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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1847.

"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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ERRATA IN VOL. XIX.

Page 380, line 16 from the top, *for* obsitis *read* obsito.
for mesosternum, wherever the word occurs, *read* postpectus.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

"................ 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. 130. JULY 1847.

I.—*Biological Contributions.* By George J. Allman, M.B., F.R.C.S.I., M.R.I.A., Professor of Botany in Trinity College, Dublin, late Demonstrator of Anatomy and Conservator of the Anatomical Museum, T.C.D.

[With two Plates.]

[Continued from vol. xix. p. 370.]

No. III. *Description of a new Genus and Species of Entomostraca**.

The interesting little Crustacean which forms the subject of the present notice, though apparently extensively distributed, would seem to have hitherto received but little attention. The first recorded notice of its existence will be found in the 'Athenæum' report of the Thirteenth Meeting of the British Association for 1843, from which it will be seen that at that meeting, Mr. Patterson of Belfast mentioned the occurrence of a minute crustacean in the branchial sac of *Ascidia communis*. The fact then noticed by Mr. Patterson was at the time familiar to me, having previously obtained the crustacean in *Ascidiæ* dredged in the harbour of Glandore, county Cork, though I had not till a later period paid any attention to its structure.

In letters since received from Mr. Thompson of Belfast, to whom the little animal was well known, and from Mr. Patterson, I have obtained full information relative to the existence of the

* Read before the Royal Irish Academy, April 12, 1847.

crustacean on the coast of the north of Ireland. The latter gentleman informs me that he procured it in great abundance in July 1840, while dredging off the coast of Bangor, county Down; he thinks that nine or ten *Ascidiæ* out of every twelve dredged up were inhabited by the parasite, the number in each varying from two to six or seven.

In March 1846 I again obtained specimens of the little crustacean in the branchial chamber of individuals of *Ascidia communis* cast upon the shore of Dublin Bay. A careful examination now convinced me that it had not yet obtained a name or place in our systems, and that it was generically distinct from all hitherto described forms, a fact which the more surprised me when I reflected on its apparently extensive distribution, and the circumstance that M. Edwards, our great authority on the Crustacea, had made certain forms of the *Ascidiæ* the subject of scarcely less elaborate and beautiful research. The following characters were accordingly at once drawn out, though their publication has been deferred up to the present time.

NOTODELPHYS*.

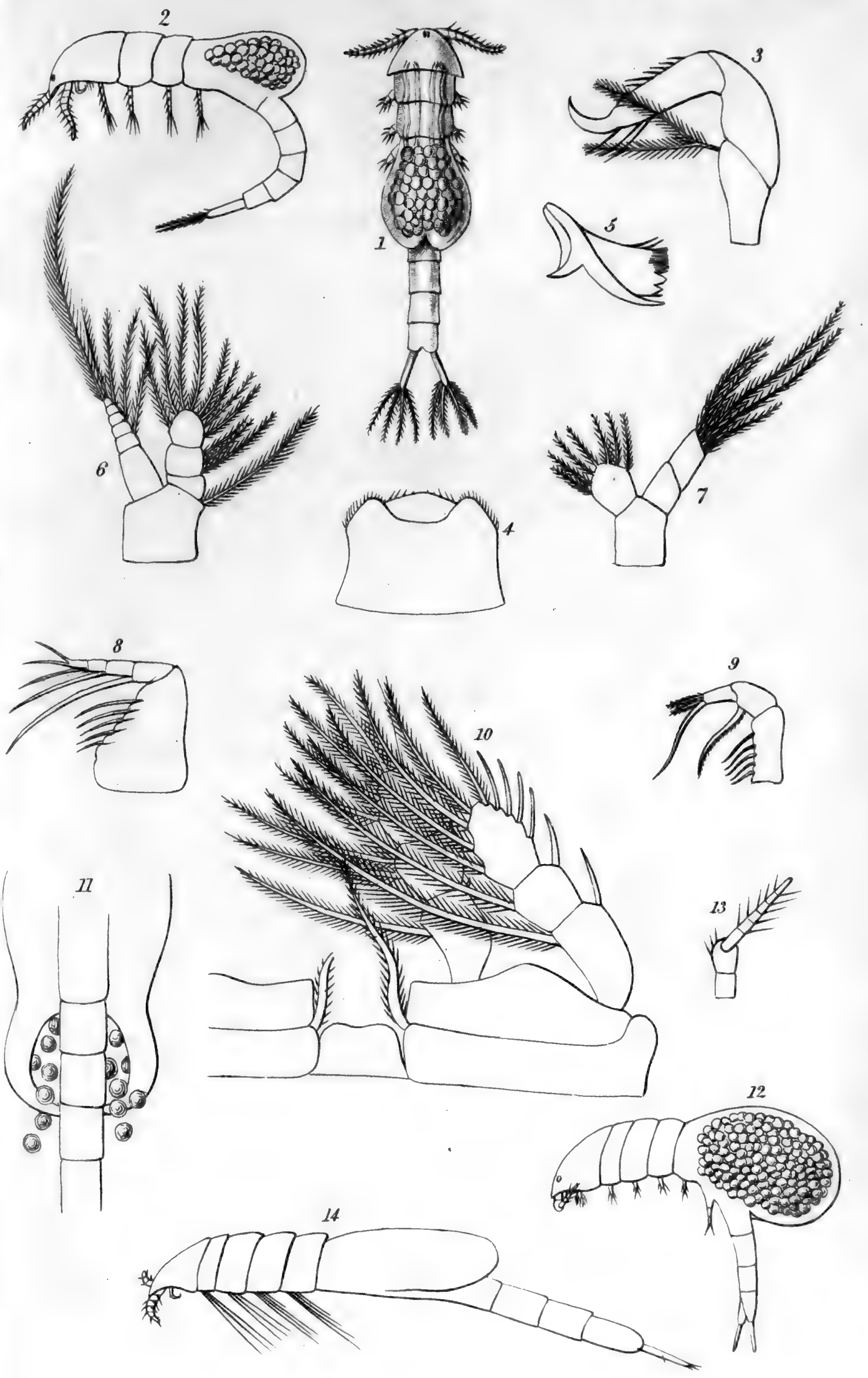
GEN. CHAR. *Body* elongated. *Head* scutiform and bearing in front a solitary median eye. *Antennæ* two, filiform, multiarticulate. *Mouth* with a pair of mandibles, and surrounded by five additional pairs of appendages, of which the anterior as well as the last two pairs are prehensile. *Thorax* having but two rings distinct, the anterior one being confounded with the head. Female with a large dorsal ovigerous receptacle immediately behind the last distinct thoracic ring. Locomotive *feet* four pairs, biramous natatory. *Abdomen* of about five rings, the last of which is terminated by two setigerous appendages.

Species unica, *N. ascidicola*. Pl. I., II.

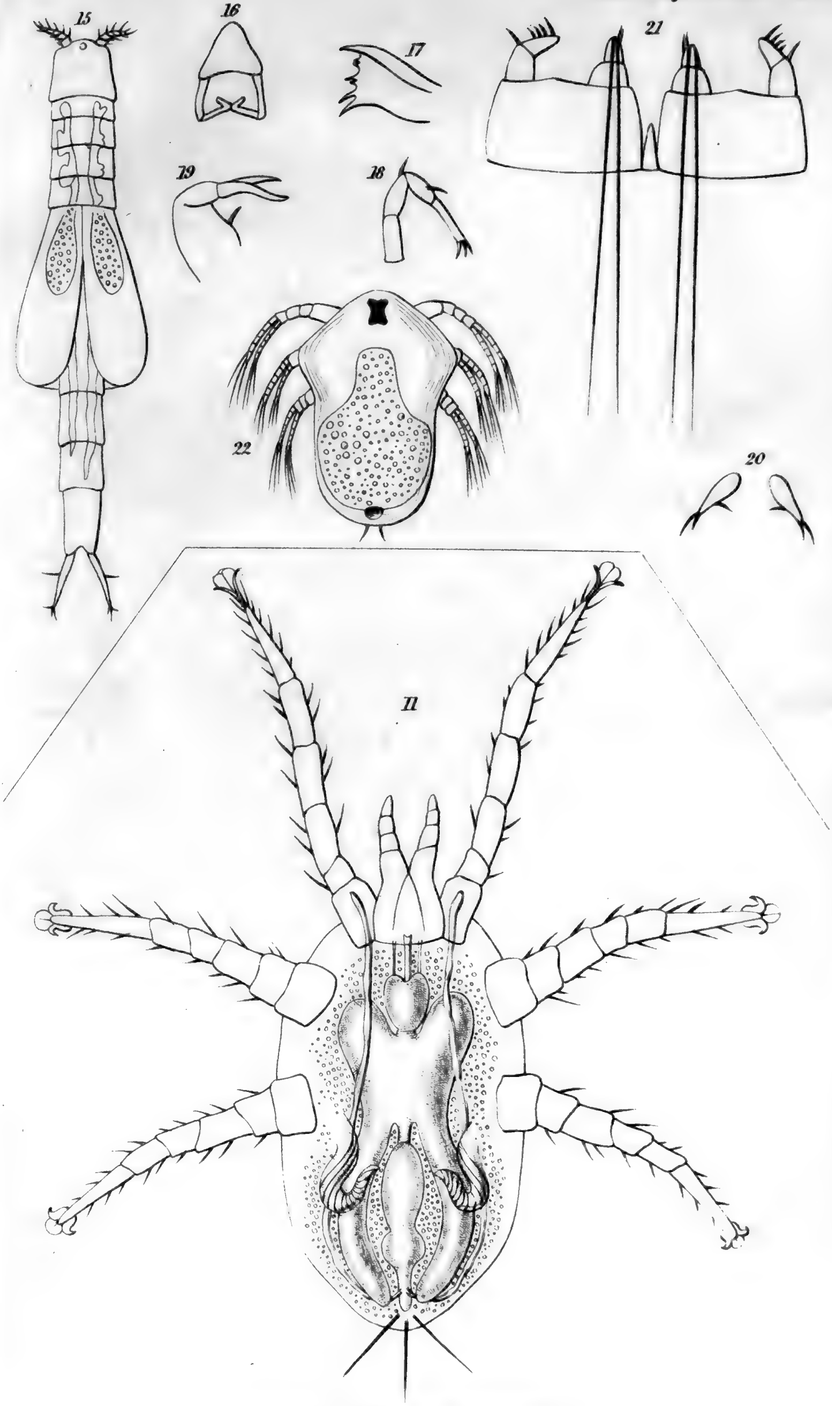
Hab. Swimming freely in the branchial sac of *Ascidia communis*. Belfast Bay, *Wm. Thompson* and *G. C. Hyndman, Esqrs.*; Bangor, co. Down, *R. Patterson, Esq.*; "found in *Ascidiæ* dredged from a muddy bottom at a depth of from fifteen to twenty fathoms in Strangford Lough, co. Down," *Wm. Thompson* and *G. C. Hyndman, Esqrs.*; in *Ascidiæ* dredged in Killery Bay, co. Galway, in 1840, *R. Ball* and *W. Thompson, Esqrs.*; Glandore Harbour, co. Cork, Dublin Bay, and Southampton water, *G. J. A.*

Notodelphys ascidicola, of which I have as yet found only females, measures somewhat less than a line in length and bears a considerable general resemblance to *Cyclops*. The cephalic segment is slightly prolonged anteriorly into a kind of beak, immediately below which is a pair of multiarticulate setigerous

* From νῶτος, *tergum*, and δελφὺς, *matrix*.



G.T.A. del. J.D.C. Sowerby sc.



Larva of Halarachne Halichœri

G. I. A. del.

J. D. C. Sowerby sc.

antennæ followed by a pair of appendages (fig. 3) composed of four joints, the terminal joint presenting itself under the form of a hooked prehensile claw, and the basal bearing at its distal extremity a double plumose seta.

Situated at a short interval behind the last-mentioned pair of appendages and occupying a position near the centre of the under surface of the cephalic segment is the mouth, covered by a largely developed upper lip (fig. 4), and guarded on each side by a strong toothed mandible (fig. 5). External to the mandibles are the first and second pairs of maxillæ. Those of the first pair (fig. 6) consist each of a flattened peduncle bearing two jointed rami which are furnished with numerous plumose setæ; upon the external ramus, one of these setæ is very large, assuming the appearance of a flagelliform appendage, and a similar, though smaller one, springs from the internal edge of the peduncle. The second pair of maxillæ (fig. 7) does not differ essentially from the first, but is smaller and not furnished with such greatly developed flagelliform setæ.

The maxillæ are succeeded by two pairs of prehensile appendages (figs. 8 and 9): each consists of a large basal joint with a terminal articulate stem; stiff setæ are carried upon the internal side of both peduncle and stem, and on the stem one or more of these becomes developed into a prehensile spine.

Behind the last-described appendages, the cephalic segment bears a pair of natatory feet resembling those which are borne upon the succeeding segments of the body.

There are altogether four pairs of natatory feet. The first of these, as just mentioned, is borne on the cephalic segment; the second and third are supported respectively on the two distinct rings which immediately follow; while the fourth is placed below the anterior end of the ovigerous region. Each of these natatory feet (fig. 10) consists of a basal lamina composed of two joints, and bearing on its distal edge two rami formed each of three flattened articulations which are copiously furnished upon their inner edge with plumose setæ; the setæ borne by the external edge are shorter and not plumose. The proximate joint of the basal lamina carries upon its inner edge a plumose spine, and it is connected with its fellow of the opposite side by an intermediate plate which renders it necessary that the motions of the basal joints of each pair of feet should be strictly in concert.

The abdomen is somewhat cylindrical, and composed of about five rings, the most posterior of which is prolonged, as in *Cyclops,* by two diverging cylindrical appendages, each of which carries upon its distal extremity four plumose setæ.

The external receptacle for the ova consists of a large dorsal sessile sac, situated between the last distinct thoracic ring and the abdomen; it is slightly lobed posteriorly, and filled with ova of a deep olive-green colour, and in the angle between it and the upper surface of the abdomen is an aperture through which the ova escape at maturity (fig. 11). As will hereafter be seen, it must be viewed as formed by the confluence along the mesial line of two pieces originally distinct. The large size of this organ and the deep colour of the contained ova render it one of the most striking features in the physiognomy of the little animal, and the contrast which it presents with the surrounding lighter tissues of the Ascidian makes the detection of the parasite a matter of no difficulty.

In company with *N. ascidicola* and differing in several important particulars from the latter as just described, I have not unfrequently met with two little Crustaceans which deserve here some attention. My belief is that they are not specifically distinct from the subject of the present notice, but must rather be viewed as immature states of this animal. In one of them (fig. 12) the antennæ (fig. 13) are geniculated, and consist of a thick peduncle, from which the terminal portion, which is subulate, multiarticulate and setigerous, passes off abruptly at an angle. The cephalic segment carries no proper feet, and the thorax presents three distinct rings with a pair of natatory feet attached to each; the fourth pair is borne as in the adult, beneath the anterior extremity of the ovigerous sac, and at a short distance behind these last is a pair of small stiliform organs terminated by setæ. The last ring of the abdomen is bilobed, and is prolonged by a pair of cylindrical appendages. The ovigerous sac is disproportionately large, and the habits of the animal are peculiarly sluggish.

The other (figs. 14 and 15) differs still more from the adult than does that just described. The antennæ are short and thick, and not geniculated. The cephalic segment, as in the last, supports no locomotive feet, while four distinct rings may be demonstrated in the thorax, each bearing a pair of biramous natatory feet, and the abdomen would appear to be composed of five segments, the last terminated as usual by a pair of cylindrical appendages. The external receptacle for the ova presents itself in this little animal as two hollow organs perfectly distinct from one another except at their origin. They appear to arise immediately behind the fourth thoracic ring, and are thence continued backwards, embracing the sides of the abdomen.

The mouth is provided with a very large labrum (fig. 16), which is prolonged anteriorly by means of a conical projection between the bases of the antennæ. The labrum conceals two strong denticulated mandibles (fig. 17), and the oral apparatus is completed by two pairs of maxillæ and three additional pairs of appendages (figs. 18—20) as in the adult; of these last, that which immediately succeeds the maxillæ (fig. 19) is well-developed and didactyle, the next (fig. 20) is rudimentary.

The proper feet (fig. 21) carry two slightly developed rami, the external of which bears some short stiff spines, and the internal is furnished with two or three remarkably long setæ not plumose, with a few short ones at their base.

The internal ovaries may be traced throughout the whole of the thoracic and a considerable portion of the abdominal region, and may already be seen forming a kind of hernia into each of the external receptacles (fig. 15).

While engaged in the examination of the first of the forms just described as immature conditions of *Notodelphys ascidicola,* I happened to witness the escape from the ovigerous receptacle of ova which were expelled through the opening already mentioned as existing in the postero-inferior part of this organ. Through the delicate transparent covering of the expelled ova, the form and motions of the embryo could be seen within, and indeed it required in many cases but a few minutes to elapse between the expulsion of the egg and the rupture of its shell by the struggles of the imprisoned embryo. The little larva (fig. 22) thus set free presented itself under the form of an exceedingly active, natatory, arachnoid animalcule with six biramous feet furnished with a pencil of setæ at the extremity of each ramus; the eye-mass, which was of a bright ruby colour, was well-developed, and had the appearance of being formed by the confluence of four distinct ocelli, and the little creature presented altogether a close resemblance to the young of *Cyclops.*

If I am correct in my opinion as to the nature of the different forms now described, we have, during the progress of development of *N. ascidicola* from the first rupture of the egg, four distinct phases; that a greater number exist there can be little doubt, but at least four well-defined forms can with certainty be demonstrated.

The first (fig. 22) is characterized by an absence of distinct segmental division; only three pairs of feet have as yet appeared; these exhibit no appearance of the lamellar character, so striking in the more advanced phases; and the intermediate plate not being yet developed, there would seem to be no mechanical obstacle to the feet of opposite sides acting independently of each other. The eyes are well-developed and already confluent, there is no trace of antennæ, and we have altogether a form which strongly suggests the *acaridan* type of the *Arachnida.*

Between this first stage of the larva and the next in point of development which I have had an opportunity of witnessing, a most striking progress has taken place. It is however almost certain that there are intermediate stages which I have not yet succeeded in detecting. Be this as it may, the creature has now (figs. 14—21) assumed the essential form of the adult, the division of the body into segments is complete, the antennæ have appeared, the mouth with its lip, mandibles, maxillæ and accessory appendages, have acquired nearly their mature condition, and four pairs of true feet are present, the head is quite distinct from the thorax, which presents four distinct rings, and the abdomen exhibits five rings and the terminal appendages. The internal ovaries are developed, and the external receptacles are present, but as yet distinct, showing no tendency to coalescence except at their origin. The true feet have assumed a lamellar condition, the rami however are but slightly developed, and the pencil of long bristles with which the internal ramus is furnished suggest to us the feet of certain *annelides*. As the intercoxal plates have begun to develope themselves, the legs of opposite sides must now act simultaneously. The habits of the animal are remarkably sluggish, and all its motions, as well indeed as its general physiognomy, remind us strongly of an *annelidan*.

In the next stage (figs. 12, 13), the progress of *consolidation* has become manifest, thus presenting us in this respect with a retrocession towards the early condition of the larva. The head continues distinct from the thorax, but the fourth thoracic ring is confounded with the posterior region of the body. The ovigerous receptacles have now become united along the mesial line, and are loaded with ova. The motions are still sluggish.

In the final stage (figs. 1—11) the progress of consolidation has still further advanced, the head has become inseparably united with the first thoracic ring, so that but two segments are now distinct in the thorax. The creature is natatory, and eminently active.

The high development of the reproductive system in the second and third of the phases just described may appear opposed to the opinion here expressed, that these are animals in an immature condition. The objection however will lose all its validity when we recollect that innumerable recent observations go to prove that the exercise of the generative function is by no means necessarily confined to the adult state. Whether however we do or do not admit the specific identity of all the forms now described, it is certain that they present us with a series of phases in progressive development; and the light thus thrown upon the morphology of *Notodelphys ascidicola* is almost entirely the same, whether we view them as different ages of a single species, or as permanent or transitory conditions of several species.

General Considerations.

As to the exact zoological position of our little crustacean, it is manifest that it possesses very marked affinities with *Cyclops*, while the dorsal situation of the receptacle for the ova presents an analogy not to be overlooked with the other entomostracan forms of *Daphnia, Cypris* and their allies. Its parasitical habits, and the form of the appendages which immediately succeed to the antennæ, as well as its general conformation, would seem to approximate it to Nordman's genus *Ergasilius*. From this suctorial parasite, however, the structure of its mouth will widely separate it. Indeed it is perhaps hardly just to consider *N. ascidicola* as truly a parasite; its habits in this respect would seem to bear to those of other Entomostraca the same relation which is found to subsist between the habits of *Pinnotheres* and those of the generality of Decapods.

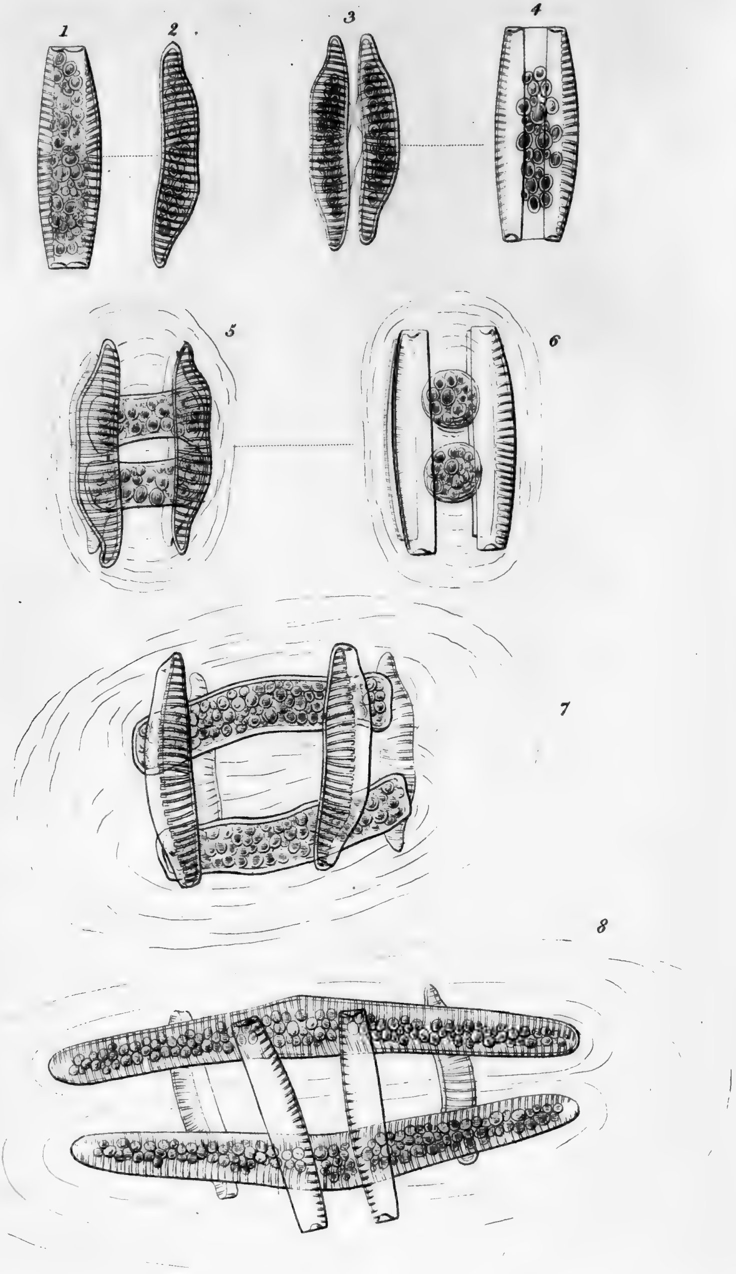
The condition of the external receptacle for the ova I believe to be one of the most remarkable peculiarities of the present genus, and to be much more interesting than it may at first sight appear. To this conclusion I have arrived from the conviction, that the organ in question is of a totally different nature from the external egg-bearing pouches in *Cyclops* and its kindred forms; that while such pouches are only a portion of the membrane of the true ovaries pushed outwards by the ova in the act of extrusion, and finally allowing the escape of these by rupture, the ovigerous receptacle in *Notodelphys* is the result of a certain development of the superior arch of one or more of the posterior thoracic rings expanded posteriorly and laterally so as to form a kind of carapace destined for the protection of the eggs. I believe it to be in every respect the representative of the singular elytroid dorsal appendages to the thorax in *Anthosoma, Cecrops,* and certain other suctorial crustacea. In one of the early stages of our Entomostracan, indeed, we may see at each side the true ovarian pouches (the real representatives of these appendages in *Cyclops*) projecting under cover of the organ we are now considering; the pouches then either continue to increase by gradual protrusion till they fill the entire chamber prepared for their reception, or else, becoming soon ruptured, discharge their contained ova into the surrounding space, from which, after having undergone there during a limited period a certain incubatory action, these ova finally escape through the definite opening already mentioned, without in any degree necessitating the rupture of the walls of the ovigerous chamber, such as must unavoidably occur in the closed pouches of *Cyclops*, &c.

It is not easy to determine with certainty the exact elements which enter into the composition of the ovigerous receptacle, whether the whole of the dorsal arch is to be found in it or only a part. From an examination however of what I look upon as the corresponding organs in the suctorial Crustacea, I am of opinion that it is composed exclusively of the epimeræ, which in consequence of the non-development of the tergum become confluent in the mesial line of the back, presenting in one of the early phases, as we have already seen, their original distinctness.

The genus *Notodelphys* thus presents us with a most interesting transitional form between the true Entomostraca and the suctorial Crustacea. Its perfect mandibulate mouth will at once place it with the former, a position indeed which its highly developed natatory feet and active habits as well as its general physiognomy would in the first instance suggest. The form, on the other hand, of the accessory oral organs or maxillary feet, which are here constructed so as to constitute organs of attachment, as well as the singular development of the dorsal arch of the posterior thoracic ring, and the connection of the feet of opposite sides through the intervention of a large intercoxal plate—a striking feature in the greater number of the suctorial Crustacea and not found in the Entomostraca—unite with the semiparasitical habits of *Notodelphys* in indicating an affinity not to be mistaken with the true suctorial tribes.

In the whole of the description now given it has been thought most convenient to adhere to the terminology in ordinary use, though the researches of Erichson (Entomographien) have in many particulars altogether disproved its correctness. The thorax, for instance, according to the philosophic views of this naturalist, consist throughout the three classes of Insecta, Arachnida and Crustacea, invariably of three segments and no more, but these often so consolidated with one another and with the neighbouring segments, as to render it necessary to have recourse to indirect indications in order to determine the real composition of the part. Erichson has moreover shown that the true abdomen among the Crustacea includes several segments, hitherto incorrectly supposed to belong to the thorax, and that it is for the most part divisible into two very distinct regions, an anterior and a posterior. To reduce the Entomostraca to the type of Insecta is believed by Erichson to be one of the most difficult problems in zoology. In attempting its solution he maintains the consolidation of the head with the thorax, and adopts the singular though apparently correct opinion, that the anterior pair of thoracic legs is invariably placed before the mouth.

In applying these original and philosophic views to the determination of the true import of the various parts in the Entomostracan which forms the subject of the present paper, we will have the first pair of thoracic legs represented by the prehensile appendages which immediately succeed the antennæ; behind these is the mouth with its mandibles and first and second pair of maxillæ, and then come two pairs of prehensile appendages, which are the second and third pairs of thoracic legs; all the



G.H.K.T. del.t J.D.C.S. sc.

three thoracic segments therefore are here blended with the head, but we likewise find the cephalic region supporting a pair of true locomotive feet, which are the first pair of abdominal appendages; the first abdominal ring therefore is also in the present instance inseparably united with the head. The next two distinct rings are the second and third of the abdomen, each with its pair of natatory feet; the fourth abdominal ring carries also a pair of natatory feet, but becomes indistinct at its posterior margin. Here commences the great ovarian chamber, behind which is the posterior region of the abdomen with its five distinct rings and terminal setigerous appendages.

EXPLANATION OF PLATES I., II.

Plate I.

Notodelphys ascidicola.

Fig. 1. *Notodelphys ascidicola* magnified and viewed from above.
Fig. 2. The same viewed in profile.
Fig. 3. *Accessory oral appendage* of the first pair.
Fig. 4. *Labrum.*
Fig. 5. *Mandible.*
Fig. 6. *Accessory oral appendage* of the second pair (*maxilla* of the first pair).
Fig. 7. *Accessory oral appendage* of the third pair (*maxilla* of the second pair).
Fig. 8. *Accessory oral appendage* of the fourth pair.
Fig. 9. *Accessory oral appendage* of the fifth pair.
Fig. 10. One of the *natatory feet.*
Fig. 11. *Ovigerous chamber* viewed from below in order to show the aperture for the escape of the ova.
Fig. 12. One of the *immature phases* of *N. ascidicola.*
Fig. 13. *Antenna* of this phase.
Fig. 14. *N. ascidicola* in a still earlier stage of development.

Plate II.

Fig. 15. The same viewed from above.
Fig. 16. Its *labrum.*
Fig. 17. One of its *mandibles.*
Fig. 18. One of the *appendages* immediately succeeding the antennæ.
Fig. 19. One of the penultimate pair of *accessory oral appendages.*
Fig. 20. One of the last pair of *accessory oral appendages.*
Fig. 21. A pair of *true feet* in this stage.
Fig. 22. *Larva* as it appears on escaping from the ova of fig. 12.

II.—*On Conjugation in the* Diatomaceæ. By G. H. K. Thwaites, Lecturer on Botany and Vegetable Physiology at the Bristol Medical School.

[With a Plate.]

To the Editors of the Annals of Natural History.

Gentlemen, 2 Kingsdown Parade, Bristol, May 11th, 1847.

It gives me great pleasure to be able to announce through the medium of your valuable journal the very interesting discovery

I have just had the good fortune to make, of *Eunotia turgida*, Ehrh., a species belonging to the natural family *Diatomaceæ*, in a state of conjugation,—a discovery which is valuable as proving that a relationship of affinity, as well as of analogy, exists between the *Diatomaceæ* and the *Desmidieæ* and *Conjugateæ*, and which will help to settle the question as to whether the former are to be referred to the animal or the vegetable kingdom.

The *Eunotia turgida* is not very uncommon in ditches, and is generally attached by its concave surface to the filaments of various freshwater Algæ. Plate IV. fig. 1 is a magnified view of this surface, and fig. 2 represents the side-view of a frustule. The process of conjugation in this, as in the species of the natural family *Desmidieæ*, consists in the union of the endochrome of two approximated fronds, this mixed endochrome developing around itself a proper membrane, and thus becoming converted into the sporangium. In a very early stage of the process the conjugated frustules of the *Eunotia* have their concave surfaces in nearly close apposition (fig. 3), and it may be observed, that from each of these surfaces two protuberances arise which meet two similar ones in the opposite frustule: these protuberances indicate the future channels of communication by which the endochrome of the two frustules becomes united, as well as the spot where is subsequently developed the double sporangium, or rather the two sporangia. A front view of the conjugated frustules at the same period (fig. 4) shows each of these to have divided longitudinally into two halves, which, though some distance apart, are still held together by a very delicate membrane, that however soon disappears.

The mixed endochrome occurs at first as two irregular masses between the connected frustules, but these masses shortly become covered each with a smooth cylindrical membrane—the young sporangia (figs. 5 & 6)—which gradually increase in length, retaining nearly a cylindrical form, until they far exceed in dimension the parent frustules (fig. 7), and at length when mature become, like these, transversely striated upon the surface (fig. 8). Around the whole structure a considerable quantity of mucus has during this time been developed by which the empty frustules are held attached to the sporangia.

I may add, that in a species of *Gomphonema*, allied to *G. dichotomum*, I have observed the first appearance of conjugation, which I hope to be able to trace to the perfect development of the sporangia.

I am, Gentlemen, your very obedient servant,

Geo. H. K. Thwaites.

June 12, 1847. Since my last communication on the subject of the *Diatomaceæ,* I have succeeded in detecting the mature sporangia of the *Gomphonema* therein mentioned, as well as those of *Gomphonema minutissimum,* Ag., and *Cocconema lanceolatum,* Ehrh. In these three species each conjugated pair of frustules gives origin to two subcylindrical, somewhat fusiform, transversely striated sporangia, which lie in a direction parallel to the empty frustules instead of across them, as in *Eunotia turgida.*

Around each conjugated pair of frustules is at first developed a considerable quantity of firm mucus or gelatine, which however gradually disappears as the sporangia become mature. The presence of this mucus affords the readiest means of detecting the conjugated state of *Gomphonema* and *Cocconema,* which is likely to escape observation owing to the great resemblance of their sporangia to frustules, especially to those of *Cocconema*: this resemblance is so striking in *Cocconema lanceolatam,* that the principal apparent difference between the sporangia and the frustules of this species consists in the far larger size of the former.

III.—*Notice of Plants collected in the line of the Rideau Canal, Canada West.* By Philip Whiteside Maclagan, M.D., Royal Canadian Rifle Regiment *.

The plants were collected in May 1843 on the line of the Rideau Canal. This great work, which commences at Bytown on the Ottawa and terminates near Kingston on Lake Ontario, was constructed several years ago by the Royal Engineers in order to obviate the disadvantages of the frontier route from Upper to Lower Canada. Its length is 137 miles, but like our own Caledonian Canal its course is naturally marked out by a string of lakes and rivers, so that the extent of actual *canal* is very small, but there is a very extensive series of large locks and dams for rendering the shallow streams connecting the lakes navigable. The summit level of the canal is 290 feet above Bytown, so that there is not sufficient elevation to affect the character of the vegetation; but in other respects there is sufficient variety in soil and situation to produce a good deal of diversity in the botany of the different stations on the line. As I happened to be passenger in a very slow steamer which occupied nearly four days in the transit, I had an opportunity of examining a good deal of the country, and on several occasions, by walking on from one lock to the next, collected a good many plants before the vessel came up. The points which I examined most minutely were—Smith's Falls, about half-way between Bytown and Kingston; the Isthmus and Davies's Locks some miles further on; Jones's Falls,

* Read before the Botanical Society of Edinburgh, May 13, 1847.

thirty miles north of Kingston; and Kingston Mills, within five miles of the latter town. At Bytown itself, although the banks of the Ottawa appear very promising, I could do little in the way of collecting. *Cupressus thyoides* was then new to me, and the common Juniper is abundant, but except these and one or two *Carices*, nothing of interest occurred. The prevailing rock here is a compact limestone with numerous large granite boulders on the surface.

For the first fifty or sixty miles from Bytown the line of canal is extremely uninteresting, passing through what is called drowned land, where the original forest has been killed by the damming up of the Rideau river. Nothing can be conceived more melancholy than the aspect of these extensive tracts of dead trees still erect, but devoid of bark and leaves. I do not know that the cause of death in these so-called drowned lands is well-ascertained, for one would hardly *à priori* anticipate that the immersion of a tree in water to a depth of three or four feet would prove fatal. The process of decay too, so far as I have seen, appears to be unusually rapid, especially as compared with what takes place after a tree has been killed by burning or girdling, *i. e.* removing a ring of bark near the ground. It was gratifying after passing two days of this dismal country to be allowed two or three hours' collecting among the woods near Smith's Falls —a large village in the Bathurst district. In a damp and rich wood there was a profusion of *Dentaria diphylla, Panax trifolium, Mitella diphylla,* and *Erythronium americanum. Mitella nuda,* a small delicate species, occurred on a mossy rock; and in drier portions of the bush, *Phlox divaricata, Pedicularis canadensis, Trillium erectum, Trientalis americana* and *Waldsteinia fragarioides* occurred in plenty. The form of *Trillium erectum* which I found was constantly the dark purple variety, nor have I observed any other in Canada. *Trientalis americana* is hardly to be distinguished from the European species except by the more acute form of both the leaves and petals; though it is possible that discriminating characters might be found on a more minute comparison of the two plants than I have been able to institute. *Waldsteinia fragarioides* appears to be rather a local species. I have never seen it either in Upper or Lower Canada except in the Kingston district. *Convallaria racemosa* and *pubescens* were found sparingly near Smith's Falls; *Asarum canadense* in its favourite habitat, the darkest recesses of the wood, among rich black mould; and *Actæa alba* and *Leontice thalictroides* in broken ground about the margin of the bush. Both these last species are popularly known under the name of *Cohoosh*—the former *white* and the latter *blue.* Blue cohoosh is in some parts of the province a popular remedy in acute rheumatism. The season was too early for collecting aquatic plants. *Menyanthes trifoliata* and *Caltha palustris* were sparingly in flower. *Viola cucullata* and *Viola blanda,* both frequenting moist ground, were abundant everywhere, and there is likewise a pubescent variety of the former species on dry ground, the *V. congener* of some authors. Four other violets were picked in various situations around the village—*V. rostrata, V. pubescens, V. canadensis* and *V. Mullenbergii,* the latter nearly allied to *V. canina.* A few stunted trees of *prickly ash, Zanthoxylon americanum,* were observed just coming into flower, and this with the *Antennaria plantaginifolia* and *Aspidium marginale* nearly completes the list of my evening's gatherings. The rock at Smith's Falls appears to belong to the same series as that at Bytown—a member of the Silurian group. But a few miles further on, the primary rocks, granite, &c., appear, and at the Rideau and Indian lakes give quite a new character to the landscape. Several new plants likewise appear at the "Isthmus" and at Davies's Locks which serve to unite two of the lakes. *Corydalis glauca,* both here and at Kingston Mills, seems to confine itself entirely to the granite, but the other species here observed, e. g. *Saxifraga virginiensis, Aquilegia canadensis,* and the beautiful little *Polygala paucifolia,* are not so particular. Here too I picked a species of *Turritis* which appears to come nearest to *patula,* though not entirely accordant with the character of that species. The siliquæ when I gathered it were rather depending than patulous, but after being confined in the vasculum for some hours they became nearly erect. It appears to me quite possible that some of the species of this section, whose characters depend very much on the direction of the seed-vessel, may ultimately prove to be not really distinct.

At Jones's Falls, where I remained upwards of an hour, the most striking plant was *Clematis verticillaris,* a handsome flowered species ascending the trees and rocks to a height of twenty or thirty feet. On a bare clay bank I observed a violet not elsewhere seen by me in Canada, which appears to be *V. ovata* of DeCandolle, which Torrey and Gray make a variety of *V. sagittata.* It presented a character unnoticed by these authors, viz. having the peduncles (previously erect) closely prostrate after flowering. A small variety of *Cardamine hirsuta* also grew there which is the *C. virginiana* of some authors, and may perhaps be a distinct species. *Hippophaë canadensis* appears to have a marked liking for the neighbourhood of waterfalls, this being the third or fourth such situation in which I have seen it, and here it grows in profusion along with *Ribes Cynosbati* and *floridum,* a species nearly allied to our common black currant. One of the few grasses in flower at this early season, *Urachne asperifolia,* is rather a rare one, and the only other which I procured was

Milium pungens of Torrey. *Asplenium melanocaulon* closely resembling our *A. trichomanes* occurred here, and at several other places in crevices of the rocks.

Kingston Mills, the last station on the canal to which I referred, was not examined at all at this time, but as during a subsequent residence at Kingston in 1845-6, I had frequent opportunities of collecting in that neighbourhood, I mention the more interesting results here to render the account of the district more complete. At Kingston Mills the canal is carried through a deep glen, surrounded by rounded hills of granite protruding through the limestone strata, and then unites with the Cataragui river, a broad, sluggish stream with extensive marshy banks which bear a profusion of *Acorus Calamus.*

On one of the southern declivities of the granite with a very scanty covering of soil, the *Corydalis glauca* reappears in great profusion and beauty, accompanied by *Silene antirrhina, Aspidium rufidulum* and *Polygonum cilinode,* a remarkable species sending long runners to a distance of ten or twelve feet over the rocks. *Arabis hirsuta, Lepidium ruderale* and *Turritis stricta* were found more sparingly in the same situation. In the damp valley itself, among the under brush composed of *Loniceræ* and *Ribes prostratum, Cornus canadensis* with *Anoplon biflorum* made their appearance. The latter, the *Orobanche uniflora* of older authors, occurs very sparingly; and of another uncommon species, the *Ranunculus fascicularis,* I only observed one small patch.

From this catalogue it will be observed that the vegetation of this district (which lies in about 76° W. longitude and between 44° and 45° N. lat.) resembles much more that of the lower or eastern than of the upper section of the province; and the rarity as well as the poor appearance of the *Podophyllum peltatum* and *Zanthoxylon americanum,* when they do occur—species abundant in Western Canada—show that they nearly reach their northern and eastern limit at the Rideau Canal.

IV.—*Description of two new species of* Carabus *from Asia.* By T. Tatum, Esq.

Carabus lithariophorus.

Entirely of a bright jet-black. *Head* rather large and smooth, with two deep indentations between the antennæ. *Palpi* with the extreme joints strongly securiform. *Antennæ* long and tapering, the last seven joints of a rusty brown colour. *Thorax* broad, rather flat and smooth except near the lateral and posterior margins, where it is thickly marked with punctures; the median furrow strongly defined; the edges slightly elevated; anterior and posterior margins square; sides convex before, concave behind, giving a somewhat heart-shape to the thorax; anterior angles rounded; posterior acute and slightly produced outwards as well as backwards, giving considerable width to the posterior part of the thorax. *Elytra* oval, convex, tapering towards the base as well as the extremity; on each, three longitudinal rows of elevated oval tubercles; occasionally two or three run into one another, producing a continuous ridge; the rows of tubercles are separated from each other, from the suture and from the external margin, by treble rows of small elevations or granules of various sizes. Length 1 inch $5\frac{3}{4}$ lines.

Hab. Mussoorie in the Himalayas. In coll. of Brit. Mus. and T. Tatum.

The general aspect of this *Carabus* is like a *Procrustes*: the sculpture on the elytra resembles that of the *Carabus Lafossei* described by the Baron Feisthamel in the 'Ann. Soc. Ent. France,' 2nd series, p. 103. t. 2. f. 1 & 2.

Carabus monilifer

somewhat resembles the preceding species in size, form and sculpture of the elytra. The *head* is smaller and studded with minute punctures. *Thorax* much smaller, its anterior and posterior margins slightly concave; sides less sinuous, and posterior angles less produced; margins slightly elevated; the surface like the head finely punctured, convex; median furrow obsolete, and on either side of this line, and near to posterior margin, a slightly elevated tubercle. Form of *elytra* as in the preceding species: the three rows of tubercles smaller, flatter, and more regular in size and form; between each row, and also near the suture and external margin, a single row of smaller tubercles, also more regular than in the former insect, and the entire spaces between the tubercles studded with punctures, giving a fine granulated appearance to those parts. The colour is a less decided black than *C. lithariophorus,* with slight tints of bronze, both on the thorax and on the margins of the elytra. Length 1 inch $3\frac{1}{2}$ lines.

It was found by A. Adams, Esq., during the voyage of H.M.S. Samarang in the Eastern Seas, in the Corean Archipelago. In coll. of Brit. Mus.

V.—*Additional Notices of British Shells.* By J. Gwyn Jeffreys, F.R. & L.S.

Since the publication in the 'Annals' for May of my notices of shells new to Great Britain or interesting by reason of their locality, the following species and memoranda have occurred to me.

The *Orbis foliaceus* appears not to belong to the Mollusca, but to the Foraminifera, although the shell is not concamerated.

Peracle (Forbes) *Flemingii*. *Fusus retroversus*, Flem. Wern. Mem. iv. 498. pl. 15. f. 2. *Peracle physoides*, Forbes, Report on Ægean Invertebrata, Brit. Assoc. Rep. 1843, p. 132? A single specimen occurred to Mr. Barlee and myself while dredging this month off Skye in about fifty fathoms water.

Bulla strigella. *Cylichna strigella*, Lov. Ind. Moll. Scand. p. 10. A broken specimen was received by Mr. Barlee from Loch Fyne. The markings and form are very characteristic, and distinguish it from any other species.

The *Bulla truncatula* of Philippi appears to be the *Cylichna nitidula* of Lovén.

Rissoa labiosa, var. *Helix labiosa*, Mont. p. 400. t. 13. f. 7. *Rissoa elata*, Phil. vol. ii. p. 124. t. 23. f. 3? Loch Fyne (a single specimen), and also at Tenby.

Rissoa soluta. *Melania* (?) *soluta*, Phil. vol. ii. p. 121. t. 24. f. 1. Loch Fyne; a single specimen.

Rissoa striatula, n. s.

Testa subcylindrica, scalariformis, teres, alba, nitidula, subpellucida, striis exaratis confertis transversim cincta. Anfractus 5, obliqui, rotundati, ultimus reliquam testæ exsuperans, sutura profunda divisi. Apex obtusus. Apertura ovalis, fere tertiam partem testæ subæquans, superne subangulata, ad basim rotundata et subeffusa. Peristoma simplex, continuum, columellæ adnatum. Umbilicus vix ullus, angustissimus. Long. $\frac{1}{8}$, lat. $\frac{1}{20}$ unc.

