America footprints similar in their general character to those of Europe—showing the extensive range, during the epoch of the new red sandstone, of the *Ornithichnites*.

Although the impressions are devoid of the rows of the joints, the claws, and the integuments which are sometimes found in the American *Ornithichnites*, and which are so well shown in Prof. Hitchcock's last publication, in the American Academy's 'Transactions,' yet still, when we consider the action to which these footprints have been subjected, after they had impressed the soft clay, viz. the force of water carrying along with it sand; we are at no loss to account for the effacing of the more minute parts of the footprints.

In order to distinguish this impression, I propose to give it, from its resemblance to the footstep of a bird, the name of *Plesiothornipos Binneyi*. The specific appellation is in honour of my friend E. W. Binney, the first geologist who brought the impressions of Weston Point into notice.

XXXVIII.—*On* Cardiaster, *a new genus of Cretaceous* Echinidæ, *allied to* Holaster. By Professor Edward Forbes, F.R.S.

In the 'Outline of the Geology of Norfolk,' by Samuel Woodward, two fossil sea-urchins are figured which seem to have escaped the notice of the authors of the 'Catalogue Raisonné des Echinides.' These are the "*Spatangus excentricus*, Rose: cylindrical; groove in front deep; tab. 1. fig. 5;" and "*Spatangus cordiformis*, tab. 5. fig. 6." The former is omitted in Morris's 'Catalogue of British Fossils,' the latter is referred with a query to the genus *Holaster*.

I have lately had ample opportunities of examining several specimens of each of these rare and curious fossils, and have satisfied myself that they belong to a genus not yet characterized, nearly allied to *Holaster* and *Ananchytes*, having the same arrangements of ambulacra, genital disk and mouth, but eminently distinguished from those genera (and in this respect linking them more closely with the *Spatangaceæ*) in having a distinct peripetal fasciole. Remarkably different as the two species cited appear, they unquestionably belong to one genus; this I propose to name and define as follows:—

Cardiaster, Forbes.

(*Echinidæ*. Fam. *Spatangaceæ*. Sect. *Ananchytidæ*.)

Test cordiform. Ambulacra converging on the summit of the back without meeting, simple and not petaloid, the anterior ambulacrum lodged in a deep and steep-sided furrow. Arrangement of the plates of the genital disk as in *Ananchytes* and *Holaster*. Anus supramarginal. A fasciole proceeding from beneath it, and making a circuit without sinuosities around the margin of the body, including the dorsal ambulacra just above it. Mouth transverse, inferior, anterior, lodged in the termination of the anteal furrow, its upper lip tumid, but not projecting over it. Dorsal and ventral surface with numerous secondary tubercles surrounded by miliary granules, a few larger or primary tubercles on the antero-lateral areas or cheeks. Spines unknown.

The following reputed species of *Spatangus* and *Holaster* belong to this genus :—

1. "*Spatangus*" *excentricus*, Woodward, *loc. cit.*

Chalk of Kent and chalk-flints in Norfolk. Specimens of this very rare and strangely-shaped species, which undergoes most extraordinary changes of form in its course from youth to age, are contained in the collections of Mr. Bowerbank and Mr. Wetherell, and in the Museum of Practical Geology. It was discovered by Mr. Rose of Swaffham.

2. "*Spatangus*" *cordiformis*, Woodward, *loc. cit.*

Specimens from the chalk of Norfolk are contained in the Museum of Practical Geology.

3. "*Holaster*" *æqualis*, Portlock, Report on Londonderry, &c. pl. 17. fig. 3.

Chalk of the north of Ireland. An examination of the original specimens has convinced me that this is identical with *C. cordiformis*. The original of the figure pl. 17. fig. 1 in the same work, referred to the *Holaster Sandoz* of Agassiz, appears to be a bad specimen of a tumid variety of the *C. cordiformis*; but of this I am not quite sure.

4. "*Ananchytes cinctus*," and

5. "*Ananchytes fimbriatus*,"

both figured and briefly described by Morton in his 'Catalogue of the Cretaceous Fossils of New Jersey,' are also members of this genus. Whether distinct from the British species and from each other remains to be seen.

6. "*Holaster Greenoughii*," Agassiz, Cat. Raisonné, Annales des Sc. Nat. tom. viii. p. 27.

Of this we have no figure or description, only the following notice :—" Espèce renflée, très voisine de l'*H. cinctus*; mais le sillon antérieur est plus profond, et les carènes qui le bordent sont plus accusées. Le bord postérieur de la face supérieure est surbaissé. Gault de Warminster, Blackdown; Cr. tuf. de Beuzeville (Calvados)."

7. There are specimens of a *Cardiaster* from the greensand of Warminster in the Museum of Practical Geology, identical with the *Spatangus fossarius* of Miss Benett, distinct from *C. cordiformis,* and in all probability identical with the "*Holaster Greenoughii*" indicated by Agassiz.

8. A small species from the lower chalk of Dover, to which I have given the name of *Cardiaster pygmæus.*

The genus *Cardiaster* will be fully illustrated, and the species *C. cordiformis* and *C. excentricus* figured in detail, in the 'Figures and Descriptions of Organic Remains,' published by the Geological Survey of Great Britain.

XXXIX.—*On the* Conovulidæ, Tornatellidæ, *and* Pyramidellidæ. By William Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, Norfolk Crescent, Bath, Oct. 19, 1850.

The small family of the *Conovulidæ,* made up of the genera *Conovulus, Carychium* and *Acme,* with very few species, and the still smaller one of the *Tornatellidæ* that has only one species, in point of natural order follow the *Bullidæ* and *Helicidæ*; with the lateral intervention of the *Littorinidæ, Trochidæ, Cerithiadæ* and *Turritellidæ,* they precede and introduce us to the numerous and important family of the *Pyramidellidæ.* As it is no part of my plan to enter elaborately on the land and freshwater Mollusca, I shall confine myself to the simple statement, that *Carychium* and *Acme* only contain terrestrial pulmonifera; nevertheless the position of the eyes of the animals of these genera shows that they are decidedly in conjunction with *Conovulus,* though they may differ with each other in some specialties, the avenues to the singular and well-characterized groups of the *Pyramidellidæ,* the grand generic distinctions of which consist in the short triangular basally conjunctive tentacula, with the eyes of the animal imbedded at their internal bases. I should also have refrained from mentioning *Conovulus,* if it was a well-determined fact, that it had the respiratory apparatus of the terrestrial pulmonifera; but as some doubts still exist on this point, and having given one of its species a rigorous examination, I think it will be acceptable to malacologists to review my notes, and form their own judgement on the long and much-disputed point, whether the animal respires free air, or eliminates it from water, by a pectinibranchous organ.

I can say little of the *Tornatellidæ* with a single genus and species, except that many years ago I examined the animal of *Tornatella fasciata*, the type: I am inclined to think that, as regards the characteristics of this tribe, it will here be nearly in a natural position; but as the animal is not unattainable, I propose at a future opportunity to give both an anatomical and general description of it.

I observe, for the consideration of the younger naturalist, that it matters not if one animal is terrestrial and pulmoniferous, and another of marine or freshwater habitat and pectinibranchous—they will take their natural position with respect to each other, and in the method, as the collective value of the characteristic organs either of one or the other preponderate; for instance, the *Cyclostoma elegans*, a land branchifer, falls into natural position with the marine pectinibranchiata. And though *Carychium* and *Acme* are pulmonifera, and the *Pyramidellidæ* branchifera, still the peculiarity of their organs and shells associates them nearly as closely with the marine as with the terrestrial mollusca.

Conovulidæ.

Conovulus bidentatus, Lamarck et auctorum.

Conovulus albus et *erosus*, auct.
Auricula bidentata, nonnull.

Animal spiral, with a white, glossy, short, fusiform shell of four volutions, and an elongated narrow aperture. The colour throughout the external organs is hyaline flake-white, except that occasionally the termination of the muzzle and lobes of the head-veil are margined with a fine red-brown line. The mantle is fleshy, and sometimes extends rather beyond the aperture of the shell; when it is viewed in the dead animal, it has the aspect of the rounded tumid margin of the *Helices*. The neck is proportionately longer than any other animal of its size I am acquainted with, and at its termination forms a veil divided by a sinuation in its centre into two arcuated lobes, from the right and left angles of which two very short, flat, setose tentacula spring; these vary, being in some animals more cylindrical: a little behind their origin the large subrotund eyes are seen at rather the internal bases; these appear dull, being imbedded within the skin. Beneath the neck-veil a narrow, flat, rather taper, grooved muzzle issues, within which the buccal mass, with high powers, may be seen in action, though neither the tongue nor the corneous plates could be detected: the muzzle rests on the foot, which always outruns it a little; it is therefore between the neck-veil and the foot this organ anteally forms two curved lobes, caused by the deep indentation in its centre. The pedal disk is moderately long and rather broad, divided transversely very deeply at a third of its length; the other two-thirds taper gradually to a moderately rounded termination, sometimes slightly emarginate and with a medial groove; the pedicle of attachment to the body is long and slender. The structure of the foot is that of *Pedipes*; I observed it twenty-five years ago, and its quality of locomotion perfectly agrees with the etymology of that term; it is very slow in consequence of a double action of the pedal disk being necessary to effect progression, the anteal portion being first carried forward, accompanied by the head and neck, and is then fixed, when the posterior portion carrying the shell is drawn up to its predecessor or *pes pedi* and so on, and thus a slow march is accomplished: there is no operculum. The neck, from the length of its protrusion, admits of close examination, but no generative organ was observed. I think that from all the fourteen specimens having ovaria, they, like the *Helices*, are hermaphrodites with mutual congression. The sac of the ova is deposited in the posterior cavity of the shell, which part is without internal spire; the animal appears to have the power of absorbing the septa; the oviduct winds entwined with the brown liver, accompanied by the intestine to its termination at the middle of the right side of the aperture. The intestine is by far the most conspicuous organ of the viscera; it is very large and always fully distended; its course after leaving the pylorus of the bursiform stomach is along the left side glued to the liver; it descends to nearly the ovarian bag before it ascends on the right side of the liver to its termination at the middle of the aperture, where the fæcal matters may be seen to issue, not in distinct pellets, but in large cylindrical-formed brown sandy masses; the rectum is a mere aperture, but, like the intestine, of large calibre; there are two slight sigmoid flexures, otherwise the form and course of the intestine and its formed contents are very similar to those parts in *Helix*; the œsophagus is long, but though we could not detect all the organs of the buccal mass, we found at the usual place the nervous cordon of two oval yellow ganglions.

I now come to the most important point of this examination, the character of the respiratory organ, as some malacologists are still in doubt whether the animal breathes pure air or extracts it from water; my own prepossessions have been of the latter cast. Having submitted fourteen live animals to the powers of an excellent microscope, I am enabled to say, that I found no traces of a regular pectinated membrane; but when the dissection turned out well, there appeared, as in the usual place of the *Helices*, what

I considered the respiratory cavity having its walls lined with an anastomosing network of vessels; one side of this membrane abutted on the rectum and the canal of the sac of viscosity. The strongest support that this is the true respiratory organ is, that I observed in several individuals large cylindrical masses, not pellets, of red-brown sandy fæcal matters ejected from a dilatation in the mantle lining the aperture. It must not be supposed that I have mistaken this orifice for the termination of the rectum: that organ ends within the mantellar dilatation, exactly as in *Helix*, in which the respiratory orifice dilates to receive air as well as to emit the rejectamenta. This dilatation in the present species has not the aspect of the terminus of a rectum; it is a simple oblong fissure, which instantly closes and is lost to view when the fæces are passed: the continual change of posture of these animals, not one of them $\frac{1}{8}$th of an inch long, prevented me observing the periodic dilatations. The facts I have stated appear to be decisive, that the animal respires free air; in addition, it has the cord-like margin of the mantle, as in the *Helices*, around the aperture of the shell, and the figure and course of the large conspicuous intestine is also as in *Helix*.

The animal when put into water instantly escapes therefrom, apparently with the view of breathing free air. All the animals exhibited the ovary: this circumstance almost amounts to proof, that they possess a similar hermaphroditism to the *Helices*, that of mutual congression. All these facts favour the opinion that the animal breathes free air. Those I examined inhabit a bank wall, that for ten days out of thirty is covered by the sea for three or four hours out of the twenty-four; they are found lying at the bottom of stones which are imbedded in a red sandy soil, and have not been disturbed for years; the detached stones at the base of the wall under which they are found are buried from 3 to 6 inches, and require force to raise them.

The fact that these animals are submerged for only a very small part of the year proves nothing as regards the plan of respiration, as the *Rissoa ulvæ* and minute *Littorinæ* adhere constantly to the outside of the bases of the stones under which the *Conovuli* are found, and are not more submerged than they, and yet these animals are decided pectinibranchiata, which nevertheless appear to have the power of living in free air with almost equal facility as the pulmonifera, and perhaps by constant exposure to the atmospheric air their branchiæ acquire the capability of extracting oxygen therefrom. Though the *C. bidentatus* are so little submerged, the places they lie in are always humid from the influences of the tidal waters.

The *Conovulus denticulatus* is rarely found at Exmouth: I have not seen the animal; it will be desirable to observe if the foot is transversely divided as in *C. bidentatus*. The *C. albus* and *erosus* of authors are undoubtedly the *C. bidentatus*.

This family, with a few of the *Bullidæ*, first show the singular deviation in the position of the eyes from the ordinary gasteropods: I place in it the *Otina* —— ?, *Velutina otis*, which is a most curious and anomalous animal, as I cannot find a more appropriate provisional depositary for it. I have given a full account of it, that naturalists may form their own opinion of its true position. It inhabits the high littoral levels, from which circumstance, and the structure of the respiratory apparatus not having been made out clearly, it may, if the *Conovuli* really breathe pure air, have a closer connection with them than appears from their present doubtful position, by having a similar respiration. Though this animal has not the tentacula of *Conovulus*, it has the singular divided foot, and the eyes at the internal points of the head, which is an analogous position to the eyes in *Conovulus*, and like in it there is no operculum, in which point it also resembles *Bulla*, as well as in the absence of true tentacula. As far as I can judge at present, this animal appears to be the intermediate link of the two families; for assuredly it is not a *Bulla*; and though closer to *Conovulus* than to *Bulla*, it can scarcely, though closely connected, be deemed its congener.

Otina —— ?, Gray.

Velutina otis, auctorum.

Animal suboval, auriform, thick, pure white; the mantle does not extend beyond the shell, its margin is plain; the head is large, very slightly lobed at its left and right points; the buccal orifice is a vertical fissure at the under surface, apparently furnished with teeth, or a short spinous tongue between the usual buccal mass of a fleshy palate and corneous plates, which are visible through the pellucidity of the head of the animal, with the œsophagus coasting under the light yellow anterior portion of the shell to the stomach. To add to the singularity of this curious creature, the head is so large, that when viewed through the under part of a watch-glass, if the animal is creeping, it has the appearance of a third lobe of the foot, and actually assists in locomotion. The eyes are large, black, placed on rounded prominences in the centre of the head: another singular feature is, that not even the rudiments of tentacula exist. The foot is of very unusual structure, being similar to Adanson's '*Pedipes*,' and to that of *Conovulus bidentatus*, the configuration of which was discovered by me many years ago at Exmouth. We refer to the description of the foot of *C. bidentatus*, which in progression and all other points is, I may say, precisely similar to that of the present so-called *Velutina otis*. The doubtful branchial plume lies under the centre of the mantle, evidenced by apparent pectinations, but the exact form escaped observation. The reproduction is not ascertained. The animal is not more than a 15th or 20th of an inch in diameter, yet there is not a point mentioned that admits of doubt, except the precise structure of the branchial organ. There is no operculum. This animal is found at the roots of the *Lichina pygmæa* on rocks about three miles east of Exmouth, often in company with *Kellia rubra*. When the animals were placed in basins of water they always made their way out of them, and fixed themselves to a dry spot, as is the case with many of the *Littorinæ*, which almost constantly live in atmospheric air. This curious and anomalous creature is entirely dissimilar to *Velutina*, and its natural position is far removed from that genus.

Tornatellidæ.

Tornatella fasciata, Lamarck.

Voluta tornatilis, auctorum.

The following notes are from M. Philippi, Enum. Moll. Siciliæ, vol. ii. p. 143:—

Animal not differing materially from *Bulla*. Colour white. An oblong foot, a little longer than the shell, truncate in front and auricled; obtuse behind, carrying a small elongated narrow arcuated operculum, with the muricidal character of the striæ of increment. The head is flat, divided from the foot by a deep groove coalescing with the tentacula, anteally a little dilated, "medio excisum?," divided above by a longitudinal mesial furrow, terminating posteally in two lanceolate lobes reflected on the middle of the shell. Two small eyes in the middle of the head.

This description, as far as it goes, bears out our preliminary observations as to natural position.

Pyramidellidæ.

This family forms an important section in the ranks of British malacology, and consists of numerous species, which, though many of them have long been known to our older conchologists, have scarcely until very lately attracted the attention of continental naturalists in consequence of their minuteness and the difficulty of obtaining the animal for examination. The only recent authors who have paid much attention to the malacology of these interesting objects are the Rev. T. Lowe, M. Lovèn, M. Philippi, and Prof. Forbes and Mr. Hanley.

The British genera comprise upwards of forty species, a third of the animals of which I have examined, and think that detailed accounts of them would be desirable and acceptable to many of the readers of the 'Annals.' These species have run the gauntlet through nearly the entire range of the British Gasteropodous molluscan genera in search of a resting-place; it is needless to allude to these ancient and variable depositaries; I will therefore only mention the recent genera in which they appear to have obtained that sort of improved provisional settlement, which is usually the precursor, from the many malacological facts that have been obtained, of a definitive natural position.

The more recent receptacles of these interesting objects are, Mr. Lowe's genus *Parthenia*, Doctor Fleming's *Odostomia*, M. Philippi's *Chemnitzia*, and the *Truncatella* and *Eulima* of Risso, with M. Lovèn's *Turbinella* and *Aclis*. The admirable manner in which Mr. Lowe has described the animal and illustrated his *Parthenia*, causes much regret that we must concur with M. Philippi in not using this appellation in consequence of the pre-occupation of the term. Though we believe Dr. Fleming's genus *Odostomia* has the priority of time, yet from the variableness and instability of the principal conchological character, the fold on the pillar, it cannot be maintained either generically or as a group: for instance, the *Odostomia interstincta* has often the fold, and often is without it; the *O. indistincta* never has a tooth; the *O. excavata* is sometimes with and sometimes without it. Many of the more elongated and turreted species are without a fold; nevertheless in some, for instance the *O. acicula*, the tooth is present, and often wanting, as our cabinet will show; therefore the appellation of *Odostomia* to this tribe is incongruous and a complete misnomer. The term cannot even be admitted as a sectional arrangement, as it would separate individuals of the same species, for example, the toothed *interstincta* and the edenticular one; on these accounts we are reluctantly obliged to decline the use of the term. Besides, we believe that this fold or tooth has had attributed to it far more generic value than it deserves: it probably gives some support to the body as a *point d'appui*; but the malacology of the animal, whether with or without it, affords no corresponding variation. We therefore propose to adopt M. D'Orbigny's genus *Chemnitzia* for those species with or without a tooth, smooth or plicated, many or few volutions, which have as a component of their specific characters a moderately long proboscis, not an internal one, which can be withdrawn or hidden under, and again evolved from the tentacular veil. All these species cannot be mistaken, as whatever may be the specialties of the animals, they have the apical one or two turns, reflected on the following descending one: this is a constant character; I have never met with a departure from it.

The next genus of this family is *Eulima*, which, though closely allied to *Chemnitzia*, is nevertheless distinct in various points to be mentioned. Then, M. Lovèn's *Aclis* next succeeds as a Pyramidellar genus, and only embraces one or two species. The *Truncatella* of Risso, the animal of which has been described by Mr. Lowe, will complete the British genera of the *Pyramidellidæ*, and admit a small number of species which either become more or less decollated, or have dome- or button-shaped apices.

As the above enumeration is not exactly in natural order, we state that the genera will stand thus: *Truncatella, Chemnitzia, Eulima, Aclis,* and *Stylifer*? They follow in natural order the *Conovulidæ* and *Tornatella*, with, as we have already stated, the lateral abutment of the *Littorinæ, Trochi, Cerithia* and *Turritellæ,* and are followed by *Ianthinæ, Scalaria, Natica, Velutina,* and *Laminaria,* all of which having a recondite proboscis, form the passage to *Cerithiopsis* and the Muricidal Canalifera. I have only mentioned this rough section of natural order, which perhaps may be modified, as a cursory view of the position of this interesting tribe.

Truncatella, Risso.

T. Montagui, Lowe, Zool. Journ. vol. v. p. 209.

I have never seen the animal of *T. Montagui,* the type, but it fortunately has been observed by a most competent malacologist, Mr. Lowe, who informs us that the animal has an extended bilobed muzzle, two contractile, subconical, short, obtuse, divergent tentacula, having sessile eyes a little above, but at the external bases. The mantle has a collar as in *Helix.* A very short foot, subtruncate in front, rounded behind, and by M. Deshayes' account transversely divided in the sole. M. Philippi doubts this: these characters are from the naturalist just named, as I have not by me Mr. Lowe's account in vol. v. Zool. Journ. Though this species, by the elongated bilobed head, has alliance with the *Rissoæ,* it is by the divided foot—if that is so—much nearer to the *Conovulus bidentatus*; and by the sessile position of the eyes, short, subconical tentacula, and simple corneous operculum, it is connected so intimately with the Pyramidellar genus *Eulima,* as to justify us in considering it and *Conovulus* one of the points of passage to the genus *Chemnitzia.*

Chemnitzia, D'Orbigny.

Odostomia, auctorum.

It is unnecessary to insert the specific characters of the animal of this genus; they will be sufficiently collected from our numerous descriptions; but we cannot refrain from alluding to the Rev. T. Lowe's account of the animal of his genus *Parthenia,* which is fully borne out by our notes, or rather it bears them out, and to his prospective intimation, that "future observations may warrant possibly the modification of the characters of *Parthenia* for the reception of the *Turbo unidentatus* of Montagu and its allies." The following notes will confirm the extreme sagacity of this able malacologist.

Chemnitzia eulimoides, Hanley.

Turbo et *Odostomia pallida*, auct., falsò Montagui.