Rissoa pulchra, Forbes, Brit. Assoc. Rep. 1843, p. 189? Cork Harbour and other parts of the Irish coast. It somewhat resembles in appearance the *R. vitrea* (with which Mr. Alder has identified it in the 'Annals' for 1840, p. 328), but it is distinguishable by its more slender form, the volutions not being so ventricose, nor the suture so deep, and the aperture not being so rounded, but above all by the elegant close-set striæ which encircle each volution.

Odostomia eulimoides, n. s.

Testa ovato-oblonga, solidula, nitida, longitudinaliter sub lente striatula, alba. Anfractus 7, planiusculi, sensim increscentes; ultimus reliquam testæ aliquantulum exsuperans et in medio subcarinatus, sutura distincta sed non profunda. Apex obtusus. Apertura subovalis, superne et infra subangulata. Peristoma simplex. Exterius labrum intus transversim striatum; interius in columellam reflexum, postice incrassatum et umbilicum angustum obtegens. Plica columellaris acuta, in medio aperturæ posita. Operculum ut in aliis Odostomiis. Long. $\frac{1}{4}$, lat. $\frac{1}{10}$ unc.

A few specimens of this shell were dredged by Mr. Barlee and myself during this month in about fifty fathoms water off Skye.

This appears to be the *O. unidentata* of Thorpe's 'British Marine Conchology,' p. xxxv, but not of Montagu, Turton, Fleming or Macgillivray. It differs from that shell in the volutions more gradually tapering, and in wanting its subconic form; the volutions also being rather flattened instead of rounded; the apex being more obtuse; the suture not being so deep; and especially in its being slightly striated longitudinally instead of having the delicate but faint spiral striæ perceptible under a magnifying glass in the other species, and having the interior of the outer lip striated transversely. It has much the appearance of an *Eulima* (*Eulimella,* Forbes), to which genus the *Odostomiæ* seem to be closely allied.

I suspect my *Eulimella gracilis* is the *Eulima affinis* of Philippi, vol. ii. p. 135. t. 24. f. 7.

Eulimella clavula. Turbonilla clavula, Lov. p. 18. Several specimens of this distinct species were received by Mr. Barlee from Loch Fyne. In many of them the first whorls are more or less eroded.

Many other species of *Rissoa,* and what are called *Odostomia* and *Eulimella,* besides those which are described in works on British Conchology, and by Messrs. Thompson and Alder in the 'Annals,' have been found by Mr. Barlee and myself on the coasts of Devonshire and South Wales; and a great deal remains to be done in elucidating the species which compose this group of Pectinibranchous Gasteropoda.

Margarita pusilla, n. s.

Testa subglobosa, nitida, subopaca, glabra, alba. Anfractus 4, convexiusculi, ultimus valde reliquos exsuperans, sutura distincta divisi. Apertura subrotunda, peristomate simplici et columellæ adnato. Umbilicus angustus, canaliculatus. Long. $\frac{1}{30}$, lat. $\frac{1}{25}$ unc.

Found by Mr. Barlee last year in deep water off the Isle of Skye, and by myself previously in the Shetland Isles and Loch Carron.

It differs from the young of *M. vulgaris* in its more globose form and consequently more contracted umbilicus, as well as in the absence of striæ on the base.

Varieties of *Natica Alderi* (*Nerita glaucina* var. β. of Turton's Conchological Dictionary) and of *N. rufa,* in each case having the whorls more produced, occurred to Mr. Barlee and myself while dredging off the coast of Skye.

I suspect that the "young specimen of *Buccinum ovum*," stated by Mr. King in the 'Annals' for May, to have been procured by him from the Northumberland coast, is the *Buccinum Humphreysianum*, which in its young state it somewhat resembles. Having the opportunity of comparing a young specimen of each of those shells, I venture to make this suggestion. The *Halia Flemingiana* of Macgillivray (p. 189) is a young shell of the *Buccinum ovum*.

Mr. Barlee has informed me that he got *Velutina flexilis* in Loch Fyne and not at Skye, and *Emarginula crassa* at Oban (where I believe Mr. Alder had previously found it), as well as in the other localities mentioned in my last paper.

A few valves of *Terebratula seminulum* (?) lately occurred to Mr. Barlee and myself by dredging off Skye.

Tellina pygmæa (Phil.), Lovén, p. 42. In deep water from several parts of the western coast of Scotland as well as from Cornwall.

Tellina proxima, Wern. Mem. viii. p. 105. pl. 1. f. 21; Macg. p. 340. A single but fresh valve, having the epidermis on it, was found by Mr. Barlee and myself in dredging off Skye from about fifty fathoms water.

Clausina*, n. g.

Testa pygmæa, orbicularis aut longitudinaliter rotundato-ovata, globosa, subæquilateralis, æquivalvis, utrinque clausa, plerumque tegumine ferruginoso vestita. Cardo in utraque valvula tuberculo et lamella laterali munitus. Apices subcentrales. Lunula nulla. Ligamentum externum. Musculares impressiones ut in *Cyprina*. Profundum maris incolit.

This genus differs from *Kellia* and *Poronia* in having only one cardinal tooth in each valve, and the ligament being external instead of internal.

Sp. 1. *Clausina ferruginosa*. *Kellia ferruginosa*, Forbes, Brit. Assoc. Rep. 1843, p. 192. *Artemis ferruginosa*, Jeffr. in Ann. of Nat. Hist.

Sp. 2. *Cl. abyssicola*. *Kellia abyssicola*, Forbes *in loc. cit.* A few specimens (mostly single valves) were found by Mr. Barlee and myself with the last, by dredging in fifty fathoms water off Skye.

It differs from the first-named species in the greater convexity of the shell, the beaks being much more prominent, having a slight sinus on the front margin, and its chalky white colour. One specimen was partly covered with the ferruginous crust.

* One of the names of *Venus*.

Sp. 3. *Cl. Croulinensis*, n. s.

Testa longitudinaliter rotundato-ovata, convexiuscula, tenuis, pellucida, nitida, glabra, alba, ad apicem purpurascens, lateribus ferruginosis, antice subangulata, postice rotundata. Umbones prominuli, recti, fere contigui. Denticulus cardinalis obtusus et valde indistinctus. Long. $\frac{1}{20}$, lat. $\frac{1}{23}$ unc.

Croulin Island, between Skye and the mainland of Ross-shire towards Applecross, where six specimens were found by Mr. Barlee and myself with the other species.

Abra (Leach) *profundissima*. *Ligula profundissima*, Forbes, Brit. Assoc. Rep. 1843, p. 191. Two young specimens occurred to us with the last.

Lepton nitidum, Turton, Br. Biv. p. 63. A single valve was found by us in dredging off Skye; but it is questionable whether this species is not the fry of *L. squamosum*.

The *Corbula granulata* of Nyst is I believe the *Poromya anatinoides* of Forbes's Report on the Ægean Invertebrata.

Neæra costellata (*Corbula*, Desh.), Forbes, Lovén, p. 48. Mr. Barlee procured a specimen of this exquisite shell from Loch Fyne, and kindly placed it in my cabinet.

The *Neæra abbreviata* of Forbes is the *N. vitrea* of Lovén, p. 48.

Norton near Swansea, June 21, 1847.

VI.—*Characters of undescribed* Chalcidites *collected in North America by* E. Doubleday, Esq., *and now in the British Museum*. By Francis Walker, F.L.S.

[Continued from vol. xix. p. 398.]

17. Eupelmus Fonteia, fem. *Cupreus, antennæ nigræ, pedes fulvi, femora piceo cincta, tarsi flavi, alæ sublimpidæ.*

Corpus angustum, lineare, convexum, cupreum, nitens, scitissime squameum, parce hirtum: caput transversum, breve, thorace paullo latius; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ nigræ, clavatæ, 11-articulatæ, thorace vix longiores; articulus 1^{us} longus, gracilis; 2^{us} longicyathiformis; 3^{us} minutus; 4^{us} et sequentes mediocres, usque ad 10^{um} curtantes et latescentes; clava longiconica, compressa, articulo 10^{o} duplo longior: thorax sublinearis: prothorax transversus, brevis, antice angustus, utrinque viridivarius: mesothoracis scutum excavatum, latitudine longius; parapsidum suturæ sat bene determinatæ, postice non approximatæ; paraptera et epimera magna; scutellum obconicum; mesothoracis sternum maximum, cyaneo-viridivarium; metathorax sat magnus, subquadratus, declivis: petiolus brevissimus: abdomen fusiforme, supra depressum, subtus carinatum, thoracis longitudine et latitudine; segmentum 1^{um} magnum, 2^{um} et sequentia breviora, subæqualia : oviductus subexsertus ; vaginæ nigræ : pedes fulvi ; coxæ cupreæ ; femora piceo cincta ; mesotarsi et metatarsi flavi, apice fusci ; mesopedum tibiæ apice spina magna armatæ, tarsi lati basi ciliati : alæ sublimpidæ, angustæ ; squamulæ fulvæ ; nervi fulvi ; nervus ulnaris humerali vix brevior radiali plus duplo longior, cubitalis subincurvus radiali paullo brevior ; stigma minutum. (Corp. long. lin. $1\frac{1}{2}$; alar. lin. $2\frac{1}{4}$.)

Var. β. Femora omnino fulva.

Allied to *Eup. urozonus*, Dalman.

18. Eupelmus Lamachus, fem. *Cupreus, abdomen rubro micans, antennæ nigræ, pedes flavi, alæ limpidæ.*

Corpus sublineare, convexum, cupreum, nitens, scitissime squameum, parce hirtum : caput transversum, breve, cyaneum, thoracis latitudine ; vertex viridi-cupreus, sat latus ; frons impressa, abrupte declivis : oculi picei, mediocres, non extantes : antennæ nigræ, clavatæ, 11-articulatæ, fronte insertæ, thorace vix longiores ; articulus 1^{us} longus, gracilis ; 2^{us} longicyathiformis ; 3^{us} minutus ; 4^{us} et sequentes mediocres, usque ad 10^{um} curtantes et latescentes ; clava longiconica, compressa, articulo 10^{o} duplo longior : thorax subovatus, viridi et rubro varius : prothorax transversus, brevis, antice angustus : mesothoracis scutum excavatum, latitudine longius ; parapsidum suturæ sat bene determinatæ, postice non approximatæ ; paraptera et epimera magna ; scutellum obconicum ; sternum maximum : metathorax sat magnus, subquadratus, declivis : petiolus brevissimus : abdomen ovatum, læve, supra rubro-cupreum, depressum, subtus carinatum, thoracis longitudine et latitudine : oviductus subexsertus, flavus, apice fuscus : pedes læte flavi ; tarsi apice fusci ; mesopedum tibiæ apice spinis armatæ, tarsi lati basi subtus ciliati : alæ limpidæ ; squamulæ fulvæ ; nervi flavi ; nervus ulnaris humerali vix brevior radiali plus duplo longior, cubitalis subincurvus radiali non brevior ; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. 2.)

19. Eupelmus Epicaste, fem. *Apterus, nigro-cyaneus piceo varius, pedes picei, tarsi flavi.*

"*E. vesiculari* affinis," Hal. MSS. Corpus apterum, angustum, sublineare, convexum, nitens, piceo- et nigro-cyaneum, subtilissime squameum, parce hirtum : caput transversum, breve, thorace paullo latius ; vertex latus ; frons impressa, abrupte declivis : oculi rufi, sat magni, non extantes : antennæ nigræ, clavatæ, 11-articulatæ, thorace non breviores ; articulus 1^{us} fulvus, longus, gracilis ; 2^{us} longicyathiformis ; 3^{us} minutus ; 4^{us} et sequentes mediocres, usque ad 10^{um} curtantes et latescentes ; clava longiconica, compressa, articulo 10^{o} duplo longior : thorax longiovatus : prothorax transversus, sat magnus, antice angustus : mesothoracis scutum excavatum, latitudine longius ; parapsidum suturæ non bene determinatæ ; scutellum obconicum : metathorax magnus, subquadratus, declivis : petiolus brevissimus : abdomen subfusiforme, læve, subcompressum, supra depressum, subtus carinatum, thorace paullo angustius non longius : oviductus exsertus, flavus ; vaginæ flavæ, basi et apice nigræ, abdominis dimidio longiores : pedes picei ; trochanteres fulvi ; genua fulva ; tarsi flavi, apice fusci ; metatibiæ fulvæ ; mesopedum tibiæ apice spinis armatæ, tarsi lati subtus ciliati. (Corp. long. lin. $1\frac{1}{4}$.)

Allied to *Eup. Degeeri*, Dalman.

20. Encyrtus (Cerchysius) Flaccus, fem. *Nigro-viridis, abdomen nigrum, antennæ nigræ, pedes nigro-picei, tarsi flavi, proalæ nigro-fuscæ basi et apice limpidæ.*

Corpus angustum, sublineare, convexum, nigro-viride, nitens, læve, parce hirtum : caput piceum, transversum, breve, thoracis longitudine ; vertex sat latus ; frons abrupte declivis, non impressa : oculi rufi, mediocres, non extantes : antennæ nigræ, subclavatæ, thorace longiores ; articulus 1^{us} longus, gracilis ; 2^{us} longicyathiformis ; 3^{us} minutus ; 4^{us} et sequentes usque ad 11^{um} transversi, lati ; clava conica, articulo 11^{o} longior : thorax longiovatus : prothorax transversus, brevis, antice angustior : mesothoracis scutum magnum, longitudine paullo latius ; parapsidum suturæ non conspicuæ ; scutellum obconicum, parvum, apice ferrugineum, metathorax brevis, postice angustus : petiolus nullus : abdomen fusiforme, nigrum, supra depressum, apice acuminatum, thorace paullo angustius vix longius : oviductus fulvus, subexsertus : pedes nigri ; femora picea ; tarsi flavi, apice fusci ; protarsi fulvi ; mesotarsi lati : alæ angustæ ; proalæ nigrofuscæ, basi et apice limpidæ ; squamulæ nigræ ; nervi picei. (Corp. long. lin. 1 ; alar. lin. $1\frac{1}{2}$.)

21. Encyrtus Gastron, fem. *Æneus, abdomen cupreum, pedes flavi, alæ limpidæ.*

Corpus angustum, sublineare, æneum, convexum, nitens, læve, parce hirtum : caput transversum, breve, thorace paullo latius ; vertex sat latus ; frons abrupte declivis : oculi picei, mediocres, non extantes : thorax ovatus : prothorax brevissimus, supra vix conspicuus : mesothoracis scutum magnum, transversum ; parapsidum suturæ non conspicuæ ; scutellum parvum, obconicum : metathorax brevis, transversus : petiolus nullus : abdomen cupreum, ovatum, depressum, basi viridi-æneum, thorace paullo longius et latius : pedes flavi ; coxæ æneæ ; mesopedum tibiæ apice spinis armatæ, tarsi lati : alæ angustæ, limpidæ ; squamulæ fulvæ ; nervi flavi. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{4}$.)

Allied to *Enc. subcupratus*, Dalman.

22. Encyrtus Vectius, mas. *Viridis, abdomen purpureo-cupreum, antennæ fuscæ, pedes flavi, alæ sublimpidæ.*

Corpus breve, robustum, convexum, nitens, punctatum, viride, parce hirtum : caput transversum, breve, thoracis latitudine ; vertex sat latus ; frons abrupte declivis : oculi rufi, mediocres, non extantes : antennæ fuscæ, hirtæ, filiformes, corpore non breviores, ad os insertæ ; articulus 1^{us} longifusiformis ; 2^{us} cyathiformis ; 3^{us} minutus ; 4^{us} et sequentes longi, subæquales ; clava longipisiformis, articulo 9^{o} paullo longior : thorax breviovatus : prothorax transversus, brevissimus : mesothoracis scutum magnum, longitudine latius ; parapsidum suturæ non conspicuæ; scutellum magnum, obconicum, sericeum, parum nitens: metathorax brevissimus: petiolus nullus: abdomen obconicum, læve, depressum, purpureo-cupreum, basi cyaneo-viride, thorace brevius: pedes flavi, graciles; mesopedes longi, tibiæ apice spinis armatæ, tarsi lati fulvi: alæ sublimpidæ, apice fuscæ; squamulæ piceæ; nervi fusci; nervus humeralis longissimus, radialis et ulnaris brevissimi, cubitalis brevis; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{2}{3}$.)

Allied to *Enc. Batillus*, Ent. Mag. iv. 442.

23. Encyrtus Reate, mas. *Piceus, subtus ferrugineus, abdomen basi cupreum, antennæ nigræ, pedes fulvi piceo et flavo varii, proalæ nigro-fuscæ basi limpidæ.*

Corpus angustum, sublineare, fere planum, piceum, obscurum, subtilissime punctatum, parce hirtum, subtus ferrugineum læve nitens: caput transversum, breve, thoracis latitudine; vertex sat latus; frons abrupte declivis: palpi picei: oculi rufi, mediocres, non extantes: antennæ graciles, filiformes, nigræ, dense pubescentes, corpore paullo longiores; articulus 1^{us} longus, sublinearis, fulvus; 2^{us} cyathiformis; 3^{us} minutus; 4^{us} et sequentes longi, lineares, subæquales; clava linearis, articulo 9^{o} paullo longior: thorax ovatus: prothorax transversus, brevissimus: mesothoracis scutum magnum, longitudine latius, parapsidum suturæ non conspicuæ; paraptera magna fulva; scutellum obconicum, mediocre: metathorax brevis, transversus, postice angustus: petiolus brevissimus: abdomen ovatum, nitens, læve, depressum, basi cupreum, thorace brevius: pedes fulvi, longi, graciles, subtus pallide flavi, supra fusco vittati; mesopedum tibiæ apice spinis armatæ, tarsi lati flavi apice fusci; metapedum femora fusca basi fulva, tibiæ piceæ, tarsi flavi apice fusci: alæ angustæ; proalæ nigro-fuscæ, basi limpidæ; squamulæ piceæ; nervi fusci. (Corp. long. lin. $\frac{2}{3}$—1; alar. lin. 1—$1\frac{1}{3}$.)

Allied to *Enc. Lindus*, Ent. Mag. iv. 451.

24. Closterocerus Damastes, fem. *Cyaneo-viridis, abdomen purpureum, antennæ nigræ, pedes albidi, proalæ fusco fasciatæ.*

Corpus sat latum, sublineare, læve, depressum, cyaneo-viride, parum nitens, scitissime squameum, parce hirtum: caput transversum, brevissimum, viride, antice impressum, thoracis latitudine; vertex sat latus; frons abrupte declivis: oculi rufi, mediocres, extantes: antennæ nigræ, pubescentes, subsetaceæ, thorace vix longiores; articulus 1^{us} fusiformis, gracilis; 2^{us} cyathiformis; 3^{us} et sequentes mediocres, quisque præcedente angustior; ultimus setiger: thorax ovatus: prothorax brevissimus, supra vix conspicuus: mesothoracis scutum magnum, longitudine latius; parapsidum suturæ non bene determinatæ; scutellum magnum, brevi-obconicum: metathorax transversus, minimus: petiolus brevissimus: abdomen ovatum, nitens, læve, basi cyaneo et cupreo-varium, thorace vix longius; discus purpureus: pedes albidi, graciles, simplices, subæquales; coxæ virides: alæ limpidæ; proalæ latæ, apud stigma fusco fasciatæ; squamulæ piceæ; nervi fusci; nervus ulnaris humerali multo longior, radialis et cubitalis brevissimi; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{3}$.)

25. Entedon Imbrasus, fem. *Cyaneo-viride, abdomen cyaneum, discus purpureus, pedes albidi, alæ limpidæ.*

Corpus sublineare, convexum, nitens, læve, fere glabrum: caput transversum, breve, thorace paullo latius; vertex latus; frons abrupte declivis: oculi rufi, mediocres, non extantes: thorax ovatus; dorsum fere planum: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ sat bene determinatæ; scutellum magnum, obconicum: metathorax transversus, brevis: petiolus brevissimus: abdomen ovatum, depressum, cyaneum, thorace non longius; discus purpureus: pedes albidi, simplices, subæquales; coxæ virides; tarsi apice fusci: alæ limpidæ; squamulæ fuscæ; nervi fulvi; nervus ulnaris humerali multo longior, radialis et cubitalis brevissimi; stigma minutum. (Corp. long. lin. $\frac{2}{3}$; alar. lin. 1.)

Allied to *Ent. Latreillii*, Curtis.

26. Entedon (Horismenus) Sardus, fem. *Atrum, antennæ nigræ, basi flavæ, pedes flavi, alæ limpidæ.*

Corpus atrum, æneo et viridi varium, convexum, validum, nitens, læve, parce hirtum: caput transversum, breve, thorace non latius; vertex sat latus; frons abrupte declivis: oculi picei, mediocres, non extantes: antennæ nigræ, clavatæ, moniliformes, thorace breviores; articulus 1^{us} flavus, longus, gracilis; 2^{us} cyathiformis; 3^{us}, 4^{us} et 5^{us} subæquales, discreti; clava conica, articulo 5^{o} multo latior et longior: thorax longiovatus: prothorax transversus, brevissimus: mesothoracis scutum longitudine latius; parapsidum suturæ bene determinatæ, postice approximatæ; scutellum magnum, brevi-obconicum, unisulcatum: metathorax magnus, obconicus, declivis: petiolus brevissimus: abdomen longiovatum, apice acuminatum, thoracis fere longitudine et latitudine; segmentum 1^{um} magnum; 2^{um} et sequentia breviora, subæqualia: pedes flavi, simplices, subæquales; coxæ nigræ; tarsis articuli 1^{o} ad 3^{um} longitudine decrescentes, 4^{us} 3^{o} paullo longior; ungues et pulvilli minuti, fusci: alæ limpidæ; squamulæ piceæ; nervi fusci; nervus ulnaris humerali multo longior, radialis nullus, cubitalis brevissimus; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{4}$.)

27. Entedon (Euderus) Herillus, fem. *Nigro-cyaneum, antennæ nigræ, pedes nigro-cyanei, tarsi albidi, alæ albo limpidæ.*

Corpus sublineare, convexum, nigro-cyaneum, parum nitens, scitissime squameum, parce hirtum, subtus purpureum: caput transversum, brevissimum, thoracis latitudine; vertex latus; frons impressa, abrupte declivis: oculi rufi, mediocres, non extantes: antennæ nigræ, subclavatæ, thorace non breviores; articulus 1^{us} longus, gracilis; 2^{us} cyathiformis; 3^{us} et sequentes mediocres, usque ad clavam latescentes; clava ovata, articulo præcedente duplo longior: thorax longiovatus: prothorax transversus, brevissimus, supra vix conspicuus: mesothoracis scutum longitudine, non latius; parapsidum suturæ optime determinatæ, postice approximatæ; scutellum obconicum, magnum: metathorax mediocris, declivis, obconicus: petiolus brevissimus: abdomen longifusiforme, nitens, læve, supra depressum, subtus carinatum, apice attenuatum et acuminatum, thorace angustius et multo longius: pedes nigro-cyanei, simplices, subæquales; protarsi fusci; mesotarsi et metatarsi albidi, apice fusci: alæ albo-limpidæ; squamulæ piceæ; nervi pallide flavi; nervus ulnaris humerali multo longior, radialis et cubitalis brevissimi; stigma minutum. (Corp. long. lin. 2; alar. lin. $2\frac{1}{2}$.)

28. Eulophus Calavius, mas et fem. *Viridis cupreo varius, abdomen* mari *flavo maculatum, pedes* mari *flavi,* fem. *fulvi, proalæ fusco maculatæ.*

Mas.—Corpus longum, gracile, sublineare, convexum, nitens, viride, scitissime squameum, parce hirtum: caput transversum, breve, thorace paullo latius; vertex latus; frons impressa, abrupte declivis: oculi rufi, mediocres, non extantes: ocelli vertice triangulum fingentes: antennæ filiformes, nigræ, triramosæ, thorace paullo longiores; articulus 1^{us} longus, sublinearis; 2^{us} cyathiformis; 3^{us}, 4^{us} et 5^{us} ramulos basi emittentes graciles hirtos; 6^{us} et 7^{us} longi, lineares; clava fusiformis, articulo 7^{o} longior: thorax fusiformis: prothorax sat magnus, angustus, conicus, latitudine longior: mesothoracis scutum parvum, longitudine latius; parapsidum suturæ bene determinatæ, postice approximatæ; scutellum mediocre, subconicum: metathorax magnus, obconicus, striatus, declivis: petiolus brevissimus: abdomen ovatum, læve, depressum, thorace multo brevius non angustius, basi flavo maculatum; discus purpureus: pedes flavi, graciles, simplices, subæquales; coxæ virides; tarsi apice fusci; protarsi fulvi: alæ limpidæ, angustæ; squamulæ piceæ; nervi fusci; nervus humeralis ulnari paullo longior, ulnaris radiali plus duplo longior, cubitalis brevis; stigma minutum; proalæ cuique apud discum macula fere obsoleta fusca. (Corp. long. lin. 1—$1\frac{1}{4}$; alar. lin. $1\frac{3}{4}$—2.)

Var. β. Proalæ apice obsolete fusco nebulosæ: antennis articulus 1^{us} basi flavus.

Var. γ. Corpus cyaneo et æneo varium.

Fem. Corpus æneum, viridi varium: antennæ nigræ, subclavatæ, 9-articulatæ, thorace non longiores; articulus 1^{us} longus, gracilis, fulvus, apice niger; 2^{us} cyathiformis; 3^{us} et sequentes longi usque ad 6^{um} curtantes et latescentes; clava conica, acuminata, articulo 6^{o} longior: abdomen longiovatum, purpureo-cupreum, basi viride, subtus carinatum, apice acuminatum, thorace non brevius; segmenta subæqualia: pedes fulvi; coxæ virides; mesotarsi et metatarsi flavi, apice fusci: alæ limpidæ; proalæ apice obsolete fusco nebulosæ, macula cuique in disco magna distincta fusca. (Corp. long. lin. $1\frac{1}{4}$—$1\frac{3}{4}$; alar. lin. $1\frac{3}{4}$—$2\frac{1}{4}$.)

Var. β. Thoracis discus cupreus.

Var. γ. Femora fusco cincta.

Var. δ. Proalis maculæ vix conspicuæ.

Var. ϵ. *Var.* β. et δ. similis: antennis articulus 1^{us} niger, basi fulvus: tibiæ flavæ.

29. Eulophus Iphinoë, mas. *Nigro-viridis, abdomen cupreum, antennæ piceæ, pedes flavi, femora fulva, metafemora fusca, alæ limpidæ.*

Corpus nigro-viride, breve, convexum, nitens, scitissime squameum, parce hirtum : caput transversum, breve, thorace latius ; vertex latus ; frons impressa, abrupte declivis : oculi picei, mediocres, non extantes : antennæ piceæ, longæ, graciles, filiformes, triramosæ, corpore vix breviores ; articulus 1^{us} longus, linearis ; 2^{us} cyathiformis ; 3^{us}, 4^{us} et 5^{us} ramulos basi emittentes graciles hirtos ; 6^{us} et 7^{us} longi, lineares ; clava sublinearis, acuminata : thorax ovatus : prothorax transversus, brevis, antice angustus : mesothoracis scutum longitudine latius ; parapsidum suturæ non bene determinatæ ; scutellum obconicum : metathorax sat magnus, obconicus, declivis : petiolus brevis : abdomen ovatum, læve, cupreum, depressum, thorace multo brevius : pedes flavi, longi, graciles, simplices, subæquales ; coxæ virides ; femora fulva ; tarsi apice fusci ; metafemora fusca : alæ limpidæ ; squamulæ fuscæ ; nervi flavi ; nervus humeralis ulnari vix longior, radialis ulnari brevior, cubitalis sat longus ; stigma minutum. (Corp. long. lin. $\frac{2}{3}$; alar. lin. 1.)

30. Eulophus Cyriades, mas. *Nigro-viridis, abdomen cupreum basi flavum, antennæ nigræ, pedes fulvi piceo varii, alæ limpidæ.*

Corpus breve, robustum, convexum, nigro-viride, nitens, scitissime squameum, parce hirtum, subtus cyaneo et purpureo varium : caput transversum, breve, thorace paullo latius ; vertex latus ; frons impressa, abrupte declivis : oculi picei, mediocres, non extantes : antennæ triramosæ, nigræ, longæ, graciles, filiformes ; articulus 1^{us} longus, linearis, nigro-cupreus ; 2^{us} cyathiformis ; 3^{us}, 4^{us} et 5^{us} ramulos basi emittentes graciles hirtos : thorax ovatus : prothorax transversus, brevis : mesothoracis scutum longitudine latius ; parapsidum suturæ non bene determinatæ ; scutellum brevi-obconicum : metathorax sat magnus, obconicus, declivis : petiolus brevis : abdomen sublineare, læve, depressum, cupreum, basi flavum, thorace brevius : pedes fulvi, simplices, subæquales ; coxæ basi nigro-cyaneæ ; femora piceo vittata ; tarsi apice fusci ; metatibiæ apice fuscæ : alæ limpidæ ; squamulæ piceæ ; nervi fusci ; nervus humeralis ulnari vix longior, radialis ulnari brevior, cubitalis sat longus ; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{4}$.)

31. Eulophus Minio, fem. *Æneo-viridis, abdomen nigro-cupreum, antennæ piceæ, pedes fulvi, alæ limpidæ.*

Corpus æneo-viride, convexum, nitens, scitissime squameum, parce hirtum : caput transversum, breve, thorace non latius ; vertex sat latus ; frons impressa, abrupte declivis : oculi rufi, mediocres, non extantes : antennæ piceæ, submoniliformes, extrorsum crassiores, thorace paullo longiores ; articulus 1^{us} longus, gracilis ; 2^{us} cyathiformis ; 3^{us} et sequentes longi, usque ad 6^{um} curtantes et latescentes ; clava conica, acuminata, articulo 6^{o} longior : thorax longiovatus : prothorax magnus, conicus : mesothoracis scutum transversum, breve ; parapsidum suturæ bene determinatæ, postice approximatæ ;

scutellum subconicum : metathorax magnus, obconicus, declivis : petiolus brevis : abdomen nigro-cupreum, ovatum, læve, depressum, subtus carinatum, apice acuminatum, thorace paullo brevius et latius : pedes fulvi, simplices, subæquales ; tarsi apice fusci : alæ limpidæ ; squamulæ piceæ ; nervi fulvi ; nervus humeralis ulnari vix longior, radialis ulnari brevior, cubitalis sat longus ; stigma minutum. (Corp. long. lin. 1 ; alar. lin. $1\frac{3}{4}$.)

32. Eulophus Gobryas, mas. *Æneus, caput nigrum, abdomen nigro-cupreum, antennæ nigræ, pedes flavi, femora nigro-ænea, alæ limpidæ.*

Corpus breve, latum, convexum, parce hirtum : caput transversum, breve, nigrum, nitens, scitissime squameum, thoracis latitudine ; vertex sat latus ; frons impressa, abrupte declivis : oculi rufi, mediocres, non extantes : antennæ nigræ, clavatæ, thorace breviores ; articulus 1^{us} fulvus, longus, linearis ; 2^{us} cyathiformis ; 4^{us} 3^o brevior 5^o longior ; clava longiconica, acuminata, articulo 5^o multo longior : thorax ovatus, altus, æneus, scite squameus, parum nitens : prothorax transversus, sat magnus, antice angustus : mesothoracis scutum breve, longitudine latius ; parapsidum suturæ remotæ, bene determinatæ, postice approximatæ ; scutellum subovatum : metathorax magnus, obconicus, declivis : petiolus brevis : abdomen ovatum, nitens, læve, depressum, nigro-purpureum, basi viridi et cupreo micans, thorace brevius : pedes flavi, simplices, subæquales ; coxæ nigro-æneæ ; trochanteres picei ; femora nigro-ænea, apice flava ; tarsi apice fusci, articulus 2^{us} 1^o brevior 3^o longior, 4^{us} 3^o paullo longior : alæ limpidæ, sat latæ ; squamulæ piceæ ; nervi fulvi ; nervus humeralis ulnari vix longior, radialis ulnari multo brevior, cubitalis sat longus ; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$; alar. lin. 2.)

Allied to *Eulophus ramicornis*, Geoffroy.

33. Eulophus Minyas, fem. *Cupreus cyaneo-viridi varius, antennæ piceæ, pedes fulvi, femora nigro-viridia, proalæ fusco maculatæ.*

Corpus cupreum, sublineare, convexum, nitens, scitissime squameum, parce hirtum, utrinque cyaneo-viridi varium, subtus cyaneo-viride : caput transversum, breve, thoracis latitudine ; vertex sat latus ; frons impressa, abrupte declivis : oculi rufi, sat magni, non extantes : antennæ piceæ, clavatæ, thorace breviores ; articulus 1^{us} longus, gracilis, fulvus ; 2^{us} cyathiformis ; 4^{us} 3^o brevior 5^o longior ; clava ovata, acuminata, articulo 5^o paullo longior : thorax ovatus : prothorax transversus, brevissimus : mesothoracis scutum magnum, longitudine latius ; parapsidum suturæ bene determinatæ, postice approximatæ ; scutellum magnum, subconicum : metathorax brevis, declivis : petiolus brevissimus : abdomen ovatum, læve, basi cyaneo-viride, supra depressum, subtus carinatum, apice acuminatum, thorace non longius ; discus nigro-purpureus : pedes fulvi, simplices, subæquales ; coxæ nigro-virides ; trochanteres picei ; femora nigro-viridia, apice fulva ; tarsi apice fusci : proalæ subfuscæ ; macula cuique apud nervum ulnarem magna fusca ; squamulæ piceæ ; nervi basi fulvi apice fusci ; nervus humeralis ulnari non longior, radialis ulnari multo brevior, cubitalis longus in alæ discum abrupte declivis; stigma minutum. (Corp. long. lin. 1; alar. lin. $1\frac{1}{2}$.)

Allied to *Eul. gallarum*, Nees d'Essenbeck.

34. Elachestus Levana, fem. *Ater, abdominis discus fulvus, antennæ fuscæ, pedes flavi fusco cincti, alæ limpidæ.*

Corpus atrum, convexum, punctatum, parum nitens, parce hirtum: caput transversum, breve, thoracis latitudine; vertex latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ fuscæ, subclavatæ, moniliformes, thorace breviores; articulus 1^{us} fulvus, longus, gracilis; 2^{us} cyathiformis; 3^{us} et sequentes mediocres, discreti, usque ad 5^{um} curtantes et latescentes; clava conica, acuminata, articulo 5^{o} longior: thorax longiovatus: prothorax transversus, brevis, antice angustus: mesothoracis scutum longitudine latius; parapsidum suturæ non bene determinatæ; scutellum nitens, læve, subconicum: metathorax magnus, obconicus, declivis: petiolus longissimus, abdomine paullo brevior: abdomen subrotundum, nitens, læve, depressum, thoracis dimidio non longius; discus fulvus; segmentum 1^{um} magnum, 2^{um} et sequentia brevia: pedes flavi, simplices, subæquales; coxæ piceæ; ungues et pulvilli fusci; mesotibiæ apice spinis longis validis armatæ; metapedum femora apice fusca, tibiæ fuscæ basi flavæ: alæ limpidæ; squamulæ fulvæ; nervi flavi; nervus humeralis ulnari non longior, radialis ulnari multo brevior, cubitalis sat longus; stigma minutum. (Corp. long. lin. $1—1\frac{1}{4}$; alar. lin. $1\frac{1}{2}—1\frac{3}{4}$.)

Var. β. Metatibiæ flavæ, apice fuscæ.

Allied to *Elachestus dimidiatus*, Nees d'Ess.

35. Cirrospilus Eunapius, fem. *Nigro-purpureus, abdomen basi flavum, antennæ fuscæ, pedes flavi piceo cincti, proalæ fusco fasciatæ.*

Corpus angustum, sublineare, convexum, nigro-purpureum, scitissime squameum, parum nitens, parce hirtum: caput transversum, breve, thoracis latitudine; vertex sat latus; frons impressa, abrupte declivis: oculi picei, mediocres, non extantes: antennæ breves, fuscæ, clavatæ, thorace breviores; articulus 1^{us} longus, gracilis; 2^{us} cyathiformis; 3^{us} et sequentes mediocres, usque ad 5^{um} curtantes et latescentes; clava conica, acuminata, articulo 5^{o} longior et latior: thorax ovatus: prothorax magnus, conicus: mesothoracis scutum læte flavum, breve, transversum; parapsidum suturæ non bene determinatæ; scutellum nitens, læve, obconicum: metathorax mediocris, obconicus, declivis: petiolus brevissimus: abdomen ovatum, nitens, læve, basi flavum, supra depressum, subtus carinatum, apice acuminatum, thorace non longius: pedes flavi, graciles, simplices, subæquales; coxæ piceæ; femora picea, apice flava; tibiæ fuscæ, basi flavæ; tarsi apice fusci: alæ limpidæ, angustæ; proalæ cuique medio fascia lata fusca bene determinata; squamulæ fulvæ; nervi flavi; nervus ulnaris humerali paullo longior, radialis ulnari multo brevior; cubitalis sat longus; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. 1.)

Var. β. Femora nigro-picea; tibiæ piceæ.
Allied to *Cirr. flavo-varius*, Nees d'Ess.

36. Tetrastichus Gala, fem. ***Fulvus, abdomen piceum, antennæ nigræ, pedes flavi, alæ limpidæ.***

Corpus breve, latum, convexum, nitens, læve, fulvum, parce hirtum: caput piceum, transversum, brevissimum, impressum, thorace non latius; vertex sat latus; frons abrupte declivis: oculi rufi, mediocres, non extantes: antennæ nigræ, subclavatæ, thorace paullo longiores; articulus 1^{us} longus, linearis; 2^{us} cyathiformis; 3^{us}, 4^{us} et 5^{us} mediocres, subæquales; clava longiconica, acuminata, articulo 5^{o} paullo longior et latior: thorax ovatus: prothorax brevissimus, supra vix conspicuus: mesothoracis scutum magnum, longitudine vix latius; parapsidum suturæ remotæ, bene determinatæ, postice approximatæ; scutellum magnum, subrotundum, bisulcatum: metathorax mediocris, transversus, postice angustus: petiolus brevissimus: abdomen piceum, ovatum, basi fulvum, supra depressum, subtus carinatum, apice acuminatum, thorace paullo latius non longius: pedes flavi, simplices, subæquales; tarsi apice fusci: alæ limpidæ, latæ; squamulæ fulvæ; nervi fulvi; nervus ulnaris humerali paullo longior, radialis vix ullus, cubitalis sat longus; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. $1\frac{1}{2}$.)

Allied to *Tetrastichus Armæus*, Ann. Nat. Hist. xi. 200; and to *T. Metra*, A. N. H. xi. 201.

37. Tetrastichus Hæmon, fem. ***Ater, antennæ nigræ, pedes picei, tibiæ apice albidæ, tarsi flavi, alæ sublimpidæ.***

Corpus breve, validum, convexum, atrum, parum nitens, subtilissime punctatum, parce hirtum: caput transversum, impressum, brevissimum, thoracis latitudine; vertex latus; frons abrupte declivis: oculi picei, mediocres, non extantes: antennæ nigræ; articulus 1^{us} longus, gracilis; 2^{us} cyathiformis; 3^{us} et sequentes mediocres, usque ad 5^{um} curtantes et latescentes; clava conica, acuminata, articulo 5^{o} longior: thorax ovatus: prothorax transversus, brevis, mesothoracis scutum magnum, longitudine latius; parapsidum suturæ bene determinatæ, postice approximatæ; scutellum obconicum, bisulcatum: metathorax declivis, mediocris, postice angustus: petiolus brevissimus: abdomen longiovatum, parum nitens, supra convexum, subtus carinatum, apice acuminatum, thorace paullo longius; segmenta 1^{o} ad 4^{um} subæqualia, 5^{um} paullo longius, 6^{um} et 7^{um} minora: pedes picei, simplices, subæquales; coxæ nigræ; genua fulva; tibiæ fuscæ; mesopedum et metapedum tibiæ apice albidæ, tarsi flavi, apice fusci; protarsi fulvi: alæ sublimpidæ; squamulæ piceæ; nervi fusci; nervus ulnaris humerali multo longior, radialis nullus, cubitalis sat longus; stigma minutum. (Corp. long. lin. 1; alar. lin. $1\frac{1}{2}$.)

Allied to *Tetrastichus Paralus*, Mon. Chal. i. 296.

38. Tetrastichus Epidius, fem. ***Ater, antennæ nigræ, pedes fulvi, femora picea, tibiæ apice albidæ, tarsi flavi, alæ sublimpidæ.***

Corpus longum, angustum, convexum, atrum, parum nitens, subtilissime punctatum, parce hirtum : caput transversum, breve, thoracis latitudine ; vertex latus ; frons impressa, abrupte declivis : oculi picei, mediocres, non extantes : antennæ nigræ, subclavatæ, thorace longiores ; articulus 1^{us} piceus, longus, gracilis ; 2^{us} longicyathiformis ; 3^{us} et sequentes longi ; 4^{us} 3^{o} brevior et latior 5^{o} longior et angustior ; clava longiconica, acuminata, articulo 5^{o} multo longior : thorax ovatus : prothorax transversus, mediocris, antice angustior : mesothoracis scutum magnum longitudine paullo latius ; parapsidum suturæ remotæ bene determinatæ, postice approximatæ ; scutellum obconicum, bisulcatum : metathorax mediocris, declivis, postice angustior : petiolus brevissimus : abdomen longifusiforme, supra convexum, subtus carinatum, apice attenuatum et acuminatum, thorace duplo longius ; segmenta 1^{um} ad 3^{um} brevia ; 4^{um} et 5^{um} longiora ; 6^{um} et 7^{um} subcylindrica : pedes fulvi, simplices, subæquales ; coxæ nigræ ; femora picea, apice fulva ; mesopedum et metapedum tibiæ apice albidæ, tarsi flavi apice fusci : alæ sublimpidæ, abdominis apicem dum quietem agunt non attingentes ; squamulæ piceæ ; nervi fulvi ; nervus ulnaris humerali multo longior, radialis nullus, cubitalis sat longus ; stigma minutum. (Corp. long. lin. $1\frac{1}{4}$—$1\frac{1}{2}$; alar. lin. $1\frac{3}{4}$—2.)

Allied to *Tetrastichus Adalia*, Ann. Nat. Hist. xi. 351.

39. Acrias (n. g.) Nileus, fem. *Purpureus, antennæ nigræ, pedes nigri, tarsi flavi, proalæ fusco maculatæ.*

Corpus gracile, convexum, purpureum, nitens, scitissime squameum, parce hirtum, cyaneo varium : caput transversum, brevissimum, impressum, thoracis latitudine ; vertex sat latus ; frons abrupte declivis : oculi rufi, mediocres, non extantes : antennæ latæ, compressæ, subfusiformes, nigræ, thorace non longiores ; articulus 1^{us} longus, apice latior ; 2^{us} cyathiformis ; 3^{us}, 4^{us} et 5^{us} mediocres, subæquales ; clava longiconica, acuminata, articulo 5^{o} multo longior : thorax longiovatus : prothorax conicus, mediocris : mesothoracis scutum longitudine latius ; parapsidum suturæ bene determinatæ, postice approximatæ ; scutellum obconicum : metathorax transversus, brevis : petiolus brevissimus : abdomen teliforme, compressum, supra depressum, subtus carinatum, apice attenuatum et acuminatum, thorace multo longius et angustius : pedes nigri, simplices, subæquales ; trochanteres picei ; genua picea ; tarsi flavi, apice fusci ; protarsi fulvi : alæ limpidæ ; squamulæ piceæ ; nervi fusci ; proalæ cuique macula in disco magna indistincta fusca et ad marginem maculæ 6 minores obscuriores ; nervus ulnaris humerali longior, radialis ulnari brevior, cubitalis brevis ; stigma minutum. (Corp. long. lin. $\frac{3}{4}$; alar. lin. 1.)

I have an undescribed British insect that belongs to this new genus.

VII.—*List of Plants gathered during a short visit to Iceland in* 1846. By Charles C. Babington, M.A., F.L.S., F.G.S. &c.*

It may perhaps be said that the following list of Icelandic plants is scarcely deserving of the space which it occupies, containing as it does so very few additions even to Hooker's 'Icelandic Flora' contained in his 'Tour in Iceland,' and still fewer to Vahl's 'Liste des Plantes' published in Gaimard's 'Voyage en Islande' (Min. et Géol. p. 371). That fact however is itself deserving of notice, from its proving that those parts of the island to which the researches of most botanists have been necessarily confined were very carefully examined, and that therefore M. Vahl's 'Liste' of 432 flowering plants is not a very imperfect catalogue of the Icelandic flora.

Circumstances over which I had no control restricted the time which I could devote to collecting plants in Iceland within very narrow limits,—far narrower than I had promised myself when leaving England. We landed at Reikiavic on June 29, 1846, and sailed from that port on July 13, after which day a continuance of stormy weather detained us so long off the Icelandic coast as effectually to prevent a visit which we had planned to some of the Fiords in the eastern part of the island. My collections were therefore confined to that small south-western district which was examined by several former visitants. The barren character of the country surrounding Reikiavic renders it very unpropitious to the botanist, and the long journey on horseback to and from the Geysers is not favourable to collecting.