Animal of six spiral turns; mantle plain; foot short, truncate in front, slightly auricled, but not emarginate or hollowed out in the centre as in its congener below, *Chemnitzia acuta*, rounded posteriorly and terminating suddenly in a short point; it is powdered on its upper surface with pale gold-coloured minute points, and in some specimens with sulphur-yellow dots; beneath the same colours prevail, though less intensely: it has a light corneous, simple, not spiral, suboval operculum; the head is a rather short proboscidiform snout, marked on each side with a pale yellow longitudinal line; the tentacula are short, flattened, triangular, not pointed, and bevelled like an awl, setaceous, and in some animals suffused with sulphur-yellow; each has also a longitudinal line running between the bevels; the eyes are at the internal points of the basally coalescing tentacula immersed in the skin. The operculigerous lobe is inconspicuous, almost obsolete, with scarcely a trace of lateral extensions.

In this species the minute branchial plume was found in the usual position attached to the neck and mantle, no head-lappets, with scarcely the rudiments of a veil; the anal pellets were observed to be ejected from the right side; the male organe générateur was not seen. This species scarcely differs from *C. acuta*: the variation is in colour, and in the anterior part of the foot being less hollowed out.

There are five or six varieties slightly differing in contour: their principal habitat is at the back of the auricles of the *Pecten opercularis* of the coralline zone, where they may be seen in clusters of six to ten imbedded in animal mucus. This is a very common species, and has long passed as the *Turbo pallidus* of Montagu, but his type, which still exists, proves the error.

Chemnitzia acuta.

Odostomia acuta, auctorum.

Animal spiral; ground colour white; mantle simple; foot short, flake-white, in front deeply emarginate, so much so as at times of full extension to present the appearance of a second pair of short tentacula, rounding posteally to a point, with a suboval corneous operculum on the posterior, scarcely to be appreciated, operculigerous lobe. The head is proboscidiform, marked with minute lead-colour blotches. Tentacula nearly conjunctive at the bases, short, broad, awl-shaped, but not pointed, setose; eyes close together at their internal angles, not on, but between them, not raised, but fixed on the surface skin; the tentacula have an intense white longitudinal line in the centre of each. To describe further would only be to repeat our notes on *C. eulimoides*. It is rare at Exmouth, and inhabits the coralline zone.

Chemnitzia unidentata.

Turbo unidentatus, Montagu.

Animal spiral, bluish hyaline white; mantle even with the shell; head proboscidiform, occasionally extended beyond the foot, bearing short, broad, awl-shaped, setose blunt tentacula, which have a fine transparent line through their centres; the eyes are within the internal bases, close together, not raised, fixed on the connecting membrane. The foot is short, truncate, slightly eared, but not in the least emarginate in front as in *Chemnitzia acuta*, or even hollowed out like that of *C. eulimoides*, rounded posteriorly, sloping to a broad obtuse lance-shaped terminus, and has on the posterior upper surface of a scarcely perceptible operculigerous lobe, a light corneous, suboval, simply striated operculum. The anterior portion of the sole of the foot is flake-white, the posterior hyaline, with a fine longitudinal line only in the centre of that part. The sole of the foot is divided from the upper pedal disk by a shallow groove, giving the foot a labiated aspect.

This species differs little from *C. acuta*; the foot not being emarginate is the principal distinction, and the tentacula are rather stronger and broader than in that species. Habitat amongst the masses of Annelida and other animals imbedded in old oyster-shells from the coralline zone.

Chemnitzia conoidea.

Odostomia conoidea, nonnull.

Animal inhabiting a spiral shell of eight volutions, hyaline bluish white throughout, slightly shot with flake-white cloudy matter; mantle plain; head, a proboscidiform cloven muzzle representing a second pair of short tentacula; mouth at the termination of the scission; the true tentacula are subtriangular, flat, bevelled, not very short, rounded at the tips, slightly setose; the eyes are very black, situated exactly at the internal bases of the tentacula immersed in the skin, and so close to each other that a hair can scarcely be laid between them: I never saw the eyes so contiguous in any other molluscum. Foot large, rather long, membranous, gently reflected at the sides on itself, which reflexion it in some measure retains on the march, largely concavely arcuated in front, causing the auricles to be pointed, and gradually tapers to a subtriangular termination. The usual operculum of the tribe is carried on a simple lobe in an advanced position nearly at the junction of the foot with the body. The animal is vivacious, displays the eyes on the march, and makes rapid progression; it is only obtained at Exmouth in the coralline zone, and is rare.

Chemnitzia diaphana.

Rissoa? diaphana, R. glabra, Alder.
Jeffreysia diaphana, nonnull.

Animal inhabiting a spiral shell of four and a half tumid volutions. Mantle pale yellow, even with the shell. The head is short and flat, and so deeply cloven as to form two distinct flake-white divergent spatulate lobes with the mouth at the angle of the fissure; these processes have the appearance of a pair of tentacula, but the true ones are external to them, of hyaline flake-white, not very slender nor pointed, and are rather longer than the pseudo-tentacula. The eyes are large, black, placed very far back on small, very little raised eminences, surrounded by a lucid spot or circle issuing from the skin a little within the internal portion of the bases of the tentacula; they are never exposed, but always carried on the march within the shell, where, from its hyaline nature, they can easily be seen. Foot rather long, but not slender, auricled in front, gradually tapering to a rounded point without any sort of caudal appendage, but has a slight longitudinal medial line on the under surface: the usual corneous operculum is placed at a little distance from the posterior upper termination of a simple operculigerous lobe; it is of suboval form, pointed at one end and rounded at the other; it has marked striæ of increment proceeding from a minute apophysis which is the nucleus; it is of very pale colour. We have omitted to mention that the operculigerous lobe extends laterally a trifle beyond the pedal disk, forming very narrow arcuated segments. The whole of the foot beneath, as well as at the posterior end above, is pale yellow, but the upper anterior portion with the neck and head, from the mouth posteally, is marked with excessively minute close-set red-brown points. The three posterior volutions are occupied by the viscera, comprising an intensely dark red-brown liver, which, with the ovarium between the lobes, are very conspicuous through the tenuity of the shell.

The animal is not shy; it shows the organs freely and marches with vivacity; it also swims and floats with perfect ease, as is usually the case with all the smaller and shorter *Chemnitziæ*. We have frequently taken it in small pools at Exmouth, in the littoral zone, in company with *C. rissoides*.

In this species I see no departure from the generic characters of the tribe to invalidate its reception as one of the *Chemnitziæ*; there are only the specialties of individual animals. The reflexion of the apical turn alone would almost have determined me to allocate this species in *Chemnitzia*, but the examination of the soft parts afforded such decisive proofs of its identity with that genus, as to leave no alternative. A new genus and specific appellation have lately been assigned to this object, which I really think may be dispensed with; I cannot see the utility of forming new genera to receive species which have already provided for them suitable and characteristic generic receptacles. This practice only adds useless matter to our already overburthened annals. The present species has enjoyed two specific names within a few years, but as it is ascertained to be the *Rissoa*? *diaphana* of Alder, it will only be an act of justice to that excellent malacologist to revert to his original appellation. If this arrangement is acquiesced in, the *O. diaphana* of Mr. Jeffreys in the 'Annals,' vol. ii. S. 2. p. 330 (No. 11), quite a different species, will require, as a *Chemnitzia*, a new specific name.

Chemnitzia rissoides.

Odostomia rissoides, nonnull.

Animal inhabiting a spiral pale horn-colour shell of four and a half rather tumid volutions stamped with very fine lines of increment. Mantle not produced beyond the margin of the shell. Head short, flat, not grooved or cloven, gently arcuated at its termination; it issues between the foot, and in this species a tentacular veil, which, with the tentacula, extends a little beyond the foot; the veil is entire with a sweeping indentation which resolves itself at the right and left angles into two very short, broad, awl-shaped, bevelled, blunt tentacula, on which there is an opake linear stripe from base to point; they are hyaline, setaceous, with the tips marked with a round opake white dot, which in certain aspects give them a clavate appearance, and at the under part they are aspersed with minute sulphur points; the eyes are large, very black, imbedded in the skin a little below the origin of the tentacula at their internal bases. The foot is very short, strictly truncate in front, scarcely auricled, with a very rounded posterior termination at half extension, but on the march tapers to a lanceolate point; it carries at a little distance from the terminus of the pedal disk, on a simple operculigerous lobe, a slightly arcuated, suboval, light horn-coloured operculum, which has its columellar edge raised and reflected outwardly throughout its length, as in *Chemnitzia diaphana*, the nucleus being at the centre of the pillar edge, from whence the striæ of increment radiate conspicuously to the outer margin. The foot, both above and below, the body generally, and the neck and head, are of a rather opake white, sprinkled not very thickly but irregularly with bright sulphur minute points.

The animal is lively, moves with celerity, displays the organs, and swims on its back. It is an inhabitant of the finer algæ of the pools of the lower levels of the littoral zone at Exmouth, in considerable abundance. Mrs. Gulson, a lady naturalist at that place, first made me acquainted with this species, by kindly consigning some specimens to my examination. It is a most polymorphous species, as out of nearly 100 specimens scarcely two are alike, varying in tumidity, length, contour and colour; indeed every 100 yards of coast appears to have its peculiar variety.

Chemnitzia plicata.

Turbo et *Odostomia plicata*, auctorum.

The animal throughout is pale frosted yellow, inhabiting a spiral shell of six or seven slightly raised volutions. Mantle simple. The head is a long, flat muzzle, with a circular, terminal, entire, compressed disk, issuing between a tentacular veil and the foot, and can be extended of concurrent length with the latter organ. The tentacula are triangular, bevelled, broad, flat, rather longer than in its congeners of the same size, and terminate in rounded sublanceolate points; the eyes are imbedded in the skin at the internal bases, but not quite so close together as in some other species. Foot short, truncate in front, slightly notched in the centre, labiated, rounded behind at rest; somewhat elongated, though not much pointed on the march; carries the very light horn-coloured operculum of suboval form, with oblique striæ of growth, on a simple upper lobe advanced to nearly the junction of the foot with the body. The foot has an inconspicuous central longitudinal line on the sole.

It inhabits in sufficient abundance the littoral zone at Exmouth, but I believe it also inhabits the laminarian and coralline districts.

Chemnitzia rufa, auctorum.

Parthenia, *Melania*, et *Odostomia rufa*, nonnull.

Animal inhabiting a shell of fourteen flat plicated volutions with interstitial short transverse lines; the general aspect as to colour is pale azure hyaline, irregularly aspersed with snow-colour opake flakes. The head or muzzle proceeds from the coalescing tentacular membrane, forming a sort of head-veil to a little beyond the foot; it is long, flat, and terminates in two arcuated lobes with a wide central indentation between them; the mouth is not quite at the extremity of the head. The tentacular veil originating in the basal coalition of those organs is entire, and diverges into two very short, flat, broad, bevelled, subtriangular tentaculiform processes rounded on the tips, on each of which there are about nine intense white subcircular minute flakes; the eyes are not on the triangular bases of the tentacula, but a little posterior to their origin, imbedded in the skin of the anterior base of the neck exactly central; that is, it can scarcely be appreciated if the inclination be external or internal. The foot is large, moderately long, auricled in front, bevelled to a very fine edge, and when in the full extension of march tapers to a point, when at rest it is rounded; it is flat, of thin texture, of a pale blue hyaline colour suffused with opake snow-white matter; it carries on a simple scarcely raised operculigerous lobe, situate quite at the middle, or at the junction of the pedicle of the foot with the body, an oblong-oval light corneous operculum, with a depressed point as a nucleus, from which oblique striæ of increment proceed. The branchiæ, buccal apparatus, and the organs of reproduction were not seen, as the shells could not be destroyed, and it is probable that their minuteness would have caused an attempt to detect them to end in failure. We are therefore in the dark whether the tongue is spinous or unarmed, as is the long flat lingual riband in the cylindrical recondite proboscis of the *Eulimæ*.

There is no tooth on the columella of this species, as in most of the preceding ones, excepting the *C. diaphana*; but there are sometimes within the aperture of the ultimate volution one or two minute denticles, as in *Conovulus denticulatus,* and we have the *C. acicula* with a decided pillar fold; these columellar appendages cannot at all be depended on from their instability and variableness; they may serve as a kind of mark to distinguish one species from another conchologically, but even that index fails when the species is sometimes with and sometimes without the denticle.

This is a rare animal on the Devon coasts, but we have taken several at Exmouth in the coralline zone; it is by no means shy, marching with vivacity, and allowing a good examination.

Chemnitzia spiralis.

Melania, Turbinella, et *Odostomia spiralis,* auct.

Animal occupying a spiral shell of four flat volutions. Mantle even. The colour in all parts is hyaline white, delicately suffused with snow-white points of several magnitudes : the head is a moderately long muzzle, flat, plain, rounded in front; it issues from the tentacular membrane, and is placed between it and the foot, with which it is of concurrent length; on the march sometimes one and sometimes the other is in advance, but the tentacula always reach beyond the head, which only very rarely, by an extraordinary exertion, is extended to the tentacula : I mention this because I have seen the animal figured with the muzzle as long as the tentacula, which is an unnatural posture, and it is never carried so on the march; the mouth is beneath. The tentacula occupy the extent of the membrane from which they originate, coalescing at their bases, and diverging greatly to their points; they are short, flat, broad, bevelled, triangular, blunt, setose, with a snow-white line from base to point, and a round intense flake-white dot at their tips, which give them the aspect of being clavate; the eyes are large, black, placed on the skin at the internal bases of the tentacular bifurcation. The foot is slightly auricled, and sinuated on each side so as to make a gradual central indentation; it is rather broad, perfectly round posteally at half extension, but in full march it tapers to a moderately pointed lanceolate termination, carrying on a plain upper lobe a suboval, light corneous finely striated simple operculum. The animal is active, and shows its points *sans façon.* It inhabits at Exmouth the coralline, laminarian, and the lowest littoral levels. It scarcely differs from *C. rissoides,* except in being white instead of speckled with yellow, and in the foot being sinuated in front instead of truncate. There is usually a fold on the pillar.

Chemnitzia interstincta.

Turbo et *Odostomia interstincta,* Mont. et auct.

Animal inhabiting a flat subcylindrical shell of six to seven volutions; it is white throughout. Mantle rather fleshy around the margin of the aperture; head narrow, cloven, with exceedingly short, strong, rather flat, setaceous, very obtusely pointed tentacula; the eyes are very distinct at their internal bases, not in the least raised; foot very small, short, and does not extend beyond the basal volution, truncate in front, moderately pointed behind, carrying on its upper surface a minute light corneous simply striated operculum. It inhabits the coralline zone, lurking in the crevices of the Annelida, in old bivalve shells. The species now described is the variety with the subrotund volutions, and of larger growth than its slender subcylindrical congener with the flat angular sutures, which possibly may be distinct; but it is probable I may meet with the animal. This species is frequently without the fold; we have many such in our cabinet.

The closely congeneric species, the *C. indistincta*, is always without the denticle. It inhabits plentifully the coralline zone.

Chemnitzia nitidissima.

Turbo nitidissimus, Montagu et auctorum.

Though the animal of this elegant minute shell remains undiscovered, still the inversion of its apical turns on the succeeding volution is so excellent and faithful a characteristic of the *Chemnitziæ*, of which I am not aware of an instance of failure, that I am induced without hesitation to consider this species as a member of that genus, and I confidently expect when the animal is *déterré*, it will support me in the step I have taken. This character, which I think of great value as a conchological aid, is far preferable to the unstable columellar fold.

Chemnitzia unica.

Turbo unicus, Montagu et auctorum.

The animal of this species still remains undiscovered, yet I confidently expect to detect it, as I know its habitat, and have taken several live shells, though they were not detected amongst the debris of marine matters until collapse had come on. I am inclined to think that the minute reflected apex, which I consider one of the best conchological characteristics of the *Chemnitziæ*, and is in live specimens apparent under the microscope, will bear me out in the present allocation; the shells when adult vary from seven to nine volutions, and at Exmouth the animal dwells in the central levels of the littoral zone.

Chemnitzia Gulsonæ (n. s.), nobis.

C. testa tenuis, lævis, anfractibus quinque cylindrico-tumidis, subobliquis. Apertura elongato-ovalis, peripheria integra, tenui, paulum reflexa, ad externum labium leviter constricta. Sutura simplex. Apex rotundato-obtusus, subreflexus. Color albus, vel pallide luteus. Axis $\frac{1}{10}$, diameter $\frac{1}{50}$ unciæ. Habitat prope ostia Iscæ Danmoniorum. Animal ignotum.

I deposit in this genus a minute and elegant species, which appears unaccountably not to have been noticed. I am informed by Mr. Jeffreys, an excellent conchological authority, who has very lately looked over my cabinet, that it is unpublished, and has probably escaped the attention of the learned authors of the 'British Mollusca.' Mr. Barlee, who also examined the shells, a very competent authority, assured me that he concurred in this opinion. Under these circumstances I considered it a paramount duty, as a faithful knight of this branch of natural history, to fly to the rescue, and I hope by the aid of my good lance to convert the undeserved neglect of this rare object into an imperishable renown, by giving it, for a specific appellation, the name of a lady at Exmouth, who has devoted her leisure to the cultivation of natural history, and by her illustrations and discoveries in the departments of algology and conchology has done much to promote the advancement of science. May more of our fair countrywomen follow her example! These pursuits not only delight and adorn their votaries, but they add new facts and new discoveries to our stock; it is only by the exertions of the many, distributed over the face of the land, that novelties are brought to our knowledge. The harvest is not yet gathered in, and the lady who discovers a new species gains an immortality co-extensive with the existing order of nature. I refrain to add to this simple acknowledgement of rare merit, lest I should invade those retiring sensibilities, which are always the concomitants of true science.

This elegant shell, of five and a half rather tumid volutions, has much the contour of some of the subelongated species. I have little doubt that it is a true *Chemnitzia*; it is therein deposited until the knowledge of the animal shall determine its position. I invite naturalists sedulously to search for it. It is a rare species: I possess three perfect specimens. The characteristic obtuse, yet reflected apex, has induced me to place it amongst its congeners of similar apical configuration, which is almost peculiar to the *Pyramidellidæ*. I believe that *Ianthina* is the only other genus that has something of a similar structure, but in it the apex presents rather a distorted irregularity than a true reflexion; but whether this is so or not, the connecting characters between *Ianthina* and *Chemnitzia* are of little value.

Having concluded the notes on the *Chemnitziæ*, I have only to remark on the singular sameness of the descriptions; indeed it is difficult to divest oneself of the idea that all of them appertain to the same animal. I may have generalized at the expense of destroying the identity of each species, by omitting the delicate particular variations, by which alone objects so similar can be distinguished malacologically, especially by the young student.

The Rev. T. Lowe, in the 6th vol. p. 511, Old Series, of the 'Annals of Natural History,' appears, in constituting the characters of his *Parthenia*, our *Chemnitzia*, only to have had the corroborating aid of a single congeneric species, the *Turbo unidentatus* of Montagu, from which he anticipitated the possibility that future investigations would require some modification of the characters to render the genus more inclusive. The present notes of many additional species of this tribe may perhaps supply the elements of a slight alteration in his diagnoses, which are so very correct as to embrace the whole tribe; indeed the only addition, if even it is required, would be to state, that in some of the *Chemnitziæ* the basal conjunction of the tentacula produces a slight veil or membrane under which the proboscidal muzzle issues. Mr. Lowe writes, "pallio ecanaliculato;" M. Lovèn says, "processus pallii dexter canaliculatus." I have not observed this canal in any of the species; it may exist, and from its minuteness have escaped detection, or be supposititious, from the effect of the various changes in the posture of the animal.

The following and some other species of minor note belong to *Chemnitzia*: *Turbinella albella*, Lovèn; *Odostomia turrita*, Hanley; *Turbo nivosus*, Mont.; *T. insculptus*, *T. sandvicensis*; *Helix arenaria*, Mont.; *O. fenestrata*, *O. excavata*, *O. scalaris*; *T. elegantissimus*, Mont.; *O. scillæ*, *O. acicula*, *O. formosa*, *O. affinis*, *O. clavula*, *Rissoa* ? *opalina*, &c. &c.

Eulima, Risso.

This genus is in close alliance with *Chemnitzia*, but is distinct in several points, and shows a nearer approach to the Muricidal tribes by its proboscis strictly "recondenda," which has a very long, flat, unarmed tongue, and by the short tentacula conically tapering, not being flat and triangular as in *Chemnitzia*, with less approach to coalition at their bases, in the skin of which the eyes are exactly medially fixed. The anatomy of the minute *Chemnitziæ* is, I believe, unknown; a comparison cannot be made with *Eulima*; we therefore only mention that in it there is an excessively long vas deferens or epididymis; we have dissected many of the *E. polita*, but never found in the proboscis, or lingual riband, the least appearance of spinous processes. It is probable that the buccal apparatus of all the *Chemnitziæ* are destitute of the spinous tongue. The conchological alliance of this genus with *Chemnitzia* is excellent, as it has the same inversion of the apical volutions.

Eulima polita, auctorum.

Eulima nitida, auctorum.
Eulima distorta, auctorum.

Animal of twelve to sixteen spiral turns, inhabiting a white, highly polished, porcellanous, conically tapering, subulate shell; mantle white, fleshy, fully lining the aperture, but there is no reflexion or extension of it to account for the perfect glabrous aspect. Head moderately large, flattish, not much produced; mouth below, vertically cloven; the tentacula are short, conical, pointed, nearly united at the bases, diverging gradually to their terminations; the basal halves are pure white, the summital portions yellow or orange, sometimes of a greenish yellow; the eyes are large, and when the animal marches generally lie under the anterior margin of the aperture, but from its tenuity and lustre are easily observed; they are very rarely exserted beyond the limits of the shell, and are fixed at the centres of the bases of the tentacula; they are mounted on minute orange-coloured eminences. The foot is small, short, seldom extended beyond the basal whorl, truncate and auricled anteriorly, very moderately acuminated behind; the sole in front is separated from the upper skin by a groove, forming double labia, and carries on the operculigerous lobe a thin, light horn-coloured flexible suboval obliquely striated operculum; the anterior upper margin of the foot is bordered by two linear segments of a circle with the convexity outwards, but indented in the middle, of a bright orange-yellow, but these colours intensely marked are only observable in adult specimens, the younger ones being white; it has been omitted to state, that several portions of the foot are more or less tinctured with orange-yellow. The verge of this species springs under the right tentaculum; it is rather long, pale yellow, flat and strap-shaped for two-thirds of its length, and at the end it becomes more spread and falcate, with two short orange-coloured stripes at the terminus, where the orifice is placed. The testis is an elongated oval yellowish lobe, situate in the posterior volutions, and communicating with the verge by a long wrinkled tortuous filiform vas deferens or epididymis, like that of *Buccinum undatum*; it is at least $2\frac{1}{2}$ inches, or three times the length of the shell. The tongue is also of extraordinary length, flat, strap-shaped, and without a spinous armature. A single branchial plume in the usual place, small, narrow, of twelve to fifteen short coarse strands, with an arterial or branchial vein in the centre; indeed we are not quite sure that the plume is not double; the colour is pale drab. We have not observed an incipient fold of the mantle, but whether it be there or not, we have sufficient evidence of an approach to the Muricidal tribes; and after, in another memoir, we have given some notes on *Scalaria, Coriocella, Velutina* and *Natica*, our scheme of natural order from the *Bullidæ* to the Muricidal families will be sufficiently developed.