The neighbourhood of Reikiavic consists of low hills, the surface of which is fully half covered with lumps of rock and large stones, between which the soil, although fertile in appearance and probably in reality, is often nearly devoid of vegetation; scattered plants of *Dryas octopetala, Lychnis alpina, Cerastium latifolium, Arenaria norvegica* and a few other species were observed. The lower grounds are very boggy, but far from rich in plants; a very few species of *Carex* and *Scirpus* occupying nearly the whole surface.

The above description will apply to a considerable portion of the country which we visited, but occasionally a small hollow occurred covered by a beautiful turf (*Festuca ovina* and *Poa pratensis* chiefly), amongst which grew rather numerous specimens of *Geranium sylvaticum, Orchis latifolia, Habenaria viridis* and *H. hyperborea*. Such spots were mostly very small. Near Thingvalla (a place of great note in Icelandic history), which is situated upon an ancient lava-current and is at a considerable distance from the sea, there is rather an extensive district of cavernous lava full

* Read before the Botanical Society of Edinburgh, 10th June 1847.

of deep hollows and cracks upon which a much more luxuriant vegetation occurs. This is called a "forest" by the Icelanders, being well-covered with low bushes, the highest not exceeding six feet, of *Betula glutinosa*, *B. intermedia*, *B. nana* (remarkably large), and beautiful but dwarf willows, especially *Salix lanata* and *S. phylicifolia*. The neighbourhood of the Geysers does not appear to be rich in plants, nor does the hot water, which issues from the ground in a state of active ebullition, seem to hasten their growth. I could not perceive that individuals growing in the warm mud by the side of steaming currents were at all more forward than others at a distance from the heated spots. It is stated that vegetation continues on this peculiar tract throughout the year, but that the want of sun-light will not allow the plants so situated to benefit by their exemption from the frost and snow to which their neighbours are subject.

During a visit of one day to the head of Hval Fiord, a deep inlet bounded by mountains situated about forty miles towards the north from Reikiavic, I had an opportunity of examining the damp ledges on the face of a mountain of moderate elevation (estimated by us at 2500 feet), and thus learned something of the alpine vegetation. It may be observed that the slopes of the mountains are usually quite dry and therefore perfectly barren, and that it is only in the few cases where the lava is more solid or the rocks basaltic that wet spots occur. The following plants may be mentioned as inhabiting the steep and moist slope of this mountain, named Reinevalla-hals: *Draba rupestris*, *Arabis alpina*, *Silene acaulis*, *Stellaria cerastoides*, *Saxifraga rivularis*, *S. Hirculus* (also not unfrequent in the bogs), *S. nivalis* and *Veronica alpina*. On its exposed and nearly dry but peaty summit there were *Viola palustris*, *Sibbaldia procumbens*, *Alchemilla alpina*, *Andromeda hypnoides* and a few others.

There is great reason to think that a rich and almost unexplored field for botanical research exists in the northern part of Iceland. All the accounts of that part of the island describe it as by far the most fertile portion of the country. It is also believed that the eastern districts would well repay examination.

The wet climate of Iceland and its short and cloudy summer render it very unfavourable to vegetation. We could not learn from the Governor and other intelligent gentlemen that any arable land exists in the country, (unless the cultivation of potatoes in the northern district may be considered as an exception,) and attempts to grow vegetables in what may in courtesy be denominated gardens, do not seem to be often made by any of the inhabitants except those of Danish origin. On the 3rd of July the people of Reikiavic were planting out turnips in their little plots of garden ground, and potatoes were just coming up in a few places. In the Governor's garden there were also some very fine radishes. I saw no other culinary plants except mustard and cress, unless archangel may be so considered. The cultivation of flowers does not seem to be attempted in the open ground, but a very few are preserved in pots in some of the Danish houses. In one house I noticed a carnation, a scarlet Chinese rose, mignionette, and a small fuchsia; all of them showing conspicuously that they were with difficulty preserved alive.

Hooker in his 'Tour,' and also in 'Mackenzie's Travels in Iceland,' gave as complete a list of Icelandic plants as he was able to prepare, and in the recent French work upon Iceland by M. Gaimard will be found a similar list of species compiled by M. Vahl. In the following list of the plants collected by me, the names of those few species are printed in italics which are not included in M. Vahl's list. I have also added the localities of a few of the more interesting plants. I am deeply indebted to Dr. Boott for examining and naming my specimens of *Carex*, with which difficult genus he is known to be peculiarly well acquainted, and his long-promised Monograph upon which is anxiously expected.

List of species of Plants gathered in Iceland between June 29 *and July* 13, 1846.

Ranunculaceæ.

Thalictrum alpinum.
Ranunculus aquatilis.
Batrachium heterophyllum, *Fries.*
R. hyperboreus.
R. acris.
R. repens.
Caltha palustris.

Cruciferæ.

Arabis alpina.
A. petræa.
Cardamine hirsuta. The terminal leaflet of the lower leaves is rounder and less angular than in the British plant.
C. pratensis.
Draba rupestris. Reinevalla-hals.
D. incana.
D. incana β. hebecarpa, *Koch.*
D. verna.
Capsella Bursa-pastoris.
Cakile maritima.

Violaceæ.

Viola canina.
V. palustris.

Caryophylleæ.

Silene maritima.
Silene acaulis.
Lychnis alpina.
Sagina procumbens.
S. nodosa, *E. Mey.*
Spergula arvensis.
Alsine peploides.
A. rubella. Near Reikiavic and on Reinevalla-hals.
Arenaria norvegica.
A. ciliata, *Hook. Icel. Fl.*
Stellaria cerastoides.
S. media.
Cerastium triviale.
C. alpinum.

Geraniaceæ.

Geranium sylvaticum.

Rosaceæ.

Spiræa Ulmaria.
Dryas octopetala.
Geum rivale.
Rubus saxatilis.
Fragaria vesca.
F. collina, *Vahl, Liste?*
Potentilla Comarum.
P. anserina.
P. alpestris.
P. aurea, *Hook.*
P. maculata, *Vahl?*

Sibbaldia procumbens. Summit of Reinevalla-hals.
Alchemilla vulgaris.
A. alpina.

Onagrariaceæ.

Epilobium montanum γ. humile, *Bab.*
E. palustre.
E. virgatum.
E. alpinum.

Halorageæ.

Myriophyllum spicatum.
Hippuris vulgaris.

Portulaceæ.

Montia fontana.

Crassulaceæ.

Sedum villosum.
S. Rhodiola.

Saxifragaceæ.

Saxifraga stellaris.
S. Hirculus.
S. cæspitosa.
S. hypnoides. Reinevalla-hals.
S. nivalis. Descending to the sea level.
S. rivularis. Reinevalla-hals.
S. oppositifolia.
Parnassia palustris.

Umbelliferæ.

Carum Carui. Thingvalla (naturalized).
[Angelica Archangelica. I have no specimen of this, and only saw it in patches of cultivated ground.]

Rubiaceæ.

Galium boreale.
G. verum.
G. pusillum.

Compositæ.

Erigeron alpinus.
Gnaphalium uliginosum.
Oporinia autumnalis.
O. autumnalis β. Taraxaci.
Taraxacum officinale.
Hieracium alpinum.
H. cæsium, Fries.
H. Lawsoni.
Pyrethrum inodorum.

Ericaceæ.

Vaccinium uliginosum.
Arctostaphylos Uva-ursi.
Andromeda hypnoides. Summit of Reinevalla-hals.
Calluna vulgaris.
Pyrola minor.

Gentianaceæ.

Menyanthes trifoliata.
Gentiana campestris.
G. nivalis.

Boragineæ.

Steenhammera maritima.
Myosotis versicolor.
M. intermedia, *Link.*

Rhinanthaceæ.

Rhinanthus minor.
Bartsia alpina.
Veronica serpillifolia.
V. alpina. Reinevalla-hals.
V. saxatilis. Near Reikiavic.

Labiatæ.

Thymus Serpillum, *Linn.*, *Fries*, not *Sm.*
Prunella vulgaris.
Galeopsis Tetrahit.

Lentibulareæ.

Pinguicula vulgaris.

Plumbagineæ.

Armeria maritima.

Plantagineæ.

Plantago maritima.
P. major.

Chenopodiaceæ.

Atriplex patula ?

Polygoniaceæ.

Polygonum viviparum.
P. aviculare.
Rumex domesticus. Only observed near the houses of Reikiavic.
R. acetosella.
R. acetosa.
Oxyria reniformis.
Kœnigia islandica.

Empetreæ.

Empetrum nigrum.

Urticaceæ.

Urtica urens. Plentiful about the houses of Reikiavic. Believed to be an introduction; confined to one garden at the time of Hooker's visit.

Amentaceæ.

Betula glutinosa.
B. alba, *Vahl?* Thingvalla.

Betula intermedia, *Thom.*
B. fruticulosa, *Vahl?* Thingvalla.
B. nana. Thingvalla.
Salix glauca, *Linn.*, not *Sm.* Reinevalla-hals.
S. phylicifolia. Thingvalla.
S. lanata.
S. pyrenaica var. *norvegica*, Fries. Reinevalla-hals.
S. herbacea.

Orchidaceæ.

Orchis latifolia.
Habenaria viridis.
H. hyperborea.

Melanthaceæ.

Tofieldia palustris, *Huds.*

Juncaceæ.

Juncus balticus. Is this the *J. effusus* of Hooker's Fl., or *J. arcticus* of Vahl's List?
J. supinus.
J. bufonius.
J. trifidus.
J. triglumis.
Luzula spicata.
L. multiflora.

Alismaceæ.

Triglochin palustre.

Aroideæ.

Sparganium natans.

Potamogetoneæ.

Potamogeton lanceolatus, Sm.
P. nigrescens, *Fries.*
P. filiformis. Maria Havn, Hval Fiord.
Zostera angustifolia, *Reich.*

Cyperaceæ.

Scirpus cæspitosus.
Eleocharis uniglumis.
Eriophorum capitatum.
E. polystachion γ. elatius, *Koch.*
Elyna spicata.
Carex dioica.
C. chordorhiza. Maria Havn, Hval Fiord.
C. incurva.
C. curta.
C. atrata.
C. capillaris.
C. vaginata.
C. rariflora.
C. cryptocarpa, Meyer.
C. filipendula, *Drej.*
C. vulgaris, *Fries.*
C. hyperborea, Drej.
C. rigida.

Gramineæ.

Anthoxanthum odoratum.
Alopecurus geniculatus.
Phleum commutatum.
Agrostis alba.
Arundo stricta. Near the Geysers and at Maria Havn, Hval Fiord.
Sesleria cærulea.
Aira alpina.
Trisetum subspicatum β. ciliatum.
Poa annua.
P. pratensis.
P. alpina.
P. Balfourii, Parn.
P. cæsia.
P. cæsia β. glauca.
Festuca ovina.
F. rubra γ. arenaria.

Equisetaceæ.

Equisetum umbrosum. Thingvalla.
E. palustre.

Filices.

Polypodium Dryopteris.
P. Phegopteris.
Woodsia ilvensis.
Athyrium Filix-fœmina.
Cystopteris fragilis α.
C. fragilis β. dentata.
Botrychium Lunaria.

Lycopodiaceæ.

Lycopodium selaginoides.

VIII.—*On the Power of the Living Plant to restrain the Evaporation of the Cell-Sap.* By Hugo v. Mohl*.

It is a known fact, attested by numerous weighings, that the living plant, when exposed to light (even diffused daylight,

* Botanische Zeitung, May 7, 1847. Translated by Arthur Henfrey.

which is not capable of increasing the production of vapour from a dead substance permeable by water), gives off a greater quantity of watery vapour to the atmosphere than it does in the dark. The fundamental cause of this phænomenon, the alterations which are brought about in the plant by light, and which condition this increased separation of water, are unknown to us*. The said phænomenon however leads, and I believe in strict correctness, to the assumption, that the evolution of watery vapour from plants is to be referred to two causes; in the first place, to the universal physical law of vaporization, in obedience to which every moist substance gives off water until the atmosphere around is perfectly saturated; and secondly, to a process the more recondite conditions of which are as yet altogether unknown to us, dependent on the vital action of the plant. If I have correctly gathered the views which are advanced in physiological works, the generally received opinion is this:—1st, that the said physical production of watery vapour is regarded as to a certain extent understood; and it is assumed that this is only more or less interfered with by the more or less perfect condition of the cuticle, which is not readily permeable by water or watery vapour; 2ndly, that the said second cause is considered to account for a more abundant separation of water than the physical cause alone would be capable of producing.

A series of facts now appear to me to stand in opposition to this view; I will only mention the well-known phænomenon, that those plants which are most difficult and tedious to dry, as for instance the bulbous plants, the genus *Sedum*, &c., dry very quickly if previously killed by immersion in boiling water. Moreover, it is well known how quickly plants dry which have been killed by poison, frost, &c. From these circumstances it undoubtedly follows that a dead plant, in what way soever it may have been killed, dries quicker than a living plant of the same species, notwithstanding that the evaporation, occurring peculiarly in the living plant under the influence of light, is wanting, and only a true physical separation of water takes place.

I did not remember to have found special researches into this circumstance brought forward in physiological writings; it ap-

* As far as my knowledge goes, no positive observations have been brought forward to show that this separation of water takes place in submerged plants, which would prove the nature of the fact to be not an exhalation of vapour, but a secretion of drops of watery fluid; yet this is in the highest degree probable, since it would be inexplicable how water-plants could accumulate in their interior large quantities of such substances as are contained in so small proportion in water, as for instance the iodine compounds in the plants of sea-water, if they did not in the course of time absorb a considerable quantity of water, and again give it off after depriving it of particular salts.

peared to me therefore not to be altogether without interest to undertake a series of weighings, by which the said facts might be more accurately determined. I selected for this purpose some hot-house plants with thick leaves, since I had reason to hope that, on account of the relatively weaker evaporation in these, the results would be more distinct than in thin-leaved plants: that they might die quickly without the subtraction or addition of water, I let them lie in the open air for twenty-four hours, at a temperature of between $-3°$ and $-9°$ R., in which time they of course were not merely frozen through and through, but also completely killed. I then weighed the plants, and let them lie for fifteen days in a heated room, and compared their loss of weight with that of cut living specimens of as nearly the same size as possible, which had laid beside the frozen specimens. I consider it superfluous to publish the whole series of weighings, and confine myself to the statement of those made at intervals of five days, the results of which are contained in the following table. The numbers express the loss of weight in per-centage of the original weight of the plants:—

	1st–5th day.	6th–10th day.	11th–15th day.	1st–15th day.
Living Plants.				
Polypodium crassifolium. Leaf.	35·9	17·0	7·4	60·3
Ficus elastica. Leaf	11·4	7·1	14·3	32·8
Vanilla planifolia. Leaf	4·9	11·5	16·4	32·8
Sanseviera guineensis. Leaf.	2·7	2·5	1·5	6·7
Epiphyllum truncatum. Stem	7·9	7·3	6·1	21·3
Stapelia hirsuta. Stem	4·6	5·8	6·3	16·7
Average	11·4	8·5	8·6	28·4
Frozen Plants.				
Polypodium crassifolium	35·8	18·3	8·9	63·0
Ficus elastica	32·0	13·3	17·3	62·6
Vanilla planifolia	19·1	14·5	10·9	44·5
Sanseviera guineensis	8·3	6·6	5·8	20·7
Epiphyllum truncatum	16·5	9·9	12·2	38·6
Stapelia hirsuta	8·9	19·5	3·0	31·4
Average	20·1	13·7	9·7	43·5

I continued the weighings no further, although none of the plants mentioned had lost all their water on the fifteenth day, because the results appeared to me to be sufficiently distinct*.

* I cannot forbear to remark, that the slight loss of weight, which is shown by the weighing of *Stapelia hirsuta* (in the frozen specimen) on the

In the figures of this table lies undoubtedly the proof, that in a dead plant evaporation goes on more actively than in a living one, and that this is the more active the thicker their leaves are. If I am asked what power limits the production of vapour in the living plant, I openly confess that I am unable to answer this question. Those even who believe in the existence of a peculiar vital force, will be little inclined to assume that this force can act in direct opposition to the physical production of vapour; there are indeed only two possible ways of explaining the phænomenon. Either it must be assumed, that in consequence of the death an alteration takes place in the solid parts of the plant, in the cell-membranes, which makes them less dense, more readily penetrable by water or aqueous vapour, than they are in the living plant; or we must assume that chemical changes occur in the cell-contents of the dead plant; that compounds, which by reason of their hygroscopic peculiarity retain water with a certain power in the living plant, are decomposed, or are separated from the cell-fluid and rendered inactive. Our present knowledge of the structure and of the nature of the chemical conditions of plants scarcely place us in the position to decide whether one or other, or both, of these circumstances occur. An alteration in the membrane of the elementary organs, which indeed many may be inclined at first to reject, does not appear to me to be so totally improbable, since in a dead plant the tension which the parts of a living plant exhibit is immediately lost in so great a degree, as to render it impossible to ascribe this to the slight loss of water occurring in the earliest period, and the mere mechanical collapsing of the cells arising from this loss of water, and one is compelled to think of the removal of a tension connected with life. That the loss of this tension renders the cell-membrane more readily permeable by water and aqueous vapour is at least conceivable, and to me at least so much the more probable that I believe that I have often observed foreign substances, such as iodine, penetrate the membrane of a cell which though dead was still full of water, much faster than that of a living cell. I am well-aware that this view will meet with little sympathy at a time when the universal endeavour is to refer the functions of living plants to purely physical and chemical processes,—when in absorption and excretion of fluids the phænomena of endosmose are singly and solely regarded: I must be content, yet entreat a consideration of how little service are these purely physical explanations in reference to the study of the absorption or excretion of sap through the cells of plants;

fifteenth day, raises a suspicion in my mind that I have made a mistake in writing down the weight. This of course I cannot now ascertain; but, at the same time, it does not essentially prejudice the general result.

how this reference of the whole phænomenon to endosmose leaves totally unexplained a series of such phænomena as the swelling up of a particular region of cells in consequence of irritation in sensitive plants. It may be also from the influence of the phænomenon in question, that in many plants the primordial utricle separates from the cell-wall in the dead plant, and in this way the cell-sap comes into direct contact with the cell-wall. However, it appears to me, as I have already remarked, that it is rash at present to talk either about this or other possibilities, since facts, on which a solid theory can be built, time has yet to furnish us with.

IX.—*On the relative Duration of the Power to germinate, in Seeds belonging to different Families.* By M. ALPH. DECANDOLLE *.

(*First experiment.*)

THE relative permanence of the faculty of germination in different species of seeds has never been examined with the precision that the present condition of science demands. The "practice" of gardens has taught in a vague and superficial manner, that certain seeds soon lose their power of germination, others but slowly; that the collecting of seeds, the manner in which they are preserved, transported, and lastly, sown, influence greatly the result of the sowings. It is well known that by a suitable degree of humidity and heat, may be obtained the germination of seeds which otherwise would remain inert or be spoilt. Facts of this kind have resulted from the observation of every horticulturist, and it would be useless to seek to contest them, because the conditions of the sowings vary and are scarcely ever comparative. On the other hand, physiologists have directed attention in their works to the germination of some very old seeds †, but these are isolated cases, perhaps exceptional, and which cannot be compared with each other, since the seeds have been submitted to different conditions.

It appeared to me to be of some interest to ascertain the faculty of germination, after a given lapse of time, in seeds, belonging to different families, but collected simultaneously in the same garden, transported and preserved in the same manner, finally, sown in equal number in similar conditions of soil, humidity and temperature. Well-observed physiological facts have

* From the Ann. des Sc. Nat., Dec. 1846. Translated by Arthur Henfrey, F.L.S. &c.

† DeC. Physiol. Végét. p. 618 *et seq.* Desmoulins, Documents relatifs à la faculté germinative conservée par quelques graines antiques. Pamphlet in 8vo. Ed. 2. July 1846.

always value in themselves. I foresee moreover, in the present case, certain applications to geographical botany. Thus the duration of the faculty of germination, be it absolute or relative, may have an influence on the frequency of the individuals of each species, on their appearance in new localities the nature of which has changed, and, when the seeds have been deposited a long time, on the effect of transportation from one country to another, and in general on the geographical extension of species.

The idea of ascertaining facts of this kind occurred to me in 1832, when I made the observations which are contained in the 'Physiologie Botanique' of my father*, on the relative rapidity with which germination takes place in the different families of plants. I then preserved packets of seeds in order to sow them after a certain number of years, and as in the summer of 1846, the students who were attending the higher course of botany showed themselves disposed to aid me in some researches or experiments, I recollected my store of old seeds and arranged to sow them at once.

The principal collection which I chose for the experiment had been sent in 1832 from the Botanical Garden at Florence. The seeds had therefore been collected in 1831, and when I sowed them on the 14th of May 1846, they were all nearly fifteen years old. During this long space of time they had been preserved in a dark cabinet, out of the influence of humidity or extreme variations of temperature. There were several hundreds of them, but I was satisfied with taking, at random, 368 species belonging to a large number of different genera and families. That the comparison might be exact, it was necessary to sow an equal number of the seeds of each species. I fixed upon the number 20. It was a long and tedious operation to pick and count them, throwing away such as appeared spoilt. In most instances it was necessary to use a lens. Seeing how many thousands of seeds were included in the sowing of certain species, I could not help thinking that the small seeds germinate less frequently than the large, and I suspected that the contrary opinion held by gardeners resulted from the enormous inequality of the number in the sowings of small and large seeds. The result of our experiment should confirm one or other of these two opinions. The seeds were sown in pots, in peat mould, in order to avoid weeds, of which in fact there were but a very small number. The seeds were watered from time to time. The mean temperature of the month of June, the period when several species sprung up, was 19° Centig. (about 66° Fahr.); that of July 18°·5 Cent., according to observations at nine in the morning and nine at night, pub-

* Physiol. Bot. p. 639 *et seq.*

lished in the 'Bibliothèque Universelle de Genève.' The maximum several times reached 30° and even 31° Cent. (about 86° Fahr.). The pots were kept under examination till the autumn, but scarcely any seeds sprung up after the end of June.

The following are the species submitted to experiment. Those which did not come up are in the ordinary type; those of which a few came up, the number being less than half the twenty seeds sown, are in italics; lastly, the single species of which more than half came up, is in small capitals:—

Asclepiadeæ.

Asclepias amœna.

Amyrideæ.

Amyris polygama.

Amaranthaceæ.

Amaranthus prostratus.
caudatus.
giganteus.
cernuus.
paniculatus.
curvifolius.
speciosus.
Celosia argentea.
cristata.

Balsamineæ.

Impatiens Balsamina, fl. pl.

Boragineæ.

Echinospermum Lappula.
Lithospermum officinale.
Asperugo procumbens.
Anchusa ovata.

Campanulaceæ.

Campanula sibirica.
pyramidalis.
medium.

Cappárideæ.

Cleome viscosa.
triphylla.

Caryophylleæ.

Silene apetala.
conoidea.
gallica.
cerastioides.
vespertina.
fruticosa.
quinquevulnera.
conica.
tricuspidata.
Silene antirrhina.
noctiflora.
Lychnis Githago.
Gypsophila scorzoneræfolia.
Arenaria marina.
media.
Gypsophila vaccaria.

Chenopodeæ.

Atriplex tatarica.
rosea.
hortensis.
Basella alba.
Blitum virgatum.
Beta maritima.
Chenopodium maritimum.
Emex spinosus.

Cistineæ.

Cistus villosus.
monspeliensis.
Helianthemum salicifolium.

Compositæ.

Gnaphalium sylvaticum.
Crepis aspera.
Parthenium hysterophorum.
Geropogon australis.
Onopordon illyricum.
Calendula suffruticosa.
Melananthera deltoidea.
Artemisia vallesiaca.
Pyrethrum corymbosum.
Flaveria contrayerva.
Chrysanthemum coronarium.
Centaurea atropurpurea.
Artemisia annua.
Barkhausia graveolens.
Artemisia Abrotanum.
Pyrethrum daucifolium.
Zinnia multiflora fl. luteo.
Artemisia camphorata.
Verbesina serrata.
Eclipta erecta.
Bœbera chrysanthemoides.
Flaveria repanda.

Cirsium eriophorum.
Eupatorium cannabinum.
Elephantopus scaber.
Onopordon tauricum.
Madia sativa viscosa.
Serratula alata.
Cacalia sonchifolia.
Calendula pluvialis.
Centaurea dealbata.
Silphium trifoliatum.
Pyrethrum tenuifolium.
Centaurea sempervirens.
Helianthus pubescens.
Urospermum Dalechampii.
Stevia ovata.
Osteospermum cæruleum.
Ampherephis aristata.
Conyza ivæfolia.
Helianthus annuus.
Calendula officinalis.
Bidens cernua.
Eupatorium sessilifolium.
Picris hieracioides.

Coniferæ.

Cupressus pyramidalis.

Convolvulaceæ.

Convolvulus sepium.

Cruciferæ.

Camelina sativa.
Brassica incana.
Sisymbrium persicum.
Alyssum micropetalum.
Iberis pinnata crenata.
Brassica Eruca.
Matthiola incana.
Barbarea vulgaris.
Erysimum perfoliatum.
Camelina dentata.
Neslia paniculata.
Arabis sagittata.
Lunaria biennis.
Alyssum rostratum.
 saxatile.
Matthiola annua.
Sinapis nigra torulosa.
Thlaspi alpestre.
Sisymbrium hirsutum.
Sinapis alba flexuosa.
Malcolmia maritima.
Sinapis dissecta.
Thlaspi perfoliatum.
Erysimum strictum.
Crambe hispanica.
Nasturtium indicum.
Biscutella Apula.
Brassica Napus.
Cochlearia glastifolia.
Bunias orientalis.
Erysimum cuspidatum.
Thlaspi arvense.
Arabis auriculata.
Sisymbrium acutangulum.

Cucurbitaceæ.

Cucumis serotinus.
 Dudaim.

Dipsaceæ.

Succisa rigida.
Dipsacus Fullonum.
Succisa pratensis.

Euphorbiaceæ.

Euphorbia chamæsycea.
 terracina.
 hypericifolia.
Phyllanthus Niruri.

Frankeniaceæ.

Frankenia pulverulenta.

Gentianaceæ.

Gentiana asclepiadea.

Geraniaceæ.

Erodium pimpinelloides.
 pulverulentum.
 melanostigma.

Gramineæ.

Bromus racemosus.
 stenophyllus.
Lappago racemosa.
Andropogon laguroides.
Phalaris bulbosa.
 canariensis.
 paradoxa.
Panicum miliaceum nigrum.
 erucæforme.
 avenaceum.
 miliaceum album.
 capillare.
Setaria scrobiculata.
 italica.
 macrostachya.
 macrochæta.
Saccharum strictum.
Poa littoralis.
 pilosa.
 verticillata.
Festuca delicatula.
Agrostis monandra.
Hordeum nepalense.

Oryza latifolia.
Paspalum scrobiculatum.
Lolium tenue.
temulentum.
Digitaria humifusa.
ciliaris.
Triticum imbricatum.
Oryza sativa monstrosa.
Eleusine coracana.

Hydrophyllaceæ.

Ellisia nyctelæa.

Hypericineæ.

Hypericum elatum.
perforatum.

Irideæ.

Iris dichotoma.
Xiphium.
Tigridia Pavonia.
Ixia ramiflora.
Trichonema neglecta.

Labiatæ.

Salvia lanceolata.
Æthiopis.
tingitana.
verticillata.
viscosa.
indica.
hispanica.
sclarea.
verticillata napiifolia.
hirsuta.
Ocymum basilicum.
Stachys annua.
Ajuga pyramidalis.
Leucas martinicensis.
Satureia hortensis.
Nepeta lanceolata.
Nepeta botryoides.
Ocymum basilicum maxim.
minimum nigrum.
Galeopsis versicolor.
Teucrium hircanicum.
orientale.
Plectranthus fruticosus.
scutellerioides.
parvifolius.
Lumnitzera tenuiflora.
Hyssopus officinalis.
Lavandula multifida.
Hyptis radiata.
Marrubium astrakanicum.

Leguminosæ.

Dolichos abyssinicus.
Dolichos niloticus.
Vicia biflora.
Vicia sordida.
DOLICHOS UNGUICULATUS.
Dolichos brasiliensis.
Coronilla valentina.
Trifolium spumosum.
Trifolium expansum.
Trifolium Gussoni.
melacanthum.
reflexum.
aristatum.
Trifolium subterraneum.
Trifolium pratense.
alexandrinum.
rubens.
arvense.
maritimum.
Acacia farnesiana.
glandulosa.
Lathyrus cicera.
Amorpha fruticosa.
Melilotus cretica.
officinalis.
messaniensis.
officinalis fl. albo.
cæruleus.
Medicago denticulata.
Ervum longifolium.
Ervilia.
tetraspermum.
Coronilla Emerus.
juncea.
Cytisus laburnum.
Baptisia australis.
Lablab vulgaris sem. nigro.
Anthyllis vulneraria.
Sesbania aculeata.
Mimosa Julibrissin.
Ononis hispida.
Phaseolus Cafer.
Phaca alpina.
Trigonella spinosa.
Lotus Jacobæus.

Liliaceæ.

Allium sphærocephalum.
cepa, ægyptiacum.
gracile.

Lineæ.

Linum usitatissimum humile.

Lythrarieæ.

Ammania latifolia.
Cuphæa viscosissima.
Ammania diffusa.

Malvaceæ.

Malva limensis.
Malva caroliniana.
lactea.
Lavatera arborea.
cretica.
Urena lobata.
Kitaibelia vitifolia.
Sida hastata.
mollissima.
Æthæa narbonensis.

Myrtaceæ.

Psidium aromaticum.

Onagrarieæ.

Œnothera biennis.
Epilobium hirsutum.
Œnothera sinuata.
mutabilis.

Papaveraceæ.

Papaver Argemone.
Rhæas.
hybridum.
orientale.
Argemone mexicana alba.
Chelidonium majus.

Paronychieæ.

Corrigiola littoralis.
Herniaria vulgaris.
Mollia diffusa.

Phytolacceæ.

Phytolacca decandra.
Rivina brasiliensis.

Plantagineæ.

Plantago lanceolata.
maxima.
vaginata.
Cynops.
media.

Plumbagineæ.

Statice spathulata.

Polygoneæ.

Polygonum orientale.
tataricum.
Rumex Lunaria.
Hydrolapathum.
littoralis.

Portulacaceæ.

Portulaca pilosa.

Primulaceæ.

Cyclamen persicum.
Anagallis carnea.
latifolia.
Lysimachia vulgaris.
Androsace maxima.

Ranunculaceæ.

Nigella Damascena fl. pl.
Thalictrum aquilegifolium.
flavum.
densiflorum.
Ranunculus parviflorus.
muricatus.
bulbosus.
Aquilegia canadensis.
Nigella Damascena.

Resedaceæ.

Reseda odorata.

Rhamneæ.

Rhus lucidus.
Ceanothus americanus.

Rosaceæ.

Sanguisorba canadensis.

Rubiaceæ.

Bigelowia verticillata.
Asperula arvensis.
cynanchica.
Crucianella latifolia.
Galium spurium.
Spermacoce rubra.

Sapindaceæ.

Cardiospermum Corindum.

Scrophulariaceæ.

Bartsia Odontites.
Verbascum phlomoides.
Blattaria.
Thapsus.
floccosum.
Digitalis orientalis.
lanata.
intermedia.
purpurea.
Scrophularia aquatica.

Solanaceæ.

Nicotiana glutinosa.
rustica, asiatica.
Solanum Zuccagnianum.
ciliatum.
tomentosum.
Datura Tatula.
Hyoscyamus Senecionis.

Tiliaceæ.

Corchorus olitorius.
Triumfetta triclada.

Umbelliferæ.

Ligusticum apioides.
Hasselquistia cordata.
Bupleurum semicompositum.
Œnanthe Phellandrium.
Bupleurum junceum.
Anthriscus vulgaris.
Selinum lineare.
Conium maculatum.
Biforis flosculosa.
Eryngium asperum.

Urticaceæ.

Datisca cannabina.
Urtica pilulifera.

Valerianeæ.

Centranthus ruber.

Verbenaceæ.

Lantana involucrata.
Verbena urticæfolia.
officinalis.
Priva mexicana.
Vitex Agnus-castus.
Stachytarpheta angustifolia.
aristata.
Lippia rubra.

One is struck, at the first glance, at the very small number of species which germinated. By counting, we find seventeen out of 386. Moreover the germinative power was much weakened in those which did come up. In fact, out of the seventeen species which came up, *Dolichos unguiculatus* is the only one that yielded more than half the seeds sown (fifteen out of twenty). The others had, for the most part, one, two or three germinations in twenty seeds. *Lavatera cretica* approached nearest to *Dolichos*, but there were only six seeds which germinated out of twenty.

The different natural families may be classed as follows; commencing with those where the largest proportion of species preserved the power of germinating, and ending with those where, more than ten species having been sown, none came up.

Malvaceæ,	of which came up	5	out of	10	species sown,	or	0·50
Leguminosæ,	——	9	—	45	——		0·20
Labiatæ,	——	1	—	30	——		0·03
Scrophulariaceæ,	——	0	—	10	——		0·00
Umbelliferæ,	——	0	—	10	——		0·00
Caryophyllaceæ,	——	0	—	16	——		0·00
Graminaceæ,	——	0	—	32	——		0·00
Cruciferæ,	——	0	—	34	——		0·00
Compositæ,	——	0	—	45	——		0·00

No conclusion can be drawn from the fact, that none came up out of nine Amaranthaceæ, nine Ranunculaceæ, eight Chenopodiaceæ, eight Verbenaceæ, seven Solanaceæ, six Papaveraceæ, six Rubiaceæ, &c., nor from that, for example, the single Balsaminaceous plant sown came up, for the numbers are too small, and the result perhaps depends on the selection of the seeds sown representing these families. That which comes out in a very evident manner is the superiority of the Malvaceæ and Leguminosæ as to the duration of the faculty of germination, and the inferiority of the Compositæ, Cruciferæ and Graminaceæ.

In this comparison of the families, we are obliged to leave on one side a large number of species. This is not the case when we compare the annual, biennial, perennial and ligneous plants. There were in the experiment 357 species, the duration of which is known from botanical books, and 11 of which this is doubtful, either in itself or on account of some doubt as to the specific name. The 357 species which may be taken into account class themselves thus:—

Species.	Total number.	Number of those which came up.	Out of 100 species came up.
Annuals	180	9	5·0
Biennials	28	0	0·0
Perennials	105	4	3·8
Ligneous	44	3	6·7
Total	357	16	4·4

Or,

Species.	Total number.	Number of those which came up.	Out of 100 species came up.
Monocarpons	208	9	4·3
Polycarpons	149	7	4·7
Total	357	16	4·4

These figures seem to prove that the woody species preserve the power to germinate longer than the others, while the biennials would be at the opposite extreme. However, we must observe the small number of species in these two categories, from which it will be concluded that with regard to them the experiment was insufficient. As to the perennial plants compared with the annuals, it seems probable that their faculty of germination is lost rather more quickly.

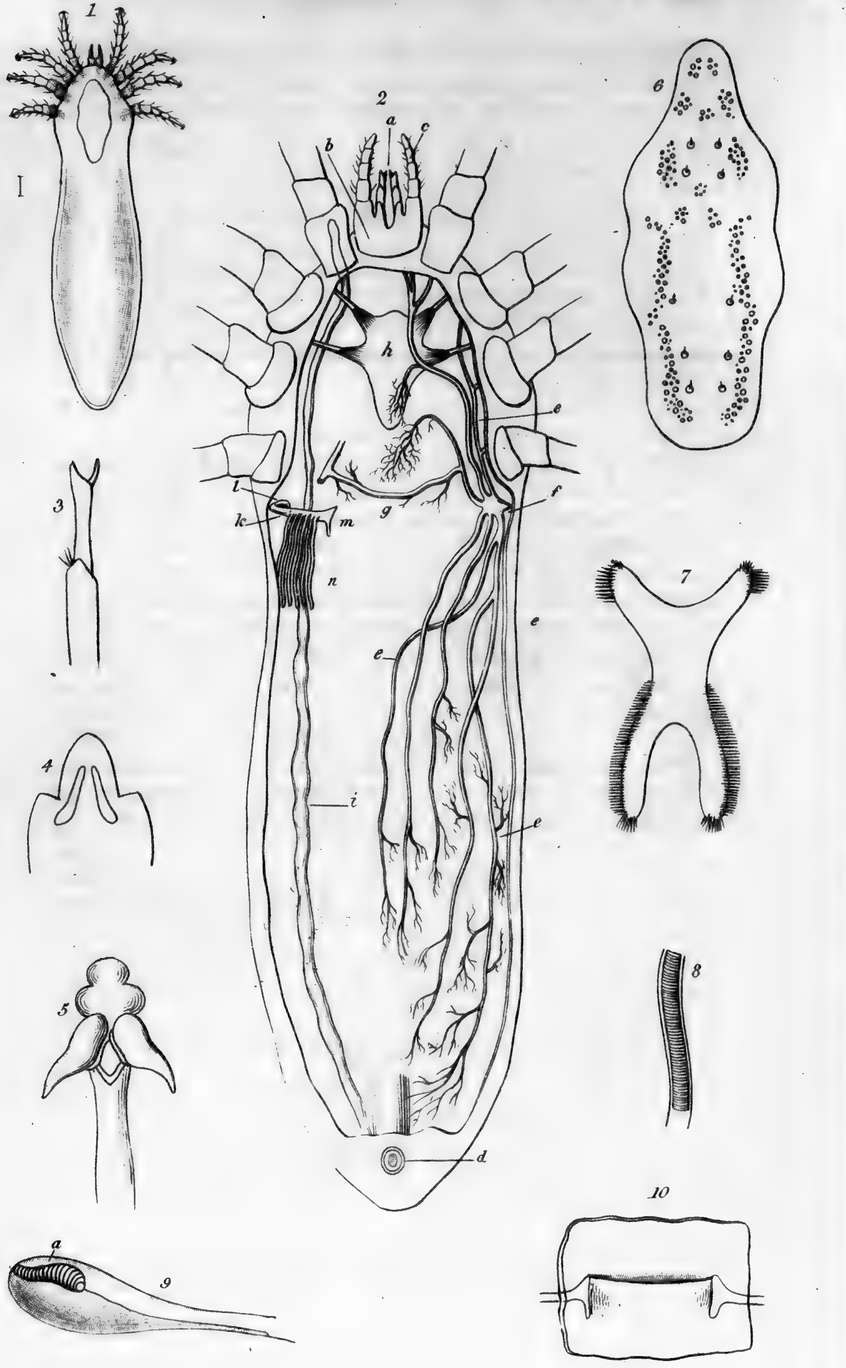
Do the large seeds preserve the faculty of germination better than the small ones? Our experiment can answer this question but imperfectly. In fact, we did not sow *very large* seeds, like those of the Cocoa for instance; nor even *large* seeds, like those of many Palms, certain Leguminosæ, Sapotaceæ or Coniferæ. The seeds in the collection were of a *mean* size, like the Haricots, the seeds of Iris, of Convolvulaceæ, &c.; or *small* seeds, like those of Compositæ, Graminaceæ, Geraniaceæ, &c.; or lastly, *very small* seeds, such as those of the Poppies, Plantago, Amaranthaceæ, &c. It would be difficult to class all the seeds sown in the different degrees of magnitude; only we may remark among the species which came up a rather large proportion of the *mean* or *small* (Dolichos, Malvaceæ, Balsam, Acacia, Vicia), while the *very small* seeds did not come up. We have thus a confirmation of the idea conceived at the time of sowing, namely, that the reproduction of the species with very small seeds is assured by their number rather than by the duration of the germinative power. This is not surprising, since the very small seeds have a much larger surface in proportion to their volume, and are consequently more readily penetrated by the variations of temperature or humidity which affect the organs. It is probable also that a much larger proportion of the very small seeds are sterile. This our experience does not allow of our stating as ascertained; but we are led to presume it by the difficulty of getting to germinate the fresh seeds of the Orchidaceæ, the Orobanchaceæ, and some other families with extremely small seeds.

The Leguminosæ and Malvaceæ, which preserve the germinative faculty so well, are seeds possessing little or no albumen, especially the Leguminosæ; but the Cruciferæ and the Compositæ, which are at the opposite extreme, have still less than they. The Graminaceæ and Umbelliferæ, which have large albumens, did not preserve their powers. Thus the circumstance of the presence or the absence of albumen appears in general indifferent; although doubtless certain albumens, like those of the Coffees, the Umbelliferæ, &c., are bad to preserve on account of special chemical conditions. In other points of view, the structure of the seed and fruit appears equally unimportant. It might perhaps have been thought, for example, that the seeds of the Compositæ, being covered by the pericarp and the calyx, would be better preserved than others. Experience has shown, on the contrary, that they lose their vital powers in the highest degree.

Finally, there is some interest in comparing the present experiment with those which I made in 1832, on the relative rapidity of germination in the different families*; it will there be seen that the Amaranthaceæ, the Cruciferæ, the Caryophyllaceæ, which germinate very quickly, lose their power of germination in a few years; that the Malvaceæ germinate rapidly, and lose their properties slowly; that the Leguminosæ, on the contrary, germinate slowly enough, and lose their power still more slowly; lastly, that the Umbelliferæ and Scrophulariaceæ germinate slowly, and lose their vitality in a few years. It appears, from these results, that the duration of the faculty of germination is most frequently in an inverse proportion to the power of germinating quickly, though without doubt there are numerous exceptions. Thus the very small seeds, which are seen to germinate quickly, are also affected sooner; while the seeds rather larger or of a mean size germinate slowly or endure long.

Such are the conclusions which result from this first experiment. They show the necessity of others, in order to compare a greater number of families and to verify certain probable speculations. The seeds which I have kept in reserve allow me to return to the subject. In the meantime, as these observations have been made with all suitable precautions, and as they form, with my experiments of 1832 and with those which I project, a general examination of germination considered in a physiological point of view, it seemed to me that it would be of use to publish them.

* Physiol. Végét. p. 648.



G.I.A. del.

J.D.C. Sowerby sc.

X.—*Biological Contributions.* By GEORGE J. ALLMAN, M.D., F.R.C.S.I., M.R.I.A., Professor of Botany in Trinity College, Dublin, late Demonstrator of Anatomy and Conservator of the Anatomical Museum, T.C.D.

[With two Plates.]

[Continued from p. 9.]

No. IV. *Description of a new Genus and Species of Tracheary Arachnidans* *.

WE are indebted to Dr. O'Brien Bellingham of Dublin for the discovery of an Acaroid Arachnidan which he found in considerable numbers in the posterior nares of a seal (*Halichœrus Gryphus*) in July 1837, and which has on examination proved to belong to a form not hitherto described.

At the Fourteenth Meeting of the British Association held at York in 1844, I noticed Dr. Bellingham's arachnidan as a new genus and species under the name of *Halarachne Halichœri,* and under the same designation Mr. Thompson of Belfast has recorded it in his Report of the Invertebrate Fauna of Ireland. The description there given had been drawn up from specimens not in the best state of preservation, and was necessarily imperfect, but within the last few weeks I have been fortunate enough to obtain, in company with Messrs. Ball and Thompson, fresh examples of the Arachnidan from a specimen of *Halichœrus Gryphus* taken off the Dublin coast. In the posterior nares of this animal they existed in great abundance with a species of *Ascaris,* and thus afforded an opportunity of drawing up a more detailed description of the new genus, to which the following characters may be assigned:—

HALARACHNE †.

GEN. CHAR. *Palps* free, filiform; *mandibles* didactyle; sternal *lip* bifid. *Legs* with the last joint terminated by two hooks and an intermediate three-lobed caruncle. *Body* entire, elongated, subcylindrical, furnished anteriorly with a dorsal plate. *Eyes* none.

Species unica, *H. Halichœri.* Pl. II., III.

Hab. Infesting the posterior nares of *Halichœrus Gryphus,* Dublin coast, *Dr. Bellingham.*

Halarachne Halichœri measures about an eighth of an inch in length. The abdomen, which presents no trace of distinction from the cephalothorax, is of a somewhat cylindrical form,

* Read before the Royal Irish Academy, April 12, 1847.

† From ἅλς, *the sea,* and ἀράχνη, *a spider.*

rounded at its posterior end, of a white colour, and causing the animal at first sight to suggest the idea of a small grain of rice. The oral apparatus is in the form of a proboscis situated on the under surface of the anterior end of the cephalothorax, and is composed of a pair of didactyle mandibles ensheathed by an upper and lower lip. The mandibles (fig. 2 *a* & fig. 3) are composed of two elongated articulations, with a minute terminal one which is opposable to a prolongation of the external side of the articulation which precedes it, so as to constitute a small prehensile forceps. The lower lip (fig. 2 *b*) is very large; it is deeply divided in the centre, conceals the bases of the mandibles, and supports at each side a filiform palp (fig. 2 *c*) with four free articulations. The upper lip is arched in front, and presents upon its external surface the appearance of two subulate organs converging towards the mesial line of the lip (fig. 4).

The oral organs are immediately succeeded by four pairs of six-jointed legs. Of these the anterior pair is a little longer and more slender than the second and third, and is directed forwards on each side of the proboscis so as to resemble a pair of antennæ. The fourth pair is also slightly more slender than the two which precede it and is directed backwards. The first three pairs arise close to one another; the fourth is separated from the third by a disproportionate interval. All the legs support, upon the distal extremity of their last articulation, a pair of strong recurved hooks with an intermediate three-lobed caruncle (fig. 5).

Upon the under surface of the cephalothorax may be observed, with the assistance of a low magnifying power, four small brown puncta; these, as will be presently seen, are the lateral lobes of the great central nervous mass appearing through the integument.

On the dorsal aspect of the cephalothorax and extending for some distance behind the origin of the posterior pair of legs is a corneous shield of a somewhat oval shape with sinuous margins (fig. 6), and on the ventral aspect a sternal plate may also be demonstrated, though this can scarcely be distinguished from the surrounding soft integument. If however the floor of the cephalothorax be separated and then viewed under compression by transmitted light, a distinct plastron (fig. 7) may be easily seen, having its posterior margin produced into two long processes which pass backwards, and its anterior into two shorter ones which are directed forwards. To the four processes the muscles are attached which move the legs. The muscular fibre is marked with very evident transverse striæ.

The alimentary canal at its commencement seems to be an exceedingly narrow tube, but it would afterwards appear to undergo enlargement, and even to be furnished with extensive cæcal prolongations. Appearances would lead one to suspect that cæca are sent off into each of the eight legs, but upon this point I am unable to come to any decided conclusion, and indeed the course of the alimentary tract has eluded all my attempts to demonstrate it with satisfaction. Just before its termination in the anus however, which occupies the posterior extremity of the abdomen (fig. 2 *d*), the rectum would appear to receive two long cæcal tubes (fig. 2 *i*); these contain a white opake substance, and may be traced forwards one on either side of the body till they terminate by entering the first joint of the anterior pair of legs. They must, I conceive, be referred to a biliary, or perhaps more correctly to a urinary system.

Respiration is effected by means of a system of tracheæ (fig. 2 *e, e, e*) which originate at each side in a minute spiracular orifice (fig. 2 *f*) occupying a latero-dorsal position at the anterior extremity of the abdomen. From the spiracles the tracheæ pass off, some forwards into the cephalothorax and others backwards into the abdomen; the former sending branches to the legs and oral apparatus, and to the other organs in the anterior part of the body, while the latter are distributed to the organs of the abdomen.

One great transverse trunk (fig. 2 *g*) passes across the posterior part of the cephalothorax, uniting the tracheary systems of opposite sides.

The structure of the tracheæ (fig. 8) is very similar to that of the same organs in insects; the spiral fibre however demands a much higher power in order to be rendered visible than is required for this purpose in the generality of true insects.

There is no part of the internal anatomy of *Halarachne* more easily demonstrated than the great central nervous mass. This (fig. 2 *h*) occupies a position near the middle of the cephalothorax, and would seem to lie beneath the alimentary canal. It is of a somewhat stellate figure, the margins being prolonged on each side into two pyriform lobes giving off from their apices nervous cords which run to the intervals between the first and second, and second and third pairs of legs. The lateral lobes differ in structure and colour from the rest of the nervous mass, and are visible through the integument without any dissection. No special organs of sense can be detected*.

The generative system is very obscure. Extending transversely

* The only other view which it is possible to take of the organ here described as a central nervous mass, is that which would represent it as a ventricular cavity with lateral prolongations. Such view however I believe a careful examination will prove to be untenable, and convince us that it is really to be referred to the nervous system, and results from the confluence of two or more pairs of ganglia.

beneath the integument from a point close to the spiracular orifice, to within a short distance of the mesial line of the under surface of the abdomen, may be observed a dark-coloured and very evident line (fig. 2 *k*). This line, which I believe we would be right in interpreting as a tube, terminates at its end nearest the spiracle in a pyriform *cul de sac* (fig. 2 *l* & fig. 9), and at the other in a conical or infundibulate expansion (fig. 2 *m*), through which it would seem that the tube opens externally into a remarkable pouch which extends across the anterior part of the under surface of the abdomen from the conical termination of one tube to that of the other, and easily admits the introduction of the point of a needle (fig. 10). The *cul de sac* of the tube contains a somewhat pyriform curved organ marked with circular or spiral striæ (fig. 9 *a*), and a careful examination will detect certain filiform organs extending from the tube in the greater part of its length backwards till lost among the contents of the abdomen. Whether however these filaments are cæcal appendages opening into the tube or muscular fibres, or something quite different from both, is far from evident. This portion of the organization of *Halarachne* I have preferred describing as referable to the generative system, though its exact function must still be viewed as hypothetical. Among the numerous specimens I have examined I could detect no traces of distinction of sex; all appeared to possess precisely the same structure and all to be reproductive. *Halarachne* would seem to be viviparous, for the rupture of the walls of the abdomen would frequently liberate the young furnished as yet with only six legs, and the abdomen scarcely visible, but in other respects the embryo to all appearance in rather an advanced stage of development. In what special organ these embryos are confined previously to parturition, or through what opening they naturally escape from their parent, I am unable to form any satisfactory opinion.

Small six-legged mites (fig. 11), most probably the larvæ of *Halarachne*, and apparently differing but little in form from the embryo condition just alluded to, may be found in considerable abundance along with the adult animal.

In these the abdomen is but little developed. The legs scarcely differ from those of the adult except in number and in being proportionably longer; they are all furnished with the double claw and intermediate caruncle. The oral organs seem also to approximate nearly to the condition already described. Neither dorsal plate nor plastron of the cephalothorax is evident.

The internal anatomy may in some respects be studied with greater facility than in the adult. The alimentary canal commences in a straight and delicate tube, which after passing above the great central ganglion expands on either side into two pouches, from each of which a large cæcal prolongation would seem to pass backwards, running along the sides of the body to its posterior extremity. Between these two cæca the canal is continued, experiencing in its course two other dilatations, and finally terminates by a straight rectum which opens at the posterior end of the body between three long bristles. Just before its termination the rectum receives the two long cæcal tubes which we have already described in the adult, and which here also contain an opake fluid, and may be traced forwards into the first pair of legs. The alimentary canal through its whole length is surrounded by a large quantity of the so-called adipose matter.

The central nervous mass is here also very easily demonstrated. It presents anteriorly two lobes, which are not however very prominent, and the lateral prolongation so conspicuous in the adult cannot here be detected. A filament would seem to be traceable from each of the anterior lobes to the organs of the mouth, but I have been unable to make any satisfactory observation with reference to the connection of other filaments with the central mass.

I have in vain sought for traces of a respiratory system.

Though but three pairs of legs are visible externally, yet the fourth or posterior pair which becomes developed in the adult exists in the larva in a rudimental condition. It may with some care be detected, confined as yet beneath the integument, and presenting the appearance of a pair of conical organs diverging at first as they pass backwards and then turning forwards and inwards. The muscular fasciculi may already be seen with their fibres assuming a spiral arrangement in the interior of the rudimental limb. The larvæ are all much more active than the adults, but not natatory.

In the structure of the oral organs as well as in other points of its external anatomy, *Halarachne* possesses very close affinity with *Gamasus*. From the latter genus indeed, the principal zoological differences will be found in the remarkably elongated cylindroid body of *Halarachne*, which contrasts so strongly with the flattened, more or less orbicular body of *Gamasus*. The habits of the two genera, though in both cases parasitical, are in all other respects totally dissimilar; *Halarachne* not only presenting us with a marine habitat, but being absolutely entozoal.

EXPLANATION OF PLATES II., III.

Fig. 1. *Halarachne Halichœri* magnified.

Fig. 2. Ditto, opened from below to show certain details of internal anatomy: *a*, mandibles; *b*, lower lip; *c*, palp; *d*, anus; *e e e*, tracheæ;

f, spiracle; *g*, transverse tracheary trunk; *h*, central nervous mass; *i*, lateral cæca; *k*, *l*, *m*, *n*, unknown organ probably referable to the reproductive system.

Fig. 3. Mandible.
Fig. 4. Upper lip.
Fig. 5. One of the feet with its terminal claw.
Fig. 6. Dorsal shield.
Fig. 7. Ventral shield.
Fig. 8. Portion of a tracheary tube showing its structure.
Fig. 9. *Cul-de-sac* probably connected with the reproductive system, and containing a pyriform striated body.
Fig. 10. Pouch existing on the under surface of the abdomen.
Fig. 11. Anatomy of the larva.

BIBLIOGRAPHICAL NOTICES.

Manual of British Botany, containing the Flowering Plants and Ferns arranged according to the Natural Orders. By Charles Cardale Babington, M.A., F.L.S. &c. 2nd edit. 12mo, pp. 428. Van Voorst, London, 1847.

In studying the species of British plants, it is of great importance to have a book which contains short and at the same time accurate discriminating descriptions, and one which can be easily taken to the fields for the purpose of consultation. Mr. Babington's 'Manual' combines these requirements. The work is portable, the characters of the species are given with great care from personal observation, and the names have been revised so as to make the nomenclature correspond as much as possible with that adopted by the best botanists in Europe. "It has been the author's wish to adopt in all cases those names which have the claim of priority, unless good cause could be shown for a contrary proceeding; and with this object he has carefully examined nearly all the best European Floras, comparing our plants with the descriptions contained in them, and in very many cases with foreign specimens of undoubted authenticity. In the adoption of genera and species an endeavour has been made, by the examination of the plants themselves, to determine what are to be considered as truly distinct; thus, it is hoped, taking nature as a guide, and not depending upon the authority of any name however distinguished."

The work is founded in some measure on the model of Koch's 'Synopsis Floræ Germanicæ,' and undoubtedly is the best Manual of British Botany which we possess. It is not a compilation, but an original work embracing the results of the author's examination of the species in most cases in their native localities. In giving the characters, the essential and distinguishing points are put in italics, thus calling the attention of the student at a single glance to the marked differences of the species. The natural system of DeCandolle is adopted with some modifications, and the Linnæan system is used as a key to the genera. In this way the work may be said to combine the artificial and natural methods of classification. The analysis of the Linnæan classes and orders, with the synopsis of the genera at the commencement of the work, render it valuable for beginners.

In the present edition several important additions have been made. There is an excellent analysis of the natural orders of British plants, and there is also an index of popular English names. Some of the more difficult genera, as *Rubus* and *Hieracium*, have been carefully revised. The species which are doubtfully native have been noticed, and all the recent additions to the Flora have been introduced. Many of these additions have already been described by Mr. Babington in the 'Supplement to English Botany,' a work which is now published regularly by Mr. Sowerby, and which well deserves the support of all British botanists.

We have no hesitation in recommending Mr. Babington's 'Manual' as the best guide to the student of practical botany in this country.

The Elements of Botany, Structural and Physiological. By John Lindley, Ph.D., F.R.S. &c. 5th edit. 8vo, pp. 238. London, Bradbury and Evans.

Dr. Lindley led the way in this country in the publication of elementary works on botany, embracing a *philosophical* view of the science. His works have long and deservedly held the first place in our universities and schools. We have now a fifth edition of his 'Outline of the First Principles of Botany.' "The author has taken advantage of the opportunity thus afforded him of bringing the work completely up to the present state of botanical knowledge, without however interfering with its original plan, by the introduction of doubtful or merely speculative matter, or of questions which do not interest a student. It was in the outset a book for learners; its purpose was to state plainly and concisely the great facts of the science, and to separate them from the ulterior questions to which they lead; and however much the work may have become extended by the addition of explanatory notes, the latter have never been permitted to appear in a form likely to divert attention from the main points. On the contrary, they have been printed in a different type, which renders them immediately distinguishable, and enables the reader to go through the principal propositions without, in the first instance, occupying his thoughts with their detailed explanation."

It is an admirable synopsis of the important principles of the science, and it is illustrated with excellent woodcuts. The addition of a glossary of technical terms, arranged alphabetically, enhances its value much, and is a great boon to the student. This edition differs from previous ones in not giving an account of the natural systems, nor a detailed description of the natural orders. For these the learner is referred to the author's 'School Botany' and his 'Vegetable Kingdom.' For one who wishes to have a short and comprehensive view of the great facts of the science of botany as regards structure, physiology and classification, we look upon this edition of the Elements, combined with School Botany, as among the best works which he can procure.

Illustrations of British Mycology. By Mrs. T. I. Hussey. Reeve, Brothers. 4to. Parts 1 & 2.

There is perhaps no country in which so little use is made of the various esculent fungi which abound everywhere in early autumn, as Great Britain. There is no doubt that we have some fifty or sixty species which would afford wholesome and agreeable food, and yet scarcely more than a tenth of this number are ever admitted to our tables. This perhaps is in some measure owing to the circumstance that no British work on esculent fungi, as far as we are aware of, has ever appeared, except the little treatise entitled the 'Mushroom and Champignon' illustrated, which is confined to a very few species. This desideratum is now supplied by the more general work of Dr. Badham, and by the 'Illustrations of British Mycology' now in progress, which bids fair to be one of the most important that has ever appeared on useful and noxious fungi. The illustrations are preceded by a general sketch of fungi founded on the concluding volume of the 'English Flora.' Since its publication the real structure of the hymenium has been ascertained, and consequently some improvements and alterations are requisite; a sketch of these has been given by the author of that volume in Dr. Lindley's 'Vegetable Kingdom,' and since its publication a long article has appeared on the subject in Orbigny's 'Dictionnaire d'Histoire Naturelle' from the pen of M. Léveillé, agreeing in all essential points with Mr. Berkeley's arrangement, and this has been applied by Dr. Mougeot to an extensive series of fungi published in the statistical account of the Department des Vosges. It has been objected to both, perhaps with some justice, that they are founded solely on the fructification, without paying sufficient attention to morphology; it is however certain that the real affinities of the genera are more truly indicated than in any former arrangement, and we shall be rejoiced if the forthcoming morphological arrangement by Professor Fries in the 'Summa Vegetabilium Scandinaviæ' remedies acknowledged defects without creating new difficulties. We do not blame Mrs. Hussey therefore for adopting the arrangement of the 'English Flora' in preference to that in the 'Vegetable Kingdom,' in which indeed there are some manifest errors, her object being to refer students to the most readily available source of information.

Some excellent observations follow on collecting and examining fungi, which will be read with interest even by practised students; and the same may be said of the general accounts of the species illustrated, in which there is always something worth notice, either from its intrinsic value, or from being placed in a novel point of view. It is not indeed to be expected as regards a subject of such immense extent, and requiring access to a multitude of rare and expensive books, in various languages, that in a work whose merits rest expressly on faithfulness of execution and personal observation, there should not be here and there some little matter for criticism, but it will be found that with that nicety of tact which is so characteristic of her sex, Mrs. Hussey has avoided in general such difficulties.

Of the original drawings of Mrs. Hussey and her sister it is impossible to speak too highly; many of them are so exquisite as to be positively fit for public exhibition, and so characteristic that it is impossible not at once to recognise the species. These are reproduced faithfully by the lithographer, but there is a certain want of force about the lithographs which does not do justice to the originals. This and some other points connected with the editorial department will we doubt not be improved in the course of publication. Meanwhile we recommend the work most cordially to our readers, who will find accurate and beautiful illustration combined with much practical and interesting matter, especially as regards the culinary use of these neglected but by no means despicable objects.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

April 13, 1847.—Wm. Yarrell, Esq., Vice-President, in the Chair.

NOTES ON SOME RARE BIRDS OF NEW ZEALAND AND AUSTRALIA. BY MR. F. STRANGE, IN A LETTER TO JOHN GOULD, ESQ., F.R.S. ETC.

"STRIGOPS HABROPTILUS, G. R. Gray.—The *Ka-ka-po*, or Night Parrot of the New Zealanders, is an inhabitant of the western side of the Middle island, and like the *Kiwi-kiwi* or *Apteryx* is strictly nocturnal in its habits, and never leaves its retreat during the day; its usual place of resort consists of burrows, formed by itself, beneath the roots of large trees or under immense pieces of rock, whence they cannot, even by the natives, be easily dug out. Its food consists of fern-roots, which it digs up with its bill, and the outer covering of the leaves of flax, which it obtains by drawing the leaves between the mandibles and leaving the flax behind. They are not gregarious, more than two never being found together, except a pair of young ones, which appear to stop with the old birds until they have attained the size of their parents. This is one of the birds the natives set great store by, the head being cut off, strung by the nostrils, and worn in the ears on their grand feast-days. It is known to the sealers by the name of the Green Bird of New Zealand.

"APTERYX AUSTRALIS.—*Kiwi-kiwi* of the New Zealanders. I am told that a second species of *Apteryx* is to be found on the Middle island, that it stands about three feet high; it is called by the sealers the Fireman. Aware, from your figures and description, that the sexes differ considerably in size, I pointed this out to my informant; but he still persisted that there are two species, in confirmation of which opinion he added, that he had taken the eggs of the two birds, and found those of one species to be much larger than those of the other. The larger kind are nearly the size of the Emu's; they are somewhat long in form and blunt at the ends; their colour is a dirty white. They are deposited in a burrow on a nest formed of roots and sticks, and a few of the bird's own feathers.

"SCYTHROPS NOVÆ HOLLANDIÆ.—I send you the egg of this species, and also the female bird out of which it was taken, after she had received two shots."

April 27—William Yarrell, Esq., Vice-President, in the Chair.

The following communications were read to the Meeting:—

1. DESCRIPTIONS OF THE EGGS OF SOME OF THE BIRDS OF CHILE. BY WILLIAM YARRELL, ESQ., F.L.S.

From my earliest acquaintance with the eggs of our British Birds, I was led to consider that this department of natural history had not been studied with the attention these beautiful objects deserve; and the examination of collections of eggs made in India, Australia, North America, and more recently in Chile, have served to confirm my first impression.

The history of a plant would be incomplete if it did not include a description of the leaf, the flower, and the fruit, as these appear in succession.

Mr. MacLeay has told us in his 'Horæ Entom.,' p. 448, that "as the knowledge of the whole life of an insect must make us better acquainted with its nature than a mere description of one of its forms, in the same proportion ought metamorphosis to outweigh every other principle of arrangement."

Of two naturalists who studied the Lepidoptera of Europe, it has been stated, that "not satisfied with an acquaintance with the insect in its perfect state, they examined it also in the early stages of its existence; they compared the various caterpillars with the butterflies which are produced from them, traced with indefatigable industry the plan of nature in these animals, and discovered the resemblance which was invariably preserved in the structure of species related to each other in affinity, in the different stages of their existence."

With these examples in view, I have been induced to consider the egg of a bird as one stage or condition in the life of the animal:

That the colour and markings we find deposited on the external surface of the shell afford indications by which classification may be assisted:

That the eggs of congeneric species will resemble each other in colour and markings, whatever may be the geographical locality in which such species are found.

Mr. Hewitson, in the introduction to his work containing excellent delineations of the eggs of British birds, observes, that "much useful and highly interesting information might be gained towards the classification of birds, by paying some attention to their eggs; and it is gratifying to find, in thus regarding them, that, with the exception of a few instances, were we to take the eggs of our British birds as our only guide, we should arrive at the best and most approved arrangement of the different genera."

I am aware that exceptions and discrepancies may be pointed out. The colour deposited on the egg-shells is an animal matter, dependent on the health of the bird. Fear or confinement acting constitutionally upon the organs of secretion are known to affect this colouring-matter.

The greatest amount of variation is found to occur among the *Laridæ*.

With these preliminary remarks, I proceed to the description of a collection of eggs of some of the birds of Chile, obtained by Mr. Bridges, and exhibited here by Mr. Cuming.

Cathartes Iota of Molina; Chilian name *Ioté*.—The egg of this Vulture measures 2 in. $\frac{8}{10}$ in length, and 1 in. $\frac{9}{10}$ in breadth: the shape is rather peculiar, being broadest at the centre and tapering gradually in both directions, so as to become pointed at both ends. The ground colour is white, slightly tinged with red; blotched with pale red; spotted and speckled with dark brownish red.

Haliaëtus aguia, Temminck; *Aquila* of the Spanish; *Calquin* of the Indians.—The egg is 2 in. $\frac{11}{20}$ in length by 2 in. $\frac{1}{20}$ in breadth; elliptic; white, with a few spots of dark red and numerous spots and speckles of pale red.

Polyborus Brasiliensis, Swainson; Chilian name *Traro* and *Taro*. —The egg of this bird is 2 in. $\frac{4}{10}$ in length by 2 in. in breadth; blotched, spotted and speckled with dark red, on a ground of reddish white. This egg, in its colour and markings, resembles those of our British Osprey.

Milvago pezoporos, Meyen; Chilian name *Tuique*.—The egg measures 1 in. $\frac{8}{10}$ by 1 in. $\frac{4}{10}$; white, tinged with red; blotched, spotted and speckled with dark brownish red.

Strix pratincola, Bonap.; *Strix flammea* of Wilson; *Strix Americana* of Audubon. Screech Owl.—The egg is pure white, and measures 1 in. $\frac{17}{20}$ in length and 1 in. $\frac{4}{10}$ in breadth.

Turdus Falklandicus of Quoy and Gaim.; Chilian name *Torzal*.— This egg closely resembles those of our British Missel Thrush. The ground colour pale bluish white, spotted and speckled with pale red. The length 1 in. $\frac{2}{20}$, the breadth three-quarters of an inch.

Geositta canicularia of Vieillot; Chilian name *Caminante*.—The egg is pure white, and measures $\frac{9}{10}$ of an inch in length by $\frac{7}{10}$ of an inch in breadth.

Cyanotis omnicolor, Swains.; Chilian name *Pajaro*.—This small egg measures only $\frac{13}{20}$ of an inch in length by half an inch in breadth; of a pure and spotless white, but some specimens of the eggs are tinged with pale buff-colour.

Crithagra brevirostris, Gould; Chilian name *Chirique*.—The egg is white, tinged with green, speckled with brownish red, and measres $\frac{7}{10}$ of an inch in length by half an inch and $\frac{1}{20}$ in breadth.

Fringilla Diuca, Mol. The Chilian name is *Thiuca* or *Diuca.*—The egg of this bird measures 1 inch in length by $\frac{7}{10}$ of an inch in breadth: the ground colour white, tinged with green, more or less mottled all over with two shades of greenish brown.

Phytotoma rara, Mol. Called *Rara* by the natives.—The egg measures 1 inch in length by $\frac{7}{10}$ of an inch in breadth, and is of a delicate bluish green, with a few specks of dark reddish brown at the larger end.

Sturnella Loica, Mol. The Chilian name is *Loica.*—The egg of this bird measures 1 in. $\frac{1}{10}$ in length by $\frac{8}{10}$ of an inch in breadth: the ground colour white, spotted and speckled with pale red, dark brownish red, and purple grey.

Icterus Thilius, Mol. The Chilian name *Thili* or *Trili.*—This egg measures 1 inch in length by $\frac{7}{10}$ of an inch in breadth: the ground colour white, sometimes tinged with buff, with a few spots and streaks of dark reddish brown deposited over the larger end.

Zenaida aurita, Temm.; Chilian name *Tortola.*—The egg of this species, which is the most common of the *Columbidæ* found in Chile, is white, and measures 1 in. $\frac{3}{20}$ in length by $\frac{9}{10}$ of an inch in breadth.

Columbina strepitans, Spix; *Tortolita cyana* of the Chilians.—The egg of this pretty little species of Dove is also of a pure white, smooth and shining; the length $\frac{9}{10}$ of an inch, the breadth $\frac{7}{10}$.

Nothura perdicaria, G. R. Gray; *Perdiz* of the Chilians.—This beautiful egg, of a uniform rich purple-chocolate brown, the surface smooth and polished, measures 1 in. $\frac{9}{10}$ in length and 1 in. $\frac{4}{10}$ in breadth.

Two other unnamed eggs in this collection, of the same character and colour as that of the *Nothura* last-described, and probably belonging to two species of the genus *Tinochorus* found in Chile, may be here referred to; the larger one 2 in. $\frac{1}{10}$ in length by $1\frac{3}{4}$ in. in breadth; the other 1 in. $\frac{8}{10}$ in length and $1\frac{1}{4}$ in. in breadth. Elliptic in shape, of a rich and uniform purple-chocolate brown; the surface highly polished.

Another egg in this collection, not named, but apparently belonging to some species of *Tinamou,* may be mentioned on account of its beauty. It measures 1 in. $\frac{3}{10}$ in length, and 1 in. $\frac{1}{20}$ in breadth; the shape is elliptic, and the colour a uniform delicate siskin-green.

Rhea Darwini, Gould, 'Voyage of the Beagle,' Birds, page 123, plate 47.—The egg of this fine species measures $4\frac{3}{4}$ in. in length and $3\frac{1}{2}$ in. in breadth: elliptic in form; the colour whitish, but tinged with very pale asparagus-green. This egg is figured by Dr. Thienemann in his new work now in course of publication on the incubation of birds in general, part 1. page 4. tab. 2. fig. 2, with the additional name of *Rhea pennata D'Orbignii.*

Scolopax Paraguaiæ, Vieill. Called by the Chilians *Avecasina* and *Porrotero.*—The egg is $1\frac{3}{4}$ in. long and $1\frac{1}{4}$ in. broad; olive-brown, blotched and spotted with dark reddish brown and pale brown. This egg, in colour and markings, exactly resembles the egg of our most common British Snipe.

Vanellus Chiliensis.—The egg thus marked measures 1 in. $\frac{9}{10}$ in length and 1 in. $\frac{9}{20}$ in breadth: olive-brown, spotted with black and greyish brown; closely resembling the eggs of our British *Vanellus.*

Rallus sanguinolentus, Swains.; Chilian name *Piden.*—This egg is 1 in. $\frac{8}{10}$ long and $1\frac{1}{4}$ in. in breadth: the ground colour white, tinged with red, partially spotted with yellowish red. In its ground colour and markings very similar to the egg of our British *Rallus.*

Gallinula crassirostris, J. E. Gray. Called by the Chilians *Taguita.* —The egg reddish white, spotted with two shades of reddish brown; the length 1 in. $\frac{8}{10}$ by 1 in. $\frac{2}{10}$ in breadth.

Fulica galeata, G. R. Gray.—This egg, closely resembling that of our Common Coot in its colours and markings, measures 2 in. $\frac{1}{10}$ in length, and $1\frac{1}{2}$ in. in breadth: pale brownish white, or stone-colour, speckled over with nutmeg-brown.

Cygnus nigricollis, Gmelin. *Cisne* is the Chilian name for this Black-necked Swan. The egg is near 4 in. in length by $2\frac{1}{2}$ in. in breadth; white, tinged with pale buff.

Rhynchaspis maculatus. The Chilian name of this bird is *Pato Abaston.*—The egg measures 2 in. $\frac{3}{10}$ in length and $1\frac{3}{4}$ in. in breadth; dull, greyish white, tinged with green.

Querquedula cærulata, Eyton. The Chilian name of this little Duck (the *Anas Rafflesii* of Vigors) is *Pato colorado.*—The egg is 2 in. in length and 1 in. $\frac{4}{10}$ in breadth: the colour a uniform pale buffy white.

Anas Bahamensis? Linn., called *Pato Jergon grande* by the Chilians, produces an egg $\frac{1}{20}$ of an inch larger in both its dimensions than the egg of the *Pato colorado* last-described, and of a richer and more decided buff-colour.

Podiceps Chilensis, Garnot. Called by the Chilians *Guala* and *Gualon.*—This large species of Grebe produces an egg of 2 in. $\frac{3}{20}$ in length by $1\frac{1}{2}$ in. in breadth, of a dull white, stained with earthy brown.

Podiceps Kalipareus, Quoy and Gaim. The Chilian name *Gualita de la Mar.*—The egg of this Grebe measures 1 in. $\frac{8}{10}$ by $1\frac{1}{4}$ in., of a dull white, some of them more or less stained with dirty brown, depending on the number of days they may have been deposited in the nest.

The egg of a third species of *Podiceps,* bearing the Chilian name *Gargari,* is yet a little smaller than the egg of the *Gualita* last described, measuring only 1 in. $\frac{6}{10}$ in length and 1 in. $\frac{1}{10}$ in breadth; the colour as usual in the eggs of all the Grebes.

2. Description of a new Genus of Emydæ. By J. E. Gray, Esq., F.R.S., F.Z.S. etc.

In the museum of the Zoological Society is a fine specimen of a large freshwater Tortoise, presented by Lieut. Mawe, R.N., who found it in South America in the year 1833.

It is marked by Mr. Fraser "Emys Mawii, Bibron, original of M. B.'s description, No. 6899," but I can find no such species described in M. Bibron's work, nor is it an *Emys* as defined by that author.

It differs from all the known Emydæ in being covered with very thin membranaceous scales, and in having a broad sternum with a series of four large distinctly defined plates placed over the sterno-costal suture. The gular plates are very small, and there are no axillary or inguinal plates.

My genus *Platystemon* has the same kind of sterno-costal plates, but quite a differently formed shell. The head is very large and the tail elongate.

DERMATEMYS, n. g.

Ch. gen.—Testa ovalis, gibba, acarinata, in lateribus rotundata, margine posteriore expanso, paulò reflexo, scutellis membranaceis tenuissimis defenso. *Scutellæ marginales* posteriores latæ. *Sternum* planum anterius rotundatum posterius emarginatum. *Squamæ gulares* parvæ, triangulares, testæ superiori per longum symphysin affixæ. *Sutura sterno-costalis* squamis magnis quatuor defensa, postremis duabus maximis squamis, minima anteriore. *Scutellæ* axillares et inguinales nullæ. *Testa* vix ad aperturam contracta.

Head ——? Toes webbed? Claws ——?

Shell oblong, convex, not keeled; sides rounded, hinder edge expanded, slightly reflexed, covered with very thin membranaceous shields. The hinder marginal shields broad. Sternum flat, rounded in front, notched behind: the gular plates small, triangular, united to the upper shell by a long symphysis; the sterno-costal suture covered with four large distinctly defined plates; the anterior smaller, the two hinder largest. The axillary and inguinal plates none. The cavity of the shell is scarcely contracted at the opening.

Hab. South America.

Dermatemys Mawii, n. s.—Vertebral plates: 1st broad, seven-sided; 2nd, 3rd and 4th longer than broad. Colour pale brown; the upper surface covered with small, close, irregular depressions of a darker brown colour; the shields pale, nearly transparent, very brittle when dry; the under surface uniform pale yellowish white, with slightly sunken grooves.

Length of upper shell 17 inches; width 11 inches; length of sternum $12\frac{1}{2}$ inches.

Remarks.—The specimen appears to be not quite full-grown. It has much of the external appearance of *Phrynops Geoffroyii*, and the general thinness of the scales of *Chelydidæ*; but there is no appearance of any scar on the inner surface of the sternum for the attachment of the pelvis; and though the gular scale is worn and nearly obliterated, yet it is sufficiently distinct to show that it has no intergular plate.

3. Descriptions of new Crustacea from the Eastern Seas. By Adam White, F.L.S.

Family Inachidæ.

Genus Doclea, Leach.

Doclea calcitrapa, White, n. s., List of Specimens of Crust. in Brit. Mus. p. 4.

Carapace with seventeen large spines on the back and sides, and sixteen smaller tubercles on the upper surface; seven of the large spines down the middle of carapace, six of them erect, the sixth springing from the base of the much-elongated horizontal terminal spine; the last of the spines of the side much longer than the other three. The whole surface seems to have been covered with hairs. The four hind pairs of legs are very long and slender.

Breadth of carapace 1 inch 4 lines; length 1 inch 10 lines.

A species distinguishable at first sight from the four species hitherto described, of all of which there are specimens in the Museum Collection.

Hab. Philippine Islands (Zebu): Brit. Museum. From Mr. Cuming's collection.

Family Maiadæ.

Hyastenus, White.

Carapace rather oblong, rounded on the sides behind, before and behind the eyes straight; a slight transverse groove in upper orbit; front with two horns as long as the carapace, at first parallel and then diverging and directed slightly downwards; outer antennæ with all the joints cylindrical; the insertion of the basal joint concealed by the frontal horn.

Fore-legs slender; second pair of legs the longest and very slender; terminal joint with the edge spined.

A genus allied to *Hyas* and *Chorinus*, the only species of which was long ago figured in the large work of Seba.

Hyastenus Sebæ, White, List of Specimens of Crust. in Brit. Mus. p. 6.

Upper surface somewhat roughish, and covered with a delicate down.

Cancer araneus cornutus alter, Seba, Thes. iii. 45. t. 18. f. 12.

Hab. Philippine Islands. From the collection of Mr. Cuming.

Also found by Capt. Sir Edward Belcher, C.B.

Family Parthenopidæ.

Ceratocarcinus, Adams & White.

Form of the carapace somewhat pentagonal; the sides, over the insertion of the first pair of legs, produced into a large spine directed slightly forwards; front wide and prominent, projecting on each side in the form of conical horns, widely separate from each other. Eyes rather small, peduncles short, the eye fitting into a groove on the side of the beak. Outer antennæ considerably developed, the terminal appendages at least half the length of the whole antennæ, and projecting beyond the horns of the beak.

First pair of legs much-elongated; the sides nearly parallel; the wrist somewhat pear-shaped, without spines on the inside, the edges of the pincers meeting and serrated. The second pair of legs longer, more slender than the last three pairs; the tarsal joint slender and elongated; fourth and fifth pairs of equal length; the fifth pair, as in *Eumedonus*, placed so high as nearly to conceal the insertion of the fourth pair; the tarsal joints of these legs thick; the claw at the end translucent. Abdomen of male as in *Eumedonus*; the female unknown.

This genus is closely allied to *Eumedonus* of Prof. Milne Edwards (Crust. i. 349), and, like it, comes from the Eastern Seas.

Ceratocarcinus longimanus, n. s., List of Specimens of Crust. in Brit. Mus. p. 125.

Two pointed transverse tubercles, tufted with hair at the end, on the back of the carapace, behind the eyes; the first pair of legs covered with minute warts and with several deep longitudinal grooves; the pincers blackish brown, except at the base.

Hab. North coast of Borneo (Balambangan): British Museum. Presented by Capt. Sir Edward Belcher, C.B., R.N.

When alive, according to the observations of Arthur Adams, Esq., who found it, the colour of this species is blood-red, with five light bands across the carapace.

Gonatonotus, Adams & White.

Carapace pentagonal, depressed, the lateral angles very sharp; the front very wide, lamelliform, dilated, rounded, slightly notched at the end. Eyes large, prominent; peduncles short, inserted in a deepish notch on the side. Outer antennæ with the terminal appendage elongated.

First pair of legs thickish; the wrist rounded and spined on the inside, the claws serrated on the edge; third and fourth pairs of legs rather longer than the second and fifth; the tarsal joints of the second, third, fourth and fifth pairs of equal size and thickness; the fifth pair of legs inserted above the fourth pair.

Abdomen of female seven-jointed; three or four of the basal joints seen from above. Male unknown.

This genus is allied to *Eumedonus*.

Gonatonotus pentagonus, n. s., List of Specimens of Crust. in Brit. Mus. p. 125.

Carapace above closely verrucose, the warts depressed; a strongish ridge across the back, extending from one lateral angle to the other, with two tubercles in the middle; the front grooved down the middle; the centre of the back with two longitudinal impressions; terminal joint of abdomen in female verrucose.

First pair of legs verrucose; the pincers grooved.

Mr. Adams found this species on the coast of Borneo. When alive it is of a brick-red colour, with the chelæ crimson; under surface rufous.

LAMBRUS LAMELLIGER, White, List of Specimens of Crust. in Brit. Mus. p. 12.

Front depressed, flat, thin; upper surface of carapace with three largish protuberances behind, one in the middle and one on each side; carapace longer than wide; sides about the middle crenated; fore-legs very long.

Breadth of carapace $4\frac{1}{2}$ lines; length $5\frac{3}{4}$ lines.

Hab. Philippine Islands. From Mr. Cuming's collection.

LAMBRUS TURRIGER, White, List of Specimens of Crust. in Brit. Mus. p. 12.

Carapace longer than wide; front small, depressed and considerably grooved in the middle, the side with a small tooth on each side; back of carapace with four elevated spines, thickened and blunt at the end, the first about midway between front and back; behind it another much higher, and one on each side of this; on the hind margin of carapace, in the middle, are two spines.

Arms very long, verrucose; legs very slender and smooth.

Breadth of carapace about 4 lines; length about $4\frac{1}{2}$ lines.

Hab. Philippine Islands: British Museum. From Mr. Cuming's collection.

Also brought by Capt. Sir Edward Belcher, C.B., R.N.

4. ON SOME UNDESCRIBED SPECIES OF LEPIDOPTERA IN THE SOCIETY'S COLLECTION. BY EDWARD DOUBLEDAY, ESQ., F.L.S. &c. &c.

Genus PIERIS.

PIERIS PHAOLA. *Pi. alis omnibus supra albis, anticarum margine externo latè nigro, posticarum punctis sex nigris notato, subtùs pallidè flavescentibus, basi flavis, marginibus externis nigro-punctatis.* Exp. alar. $2\frac{1}{4}$ unc. vel 57 millim.

Hab. Fernando Po.

Above, all the wings white, very slightly tinted with yellowish at the base; anterior wings with the costa narrowly black; the outer margin with a broad black border, dentate internally, broadest at the apex. Posterior wings with a series of seven round black dots on the margin.

Below, pale cream-colour or white, slightly tinged with yellow; palest on the disc of the anterior wings; the base and costa of the anterior and the costa of posterior wings yellow; apex and outer margin of anterior wings with a series of nine black dots, of which the first to the sixth are minute, the seventh larger and double, the eighth and ninth larger than any except the seventh. Posterior wings with a marginal series of seven black dots: the first, second and third very minute, fourth, fifth and sixth progressively larger, seventh small.

Head, thorax and abdomen black, sprinkled especially below with white scales. Antennæ black, annulated with white.

In the collection of the Zoological Society.

This species is closely allied to *P. Eudoxia*, but differs in wanting the bright orange patch at the base of the anterior wings, and in the form and number of the dots on the posterior wings, as well as in the colour of the under surface, which is pure white with a silvery lustre in the males of that species.

PIERIS MATUTA. *Pi. alis omnibus supra albis, apice anticarum nigro; margine posticarum nigro punctato; subtùs albidis basi anticarum costaque posticarum luteis.* Exp. alar. $2\frac{1}{2}$ unc. vel 63 millim.

Hab. Fernando Po.

Wings above white, the anterior with the apex and outer margin as far as the third median nervule irregularly black; a black spot on the margin above the first and second median nervule. Posterior wings with a slender cuneiform dot at the extremity of each nervule. Below, anterior white, the costa itself very narrowly black, the base marked with a broad luteous patch. Posterior wings very pale cream-colour, with slight pearly reflections, the costa at the base luteous. Extremities of the nervules slightly fuscous. Head and thorax black, clothed with white hairs. Abdomen black, covered with white scales. Antennæ black, annulated with white.

Genus ATERICA.

ATERICA BARCE. *At. alis omnibus supra æneo-nigris, marginibus externis fuscis, subtùs ochraceis, fascia communi transversa, plaga discoidali anticarum, strigis undatis maculisque brunneis.* Exp. alar. $2\frac{1}{4}$ unc. vel 55 mill.

Hab. Sierra Leone.

Above, all the wings æneo-fuscous, with green and bluish reflections; the outer margin of the anterior broadly fuscous at the apex, less so at the anal angle; a slight fuscous cloud at the end of the cell and another much larger beyond it. Posterior wings with the costal and abdominal margins and the outer angle broadly fuscous; outer margin, except at the angle, narrowly so. Abdominal fold thickly lined with long hairs. Cilia fuscous, spotted with whitish. Below ochrey brown, the anterior wings with a minute dark brown spot in the cell close to the base; a large, irregular, subtriangular, dark brown patch before the middle, divided in the cell by a spot of the ground colour. Beyond the middle is a much-waved abbreviated brown striga, and a similar one extends along the whole outer margin. Between these two strigæ is a transverse band of a vinous brown, commencing at the apex and extending to the middle of the inner margin, narrow at its commencement, broad at its termination, where it occupies nearly the whole space from the middle of the wings to the anal angle, and is divided by a faint ochrey cloud. Posterior wings with a broad reddish brown band across the middle, divided by a pale ochreous spot near the costa, beyond which is a paler brown cloud. Near the margin is a much-waved brown striga, and the outer angle is brown. Near the base is a somewhat reniform brown spot, paler in the centre, and below it a ring of the same colours.

Head, thorax and abdomen fuscous above, rufescent below. Antennæ very long, black.

In the collection of the Zoological Society.

Genus Charaxes.

Charaxes Phraortes. *Ch. alis omnibus supra fulvis, nigro limbatis maculatisque, anticis serie marginali punctorum, posticis lunularum fulvarum; subtùs saturatè fulvis, fascia media alteraque submarginali argenteis, maculis plurimis, vittisque numerosis nigris argenteo cinctis.* Exp. alar. $4\frac{1}{2}$ unc. vel 116 mill.

Hab. Madagascar.

Above, all the wings fulvous, with a broad black border externally, broadest on the posterior wings, marked on the outer margin of the anterior with a series of fulvous dots between the nervules, and on the posterior just within the margin with a series of lunules also placed between the nervules; this border is irregularly dentate within on the anterior wings, and divided near the apex by a row of four fulvous dots; not dentate internally on the posterior wings, but less defined, being slightly shaded into the fulvous. The base both of the anterior and posterior wings is slightly shaded with fuscous, and the anterior are marked, in the cell, with two rounded spots, an elongate subquadrate one on the disco-cellular nervules, a subquadrate one immediately beyond the cell above the third median nervule, a longer one immediately below this, and another broadly lunate between the first and second median nervule, all black. Between these spots and the black margin is a short submacular band extending from the costa to the second disco-cellular nervule. Outer margin of anterior wings sinuate, dentate, of posterior dentate, caudate.

Below, the anterior wings are bright deep fulvous at the base and along the costa beyond the middle of the wings; marked as above with black spots and a short marginal black band, but all these markings are broadly margined with silvery white; and there are, in addition to the spots of the upper surface, a small round spot in the cell close to the base, and an oval one above the first median nervule near its origin, both black with a silvery border. Beyond the middle is a silvery white irregular band, narrowed on the costa, where it is marked by four black dots, the third and fourth indistinct, broadest on the inner margin, where it becomes of a pearly hue. Between this band and the margin the prevailing colour is a pale fulvous. A band composed of a series of silvery grey lunules commences on the costa and terminates on the submedian nervure. These lunules have their points directed inwards, and are margined internally with black, those nearest the costa less broadly than the others. The terminations of the nervules are bordered with silvery grey, and beyond this with black, and the cilia are spotted with the same colours. The posterior wings are bright deep fulvous, paler towards the outer margin, traversed beyond the middle by a flexuous silvery band. At the base, before the precostal nervule, is an oval black spot bordered with silvery white; beyond this is a macular band composed of four black transverse vittæ bordered with silvery white, extending from the costa to the abdominal fold; the inner vitta transverse only at its origin, extending down the abdominal to unite with a similar fold which traverses the cell and descends obliquely between the first median nervule and the submedian nervure. The inner margin of the silvery band is marked with a series of black spots and vittæ, and the abdominal fold is beautifully marked with alternate silvery, bright fulvous and black vittæ. Near the outer margin is a broad silvery white band sprinkled with grey and fulvous scales, and clouded with these colours, bordered externally with black. On the outer margin itself is a narrow black border, margined internally with white. Cilia, except on the tail, white.

Head fulvous. Thorax fulvous above, streaked below with fulvous and white. Legs white.

In the collection of the Zoological Society.

This beautiful insect is closely allied to *Ch. Castor*, but may at once be known by the silvery markings below.

5. Description of Strigops habroptilus. By G. R. Gray, Esq., F.L.S. &c.

With reference to the interesting particulars about *Strigops habroptilus*, communicated by Mr. Gould (*suprà* p. 55), I am induced to remark that this singular bird was first noticed under the native name of Kakapo in the Appendix to Dr. Dieffenbach's Travels in New Zealand, where it was suggested to belong to the family of *Cuculidæ*, from the supposed similarity of the few feathers brought by that gentleman to those of the genus *Centropus*. This idea was at once dispelled by the arrival of the perfect specimen now in the British Museum, from which a figure was made by my friend Mr. Mitchell, and published as pl. 105 in the 'Genera of Birds.' The singular appearance of the feathers of the head, and especially their arrangement about the bill, gives it much of the expression of the family *Strigidæ*. It was this resemblance that induced me to give it the above generic name. Dr. Dieffenbach states that its native name implies that its habits are nocturnal: the natives catch the bird by torchlight. He further informs us that it chiefly inhabits the South island of New Zealand, but is very rare even in that locality, which is in some degree the result of the destruction it meets with from the attack of cats and dogs, to which its habit of frequenting the lower branches only of trees the more readily exposes it.