It is scarcely doubtful that the *E. nitida* is a mere variety of the type, *E. polita*, and the two varieties of *E. distorta* are the young. The *E. polita* is lively, not at all shy, and inhabits the coralline zone at Exmouth in abundance. The other acknowledged British species are the *E. subulata* and *E. bilineata*, but their distinctness admits of doubt, and it is by no means certain that when the animals are better known, some of the more polished elongated *Chemnitziæ* may not be transferred to the *Eulimæ*.

Aclis (n. g.), Lovèn.

This genus contains only two very rare British species, the

Turbo ascaris of Turton and the *A. supranitida* of S. Wood; the animal of neither has, I believe, occurred to a British observer; we earnestly request the discoverer of either to carefully examine and communicate his notes, as the animal requires further investigation before its position is permanently settled. It is doubtful if the *Turbo àscaris* of Turton ought to enter M. Lovèn's genus; however, as it is only an ad-interim deposit, we give his generic diagnoses:—

Animal slender; head not proboscidiform; tentacula slender, cylindrical, somewhat inflated, approximating at the bases, at which points the eyes are immersed and externally inclined; there is a long, strong, and recondite proboscis; tongue simple?; the upper lobe of the foot is divided from the sole, which is narrow and produced. The operculigerous lobe is large, differing in shape on each side; the right one is the largest, with three to four plications; the left forms a single rounded lobe, posteally produced into a fold. The sole of the foot is tongue-shaped, and anteally truncate. Operculum? Shell turreted, rough or pitted, having numerous volutions furnished with elevated spiral striæ or sharp ridges. Aperture oval.

Though this genus appears to have several connecting characters with the two preceding ones, the above generic characters are so very distinct in many particulars, that it is unnecessary to make any comparative observations. The discovery of the animal of our *Turbo ascaris* will clear up doubts.

Stylifer, Broderip.

We have hesitated to include this genus as one of the pyramidellar tribes, yet it would be difficult to find a more suitable position, at least for the present; we have however our suspicions, that when the proboscidal structure is made known and the reproductive organs, it may possibly pass to the vicinity of the *Naticæ* or *Velutinæ*; at present however we may observe, that the conical tentacula and external position of the eyes remove it from the *Bullidæ* and *Conovuli*: as a *Pyramidella*, it will be the only species without an operculum; but if the tongue is unarmed, that would be an approximation to *Eulima*. The case is surrounded with difficulties only to be removed by a more extended investigation of the animal: we strongly recommend it to the attention of naturalists: I have in the last thirty years examined hundreds of various species of *Echini*, in vain, for this rare animal.

All that is known of it is due to the assiduous researches of the learned authors of the 'British Mollusca.' We refer with pleasure to this valuable work, which has supplied us with many interesting facts; indeed we may add, that the votaries of this fascinating branch of natural history will receive both pleasure and information by consulting its pages.

I am, Gentlemen, your most obedient servant,

William Clark.

Postscript.—I have just taken from the coral zone of the South Devon coast, at Exmouth, in thirteen fathoms water, the rare *Megathyris cistellula* of the 'British Mollusca,' the *Terebratula seminulum*? Philippi, which I believe has not been found so far south in the United Kingdom, except, *fide Turtoni*, in Torbay; I am sure that Professor Forbes and Mr. Hanley will feel pleasure in the corroboration of the correctness, in this instance, of Dr. Turton's habitat: see the note in the 'British Mollusca,' vol. ii. p. 362. I have had on several occasions personal intercourse with Dr. Turton, and became the original purchaser of his collection of British shells, which, during my temporary secession from malacological pursuits, passed into Mr. Jeffreys's possession; Dr. Turton also did me the honour of the dedication of his Manual of the Land and Freshwater Mollusca. Under these circumstances, I consider it to be my duty, to say, in respect to the note referred to, that I am confident my old friend never intentionally led us into error; nor do Professor Forbes and Mr. Hanley state otherwise. The fact is, that Dr. Turton was a man of great simplicity, and so far from age giving an increase of caution, it appears, with him, to have had a contrary effect; if it were necessary, I could relate several curious and laughable stories of his being duped by the frauds of crafty shell-dealers. Whilst I admit that Dr. Turton lent too credulous an ear to the impositions of unscrupulous communicators, which has impaired our dependence on the habitats of various doubtful testacea recorded in his 'Conchological Dictionary,' I trust I have cleared the memory of my friend, to whom British conchology is much indebted for his care and nurture, from every suspicion of gross and indesinent error: we must not forget that Dr. Turton and the excellent Montagu fanned the flame of this branch of natural history when almost extinct, and its supporters were few and far between.

The present shell is quite fresh, with the dried animal in it; it is of subquadrate form, pale brown colour, much more compressed than the Shetland specimens, and has the mesial groove more distinctly developed; still it is only a variety of the *M. cistellula*, which M. Philippi states to be subject to much variation of outline. Axis et diameter $\frac{1}{10}$ unciæ.

Note.—I withdraw *for the present* my notes on the *Fusus Branscombi*, inserted in the December 'Annals' for 1849, p. 424.

XL.—*On the Hairs of marine Algæ and their development.* By Dr. Robert Caspary.

[With three Plates.]

The following observations, which by no means exhaust their subject, are destined to direct the attention of botanists to one point of marine algology, which up to this time has scarcely been noticed, viz. the characters of the hairs of the Seaweeds. A person, who from other parts of botany knows how much attention is paid to the external covering of plants, as well by the physiologist as by the merely descriptive botanist, and enters upon marine algology with the expectation that the external covering here will be the more scrupulously noticed, as everything is treated with the microscope, will find himself totally disappointed. I need scarcely observe, that in other parts of botany even the recognition of the species often depends upon the hairs; I mention only the genera *Myosotis, Leontodon, Orobanche, Polypodium,* &c., and that none of the better books ever fail to notice them. Many of the marine Algæ have a very peculiar external covering, which will, I trust, before long not only be found of importance to the physiologist, as it partly already has been, but also to the descriptive botanist in establishing striking characters for the recognition of genera and species. By some of my friends to whom I have mentioned the importance of the hairs in marine Algæ, the objection has been raised, that they are not essential. But what is essential? Without entering upon metaphysical speculations, I trust that the reader will agree with me, that everything in a plant is essential, which under regular and ordinary circumstances is always produced by it. But if this is the explanation of the notion of essential as far as a botanist wants it, then the hairs of the marine Algæ are no longer to be overlooked or to be treated as inessential, as every plant which is nôt taken from high-water mark or a very exposed situation, but from a sheltered pool or deeper water, will invariably, if hairs at all are produced by it, exhibit them. I beg to observe, that the following observations were all made on living plants and with sea-water. Those who would criticise them must not judge from dry specimens, to which in describing Algæ recourse should be had only in utter want of fresh ones, from reasons so obvious that I need not to state them. Descriptions and representations not taken from the living plant are in algology of no value whatever to the physiologist, and of very little indeed to the systematic botanist.

Harvey calls the hairs of Seaweeds either by this name, see 'Manual,' 1849, p. 31, or "*fibres,*" *l. c.* p. 71, or "*filaments,*" *l. c.* p. 12. We would propose that the term "*filament*" be banished altogether from algology, as having already in phænogamous botany a fixed signification; particularly as it is used in algology not only in *one* signification, but, what is scarcely credible, in *four*; signifying, as mentioned, first, "hair," *l. c.* p. 12; secondly, "stem," as in the Confervæ, *l. c.* p. 198, which Kützing with a very good name calls "trichoma"; thirdly, "strings of cells placed end to end," forming in the stem only a component part and not being isolated as such, *l. c.* p. 146; fourthly, "elongated single cells," as in *Codium tomentosum*, 'Phycol. Brit.' t. 93, 'Manual,' p. 193. What good can be expected from such an indefinite signification of a term, particularly in science, where clearness of expression is the first condition? The expression "fibre," which is also used for signifying the hairs of Seaweeds, is equally to be rejected. A "fibre" is in other parts of botany an elongated cylindrical or flattened body of no cellular texture, but simply consisting of solid cellulose, as the spiral fibre, &c. In analogy with this signification, I propose to restrict the term in algology for such thin, elongated, solid, more or less cylindrical bodies, not having cellular texture, as are *e. g.* found in the genus *Schizosiphon*, Kütz. (see 'Sp. Alg.' p. 327, 'Phyc. Gen.' p. 233), where the sheaths split into such long, thin, often curled and spirally twisted bodies, probably composed of gelatine. The term "hair," finally, is in other parts of botany applied to "cells of soft thin walls, attached to the external surface of the plant, of different form or arrangement" (see Schleiden's 'Wissenschaftliche Botanik,' i. p. 258); and this signification of the term "hair" is entirely that which we attribute to the word in algology, although with this addition, that such bodies bear no fruit or antheridia, nor are threads of fixation.

After having thus fixed the signification of "hair," we shall give a general survey of the sorts of hairs we have examined, and then describe their form and development in the individual plants.

The following table shows the kinds of hairs we have found.

I. Hairs of one cell:

1. Single ones: *Callithamnium Daviesii.* [We quote the names according to Harvey's 'Manual,' and omit for the sake of brevity the name of the author.]
2. Many placed in an irregular whorl at the junctions of two cells of the stem: *Ceramium rubrum, strictum, nodosum, flabelligerum, acanthonotum, ciliatum.*

II. Hairs composed of many cells:

1. Undivided:

   A. Single ones: *Sphacelaria cirrhosa.*

   B. Placed in tufts of 5–16: *Chorda filum* and *lomentaria*; *Punctaria plantaginea*; of 4–5: *Leathesia tuberiformis*; in the axils of the branchlets: *Cladostephus spongiosus, Sphacelaria scoparia*; in an undefined number at the conceptacles: *Cystoseira granulata.*

2. Divided, dichotomously: *Rhodomela subfusca*; *Polysiphonia urceolata, fibrosa, nigrescens*; in the conceptacles amongst the antheridia: *Cystoseira granulata.*

We turn now to the description of the hairs in each plant.

The hairs in *Callithamnium Daviesii* are very long, cylindrical, consisting of one cell, rounded at the apex, without a nucleus or granular contents, but towards the apex (Pl. XVI. fig. 10) there is in younger hairs a small portion of a slimy, not granular matter, filling out the whole breadth of the hair. The hair is produced here and there at the apex of the cells of the stem (see fig. 10, which represents a branch of *Callithamnium Daviesii* with two hairs). Their length is: 0·1094; 0·0474; 0·0712 of a French duodecimal line. I did not find any hairs on other species of *Callithamnium, i. e.* on *Call. Rothii β. purpureum, polycarpum, Turneri,* and two other species. Therefore, and as the nucleus in *Call. Daviesii* is a free one in the apex of the cells, whilst the other *Callithamnia* just named have the nucleus attached to the middle of the wall of the cell, I doubt whether this species rightly holds its place in the genus *Callithamnium.* It would be desirable to make it a point for observation, whether *Call. Daviesii* has favellæ and tetraspores: I myself have seen neither, but in March and April of this year plenty of simple globular spores.

Hairs, which are almost entirely like those of *Callithamnium Daviesii,* but standing in whorls round the stem, where two cells join, occur in six species of *Ceramium* enumerated above, which I have examined in a living state. But probably all the species of the genus will exhibit such hairs, if searched for. They are cylindrical, with a rounded apex, without granular contents or nucleus, but showing in a young state here and there heaps of a not granular slime, which in the adult hair is only found at the apex in a small quantity. *Ceramium rubrum,* when it is uninjured, exhibits these hairs particularly numerous on the apices of the branches; some branches are so covered with them, that they look like brushes. *Cer. flabelligerum, acanthonotum* and *ciliatum* have such hairs besides the spines, but more numerous on not quite young parts of the branches, than on the apices. Pl. XV. fig. 1 represents a point of a branch of *Cer. ciliatum*, which shows as yet only spines on the back, and three hairs between them, here and there dotted with portions of slime. Fig. 3 exhibits such a hair of *Cer. rubrum*, and fig. 24, Pl. XVII. a point of a branch of *Cer. rubrum*, seen with a moderate power. The length of the hairs is : 0·1395‴; 0·1566‴; 0·1272‴. Iodine colours the contents dark brown, but not the membrane. Different and not to be confounded with these hairs, are little threads of fixation, sent out at the nodes at the basis of the stem, consisting of a single row of cells without granular contents, here and there branched. Fig. 2 represents such threads of fixation produced by one of the nodes at the base of a specimen of *Cer. ciliatum*. I saw these threads of fixation also on *Cer. acanthonotum*.

In *Sphacelaria cirrhosa*, a single hair is formed near the point of the branches on the upper part of one of the cells; it is undivided, but consists of about nine or ten cells and is closely appressed to the branch. The length of the single cells in these hairs is : 0·1534‴; 0·0886‴; 0·0686‴; 0·0339‴; 0·0261‴. It is very interesting to see it in its different stages of growth. The topmost cell of a young branch forms several protuberances, two or three thick and rounded, but one thin and pointed. Fig. 6 represents a point of a branch with three protuberances. The highest and thickest, *a*, becomes the continuation of the axis of the stem; *c*, a side branch, and *b*, a hair. None of these protuberances are as yet separated by a partition-wall from the cell which produced them. But this partition-wall is finally formed, the hair lengthens now and is quite full of grayish or brownish granular contents. Then at the point of it begins first to appear a division-wall or several, as in fig. 5, where the interior of the young hair exhibits at the point three division-walls, but the whole of each of these divisions is still filled with granular contents. These separate finally from the division-walls and become the centre of the growth of the cell, sending out threads of slime to and along the wall of it, as seen in fig. 4, in the fifth and fourth cell from the point; then by degrees the cell lengthens more and more, the threads of slime disappear, and in the middle of the cell alone is found a small heap of grains, of which I had no opportunity of deciding if it is attached to the wall or free. Fig. 4 represents an almost mature hair, showing all the stages of the growth of the cells. The single, lateral, appressed hair in *Sphacelaria cirrhosa* affords a good specific character.

In *Chorda filum* and *lomentaria*, and in *Punctaria plantaginea*, are scattered over the whole frond tufts of hairs, having about sixteen cells, each tuft containing from five to fifteen hairs. These hairs are nearly cylindrical, a little attenuated towards the point, having in *Chorda lomentaria* the length of 0·5040‴, 0·5070‴, 0·5427‴; the single cells measuring, 0·0629‴, 0·0500‴, 0·0353‴, 0·0425‴. Fig. 13 represents a hair of *Chorda lomentaria*: those of *Chorda filum* and *Punctaria plantaginea* are exactly similar. The undermost two or three cells contain brownish grains; the other cells in *Punctaria plantaginea* contained only in the middle some grains, and those of *Chorda filum* a roundish mass of slimy matter, a nucleus, attached to the wall in the middle of the cells; as the figure shows.

In *Leathesia tuberiformis*, tufts of undivided long hairs are found, slightly tapering to the point; each tuft containing from three to five hairs, and each hair from seventeen to eighteen cells. Fig. 11 represents a hair of *Leathesia tuberiformis*. As I had only an opportunity of examining young plants of $\frac{1}{4}$–$\frac{1}{2}$ inch in diameter, I found the hairs not yet quite come to maturity. Each hair proceeds from the uppermost cell of a little string of cells, consisting of about three or four globular cells, having brown grains attached to their walls. I found the undermost cells of the hair to be the smallest and their walls scarcely recognisable. They were entirely filled with colourless grains and a colourless mucus. The upper three-quarters of the hair showed clearly defined cells, each bearing in the middle attached to the wall a nucleus of granular slime, from which threads ramify over the whole wall, sometimes anastomosing. Fig. 16 represents a cell with its nucleus and threads of slime. Iodine hardly colours the walls of the cells of the hair, but the nucleus with its network of slime is coloured dark brown and is brought very clearly to light by iodine. The length of the whole hair was: 0·2950; 0·2320; and of the single cells in it: 0·0188; 0·0180; 0·0354; 0·305.

The hairs of *Sphacelaria scoparia* are not like those of *Sphacelaria cirrhosa*, single, or protruding laterally from the stem, but are found in tufts of three to four in the axils of the spine-like branchlets. To save space, I have not given a figure of a whole branch, with its hairs in the axils of the branchlets. The hairs are long, undivided, consisting of many cells. Pl. XVI. fig. 9 represents one. The undermost short cells are quite filled with granular colourless matter; the upper, longer cells contain this only in the middle as a little heap, but I had no opportunity of ascertaining whether it is free or attached to the wall. Pl. XVI. fig. 12 represents the point of a branch of *Sphacelaria scoparia*: *a* is the point of the main-branch; *b* is the point of a branchlet, and between the two in the axil at *c* are four young hairs, consisting of only one cell, filled with colourless granular matter, and not yet separated by a partition-wall from the mother-cell. This and the walls of the cells of the hair however soon make their appearance, and from the internal heap of grains, as a centre, the cells grow in length at both ends.

In *Cladostephus spongiosus*, also in the axils between the branches and their branchlets, are found tufts of three or four hairs, which are undivided, slightly tapering to a blunt point, containing from eleven to fourteen cells. The development of these hairs is very interesting. Fig. 7 represents a branch with four mature hairs in the axil between the main-branch and its branchlet. The undermost cells contain granular substance, slightly tinged with grayish brown. The uppermost contain granular, colourless substance only in the middle and attached to the wall. If touched with iodine, the heap of granules attached to the wall loses almost entirely its granular appearance, and looks like a solid dark brown coloured mass of slime and iodine; a network of little threads of slime, coloured brown, proceeding from the slimy nucleus, makes its appearance, which is invisible before the application of iodine. Fig. 8 represents one cell with this network of slime-threads. The young hairs appear first as protuberances in the axil between the branch and branchlet. Fig. 14 shows a point of a branch of *Cladostephus spongiosus*: *b* is the main-branch, *a* the branchlet, and between both are two hairs, as yet protuberances, filled with brownish grains and not yet separated by a partition-wall from the cell from which they proceed. Fig. 15 shows also the point of a branch, which exhibits in its axil four hairs in a more developed state. They are already separated from the mother-cell by a partition-wall, and the walls of their own cells are about to make their appearance, beginning from the point, as the one hair at the right-hand side shows already at its point such a division-wall. The young cells in the hair are quite filled with granular substance, but this soon separates from the division-walls, and the cell growing from the heap of granules in both directions in length, bears it finally only in the middle, whilst it sends out along the walls of the cell the threads of slime above mentioned.

Cystoseira granulata has at the aperture of the conceptacles a thick tuft of undivided hairs, which partly consist of colourless, empty cells, being from 0·0648–0·0768‴ long, partly of very small cells, the walls of which are covered with brown grains. The latter sort of hairs is found more in the interior of the aperture, the first sort near its mouth. Fig. 23 represents a point of one hair of the interior part of the aperture, showing cells, the length of which is only $1\frac{1}{2}$–2 times as large as their breadth, and bearing brown grains on their walls. The cells of such a hair measured in length: 0·0113‴; 0·0266‴; 0·0202‴;

0·0195‴. The interior of the cavity of the conceptacle shows amongst the antheridia and spores forked or simple hairs, consisting of a few short, thick cells, having a nucleus, formed by a heap of slime, attached to the wall, along which it sends out some threads of slime, which although visible without iodine, appear better if coloured brown by it. Fig. 20 and 22 represent such hairs with their nucleus attached to the wall, and its slime-threads. I observe, that not only these hairs have the nucleus attached to the wall, but also the cells of the interior of the stem of *Cystoseira granulata* and *ericoides*. Nägeli (Memoir on the Nuclei, &c., translated by Arthur Henfrey, published by the Ray Society, 1846, p. 223) is mistaken in stating that the nucleus in the genus *Cystoseira* is a free and central one; I found it in *Cystoseira granulata* and *ericoides* to be attached to the wall.

Rhodomela subfusca, Polysiphonia urceolata, fibrillosa and *nigrescens* have dichotomously divided hairs; those of *Rhodomela subfusca, Polysiphonia urceolata* and *fibrillosa* are twice, those of *Polysiphonia nigrescens* four to five times dichotomous. The basal cells are the thickest, those towards the point attenuated. Such hairs form tufts on the points of the branches. Harvey, 'Manual,' p. 71, observes: "They will be found in every species (of *Polysiphonia*), if the specimen examined be in a sufficient young state." The presence of the hairs is however not dependent upon the young state of the specimens—even decaying ones of the above-named species of *Polysiphonia* exhibited them—but upon their place of growth, whether this was an exposed one or not. I add, that I have not observed such hairs on *Polysiphonia fastigiata*, many as have been the specimens which I have examined; but I have not seen specimens from deep water. As the dichotomous hairs of the above-named four plants are entirely alike, with the exception of the one difference already stated, to describe one will be to describe all. Fig. 21 represents a mature hair of *Polysiphonia urceolata*; it has no visible contents. Pl. XVII. fig. 17. represents a point of a branch of *Polysiphonia urceolata*: A is the point of the branch, B is a hair in its first stage of growth. It is already dichotomously divided in the two branches *c* and *d*, which, as the base of the hair does, show already the division-walls of their cells; but those of the base are very obscure, and only recognizable in the middle. The contents are a slimy, granular, brownish mass, which by continued growth is discoloured and remains only in the middle of the cell, attached to its wall. The two branches *c* and *d* bear each on one cell a protuberance *e* and *f*, not yet separated by a partition-wall from their mother-cell. These protuberances are the first beginnings of the second dichotomous division. Fig. 19 represents a point of another hair, in which the cells are as yet entirely filled with granular, colourless matter. But as the cell advances in growth, this granular substance separates from the division-walls and the cell lengthens on both ends from it as a centre; it is attached only to the wall, and sends out along the wall threads of slime, which by iodine become very visible, although the eye alone is sufficient for observing them. Fig. 18 represents a young branch with the nuclei attached to the walls of the cells and their threads of slime. Finally, in the mature hair, nuclei and slime-threads disappear, and the hair looks like that represented by fig. 21.