As I have never published a specific character, I subjoin the following:—

Strigops habroptilus, G. R. Gray. *Str. olivaceo-viridis viridi-griseo tinctus, plumis singulis strigâ medianâ flavâ nigro-marginatâ extus irregulariter transversè nigro-fasciatis, tectricum majorum remigum secundariorumque pogoniis exterioribus caudâque totâ pallidè umbrinis transversè luteo-fasciatis fasciis irregulariter nigro-marginatis; subtùs pallidior luteo tinctus plumis singulis strigâ medianâ luteâ piceo-marginatâ extus irregulariter transversè*

piceo fasciatis; fronte, genis, regionibus auricularibus plumisque ad rostri basin prominentibus pallidè umbrinis medio luteo-notatis; rostro albo, pedibus plumbeis.

Upper surface sap-green, with a verdigris tinge on the wings; each feather marked in the middle with yellow, which is margined on the sides with black, from which spring irregular transverse bands of the same colour; the outer webs of the greater wing-coverts, quills, secondaries and the entire tail, brownish buff, irregularly banded transversely with black; between every alternate set lemon-yellow; the inner webs of quills and secondaries black, more or less transversely banded with lemon-yellow. Under surface pale greenish yellow, tinged with lemon-yellow, more or less marked along the shaft with pale yellow, which is narrowly margined with brownish black; some of the feathers have transverse bands of the same colour.

The top of the head brownish black, margined outerly with sap-green, tinged in some places with verdigris, and marked in the middle with pale yellow; the front, cheeks, ear-coverts and the projecting feathers of the face pale umber, marked in the middle with yellowish white. Bill white; feet plumbeous black.

Length, 2 feet 4 inches; bill, 1 inch 8 lines; wings, $11\frac{1}{2}$ inches; tail, $9\frac{1}{4}$ inches; tarsi, $1\frac{3}{4}$ inch.

May 11.—William Spence, Esq., F.R.S., in the Chair.

The following paper was communicated to the Meeting:—

On the Genera of the Family Chitonidæ. By J. E. Gray, Esq., F.R.S., F.Z.S. etc.

This family now contains so many species, offering such varied modifications of form and structure, that it becomes necessary to separate it into several genera, for the purpose of more accurately determining the species and showing their relations to each other.

Most authors have regarded the family as a single genus, and even M. De Blainville, who formed the family into a class under the name of *Polyplakiphora*, so regarded them. He forms of this class and his *Nematopodes* or Barnacles a subtype of the animal kingdom, which he called *Malentozoaria* or *Molluscarticulata*; but there is no sufficient character to separate the Chitons from the other Mollusca, and the *Nematopodes* are now known to be *Crustacea*, so that this division or subtype of the animal kingdom has been erased from the system by most succeeding authors.

Dr. Leach in his MSS. proposed to divide this family into genera, according to the form of the appendages which cover the upper surface of the mantle; and Risso, who was in constant correspondence with Dr. Leach, has in his work published two of Dr. Leach's genera. Mr. Guilding has formed some genera on the same principles in the Zoological Journal, and I have added two others in the Synopsis of the British Museum for 1841.

I may remark that these appendages of the mantle form exceeding good characters for the more minute division of the groups, but the scales so gradually pass into spines or tubercles on the one side, and on the other they so gradually diminish in thickness to furfuraceous scales, which are easily deciduous that it is difficult to define when they are quite absent; therefore they do not afford characters of sufficient importance to use them as Leach, Risso and Guilding have done, for the primary divisions of the family.

Lamarck divided the family into two genera, *Chiton* and *Chitonellus*, but he left in the former genus several species which are more naturally allied to the latter.

M. De Blainville in 1825 published a monograph of the family, under the article 'Oscabrion' in the Dict. Sci. Nat. xxxvi., in which he introduced some new characters for the division of the species into sections. He observes: "Les organes sur lesquels nous appellerons successivement l'attention pour le distinction des espèces sont les suivants:—

"1. L'existence ou l'absence des paires de pinceau de soies disposés bien regulièrement de chaque côte du limbe, qu'il soit revêtu ou non d'écailles, d'épines, ou même de poils.

"2. La disposition des branches commençant plus ou moins en arrière et se terminant plus ou moins en avant.

"3. La forme de valves de la coquille, considérée spécialement dans l'existence plus ou moins marqué des aires latérales.

"4. La grandeur proportionnelle de ces valves et leur dégré d'occlusion.

"5. La forme des lames d'insertion et le nombre de leur échancrures ou dents.

"6. Enfin la disposition des couleurs de la coquille."—*D. S. N.* xxxvi. 536.

Certainly this was a great improvement to what had been previously done, but unfortunately M. De Blainville appears to have had the opportunity of observing only a limited number of species, and has placed the others in the sections to which, from their external appearance, they appeared to belong, though on examination they have not the characters assigned to the division in which they were placed: thus *Chiton amiculatus*, p. 546, is said to have the front and hinder valves lobed and pectinated; *C. niger*, p. 541, the teeth of insertion pectinated; *C. echinatus*, p. 550, the anterior and posterior valve toothed; and *C. gigas*, the lobes not pectinated.

From repeated examination and comparison I am inclined to consider the following as the best characters for the distinction of the genera and species, arranged according to their permanence and importance:—

1. The presence or absence of the pores, furnished with a bundle of spicula on each side of the mantle.
2. The comparative length and position of the gills.
3. The form and modification of the plate of insertion of the valves, especially of the posterior valve.
4. The size and form of the exposed part of the valve, and the kind of sculpture on its surface.
5. The absence or presence of appendages on the mantle, and the

form, sculpture on the surface, disposition, and equality or inequality of size of these appendages.

6. The colour of the valves and appendages of the mantle.

It has been objected, that the character derived from the form of the plates of insertion can only be seen by the destruction of the specimens, as they are generally kept in the cabinets: this is not always the case, for they can generally be seen from the under-side or through the substance of the mantle; but when this is not the case, the form of the plates of insertion can be easily discovered by carefully paring away the under part of the mantle, so as to show part of the edge of the valve without any injury to the specimen. And it should be recollected too, that the separate valves are the only part of the molluscous animals which are usually kept in cabinets.

The number of lobes into which the edge of the margin of insertion is divided may be also easily seen by the porous lines which are to be observed on the inner surface of the valves, diverging from the apex to the margin, each of these lines going to the bottom of the notch which separates the lobes on the inner processes of insertion.

Various authors, as Spengler, Chemnitz, De Blainville, Sowerby, Barnes and Reeves, have described and figured many species of the genus.

Synopsis of the Genera.

I. *Mantle simple, without any pores or tuft of spines on the sides.*

A. *The plate of insertion of the anterior and posterior valve divided into several lobes, and of the central valves into two lobes.*

a. The valves exposed, broad, with regular, equal, well-defined margin for insertion, divided into lobes more or less denticulated. The hinder valve with the apex superior, subcentral.

1. Chiton. The posterior valve entire; margin covered with regularly-disposed imbricate scales.

2. Tonicia. Posterior valve entire; margin naked.

3. Acanthopleura. Posterior valve entire; margin spinose, spinulose or bristly.

4. Schizochiton. Posterior valve with a deep notch on its central hinder margin; mantle slit behind.

b. The valves exposed, broad; the hinder valve with a slightly raised, smooth or slightly crenated plate of insertion (not divided into lobes on the sides), and with the apex subterminal.

5. Corephium. The hinder valve with a rather raised apex, and the plate of insertion crenulated, with one small central slit.

6. Plaxiphora. The hinder valve with a produced posterior apex, and the plate of insertion entire, smooth, rounded; valves thin; mantle with tufts of bristles.

7. Onithochiton. The hinder valve with a produced terminal apex; plate of insertion entire, rounded; valves thick; mantle covered with spines, bristles, or chaff-like scales.

8. Enoplochiton. The hinder valve with a produced terminal

apex; plate of insertion entire, rounded; valves thick; mantle covered with oblong, unequal, elongated, oblong scales.

B. *The plate of insertion of all the valves with only a single notch on each side. The valves more or less covered; the hinder valve with expanded plates of insertion (as in the central valves), with only a single notch on each side, and a concave sinuosity below.*

9. Mopalia. Valves, exposed part broad, transverse; plates of insertion moderate; mantle spinulose; front edge sometimes expanded.

10. Katharina. Valves, exposed part small, cordate, as long as broad; mantle smooth.

11. Cryptochiton. Valves entirely hidden; mantle covered with tufts of spicula.

II. *Mantle with a series of pores (each furnished with a tuft of spines) on each side. The plates of insertion of all the valves with only a single notch on each side, which is sometimes rudimentary.*

12. Cryptoconchus. Exposed part of valves very small, linear, much longer than broad; mantle smooth.

13. Amicula. Exposed part of valves small, subcordate, as broad as long; mantle bristly.

14. Acanthochites. Exposed part of valves moderate, broad, cordate, as long as broad; mantle spinulose.

15. Chitonellus. Exposed part of valves linear-lanceolate, elongate; body vermiform; mantle spinulose.

MISCELLANEOUS.

Researches to determine the Number of Species and the Mode of Development of the British Triton. By J. Higginbottom, Esq., F.R.C.S.

The observations of the author, of which he gives a detailed account in the present memoir, have led him to the following conclusions:—

Two species only of the genus Triton are met with in England; namely, the *Triton verrucosus* and the *Lisso-triton punctatus*. It is three years before the animal is capable of propagating its species, and four years before it attains its full growth. In its tadpole state, it remains in the water till its legs acquire sufficient strength to qualify it for progressive motion on land. While a land animal, it is in an active state during the summer, and passes the winter in a state of hybernation; but does not then, as has been erroneously supposed, remain at the bottom of pools. Very dry, or very wet situations are incompatible with the preservation of life during the period of hybernation. At the expiration of the third year, the triton revisits the water, in the spring season, for the purposes of reproduction, and again leaves it at the commencement of autumn.

Impregnation is accomplished through the medium of water, and not by actual contact. The growth and development of the triton are materially influenced by temperature, and but little by the action of light. The triton possesses the power of reproducing its lost limbs, provided the temperature be within the limits of 58° and 75° Fahrenheit; but at lower temperatures, and during the winter, it has no such power.

METEOROLOGICAL OBSERVATIONS FOR MAY 1847.

Chiswick.—May 1. Very fine. 2. Cloudy. 3. Rain. 4. Cloudy. 5. Cloudy and fine. 6. Slight fog: fine. 7. Overcast: showery. 8. Rain. 9. Fine: cloudy: densely overcast: rain. 10. Very fine: slight showers. 11. Cloudy. 12. Very fine. 13. Cloudy and fine: showers. 14. Showery. 15. Fine: rain at night. 16. Rain: cloudy: rain at night. 17. Cloudy. 18. Fine: rain. 19, 20. Cloudy and fine. 21, 22. Very fine. 23. Very hot and sultry. 24. Cloudy and fine. 25—27. Very fine. 28. Slight haze: sultry. 29. Cloudy: thunder and heavy rain. 30. Clear and fine. 31. Cloudless: exceedingly fine.

Mean temperature of the month	56°·83
Mean temperature of May 1846	56 ·16
Mean temperature of May for the last twenty years ...	55 ·01
Average amount of rain in May	1·84 inch.

Boston.—May 1. Fine. 2. Cloudy: rain early A.M.: rain P.M. 3. Cloudy: rain A.M. and P.M. 4. Cloudy. 5. Fine: rain P.M. 6. Cloudy. 7. Fine: rain P.M. 8. Cloudy: rain P.M. 9. Cloudy. 10. Cloudy: rain early A.M. 11. Rain. 12. Fine: rain, with thunder P.M. 13. Fine: rain P.M. 14, 15. Fine: rain early A.M. 16. Rain: rain, with thunder P.M. 17. Cloudy. 18. Cloudy: rain P.M. 19, 20. Cloudy. 21—24. Fine. 25. Windy. 26, 27. Fine. 28. Fine: 1 o'clock P.M. thermometer 82°. 29. Rain: 4 o'clock A.M. thunder, hail and rain: rain all night. 30. Fine: rain early A.M. 31. Fine.

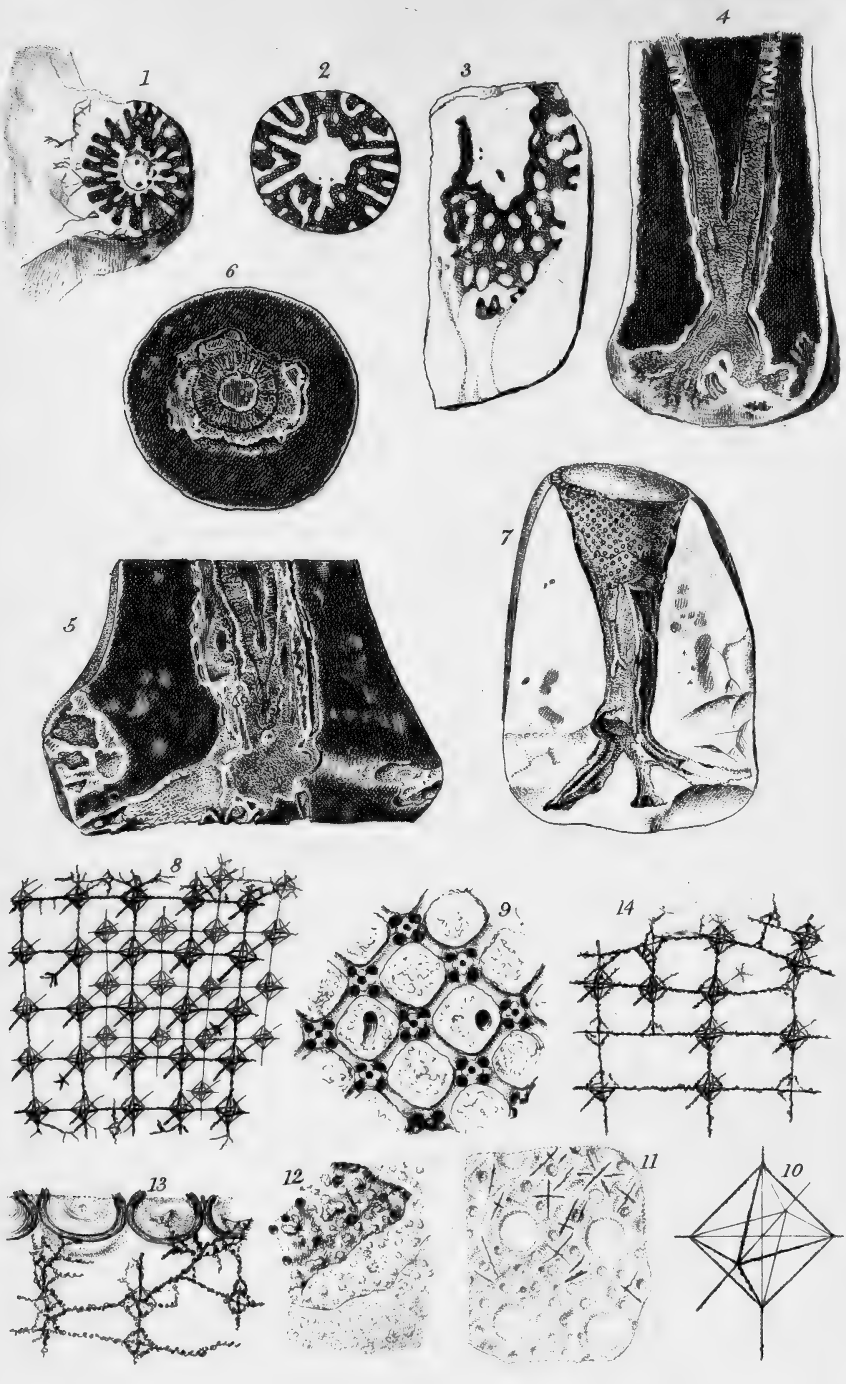
Sandwick Manse, Orkney.—May 1. Bright: clear. 2. Bright: drops. 3. Bright: clear. 4. Bright: damp. 5. Fine. 6, 7. Cloudy: damp. 8, 9. Drizzle: fog. 10. Clear: fine. 11. Cloudy: rain. 12. Rain: cloudy. 13. Cloudy. 14. Rain: fog. 15. Damp: rain: fog. 16. Bright: cloudy. 17, 18. Cloudy: clear. 19. Showers: drizzle. 20. Fog: cloudy. 21. Bright: rain. 22. Showers. 23. Clear. 24. Fine. 25. Bright: cloudy. 26. Bright: showers. 27. Fine: clear. 28. Fine: cloudy: fine. 29. Rain: thunder: cloudy: fine. 30. Clear: fine. 31. Cloudy: fine.

Applegarth Manse, Dumfries-shire.—May 1. Fine summer day. 2. Mild: showers. 3. Cloudy: keen. 4. Spring, but keen. 5. Cold: wet P.M. 6. Growing: wet P.M. 7. Dull: showers. 8. Dull: wet P.M. 9. Mild: dull: wet P.M. 10. Fine growing day. 11—14. Dull: showers. 15. Fine summer day. 16. Stormy: wet all day. 17. Wet and cold. 18. Wet and stormy. 19. Dull: wet. 20. Sunshine: fine. 21. Dry: cloudy. 22. Cloudy: showers. 23. Warm: thunder: rain. 24. Fine: clear: wet P.M. 25. High wind: clear. 26. Fine: clear: light: cloudy. 27. Fine: clear: thunder. 28. Fine: wet P.M. 29. Fine: heavy rain P.M. 30. Fine: warm. 31. Remarkably fine.

Mean temperature of the month	51°·1
Mean temperature of May 1846	52 ·6
Mean temperature of May for twenty-five years	51 ·1
Mean rain in May for twenty years	1·69 inch.

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.
1847. 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.	29·844	29·669	29·40	29·60	29·57	29·70	29·75	58	44	49	53	39	47	41	sw.	w.	w.	calm	·03	......	......	......
2.	29·743	29·577	29·22	29·55	29·58	29·76	29·86	59	30	49	49	40	46½	44½	s.	s.	sw.	nne.	·03	·14	......	......
3.	29·828	29·788	29·37	29·73	29·71	29·95	29·99	53	40	46	52	39	41½	44½	nw.	w.	w.	ne.	·15	·10	......	·14
4.	29·868	29·858	29·52	29·75	29·80	29·99	29·96	58	36	50	53	41	46	45	e.	e.	w.	se.	·02	·12	......	......
5.	29·759	29·721	29·40	29·77	29·79	30·05	30·00	60	31	51	55	41	51	45	se.	ne.	e.	e.	......	......	......	......
6.	29·744	29·710	29·32	29·63	29·55	29·86	29·80	62	40	51	54	41	49	43	s.	se.	e.	ese.	......	·16	......	......
☾ 7.	29·683	29·569	29·30	29·57	29·57	29·77	29·80	65	50	59·5	60	42	48	44	se.	s.	ese.	ese.	·14	......	......	......
8.	29·611	29·334	29·03	29·48	29·35	29·72	29·61	60	48	53	53½	45	47	47	s.	e.	e—s.	e.	·15	·18	......	......
9.	29·830	29·757	29·26	29·38	29·60	29·53	29·56	65	44	55	53½	46	47	46	sw.	sw.	w.	se.	·04	·68	0·20	......
10.	29·813	29·726	29·39	29·73	29·70	29·80	29·82	72	54	58	65	47	55	47	sw.	calm	sse.	se.	·04	·18	......	·10
11.	29·681	29·591	29·20	29·60	29·55	29·78	29·71	65	40	50	61	46	52	48	sw.	ene.	se.	e.	......	·32	......	......
12.	29·759	29·714	29·25	29·53	29·50	29·66	29·66	65	45	60	62	42	50	46½	sw.	se.	se.	e.	·01	·38	......	·25
13.	29·834	29·821	29·35	29·57	29·57	29·65	29·67	68	41	58	63	49	47½	43½	sw.	s.	s.	e.	·02	·22	......	·07
● 14.	29·892	29·845	29·37	29·58	29·60	29·66	29·64	65	46	59	59	50	47	46½	sw.	sw.	s.	e.	·08	·04	......	·06
15.	30·123	29·869	29·43	29·70	29·73	29·73	29·90	67	51	59	60	49	45	43	sw.	sw.	sw.	e.	·19	·02	......	......
16.	29·731	29·581	29·20	29·50	29·47	29·91	29·81	68	49	55	50	48	46	41½	sw.	se.	ne.	e.	·09	·18	0·30	·04
17.	30·001	29·871	29·32	29·57	29·83	29·84	30·01	69	45	59·5	50	41	45½	39½	sw.	wsw.	ene.	ne.	......	·62	......	......
18.	29·989	29·785	29·54	29·88	29·72	30·06	30·00	70	45	53	50	41	47½	42	s.	ene.	e.	se.	·02	......	......	......
19.	29·902	29·827	29·37	29·58	29·59	29·79	29·67	66	49	61	50	46	44	45	sw.	sw.	ssw.	ese.	......	·24	......	·03
20.	30·048	29·841	29·30	29·55	29·80	29·59	29·66	67	42	60	54	49	49	47	sw.	w.	w.	wsw.	......	......	......	......
21.	30·134	30·114	29·57	29·88	29·90	29·74	29·70	69	45	60	63	46	50	48	w.	w.	wsw.	sw.	......	......	......	......
☽ 22.	30·048	30·004	29·50	29·75	29·82	29·51	29·71	77	50	63	61	48	47½	46	sw.	w.	sw.	w.	......	......	......	·29
23.	30·070	29·780	29·50	29·80	29·68	29·84	29·68	89	59	65·5	65	40	49	47	sw.	sw.	se.	se.	......	......	......	·04
24.	29·885	29·861	29·36	29·68	29·48	29·50	29·41	71	44	63	60	51	57	51	sw.	w.	w.	se.	......	......	1·45	......
25.	30·230	30·112	29·50	29·70	29·93	29·46	29·77	69	35	60	...	46	51	52	w.	w.	w.	s.	......	......	......	......
26.	30·242	30·103	29·19	29·93	29·98	29·81	29·93	75	36	61	...	50	52	51½	sw.	sw.	sw.	s.	......	......	......	......
27.	30·084	29·968	29·62	30·00	29·90	30·05	30·05	84	50	66	69	46	55	50	e.	sse.	w.	ese.	......	......	......	·05
28.	29·932	29·860	29·46	29·83	29·83	29·92	29·93	91	59	75	72½	...	55	53	s.	se.	w.	s.	·56	......	......	......
29.	30·157	29·746	29·34	29·66	29·84	29·82	29·83	77	45	68	...	...	52	50	s.	w.	w.	w.	......	1·75	......	·65
○ 30.	30·410	30·351	29·81	30·07	30·30	30·09	30·30	77	44	64	...	...	55	55	sw.	calm	sw.	se.	·02	·08	......	·56
31.	30·471	30·439	29·95	30·39	30·41	30·38	30·47	80	46	68·5	...	...	63	55	ne.	calm	sw.	calm	......	......	0·55	......
Mean.	29·946	29·832	29·39	29·707	29·730	29·803	29·827	69·06	44·61	58·3	57·5	44·8	49·61	46·70					1·59	5·41	2·50	2·28



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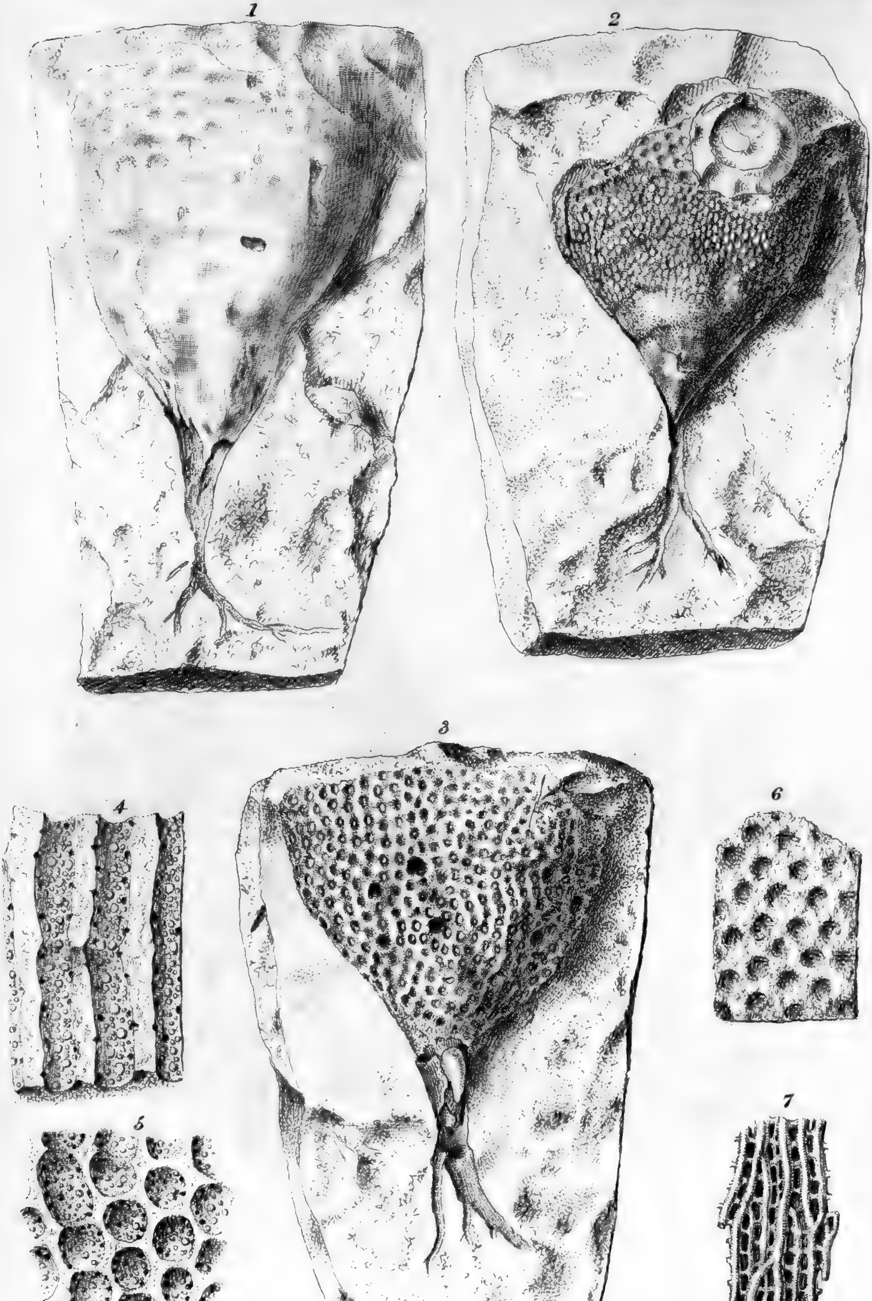

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THE ANNALS

AND

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XI.—*On the* Ventriculidæ *of the Chalk; including the description of peculiar Characters of Structure observed in their Tissues.* By J. Toulmin Smith, Esq.

[With two Plates.]

Almost one hundred years have now elapsed since Guettard drew attention to "some fossil bodies little known," the elucidation of which he attempted in an elaborate paper*. Of the two classes of bodies described by him it is clear that the *Choanites* are one. The figures and descriptions appear conclusive on this point, and the true affinities are very shrewdly pointed out by the writer, while the prevailing notion of the bodies described being petrified figs and other fruits is completely disposed of. It may not perhaps be quite so clear that the other class of fossil bodies described by Guettard comprises some of the forms of the Ventriculidæ. The true characters of the Ventriculidæ will be presently seen to be in almost all cases so obscured from the general observer, and even, without careful attention to the mode of observation, from the experienced palæontologist, that we cannot expect to find in either the figures or description of a century ago positive evidence of identity. Still I think those of Guettard warrant the conclusion that objects of this class were before him.

It was not till Dr. Mantell in 1814 figured and described in the 'Linnæan Transactions,' vol. xi. p. 401, "a fossil Alcyonium from near Lewes," that any particular attention appears to have been given in this country, or, since the time of Guettard, in any other, to these bodies. That paper was but one among the many

* Mém. de l'Acad. Royale de Sciences for 1751. The paper is erroneously cited by Parkinson under the year 1757. I have found no other direct notice of it. Michelin, in his 'Iconographie Zoophytologique,' p. 121, cites M. Guettard's 'Mémoires Académiques.' I have been unable to obtain that work, but conceive it to be merely a reprint of M. Guettard's various scientific papers, including the one above named.

results of the indefatigable labours of its author in a field then little trodden and by few feet. The views expressed in it seem to have undergone little modification since; for though, apparently rather in deference to the opinions of others than from any conviction of his own, changes of opinion on some points have been expressed by Dr. Mantell in later works, they are expressed without any grounds being stated whereon they were adopted*. It can be no reflection on the Discoverer of the Wealden and First Investigator of the Chalk to show that, amid the multitude of objects which engaged his attention, one was not followed out exhaustively. It is sufficient at present to say that, whatever Dr. Mantell may have left undone in reference to the Ventriculidæ, has been hitherto filled up by no other hand.

The different members of the large family of Zoophytes have done so much towards the actual formation of the solid crust of the earth, that anything which relates to any branch of it must be interesting and important; and it is certainly remarkable that, amid the great attention given within recent years by so many eminent observers to this family, no one has entered on an investigation of the Ventriculidæ. And yet the wide development of these forms and their great elegance and variety cannot but have attracted the attention of all who have ever glanced at the contents of any good and extensive series of chalk fossils;—an elegance and variety which the most untutored eye cannot fail to notice and admire.

I doubt not that the difficulty of the investigation affords the real explanation of the neglect to which these bodies have been subject. To investigate the living structure and affinities of an entirely soft-bodied animal whose only remains have come down to us encased either in intractable flint or in friable chalk will be at once felt to be a task of no ordinary difficulty. Such a task is very different from the examination of any living forms, to whatever class they may belong, or even from that of any of the more solid fossil forms, which latter themselves however call into activity the greatest patience and skill of the ablest observers.

Space will not permit me to examine in detail all the notices which have incidentally been taken of different forms of the Ventriculidæ. I must confine myself to a brief glance at the different works in which any direct allusion to these bodies may be found, leaving it to the full details hereafter to be given of

* I allude particularly to the separation of "*Ocellaria*" in the 'Medals of Creation,' p. 279; to the stating Ventriculites to be a composite instead of single animal in note to p. 272 of the same work; and to the still more remarkable entire separation of "*V. quadrangularis*" (p. 283 *ib.*) and placing it among *Flustræ*.

the results of my own investigations to show wherein the figures and descriptions in which such allusions consist have erred or fallen short.

To the paper of Guettard I have already alluded. It is sufficient further to say, that he was not content with that mere superficial glance which most later observers have given. He expressly says* that, though at first he regarded these bodies as related to the sponges, he was obliged to abandon that idea when he had given a more careful attention to the examination of them; and he concluded that their nearest affinity was to the Madrepores.

In 'Edvardi Luidii Ichnographia' (1760), tab. 2. fig. 176, is figured a Ventriculite, which he describes (p. 10) as "Astroitæ congener Radularia cretacea."

Parkinson, in his 'Organic Remains of a former World' (1807), alludes to the paper of Guettard, and gives descriptions and figures of several fossils which he considers as allied to *Alcyonia,* but whose differences from which he yet felt to be marked. Plate 9. (of vol. ii.) figs. 2, 6, 9 and 10; pl. 10. figs. 12, 14, 15 and 16; and pl. 12. fig. 9 I consider to be certainly forms of Ventriculidæ; and I think it probable that pl. 11. figs. 1 and 6, and pl. 12. fig. 8, are so also†.

In Mr. Parkinson's later 'Outlines' (8vo, 1822) he makes some sound observations on the necessity for separating from the *Alcyonia* the various bodies figured and described in his former work, but he gives no additional details of importance.

On p. 54 of the 'Outlines,' Mr. Parkinson, alluding to what are undoubtedly true Ventriculidæ, describes them by characters which are purely external, and treats as generic characters those which are merely accidental and non-essential.

The 'Organic Remains' of Parkinson did not in the least degree forestall the labours of Dr. Mantell, whose figures and descriptions (1814) convey far more information on the subject than all else that has even yet been published. It is but justice therefore to extract at some length the description given by him of these bodies.

The generic characters assigned by Dr. Mantell, as corrected in his very valuable work on 'The Fossils of the South Downs' (1822), p.168, are :—"Body inversely conical, concave, (1) *capable of contraction and expansion*: original substance spongeous? or gela-

* Mém. p. 259.

† The frontispiece to the second volume, which is mentioned by Mr. Rose (citation below, p. 339) as "so beautifully delineating" the structure of the Ventriculite, is no Ventriculite at all, but an exceedingly different fossil in all respects, viz. a Wiltshire sponge.

tinous ?*: (2) *external surface reticulated* †: (2) *internal surface covered with openings or perforated papillæ*: base imperforate, (1) *prolonged into a stirps, and* (1) *attached to other bodies.*"

Of the characters thus described as generic I shall hereafter show that all those which I have put in italics are erroneous; those marked (1) being altogether in opposition to the fact; those marked (2) being characters which are merely accidental and non-essential.

In describing these bodies in the above-cited paper Dr. Mantell says:—"The specimens which occur at Lewes, though generally considered as *Alcyonia*, do not entirely conform to the characters of that genus as given by modern writers; yet they are evidently very nearly allied to it. It is certain that the recent animal possessed great powers of contraction and expansion which enabled it to assume various dissimilar forms. In a quiescent state it was more or less funnel-like; when partly expanded cyathiform; and when completely dilated it presented the figure of a broad circular disc. To this versatility of shape is to be attributed the great diversity of appearance observable in its reliquiæ, whose forms must have been derived from the contracted or expanded state of the original at the period of its introduction into the mineral kingdom. That the animal enjoyed the power of contraction and expansion above ascribed to it, will appear evident from an investigation of its structure. The epidermis or external coat is composed of *fasciculi of muscular fibres, which, arising from the pedicle, proceed in a radiated manner toward the circumference, and, by frequently anastomosing, constitute a retiform plexus* capable of dilating, lengthening and contracting, according to the impressions it received ‡. The fasciculi are further connected by lateral processes §, which increase the firmness and coherence of the external integument. From the inner surface

* This language and query show that the author had found no specimen which enabled him to ascertain the actual internal structure.

† The "reticulation" here meant was merely that of the "*anastomosing tubuli*" named by Parkinson (8vo, p. 54), and has no reference whatever to the beautiful reticulated fibrous structure hereafter to be described, and which appears never to have come under Dr. Mantell's notice. If proof of this remark were wanted, it is found as well in the extract which follows from the paper in the 'Linnæan Transactions' as in the *specific* description given by him in the same page (South Downs, p. 168), where he speaks of the "external integument composed of *cylindrical, anastomosing fibres, radiating from the centre to the circumference.*"

‡ Mr. Parkinson had already expressed a similar opinion as to some of the fossils above named as figured by him. See 'Organic Remains,' vol. ii. p. 145.

§ These lateral processes are in reality the fibres going off to the polyp-skin hereafter described.

of the muscular envelopment arise innumerable tubuli, which pass direct to the ventricular cavity, and terminate in openings on its surface. In *some specimens* a substance of a sponge-like appearance fills up the interstices between the tubuli, and probably is the remains of a membrane which served in the recent animal to connect the tubes and assist in strengthening and uniting the whole mass. The sides of the ventricular cavity are generally about one-third of an inch in thickness. From the bases or pedicle proceed fibres by which the animal was attached to its appropriate habitation."

The portions of the structure here described as internal, and considered by Dr. Mantell to be absorbents, are in the 'Wonders' and 'Medals' of Dr. Mantell considered as polyp cells, and the animal described as a composite and not a single one. I shall show that each appropriation of those so-called tubuli is erroneous.

The paper in the 'Linnæan Transactions' is accompanied, as is the description in the 'South Downs,' by many figures, the truthfulness of which, as conveying the general characters of outward form, has never been even approached by any later writer.

M. Ramond in his 'Voyage au Mont Perdu' (before 1815; but this is the only case in which I have been unable to obtain access to the original work) figured the silicified remains of one species and the cast of the same under the two names of *Ocellaria inclusa* and *Ocellaria nuda,* assigning to them characters which a very little study of the nature of flint and of the process of fossilization would have prevented.

In the first edition of Lamarck's 'Animaux sans Vertèbres,' (1816, vol. ii. p. 187), the bodies thus figured and described by Ramond are included. In the second edition of that work (1836) Milne-Edwards expresses doubts (p. 291) of the correctness of the description which had been given of the *Ocellaria,* but without affording any fresh insight into the real structure of the fossils. In the same edition are included (p. 459) three species of what Goldfuss had previously named *Coscinopora,* and which is a form of the Ventriculidæ.

William Smith, the "Father of Geology," in his 'Strata Identified' (1816), figures two Ventriculidæ in flint (tab. 3. figs. 1 and 2), of which the first is a very characteristic figure. He calls them *Alcyonia.*

In the 'Icones Fossilium Sectiles' of König (1820), Ramond's figures are copied (pl. 8. figs. 98 and 99), but without any description.

In the 'Exposition Méthodique des Genres de l'ordre des Polypiers' of Lamouroux (1821) the so-called *Ocellariæ* are also figured and described, p. 45. pl. 72. figs. 1, 2, 3, 4, 5, but with no fresh information.

The Ventriculidæ were justly considered by Conybeare and Phillips so interesting and remarkable that a larger proportionate space is devoted to their description in the well-known 'Outlines of Geology' (1822) than to any other fossil, and they are the only fossils figured throughout their volume (p. 76). They only however abridge the description given in Dr. Mantell's paper, suggesting, however, that they were composite instead of single animals as described by the latter.

In Goldfuss's 'Petrefacta' (1826) there are given, under still new names, figures which appear to represent some of the Ventriculidæ. I think it quite clear however that the two forms which alone are referred to in Mr. Morris's 'Catalogue' as figured by Goldfuss (*quadratus* and *radiatus*, pl. 33. fig. 1, and 65. fig. 7) are not figures of any of the family of Ventriculidæ. Goldfuss himself (p. 243) refers the genus *Ventriculites* to his genus *Scyphia*, though it is clear one of his *Coscinoporæ* is a Ventriculite also.

It appears to me that the following figures in Goldfuss represent forms of Ventriculidæ; but there is nothing in the descriptions which enables us to identify them: tab. 2. figs. 8, 9, 10, 11, 12, and perhaps 15 and 16; tab. 3. figs. 1 and 5; tab. 30. fig. 10; and perhaps tab. 32. figs. 3 and 8. It is to be observed however with respect to all these figures, that they are too imperfect to enable me to speak with absolute confidence of any one. It is certain that he has no figure of any one of the most characteristic forms of Ventriculidæ. And this is not the less the case though he professes to give magnified views of some of the structure; those magnified views themselves exhibiting, without exception, want of accurate observation, and so being calculated to mislead rather than aid the inquirer.

Mr. Rose published in vol. ii. of the 'Mag. of Nat. Hist.' (1829) a paper "On the Anatomy of the Ventriculites of Mantell," in which he professes to detail the intimate anatomical structure of those fossils, and accompanies his descriptions with figures. The figures however, which are in wood, are not such as to convey any correct or clear idea of the originals, while the whole paper certainly does not elucidate the structure further than had been done by Dr. Mantell*. The writer considers them single animals like the *Actinia*.

* I had proposed briefly pointing out the cause of the essential errors into which Mr. Rose has fallen, but my limits prevent (see note *ante*, p. 75). The course which I subsequently show to be absolutely necessary to the investigation of these bodies is the best explanation of the imperfect and erroneous notions hitherto prevailing in regard to them.

In Miss Bennett's 'Catalogue of Wiltshire Organic Remains' (1831) are given, but again without any description, the best figures yet published of one form of the Ventriculidæ, which is there called *Choanites subrotundus* (tab. 16. figs. 1 and 2: figs. 3, 4 and 5 are bad).

In Woodward's 'Geology of Norfolk' (1833) two figures are given (tab. 4. figs. 20, 21) of what the author calls *Ventriculites infundibuliformis*, but unaccompanied by any description, and the figures are too indefinite to afford any information: the author includes *V. radiatus* in his list (p. 46).

Blainville, in his 'Manuel d'Actinologie' (1834), figures on pl. 76. figs. 4 and 4 *a* the *Ocellariæ* of Ramond, and on pl. 60. fig. 5 the *Coscinopora* of Goldfuss; but in his description of each, pp. 386, 430, he intimates doubts as to their real nature. He describes each, however, as having a stony polypidom!

Phillips, in his 'Illustrations of the Geology of Yorkshire' (1835), vol. i. p. 118, gives several figures, unaccompanied however by any description, and which figures are so very imperfect that it is impossible to make out from them any character at all. It would indeed be impossible to know that any of them represented Ventriculidæ, did not the heading of the list of figures state such an intention. This imperfection of these plates is the more to be regretted, and the absence of all description the more surprising, inasmuch as the able author himself remarks (p. 121), that "the remains of the [so-called] *Spongiæ** are nowhere so well-developed as in England, and perhaps nowhere in England so well as in Yorkshire. On the shore near Bridlington they lie exposed in the cliffs and scars, and, being seldom inclosed in flint, allow their organization to be studied with the greatest advantage."

Bronn, in his 'Lethæa Geognostica,' (1835–7) allows a place to two of the Ventriculidæ under that name, and figures another under Goldfuss's name of *Coscinopora* (tab. 29. fig. 1). He figures Goldfuss's *Scyphia Oeynhausii* as *V. radiatus* (tab. 27. fig. 18), in which he is clearly mistaken. Neither the figure of natural size nor magnified has any resemblance to any of the Ventriculidæ.

In 'Die Versteinerungen des Norddeutschen Kreidegebirges' of Roemer (1840) are figured, with very meagre descriptions, some forms which seem intended to represent some of the Ventriculidæ. They are however too indefinite to enable me to fix

* Though thus called "*Spongiæ*" by this author, and though some other writers have so called them also, it is really needless to expend one line in showing the total absence in them of all resemblance to sponges. No two classes of objects in natural history can be more different, and the affixing of such a name can only arise from an entire want of opportunity for the examination of specimens.

with confidence on particular figures. All are described under the name of *Scyphia*. The nearest forms are perhaps tab. 3. figs. 2, 9, 11, and tab. 4. fig. 1, but others are probably intended for these objects.

In Portlock's 'Report on the Geology of Londonderry' (1843) are contained descriptions, but no figures, of *Ventriculites radiatus* of Mantell, and *Scyphia alternans* of Roemer (tab. 3. fig. 9), and also of the one figured by Goldfuss (pl. 30. fig. 10) as *Coscinopora infundibuliformis*; but this writer does no more in effect than repeat the descriptions given by former authors.

Michelin, in his 'Iconographie Zoophytologique' (1843–7), has figured (pl. 30.) and described (p. 121) under the name of *Guettardia*, a variety of the Ventriculite already figured by Dr. Mantell (South Downs, tab. 15. fig. 6) under the far more characteristic name of *V. quadrangularis*.

On pl. 38. fig. 3 of the same work is a very imperfect figure* of *Ventriculites Bennettiæ*. On pl. 41. fig. 3 is a far better figure than had before been given of the so-called "*Ocellaria nuda*;" while on pl. 40. figs. 3 *a* and 3 *b* are figures of what he calls *Ocellaria grandipora*, being really a very different species of Ventriculite from the other so-called *Ocellariæ*. These figures admirably represent the original as it appears when first broken out of the flint. The description (p. 145) contains however, in this as in other cases, nothing new. On pl. 40. fig. 4 *a*, 4 *b*, is also represented, under the name of *Retepora crassa*, another form of Ventriculite.

In 'Die Versteinerungen der Böhmischen Kreideformation' of Reuss (1846) no new details are given, while the figures (tab. 17. fig. 14, and tab. 18. fig. 11) are remarkable, in a work marked by the general beauty and correctness of its figures, for the want of any character or truthfulness whatever.

Such are the notices of this very interesting class of bodies which I have met with. Doubtless others may exist in works which have not fallen into my hands. The above will satisfy every reader that all that has been done by recent palæontologists has been to copy from one another. It is important to observe that in none of the figures or descriptions which I have cited does there exist the slightest indication of what I shall show to be the actual structure of these remarkable bodies, and without an insight into which all attempts at classifying them and determining their affinities must necessarily be uncertain and unsatisfactory and a true knowledge of their natural history impossible. Dr. Mantell is, indeed, the only author who has presented

* Probably a mere copy,—for Michelin's plates are usually very good and characteristic.

us with an extensive series of figures and descriptions. And although, as he himself properly remarks*, "some respectable writers have amused themselves with either giving them new names or arranging them as *Spongiæ, Alcyonia,*" &c., those writers have assuredly done nothing more; and thereby, instead of advancing the knowledge of these fossils, they have introduced all the confusion and uncertainty which it has been possible to do as to even their identity.

Dr. Johnston, in his 'British Zoophytes' (2nd ed. 1847, p. 180), merely takes a passing notice of the Ventriculidæ; but his work does not profess to include fossil species.

Finally, Mr. Morris, whose wand has in many instances restored order where numberless writers had "amused themselves with giving new names," while he properly readmits the Ventriculidæ to their position as a separate genus, has placed them among the *Amorphozoa*. It is needless to dwell on the impropriety of that position, as Mr. Morris is now fully satisfied, from an inspection of my collection, that they deserve a very different place. And if constancy and elegance of form, delicacy of structure, and a high state of organization are to be taken as tests, the Ventriculidæ will assuredly have hereafter to be ranged in a very different group from that of the *Amorphozoa*.