I repeat, that the hairs of *Leathesia tuberiformis, Chorda lomentaria, Cladostephus spongiosus, Cystoseira granulata* and *Polysiphonia urceolata,* have nuclei attached to the wall, and that, with the exception of *Chorda lomentaria,* where I did not observe it, threads of slime, partly anastomosing, spread from the nucleus along the walls of the cells. These results agree entirely with Nägeli's observations (*l. c.* p. 226) on the hairs of *Laurencia dasyphylla, Rytiphlæa tinct., Rhodomela pinastroides,* and a species (?) of *Hutchinsia.* But when Nägeli adds of the nucleus, "It displays itself as a transparent utricle with a delicate membrane and a small point-like nucleolus," I must avow, that I have never observed this. The nuclei which I saw were all more or less solid heaps of granular slime, in all stages of growth.

It is singular that it seems to be a particular property of the hairs and hair-like bodies to have the nucleus attached to the wall, so that if a plant has in the stem free, central nuclei, but the points of its branches are drawn out in a hair-like way, these points acquire nuclei, attached to the wall. *Ectocarpus siliculosus* is an instance of this sort. It has in the stem free central nuclei; but in the hair-like points of the branches, beyond the cells, containing the sporules, it has nuclei attached to the wall.

XLI.—*Observations on some British Plants.*

By George A. Walker-Arnott, LL.D. &c.

To the Editors of the Annals of Natural History.

Gentlemen, Glasgow, Nov. 11, 1850.

In a notice of the new edition of the 'British Flora' in your last Number, p. 380, a note is added, that "it is sufficiently known that I alone am really responsible for nearly all the additions and alterations:" this it is not my present purpose either to affirm or deny, but I willingly hold myself responsible for all the errors or "blemishes" the writer has pointed out, particularly as I am, as yet, so little convinced by his arguments, that I would, if a new edition were called for tomorrow, be disposed to repeat many of them. Thus, without better authority than seeing the names in a foreign Flora, I cannot assert that either *Primula scotica*, Hook., or *Saxifraga pedatifida*, Sm., are found abroad: nor could I, even now that my attention has been called to them, do more than introduce by name such plants as *Thlaspi virens*, *Achillæa tanacetifolia*, or *Carex brizoides*, having seen no specimens from England,—having no evidence that the plants found were correctly named—and as little that they were truly indigenous. As to *Carex aquatilis* not being the plant of Wahlenberg, allow me to state that we have merely given Dr. Boott's opinion, stated in a former edition, and have *not* expressed one that the Clova plant is *C. cæspitosa* of Fries. It is known to all that Fries says his *C. cæspitosa* was sent him by Dr. Greville from Scotland: the species itself is not in Dr. Greville's herbarium; and therefore there is a strong presumption that Fries, misled perhaps by the specimen being imperfect, had called by that name something known to us by a different one: many things indeed concurred to make an impression on my mind that Fries had only received our *C. aquatilis*. With regard to the fruit of *C. cæspitosa*, Fr., being described by us *acute* instead of *obtuse*, the writer is perfectly correct in supposing that in the temporary absence of Fries' work, I trusted to Mr. Babington, whose accuracy I had proved in almost every other case.

In addition to this error there are some others of as grave a nature, omitted in the list of errata: thus,

P. 80, l. 8, *for* "base" *read* "back."

P. 92, l. 2 from the bottom, *after* "nearly equally" add "but obliquely"; for the mouth of the calyx of *Anthyllis vulneraria* is oblique, but the teeth are nearly equal in size.

P. 534, l. 17, *for* "winged" *read* "unequal."

There may be many others.

Upon *Lastrea*, or *Aspidium dilatatum*, and its allies, I may perhaps make some observations at a future period: in the mean time I may state that I possess *Nephrodium fœnisecii*, Lowe, from Lowe himself, and it is clearly not the form or species called *Lastrea recurva* by Newman, nor does Lowe's description tally with our plant, which was detected in the Isle of Arran (Scotland) twenty years ago, by Mr. Steuart Murray of the Botanic Garden here, and is perhaps, as first observed by Dr. Balfour, more decidedly known by a section of its root or lower part of the stipes, than by any of the characters yet proposed. The 'Eng. Bot.' *Aspidium spinulosum*, or the plant from Spike Island, is to me as yet doubtful: it is evidently, however, not the form so called in England, but whether it ought to be referred to *Lastrea dilatata* or *L. recurva*, Newm., I could not satisfy myself from the authentic but imperfect specimen I examined a few days ago in the late Mr. Brodie's herbarium. I may here mention that a small mountain state of *A. dilatatum* has the scales of the stipes uniform in colour, or so nearly so that the dark centre is undistinguishable; and that the glands on the under side of the frond may be perceived in both *L. dilatata* and *recurva,* although often wanting in the former.

When correcting p. 358 of the 'Flora,' I ought to have stated that I had seen no authentic specimens of *Rumex pratensis*; since then Mr. Borrer pointed out to me, at Killin, a plant which he called so, and I find that I had long ago collected the same in other parts of Perthshire, as in Glen Farg; at present I am disposed to look upon it as a hybrid between *R. obtusifolius* and *R. crispus,* with both of which it was growing: and I may add, that about six weeks ago I found in Kinross-shire what I conceive to be also a hybrid between *R. obtusifolius* and *R. aquaticus,* differing from the *R. pratensis* by the sepals almost as large and as cordate as in *R. aquaticus*: this last hybrid rarely perfects its achenes, perhaps never, for although some of them appear mature, they may not spring when sown: if they do, or if even only one does, I expect the offspring to produce perfect seeds more readily than the original plants, till ultimately it may be ranked as a species by those who have not traced its history,—as good a species, at least, as many others in the European Flora, upon which we only pronounce by *de præsenti* observations without the aid of analogy and theory.

Yours, &c.,
G. A. Walker-Arnott.

XLII.—*On some new Silurian Radiata.* By Frederick M'Coy, Professor of Geology and Mineralogy in Queen's College, Belfast.

To the Editors of the Annals of Natural History.

Gentlemen, Queen's College, Belfast, Nov. 16, 1850.

In my paper in the 'Annals' for October, the following few species were by some accident omitted.

I have the honour to remain, Gentlemen,
Your most obliged and obedient servant,
Frederick M'Coy.

Strephodes pseudo-ceratites (M'Coy).

Sp. Char. Corallum small, simple, curved, conical, obscurely wrinkled concentrically; ordinary specimens about 1 inch 3 lines long, and 9 lines in diameter at that distance from the apex, rarely exceeding that diameter, though occasionally longer; outer wall with faint vertical lamellar sulci, nine in 3 lines, at 9 lines in diameter, or about sixty-five all round: *horizontal section* shows a dense, nearly solid, outer area less than one-third the diameter of the tube, in which the radiating lamellæ and the excessively close fine vesicular connecting plates are obscure; an inner circular area about half the diameter, into which only thirty-two to thirty-four (or each alternate one) of the radiating lamellæ penetrate, uniting irregularly and slightly twisted about the centre, connected by very few, thin, vesicular plates: *vertical section,* the nearly solid outer area as above (about half an inch of the apex often also filled with solid matter), inner area traversed by numerous depressed small irregular cells, arranged almost horizontally, or with a slight upward curvature.

This species almost exactly resembles the small variety of the Devonian *Cyathophyllum ceratites* of Goldfuss (which I also find to be a *Strephodes,* thus differing from his larger variety to which I restrict his name), but is readily separated by its closer and more numerous lamellæ (that having only thirty-seven lamellæ at the above diameter). The *Streptoplasma corniculum* (Hall), from the Trenton limestone, is still more closely allied, but as it is impossible to be certain of the species of those turbinated corals without knowing their internal structure, I cannot venture to unite our British species, which I have worked out, with the American one, in which that has yet to be done, and of which I have no specimens to do it.

Common in the limestone of Old Radnor, Presteign, Radnorshire; Wenlock limestone of Dudley, Staffordshire and Sedgley.

(*Col.* University of Cambridge.)

Strephodes trochiformis (M'Coy).

Sp. Char. Corallum simple, slightly curved, widely turbinate, average length 1 inch 3 lines, and width at mouth 1 inch 1 line, with irregular swellings of growth; outer wall very thin, marked with equal lamellar sulci (six in 3 lines at $1\frac{1}{4}$ inch in diameter, or eighty-three all round); terminal cup very deep, conical, margin rounded, sides gradually sloping, lined by the thin, alternately longer and shorter uneven-edged lamellæ, the longest of which are irregularly blended at the centre, connected throughout by numerous curved transverse vesicular plates: *horizontal section* shows the same characters as the terminal cup, the alternate lamellæ extending about half way to the centre: *vertical section,* apex filled with solid matter, centre with irregular vermicular lines (the sections of the complicated edges of the radiating lamellæ), from thence to the walls made up of small, thick, rounded, vesicular plates, the obscure rows having a slight downward curve.

One worn specimen from Dudley, in the collection of Count Münster, was considered by him and Dr. Goldfuss to be a variety of the *Cyathophyllum dianthus* (Goldf.) of the Devonian rocks, from which I find it differs generically.

Not uncommon in the Wenlock limestone of Dudley, Staffordshire.

(*Col.* University of Cambridge.)

Cœnites strigatus (M'Coy).

Sp. Char. Corallum forming cylindrical, dichotomous branches, 2 to 3 lines in diameter; surface with small, narrow, triangular cells, the base of the triangle below, and the apex usually more or less prolonged upwards into a vermiform channel, often upwards of half a line long; four to five rows of cells in the space of 1 line, measured transversely, about two in the same space measured longitudinally; compact interstitial space between the rows of cell-openings usually rather exceeding their width.

The usual compact appearance of the *Cœnites*, combined in this species with the interrupted scratch-like channels of the cell-mouths, completely distinguish it from any species of *Favosites* or *Stenopora*.

Not uncommon in the Wenlock limestone of Dudley, Staffordshire.

(*Col.* University of Cambridge.)

Palæopora subtilis (M'Coy).

Sp. Char. Corallum forming cylindrical branches, usually $1\frac{1}{2}$ to 2 lines in diameter; large stellular tubes about one-sixth of a line in diameter, and a little more or less than their diameter apart; polygonal intervening tubuli invisible to the naked eye, usually five between adjacent cell-tubes, or about thirty in the space of 1 line; three cell-tubes with their intervening tubuli in a space of 1 line; main tubes often weathering as separate sulcated columns.

In the middle of the branches the cell-tubes seem to be parallel and vertical, but diverge rapidly at the circumference to reach the surface; they are very often weathered as separate tubuli, as in *P. subtubulata* and *P. tubulata*, and on the other hand they often break away from casts of the surface, leaving so little trace among the intervening tubuli, that the surface seems merely shagreened under the lens, bearing some resemblance to the

Ptilodictya (*Stictopora*) *fucoides* (M'Coy), but the casts of the cells are polygonal instead of oval, and far more minute in the present coral. The extreme minuteness of the parts of this species distinguishes it easily from the *P. subtubulata*, to which alone it has any affinity.

Very common in the fine Caradoc sandstone of Mulock, Dalquorhan, Ayrshire.

(*Col.* University of Cambridge.)

Retepora Hisingeri (M'Coy).

Sp. Char. Corallum forming irregular fan-shaped expansions, interstices about one-third of a line wide; dissepiments narrower than the interstices, fenestrules ovate, slightly angulated, about two-thirds of a line long and half a line wide (five interstices in the space of 2 lines); cells very small, from four to seven rows on the interstices, generally about three on the dissepiments (internally forming short ovate cells), about a third longer than wide, obverse, very minutely granular.

As it is scarcely possible even to determine Hisinger's *Retepora reticulata* with certainty, as he gives no information relative to the pores, there could be no objection to apply that name to the present species, which agrees with his figure as far as it goes, were it not that Mr. Lonsdale has already applied it to a very similar coral, which he however places in the genus *Fenestella*, and figures with only the two rows of pores usual in that genus.

Very abundant in the slates of Cefn Coedog; Cirn y brain, W. of Wrexham; Blain y Cwm, W. of Nantyre, Glyn Ceiriog; slates of Mynydd Fron Frys, five miles W. of Chirk; Coniston limestone of Coniston Water Head, Lancashire.

(*Col.* University of Cambridge.)

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

November 27, 1849.—R. H. Solly, Esq., in the Chair.

On the evidences of affinity afforded by the Skull in the Ungulate Mammalia. By H. N. Turner, Jun.

I had occasion in the introductory part of my communication on the arrangement of the Carnivora*, to make allusion to certain details of structure in the crania of the Pachydermatous and Ruminant Mammalia; and I there pointed out a few peculiarities, which clearly distinguished the Perissodactyla of Professor Owen, both from the Ruminant and Non-ruminant Artiodactyla, and also the two latter divi-

* Ann. Nat. Hist. S. 2. vol. iii. p. 397.

sions from each other. It is to our eminent Comparative Anatomist that we are indebted, by the discovery of some new characters, and the correction of certain former errors of observation, for the establishment of that mode of subdividing the Ungulata which first suggested itself to Cuvier; but there can be no doubt, that when the entire anatomy of the order is investigated with this view, many constant distinctions will yet be made apparent, and our appreciation of the comparative degrees of affinity among its members will become clearer as we proceed.

In taking up the subject as it has thus been left, I have first directed my attention to the skull, as being that part in which the greatest number of characters are presented at one view, and for the study of which I have had the most ready opportunities; and I now propose to offer such results of my observations as I have been able sufficiently to mature. In pointing out the characters of the skull which distinguish these two grand divisions of the Ungulata, the differences will appear more striking if I consider the Perissodactyla as they are restricted by Prof. Owen, namely exclusive of the Proboscidian and other aberrant forms, which, though they agree with them in the most essential characters, differ in many points of conformation.

The nasal bones in the Perissodactyla are gradually widened behind, so that their posterior angles approach the anterior margins of the orbits, between which the suture which separates them from the frontals runs more or less directly across the skull; we may naturally expect such a character to be masked by the singular modification which these bones undergo in the Tapir; but in the Artiodactyle division, even though the extreme points of the nasal bones occasionally extend very high, or as in the Llama, and in the genus *Cephalophorus* among the Antelopes, a sudden extension from their outer edge descends a little on each side of the face, this decided character is never manifested.

The intermaxillary bones in the Perissodactyla, if there be teeth developed in their median portion to a functional size, are always deep enough to allow them to be vertically implanted, while in the Artiodactyla, the teeth when existing in this bone always incline towards each other, their roots being divaricated to allow the nasal opening to extend down between them. In this group, with the singular exception of the genus *Hippopotamus*, we find a distinct foramen above the orbit for the passage of the supraorbital nerve, with a groove extending from it down the face; while in the Perissodactyla, it would appear as though this nerve would issue at a point more towards the outside, since the foramen only exists in the Horse, in which it is placed quite at the commencement of the postorbital process, and has no groove continued from it.

In the interior of the orbit, there is always, in the Artiodactyla, an increased concavity of surface upon the anterior side about the junction of the lacrymal and frontal bones; and in the middle of this fossa, upon the edge of the lacrymal somewhere between the ductus ad nasum and the entrance of the infraorbital canal, a pit, most strongly marked in the Hogs, which serves, as I have found in the Sheep, for the origin of the obliquus inferior muscle of the eye, the remainder of the fossa being filled up with adipose matter. In the Perissodactyla no such fossa exists, and there is never more than a very slight depression marking the origin of the muscle, in most cases not perceptible at all. The shortening of the bony palate in the latter group, the small difference of level between it and the base of the cranium, together with the longitudinal extension of the posterior nasal orifice, the lateral spreading-out of its walls and the constant existence of the alisphenoid canal, which I pointed out in my former communication, may be again adverted to.

The pterygoid ridge in this group is not very strongly marked, and gradually dies away upon the lamina enclosing the alisphenoid canal; the pterygoid processes have considerable antero-posterior extent, and the true pterygoid bones are reduced to mere ribands. On the other hand, in the Artiodactyla, the pterygoid ridge, continued from the inferior root of the zygoma, terminates abruptly, with a free process in the Ruminants; while in the Hogs and other allied forms, it is from this process that a laterally projecting plate extends down on the outer side of the pterygoid process, forming a pterygoid fossa in a manner different from all other mammalia, and very characteristic of these Non-ruminant Artiodactyles. The temporal bone in the Perissodactyla also furnishes characters in the back of the zygoma, which gently slopes away to its origin, and in the association of a distinctly marked eminentia articularis with a rather large and more or less thickened and mamilliform post-articular process. The principal differences in the occipital bone I pointed out in my former paper, and notwithstanding the marked difference between the Hog and the Ruminant, I must observe that they agree in the flatness and squareness of the basal portion, while in the Perissodactyla it is transversely convex, being rounded off on each side into the great foramen lacerum.

I mentioned in a note appended to my former communication, an idea which occurred to me just before that paper went to press, that a further distinction between the two groups might be found in the structure of the premolar teeth. I have found, on investigation, that the character will not always admit of being rigidly applied, since in some genera of Perissodactyla, as the *Lophiodon* to which I there alluded, the posterior lobes of the premolars are not so completely developed as they are in the true molars; and on the other hand, in some of the Artiodactyla, as the Peccary, they advance a little beyond the rudimentary condition in which they are usually found, though never attaining an equal development with the others. The character will however in most cases enable us to distinguish; and in the course of the observations I was thus led to make, I have discovered another more important one, which I will next proceed to explain.

If we consider as an entire molar tooth that which has four principal tubercles, the molars of the lower jaw must be said to be placed each in advance of its homologue in the upper jaw to the extent of a quarter of a tooth, so that the premolars, which in most cases represent but half molars, alternate with their opposing teeth above.

It is in accordance with this universal law, that the last lower milk molar in the Artiodactyle division of the Ungulata has three pair of lobes; not, as has been imagined, that it may pretypify the last true molar, which in the same group is usually also six-lobed. The last lower true molar, being placed like the rest, a quarter of a tooth in advance of its four-lobed opponent, the pair of tubercles that are added to it behind play against the posterior surface of the hindmost pair of lobes of the upper tooth; but in the last lower milk molar it is the anterior pair of cusps that are supernumerary, since they close between the two pair of principal tubercles of the penultimate upper milk tooth, which like the last one has the form of a true molar; while the penultimate lower milk molar, which in this as in most groups represents but the half of a true molar, furnishes opposition to its most anterior surface. Although it is not always literally true, that in the Artiodactyla the premolars represent each but the half of a true molar, and in the Perissodactyla an entire one, it is certain that in the exceptional cases among the former group, the parts representing the posterior division of the tooth are small, or merely rudimental; and that in the latter group, it is only in the most anterior of the series that the posterior portion of the tooth is ever altogether wanting. It is also certain, that all those genera of which the milk dentition has been seen, conform in that particular to the general character, the distinction being well-marked in the Artiodactyla between the *two last* upper milk teeth, whose characters are those of true molars, and those which precede them and represent but half ones, the same difference also prevailing between the *last* and those which precede *it* in the lower jaw; always necessitating the existence of a third pair of tubercles in the last lower milk molar to work in the interval of the two pairs in the penultimate above; while in the Perissodactyla, the constant existence of a well-developed posterior pair of lobes in the penultimate lower milk tooth abrogates the necessity of a third pair in the last one, and consequently we need not expect to find it, even in those genera, such as *Lophiodon* and *Palæotherium*, of which the additional lobe to the last true molar is characteristic. Of the first-named genus, the milk dentition, so far as I am at present aware, is as yet unknown; but among the plates in the 'Ossemens Fossiles' examples may be seen of the lower jaws of young Palæotheria, exhibiting the milk teeth, of which the last has but two lobes*. Therefore the tripartite condition of this tooth becomes a constant and important character of the Artiodactyle division.

Most of the characters which separate the Ruminant and Non-ruminant divisions of the Artiodactyla have been pointed out in my former paper, as well as those which distinguish the two subdivisions of the Hog-tribe, which by the analogy of the amount of difference in those of other groups, I think must be looked upon as families,—*Suidæ* and *Hippopotamidæ*. The striking character derived from the sudden termination of the pterygoid ridge in the Ruminant, and the formation of the pterygoid fossa in the other division, has been alluded

* Pl. 4. fig. 1 (alluded to by Professor Owen), and pl. 56. fig. 2.

to above*. The considerable upward extension of the masseteric ridge upon the os malæ beneath the orbit seems also characteristic of the Ruminants, as well as the bifurcation of the orbital ala of the sphenoid, which sends a branch forwards for a considerable distance, often so far as to articulate with the lacrymal bone. They also differ from the Hog-tribe in having, like the Perissodactyla, a distinct styloid process, emanating from the mastoid bone, partly enclosed by a portion of the tympanic, and with a truncated extremity, to which one of the angles terminating the "lesser cornu" or stylo-hyal bone is attached; while in the Hog-tribe this process is so completely pressed between the paroccipital process and the auditory bulla, that in most cases it does not seem to exist.

It will perhaps be most convenient to assign the rank of "family" to the four generally received subdivisions of this ancient order, although the osteological differences which they present are very slight; such few as I could find in the skull I will now point out. In the Camels and Llamas, the articulation of the lower jaw differs from that of Ruminants in general, in having a distinct eminentia articularis, separated by a fossa not having the character of an articulating surface from the post-articular process, upon which is another facet; the condyle of the jaw having likewise two articulating surfaces placed at right angles with each other. There is also a marked peculiarity in the auditory bulla, since the outer wall of the vaginal process forms a deep, thickened, vertical plate, burying the styloid process between it and the opposite part of the bulla. On looking at the casts of the skull of the *Anoplotherium* existing in our museums, I perceive, immediately under the meatus auditorius, a strong vertical process, apparently the outer edge of this lamelliform expansion, the remainder being concealed in the matrix. I fully concur in Professor Owen's reasons for considering the Anoplotherium as a ruminant, and this indication of character, in addition to the many resemblances which authors have pointed out, renders it probable that this early representative of the Artiodactyla belonged to the family *Camelidæ*. The existing members of this family also most approach the Anoplotherium in the form of the ascending ramus of the lower jaw, and the strongly-marked notch which bounds the angular process above.