Having thus shown what has been already done in the field upon which I have entered, it is necessary, in order that the reader may have any confidence in the results and observations which will be presented to his notice here, to state the course which I have myself pursued in these investigations.

The first specimen of the Ventriculidæ which came under my notice strongly attracted my attention from its great elegance of form and the peculiarities I observed in it. I was disappointed in finding any satisfactory information on its nature, and soon perceived that every one of the characters described in the books had reference to some superficial characters only, and not to the intimate structure of the animal. Being fully satisfied that "it is only by a strict investigation of the *intimate structure* of the various forms of these animals," as an accurate observer has well remarked†, "that any permanent arrangement that shall indicate their true and natural affinities may be hoped for," I set about that task myself: this has now engaged my attention for upwards of two years; and in now publishing the results of my careful observations, I feel that I may add with even more truth than could be done by that writer, that the task I have undertaken "is a task of no little difficulty in the accomplishment,

* Geology S.-E. England, p. 97.

† Farre on the *Ciliobrachiata*, Phil. Trans. 1837, p. 387.

and one that may fairly entitle him who enters upon it to expect to meet with indulgence,"—an indulgence, however, which those best qualified to judge of the value of such observations will, happily, be also most able and willing to yield*.

My first step was to obtain as large and varied a series as possible. I have in truth examined and compared with laborious care several thousand specimens, of which certainly upwards of one thousand are at this time in my own collection. These specimens are in all conditions and from various localities.

But I soon felt a new difficulty. These bodies exist both in the chalk and in the flint, substances about as different as well may be. I saw that much error and inconsistency had arisen from not comparing and regarding the differing conditions in which these fossils exist in such different substances. Hence a preliminary step seemed to be, an examination of the nature and mode of formation of the flints themselves. The conclusions resulting from that examination have, to a great extent, been communicated in two papers in the 'Ann. and Mag. of Nat. Hist.' for January and May of the present year.

The exposition given by Dr. Turner† of the *origin* of the siliceous fluid,—in the solution of silex consequent on the disintegration of the felspar of igneous rocks, at which moment of disintegration the silex is liable to free solution in water,—was consistent and satisfactory. But no consistent or satisfactory view could be discovered explanatory of the modes and forms in which the *flint* is actually found. I endeavoured in the above-cited papers to show that those modes and forms are owing to the very rapid solidification of the siliceous fluid—induced by special circumstances—combined with the activity of molecular attraction: that those special circumstances were generally the presence of an organic body which acted as a nucleus,—the softer bodies being more operative in this respect than the harder: that some-

* One of the most pleasing duties of the student of natural history is to acknowledge and reciprocate the assistance received from, and always so ready to be rendered by, other naturalists. I take this opportunity of acknowledging my obligations to Professor Owen for, among other things, affording me the opportunity of fully examining several recent specimens of the highest interest, some of which I shall have occasion particularly to mention hereafter; to Mr. Morris, the well-known author of the 'Catalogue of British Fossils,' for assistance rendered in more ways than it would be easy for me to enumerate; to Mr. Tennant of the Strand, and Mr. Harris of Charing in Kent, who have each placed at my disposal several valuable specimens with the liberal permission to make any sections I desired; and to Miss Emma Naylor of Wakefield for the donation of many fine specimens of recent British Polypifers collected by herself. To many others my acknowledgements are also due, for the loan of specimens, both fossil and recent, for examination and comparison.

† Lond. and Ed. Phil. Mag. vol. iii. p. 25.

times mere mechanical action was sufficient to induce solidification. I further showed* that from these facts certain very remarkable and hitherto unnoticed results had followed; namely, that when a mass of the siliceous fluid had solidified thus suddenly round a soft body, a Ventriculite for example, in which the soft parts were existing at the time of its envelopment, it necessarily formed a solid mould round the nucleus: that when the soft body decayed, its gases and softer components having escaped through or been absorbed by the surrounding and hardening chalk, a more or less complete hollow was necessarily left in the solid flint in the place formerly filled by the animal body: that the firmer fibre of such bodies remaining after the softer parts had thus passed away would afford and did afford centres of crystallization for any silex slowly permeating the stratum in a liquid or gaseous form after that stratum had acquired consistency: that according to the greater or less quantity of such permeating silex would be the result in either wholly or only partially filling up the hollows whose origin I thus explained. I showed the accordance of these views with the known laws of the development of crystals†.

The most important results follow from these observations; and I immediately saw that that which had been generally described as the remains of the body itself was in truth the incrustation of a crystallized foreign substance round such remains. It will be obvious how erroneous must be all descriptions founded upon the former notion.

It remained to adopt a mode of examination of the Ventriculidæ in chalk and in flint which should realize the living animal in the same form from an inspection of its remains in either matrix. To effect this I made many sections of chalk specimens in every direction, for examination both as opake and transparent objects,—an attempt which I believe was novel. Aware that it is by

* Ann. and Mag. Nat. Hist. vol. xix. p. 306.

† The mode of crystallization most commonly exhibited in these cases is the acicular. Silex is known to crystallize in this way from sublimation. In the 2nd vol. of the 'Transactions of the Geol. Soc.' p. 274, is a paper by Dr. MacCulloch on an instance observed by him of the actual formation of such crystals, which he there describes aptly as "filamentous crystals crossing each other in all directions." It seems to me, from careful observation, that it was in cases where an almost or altogether entire hollow was left, all the fibre having decayed as well as the soft parts, that the geometric crystals were more disposed to form within the flints. The centres were fewer, the space larger. A botryoidal form is frequently assumed under such circumstances by the aggregation of acicular crystals; and traces of its former existence are visible in many now solidly filled spaces. The greater or less degree of slowness of the deposit no doubt had an important influence in determining the silex to assume the geometric form of so-called quartz or the botryoidal form of so-called calcedony; the quartz being the result of a still slower deposit than the calcedony.

careful personal manipulation only that results can be obtained which may be relied on, I further procured the necessary machinery and made a large number of sections, in every possible direction, of numerous *entire* flints*. The results have far surpassed my most sanguine expectations. I have not only discovered, beyond possibility of question, the intimate structure of the Ventriculidæ,—and in so doing have discovered an entirely new and most remarkable form of animal tissue,—but I shall be able to show the cause and character of all the modifications of form under which the Ventriculidæ are found; and I further hope to afford indications (I wish to express myself here as cautiously as possible) of the natural affinities and habits of the living bodies to which these very interesting fossils owe their origin.

It should be remarked, that the difficulties in the way of observation of structure in chalk specimens is no less, in reality, than of those in flint. The very friable nature of the chalk, coupled with the almost invariable presence of oxide of iron, would be sufficient to obscure and practically to obliterate a structure far less delicate than that of these bodies. Hence the coarser superficial characters which have been seized upon by all authors as characteristic of genus are all that is usually visible. It was not without much difficulty and care that I succeeded in examining satisfactorily the intimate structure of these bodies as actually preserved in that matrix.

It will clearly be only by thus gaining an insight into the true comparative values, if I may so speak, of the facts exhibited by remains preserved in both chalk and flint, that the inquirer can be in a position usefully to commence his researches with the hope of reaching any definite and satisfactory results.

We find specimens of the Ventriculidæ preserved in flint in one of three ways: the place of the body either wholly solid, the crystallized silex having entirely filled up the original hollow: partially solid, and that is generally towards the central parts of the flint,—the marginal parts, and especially the roots, remaining the last to be solidly silicified: or, lastly, the whole occupied by an open network only. Each case may be examined with great instruction, the key to what it teaches having first become thoroughly understood upon the principles above indicated, to the deduction of which principles instances like these were steps, and of which they do but afford illustrations.

It follows from those principles that, where the calcedony†, whether solid or open, began by crystallization round some re-

* The sections of flints usually examined by microscopists are of mere chips and fragments. They can be of no value in an investigation of this nature.

† See note Ann. and Mag. for May last, p. 307.

maining fibres of the body as centres, the fibre itself, when by this process hermetically sealed up, would remain there to this day in much the same condition as it then was, usually more or less charged with sulphuret of iron; and that, where not so hermetically sealed, it would, on its subsequent decay, either leave the incrusting calcedony in the condition of a series of hollow tubes, or such hollow tubes would, still subsequently, be again filled up by a continuation of the process of siliceous crystallization. I have many specimens of the Ventriculidæ in each of these conditions. It will further be obvious, that where, as occasionally might happen,—but comparatively rarely, because dead fibre would have less attraction for the siliceous fluid than soft animal matter,—the fibrous skeleton of an animal of which the soft parts had already decayed away was enveloped in the siliceous fluid, no hollow would ever be formed, but that fibrous skeleton would be preserved hermetically sealed. I have instances of this latter mode of preservation also.

The flint specimens are, in the vast majority of cases, found with flint on both sides; a fact resulting, there can be little doubt, from the operation of some cause connected with electricity, which, though there is in no part any communication between the two surfaces, determined an attraction and affinity between equivalent masses of siliceous fluid on the two opposite sides, just as we see the needle follow the magnet though a solid plate intervene. Cases are however not very uncommon in which the flint exists in a mass only on one side, there being on the other merely narrow filamentous threads of flint. When the mass is thus found on one side only, that side is, in almost all cases, the inside. Now the Ventriculites being funnel-shaped, there would necessarily be a much greater attraction for the siliceous fluid on the inner side of the body than on the outer side, in precisely the proportionate difference that there is between a single exposed plane surface and a surface closed in on all sides by opposite surfaces. If a mass of siliceous fluid were not great in a particular spot, the greater part of it would thus be drawn to the inside, the electric attraction before hinted at operating however generally to attract a small portion to the outer corresponding surface, where it would spread in what now appear as filamentous threads between the foldings of the outer surface of the animal, in which spots the greatest attraction on the outside would of course be, in consequence of the opposite surfaces there present*. Occasionally a similar appearance is found both on the external and internal surface; but that is usually towards the margin of a flint which is otherwise encased on both sides, as in the specimen fig. 2 of my paper of January, and betokens an exhaustion

* See and cf. p. 9 and note to p. 301 of the two articles before referred to. The threads of flint are there found though the body was not encased.

of material. It would sometimes happen that a very small mass of the fluid would approach the outside only of a large Ventriculite. In such case none could reach the inside, and we should find, and do, that it is external only.

It may at first sight be thought that there would be hollows in chalk specimens similar to those in flint, and that these would be as subject as the latter to have any inclosed fibre incrusted with calcedony. A little reflection will however satisfy the careful reader that this could not be the case. The mould of the individuals inclosed in flint was perfectly solid. Though sulphuretted hydrogen were evolved, which it necessarily would be, from the decomposing body, the encasement in that solid matrix would generally prevent the so free deposit of sulphuret of iron as would take place in the open chalk. Consequently the remaining fibre would offer more affinity for the gaseous silex than would such fibre remaining in the open chalk and more highly charged with sulphuret of iron. And the fact is, that specimens preserved in the chalk exhibit a much larger proportion of sulphuret of iron than those preserved in flint,—frequently so much that the specimen, after a short exposure to the air, becomes a mere mass of oxide of iron, and all structure is undistinguishable. In other cases it is less so, and I have in fact found, in several chalk specimens in which the presence of iron is the least marked, that the deposit of crystallized calcedony*—pure and without the presence of a particle of flint on either external or internal surface—has taken place to a small extent, but in a most exquisite manner. It is clear however that, in general, when any part of the *soft* substance of a body encased in chalk decomposed, its place was soon filled up with particles of chalk, which in its then scarcely hardened state were readily carried in. The firmer fibre would, thus inclosed, endure for a much longer period, probably indeed until the chalk had become comparatively dry, on which event its absorption, where little sulphuret of iron was present, would follow and the space be left vacant. The instances of calcedonized fibre in chalk specimens are then quite as frequent, and to just such an amount in individual cases, as might be anticipated, while the frequent excellent preservation of the forms of the Ventriculidæ in the chalk is also explained.

A piece of dead fibrous skeleton in the chalk would evolve but little sulphuretted hydrogen, consequently would induce the deposit of little sulphuret of iron. It follows that, when buried in the chalk mud, it would be at once closely encased. The hardened chalk would, on the absorption of all the components of the fibre, also leave the places of those fibres vacant. On cutting open these, as well as on cutting open specimens encased with their soft parts and whose phænomena it is above attempted to ex-

* *Not flint*:—it is important to remember this.

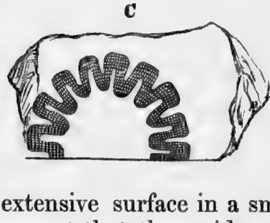
plain, we should find the places of the fibres indicated by hollow tubes disposed through the mass. Of course the presence of great pressure, or the percolation of water or other causes, will have frequently destroyed every trace of the animal, or partially destroyed it, leaving perhaps a mere iron-mould to mark its place; if the fibre were dead, not even that. I am fortunate in having some very beautiful specimens of the dead fibre tubes in my possession,—specimens which naturally escape ordinary attention, there being no colour to attract the eye, and the aid of the microscope being necessary to detect the facts.

In my notes I find several other points examined, but the space to which I am necessarily restricted prevents my entering into further detail here, and I think that I may rely on the candour of every competent observer, that, having thus far touched on material points, others which may occur to him have not escaped my attention. Proceed we now to the *results* of these observations.

I propose to point out, first, some of the general and most important characters connected with the external form of the *body* of the living animal; second, the same of the roots; third, to show what is the intimate structure of both; and lastly, to endeavour to indicate the natural affinities of the whole group. And though it is impossible for me to do otherwise than painfully feel that the attempt is vain to convey, by a few words and figures, that certainty of conclusion which I have derived from such very extended observation, I will hope to impart some consciousness of a reality.

Every reader familiar with the human brain is aware that it consists of a very extensive surface folded up in numerous convolutions in order to pack it in the small compass of the skull, just as for convenience the pocket-handkerchief is doubled up to put it in the pocket. The remarkable resemblance between the annexed section of a Ventriculite (in flint) in my possession, and any cross section of the cerebellum cannot fail to strike every reader,—a resemblance arising from the simple circumstance that both are examples of a similar mode adopted by nature for packing an extensive surface in a small space*. But no one will pretend to assert that those ridges, of which the outline is seen in the section of the cerebellum, are "cylindrical fibres;" nor will any one infer a power of expansion

Fig.
C



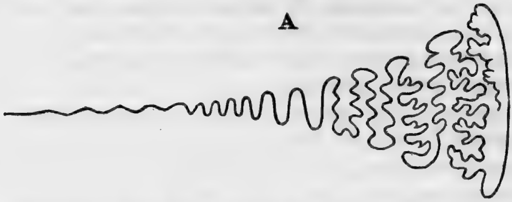
* Plates 63 B, 64, 64 A, and 64 B of Prof. Owen's 'Odontography' afford striking illustrations of the application of the same contrivance to the hardest, as in the brain it is applied to one of the softest, of organic tissues.

and contraction to reside in these bundles, as Parkinson* and Dr. Mantell have done, from a similar appearance, in respect to the Ventriculidæ.

A glance at the following figure will satisfy any one that a simple and plain membrane may be folded up in the most intri-

Fig.

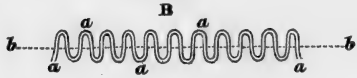
A



cate way without in fact destroying its simplicity, and having the only effect of packing a larger surface into a smaller compass. The mode of folding may be either longitudinal, in which case we shall have the "cylindrical fibres radiating from the basis to the circumference" of Dr. Mantell; or it may be transverse; or it may be more or less intermediate between the two, thus causing those longitudinal ridges to appear to anastomose; or it may be so regularly intermediate as to give to the surface a mammillated appearance. The appearance of the body may even differ on the external and internal surfaces, inasmuch as the folds may assume a different direction as they reach the respective surfaces, as we see familiarly in a rhubarb leaf just burst from its sheath. But none of this can alter the nature of the membrane itself, or serve to establish a generic character. It is further evident that if the folding assume the mammillated character,—that is, if a membrane of some thickness be folded in and out in regular figures,—a section across any part will, according as its direction shall be, represent a series of apparent tubules or of reticulations regularly disposed, as seen in Pl. VII. figs. 1 to 4; and again, that if any foreign substance fill up any of the superficial depressions on this mammillated surface, that surface will appear to be regularly perforated by tubules. Hence the figures of Goldfuss and Roemer, which profess to give magnified views of the exteriors of Ventriculidæ. The following figure will illustrate this: *a, a,* is the membrane, which is folded in and out with

Fig.

B



the exactest regularity, each fold being of equal breadth and

* Organic Remains, ii. p. 145.

length, thus making each depression and elevation regularly round. It is evident that a section made in any part from *b* to *b*, in the plane of the surface, would be more or less of the character of Pl. VII. fig. 3, while a section made in any part perpendicular to that plane would resemble the upper part of fig. 4, or fig. C (p. 87).

A very careful examination and comparison of innumerable entire specimens and sections, both in chalk and flint, of every form and variety of Ventriculidæ, early satisfied me that, though contrary to every figure and description that has been published, the above was the true explanation of their forms. Every subsequent observation has confirmed this conclusion. Let the reader examine Pl. VII. figs. 1 and 2, and fig. C (p. 87), and he will see three out of many of the modes in which transverse sections of Ventriculidæ in my possession show that the membrane is folded. Let him, again, examine Pl. VII. figs. 1 and 2, and he will see in fig. 1 a surface perfectly plain and smooth, except so far as the fibrous structure marks it; while in figure 2 he will see the lower part of the surface smooth like fig. 1, but the upper part gradually passing into the mammillated character. These varieties (never before figured) are both in my possession, and I have every shade and variety from the perfectly plain to the most convoluted form of fig. A above. It will easily be conceived what a variety of markings in the chalk and flint,—at first sight wholly inexplicable and unconnected,—will be presented on longitudinal and transverse sections of such complicated convolutions.

Nor does such variation in external form indicate in the least degree a habit or power of contractility. I have shown, by analogy, that it does not necessarily do so. I will show by actual facts that the Ventriculidæ were not contractile. Not only is it an important fact that we find deeply convoluted specimens as wide-open-spreading as any, while we find specimens of the perfectly plain varieties as narrowly funnel-shaped as any, but we find, fixed on the surfaces of specimens of every variety, Ostreæ, Dianchoræ and other shells which are in the habit of attaching themselves by peculiar processes to other bodies. In every such case the shape of the attached shell *departs from its ordinary form*, and is precisely adapted to, *moulded on*, that of the Ventriculite—proving that it *grew thereon*, and thus testifying at once to the firmness of the texture of the body and to its noncontractility, as well as to its durability. Further, we sometimes find delicate Flustræ spread over parts of Ventriculites—always, as before, without trace of distortion or disturbance. But there is, if possible, yet stronger evidence in the fact that an entire and very large group of the Ventriculidæ, and those, too, the very ones which are pointed out as exhibiting the most "contracted state," have distinct heads—which heads are perfectly smooth and regular in general form, and with no deep anfractuosities, instead of being, as the contractile theory requires, most of all convoluted. Finally, I shall presently show that there was a special and most beautiful provision in the intimate structure of these animals against contractility either voluntary or by ordinary accident.

Nor is there any want of examples of the presence of similar convolutions without contractility in what I hope to show to be kindred zoophytes of the present day. The *Eschara foliacea* is familiar to every one. But I am indebted to the kindness of Professor Owen for a still more striking illustration of this arrangement in a recent zoophyte. That gentleman a short time ago placed in my hands, with the liberal permission to examine it in any mode I chose, a specimen of *Meandrina* recently brought from the Indian Ocean, and which had been treated with muriatic acid. All the calcareous parts being thus dissolved, there remained only the soft animal parts. I observed with much gratification that these consisted, in fact, of a single membrane folded up almost exactly after the manner of some of the more irregular of the Ventriculites—very much indeed like the *Ventriculites radiatus* described by Mantell and others as having an "integument formed of cylindrical fibres anastomosing," &c.

However much differing in the complexity and mode of the convolution of its membrane, the body of every member of the family of Ventriculidæ appears to have had an opening at its upper part, and that body approached more or less to the form of an inverted cone. They usually grew single. In one or two species they are grouped, and there are occasional instances, but very rare, of double specimens of those whose usual habit is single —just as we occasionally find a double *Actinia*.

Having thus shown the general character and habit of the body of these animals, I next proceed to show the nature of the root.

The attention of Ellis was particularly attracted, in describing his Corallines, to one variety, the *Corallina astaci corniculorum æmula* as he calls it, or Lobster's Horn coralline, as having roots very different from those of ordinary corallines, "which rise up from an irregular mass matted together to form the stem*." The roots of this zoophyte, on the contrary, "regularly enter in in whirls round the joints;" the body of the animal, according to his figure, tapering off to a point in the midst of these root fibres†.

Something after such a type was the habit of the roots of the Ventriculidæ. They were *not*, as described by Dr. Mantell, de-

* Ellis's Corallines, p. 16 and pl. 9. B.

† This peculiarity is not marked either in the description (p. 86, 2nd ed.) or figure (pl. 19) of Dr. Johnston; but the figures and descriptions of Ellis are seldom unworthy of dependence.

rived from the base of the body "prolonged into a stirps and attached to other bodies." The body of the Ventriculite tapers off regularly to a point at the bottom. At about an inch from its base,—the distance varies according to size,—fibres of a very different aspect from those composing the membrane of the body begin to be attached to the external part of that body. They do not begin all round at exactly the same distance from the base, nor, as they increase in mass, is that mass of the same thickness on all sides. They are at first very few and thinly disposed. As the base narrows they increase rapidly in number and mass, till, immediately below the base, they form a bundle of considerable size, which is continued, thus united, for some distance, from one to three inches according to circumstances, when it divides into several radicles, sometimes more, sometimes less: I have counted as many as forty in one specimen. These sometimes extend very far and always terminate in very delicate extremities.

The root-mass is never itself convoluted like the body, even in its upper parts, and where it forms a thin membrane only. It necessarily follows the form of any convolution, usually slight, which exists at the lower part of the body. The mass of the root is not regularly cylindrical, but irregular on the different sides (see Pl. VII. fig. 6). Occasionally it assumes a tubular aspect in places, but this is quite accidental and in nowise characteristic of genus or species.

Pl. VII. fig. 5 gives a longitudinal section in which the difference between the body and root is very clearly seen: fig. 6 is a transverse section of the same specimen. These two will realize to the observer how admirably the body was lodged in this root-case as in a sheath or socket. They remind one of a balloon to which the car is attached by a network of rope gathered in on all sides round the narrow base. Pl. VII. fig. 7 is the external appearance of another specimen, showing the root-fibres commencing round the body and spreading at the root.

The substance of the root was different, as the fibres were differently arranged from those of the body. This is proved by the fact that the root exists generally in a very different condition, both in chalk and flint, to that in which the body is found in the same specimen. In flint its place is much less often solidly filled with calcedony than is that of the body. In the chalk it is the rare exception to find the substance of the root in sound condition. It generally falls away to dust the moment the specimen is opened, while the body of the Ventriculite remains entire and perfect down to its very point, having all around it a hollow space where the root was.

The Ventriculites were never "affixed to other bodies." It is possible that the animal was locomotive like the *Actinia*, and that, like the *Pennatulidæ,* it fixed itself during pleasure in the soft mud. Among all the thousands of specimens which I have examined, I have never seen one attached to a shell or to any other solid body. Shells are indeed sometimes found *growing onto* the *upper part* of the root, where it was of course immoveable, as they do on the body. The most delicate terminations of the roots may be always traced by their impression in the chalk. If the animals were locomotive, it was by aid of the lower radicles that they progressed.

Occasionally, but it is the rare exception, a small bundle of root fibres is given off from the side of the animal. This is similar in character to the true root, but slighter, and it is merely affixed by apposition of its thick extremity, without any of the encasement. Such instances appear as if some circumstance rendered an additional support necessary in the particular instance. There are instances among our native zoophytes of upright habit, in which a similar circumstance is not uncommon —much more common than among the Ventriculidæ.

I have one example in which there is no encasing root-sheath. And in that specimen, as if to make up for want of it, the rootlets begin to arise about an inch from the base, being already of considerable strength: they spread out immediately on each side, and so support the body just as a tent is supported by the staying ropes on all sides. I have another example having two complete roots, and of course a divided base to the body. Each root is however smaller than usual. These examples only show that the world was under the same laws in the days of the chalk formation as it now is: that then, as now, monstrosities would sometimes appear, which, however, only themselves serve to show the permanence of Law and Unity, inasmuch as in these very monstrosities there is always present some compensating phænomenon which it is interesting and instructive to observe.

I have already stated that my investigations into the *intimate structure* of the Ventriculidæ have rewarded me by the discovery of an entirely new kind of animal structure.

In 1841 Professor Owen read before the Zoological Society a paper* on a remarkable production from the Philippine Islands, of which he says, "in the exquisite beauty and regularity of the texture of the walls of the Cone, the species surpasses any of the allied productions that I have, as yet, seen or found described," and he gives to it the very appropriate name of *Euplectella.* While the *Euplectella* is the only object which approaches the Ventriculidæ in the beauty and regularity of its texture, the latter far surpass it not only in possessing a much higher degree

* Zoological Transactions, vol. iii. p. 203; and Ann. and Mag. Nat. Hist. vol. viii. p. 222.

of that very beauty and regularity, but in the exquisite delicacy of a further texture, of which the *Euplectella* does not possess a trace, and which, so far as I can learn from the best authorities, has never been hitherto observed in any object, animal or vegetable, recent or fossil.

Through the kindness of Professor Owen and the liberality of the proprietor of the specimen, Mr. Broderip, I have had an opportunity of carefully examining the *Euplectella.* While I am thus enabled to speak to the fidelity of Prof. Owen's description, I can also speak with more assured certainty as to points to which, having the structure of the Ventriculidæ before my eye, my attention was more particularly directed.

The *Euplectella* is composed of an arrangement of fasciculi of fibres, *one course over the other*, not anastomosing together: its principal substance consists of two layers, a longitudinal and a transverse one, of which the former is external to the latter. These, thus crossing at regular intervals, form the regular texture which excites Prof. Owen's just admiration,—an arrangement in which they are held by the interlacement of other and more delicate fibres tied by the same fairy fingers which Dr. Johnston describes as knitting the plexus of one of his delicate zoophytes. The squares thus formed are about the eighth of an inch in size,—gigantic in comparison with the squares filling the membrane of the Ventriculidæ.

The membrane of the Ventriculidæ is composed of very delicate fibres arranged in squares, of which the larger ones measure, on an average, considerably less than the 100th of an inch on each of their sides*. The fibres of the Ventriculidæ are not arranged in fasciculi, nor in layers the one overlying the other concentrically or otherwise. Neither are they at their points of crossing wrapped together by other interlacing fibres. The substance of the *Ventriculites simplex* (see Pl. VIII. fig. 1), which is the true type of the whole family, is not quite one line in thickness (about the sixteenth of an inch). It consists of five thicknesses of the squares I have mentioned. Consequently the substance of the body of the animal consists of a membrane composed of an exceedingly delicate fibre anastomosing in every direction, so as to form both in the plane of its surface and of its thickness regular squares (see Plate VII. fig. 8). As the body increases in size from the base to the upper margin the fibres increase in number, and this takes place, not, as in the *Euplectella*, by the "convergence and interblending of contiguous fibres," but by the addition of a fresh fibre, generally at the middle of the outward boundary fibre of a

* The sizes are pretty constant in different species. There is some variation however. Those described are the largest. The *relative* dimensions appear constant.

square,—thus causing less disturbance to the regularity of the squares than happens in the *Euplectella* (see fig. 14). But this is not all the beauty and delicacy of the intimate structure of the Ventriculidæ. A structure remains to be described, to which the expressions of Prof. Owen in describing the *Euplectella* may well justify me in saying that no language can do justice, and which no one can contemplate without delight, wonder, and exquisite admiration.

If the reader's attention has ever been attracted by the roofs of the large railway stations, he will have perceived that they are held together by the mutually counteracting and balancing effects of thin rods obliquely placed—any one of which would singly be very inefficient for any substantial purpose. To give a barred gate strength, or to keep a loose door or window-frame to its true square, we see the carpenter fix a bar obliquely subtending the right angle, which will hold the more securely the nearer it is fixed to each side at equal distances from the angle. The principle of the bracket which supports a shelf or bust is but the same.

But there is nothing new under the sun. Ages before railways or carpenters existed, nature had adopted this very plan, to give strength and stability to the deep ocean forms of the whole family of Ventriculidæ; only, as she ever does, adopting a method far more delicate, complete and beautiful than it were possible for the hand of man to execute.

I have said that the fibre is arranged in a tissue of regular squares, which are formed by the anastomosing, at each angle, of that fibre. But, besides these fibres, of which there necessarily occur at each angle three entire ones crossing each other, or six looking at them as radiating from the angle as a centre, these crossing and anastomosing fibres are strengthened and secured by twelve still finer oblique fibres, each about one-fourth of the length of any one square itself. Each of these fibres subtends one of the angles formed by two of the primary crossing fibres, and of which angles there are of course at each crossing twelve. Each of them anastomoses with one pair of the primary fibres in each position in which they meet to form a right angle. This anastomosis takes place at an equal distance on each primary fibre from the angle itself, namely, at a distance of about one-fifth of the length of one side of the square. Thus it will be seen that at each place of crossing there are twelve subtending fibres and six primary fibres, in all eighteen fibres. Now, taking a Ventriculite of very moderate size, say three inches in height and plain, we shall have a membrane containing at least 750,000 squares, and at least nine million of these delicate subtending fibres, each faultless. What a marvellous piece of workmanship is this!

It will be perceived that by this most admirable contrivance a regular octahedron is formed round about the point of union of every four squares throughout the whole body of the Ventriculite, thus forming, of course, as many octahedrons as there are squares. See Plate VII. fig. 8, and more clearly fig. 10, as seen in flint, and fig. 9 as seen in chalk*.

It is needless to point out the strength given to the whole membrane by this arrangement, and the obvious design of it to prevent any injury of the animals to which it belonged arising from any yielding or distortion to which it might otherwise be liable from the operation of ordinary causes present in the ocean where they dwelt. They generally suffered fracture rather than yield to such impulse.

As the texture reaches the surface, both external and internal, it assumes a different appearance in order to attach to it the more securely what I shall crave permission to call, for the present, the *polyp-skin*. The regular squares and their octahedral junctions are still present, but under a different aspect; their size being contracted to about the 300th of an inch. This appears to be effected by the *addition* of finer fibres crossing each other within each square, so as to make at least four squares equivalent to each of the larger ones. This membrane presents a solid series of these squares; that is, they extend, in a single layer, as well in the plane of its thickness as of its superficies. The membrane spreads over every convolution and descends every anfractuosity of the body. Plate VII. fig. 11 shows this membrane in calcedony, where several of the actual fibres are preserved and the crystallization round them is very visible.

External to the whole, the polyp-skin itself,—spread over both external and internal surface and depressed also into each of the anfractuosities,—stretches over the delicate membrane last described, with which it is closely united (see Plate VII. figs. 12 and 13, and Pl. VIII. fig. 6). In specimens both in flint and chalk, prepared with care and in a high state of preservation, an equidistant row of apparent denticles seems to extend from the inner substance to the external encasing wall. This is caused by the transverse fibres (in the flint, incrusted with calcedony; in the

* It is obviously impossible to find individual specimens which shall fully show those states of fact which have been only ascertained by careful examination of many hundred specimens. Again, the least obliquity in any section will cause an *apparent* elongation of some and a cutting off of parts of other squares; while the slightest variation in focus will cause fibres in different planes to appear on the same plane. Hence, oftentimes, an *apparent* irregularity which does not really exist, but which may easily deceive an unpractised eye either in the object itself or in the engraving. Figs. 8, 11, 13 and 14 illustrate this. It should be added, that the octahedral structure could not be given with any clearness in figs. 8, 9 and 14, without somewhat exaggerating its relative size. No engraving can do justice to the exquisite delicacy of the original.

chalk, the place of the fibre left hollow and the intervals filled with chalk) of the delicate membrane which underlies the polyp-skin.

The polyp-skin itself is of extreme tenuity, and differs altogether in structure from the internal parts. It is not fibrous, but of a uniformly close texture which yields to the highest powers of the microscope no other than a minutely granular appearance.

It is only in very rare cases that the polyp-skin is found in any degree of perfection. Careful observation and comparison of an immense number of specimens, *with their casts,* led me to infer the existence of this polyp-skin, as matter of unevadable conclusion, long before I was fortunate enough to find, as I have since done, specimens in which it was so preserved as to be found on the body of the fossil itself. In such cases as the latter, the internal structure is always clearly seen where any parts of the polyp-skin are ruptured. See Pl. VII. fig. 12.

I shall presently enter on the consideration of the polyps themselves and the accompanying phænomena.

It will of course be understood that the membranes I have described must, during the life of the animal, have been filled with soft parts, which, with whatever minutely ramifying vessels they contained, rapidly decomposed, and of which therefore I have as yet discovered no trace.

There existed no spiculæ, siliceous or calcareous, in any of the Ventriculidæ; some spiculæ in the adjoining chalk or flint may sometimes deceive an inexperienced observer.

The structure of the root differs much from that of the body. Annexed to the body by short fibres clearly seen on a good section, it is, like the body, arranged in squares, but those squares have not all that regularity which those of the body have. They are, in general, smaller in their average size than those of the body, and have throughout a tendency to elongation in their longitudinal direction, whence they are often narrowed on one or both of their lateral planes. The fibres of the root are also thicker in their longitudinal direction than in their transverse.

It is particularly important to observe that there is no trace in the roots of the octahedral structure, a fact precisely in accordance with the functions of those roots. The safety of the animal would be more secured by the latter yielding to every impulse, and waving their so delicate load from side to side, than by an unbending stiffness. The octahedral structure had therefore no place in the roots.

The integument of the root was also very different from that of the body. It is impossible for a moment to confound the two. Its longitudinal fibres were much thicker than the transverse ones; and, there being no octahedral structure to secure an unyielding exactness, it appears as if disposed in long, narrow, and not very regular meshes. When encrusted with calcedony it appears not unlike some vegetable tissues (see fig. 7. Pl. VIII.). The deceptiveness of appearances thus caused has been already fully pointed out. This integument was very possibly muscular.

The fibres of the roots, like those of the body, all anastomose together. They do not overlie nor entwine.

When it is remembered that sulphuret of iron is deposited more or less on every fibre that has been actually preserved, it will be obvious that it is impossible to ascertain the exact size of the recent fibre. I have however frequently observed the better-preserved fibre to be less than the 4000th of an inch in diameter in its present condition; much appears about the 2000th of an inch; and the coarser and less perfectly preserved rarely exceeds the thousandth of an inch in its present condition. The fibre is single and solid (never fistular). It is generally found both in flint and chalk reduced, more or less, to its ultimate granular texture, in which case it resembles the granular texture of other animal fibre. This granular texture is finer, even in its present condition, than that of the recent *Actinia*.

The description of another most interesting point which I have discovered in connexion with these animals—the ovarian cells—will more properly come under the next division of the subject, when the natural affinities of the animal are considered. I content myself for the present with stating the fact of the discovery and clear establishment of these ovarian cells, a fact which cannot but be felt by every naturalist to be of the very highest importance, both in relation to the individual beings themselves and as an aid in determining their natural affinities (see Pl. VIII. fig. 3).

And now, having thus too imperfectly described the intimate structure of these animals, so elegant and graceful even in their external forms, I hope that I shall be felt not to have expressed a too strong sense of the exquisite beauty of that structure. I have searched in vain amid zoophytic forms for any structure that may compare with that of the Ventriculidæ in delicacy, beauty, and obvious adaptation. The pride of man may call all those beings who differ most from him in structure the "lower animals;" but I would ask, Where can be found an organization more complex or more exquisitely delicate, or where adaptation more perfect, than is displayed in the structure of the Ventriculidæ? Where can we find a structure affording more conclusive evidence of the all-prevalence of those laws of Unity and Design which it is the grateful task of the naturalist to develope, and of which his inquiries, the further they extend, do but unfold a wider field of illustrations for man to study and admire?

[To be continued.]

XII.—*On the Geographical Distribution and Classification of Zoophytes**. By James D. Dana.

Heat, light, pressure, and means of subsistence, influence more or less the distribution of all animals; and to these causes should be added, for water species, the nature or condition of the water, whether fresh or marine, pure or impure, still or agitated. Next to the character of the water, heat is the most prominent limiting agent for marine animals, especially as regards latitudinal extent, while light and hydraulic pressure have much influence in determining their limits in depth.

Although these causes fix bounds to species and families, they do not necessarily confine tribes of species to as small limits. This is sometimes the case, and it is nearly true of a large group of zoophytes; yet other tribes and orders include species whose united range comprises all the zones, from the equator to the polar ices, and every depth, to the lowest which man has explored, affording traces of life.

Order Hydroidea.—The Hydroidea are met with in all seas and at great depths, as well as at the surface. The tropics and the cold waters of the frigid zone have their peculiar species, and a few are found in fresh waters. The rocks and common marine plants of the sea-coast, the dead or living shell, or the floating fucus of the ocean, are often covered with these feathery corals; and, about reefs, they occasionally implant themselves upon the dead zoophyte, forming a mossy covering, taking the place of the faded coral blossom.

The species are most abundant, however, in the waters of the temperate zone, and are common upon some portions of our own coast.

Order Actinoidea.—The Actinoidea are marine zoophytes. All oceans have their species, yet in the torrid zone they more especially abound, and display most variedly their colours and singular forms.

The soft *Actinidæ* and the *Alcyonaria* have the widest range, occurring both among the coral reefs of the equatorial regions, and, to the north and south, beyond the temperate zone. The Mediterranean affords species of *Gorgonia, Corallium* and *Alcyonium,* besides numerous *Actiniæ.* The coasts of Britain have also their *Alcyonia* and *Actiniæ,* and from far in the northern seas, come the *Umbellularia,* and some other species of the *Pennatula* family.

Among the coral-making *Actinaria,* the Madrepore and Astræa tribes are almost exclusively confined to the coral-reef seas,—a

* From Silliman's American Journal for March and May 1847.

region included mostly between the parallels of 28° north and south of the equator,—while the *Caryophyllia* family are spread as widely as the species of *Actinia*. Several species of *Caryophyllidæ* occur in the Mediterranean, and others in the high northern seas, and they are met with at depths of several hundred feet. They are also common among the coral reefs of the tropics.

The Madreporacea and Astræacea, with the *Gemmiporidæ*, are the principal constituents of coral reefs. The temperature limiting their geographical range is 66° or 68° F., this being the winter temperature of the ocean on the outskirts of the reef-growing seas. The waters may sometimes sink to 64°, but this appears to be a temperature which they can endure, and not that in which they germinate. The extremes which they will survive prove only their powers of endurance, and do not affect the above statement; for their geographical distribution will be determined by the temperature which limits their powers of germination.

The temperature of the ocean in the warmest parts of the Pacific varies from 80° to 85°, and here Astræas, Meandrinas, Madrepores, &c. are developed with peculiar luxuriance, along with thousands of other strange and beautiful forms of tropical life. A range from the above temperature to 72° does not appear to be too great for the most fastidious species. At the Sandwich Islands, which are near the northern limits of the coral seas, *Porites* and *Pocilloporæ* prevail, and there are very few species of the genera *Astræa*, *Mussa** and *Meandrina*, which are common nearer the equator.

The range of these reef-forming corals in depth is singularly small. Twenty or perhaps *sixteen* fathoms will include very nearly all the species of the Madrepore and Astræa tribes†. Temperature has little or no influence in occasioning this limit, as 68° F. will not be found under the equator short of a depth of 100 fathoms. Light and pressure, the latter affecting the amount of air for aëration, are probably the principal causes. The waves, moreover, seldom reaching to a greater depth than thirty fathoms, cannot aid in renewing the expended air below as they do at the surface.

In recapitulation we state that the Astræacea, Madreporacea, and the Gemmiporidæ among the Caryophyllacea, are, with few exceptions, confined to the coral-reef seas‡, and to within twenty fathoms of the surface. The *Caryophyllidæ*§ extend from the

* *Lobophyllia* of Blainville, *Mussa* of Oken.

† The evidences on this point will be presented in the Report on Coral Islands.

‡ The exceptions belong mostly to the genus *Euphyllia*, which includes the genus *Flabellum*, some *Turbinaliæ* and the *Lobophyllia*, having entire lamellæ.

§ The *Caryophylliæ* of Blainville, with the *Dendrophylliæ*, *Oculinæ*, &c.

equator to the frigid zone, and some species occur at a depth of 200 fathoms or more. The *Alcyonaria* have an equally wide range with the *Caryophyllidæ*, and probably reach still farther towards the poles. The Hydroidea range from the equator to the polar regions, but are most abundant in the waters of the temperate zone.

Besides the above-mentioned limiting causes, there are others of importance, one of which may be alluded to in this place; the remaining, belonging more properly to the Geological Report on Coral Reefs and Islands, will be particularly considered in the forthcoming volume by the author. The cause referred to, is that proceeding from original sites or centres of distribution. There is sufficient evidence that such centres of distribution, as regards zoophytes, are to be recognized. The species of corals in the West Indies are in many respects peculiar, and not one can with certainty be identified with any of the East Indies. The central parts of the Pacific Ocean appear to be almost as peculiar in the corals they afford; but few from the Feejees have been found to be identical with those of the Indian Ocean. A more complete acquaintance with the corals of these different seas will undoubtedly multiply the number of identical species; but observations, thus far made, seem sufficient to establish as a fact, that a large part of zoophytes are confined to a small longitudinal range. This will be seen from the following table, exhibiting in a general manner, as far as known, their geographical distribution. Each column gives the number *peculiar* to the region specified at top.

	East Indies, Indian Ocean, or Red Sea.	Pacific Ocean.	West Indies.	Pacific and the East Indies, or Indian Ocean.	Extra-tropical.	Doubtful.	Total.
Tribe ASTRÆACEA.							
Fam. Astræidæ	37	50	29	4	3	16	139
Fungidæ	14	29	6	6	0	10	65
Tribe CARYOPHYLLACEA.							
Fam. Caryophyllidæ	13	7	9	2	13	5	49
Gemmiporidæ	4	5	1 ?	2	0	2	14
Tribe MADREPORACEA.							
Fam. Madreporidæ	30	42	4	8	1 ?	7	92
Favositidæ *	14	15	5	3	0	4	41
Poritidæ †	5	14	6	2	0	1	28
	117	162	60	27	17	45	428

* The *Pocilloporæ*, *Sideroporæ*, *Milleporæ*, *Favosites*, and other genera of Madreporacea, in which the cells are internally divided by horizontal septa.

† Part of the *Porites* of authors, the species having shallow cells closed

From this table, it appears that only twenty-seven species out of 306 are *known* to be common to the East Indies and Pacific Ocean. With regard to those common to the East and West Indies, for which no column is assigned, there are but two,—the *Meandrina labyrinthica* and *Astrea galaxea,*—about which much doubt remains.

We have no authority for accrediting to the West Indies any species of the genera *Fungia, Pavonia, Herpetolithus, Merulina, Monticularia, Gemmipora, Anthophyllum*, Pocillopora, Sideropora* or *Seriatopora,* all of which are common in the opposite hemisphere. The *Agariciæ,* with the exception of two osculant species, are confined to the subgenus *Mycedia,* exclusively West Indian, which contains very firm compact corals, often with an *Astræa*-like character. The Millepores are the only known *Favositidæ,* and but half a dozen Madrepores have yet been distinguished. The *Manicinæ, Caryophylliæ* and *Oculinæ* are more numerous in the West Indies than elsewhere, and the *Ctenophylliæ* (*Meandrinæ* with stout entire lamellæ) have been found only in the West Indies. The genus *Porites* contains several species, but they are uniformly more fragile and more porous species than those I have seen from the Pacific and Indian Oceans; and the polyps, as figured by Lesueur, are more exsertile, approaching in this particular the *Goniporæ.*

General Remarks on Classification.—It has often been justly said, that there can be but one strictly natural classification in either of the organic kingdoms. Yet if we look upon any system presented in the usual order on paper, as correctly and completely *the* natural system, we greatly mistake nature; for the various affinities cannot be fully expressed on a plane surface. The lines are so many, and so interlaced, that to be understood, they must be conceived of as ramifying in space. The mind, proceeding properly to its work, determines first upon those qualities which are physiologically of the most fundamental importance: it follows out the variations of structure under the grand divisions thus ascertained, fixing its attention successively upon qualities of a less and less general character; it traces the species through the various modifications in these several particulars, marking out the lines of gradation in affinities,—observing, some it may be,

at bottom (*Porites clavaria* and the allied). The other *Porites,* with a few exceptions, belong to the genus *Manopora* of the author, and are true Madrepores in their cells, but with imperfect calicles or none: the *P. spumosa* of Lamarck, and the allied, are here included, besides the *Montipora* of Blainville.

* *Sarcinula* in part of Blainville, *Caryophyllia* in part of Lamarck; *Anthophyllum* of Schweigger, who introduces the name, but not of writers on fossil corals.

partly isolated and terminating abruptly, others graduating into the different series by frequent blendings or anastomosings, and often between different lines detecting a serial parallelism: in this way the network is finally completed to the mind's eye.

When the relations are fully understood, we are ready to divide off into classes, orders, and the smaller subdivisions, cutting the threads here and there, as shall best exhibit the general character of the whole, remembering to make the corresponding divisions of equivalent importance and character. The institution of these various groups is not properly classifying; for the classification is completed when the branchings and interlinkings of affinities are made out. Subdivisions with appropriate names are however necessary, to aid the memory and convey this knowledge in words. Genera are convenient artificial sections, based on natural affinities; and very commonly they shade almost imperceptibly into one another. Whoever has attempted to lay out classes and their families and genera, has perceived the interlinkings, and felt the perplexity they produced. It may often have seemed vexatious to the systematist to have had a *well-characterized* family or genus spoiled in its characteristic, and *exceptions* introduced, by the discovery of new species which blend it with another group, before considered quite distinct. But such perplexities will not be perceived, if we follow nature with docility, and make it our aim to bring out prominently the various shadings between subdivisions. The true object of classification is not to dissect the departments of life into as many distinct parts as possible for display like anatomical preparations; but to illustrate the system of nature in its unity, and exhibit the myriad parts blended in one concordant whole.

The modifications of structure in living beings evidently proceed, to a great extent, from the nature of the world we inhabit, and the general laws and necessities of life. There are air, earth, and water, and these have their varieties of condition. Plants and animals offer other sites for living beings. The same circumstances may be said to call for the variety of size which exists in nature, for otherwise there would be possible conditions for existence unoccupied. The general nature of life and its modes of exhibition, with the primary systems of structure, being determined upon in infinite wisdom, we need attribute no other plan to creative power than that of the simple adaptation of life, as thus constituted, to the conditions the world affords. Circles and numerical relations may amuse the imagination; but we have no evidence that the Hand which made was confined by such prescribed courses. We cannot fail to see, however, that in the primary plan of structure in living beings, certain organs or their parts, through extended groups, have been limited by fixed numbers: and this is so distinct in some classes, that it becomes an interesting study to trace out the sources of variations from the typical number*. We see the boundless resources of nature's Author displayed with greater force, the fewer the types from which an infinite variety might proceed; but not in any limiting of the number of species constituting groups.

Among the organs upon which the range of characters in the animal kingdom depends, the nervous system takes necessarily the precedence, for, as has been said with much propriety, this system is itself *the species*; since upon its characters, in connexion with the general laws of organic growth, depends in a very great degree the nature of the individual. Next to this, come those organs which are intimately connected with the sustaining of life, *primarily*, those pertaining to respiration and circulation, and *secondarily*, those adapted to the receiving and digesting of food; and next, or of parallel value with the last, the provision for the continuation of the species. The means of locomotion and the associated structure, constitute a characteristic intimately connected with the causes just mentioned. Under the several grand divisions to which we are led by the above considerations, there are subordinate variations arising from the adaptation of life to minor differences in the conditions of existence around us:—such as minor differences of soil (if we may extend this word to all those varieties of sites, afforded by the air, earth, water, vegetable and animal structures, variously modified by temperature, light and pressure); differences in the modes of taking prey or food of whatever kind, and in some peculiarities of the organs of digestion; certain differences depending on the sexual relations, and the means of preserving and developing the young, varying with the modes of existence alluded to; modifications of the provisions for self-preservation against enemies. These minor differences are exhibited in two ways: either particular organs retaining the *same* functions, undergo modifications in form and structure; or with other modifications, they subserve the purposes of *different* functions. When adaptations to different circumstances or pur-

* Milne Edwards has well illustrated the fact, that *seven* is a normal number in Crustacea, the cephalic, thoracic and abdominal parts each consisting normally of this number of segments, and variations taking place by a union of two or more segments, or by subdivisions; and this same law extends even to the joints of the legs and antennæ. The prevalence of such a law through so large a class affords a sufficient ground for belief that specific numbers have not been entirely disregarded in any branch of nature, though the actual exhibition of them has been obscured in ways not understood. We cannot disbelieve, therefore, that numerical relations were involved in the plan of creation; yet, while admitting them as regards the *nature* of organic structures, we do not admit that the *number* of structures made on any particular type had reference to any similar ratio.

poses take place by variations in corresponding sets of organs or parts of organs, the relations produced are termed *homological*; and the relations are *analogical* when they depend on a similarity of function, however produced*.

As the several families or classes of animals are exposed, in some respects more or less general, to the same circumstances, they would naturally undergo, in many instances, either *homological* or *analogical* modifications, occasioning that serial parallelism alluded to on a preceding page. And again, as the animals of the same class may be fitted to many different circumstances in nature, other parallelisms should exist, of a wider character.

The order in which the above sources of distinctions in the animal kingdom are mentioned, may be in the main nearly that of their relative importance. Yet it is well known that a set of characters valuable in one group is worth nothing in another: and this holds true in some cases even with those characteristics that are in general fundamental. It seems at first a violation of all propriety, to arrange together animals having gills, and those that have none; those that have a heart, and those that are destitute of even a vestige of one beyond a distant valve or two in the circulating system; those that have distinct arteries, and those whose arteries are only the lacunal passages among the muscles and other organs. Still this may be in accordance with a philosophical classification. The class Crustacea actually illustrates each of the three anomalies just stated. If the singular Amphioxus is truly a fish, as many ichthyologists affirm, we may have a vertebrate animal without a brain, and without a sense to

* Prof. R. Owen, the eminent comparative anatomist of England, mentions three kinds of homology, viz. "general," "serial," and "special." "General homology is the relation in which a part or series of parts stands to the ideal or fundamental type; and thus, when the basilar process of the occipital bone in Anthropotomy is said to be the 'centrum' or 'body of the last cranial vertebra,' its *general* homology is enunciated. When it is said to repeat, in its vertebra or natural segment of the skeleton, the body of the sphenoid bone, the body of the atlas, and the succeeding vertebral bodies or centrums, its *serial* homology is indicated. When the essential correspondence of the basilar process of the occipital bone in Man with the distinct bone called 'basi-occipital' in a crocodile or a fish is shown, its *special* homology is determined."—*Phil. Mag.* xxviii. 3rd ser. 526, June Supp. 1846.

We refer the reader also to a very excellent paper "on the Structural Relations of Organized Beings," by H. E. Strickland, F.G.S., Phil. Mag. xxviii. 3rd ser. 354, in which the subject of affinities in organic beings is presented in a clear and philosophical light. In addition to the terms *homology* and *analogy*, Mr. Strickland proposes the word *iconism*, to express *resemblance of form without a similarity of structure or function*; for example, the resemblance of the flower of the pea to a butterfly, or the shell Haliotis to an ear; and it includes also resemblances between species arising from accidental coincidence of colour; while *analogy* includes such resemblances as depend upon a similarity of function.

raise it above the Polyp. In such cases, the system of structure typical of a group is ascertained by a general study of the species, and then an acquaintance with this structure assists in tracing out transitions, and determining how far one and another organ may fail without requiring an entire separation of an individual from the group.

To classify requires therefore the widest possible range of knowledge of organic beings, and the nicest balancing of affinities: and we remark again, that it consists rather in expressing the various chains of affinities or homologies direct and parallel, with their shadings and blendings, than in searching for certain inviolable characteristics for distinguishing groups of species.

Classification of Zoophytes.—In view of the foregoing principles, any classification of Zoophytes made out without reference to the structure of the animals must necessarily be faulty. There have been several of this kind in the department of Corals; and as the subject has been little understood till within a few years past, errors were to be expected. They subserved, for the time, the purpose of systematizing the facts known, and afforded a means of characterizing species: so far they were good. But at the present day, to make out a classification based on the corals alone and the easiest method of distinguishing them, would partake of times of past ignorance: they can no more be properly arranged without reference to their animals, than shells without regard to their mollusks. The zoological relations of the species should be first studied, and afterwards such characters laid down for the corals as belong to the orders and families thus deduced.

The first classification of Zoophytes in which the animals received attention was offered by Blainville*. Lamarck had led the way with a discriminating study of the corals. Blainville availed himself of the observations of Quoy and Gaimard, besides the few investigations of older authors, and with great acumen made out an arrangement, which in its general features was highly natural. He divided Zoophytes, *including the Actiniæ*, into the groups *Zoantharia*, *Polypiaria*, and *Zoophytaria*; and if we strike out from Polypiaria a few species that belong to the first division, and others that are Bryozoa, we have the groups Zoantharia and Zoophytaria corresponding to the groups *Actinaria* and *Alcyonaria* of the classification by the writer, and Polypiaria nearly to the *Hydroidea*. The only other change of importance which the writer has proposed in these primary subdivisions is

* Manuel d'Actinologie ou de Zoophytologie, par H. M. D. de Blainville. 644 pp. 8vo, with an atlas of 100 plates. Paris, 1834. (The printing began in 1830.)

the union of the Actinaria and Alcyonaria into a single group, Actinoidea, equivalent in importance to Hydroidea. Blainville was the first author who actually introduced coral zoophytes fairly into the animal kingdom by his mode of describing and arranging them. He did not call the department a branch of zoology, and then describe corals as if they were *porous, stelligerous stones*, which is even now in many instances the case*. Still he speaks of the cells as *containing* the polyps, which is the reverse of the fact.

Ehrenberg in 1834†, after a more thorough acquaintance with coral animals obtained by investigations in the Red Sea, made some important improvements in the minor subdivisions; but his grand divisions were unfortunate. He separated in many cases the attached from the unattached species, and again, the simple from the compound, and thus broke up the natural assemblages which Blainville had made out. Even the natural group Alcyonaria (Blainville's Zoophytaria) is subdivided by him, and the parts widely separated. His system, notwithstanding some anomalies, exhibits great reach of mind and searching investigation. He removed correctly the Bryozoa from other Zoophytes, and first suggested the relation of the Millepores and Favosites to the Madreporacea. He pointed out the true nature of coral secretions, and described the mode of reproduction by spontaneous subdivision, which had not before been noticed. The modes of growth were also to a considerable extent described by him, and important use made of them, though not always correctly, in the classification of Zoophytes.

Milne Edwards, whose acquaintance with Zoophytes had been extended by a personal examination of many species, and by a thorough study of the labours of others, besides a comprehensive knowledge of nature, proposed, in 1837, a brief outline of a classification, which, as far as detailed, exceeded those preceding it in philosophical character. The Hydroidea ("Sertulariens"), the Actinaria ("Zoanthaires"), and the Alcyonaria ("Alcyoniens"), are laid down as the grand divisions, and without the striking violations of affinities which appear in Blainville's order Polypiaria. We only observe that the Favosites are separated from the Madreporacea, with which group they were placed by Ehrenberg, and where they beyond doubt belong.

* In descriptions of corals (the *internal* or *basal* secretions of Zoophytes), those characters which belong to the Zoophyte ought to be first stated, such as the general form, mode of growth, &c.; and afterwards, separately, whatever, not already stated, may require mention with respect to the coral itself.

† Abhandl. der Königl. Akad. der Wissensch. zu Berlin for 1832, pp. 225–438.

These are the principal authors since Lamarck who have undertaken a general arrangement of the class of Zoophytes. The "Stony Corals" have quite recently been arranged mostly from the corals alone by Mr. J. E. Gray of London*. We may express the belief, without entering into any criticisms on his classification, that with a more extended study of the animals and their corals, he would not have separated the *Milleporæ* and *Helioporæ* so widely from the *Pocilloporæ*; the *Stylastridæ* from the *Sideroporæ*; the *Montiporæ* from a part of Lamarck's *Porites*; the *Fungiæ* from the *Pavoniæ*; nor united into a single group the *Pavoniæ* and many *Astrææ*; nor the *Fungiæ*, *Flabella* and *Meandrinæ*:—in the last case giving an unreal importance to the oblong shape of the Flabella, and implying a relation which is wholly without foundation between the oblong cell of the *Meandrinæ*, *Flabella* and *Fungiæ*; for in the *first*, the form arises from budding; in the *second*, it is the shape of the polyp's disc; and in the *third*, the cell is only a depression *at the centre of the disc*, and the form has not even generic importance.

Before giving a general view of the classification of Zoophytes, to which the writer has been led by the study of coral animals†, the importance of different characters as a basis of classification may be briefly considered.

Owing to the simplicity of polyps, there are few organs or functions to afford distinctive characters. They are as follows: I. The digestive system. II. The ovarian. III. The modes of budding and growth. IV. The tentacles and general character of the exterior. V. The secretion of coral and its nature.

I. *The Digestive System.*—In this system the stomach varies (1) in length as compared with the internal or visceral cavity below, and (2) in the character of the parts below and around it. In the *first* particular, the difference is one of less general importance than has been allowed; the relative length in the *Actiniæ* and most Actinoid corals is between *four-fifths* and *one-third*; in the *Zoanthidæ* it is between *one-third* and *one-sixth*; in the Alcyonaria, between *one-third* and *one-twentieth*; in the Hydroidea the stomach is sometimes much shorter in proportion than in many Alcyonaria, though often far longer. In the *second* particular the difference is wide, the Actinoidea having the sto-

* "An Outline of an Arrangement of Stony Corals," by J. E. Gray, F.R.S. &c.: Annals and Magazine of Natural History, xix. 120, Feb. 1847.

† As it may be of some importance to those interested in the department of Zoophytes, the writer here states that the animals of more than sixty species of coral animals, exclusive of Alcyonaria and Hydroidea, and pertaining nearly to every genus, have been figured by him, from living specimens obtained in the Pacific and East Indies, and these figures will appear, along with others of different corals whose animals were not obtained, in the forthcoming Atlas to accompany the Report on Zoophytes.

mach suspended within the visceral cavity, and attached to the sides of the polyp by a radiating series of vertical fleshy lamellæ, which are wanting in the Hydroidea. The visceral cavity is a simple tube in the latter, and is radiated with vertical lamellæ in the former; but these peculiarities are also connected with the modes of reproduction. We omit other less obvious points of difference.

II. *Ovarian System.*—In this system, ranking in importance with the digestive, the absence of special organs with spermatic and ovarian functions distinguishes the Hydroidea, and the existence of such organs the Actinoidea. No character can be of higher value, or more marked in its attending peculiarities.

Among the Actinoidea, there is a great variation in the number of genital lamellæ, and in the relative position of the two kinds, the spermatic and ovarian. In the Alcyonaria there are uniformly *eight* in all; in the Actinaria, either *six, twelve,* or *more**. In many of the latter division, if not in all, the two kinds of lamellæ (spermatic and ovarian) are distinct: in some of the former, the same lamella is ovarian above and spermatic below, or two are spermatic and the rest ovarian; or perhaps other conditions may exist. There is good reason for separating the Alcyonaria from the Actinaria, but not for making each division equivalent in rank to that of Hydroidea.

III. *Process of Budding and Growth.*—1. We find that the fact of species *budding* or *not budding,* is not connected in Zoophytes with any peculiarity of structure that can be detected, and farther, the transitions are gradual and frequent. This character therefore, as it indicates no difference of concentration in the nervous system, is entitled to little consideration as a means of distinction in the classification of these animals:—it is no more important here than in botany, where a plant consisting of a single individual bud may be placed alongside of one which consists of several. It may sometimes however be used to distinguish genera: yet in the genus *Fungia* there are a few species

* A passage of the *Actiniæ* into the Alcyonaria may perhaps be observed in the *Lucernariæ,* which have a four- or eight-lobed summit; and other *Actiniæ* approximate to this lobed character. These lobes bear a number of tentacles, or correspond to a number; and hence analogy suggests that possibly in the Alcyonaria each tentacle properly corresponds to two tentacles or more, or to a lobe in the *Actiniæ* alluded to. This view is borne out by finding in the larger Alcyonaria the tentacles having a size wholly incompatible with the structure of the Actinaria; for the writer has shown in another place that in the Actinaria there are limits to the relation between the number of tentacles, as well as the width of interval between the genital lamellæ, and the size of the animal. Whether the analogy holds or not, the facts show striking differences between the Actinaria and Alcyonaria. See further, 'Report on Zoophytes,' pp. 34, 123.

that increase until they consist of two or three individuals; and there is thence a passage to the *Herpetolithi*, Eschsch. (Haliglossæ, *Ehr.*) and *Polyphylliæ*, Q. and G. The simple and compound *Cyathophylla* are other examples of the difficulty of this separation.

2. But the *modes of budding and growth* are of higher character; especially the distinction of *superior* and *inferior* gemmation, in the former the buds being terminal or at the summit, and in the latter lateral or basal. It is of little importance whether the summit-widening, which accompanies superior gemmation, takes place in the discs, or just exterior to the discs. In either case, the visceral lamellæ are prolonged at top beneath the upper surface by the process of growth, and hence such species have the upper surface of the corallum lamello-striate.

3. In superior gemmation, when the discs widen and bud, they sometimes subdivide as each new mouth opens, and sometimes not till several mouths have opened. This difference (distinguishing the genera *Astræa* and *Meandrina*) is of small importance. There are *Astrææ* in which the discs become 2- or 3-compound before they subdivide; and thus the two genera graduate into one another. There are simple and meandrine *Mussæ*, Oken (Lobophylliæ, *Bl.*), between which no line of separation can be drawn, and they have been always retained in the same genus. The *Monticulariæ*, in the same manner, are related to the *Meandrinæ**.

4. There is a group of species having superior gemmation, in which the discs have no proper limits; and in the compound species the surface is a single disc with many mouths and scattered tentacles (the latter often obsolescent). The *Fungiæ* are examples of simple species of this kind; and the *Polyphylliæ, Pavoniæ*, &c. (including the *Astræa siderea*) are compound species. The coralla of compound species are characterized by the continuation of the lamellæ of the stars from centre to centre, without interruption along a medial line; and they have no cells except it arise from a prominence of the intervals between the polyp-mouths. They thus differ from the *Astrææ*; for the cells in the *Astrææ* correspond to the visceral cavities of the polyps.

5. Growing *free* or *attached* is a character of minor importance. It is sometimes a convenient *generic* distinction, as with the *Fungidæ*, but in other cases cannot be appealed to. All species, as is well-known, are attached in the young state; and the time of becoming free varies with the species, some earlier and some later. The *Flabella* thus pass so gradually to attached species, and the animals in the two cases are so completely iden-

* See on this subject Report on Zoophytes, pp. 76, 77.

tical, that the separation can be sustained only on the ground of convenience in a distribution. We add, that in this last-mentioned case the simple species pass as gradually into the compound, and they are closely connected with the group *Euphyllia*, D. (a part of *Lobophyllia*, Bl., having entire lamellæ).

6. Growing *massive*, or *calicularly branched* (aggregate or segregate), is sometimes a good generic distinction. But polyps in contact grow together so readily that it can be of importance only when supported by other characters. In the group *Manicina* no line can be drawn between the segregate and coalescing species; and the *Cyathophylla* are other examples. Difficulties in the way of characterizing groups thus arise, which must be fairly met and not denied nor overlooked.

7. The *forms of growth*, whether branching, massive or explanate, afford good distinctions for species, but seldom generic characters. We find *explanate* and *massive* Gemmiporæ and Porites; *explanate, massive* and *branching* Porites and Manoporæ; and *explanate* and *branching* Merulinæ and Echinoporæ. No more unfortunate generic character can be laid down than one drawn from this source: it may, however, be occasionally used when sustained by other characters. The genus *Explanaria* of Lamarck is an agglomerate of species of several genera.

We have elsewhere shown that the sizes of branches, the frequency of branching, and the width of intervals in groups between branches, are good trivial characters within certain limits. But in all cases in instituting species, the specimens examined should be good and full-grown, and not fragments.

8. Growth by budding from an apical polyp, or from serial budding, are points that may afford good generic distinctions.

IV. *Tentacles and General Character of the Exterior.*—In many genera the tentacles are too short to take any part in the prehension of food, and apparently subserve only the purpose of aëration. As the whole body takes part in this function, the size of the tentacles must necessarily be unimportant as a family character. Hence we find, even in the same genus (*Fungia, Porites*), species with comparatively long tentacles, and others in which they are almost obsolete. The species of the genus *Actinia* are almost as various in the sizes of the tentacles. Among the *Astrææ*, one species was observed by the writer in which the place of tentacles was supplied by numerous spine-like processes over the surface between the discs; and the same is true of the *Echinoporæ*, or at least partly so, for the writer observed no tentacles in the two species he examined. The same reason shows that the moss-like subdivision of tentacles, observed in some *Actinidæ*, is a character only of generic importance, for it takes place generally in such species as live more or less buried in the sand or mud, which fact seems to require an extension of the aërating surface, such as this delicate branching affords.

The *number* of tentacles appears to have a relation to two distinct series; in one the number is *six, twelve,* or *more,* with the alternate usually unequal when exceeding six (and always so when over twelve); in the other, *eight* simply, and all equal. The *character* of the tentacles is different in the two series: the former (the Actinaria) having them naked, the latter (Alcyonaria) having them fringed with perforate papillæ. A large number of species of Actinaria are characterized by *twelve* tentacles, and have been separated to form the group Madreporacea; but notwithstanding this point of resemblance, the several genera are as closely related to species having a greater number of tentacles.

The occurrence of suctorial vesicles on the lateral surface or disc is a character of only generic importance.

Colour is seldom of much importance, even for trivial distinctions; yet the mode of arrangement of colours may be characteristic of species. A mutual dependence or relation of certain colours may possibly be hereafter ascertained, by which a knowledge of one will determine the others that may be possible in a species; and in such a case, the character may have a value which cannot now be allowed it.

V. *Secretion of Coral.*—1. The *secretion* or *non-secretion of coral internally* is at the best no more than a family distinction; and among the Alcyonaria it is only generic. This is an admitted truth with regard to calcareous secretions among Mollusks; and Olivi and Blainville long since acknowledged it with reference to zoophytes.

2. The *secretion of coral at base, distinct from internal secretions,* is a characteristic of much value; it produces the structure of the *Gorgoniæ* and allied zoophytes, and also of the *Antipathi.*

3. The *nature of coral secretions* sometimes affords generic distinctions, and with other characters, in some instances, distinguishes the higher divisions of zoophytes. The Hydroidea, as far as known, never form any but membranous or horny coralla. The Astræacea, Caryophyllacea and Madreporacea secrete only calcareous coralla, excepting a few marine *Actinidæ* (*Actinectæ*) which form a cellular membranous float at base to keep them at the surface. The *Antipathi* form only basal horny secretions, and therefore have a horny axis. The Alcyonaria are more various in this character, the different genera having their peculiarities: the *internal* secretions are always calcareous and in *grains* or *spiculæ,* and in this last particular they differ from the calcareous of the Actinaria; these grains are sometimes so abundant as to unite into solid tubes (*Tubiporæ*). The *basal* secretions are either horny (*Gorgoninæ*), calcareous (*Corallium*), or siliceous

(*Hyalonema*); and in some instances, from a mixture of membranous tissue with the earthy matter, they resemble cork.

4. Among the calcareous corals the texture or density of the coral is often of little importance, as it may vary in different parts of the same specimen, according to their full exposure to the free ocean waters or not.

In species with stellate cells there is always a definite number of rays to the *adult* cell, excepting among those that bud in the discs, and this number is some multiple of four or six, and usually of both. The characters of the cells—whether immersed or occupying a prominent calicle; and, *internally*, deep and open at bottom, or transversely septate, or spongy cellular or solid,—are important; also the peculiarities of the lamellæ, whether entire or not, equal or irregular, exsert or included.

In transverse sections of the stellate cells, the number of rays (when adult), the diameter, and the character of the centre and of the interstices, are generally good characteristics for species.

The corals of Alcyonaria never have rays to their cells or tubes; the Madreporacea have never more than *twelve* rays; the Caryophyllacea and Astræacea have always more than twelve; and the last order is distinguished by having the interval between the cells lamello-striate (see p. 109, III. 2) *internally*, with few exceptions, as well as *externally*.

This brief review of the characteristics of zoophytes has prepared the way for an exposition of the classification into which the species naturally fall.

[To be continued.]

XIII.—*On the Circulation in Insects.* By Emile Blanchard*.

The celebrated author of the 'Anatomie Comparée,' finding no other vessels in insects than the dorsal one, believed that no true circulation existed in these articulated animals. According to Cuvier, the tracheæ ramifying throughout the entire body of the animal, the air in them must proceed in search of the blood, just as, in animals having a pulmonary or bronchial respiration, the blood is conveyed to the air.

Since his time, many anatomists have studied the circulation in insects. They have usually selected transparent larvæ which have allowed them to distinguish, through the tegumentary envelope by the aid of the microscope, currents of liquid blood. In this manner Carus observed a circulatory movement in the larvæ of the Ephemeridæ and Agrions. Wagner, Bowerbank, Newport, and others have verified these facts. According to these observers,

* Translated from the Comptes Rendus for May 17, 1847.

the entire circulation in insects is reduced to this: the blood, urged forwards by the dorsal vessel, bathes the organs by being poured into the cavities of the body, where a retrograde movement causes it to return into the dorsal vessel by orifices at its posterior part. Léon Dufour, who has contributed so much to our knowledge of the organization of insects, denies, with Cuvier, the existence of any circulation whatever in these animals. According to that anatomist, the dorsal vessel is only a simple cord, without an internal cavity. Its movement, he says, is only the result of the simple contractility of its tissue, a kind of fibrillar vibration common to many living tissues.

Such are the various opinions regarding the circulation in insects. What might perhaps have caused surprise, was that, in accordance with the ordinary explanation, the circulatory and respiratory apparatus were to a certain extent independent, the tracheæ, according to the general opinion, not coming into contact with the nutritive liquid except by currents traversing the lacunæ between the organs. However, this did not attract attention. Their study by the aid of their transparency, not allowing of accurate details being distinguished, the question has always remained much in the same state.

A very simple means, however, of tracing the whole course of the circulation in insects would have been to inject coloured liquids. Recourse has not been had to this proceeding; or if so, no benefit has been derived from it. Nevertheless, among the invertebrate animals, there are few in which this means of investigation so easily yields a good result. Whether we inject by the dorsal vessel or the lacunæ, the entire circulatory system is immediately filled. Nothing is more remarkable and elegant than an insect properly injected: all the tracheæ, which ramify throughout the organs in such delicate branches, are coloured by the injection; however, not even the smallest drop of liquid penetrates their interior.

The tracheæ of insects, as well known, are composed of two membranes between which there is a thread spirally coiled. The sanguineous fluid penetrates between the two membranes. Every part of it thus comes into contact with the air contained in the tracheal tubes, and the re-organization of the blood is effected as in animals furnished with lungs, although the anatomical disposition is so different. This observation explains the structure of the tracheæ. The spiral thread not only serves to give them a certain solidity, it has also the purpose of keeping the two sheaths of which they are composed apart, and of keeping them open near the respiratory orifices so as to give passage to the nutritive fluid. When the tracheæ are vesicular the spiral thread disappears, and then the very numerous and excessively fine canals traverse them in all directions. If we inject an insect by the dorsal vessel, the liquid, after having traversed it in its whole extent, is soon poured into the lacunæ of the head and thorax, and is diffused into the abdominal lacunæ. It then penetrates between the two tracheal membranes by lacunæ which surround the respiratory orifices; finally it is returned to the dorsal vessel by lateral afferent canals, which extend over the dorsal parts as far as the origin of the tracheal bundles. Thus these afferent canals are equal in number to the stigmata of the abdomen; it is the same with the number of segments of the dorsal vessel, which also varies according to the types.

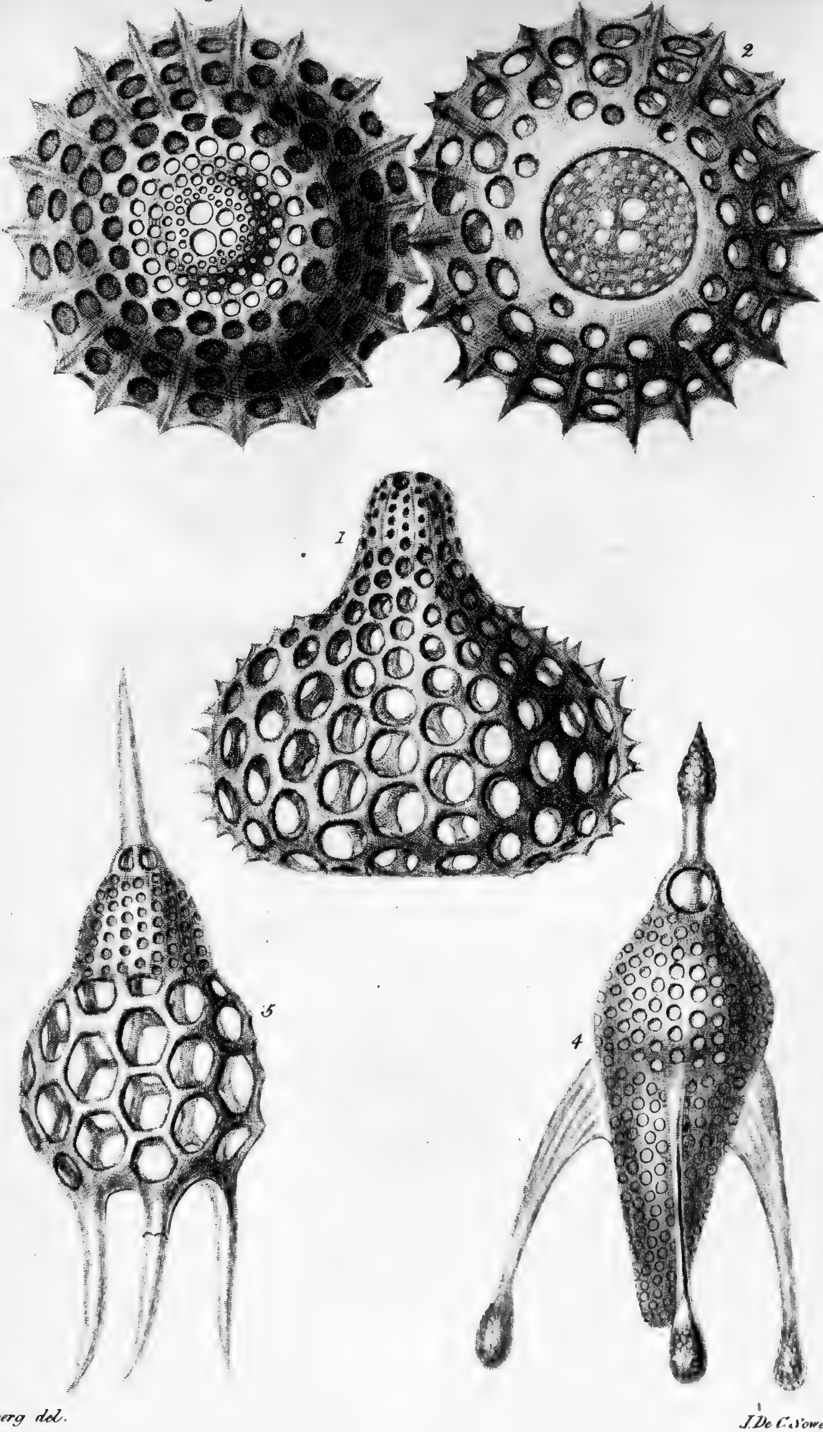
The tracheal tubes, therefore, which convey the air into all parts of the body also carry the re-oxygenated blood to all the organs: the space existing between the two sheaths of the respiratory organs appears to perform the office of nutritive vessels. The circulation in insects is effected therefore in the same manner as in many invertebrate animals which have a partly lacunar circulation. But there is a very peculiar anatomical disposition: the activity of the circulatory movement here as elsewhere is in relation with the activity of the respiration.

I have investigated the circulation in a tolerably large number of genera of insects, so as to be assured that there is no essential difference between the different types of the entire group. I am convinced that the anatomical modifications are very trifling, even between the representatives of the different orders of this large class of animals.

My observations have been made, in the order Coleoptera, principally upon species of *Meloë, Dytiscus, Hydrophilus, Geotrupes,* &c.; in the Orthoptera, especially upon *Blatta*; in the Hymenoptera, upon the Humble Bees, Wasps, and especially on the Bee; in the Hemiptera, upon *Nepa* and *Ranatra*; several on Lepidoptera and different Caterpillars, and on some Diptera both in the larval and perfect state.

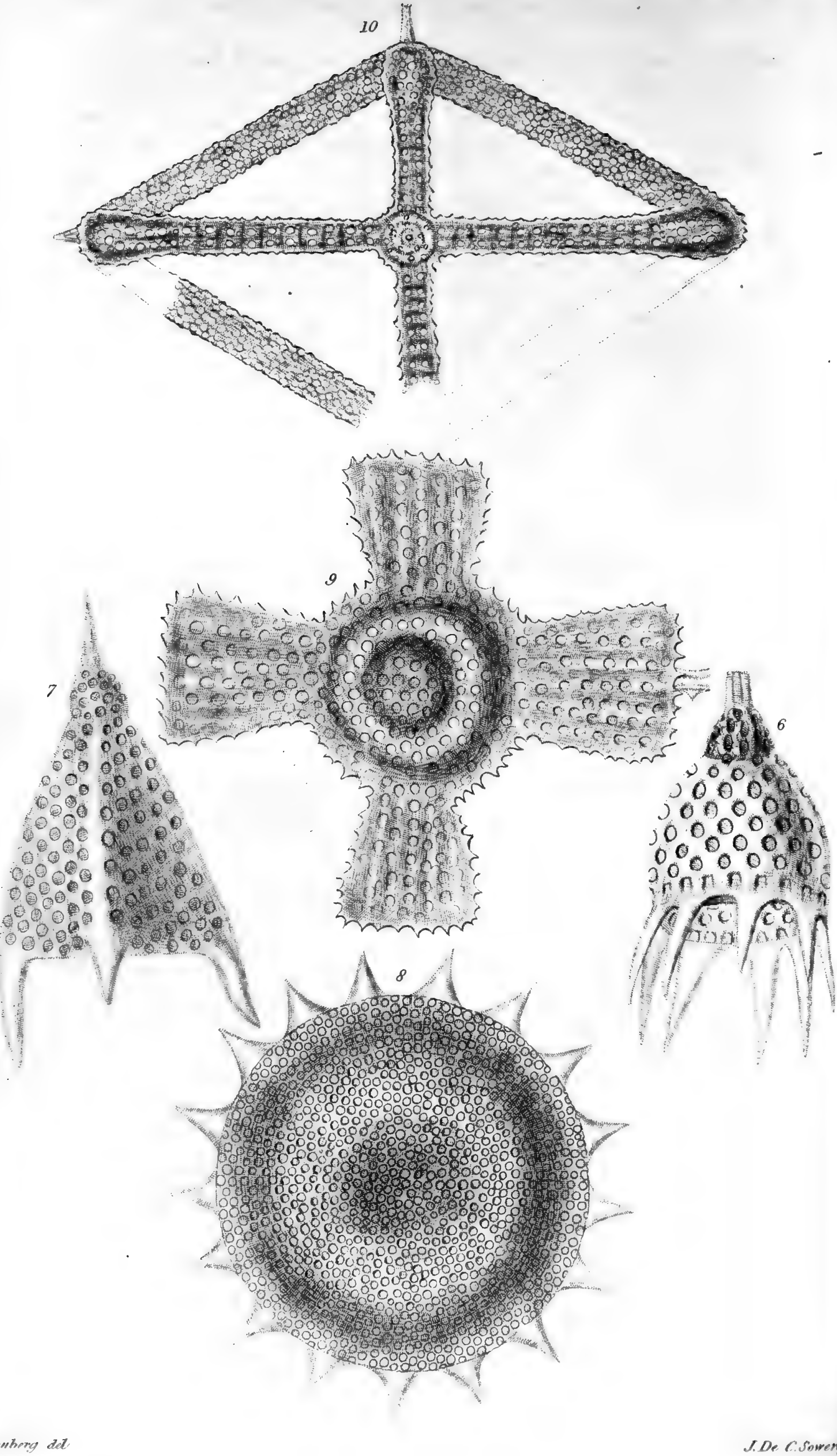
Throughout I observed the same facts, and I have proved that the larvæ and the adult insects do not differ in any but unimportant relations.

The facts I have detailed may very soon be verified by merely injecting a coloured liquid through a simple aperture in the abdomen of an insect: in this way all the lacunæ are immediately filled, as also the vascular portion of the tracheæ, and ultimately the dorsal vessel itself.



Ehrenberg del.

J. De C. Sowerby sc.



Ehrenberg del.   J. De C. Sowerby sc.

XIV.—*The Microscopical Siliceous* Polycystina *of Barbados, and their relation to existing Animals, as described in a Lecture by* Professor Ehrenberg *of Berlin, delivered before the Royal Academy of Sciences on the* 11*th February* 1847. By Sir Robert H. Schomburgk.

[With two Plates.]

Professor Ehrenberg's examination of the different specimens of rock which I transmitted to him from Barbados, proved to him that the geological structure of the district called Scotland in that island owed its origin to submarine organic life, a formation which Ehrenberg designated by the term *halibiolithic*. These forms of minute organic life were so interesting and surprising, that Professor Ehrenberg gave a preliminary abstract of the discovery in December 1846 to the Royal Academy of Sciences in Berlin, when he described above a hundred species previously quite unknown, and exhibited drawings of eighty species. In the monthly report of the Academy he described 140 new species, divided into twenty-six new and five known genera. Professor Ehrenberg observed at the same time, that the short period which had elapsed since he had commenced the investigation of the rocks of Barbados, rendered it improbable that the prolific source of the new organic forms was exhausted. This multiplicity of new forms was unparalleled in the science of natural history; and he considered it more than probable, that further investigations would make him acquainted with double the number of new forms which he then described. He observed also, that it appeared to him unlikely that the island of Barbados should only contain these peculiar microscopical animals; and he expected that this would prove to be a new page in the book of science; but he scarcely could at that time have supposed that in the space of two months he should be able to announce to the Academy that the number of new forms he had examined so far surpassed his expectation, as to lead him to consider this discovery an intimation that our globe still contains a greater abundance of forms than we had previously any idea of.

Professor Ehrenberg described in 1839, under the name of *Polycystina* (*Zellenthierchen*, 'minute cellular animals'), a section of organic forms which belong to the order of Polygastric animalcules with siliceous shields, containing the genera *Cornutella, Flustrella, Haliomma* and *Lithocampe**. They had been found hitherto in the chalks and marls of Sicily, in Oran in Africa, and in Greece, and were ascribed to the tertiary period of geologists. At a later period the genus *Lithobotrys* was added, which Ehrenberg discovered in the Tripoli of Richmond in Virginia, and in Bermuda. The number of genera and species de-

* See Taylor's Scientific Memoirs, Parts X. and XI.

scribed previous to Ehrenberg's examination of the Barbados rocks consisted of thirty-nine species, including five genera, which were partly found in a fossil state in rocks of different ages, and partly existed in living forms in the North Sea, and at the bottom of the sea near the South Pole. The discovery of so many additional forms has enabled him to class the *Polycystina* under fifteen genera, all of which occur in the rocks of Barbados in numerous species. The species previously known are now named as follows:—

Cornutella Cassis	=	Cornutella Cassis.
clathrata	=	clathrata.
Lithocampe	=	Eucyrtidium Lithocampe.
obtusa	=	Lophophæna ? obtusa.
Flustrella bilobata (Lagena)	=	Rhopalastrum lagenosum.
concentrica	=	Flustrella concentrica.
limbata	=	Perichlamydium limbatum.
prætexta	=	prætextum.
spiralis	=	Flustrella spiralis.
Lithobotrys cribrosa	=	Lithobotrys cribrosa & triloba.
denticulata	=	Lithopera denticulata.
Galea	=	Lithocorythium Galea.
quadriloba	=	Lithobotrys quadriloba.
triloba	=	triloba.
Lithosambe antarctica	=	Eucyrtidium antarcticum.
aculeata	=	Pterocanium aculeatum.
acuminata	=	Eucyrtidium acuminatum.
aurita	=	auritum.
Auricula	=	auritum ?
australis	=	australe.
Hirundo	=	Lithornithium ? Hirundo.
lineata	=	Eucyrtidium lineatum.
punctata	=	punctatum.
Radicula	=	Lithocampe Radicula.
solitaria	=	Carpocanium solitarium.
stiligera	=	Eucyrtidium ? stiligerum.
Haliomma Amphisiphon	=	Astromma ? Entomocora.
Æquorea	=	Haliomma Æquorea.
(cornutum	=	Caryolithis crenata).
crenatum	=	Haliomma crenatum.
didymum	=	Astromma Entomocora ?
dixiphos	=	Haliomma dixiphos.
(Lagena [Flustrella]	=	Rhopalastrum lagenosum).
Medusa	=	Haliomma Medusa.
nobile	=	nobile.
oblongum	=	oblongum.
ovatum	=	ovatum.
radians	=	radians.
(radiatum)	=	
radicatum	=	Ceratospyris radicata.
Sol	=	Haliomma Sol.

As long as a few forms only of this peculiar group were known, it was not difficult to assign to them a place in our existing classification: it is however different at present, when Ehrenberg describes nearly 300 species—a larger number of specific forms than is contained in some classes of animals. "It would be almost impossible," continues Ehrenberg, "to bring 280 different and distinct forms under a general view, were I not to avail myself of a physiological systematical arrangement."

The minute and elegant shells of the *Polycystina* undergo no change upon being immersed and boiled in hydrochloric acid; on the contrary, they are separated from all adherent foreign matter and become as transparent as crystal.

In 1838 Ehrenberg classed provisionally the few fossil forms of *Polycystina* then known, under a separate division of Polygastrica with siliceous shells or shields, in expectation that the examination of living forms would point out their true place. But the very distinct and beautiful forms recently discovered, amounting to several hundreds, admit no longer of such an arrangement. The formation of these animalcules is very peculiar, and differs from *Bacillaria* not only in their external form, but also in their internal structure. The reasons which have led Ehrenberg to such a consideration are the following:—

"If it were possible, in a philosophical point of view, to imagine the existence of *Mollusca with siliceous shells* among such as possess shells of a calcareous structure, or to ascribe to nearly related animals, to some a transudation of siliceous matter, to others a calcareous nature, such a supposition would be liable to great objections. The laws intimately connected with the principles of life prescribe the transudation of phosphate of lime from the bones of man and vertebrated animals, and carbonate of lime from the shells of Mollusca and skeletons of Polypi. A human being, or a vertebrate animal with siliceous bones, appears possible if considered in a logical point of view; but reflections based upon the laws of natural history denounce it as inconsistent, if not illogical. Similar in effect would be the idea of a mollusk with a siliceous shell, or a Polythalamia of such a structure—similar to a sickly or anomalous individual of that division; it might indeed be compared to a stone of leather or a medal of wood.

"If we except the *Polygastrica*, such a physiological law separates the *Polycystina* with siliceous shells from all classes of crustaceous and vertebrated animals. It would be impossible to assimilate these constant and well-defined forms to individuals of a sickly organization, as we do not possess forms of a similar structure that might be considered as existing in a perfect and healthy state, to serve as a standard for comparison.

"It remains now to investigate, whether these minute normal bodies of organic nature are of an independent organization, or whether they are merely parts of organic forms; whether their structure is of vegetable or animal origin, or whether they are forms of crystals.

"As we are already acquainted with several instances of living forms of that structure which possess intestines, although their examination has not been quite perfect, the idea of crystallization is rejected as distinctly as we reject such a supposition in fossil shells and in fossil bones of mammalia; though their cruciform structure (*Kreuzformen*) might *primâ facie* afford some shadow of ground for such a supposition. With regard to the possibility of their being of a vegetable nature, although *Phytolitharia*, chiefly *Spongia* and *Tethya*, might afford some analogical points of comparison, the author (Prof. Ehrenberg) rejected such a conjecture as early as the year 1838, since his numerous examinations of sponges from all seas and all geological formations where they had hitherto occurred, made him acquainted with hundreds of forms doubtless of a regular structure and easy of recognition, but never with such forms as indicated development of organization. The great number of *Polycystina* also furnishes arguments opposed to such a supposition in the structure of their shields or shells; and as there are recent specimens existing in the mud at the bottom of the sea, and which possess distinct parts of organization, we are authorized at coming to a similar conclusion with regard to the origin of those in a fossil state. The regular apertures and articulation of the minute shells distinctly bespeak an independent animal structure and development. The large apertures at the extremity of the body possess no analogy among plants, but occur very commonly among animals."

With respect to the affinities which these minute forms of animals bear to the known classes of animal life, Professor Ehrenberg has again assumed that fundamental principle which he adopted in 1835, when he brought before the Royal Academy his classification of the animal kingdom*, namely "a development everywhere equally perfect †." Several circumstances at that time alluded to have since been determined more in detail, but the principal groups and characteristic features have remained unchanged. Accordingly the siliceous-loricated organic forms from the rocks in Barbados differ alike from *Polygastrica* and *Polythalamia*, but develope an important relation to these two groups, which Professor Ehrenberg considers, not upon conjecture, but from actual investigation, to form two separate types of formation. The siliceous shell connects them with the *Polygastrica*, the intestinal structure of which has a radiated form; but the transverse articulation, and the cellular arrangement of their structure, point to a connexion with those which have not a radiated but a tubular formation of the intestinal canal, and the shields of which are always calcareous, and not siliceous. As the intestinal structure of a living form of *Polycystina* has not as yet been examined, Professor Ehrenberg infers, from the physiological formation alone of the whole numerous group, a close analogy to the Moss-animalcules (*Bryozoa*) and chiefly to

* Die Akalephen des rothen Meeres und der Organismus der Medusen der Ostsee. (The *Acalephæ* of the Red Sea, and the *Medusæ* of the Baltic.)