I am glad to find that I have the sanction of Professor Owen's opinion in referring the *Merycopotamus* to the ruminant division, since on examining the specimens in our National Museum, I find that in addition to the form of the teeth, which if taken alone are not always to be depended on, all the essential characters of the skull are

* In the Hippopotamus the pterygoid ridge runs inwards and even a little backwards, and then forms a slight angle at the point of junction with the pterygoid process, which then runs downwards and forwards, so that the outer wall of the fossa exists as in the allied forms, while, as I have before observed, it is the inner one which is wanting. I must again refer to the remarkable osseous bulla within the orbit of this animal, since I find that the same thing exists, though of much smaller size, in most ruminants; in many skulls it is broken away, and when remaining it so lies upon the "tuberosity" or posterior termination of the alveolar process of the maxillary bone as to appear at first like a part of it. It opens into the nose and antrum maxillare, and has no connection with the lacrymal apparatus.

in accordance with that type. The masseteric ridge reaches to within half an inch of the orbit, and above the zygoma is a distinct indication of the foramen usually existing there in Ruminants. The glenoid surface is slightly convex anteriorly, and terminated behind by a distinct post-articular process, on to which the articulating surface is continued without intermission, thus indicating the animal to be ruminant, but removing it from the *Camelidæ.* The pterygoid ridge terminates in an angle, which, however, is not prolonged into a process; from this angle there is *no* transverse lamina extending down to join the pterygoid process, and consequently no pterygoid fossa. The articulating surfaces of the occipital condyles seem to extend on to the processes anterior to them; the auditory bulla is rounded, but as the state of the specimens will not permit any definite character to be drawn from it, I will not venture an opinion as to which family of Ruminants should claim this remarkable form.

Among the remaining families, I have noticed that in the *Moschidæ* and *Cervidæ* the styloid process becomes free almost immediately at the base of the auditory process, while in the *Bovidæ* or Cavicorn Ruminants, it is enclosed more or less completely for some distance in the downward and forward direction. The *Cervidæ* may also be distinguished from the latter by the form of the infraorbital depression, which has its most sudden sinkage on the upper side, or that which is next the infraorbital fissure. The Giraffe, although it has neither the depression nor the fissure, resembles the *Cervidæ* in the character of the auditory bulla, and in having the molar teeth expanded at the base of the crown, and compressed towards the summits of the lobes. The *Moschidæ* must, of course, be distinguished from the *Cervidæ* by their trilocular stomach, and by the presence of the gall-bladder*, and it is probable that further differences in their internal anatomy may yet be found; I must however revert to the subject of dentition to point out some characters in which they differ from all other Ruminants, and agree with the non-ruminant Artiodactyla. In these, as well as in some of the Musk-deer, the premolars, and those that represent them among the milk series, assume a trenchant form, and have a more or less developed additional cusp both before and behind; this little cusp also shows itself upon the anterior extremity of the penultimate upper milk tooth, which, as well as the last one, has the bipartite form of a true molar, and therefore by this combination of characters may be recognised if found alone. In most Ruminants the cusp is very small, and when worn down shows itself merely as a thickening of the anterior border of the crown. This tooth, however, also presents us occasionally with a zoological character in the development or non-development of the internal tubercle of the anterior pair; it is absent in the Hog; in the Peccary (who seems loath to relinquish any of the full number of cusps that nature can allow him) it is present; the *Moschidæ* are the only true Ruminants in which I have found it wanting; this seems to characterize

* The singular variety in this respect noticed by Prof. Owen in the Giraffe, must detract somewhat from the value of the character; but as the absence of the gall-bladder seems to be the rule in this animal, it strengthens, so far as it can avail, the idea of Cervine affinity.

the family, and together with the trenchant character of the premolars in the *Meminna* and *Hyeomoschus*, seems to associate with them the genera *Dichobune, Dichodon,* and *Cainotherium* *.

This characteristic form of the penultimate upper milk tooth, namely the want of the inner crescent of the anterior pair, with the presence of the additional cusp in front, plainly marks as this tooth, that which Prof. Owen has indicated as the penultimate premolar in his recently discovered genus *Hyopotamus*, and as the *last* premolar in his also newly-described genus *Dichodon*; the tooth behind it in each case being the last milk tooth, which always agrees exactly with the true molars, but is distinguishable from them by its suddenly diminished size. The series of upper molars of the latter animal have been placed, in the published figure, to the extent of one tooth too far back; were they brought forward to their true position, the tripartite tooth below, which, according to all laws of form and succession, can be no other than the last milk molar, (of which the successor has not begun to appear,) would antagonize by its anterior pair of crescents with the space in front of the posterior pair in the penultimate milk tooth above. Of the *Hyopotamus Vectianus*, the figure represents a series of the crowns of five upper molars, of which the first is, as I have before observed, manifestly a penultimate milk tooth. These being represented without any appended portion of jaw, and no mention being made in the text as to whether they were found connected, it seems rather probable that such was not the case, and in the side view roots are added in outline to certain of the teeth and not to others, which makes that matter still more doubtful. At all events, this condition of things could not possibly have co-existed with that represented in the lower jaw attributed to the same species; since in the upper series of teeth we may count ten principal transverse eminences, while in the lower series of five molars, which ought to fit them, there are only eight depressions: besides which, it is impossible that the elevated summits presented by the trenchant lower premolars, with the correspondingly deep notch which their interval affords, could ever fit the comparatively diminutive elevations and depressions presented by the foremost teeth above. The lower true molars, however, show a much more worn condition than the upper ones; but even if it should be possible that the series of upper molars represented were in place and in use at the same time, it is evident that the foremost of them cannot be premolars †.

* In the true *Moschus* the premolars have much the same form as in the generality of Ruminants; the incisors are uniform and nearly equal in size, and the auditory bulla is small: in the *Meminna*, and in those to which the generic name *Tragulus* has been applied (which I can see no reason for separating from it), the last upper premolar alone is bicuspid, the other two and all the lower ones being trenchant; the two median incisors are expanded, the others narrowed and curved outwards to make room for them, and the auditory bulla swollen: *Hyeomoschus* only differs from these in the penultimate upper premolar, which though trenchant is short, and when worn down has the appearance of being simply conical.

† I do not claim to be the sole discoverer of these incongruities (apparently the results of a too hasty determination), since I am aware that the true nature of the tripartite inferior tooth in the *Dichodon* has been perceived by some eminent comparative anatomists and naturalists; but I am here compelled to attempt

Having now summed up as much of my series of observations with regard to the Artiodactyle division as I think it at present expedient to offer, I proceed to consider the Perissodactyle group. I observe that Prof. Owen separates the Proboscidia as a third group, to which he seems to assign a rank equivalent to that of the other two, and passes the *Deinotherium* and the *Toxodon*, as well as the "Sirenoid" forms, with some remarks which do not assign to them any very definite location. There will always be room for difference of opinion as to the rank that should be assigned to a group, even when its limits are fully recognised; since, as I have elsewhere endeavoured to show*, "granting affinities and even groups to be natural, the limits assigned to those degrees of difference and similarity which we are wont to indicate by definite terms are not;" but it seems to me, that although these more aberrant groups of Ungulata possess several peculiarities which are entirely their own, they do not differ from the Perissodactyla in essential characters to the same degree as the latter do from the Artiodactyla, while in certain respects they agree among themselves, as though they would constitute a second subdivision of the Perissodactyla again divisible into strongly marked families. Among the characters which I have brought forward, we find that the Proboscidia, the Sirenia, and the singular fossil genus *Toxodon*, agree with the more typical Perissodactyla in the depth of the intermaxillary bone and the vertical implantation of the incisors, in the absence of the supraorbital foramen, of the fossa and pit within the orbit, and of a strongly marked pterygoid ridge, in the character of the zygoma, except that in the Proboscidia there is no descending post-articular process; in the narrowing anteriorly, and rounded sides of the basioccipital bone, and in the resemblance between the anterior

their refutation, since, were Prof. Owen's determinations in these instances correct, insuperable objections would be presented to my generalizations on the character of the premolars as distinguishing the two groups of Ungulate Mammalia, and on that of the penultimate upper milk tooth as indicative both of its position in the series, and of the affinities of certain genera.

That the character of the penultimate upper milk tooth was appreciated by Cuvier, will appear from a passage in the 'Ossemens Fossiles,' although it is rather vaguely and not quite correctly described. In speaking of a fragment of the upper jaw of a deer from the breccia at Nice, he observes: "On reconnait aisément la seconde de lait pour ce qu'elle est, à sa forme allongée, à ses trois paires de croissans, et à son appendice transverse placé avant les croissans."—*Deux* "paires de croissans" would have been more correct. The possibility of an error in relation to the upper molars of the *Dichodon* seems to have crossed the mind of Prof. De Blainville, for in a recent number of the 'Ostéographie,' after describing the dentition of the lower jaw in that animal, he proceeds: "D'après ce qui vient d'être dit du système dentaire de cette mandibule, on voit qu'il est incomplet par l'absence de la dernière molaire non encore sortie; mais ne doit-il pas en être de même pour la série d'en haut, si les deux pièces proviennent du même individu? Alors il faudrait admettre qu'au lieu de deux, il ne manquerait qu'une seule avant-molaire, ce qui parait peu probable."

With regard to the *Hyopotamus Vectianus*, M. De Blainville seems to doubt a little that the upper and lower jaw really belong to each other, but refrains from a decided judgement, not yet being acquainted, as he observes, with any principle that can direct the mind in the question of the relation of two parts of the dental system to each other. He inadvertently calls this species "*annectens*," the name given by Prof. Owen to his *Paloplotherium*.

* Essay on Classification, 'Zoologist' for December 1847.

and posterior molares. They differ from the typical Perissodactyla and agree among themselves, in the upward direction of the nasal opening, the large size of the infraorbital foramen, the lengthening of the bony palate, with the comparative narrowing of the posterior nares, in the short antero-posterior extent and the transverse thickening of the pterygoid processes, and in the considerable angle formed between the basioccipital and basisphenoid bones (least marked in the Manatee), the latter being inclined upwards, of course with reference to the upward direction of the nasal canal. Points of resemblance and of difference no doubt may be traced through the entire structure; as, for instance, the femur of the Proboscidia, although it wants the third trochanter, so characteristic of the more typical Perissodactyla, resembles the corresponding bone in that group in the characters of the posterior side of its upper part.

If it be admitted that this assemblage of singularly modified forms have sufficient resemblance to form a group which shall, with the more typical Perissodactyla, constitute two divisions, about equal in rank to the two divisions of the Artiodactyla, there cannot be much difference in opinion as to the manner in which this group should be subdivided into families. The Proboscidia stand forth as one (*Elephantidæ*), and the Sirenia as another (*Manatidæ*); while the *Toxodon*, which in its most essential characters seems to agree with both, and in some points with each, has so many peculiarities of its own, that it appears entitled to rank as a distinct family of itself, which should be placed between the other two, not as a "connecting link," which its marked differences from either must forbid, and which if it were, it would but annihilate the distinction that exists.

It seems time that naturalists should have decided what it is that constitutes an affinity; whether a form can really be allied to several widely-different groups. We may naturally expect to find, that amidst the varied forms each part assumes, a character which is the rule among the members of one group may be the exception in another, without of necessity supposing that a species presenting such a character can truly belong to both, and thus tend to destroy the difference of the original models on which the two groups are organized. In the present case, notwithstanding the peculiarities of structure mentioned as connecting the *Toxodon* with the Rodentia, its renowned describer, even while strengthening the idea of that affinity by adverting to Cuvier's assertion that the Elephants approach the same order, yet places it, apparently without a doubt, among the Ungulata, to which it obviously belongs. Although Cuvier affirms, that if all the parts of the head of the Elephant be compared successively with those of other animals, it is almost always among the Rodentia that their analogies will be found, he alludes only to three parts as indicating any such affinity. The relative size of the incisors and their alveoli can signify but little when their widely different structure is considered; and he correctly tells us why the infraorbital foramen is large in both: the character of the os malæ is common to the Bats and Insectivora as well as the Rodentia, and seems to be a frequent concomitant of a degree of organization comparatively low.

The direction of the incisors in the *Toxodon* differs very little from that which we find in many of the typical Perissodactyla, and the absence of roots is simply a physiological adaptation, and an indubitable proof that the detrition to which they were subjected was considerable; while on the other hand, the whole structure of the cranium is on the ungulate type, especially different from the Capybara and the forms allied to it, whose skulls present so many striking characters, that if any resemblance really did exist, an anatomist to whom they were familiar would certainly perceive it at a glance.

It is a matter of considerable regret to me, that before concluding my notice of the Perissodactyla, I am again compelled to differ from that high authority to whom we owe so much, and in whose footsteps I may here be said, as it were, to follow. Although I am prepared to show that the evidence of the teeth, on which Prof. Owen decided the place of his genus *Hyracotherium*, is not so strong as it may appear; yet, on the other hand, their resemblance to those of the group to which I must transfer it is not so striking as to have caused me in the least to doubt the correctness of the place assigned to it, until I was well satisfied of the value of the cranial characters which I have pointed out. Although the true molars resemble those of the *Chœropotamus* and other non-ruminant Artiodactyla in the tubercular form of the four principal eminences, and in having the ridge surrounding the base more complete than is usual in the Perissodactyla, yet to make the resemblance good, they should have, in addition to the two smaller tubercles, the one in the front, the other in the middle of the tooth, a third one behind; and the fact is well worthy of attention, that each of these secondary tubercles is placed upon the angle of a bent ridge which connects the pair of larger ones immediately behind it, and which in the smaller species (*Hyracotherium Cuniculus*) exists, while the little tubercle itself is wanting; thus showing that the ridge is a more essential part of the tooth than the tubercle developed upon it; and this ridge just marks out in a rudimental way the bent transverse ridges in the Rhinoceros, Tapir, Palæotherium, and other allied genera. The two last premolars differ from the true molars only in the non-development of the inner tubercle of the posterior pair, but of which a slight rudiment is still traceable; and the sudden change of form between these teeth and the two first is met with in no other genus, either of the Artiodactyle or Perissodactyle group. This would be perfectly in accordance with law, if the third and fourth molars belonged to the milk series, and the animal were Artiodactyle; but the whole series has the appearance of adult completeness, and neither the form nor the degree of wear of these teeth at all indicates such to be their nature;—indeed Prof. Owen himself never once hints at such an idea. To whichever group, then, this little animal be referred, the teeth will present marked exceptional characters, and therefore it becomes more necessary to seek for further evidence. I was first led to suspect a Perissodactyle affinity, through observing, by the figures and description published in Prof. Owen's very useful work on the British Fossil Mammalia, that the nasal bones exhibit the character of this group in a very decided manner, and that the supraorbital foramen and groove are entirely wanting. This induced me to examine with care the unique specimen in the Museum of the College of Surgeons, and I thus confirmed these characters, and also found that the mark indicating the origin of the obliquus inferior oculi is but a slight depression, not more marked than I have seen it in some skulls of Rhinoceros and Hyrax, and not placed in a fossa, but simply upon the general uniform concavity. Although the posterior portion of the skull is entirely lost, yet enough remains to show that there was but a slight difference of level between the base of the cranium and the palate; and to the inner side of the posterior molars there is just sufficient of the matrix removed to show a slightly raised curved line whose place is about that which the edge of the posterior nasal opening should occupy, if the animal be organized upon the true Perissodactyle type. A further confirmation is afforded by the distinct appearance of a groove, whose broken edges testify the loss of the little piece with which the alisphenoid canal should be enclosed; so in the only fragment we possess every character that remains agrees, to help us through the difficulty in which the ambiguous dentition leaves us.

May I be permitted to express the hope, that before forming a decided judgement on these matters, naturalists will carefully investigate for themselves; recollecting, that so long as man is not infallible, the continued progress of research must with new discoveries find something to be corrected in that which has been done before? but whatever be the judgement on these points of difference, I trust that doubts will cease as to the truth of the original idea, which nought but error hindered from being sooner developed; and that one important step may thus be gained towards that correct appreciation of the comparative value of groups, which we must attain throughout organic nature, before further generalizations can safely be attempted.

I will conclude by giving a list of genera arranged as I should now propose; the characters of the groups, although many remain to be discovered, are already too numerous to be again repeated, and I only include such genera of which I have been able to examine skulls; or in the case of fossils, of which actual specimens, casts, or well-authenticated figures of some characteristic portion of the skeleton have come within my observation.

ARTIODACTYLA.

RUMINANTIA.

Merycopotamus.
Chalicotherium*.
Bovidæ.
Sivatherium.
———
Bos.

NON-RUMINANTIA.

Hippopotamidæ.
Hippopotamina.
Hippopotamus.
Hyopotamus.
Anthracotherium.
Chœropotamus.

* Of these two genera I have not yet sufficient evidence to determine the family.

RUMINANTIA.

Ovis.
Capra.
Antilope, and several of the genera into which these have been dismembered.

Cervidæ.
Cervina.
Cervus, and various subgenera.
Camelopardalina.
Camelopardalis.

Moschidæ.
Moschina.
Moschus.
Meminna.
Hyeomoschus.
Dorcatherium.
Dichobunina.
Cainotherium.
Dichodon.
Dichobune.
Xiphodon.

Camelidæ.
Anoplotheriana.
Anoplotherium.
Camelina.
Llama.
Camelus.

NON-RUMINANTIA.

Adapis.
Dicotylina.
Dicotyles.

Suidæ.
Sus.
Hippohyus.
Babirussa.
Phascochœrus.

PERISSODACTYLA.

TYPICA.

Rhinocerotidæ.
Equina.
Equus.
Rhinocerotina.
Macrauchenia.
Nesodon.
Rhinoceros.
Acerotherium.
Elasmotherium.
Hyrax.
Palæotherium.
Paloplotherium.
Tapirus.
Lophiodon.
Coryphodon.
Hyracotherium.

ABERRANTIA.

Elephantidæ.
Deinotherium.
Mastodon.
Elephas.
Toxodontidæ.
Toxodon.
Manatidæ.
Halicore.
Manatus.

MISCELLANEOUS.

ON THE TENACITY OF LIFE IN SNAILS.

Dear Sir,

Last year I was told by Mr. Pickering that he had procured some foreign *Cyclostomæ* of Argent, which he kept some weeks, and then resuscitated by placing them in water; also that he had received a whole basketful of Madeira snails, of various species, from Mr. Wollaston, which after several months' fasting and captivity were revived in the same manner. Naturalists, who make foreign tours, seldom have the time or means of killing and cleaning large numbers of land-shells; it is therefore satisfactory to know that, with a little care in packing, a collection may be brought home *alive* and attended to at leisure. The following particulars, communicated to me by Mr. Wollaston, will show to what extent this may be done:—

"25 Thurloe Square, Brompton, Oct. 19, 1850.

"During my residence in the island of Porto Santo, *from April* 27 *to May* 4, 1848, I collected a large quantity of Helices peculiar to the spot, and having placed a small set of each, as types, in separate pill-boxes (for examination by Mr. Lowe on my return to Madeira), the rest were killed. These types were named the following week by Mr. Lowe; and as I had to leave immediately for England, I had no time to kill the specimens. On my return home the boxes were placed in empty drawers of my insect-cabinet, since which, up to the present time (Oct. 19, 1850), they had never been opened, or if opened, the specimens had certainly never been taken out. I concluded of course that they were dead long ago, thinking it more than probable that they never survived the voyage to England, and therefore, *à fortiori*, that two years and a half in dry pill-boxes was quite sufficient to remove all traces of existence. However, by immersion in cold water, I find that many of them are still alive; and though a large proportion have perished in this long interval, yet I have fourteen specimens now before me crawling about with the greatest activity. Thirteen of these are of the same species, viz. *Helix* (*Carocolla*) *papilio*, Lowe; and the other *Helix tectiformis*, Lowe, both collected May 1st, 1848, on the Ilheo de Baxo, a small limestone island off the south-western extremity of Porto Santo. And that there can be no possible mistake in this statement is made perfectly clear by the fact that *Helix papilio* is found in no other locality, and that May 1st, 1848, was the only occasion on which I have ever visited that remarkable rock. I regret that many of the types placed in the pill-boxes at the time of collecting were (purposely) dead specimens, as being sufficient for the mere discrimination of the species.

"I may also mention that I possess a whole bagful of the beautiful little *Helix turricula*, Lowe, collected on the Ilheo de Cima (another and smaller rock, off Porto Santo,) on the 24th of April 1849,—*all* of which, I find by immersion, are alive, though the dry and dusty bag in which they have been inclosed has never been opened since they were placed there, exactly a year and a half ago. The same may be said of *Helix duplicata* and *paupercula* of Lowe (collected at the same time as the last); I have both in large quantities, perfectly active, though only now for the first time taken out of the boxes in which they were originally placed.

"I have also a few specimens of a minute Madeira species, *Helix lentiginosa*, Lowe, which I have ascertained to be alive, although they are so small that it is difficult to conceive how sufficient moisture to support life can have been retained through this long period."

These observations, made by an accurate and trustworthy naturalist, may well take the place of those extravagant stories—borrowed from newspapers—which we too often find detailed in "popular Conchologies." Yours truly,

W. Francis, Esq. S. P. Woodward.

CHARACTERS OF NEW BRITISH RUBI*.

1. "*R. Colemanni* (Blox.); stem smooth, angular, with very numerous straight unequal slightly declining scattered prickles arising from a dilated base; aciculi and setæ few; leaves quinate and ternate, green with scattered hairs above, paler and densely pubescent beneath, central leaflet orbicular cordate abruptly cuspidate, lower pair nearly sessile overlapping [the intermediate pair]; panicle long, narrow, leafy, branched at the base, setose, with very numerous straight declining prickles; calyx reflexed.—It differs from *R. dumetorum* in the almost total absence of setæ from the barren stem, the form of the terminal leaflet and direction of the calyx. Discovered by the Rev. W. H. Coleman in a hedge at Packington, near Ashby de la Zouch. It appears somewhat intermediate between *R. infestus* (W. and N.) and *R. Grabowskii* (W.)."—*Fl. Leic.* 38.

This plant does not appear to me to have either the look or characters of *R. dumetorum* (W. and N.), and is much more nearly allied to *R. Grabowskii* (Bab.). Its barren stems appear to lose their setæ at an early period, as I can find none upon the specimens with which I have been favoured by Messrs. Bloxam and Coleman. The presence of setæ upon the barren stem and the unequal prickles of that part will distinguish it from *R. Grabowskii*.—*C. C. B.*

2. "*R. calvatus* (Blox.); stem arching, angular, sulcate, nearly devoid of hairs, of a shining red when exposed to the sun, prickles numerous strong declining not confined to the angles; leaves large, quinate, green on both sides, almost devoid of hairs the prominent ribs only being conspicuously ciliated, leaflets all stalked, the central one ovate or cordate-ovate sharply and deeply apiculate-dentate-acuminate; panicle long, flexuose, with numerous axillary gradually shortening, many-flowered branches, leafy nearly to the summit; peduncles densely hairy, closely armed with long pale prickles; calyx tomentose, the sepals loosely reflexed in flower and fruit.—A large

* Extracted from Miss Kirby's 'Flora of Leicestershire.' They are from the pen of the Rev. Andrew Bloxam. The book was published in June 1850.

and remarkable species nearly allied to *R. sylvaticus,* common in several parts of the county [Leicestershire]."—P. 42.

This is the plant which has been long known to the British students of Brambles as the "*R. sylvaticus* of Bloxam." I have long considered it distinct from my *R. sylvaticus,* of which the following is the character according to Mr. Bloxam. My friend Mr. John Lange of Copenhagen has sent me a bramble which seems to be *R. calvatus* which he finds "in sylvis Fioniæ frequens."—*C. C. B.*

3. "*R. sylvaticus* (W. and N.); stem angular, with solitary spreading hairs, prickles moderate numerous declining; leaves quinate, large, soft, and flexible, green on both sides, softly pubescent beneath, central leaflet cordate-ovate with narrow apiculate dentations and a long cusp; flowering branches numerous, leafy; floral leaves usually trifid or simple; calyx clothed with long soft hairs; sepals elongated, closely reflexed in flower and fruit."—P. 43.

4. "*R. mucronatus* (Blox.) (*R. sylvaticus,* Leighton's Fasc.?); stem round or very slightly angular, densely hairy near the root, less hairy above, prickles very few weak straight; leaves quinate, thin, green on both sides, slightly hairy, central leaflet cordate-orbicular or broadly ovate abruptly cuspidate; panicle narrow, of few branches mostly one- and two-flowered (rarely more than three) on long peduncles, rachis clothed with a dense ashy tomentum with setæ and glands intermixed.—This apparently well-marked species has been referred by some to *R. sylvaticus* (W. and N.); but its general aspect, peculiarly formed leaves, and simple panicle with long pedicels usually one- and two-flowered, indicate a closer affinity to the *R. Lingua* of W. and N. than to their *R. sylvaticus.*"—P. 43.

In my opinion the *R. sylvaticus* of Leighton's Fasciculus is certainly this species. I have gathered it in several parts of Scotland. —*C. C. B.*

ON VICTORIA REGIA.

Sir William Hooker having referred to me to furnish him with some dates respecting my account of *Victoria Regina* in the 'Annals of Natural History' for August, I was induced to go to the Geographical Society last Friday (the 22nd instant) to see what I could find there relating to the subject. Having obtained permission of the President, my excellent friend Capt. William H. Smyth, R.N. &c., to consult the minutes and other archives of the Society to make extracts from them and print any I should think necessary, I was much surprised with the new light they threw on the question, and therefore hasten to send you the more important documents as an appendix to my former paper.

It appears by the correspondence which I send you, that the Geographical Society determined to appropriate Mr. Schomburgk's paper on the Water Lily as soon as it arrived, and before they transmitted it to the Botanical Society. They immediately deputed Dr. Lindley to describe and figure it; but why the Secretary subsequently borrowed from me the drawing and description belonging to the Botanical Society is still a mystery to me; the drawing was faithfully returned, and is now on the walls of the Botanical Society's library.

If the Geographical Society had communicated their determination to the Botanical Society, and had sent them an account of what they were doing, the whole of this confusion would have been avoided; and this silence on their part is the more remarkable, as I have been a Fellow of that Society from its foundation.

Of the documents which follow, the second and sixth are from the originals; the first, third, fourth and fifth are from the copies in the Letter-book of the Geographical Society. I may further observe, that the letter to the Botanical Society is the only one they ever received from the Geographical Society on the subject.

No. 1. *Mr. Hamilton, the President of the Geographical Society, to Major-General Sir H. Wheatley, G.C.B.*

July 27, 1837.

Dear Sir Henry,—In pursuance of Her Majesty's command, which you have been good enough to signify to me by yours of the 26th, I have the honour to send you the drawing of the singular species of *Nymphæa* discovered by Mr. Schomburgk, the traveller engaged by the Royal Geographical Society to explore the province of British Guyana in the upper part of the river Berbice, in long. 58°, lat. 4° 30′.

The drawings are accompanied by a memoir drawn up by Mr. Schomburgk descriptive of the flower, and I beg to add his humble request that he may be allowed to affix to it the name of "*Victoria.*"

I have the honour to be, dear Sir,

Sir Henry Wheatley, &c. W. R. Hamilton, P.R.G.S.

No. 2. *Sir Henry Wheatley to Mr. Hamilton, P.R.G.S.*

St. James's Palace, 29 July 1837.

My dear Sir,—I this morning received the drawing of the species of *Nymphæa* discovered by Mr. Schomberg, which I have lost no time in submitting to the Queen, and Her Majesty has directed me to express her sense of Mr. Schomberg's attention in sending it, and to convey to that gentleman Her Majesty's permission that the name of *Victoria regia* should be affixed to the flower.

Believe me to remain, my dear Sir, very sincerely yours,

W. Hamilton, Esq. W. H. Wheatley.

The Queen has directed me to return the drawing for the purpose named in your letter.

No. 3. *Capt. Washington, Secretary of the Geographical Society, to the Secretary of the Botanical Society.*

July 30, 1837.

Sir,—I have the honour to forward to the Botanical Society the accompanying drawing of two flowers, with descriptions, transmitted to this Society by Mr. Schomburgk, our traveller in British Guyana, who has written requesting permission to that effect, which request the Council has immediately complied with; and I am further directed to state, that as Mr. Schomburgk is travelling entirely under the control and at the expense of this Society, the Council are of opinion that it would be more becoming, that whatever drawing or other object he may wish to present to Her Majesty should pass directly through the hands of the Royal Geographical Society, and will relieve the Botanical Society from any further trouble on that account. Should you wish to write to Mr. Schomburgk by the next mail, I shall have great pleasure in forwarding any letters sent to me by Tuesday 1 Aug. next.

I am, Sir, &c.

No. 4. *Extract of Letter from Capt. Washington to R. H. Schomburgk, Esq., dated Aug.* 1, 1837.

"The drawings also of the new genus of flower discovered by you, and named *Nymphæa*, and of the *Loranthus*, have been forwarded by permission of the Council with the descriptions to the Botanical Society. The only point in which your request has not been complied with literally, is with respect to the drawing to be presented to Her Majesty, which the Council conceived it would be more becoming to present direct from this Society in your name, instead of going through the hands of a third party, with whom you have no sort of connexion. You will be glad to know that Her Majesty has been pleased to accept the dedication of the flower, and to allow it to be named *Victoria regia*; it will be placed in proper train for being suitably engraved, described and published."

No. 5. *From Capt. Washington to Dr. Lindley, Sec. Hort. Soc.*

Aug. 3, 1837.

Sir,—I have the pleasure to transmit to you the original drawing, with the description, of a new species of flower discovered on the 1st of Jan. 1837, in the upper part of the river Berbice, in lat. 4° 30′ N., long. 58° 1′ W. nearly, by Mr. Schomburgk while travelling on account of the Society in the Colony of British Guiana, and as you have kindly acceded to the request to undertake the publication of the flower, and to prepare a correct description of it, I am directed by the President of the Society to state, that it is now confided to you for that purpose, and also to acquaint you that the drawing has been presented to Her Majesty, who has graciously been pleased to accept the dedication of it, and also to signify her pleasure that it should bear the name *Victoria Regia*, if, as it is believed, it should prove to be an undescribed genus. May I request you will have the kindness to send back the original drawing as soon as done with, that it may be returned to Her Majesty's Library?

I am, Sir, &c.

No. 6. *Extract of a Letter from R. H. Schomburgk, Esq. to Capt. Washington, dated Port Amora, River Essequibo, Sept.* 14, 1837.

"I think you did very well to present the new plant. I scarcely ventured to request that favour from the Council, as never any interest was shown to my botanical discoveries."

The Botanical Society, on receiving the communication from Mr.

Schomburgk, which was spontaneous and unsolicited, not being aware of what had been done, and believing that the Water Lily was a new genus, also communicated with Sir H. Wheatley, and obtained Her Majesty's permission that Mr. Schomburgk might call it *Victoria regina,* and under this name his description of the plant was first published in the Athenæum, the Morning Herald and the Morning Post of the 9th of September 1837. Dr. Lindley's privately printed edition of Mr. Schomburgk's description and plate was presented to the Geographical Society with a letter dated the 3rd of November 1837.

Had the Botanical Society known that the Geographical Society considered the communication as their property, and had deputed Dr. Lindley to publish it, and that Her Majesty had already given Mr. Schomburgk permission to affix the name of *Victoria regia* to the flower, they would certainly have used that name, and, indeed, I believe, that under those circumstances they would not have published it at all; but such having proved to be the case, I should be inclined, now that I am for the first time aware of these circumstances, to forgo the priority of publication and in future use the name of *Victoria regia* for the plant.—J. E. Gray, 26 Nov. 1850.

JOURNEY TO EXPLORE THE NATURAL HISTORY OF THE AMAZON RIVER.

To the Editors of the Annals of Natural History.

24 Bloomsbury Street, London,
Nov. 20, 1850.

Gentlemen,

In the February Number of your valuable Magazine, you kindly inserted a few lines extracted from a letter that I had received from my friend Mr. Wallace, who is investigating the natural history of the Amazon River; I therefore make bold to send you a few more, taken from letters received since.

I remain, Gentlemen, yours very truly,
Samuel Stevens.

Santarem, Nov. 15, 1849 (500 miles above Parà).

"I spent about three weeks at Montealegre and have now been back here nearly a month, so before I leave for the Rio Negro I send you a small lot of insects; they consist almost entirely of Lepidoptera, the *Beetles* not yet having made their appearance; in the wet season I hear there are plenty both at Montealegre and here, so I shall probably return here, unless I meet with something much better to keep me up above. Of the boxes sent, Nos. 1 and 2 only are for you to dispose of. Your lot, though a small one, I trust will be found a good one; there are a very considerable number of fresh species, one of which (No. 605*) is, I think, the *most beautiful thing* I have yet taken; it is very difficult to capture, settling almost invariably high up

* This beautiful species I find to be the rare *Callithea Sapphira*, Hub., of which hitherto only one example appears to have existed in the collections in this country.

in trees; two specimens I climbed up after and waited for; I then adopted a long pole which I left at a tree they frequented, and by means of persevering with it every day for near a month have got a good series: the sexes I have no doubt whatever about, though I have not taken them *in copula*; the female flies lower and is easier to take than the male. The allied species (606*) was rather abundant at Montealegre; the orange Heliconia-like insect occurred there plentifully. Of all *new species* and others which I know to be good, I have sent plenty; of old things I have sent a few only.

"In the *Erycinidæ* there are a great many species fresh to me, and I hope *some new* to Europe: I have now made descriptions of all the species sent, so that should I be obliged again to send home my duplicates or lose any of them, I can still recognize the species. The handsome species I hope will sell well. In box No. 3. I have put a lot of miscellaneous insects, which please take out and dispose of. There is also a small stuffed alligator, a species I think they have not in the Museum; it is the Jacare tinga, of which the tail is *eaten* and is very good; they are an immense deal of trouble in skinning. I have sent also a larger one, which I think is the common species; also a tortoise-shell and a few vertebræ of the large alligator of the Amazon I have put in to fill up; perhaps they may be interesting to geologists to compare with those of fossil Sauria. Shells there are none here. There are two painted calabashes in paper with your name outside; please accept them as a specimen of the Indian girls' work at Montealegre; the varnish, colours, &c., are all made by themselves from the leaves and bark of different trees and herbs; they paint them with bits of stick and feathers, and the patterns are all their own design; they are the usual drinking-vessels here, but less ornamented for common use. I am much in want of some work on the species of butterflies; I think the 'Encyclopédie Méthodique,' vol. ix. by Godart, is the only thing that will do. The leaf in the box is a segment of the *Victoria regia*; if any one wants it, you may sell it."

"Barra de Rio Negro (1000 miles above Parà), March 20, 1850.

"After sending off the box from Santarem (which I trust you have received safe), I was delayed a fortnight waiting for men to go up the river. After great difficulty I obtained them, but to Obidos only, a distance of about eighty miles (three days); there I was delayed four days, and then got others another stage of four days on to Villa Nova. There I was delayed a week, and was there indebted to the kindness of a trader, who lent me some of his men to get on to Barra. Now however the rains and head winds had set in, so that after rather an unpleasant journey owing to wet and mosquitoes, we arrived at Barra on the 30th of Dec. in thirty-four days from Santarem. I was so anxious to reach here before the wet season had regularly set in, that I never wasted an hour to go on shore but once a day to cook, so that I literally collected nothing on the road except at Villa Nova, where we had tolerably fine weather. After the muddy, monotonous, mosquito-swarming Amazon, it was with great pleasure we found

* This is *Callithea Leprieurii*, Feisthamel, also very rare.—S. S.

ourselves in the black waters—*black as ink* they are, and well deserve their name; the shores are rugged and picturesque—and greatest luxury of all, mosquitoes are unknown except in the islands. Our voyage, however, was not near so bad as it might have been, for Mr. Spruce, who left Santarem for Obidos exactly a week before us, arrived there only the evening before, having taken *nine* days owing to the want of wind, without which it is impossible to stem the current. We are here staying with Sir Henrique Anthony, in the same house Edwards occupied; he is a most hospitable fellow, and his house is the general receptacle of strangers. I soon found that insects were exceedingly scarce here at this season, it being almost impossible to get half a dozen in a day worth bringing home. Birds too are equally scarce, so I resolved on a short trip up the Rio Negro to where the *Umbrella chatterers* are found. I spent a month there, and being fortunate in finding a good hunter, have got a small but pretty good collection of birds, considering the season.

"With regard to living animals, &c., it is quite impossible to send them from here. At Parà they can only be bought at such high prices as not to make it worth the risk. The captains too require half the price for the passage. I had intended, if I could have been now on my voyage up the Rio Negro, to have returned about next Christmas, getting all the live animals I could on the way and coming home myself with them, calculating that I could get sufficient to pay all expenses to England and back; but I do not think now I shall do so, as I shall probably not be able to start for the frontiers till June or July, and it is nearly a two months' voyage. If therefore sufficient funds arrive by that time, I shall probably stay up in the neighbourhood of the Cassiquiare a year, and then on returning to Barra see about a journey up towards the Andes. I am anxiously waiting also to know about the fish and reptiles, as I do not want to get more if they do not pay.

"Besides the umbrella birds, the little bristle-tailed manakin will, I think, be good; also the trumpeter, which is a species different from that at Parà; the muscovy ducks also. Both among the birds and insects there are, I know, many common as well as rare species. There are also two bad specimens of the celebrated "bell bird," which I believe is rare; they frequent the highest trees out of ordinary gunshot; my hunter fired five or six times at each of them, and after several ineffectual shots at another gave it up in despair. Of the curl-crested araçari, I have only at present got a single specimen. The araçaris I send are two species new to me, and are both much prettier than the curl-crested. I must now not forget to thank you for the prints you sent me, which I only discovered a short time ago, never having opened the box containing them. Any newspapers or scientific periodicals you can send me will be particularly acceptable."

On the Occurrence of Regalecus glesne *at Redcar, Yorkshire, in* 1850. By J. E. Gray, Esq., F.R.S.

A specimen of this fish was cast ashore on Redcar Sands, Yorkshire, on Thursday, the 3rd of January 1850. "The fish was alive when found. Length without the tail-fin, which is wanting, about 11 feet; width at the broadest part, 12 inches; weight, 4 stone 10 lbs."

It was salted and exhibited at Redcar. During the exhibition the rays of the dorsal and ventral fins were almost entirely destroyed, and it broke transversely into three nearly equal lengths on being moved from the sand.

It was eventually sent to London, and now forms part of the Collection of British Animals in the British Museum. The specimen, when it arrived in London, agreed in general appearance and in all essential characters with the specimen from Cullercoats which was exhibited in London last year. Mr. Wrightson, who had the care of it at Redcar, considered, because it had no expanded forked tail, that the tail was wanting.—*Proc. Zool. Soc.* March 26, 1850.

METEOROLOGICAL OBSERVATIONS FOR OCT. 1850.

Chiswick.—October 1. Fine: cloudy: clear. 2. Very fine. 3. Slight rain. 4, 5. Foggy: very fine. 6. Foggy: very fine: rain. 7. Boisterous. 8. Clear: fine. 9. Slight fog: very fine. 10. Clear: very fine: rain. 11. Windy: stormy showers: clear. 12. Clear: very fine. 13. Overcast. 14, 15. Exceedingly fine: sharp frost at night. 16. Clear and fine. 17. Very fine. 18. Foggy: very fine. 19. Overcast: fine. 20. Fine. 21. Fine: clear and cold. 22. Clear: dense clouds: overcast. 23. Heavy rain. 24. Densely overcast: rain. 25. Cloudy. 26. Clear: cloudy and fine: clear and frosty at night. 27. Clear: fine: rain. 28. Rain: fine: clear. 29. Clear and fine: sharp frost. 30. Frosty: rain: clear. 31. Overcast: fine.

Mean temperature of the month	44°·32
Mean temperature of Oct. 1849	49 ·55
Mean temperature of Oct. for the last twenty-four years .	50 ·51
Average amount of rain in Oct.	2·67 inches.

Boston.—Oct. 1, 2. Fine. 3, 4. Cloudy. 5. Fine. 6. Fine: rain P.M. 7. Cloudy: rain early A.M. 8. Cloudy. 9, 10. Fine: rain P.M. 11. Cloudy: rain A.M. and P.M. 12. Fine. 13, 14. Cloudy. 15, 16. Fine. 17. Cloudy. 18. Fine. 19, 20. Cloudy. 21. Cloudy: rain early A.M. 22. Cloudy. 23. Fine: rain A.M. and P.M. 24—26. Cloudy: rain A.M. and P.M. 27. Fine: rain P.M. 28. Fine: rain early A.M. 29. Fine. 30. Cloudy. 31. Cloudy: rain early A.M.

Applegarth Manse, Dumfries-shire.—Oct. 1. Fair, but unsettled-looking. 2. Fair, but dull and cloudy. 3. Drizzling greater part of the day. 4. Heavy showers P.M. 5. Fog A.M.: hail: rain P.M. 6. Fog A.M.: heavy rain P.M. 7. High wind: heavy rain. 8. Fair, but cloudy. 9. Slight hail: light rain P.M. 10. Fair and frosty: shower P.M. 11. Fair and cold. 12. Fair and cold: frost A.M. 13. Moist and drizzly. 14. Slight showers. 15. Frost: high wind P.M. 16. Rainy, but slightly so. 17. Slight showers: cleared P.M. 18. Cloudy all day. 19. Slight showers. 20. Clear and fine. 21. Frost A.M.: shower P.M. 22. Frost severe: rain P.M. 23. Frost still: shower. 24. Frost severe. 25. Raw: dull: slight shower. 26. Frost hard: fair all day. 27. Frost very hard: thermometer 27°: shower P.M. 28. Thaw: fine: clear. 29. Frost again: fine and clear. 30. Rain A.M.: moist all day. 31. Fair and fine throughout.

Mean temperature of the month	44°·2
Mean temperature of Oct. 1849	44 ·0
Mean temperature of Oct. for the last twenty-eight years ...	46 ·0
Average rain in Oct. for twenty-three years	3·50 inches.

Sandwick Manse, Orkney.—Oct. 1. Clear: dry: aurora. 2, 3. Fine: aurora. 4. Fine. 5. Fine: showers: aurora. 6. Fine: solar halo. 7. Rain. 8. Cloudy: showers. 9. Showers: drying. 10. Showers: sleet-showers. 11. Bright: fine. 12, 13. Drizzle: showers. 14. Showers: sleet-showers. 15. Bright: rain. 16. Rain. 17. Rain: cloudy. 18. Rain. 19. Bright: cloudy. 20. Bright: clear. 21. Clear. 22. Cloudy: rain. 23. Showers. 24. Showers: clear. 25. Clear: showers. 26. Clear: frost: fine: aurora. 27. Cloudy: rain: aurora. 28. Bright: clear: aurora. 29. Sleet-showers: fine: aurora. 30. Rain: showers. 31. Bright.

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

Days of Month.	Barometer.							Thermometer.							Wind.				Rain.			
	Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1850. Oct.	Max.	Min.	$8\frac{3}{4}$ a.m.	9 a.m.	9 p.m.	$9\frac{1}{2}$ a.m.	$8\frac{1}{2}$ p.m.	Max.	Min.	$8\frac{3}{4}$ a.m.	Max.	Min.	$9\frac{1}{4}$ a.m.	$8\frac{1}{2}$ p.m.								
1.	29·596	29·249	28·87	29·34	29·61	29·62	29·77	59	38	47	$58\frac{1}{2}$	40	52	49	nw.	wsw.	n.	n.	·08	......	......	·36
2.	29·870	29·799	29·32	29·71	29·71	29·82	29·78	58	43	52	$56\frac{1}{2}$	$38\frac{1}{2}$	$52\frac{1}{2}$	45	n.	nnw.	sw.	se.	·02	......	......	......
3.	29·877	29·874	29·46	29·73	29·77	29·73	29·76	56	44	52	55	$38\frac{1}{2}$	$51\frac{1}{2}$	49	e.	w.	sw.	s.	·02	......	......	......
4.	29·886	29·798	29·44	29·70	29·60	29·67	29·68	60	33	52	54	41	52	46	sw.	ssw.	sw.	se.	......	......	......	·03
● 5.	29·771	29·734	29·35	29·56	29·55	29·57	29·56	61	28	45	52	44	$46\frac{1}{2}$	46	w.	w.	sw.	calm	......	......	......	......
6.	29·746	29·427	29·26	29·52	29·00	29·51	29·42	59	44	43	52	35	44	$44\frac{1}{2}$	sw.	s.	se–e.	e.	·15	......	......	·22
7.	29·544	29·377	28·75	28·80	28·97	29·09	29·22	59	42	52	51	$46\frac{1}{2}$	51	$48\frac{1}{2}$	sw.	wsw.	sw-w.	ne.	......	·22	......	1·00
8.	29·779	29·557	29·10	29·38	29·60	29·44	29·63	60	31	51	56	$47\frac{1}{2}$	$49\frac{1}{2}$	46	sw.	wsw.	nnw.	n.	......	......	1·32	·87
9.	29·960	29·891	29·36	29·79	29·95	29·85	30·04	56	32	47	54	36	48	$42\frac{1}{2}$	sw.	nw.	ne.nw	nw.	·02	......	......	·12
10.	30·037	29·933	29·66	29·89	29·90	29·88	30·10	56	37	40	52	32	48	41	n.	nw.	nnw.	n.	·06	·18	......	·09
11.	30·153	29·915	29·67	30·08	30·26	30·31	30·37	51	34	40	49	38	42	43	n.	nw.	nnw.	n.	·02	·10	......	·25
12.	30·357	30·241	29·96	30·33	30·25	30·23	30·18	53	27	41	48	$31\frac{1}{2}$	49	$50\frac{1}{2}$	n.	nw.	nw.	w.	......	·20	......	·05
☽ 13.	30·306	30·151	29·80	30·10	29·97	29·96	29·77	49	39	47	54	42	51	52	w.	nw.	wnw.	w.	......	......	......	·05
14.	30·091	29·933	29·71	29·74	29·74	29·53	29·75	50	35	49	51	$46\frac{1}{2}$	46	37	sw.	w.	nw.	n.	......	......	......	·39
15.	30·069	30·030	29·65	29·88	29·78	29·76	29·50	54	24	39	49	$29\frac{1}{2}$	41	50	n.	nw.	sw.	w.	......	......	......	·09
16.	30·076	30·046	29·64	29·79	29·78	29·44	29·69	60	30	43	54	47	52	44	w.	sw.	sw.	nw.	......	......	0·09	·80
17.	30·057	30·042	29·58	29·71	29·81	29·43	29·73	60	34	50	56	$48\frac{1}{2}$	53	48	sw.	sw.	sw.	nw.	......	......	......	·78
18.	30·105	30·058	29·60	29·88	29·78	29·72	29·60	63	44	51	57	$49\frac{1}{2}$	49	52	w.	w.	sw.	w.	......	......	......	·36
19.	29·957	29·901	29·43	29·71	29·77	29·70	29·93	59	37	56	55	50	47	44	w.	w.	sw.	nnw.	......	......	......	·53
20.	29·892	29·856	29·47	29·90	29·90	30·01	30·09	55	35	49	51	$42\frac{1}{2}$	$42\frac{1}{2}$	$41\frac{1}{2}$	nw.	n.	n.	n.	......	......	......	·08
○ 21.	30·028	29·917	29·59	30·07	30·18	30·27	30·30	52	33	40	48	$35\frac{1}{2}$	$43\frac{1}{2}$	$41\frac{1}{2}$	ne.	n.	n.	nw.	......	·15	......	·06
22.	30·110	29·777	29·79	30·06	29·38	29·76	29·31	52	34	37	48	29	$43\frac{1}{2}$	$44\frac{1}{2}$	n.	n.	n–sw.	nw.	·11	......	......	·05
23.	29·308	29·165	28·90	29·20	29·21	29·29	29·32	48	38	41	47	$34\frac{1}{2}$	$39\frac{1}{2}$	$40\frac{1}{2}$	n.	w.	nnw.	e.	·46	·28	0 18	·41
24.	29·311	29·217	28·90	29·26	29·50	29·65	29·87	41	35	42	44	28	45	40	e.	se.	e.	calm	·21	·27	......	·07
25.	29·506	29·410	29·13	29·57	29·59	29·82	29·78	46	30	41	43	37	44	42	ne.	ne.	nne.	calm	......	·20	......	·02
26.	29·801	29·624	29·22	29·69	29·76	29·78	29·81	48	23	42	47	$29\frac{1}{2}$	38	39	ne.	n.	ne.	calm	......	·17	......	·02
27.	29·906	29·745	29·50	29·70	29·37	29·57	29·35	49	37	32·5	47	27	43	$45\frac{1}{2}$	w.	w.	nw.sw	wsw.	·26	......	......	......
☾ 28.	29·419	29·313	29·30	29·22	29·24	29·26	29·25	52	29	45	48	34	$45\frac{1}{2}$	43	w.	w.	w.	nw.	·02	·33	......	·24
29.	29·638	29·475	29·19	29·35	29·50	29·35	29·52	49	24	34	47	28	43	39	n.	nw.	nnw.	s.	......	......	......	·09
30.	29·692	29·682	29·27	29·33	29·45	29·03	29·25	50	36	34	$54\frac{1}{2}$	31	$47\frac{1}{2}$	46	sw.	ssw.	w.	wnw.	·04	......	0·20	·26
31.	29·938	29·872	29·43	29·65	29·69	29·62	29·68	56	37	37·5	$53\frac{1}{2}$	45	$41\frac{1}{2}$	$44\frac{1}{2}$	w.	w.	sw.	se.	·08	·10	......	·03
Mean.	29·861	29·742	29·39	29·665	29·663	29·666	29·710	54·22	34·42	44	51·3	38·1	46·50	44·67					1·15	2·20	1·79	7·32

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END OF THE SIXTH VOLUME.

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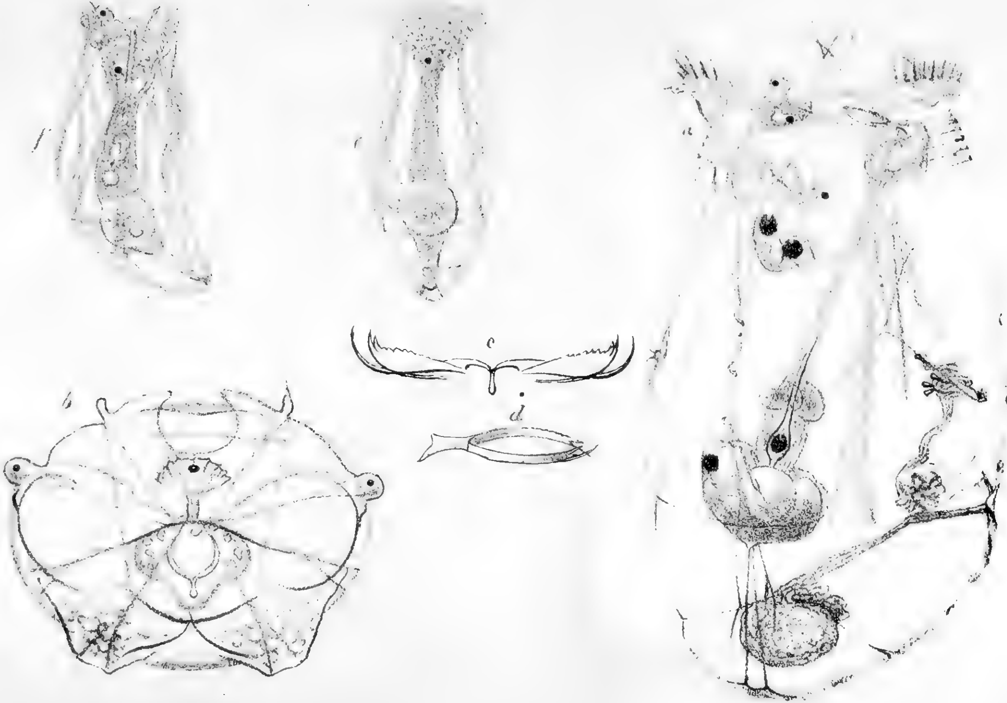
ALERE FLAMMAM.



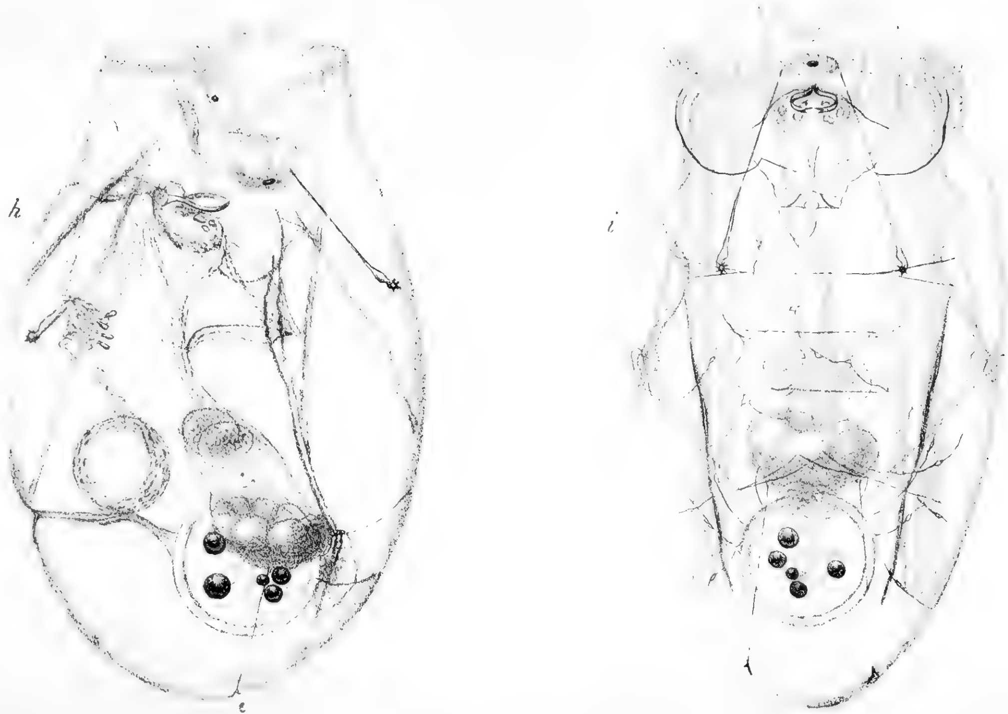
P. H. Gosse del. et lith.

ASPLANCHNA PRIODONTA. (Gosse.)

a, Female; b, the Head

c, d, Jaws; e, f, Male

Day & Son, lith. to the Queen.



P.H.Gosse, del. ad viv.

ASPLANCHNA PRIODONTA, Gosse.

Pleistocene Entomostraca.

Fig. 1.

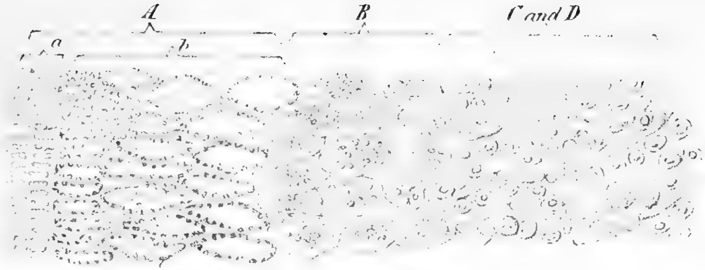
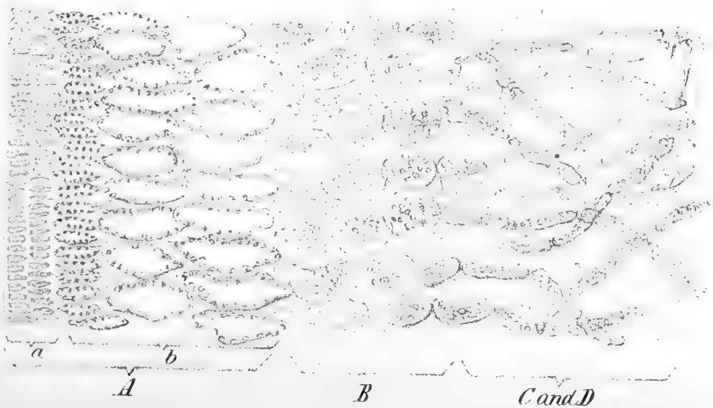


Fig. 2.



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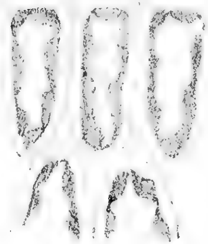

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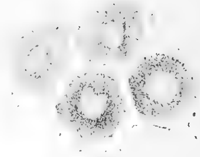
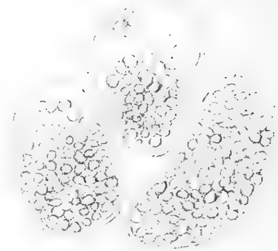


Fig. 5

Fig. 6.



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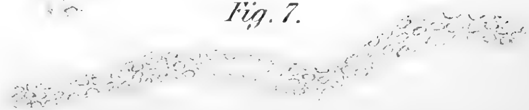
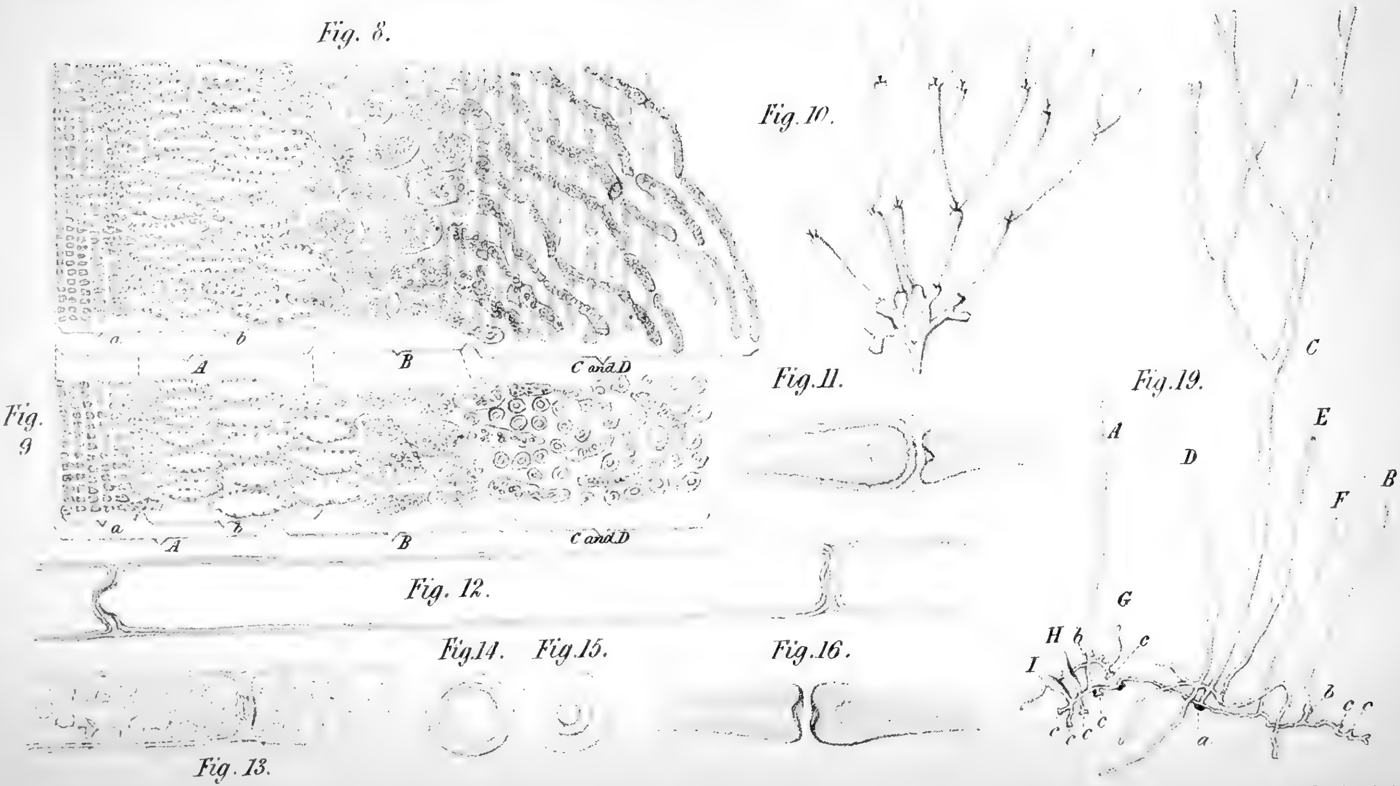


Dr Caspary, del.

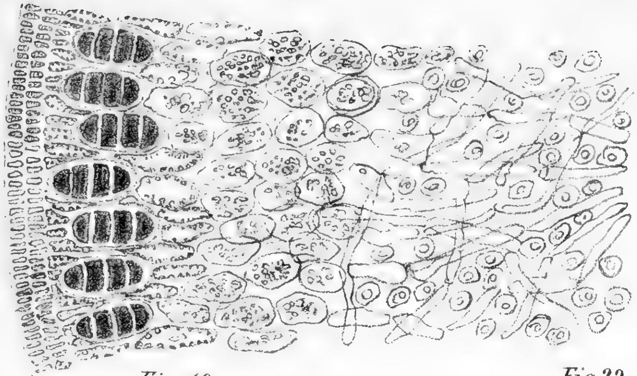
J. Basire, lith.



Dr. Caspary del.

J. Basire lith.

Fig. 17.



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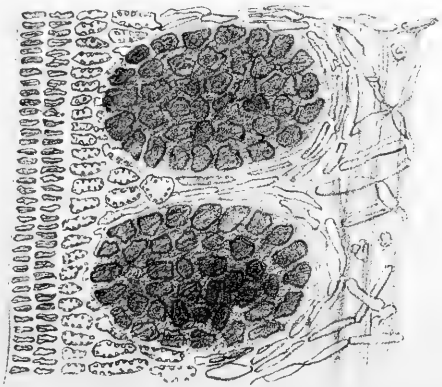

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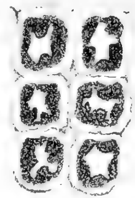

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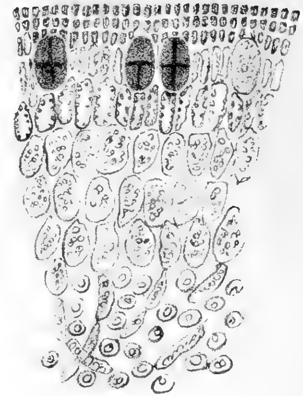


Fig. 22. 23. 24. 25. 26. 27.

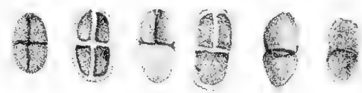
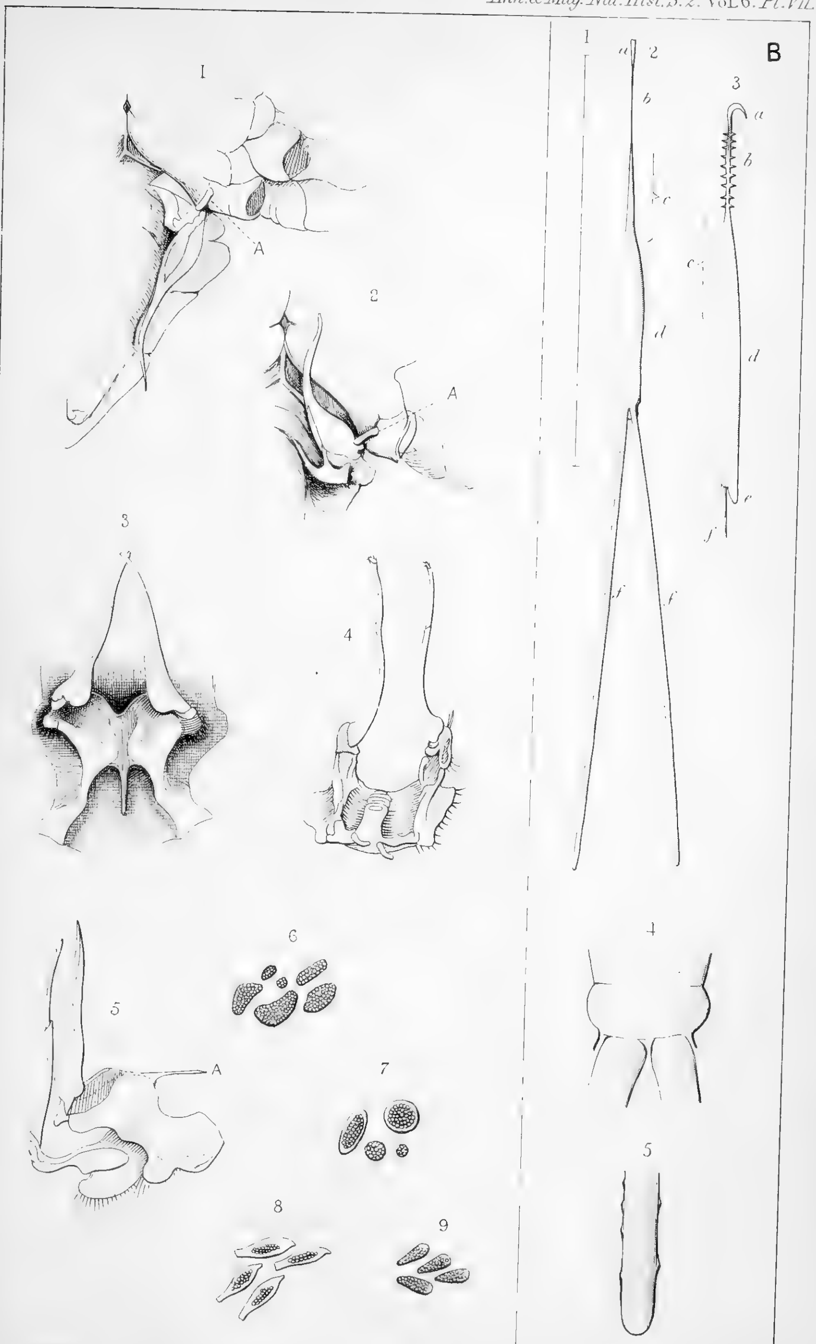


Fig. 20.

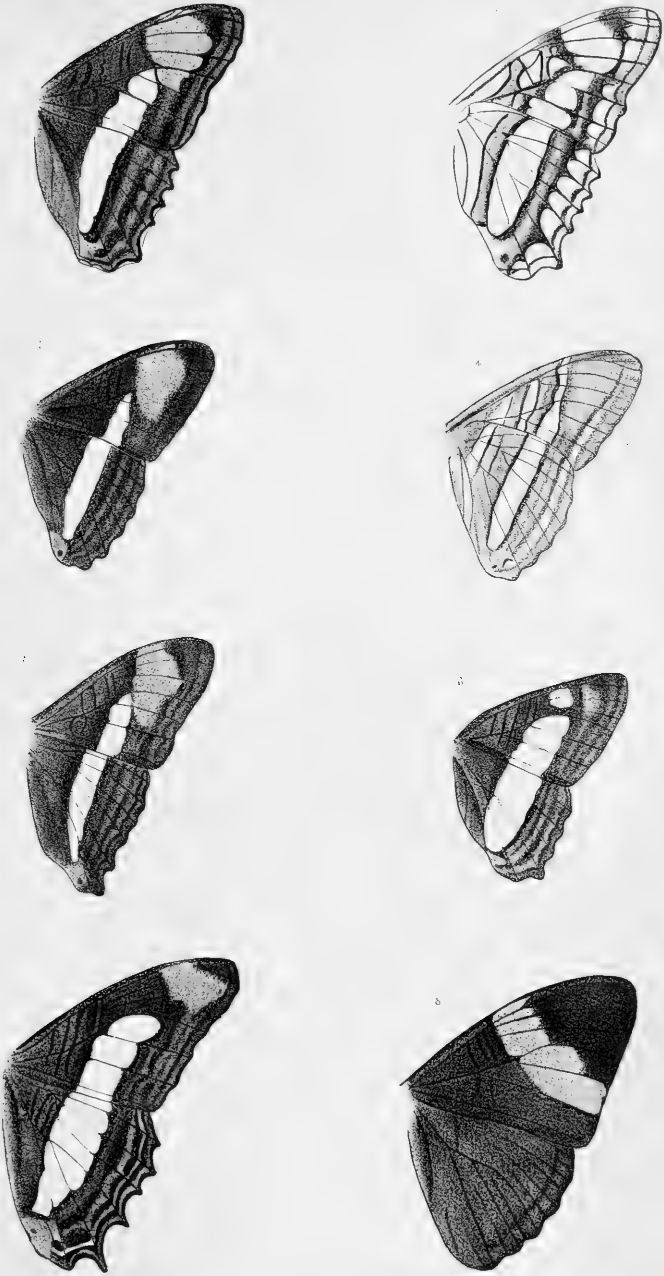
Dr. Caspary, delt. J. Basire, lith.



J. Basire sc.

R. Caspary del.

J. De C. Sowerby sc



W. C. Hewitson del. et lith.

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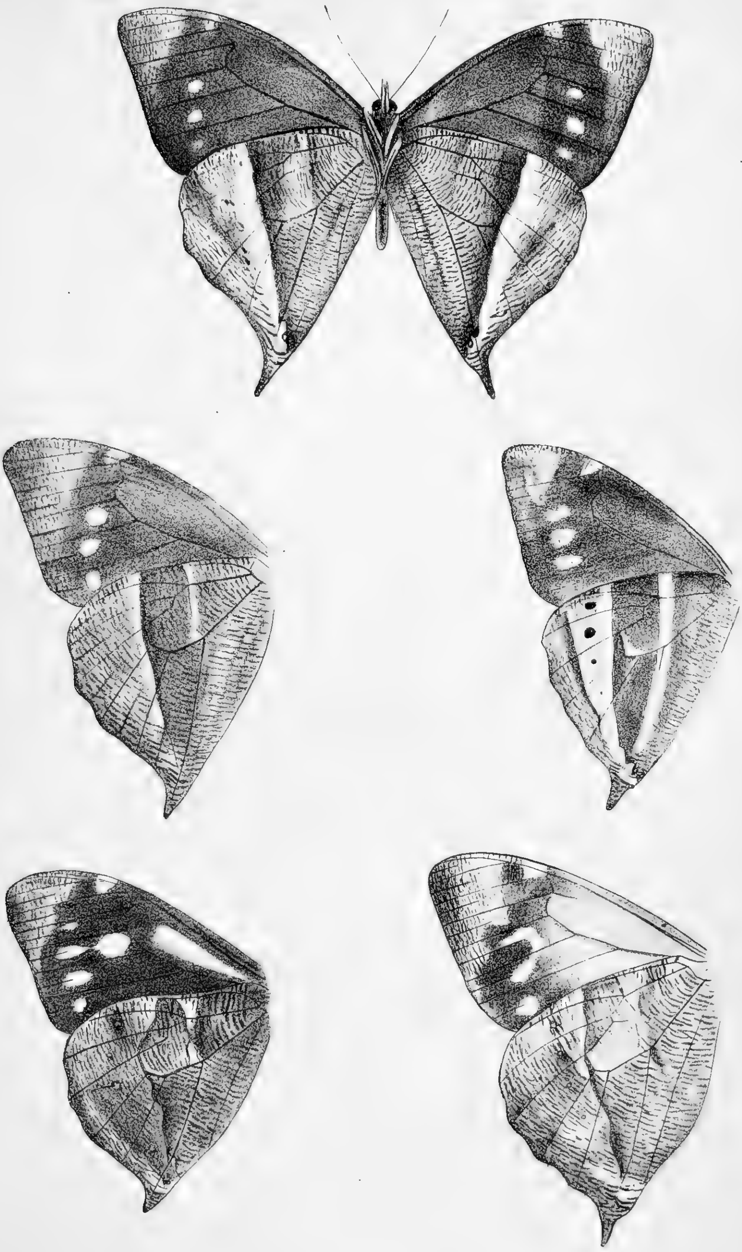
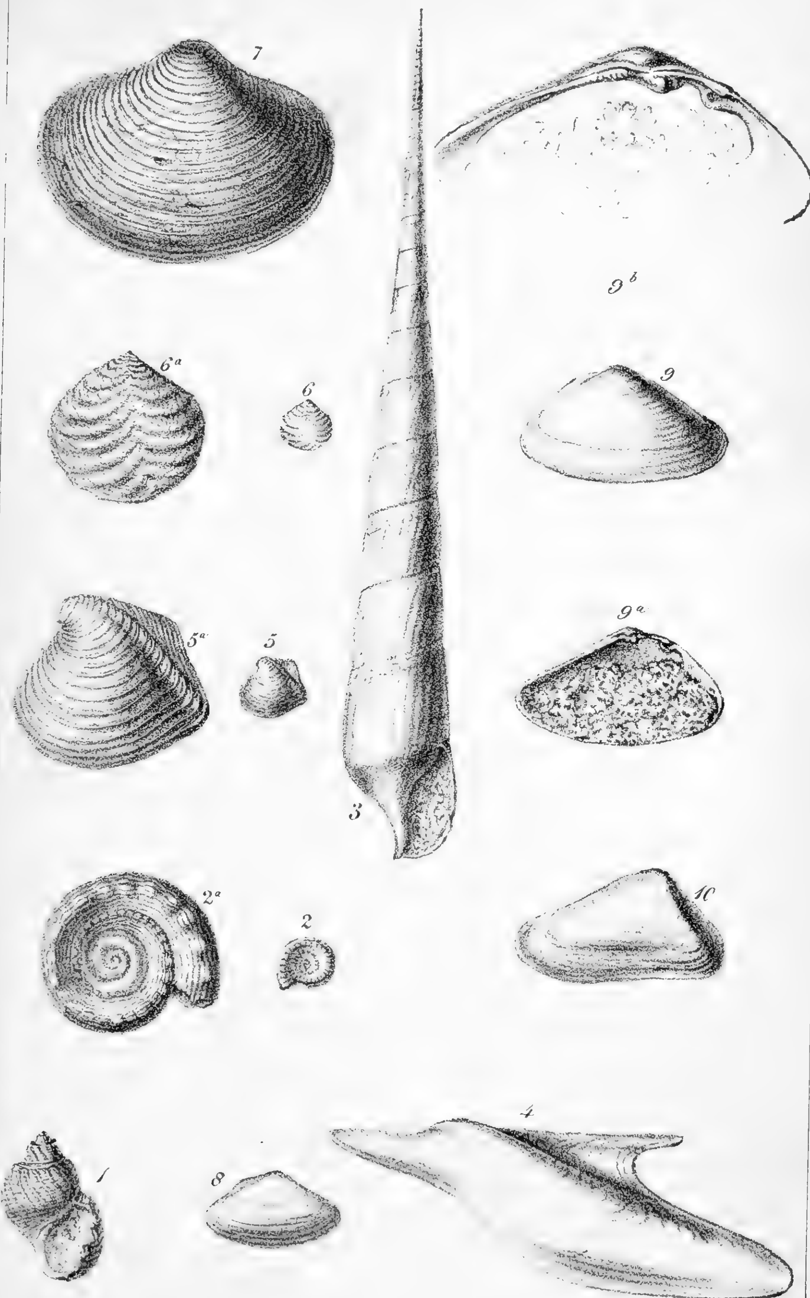
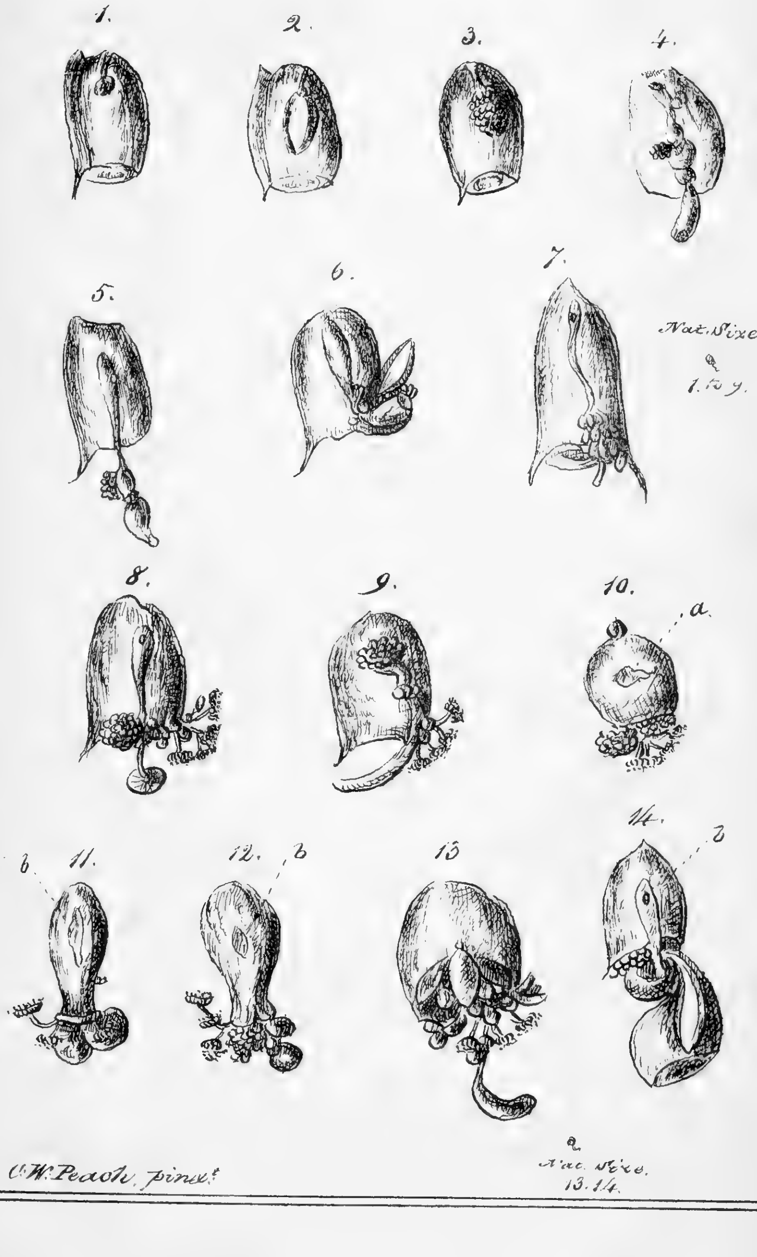


W. C. Hewitson del. et lith

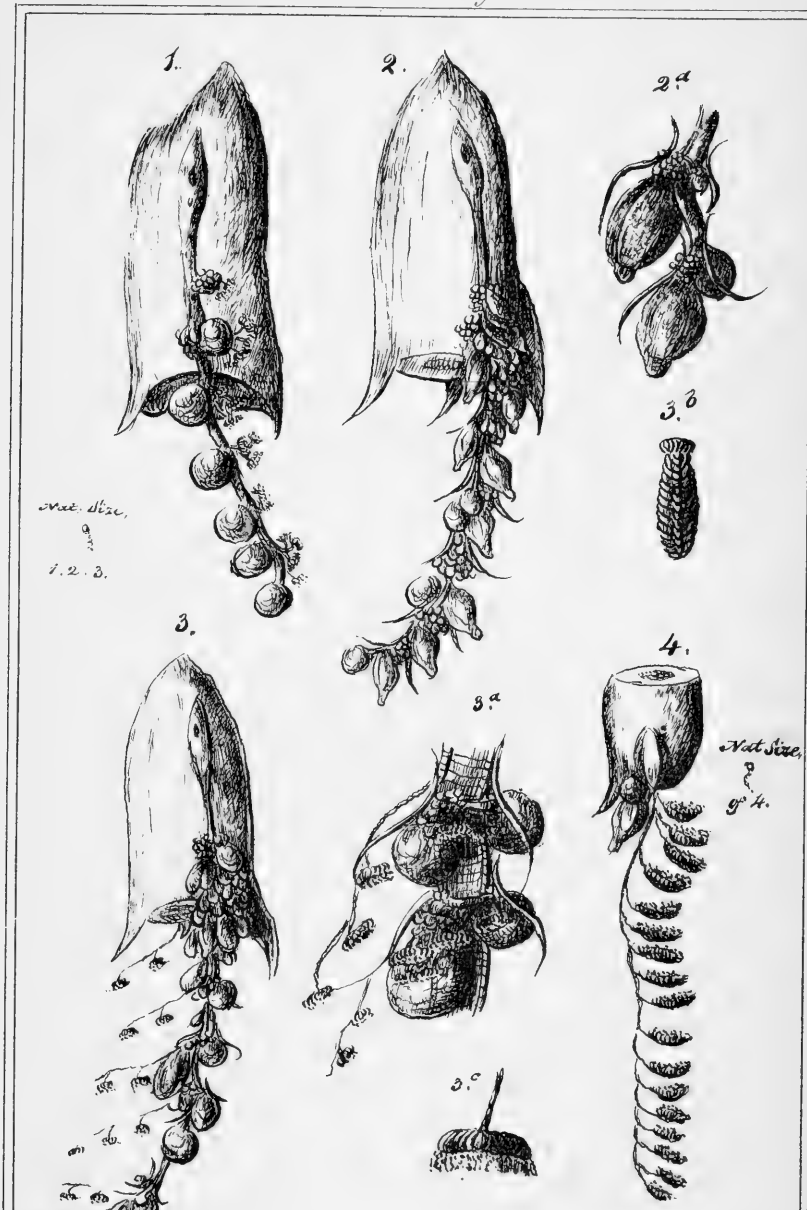


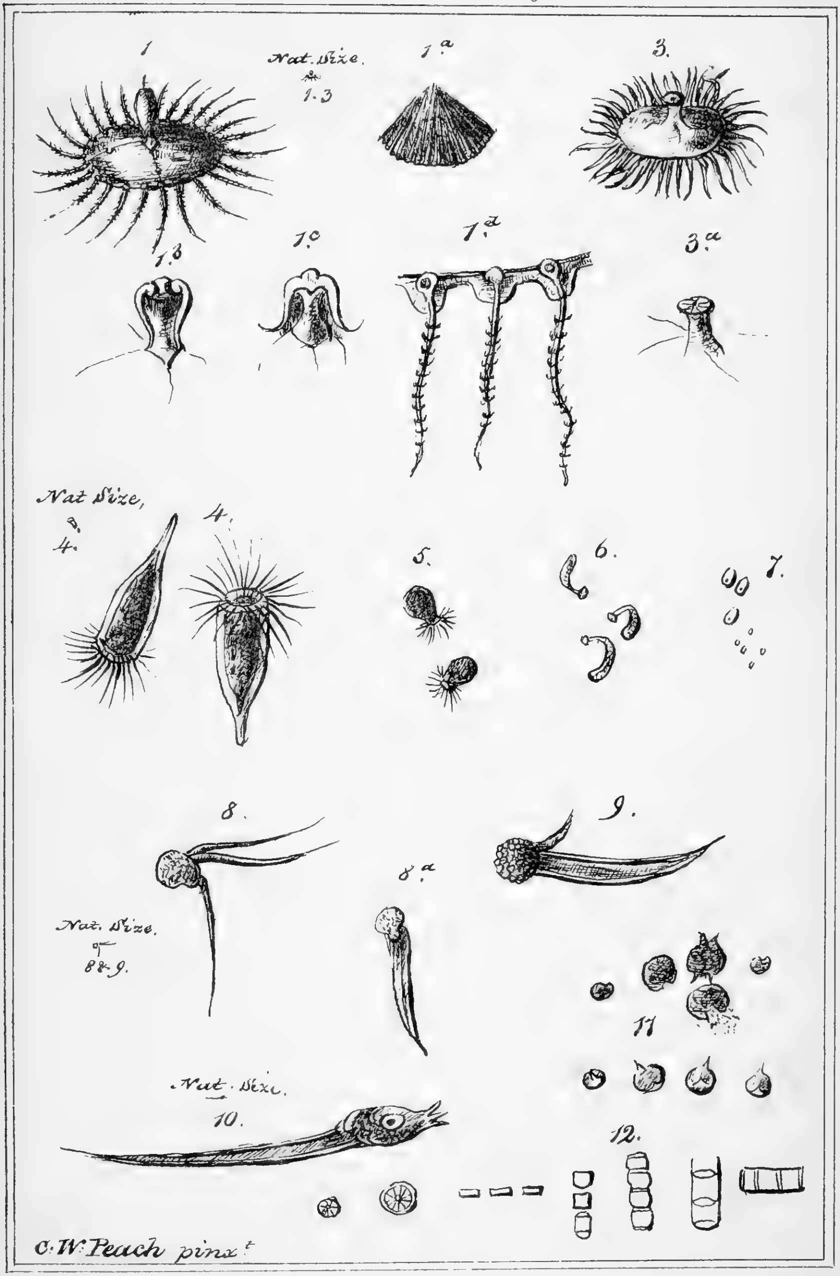
Madeley lith. 3 Wellington St. Strand

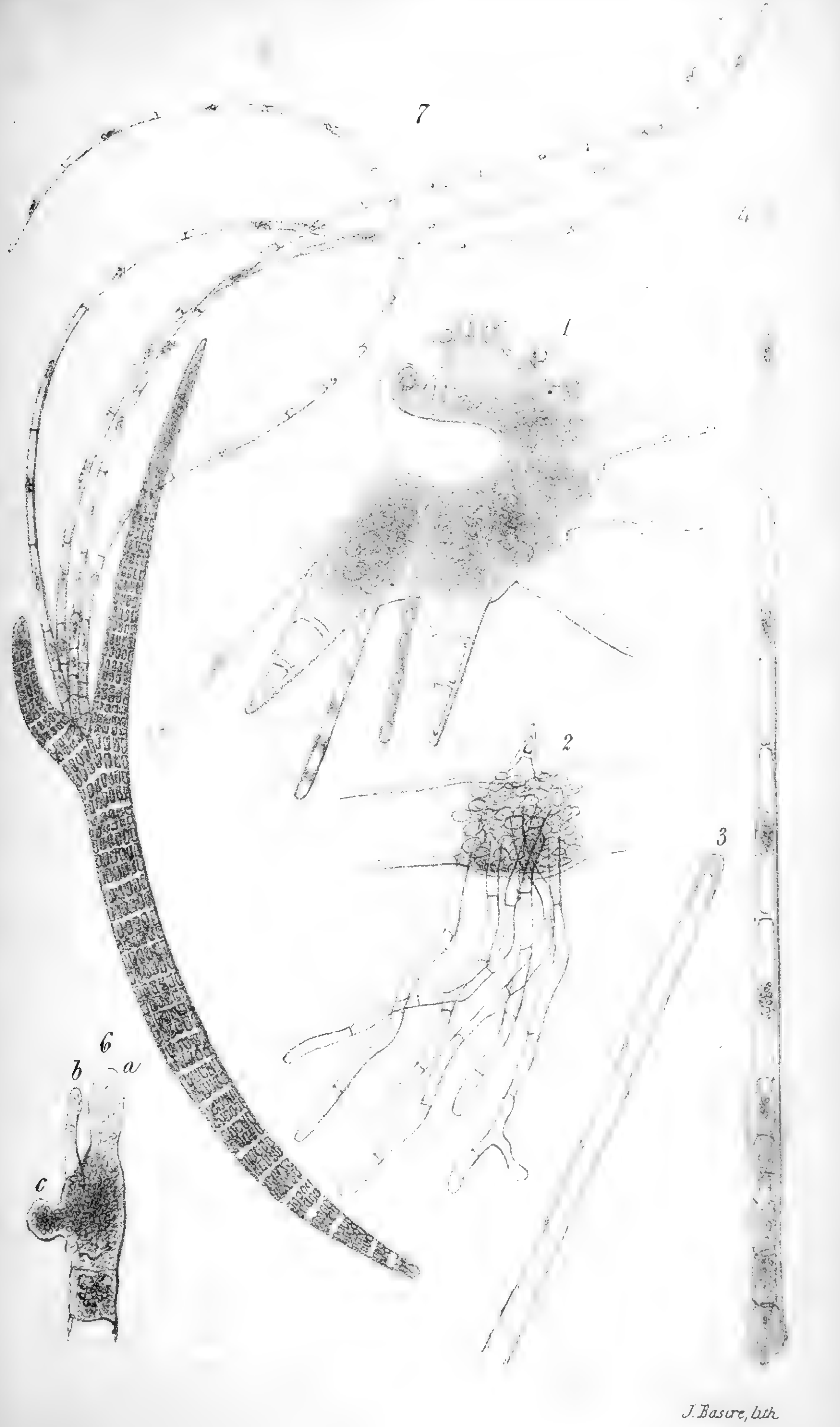
J. De C. Sowerby fec.



C. W. Peach, pinxt.


1.
2.
2.a
3.b
Nat. Size,
1. 2. 3.
3.
4.
3.a
Nat Size,
of 4.
3.c
C. W. Peach pinx.t


1
Nat. Size.
1. 3
1.a
3.
1.b
1.c
1.d
3.a
Nat Size,
4.
4.
5.
6.
7.
8.
9.
8.a
Nat. Size.
8 & 9.
11
Nat. Size.
10.
12.
C. W. Peach pinx.t


7
4
1
2
3
6
b
a
c
J. Basire, lith.

J. Basire, lith.

J. Basire, lith.

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