† Das Princip einer "überall gleich vollendeter Entwicklung."

Polythalamia, which contain in the subdivision *Nodosarina* forms very similar to *Polycystina solitaria,* and in *Sorita, Pavonina, Melonia,* a striking similarity to *Polycystina composita, Haliommatina* and *Lithocyclidina.* The cruciform and radiated structure of *Siderolina* and *Siderospira* is likewise present; nay, even the structure of recent oceanic forms may be traced in some. Nevertheless the minute shells of the *Polycystina* possess physiological characters, which, independent of their being siliceous, separate them entirely from *Polythalamia*; such characters namely as the absence of real cavities, the presence of which contributes to a different structure in the *Polythalamia,* and from which peculiarity their name has been derived. It is likewise evident in the greater number of instances, that the articulation of the body does not increase in number with age, as is the case in *Nodosaria* and *Rotalia,* but is individually definite, which is a very important character. Otherwise, the more easily-closed transverse articulation of the *Polycystina* is a character entirely wanting in the *Bacillaria,* which possess a longitudinal structure in their skeleton and development.

These considerations have determined Professor Ehrenberg to relinquish his former opinion that the *Polycystina* constitute a family of Polygastric animalcules, or that they belong to *Arcellina* of compound structure, and he arrives at the conclusion, that they form like *Bryozoa* a subdivision of *Tubulata,* but in this instance with siliceous shields and individual organized forms. They approach most nearly in systematic arrangement to *Polythalamia,* and would occupy a separate group among animals possessed of vessels but without a heart and pulsation, and provided with a simple tubular intestinal canal. The forms developed in the highest degree in that division would be *Holothuriæ* and *Echinoidea.*

Professor Ehrenberg, in his former paper on *Polycystina,* described five species; two of which belong to the genus *Haliomma,* and are found near Cuxhaven in the North Sea (they are otherwise widely distributed in the ocean): three species also, two of which belong to the genus *Eucyrtidium,* and one to the genus *Lithopera,* have been found at the bottom of the sea near the South Pole. These are—*Haliomma ovatum, H. radians, Lithopera denticulata, Eucyrtidium antarcticum, E. australe.* The two first forms, which he himself examined, belong to the *Polycystina composita,* but in consequence of their soft nature their structure remained doubtful. The cells appear to be filled with an olive-brown substance. The other three forms, of which only the empty shells were examined, were found in large numbers among living infusoria at the Antarctic Pole; hence Ehrenberg concludes that they belong to the organic beings of the present period.

The fossil species have been found partly in the calcareous marls (Kreidemergel) from Sicily, partly in the Tripoli formation of Oran, Engia, Zante, from different localities in Virginia and the Bermuda Isles. These different localities belong, according to the prevailing opinion of geologists, to two different periods; and it is consequently important to separate the different species of *Polycystina* which have been found in them.

In the monthly report of the Royal Academy, Ehrenberg described in 1844 eighteen species of *Polycystina* which had been found in the chalk-marls of Caltanisetta. The remainder, with the exception of the five recent forms, would belong to the tertiary formation.

In possession of the materials above indicated, to which may be added a few recent observations that increase the number of fossil species of the tertiary period, Professor Ehrenberg now compares the numerous forms which he found in the rocks from Barbados, 1st, with the recent forms; 2ndly, with those of the tertiary rocks; and 3rdly, with the forms from the chalk or secondary period. The result of the comparison is—that of the 282 species minus 15 which form the rocks in Barbados, only one species (namely *Haliomma ovatum*) can be said with certainty to occur among recent species. Of the eighteen species formerly described as belonging to the chalk formation are eight among the 282 fossil species from Barbados, and a new revision of the Sicilian marls rewarded Professor Ehrenberg with the discovery of six additional species; consequently altogether fourteen which do not differ from those in Barbados specifically, but may be perhaps slight varieties. They are—

Cornutella clathrata.	Haliomma Medusa.
Lithobotrys acuta.	nobile.
Lophophæna obtusa.	Entactinia.
Eucyrtidium Eruca.	Dictyospyris tristoma.
lineatum?	Ceratospyris radicata.
Cycladophora spatiosa.	Flustrella concentrica.
Haliomma Dixiphos.	Astromma Entomocora?

Ten of the forms discovered on a former occasion in the chalks of Sicily were not observable in the rocks from Barbados, and one species, *Eucyrtidium lineatum*, which is most abundant in Sicily, and which occurs likewise in the so-called tertiary rocks, is not only very scarce in Barbados, but its identity is likewise doubtful; however, forms nearly related to it are so very numerous in Barbados that they compose whole masses of rocks. The so-called tertiary Tripoli and tertiary marl, or *halibiolithic* rocks, from Oran, Engia, Zante, Virginia, Bermuda, contain only a few *Polycystina* interspersed here and there: their masses are formed of polygastric shells. According to the former communications of Professor Ehrenberg, they contained twenty-one forms which agreed in their structure: a few have been added by him more recently. Of those twenty-one, only ten have been found in Barbados; and of the additions recently made, only a part are to be found in the rocky masses of Barbados. These results lead to the conclusion, "that the *Polycystina* of Barbados, as far as they have been examined, resemble only in a few instances forms now living, and come nearer in structure to those which are contained in the rocks of the secondary period than in those of the tertiary formation."

Of other siliceous forms which constitute the rocky masses of Barbados, Professor Ehrenberg mentions, besides the *Polycystina*, three other groups:—

1. Some of the specimens of rocks contain shells of Polygastric Infusoria; in others they are entirely absent. Of eighteen species with siliceous shields found in Barbados, only one agrees with the chalk formation of Sicily, and only two with those found in the tertiary rocks of Oran, Engia, Zante, Virginia and Bermuda. It is very remarkable that many of the Barbados forms of animalcules are quite peculiar, and do not occur in any other locality on the globe as far as hitherto known to Professor Ehrenberg. A number of these new and peculiar forms constitute three, or perhaps four new genera, which Professor Ehrenberg calls *Actinogonium, Dictyolampra,* and *Liostephania*. *Biddulphia cirrhus,* a new species, is very abundant, and the new genus *Liostephania* with its varied forms apparently constitutes three new species.

2. The *Phytolitharia* consist of fragments of *Spongilla* and *Tethya,* of which only a few are peculiar. Professor Ehrenberg described twenty-seven species. The most remarkable form appears to be *Spongophyllium cribrum,* which is likewise found in the rocks of Caltanisetta, but it is much more frequent in the marls of Zante, where it occurs almost in masses. *Amphidiscus annulatus* and *Spongolithis annulata* are especially distinguished in their structure. The *Spongophyllia* are so remarkable that Ehrenberg considers them the commencement of a new series of forms hitherto unknown, belonging neither to *Tethya* nor to *Spongia*. *Phytolitharia* derived from freshwater or terrestrial plants do not occur in any of the rocks.

3. The third group of siliceous fragments in the Barbados marl consists of perfectly new and very peculiar forms, which are called *Geolithia* by Ehrenberg. They are regularly formed and consequently easily recognizable, and considered as siliceous fragments of animals, they may prove as useful for geological purposes as *Phytolitharia* are with respect to plants, and *Zoolitharia* in calcareous fragments as regards animals. They are neither fragments of *Spongia* nor of *Tethya*; but occasionally parts of *Polycystina* are recognized. Ehrenberg frequently observed the beaks and heads of *Eucyrtidia,* or the nuclei of *Ha-*

liommatina; likewise the posterior apertures of the shields or shells of several forms which appear in elegantly-shaped denticulated rings; or the lateral rays, spines and feet occur in a free spinulate form; and the broken trellis-like portions of their bodies might be compared to siliceous nets. In some of the specimens of rock where the forms are well-preserved, the origin of the fragments is easily recognized; this is unfortunately seldom the case; and Ehrenberg observes, that under such circumstances it is requisite to draw a conclusion from such fragments as are recognizable, in a similar manner as in a geological point of view sharks' teeth must serve to determine the species from which they came. Hence Professor Ehrenberg has divided the *Geolithia* into the following groups, which for the sake of analogy he terms only provisionally genera:—

Stelliform siliceous fragments	*Actinolithis.*
Net-like „ „	*Dictyolithis.*
Annular „ „	*Stephanolithis.*
Tabular „ „	*Placolithis.*
Staff-like „ „	*Rhabdolithis.*
Nuciform cellular fragments (Polycystine nuclei) ...	*Caryolithis.*
Cephalotic and rostrate fragments (Polycystine beaks)	*Cephalolithis.*

In some instances the whole geological specimen from Barbados is composed of such fragments, in which case it becomes difficult to determine the true species; the genera however are easily defined. In the atmospheric dust borne along by the storm, and in the dust from the craters of volcanos, it will henceforth be easier to recognise the siliceous forms of *Geolithia,* and to compare and determine them with as much certainty for the purpose of geological deductions as the spines of *Echini,* the teeth of fishes, scales and bones of various kinds.

Ehrenberg has determined twenty-seven species of *Geolithia,* several of which bear no relation to any of the 282 species of *Polycystina* from Barbados, but possess nevertheless well-defined characteristic forms. If any of these fragments should hereafter be discovered in atmospheric dust, we should be authorized to consider Barbados as its source. The remarkable genera *Actinolithis* and *Placolithis* are quite unknown with respect to their origin.

"If an unknown net-like or reticulated fragment is hereafter named a *Dictyolithis* of such a form and size, it will be a more appropriate and shorter description, and less subject to error, than if described as *Podocyrtidis* or *Spongiæ,* or *Eucyrtidii fragmentum,* or by any other name. Where it is not requisite to notice mere fragments, no person would reasonably enumerate them."

Professor Ehrenberg has next directed his attention to the partly organic, partly morpholithic calcareous ingredients, which, besides the siliceous, are contained in the Barbados marl. The organic parts consist of a small number of *Polythalamia*: the morpholithic, which have the appearance of a secondary formation, differ in some respects from the chalk Morpholithes (*Kreide-Morpholithen*), being sometimes stelliform, sometimes elliptical with a nucleus.

The rocks in general containing these forms, which are sometimes scarcely discernible, at other times little changed, and occasionally surprisingly well preserved, are partly Tripoli, very friable and whitish in appearance, partly compact calcareous sandstone, and become marly by a combination with a considerable quantity of calcareous earth.

In some localities the strata of marl contain semi-opal, and occasionally veins of a carboniferous appearance. Burnthill, which has been considered by some of the inhabitants to be of volcanic origin, does not show any traces of having been on fire on the summit; the rocks have received the blackish appearance from the admixture of bitumen, which they lose when subjected to fire. They contain Polycystina in good preservation*.

The semi-opal is a very remarkable character of the Barbados formation, which has hitherto not occurred in calcareous marls, while on the other hand flints, which are so numerous in the European chalk formation, are entirely wanting in Barbados. Semi-opal occurs sometimes in Europe in the tertiary biolithic Tripoli.

Another remarkable peculiarity of the Barbados marls is the large admixture of pumice, which would almost authorize the denomination of a volcanic tufa. One of the geological specimens, from Skeete's Bay (No. 58), consists of a pure volcanic tufa. Professor Ehrenberg does not recollect having previously met with a similar combination of volcanic dust or ashes, chalk and marl; and it is his opinion "*that these rocks, which consist of volcanic ashes and organic remains, formerly constituted a submarine bottom which was subsequently raised, and hence these rocks belong to a much older period than the coralline rocks which rest upon the former and constitute the largest portion of the superficial area of the island.*" The whole formation of the island possesses a uniformity of character which is only modified by different combinations, changes and transformations.

The minute forms of organic life in the rocks of Barbados, as far as investigated by Professor Ehrenberg in February 1847, consist of the following groups:—

	Species.
Polycystina	282
Polygastrica	18
Phytolitharia	27
Geolithia	27
Polythalamia	7
	361

Of these more than three hundred are new forms.

* There is a tradition in existence that this hill was burning for the space of five years, the bitumen having been set accidentally on fire.

The following tabular survey of Ehrenberg's description of the Barbados animalcules exhibits the large new group of *Polycystina,* which, as will be observed, now consists of 282 species, subdivided into seven families and forty-four genera. The nature of the limitation of the individual animals, and in the individuals, the apertures in the shield, of which the anterior aperture is generally lattice-like or fenestrate, and the posterior one open, have been used in a physiological point of view to furnish the important and necessary characters for the greater divisions, subdivisions, and generic differences of the group.

A short Systematic Arrangement of the Families of Cellular Animals.

Polycystinorum Familiæ.

I.—Polycystina solitaria.

Testæ siliceæ spatio interno ample pervio aut passim levius transverse constricto.

			Gen.	Sp.
Testæ apertura unica (simplex aut cancellata)	Spatium internum liberum (articuli, dissepimenta, stricturæ nulla) ……	I. *Halicalyptrina.*	III.	13
	Spatium internum stricturis articulatim contractum ………………	II. *Lithochytrina.*	VII.	31
Testæ apertura duplex, anterior sæpius cancellata, posterior tota aperta ……….		III. *Eucyrtidina.*	XV.	149

II.—Polycystina composita.

Testæ siliceæ spatio interno celluloso aut strictura longitudinali constricto.

Testæ nucleo destitutæ (associatæ et coalitæ)……..	Cellulæ binæ clathratæ nucis forma amplæ, strictura longitudinali levius discretæ …………	IV. *Spyridina.*	V.	36
	Cellulæ numerosæ parvæ, ordine concentrico, spirali aut nullo (spongiose) in orbes consociatæ, interdum radiatæ ……	V. *Calodictya.*	VI.	15
Testæ nucleatæ (involutæ)	Simplices, subglobosæ aut lenticulares, interdum margine simpliciter elegantissime radiatæ ….	VI. *Haliommatina.*	IV.	30
	Parte media nucleata (ocellata) margine subconcentrice, celluloso aut spongioso (forma complanata orbiculari interdum eleganter lobata et stellata aut margine radiata) ..	VII. *Lithocyclidina.*	IV.	8
			XLIV.	282

A short Systematic Arrangement of the Genera of Cellular Animals.

Polycystinorum Genera.

I.—POLYCYSTINA SOLITARIA.

					Genus	Species.
HALICALYPTRINA.						
Apertura patens ampla	sensim amplior (forma conica)				*Cornutella*	8
Apertura patens ampla	subito ampla (forma campanulata)				*Halicalyptra*	2
Apertura constricta aut cancellata (forma subglobosa)					*Haliphormis*	3
LITHOCHYTRINA.						
Testæ strictura unica	neutro fine lobato	appendicibus laterum nullis			*Lithopera*	6
Testæ strictura unica	neutro fine lobato	latera spinis alata			*Lithomelissa*	4
Testæ strictura unica	capitulo (?) lobato				*Lithobotrys*	7
Testæ stricturæ plures	postremo articulo integro	appendicibus mediis nullis	apertura simplici		*Lithocampe*	3
Testæ stricturæ plures	postremo articulo integro	appendicibus mediis nullis	apertura cancellata		*Lithocorythium*	4
Testæ stricturæ plures	postremo articulo integro	appendicibus mediis alata			*Lithornithium*	3
Testæ stricturæ plures	postremo articulo lobato aut aculeorum corona ornato				*Lithochytris*	4
EUCYRTIDINA.						
Testa simplex continua, non constricta (postremo fine lobato aut fimbriato)					*Carpocanium*	2
Testa semel constricta	articuli postremi apertura ampla	costæ a capitulo oriundæ in spinas terminales productæ			*Dictyophimus*	2
Testa semel constricta	articuli postremi apertura ampla	costæ spinescentes nullæ	capitulo extus non discreto		*Cryptoprora*	1
Testa semel constricta	articuli postremi apertura ampla	costæ spinescentes nullæ	capitulo strictura externa discreto	(sæpe cristato) spinarum corona postrema nulla	*Lophophæna*	10
Testa semel constricta	articuli postremi apertura ampla	costæ spinescentes nullæ	capitulo strictura externa discreto	spinarum aut laminarum corona terminali	*Anthocyrtis*	9
Testa semel constricta	articuli postremi apertura constricta (sæpe appendicibus stiliformibus, pedicellisve ornata)				*Lychnocanium*	13
Testa duabus pluribusve stricturis articulata	corporis utroque fine arctato	appendicibus postremis mediisque nullis	frontis aculeo nullo aut simplici		*Eucyrtidium*	56
Testa duabus pluribusve stricturis articulata	corporis utroque fine arctato	appendicibus postremis mediisque nullis	frontis aculeo spinuloso		*Thyrsocyrtis*	10
Testa duabus pluribusve stricturis articulata	corporis utroque fine arctato	appendicibus postremis spinosis, mediis nullis			*Podocyrtis*	25
Testa duabus pluribusve stricturis articulata	corporis utroque fine arctato	appendicibus mediis, postremis nullis	a secundo inde articulo		*Pterocanium*	8
Testa duabus pluribusve stricturis articulata	corporis utroque fine arctato	appendicibus mediis, postremis nullis	a tertio inde articulo		*Rhopalocanium*	1
Testa duabus pluribusve stricturis articulata	corporis postremo fine non arctato	appendicibus nullis	postremo margine integro		*Cycladophora*	5
Testa duabus pluribusve stricturis articulata	corporis postremo fine non arctato	appendicibus nullis	postremo margine laciniato		*Calocyclas*	2
Testa duabus pluribusve stricturis articulata	corporis postremo fine non arctato	appendicibus a postremo margine productis cellulosis			*Dictyopodium*	2
Testa duabus pluribusve stricturis articulata	corporis postremo fine non arctato	appendicibus a secundo articulo, alarum instar, productis			*Pterocodon*	3
						193

II.—POLYCYSTINA COMPOSITA.

				Genus	Species.
SPYRIDINA.					
Testarum binæ clathratæ cellulæ	appendicibus nullis..	apertura clathrata media		*Dictyospyris* ..	9
		apertura clathrata laterali		*Pleurospyris* ..	1
	appendicibus spinosis	simplicibus		*Ceratospyris* ..	14
		ramosis		*Cladospyris* ..	2
	laminarum corona aperturam vinciente			*Petalospyris* ..	10
CALODICTYA.					
Testarum intus spongiosarum et nucleo destitutarum orbes	non radiati (Flustrarum instar)	disci limbo nullo		*Flustrella*	2
		disco limbato		*Perichlamydium*	2
	lobati aut radiati (Stellarum instar)	radiis liberis	simpliciter stiliformibus	*Stylodictya* ..	7
			spongiosis: liberis turgidis	*Rhopalastrum* .	1
			spongiosis: membrana cellulosa basi conjunctis	*Histiastrum* ..	2
		radiis vinculo celluloso, serti instar, apice conjunctis		*Stephanastrum*	1
HALIOMMATINA.					
Testæ subglobosæ, nucleus radiatus	radii duo spinescentes producti a centro inde oppositi	testæ externæ cellulæ in superficie sola		*Stylosphæra* ..	6
		testæ ext. cell. in serie multiplici spongiosæ		*Spongosphæra* .	1
	radii plures e centro exeuntes (exserti aut non exserti)	margine testæ nullo aut radiato		*Haliomma*	22
		margine integerrimo circulari		*Chilomma*	1
LITHOCYCLIDINA.					
Testarum disci in media parte nucleati margine celluloso ..	integro orbiculari, nec radiato			*Lithocyclia* ...	2
	lobato aut radiato (stellari)	non lobato radiis simpliciter spinescentibus		*Stylocyclia* ...	1
		lobato radiis cellulosis liberis (apice sæpe spinescentibus)		*Astromma*	4
		lobato radiis cellulosis membrana cellulosa a basi conjunctis		*Hymeniastrum*.	1
					89
					193
					282

A short Diagnosis of the three new Polygastric Genera.

1. *Actinogonium.*

Animalculum e Polygastricorum Bacillariis Naviculaceis prismaticis non concatenatis, testæ suborbicularis angulis 7 (aut pluribus ?).

A. septenarium.

2. *Dictyolampra.*

Animalculum e Polygastricorum Bacillariis Naviculaceis orbicularibus non concatenatis, testæ bivalvis disco aperturis non perforato, dissepimentis internis nullis, valvulis paribus in solo medio disco cellulosis, in lævi margine radiatis.

D. Stella.

3. *Liostephania.*

Animalculum e Polygastricorum Bacillariis Naviculaceis orbicularibus non concatenatis, testæ bivalvis disco aperturis non perforato, dissepimentis internis nullis valvulis paribus (?) in medio disco et in margine lævibus, radiorum, sæpe validorum, corona centrum læve cingente.

L. Rotula, radiis (6—14) simplicibus.

L. comta, radiis (6—13) supra punctorum corona conjunctis.

L. magnifica, radiis (12), infra radiolis binis, supra punctis interpositis.

EXPLANATION OF PLATES V. AND VI.

The figures contained in these plates represent a few of the numerous elegant forms of the cellular animalcules of Barbados, magnified from 200 to 100 times in diameter *.

The figures 1 to 7 are solitary animalcules, and belong consequently to the first division of *Polycystina.*

The figures 8, 9, 10 are forms of compound animalcules (*Polypenstöcke*) belonging to the second division of *Polycystina,* and are of a similar relation as *Peneroplis* and *Pavonina* among *Polythalamia.*

Plate V.

Fig. 1. *Eucyrtidium Ampulla,* front view.
Fig. 2. " " seen from below.
Fig. 3. " " seen from above.
Fig. 4. *Rhopalocanium ornatum.*
Fig. 5. *Podocyrtis Schomburgkii.*

Plate VI.

Fig. 6. *Anthocyrtis Mespilus.*
Fig. 7. *Lychnocanium Lucerna.*
Fig. 8. *Haliomma Humboldtii.*
Fig. 9. *Astromma Aristotelis.*
Fig. 10. *Stephanastrum Rhombus.*

It has been considered preferable to omit some of the minor figures of the original plate, and to substitute his interesting *Eucyrtidium Ampulla* as seen in different positions, a drawing of which was obligingly furnished for that purpose by Professor Ehrenberg.

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* Professor Ehrenberg observes, that these illustrations are magnified about a third less than his figures of *Polygastrica,* which are uniformly magnified 300 times.

BIBLIOGRAPHICAL NOTICES.

A Treatise on the Esculent Funguses of England. By C. D. Badham, M.D. 8vo. Reeve, Brothers, 1847.

This is the work of a person of considerable tact and powers of observation, and has the singular merit of containing much that is new and interesting on a subject which has been treated again and again by persons of as various merit as the books they have published. The prospectus was peculiarly well drawn up, and was calculated to make a very favourable impression. The work itself forms a handsome octavo volume; the illustrations are for the most part admirable, and faithfully represent the species with which they profess to make the unlearned reader familiar, and the culinary "*indications*" such as will satisfy the most fastidious.

Dr. Badham does not pretend to be a learned mycologist, but during a long residence abroad he had collected a mass of information on the subject, to which much has been added since his return, and which he has laid before the public with that ability for which he was remarkable during his earlier course, and which he has displayed in his publication on Insect Life. It would be easy indeed to point out minor errors which a more familiar acquaintance with the works of some of the leading mycologists of the day would have enabled him to avoid, but these are of little importance, and do not at all detract from the general merit of the work, which is professedly of a popular character, its very aim being the diffusion of useful knowledge on a subject too much neglected in this country.

The mode of cultivation of the common mushroom is familiar to almost every one, though it is not carried in this country to an extent at all proportionate to that which prevails in Paris, where the markets are entirely supplied with mushrooms obtained artificially, millions being produced weekly in the catacombs. In Italy several species are obtained by the most simple processes. At Naples an Agaric is abundantly produced from spent coffee grounds simply by depositing the marc in cellars of a proper temperature. A Polyporus is raised from stony masses impregnated with mycelium by transferring them to the garden with a portion of the original mould and watering them daily. Specimens were some years ago raised by Messrs. Lee of Hammersmith in this way which are preserved in the British Museum. Two other fungi are produced in a very simple manner which we do not recollect to have seen noticed before. Dr. Badham shall however speak for himself.

"A third fungus which we have the means of producing *ad libitum* is that which sprouts from the pollard head of the black poplar; these heads it is usual to remove at the latter end of autumn as soon as the vintage is over and their marriage with the vine is annulled; hundreds of such heads are then cut and transported to different parts; they are abundantly watered during the first month, and in a short time produce that truly delicious fungus *Agaricus caudicinus*, the *Pioppini*, which during the autumn of the year make the greatest show in many of the Italian market-places. These pollard blocks continue to bear from twelve to fourteen years; I saw a row of them in the Botanical Garden at Naples which after this period were still productive, though less frequently and of fewer Agarics at a crop. The practice of rearing funguses from the poplar is not modern: Dioscorides knew, for he tells us, that if we bark the white or black poplar, cutting the bark into pieces and covering it with horse-dung, an excellent kind of fungus will spring up and continue to bear throughout the year. By way of comment to which passage, Matthiolus adds, that a little leaven will produce an abundant crop in four days. Another fungus which I have myself reared (*Polyporus avellanus*) is to be procured by singeing over a handful of straw a block of the cobnut tree which is then to be watered and put by. In about a month the funguses make their appearance, which are quite white, of from two to three inches in diameter, and excellent to eat, while their profusion is sometimes so great as entirely to hide the wood from which they spring. All blocks of this nut wood do not bear. Professor Sanguinetti informs me that the peasants in the Abruzzi, who bring in these logs, know perfectly which will succeed and which will not; a knowledge, he adds, to which the closest attention during all the years that I have been employed by the Papal Government as superintendent of the fungus market has not enabled me to attain."

Many other passages of general interest will be found dispersed through the work, and those who look for especial information will not often be disappointed. The truffles alone, though one of the most interesting groups of fungi, whether regarded as objects of commerce or on account of their curious and multifarious structure, form an exception.

We cordially recommend this work in connexion with the larger one of Mrs. Hussey to the attentive notice of our readers. We do not indeed exactly understand why Dr. Badham's obligations to that lady are not more particularly noticed. Her name does not appear on the plates, though far the greater part of the figures are due to her pencil. Other obligations of a minor character from another quarter ought also we think to have been acknowledged, but we would rather suppose that in either case there has been some accidental omission.

PROCEEDINGS OF LEARNED SOCIETIES.

LITERARY AND PHILOSOPHICAL SOCIETY OF ST. ANDREWS.

April 5, 1847.—Dr. Reid gave an account of observations on the development of the Medusa, and exhibited the animals to the Society.

He recalled to the attention of the Society the account which he gave of the structure and habits of the larvæ of the Medusæ on a former occasion. In the remarks already printed in the Society's 'Transactions,' it was stated by Dr. Reid, that he had kept these animals alive at home from September 1845 to the end of July 1846, without their dividing into young Medusæ. Towards the end of July the larvæ ceased for a short time to reproduce themselves by buds and stolons, but by the beginning of August they were again propagating themselves in this manner, though less actively than in April and May. On the 10th of February last, the upper part of some of the larvæ had become elongated, cylindrical, of considerably diminished diameter, with transverse rings commencing at the top. Each of these transverse rings developed itself, in the manner that Sars has described, into a young Medusa, having eight bifid processes projecting from the margin of the disc. In many of the larvæ, while the upper part of the body was of a reddish brown colour, and was splitting itself into as many as thirty or forty young Medusæ, the lower part was of its usual white colour, and was reproducing new larvæ by means of buds. In no case in which the process of splitting was watched, did the whole of the larva break itself up into young Medusæ, but a portion, often very small, at its attached extremity, continued to live as a larva, and threw out new tentacula before the last of the young Medusæ, into which the rest of the body had split, had been detached. Dr. Reid then gave a detailed description of these young Medusæ, and explained their structure as seen under the microscope. Among other things, he stated that the appearances described by Steenstrup as vessels in the young Medusa, at the period of its separation from the larva, are merely ridges on its lower surface. Cilia were observed on the inner surface of the mouth, stomach, and on the surface of four remarkable double processes adhering to the inner surface of the stomach. The ocellus, as it is termed, placed in the cleft of each of the eight processes projecting from the margin of the disc, is chiefly made up of several cylindrical crystals, presenting several interesting appearances not hitherto described.

Dr. Reid also stated, that since his last communication on this subject to the Society, he had made additional observations on the locomotive powers of the larvæ. The young larvæ developed from buds generally move to some little distance, sometimes a considerable distance, from the older larva which formed these buds, even after they have been fairly detached from their parents. This locomotion is slow, and is effected by a kind of sliding motion of the attached end over the substance to which it is fixed. Dr. Reid had also observed very minute cilia on the external surface of the bodies of some larvæ*.

* A delay in the publication of the Abstracts of the 'Transactions' of the Society enables Dr. Reid to add, that the larvæ ceased to split into young Medusæ about the end of the first week in May; that the surface of the stones are as thickly covered with them at present (30th May) as before they began to split, so that he has now kept this colony of larvæ above 20½ months, and it was not until they had been 17½ months in his possession that some of these larvæ began to split into young Medusæ, while many of them have not yet done so at all. These observations of Dr. Reid confirm some of those made by Sir John Dalzell on the larvæ of the Medusa, under similar circumstances (vide Jamieson's Philosophical Journal for 1836), and differ very considerably from some of those made by Sars and Steenstrup upon these animals, placed under different conditions.

ZOOLOGICAL SOCIETY.

May 11, 1847.—William Spence, Esq., F.R.S., in the Chair.

On the Genera of the Family Chitonidæ (*continued*).
By J. E. Gray, Esq., F.R.S., F.Z.S. etc.

1. Chiton, *Linn.* (part), *Guilding, Z. J.* v. 27; *Swainson*; *Gray, Syn.*

Lepidopleurus, "*Leach MSS.*," *Risso, Eur. Merid.* 267. Chiton, sect. A. 1. *Blainv.* Lepas spec., *Adanson.* Corephium, *Brown.* Lophurus, *Poli.* Gymnoplax, *Gray.*

* *Scales of the margin moderate, smooth, polished; valves thickish.*

Ch. striatus, *Barnes.* Ch. olivaceus, *Frembly, Sow. C. Ill.* f. 3, 41. Chiloe.
Ch. Cumingii, *Frembly, Sow. C. Ill.* f. 32, 51. Chili.
Ch. albolineatus, *Sow. C. Ill.* f. 39. Mexico.
Ch. squamosus, *Linn.* Ch. bistriatus, *Wood.* Ch. obscurus, *Sow.* West Indies.
Ch. sulcatus, *Wood, Sow. C. Ill.* f. 12.
Ch. granosus, *Frembly.* Chili.
Ch. Barnesii, *Gray.* Coquimbo.
Ch. glaucus, *Gray, Spic. Zool.*=Ch. viridis, *Quoy.*
Ch. granulosus, *Frembly.* Conception.
Ch. Siculus, *Gray.* Ch. Polii, *Desh.* Sicily.
Ch. lyratus, *Sow. C. Ill.* f. 126.
Ch. foveolatus, *Sow. C. Ill.* f. 60.
Ch. excavatus, *Gray, Sow. C. Ill.* f. 131.
Ch. fasciatus, *Wood, Sow. C. Ill.* f. 153.
Ch. australis, *Sow. C. Ill.* f. 46.
Ch. Stokesii, *Brod., Sow. C. Ill.* f. 24.
Ch. virgulatus, *Sow. C. Ill.* f. 132.
Ch. patulus, *Sow. C. Ill.* f. 134.
Ch. marmoratus, *Gmelin, Sow. C. Ill.* f. 148. West Indies.
Ch. evanidus, *Sow. C. Ill.* f. 139.
Ch. articulatus, *Sow. C. Ill.* f. 18. California.
Ch. lævigatus, *Sow. C. Ill.* f. 18*. California.
Ch. Goodallii, *Sow. C. Ill.* f. 50. Galapagos.

** *Scales of the mantle small, smooth, polished.*

Ch. Bowenii, *King, Sow. C. Ill.* f. 37. Magellan Str.

*** *Scales of the margin transversely grooved; valve rounded, not keeled, thin.*

This section forms a very natural group.

Ch. textilis, *Gray, Spic. Zool.*=Ch. longicymba, *Blainv., Quoy.*
Ch. Indicus, *Sow. C. Ill.* f. 55. Ch. Solea, *Sow. C. Ill.* f. 61. Cape of Good Hope.
Ch. Magdaliensis, *Hinds.*

**** *Scales of the margin lanceolate, elongate, erect, closely pressed.*

Ch. lævis, *Mont.*=Ch. corallinus, *Risso.*

2. Tonicia, *Gray, Syn.* Chiton, *Risso, E. M.* 267.

* *Valves broad, transverse.*

T. atrata. Ch. atratus, *Sow. C. Illust.* f. 57, 58. Falkland Islands.

T. elegans. Ch. elegans, *Frembly, Sow. C. Illust.* f. 73, 74. Ch. Chiloensis, *Sow.* Ch. lineolatus, *Frembly.* Ch. graniferus, *Sow.* Ch. Sparius, *Sow.* Conception Bay.

T. rubra. Ch. ruber, *Linn.* Ch. marmoreus, *O. Fab.* Ch. latus, *Lowe.* Ch. fulminatus, *Couth.*

T. fulva. Ch. fulvus, *Wood, Sow. C. Ill.* f. 53. Cadiz.

T. lineata. Ch. lineatus, *Wood, Sow. C. Ill.* f. 77.

T. Swainsonii, *Sow. C. Ill.* f. 5. Peru.

T. cerasina.

T. lævigata. Ch. lævigatus, *Flem.*

T. lyrata.

T. Grayii. Ch. Grayii, *Sow. C. Illust.* f. 8—16. Peru.

T. castanea. Ch. castaneus, *Wood, Sow. C. Illust.* f. 114, 115, 116. Cape of Good Hope.

T. fastigiata. Ch. fastigiatus, *Gray, Sow. C. Illust.* f. 11. California.

** *Valves moderate, subcordate, rounded, and far apart on the sides; lobes of insertion wide; mantle broad.*

T. disjuncta. Ch. disjunctus, *Frembly, Zool. Journ.* t. 77. f. 5, forms the passage to the Chitons, which have only a small part of the valves exposed.

3. Acanthopleura, *Guild. Z. J.* v. 27; *Gray, Syn.*

Canthapleura, *Swains.*

This genus gradually passes to *Onithochiton.*

* *The plate of insertion of the hinder valve well-developed, regular; valves thin; lateral area distinct; margin bristly.*

A. Peruviana. Ch. Peruvianus, *Lam., Sow. C. Ill.* f. 44. Peru.

A. bicolor. Ch. bicolor, *Adams.* West Indies.

A. Hennahi. Ch. Hennahi, *Gray, Sow. C. Ill.* f. 1 & 33.

A. Watsonii. Ch. Watsonii, *Sow. C. Ill.* f. 81, 82, 130 = Ch. castaneus, *Quoy.*

** *The plate of insertion of the hinder valve narrow, rather irregular.*

† *Margin bristly; lateral area distinct.*

A. nobilis, *Gray.* New Zealand.

†† *Margin spinose or spinulose; lateral area indistinct.*

A. picea. Ch. piceus, *Sow. C. Ill.* f. 147. West Indies.

A. spinigera. Ch. spinigerus, *Sow. Conch. Ill.* f. 68. Peru.

A. Owenii, *Gray.* West coast of Africa.

A. spinosa. Ch. spinosus, *Brug., Sow. C. Illust.* f. 151. Australia.

A. brevispinosa. Ch. brevispinosus, *Sow. C. Illust.* f. 136. Island of Johanna.

A. magnifica. Ch. magnificus, *Gray, Sow. C. Illust.* f. 52.

††† *Margin smooth ?; lateral area very distinct.*

A. ? gigas. Ch. gigas, *Gmel.* Cape of Good Hope.
A. ? truncata. Philippines.

4. Schizochiton.

Valves elongate, subcordate, narrow; lateral area short, distinctly defined; the hinder valves large, with a subposterior superior apex and a deep notch on its hinder lower edges, and the plate of insertion small, with a few oblique notches, scarcely pectinated. Mantle broad, covered above with small chaff-like scales, deeply notched behind.

Schizochiton incisus. Chiton incisus, *Sow.* Philippines.

5. Corephium.

Valves broad; wing of insertion of the anterior valve lobed and pectinated; the hinder valve oblong, with a subcentral, subposterior, not produced apex; the edge of insertion distinct, not lobed on the sides, with a single nick behind, and slightly denticulated; mantle spinose.

C. echinatus. Chiton echinatus, *Barnes.* C. tuberculiferus, *Sow.* Ch. spiniferus, *Frembly*; *Sow. C. Illust.* f. 47, young.

6. Plaxiphora.

P. Carmichaelis. Chiton Carmichaelis, *Gray, Spic. Zool.* Ch. albidus, *Blainv.* 547. Ch. raripilosus, *Blainv.* 547. Ch. costatus, *Blainv.* 547. Ch. biramosus, *Quoy, Voy. Astrol.* t. 74. f. 12, 16. Ch. setiger, *King, Z. J.* v. 338; *Sow. Conch. Ill.* f. 17. Ch. Fremblii, *Brod. P. Z. S.* 1832, 28; *Sow. Conch. Ill.* f. 2. Ch. setosus, *Sow.*, *Beechey Voy.* Terra del Fuego.

See also Ch. setosus, *Sow. C. Ill.* f. 19 ?

7. Onithochiton.

O. Gaimardi. Chiton Gaimardi, *Blainv.* 546.
O. hirtosus. Chiton hirtosus, *Blainv.* 546.
O. undulatus. Ch. undulatus. Van Diemen's Land.

8. Enoplochiton.

E. niger. Ch. niger, *Barnes.* Ch. Coquimbensis, *Frembly.* Coquimbo.

The valves become very much eroded.

9. Mopalia.

Valves broad, transverse, depressed; margin of insertion moderate; the hinder valve with a rounded lobe on the hinder edge; mantle moderately broad, bristly above, narrow behind.

* *Margin moderately wide in front.*

M. Hindsii. Ch. Hindsii. West coast of America.
M. Simpsonii. Ch. Simpsonii, *Gray.* Brit. Mus.

** *Margin very wide in front.*

M. Blainvillii. Ch. Blainvillii, *Sow. C. Ill.* f. 6. Inner Lobos Island.

10. Katharina.

K. tunicata. Chiton tunicatus, *Wood, Conch.* ii. t. 2. f. 1; *Cat.* t. 1. f. 10. Wood's specimen is now in the British Museum.

K. Douglasiæ. Ch. tunicatus, *Sow. C. Illust.* f. 152. California.

11. Cryptochiton.

The gill only occupies the hinder part of the sides.

C. amiculatus. Ch. amiculatus, *Pallas, Nov. Comm. Petrop.* ii. 241. t. 7. f. 26, 30; *Sow. Tank. Cat.* (spec. Brit. Mus.); *Wood, Cat.* t. 1. f. 12, inner side of shell; *Sow. Conch. Illust.* f. 80, half-grown. Chiton Sitkensis, *Reeve's Conch. Icon.* f. 55, adult. Kurile Islands.

12. Cryptoconchus, "*Blainv.*," *Swainson*; *Gray, Syn.*

Body oblong, rather convex; back flattish or concave in the centre, with the tuft of spines on the upper part of the sides of the back. The gills extend about half the length of the sides.

Cryptoconchus porosus, "*Blainv.*," *Burrows, Elem. Conch.* 190 (1815), spec. Brit. Mus. Chiton porosus, *Burrows, E. C.* t. 28; *Wood, Cat.* t. 1. f. 39. Ch. Leachii, *Blainv. D. S. N.* 554, spec. Brit. Mus. Ch. monticularis, *Quoy, Voy. Astrol.* t. 73. f. 30, 34, 36, and lower fig. 7; *Sow. Conch. Illust.* f. 129, valves. New Zealand.

13. Amicula, *Gray, Syn.* 1840.

Body ovate, convex; back convex; mantle bristly.

Amicula vestita. Chiton vestitus, *Sow. Zool. Journ.* iv. 368; *Sow. Conch. Illust.* f. 128. Ch. Emersonii, *Couthoy*. Atlantic Ocean.

14. Acanthochites, *Leach, B.M.*; *Gray, Syn.*

Acanthochites, "*Leach.*" Acanthochitus, *Risso*. Phakellopleura, *Guild., Swainson*. Chitonellus (part.), *Guild.* Acanthochiton, *Herrm.*

Body oblong, elongate, rather depressed; mantle spinulose; tuft of spines generally large; gill extending about two-thirds the length of the sides.

M. De Blainville says, the valves of this genus are always without any trace of lateral area (*D. S. N.* xxxvi. 537), but this must have arisen from his only having examined worn specimens.

A. fascicularis. Ch. fasc., *Linn.* C. echinites, *Blainv., Sow. Conch. Ill.* f. 87—93.

A. Garnoti. Ch. Garnoti, *Blainv. D. S. N.* 552?; *Quoy, Voy. Astrol.* t. 73. f. 9, 14. Asc. Zelandica, *Quoy, Voy. Astrol.* t. 73. f. 5. A. Hookeri, *Gray, Dieffenbach*, 262.

A. polychetus. Ch. polychetus, *Blainv.* 553.

A. roseus. Ch. roseus, *Blainv.* 553.

A. Lesueurii. Ch. Lesueurii, *Blainv.* 553.

A. scaber. Ch. scaber, *Blainv.* 553.

A. violaceus. Ch. violaceus, *Quoy, Voy. Astrol.* 73. f. 13, 16, 17, 20; not *Sow. Ill.* f. 133.

A. hastatus. Ch. hastatus, *Sow. C. Ill.* f. 127.

A. hirundiniformis. Ch. hirundiniformis, *Sow. C. Ill.* f. 148.

A. strigatus. Chitonellus latus, *Guild. Z. Journ.* v. 28. Chitonellus strigatus, *Sow. C. Ill.*

15. Chitonellus, *Lam.*

Chitonella, *Desh.* Cryptoconchus, "*Blainv.*," *Burrows.* Cryptoplax, *Blainv.* Chitoniscus, *Herrm.*

Body elongate, compressed, convex above; mantle covered with crowded spines; the exposed part of the front valves oblong, square, broad, often worn; of the hinder ones narrow, lanceolate; the plates of insertion large, produced in front, and scarcely notched on either side. The gills occupy the hinder third of the sides.

M. De Blainville inserts Lamarck's species of Chitonelli with the spiny Chitons in section D., and in section E. he redescribes them, from specimens in spirits in the British Museum.

Chitonellus lævis, *Lam.* Chiton vermiformis, *Blainv. D. S. N.* xxxvi. 553. Oscab. fascie, *Quoy, Voy. Astrol.* t. 73. f. 21, 29. Cryptoconchus larvæformis, "*Blainv.*," *Burrows, Elem. Conch.* 190. t. 28. f. 2, 4; *Wood, Cat.* t. 1. f. 40. Philippines.

Chitonellus striatus, *Lam.*; *Sow. Conch. Illust.* f. 62? Oscab. ocule, *Quoy, Voy. Astrol.* t. 73. f. 37, 38. Australia.

The fossil Chitons of the older strata described by Munster, more lately by Ryckholt, *Bull. Acad. Brux.* 1845, xii. 36. t. 1—4, appear to belong to a peculiar genus, which may be called *Gryphochiton,* most nearly allied to *Chitonellus.*

I have described some peculiarities in the development, disposition and structure of the valves of the Chitons in a paper which will be read at the Royal Society on the 16th of June next.

MISCELLANEOUS.

Notice of the capture of Sylvia Turdoides (*Meyer*) *in Britain.* By John Hancock, Esq.

A male specimen of this fine Warbler was shot, three or four miles west of Newcastle, near to the village of Swalwell, by Mr. Thomas Robson of that place, on the 28th of last May. The attention of this gentleman, who is perfectly familiar with the song of all our summer visitants, was arrested by a note which he had not before heard; and after some search he succeeded in getting a sight of the bird. It was concealed in the thickest part of a garden hedge close to an extensive mill-dam, which is bordered with willows, reeds and other aquatic plants. It would scarcely leave its retreat, and when it did so never flew far, and always kept close to the herbage. Its habits resembled those of the Reed Fauvette, being continually in motion, occasionally hanging with the body downwards or clinging to the branches and stretching forwards to take its prey.

Its song was powerful, and resembled that of the Black Ougel, but was occasionally interrupted with the harsh craking note common to many of the Warblers, and at intervals it uttered a single shrill cry.

The specimen was very fat, and when opened the testicles were found to be much enlarged; the stomach contained small beetles and flies.

From the nature of the locality, from the time when captured, and from the enlarged state of the testicles, there can be little doubt that this bird was breeding in the neighbourhood: and I have some reason for believing that the nidification of this species has occurred in another part of England. I have had in my possession for nearly two years an egg taken by a friend of mine in Northamptonshire, which agrees in every respect with Thienemann's figure and description of the egg of *Sylvia Turdoides*; and now, since the capture of the bird in Britain, it is impossible to doubt that this egg belongs to that species. It would therefore appear probable that this delightful songster, the largest of the European Warblers, may be a regular summer visitant to our island. Notwithstanding its large size it might easily pass unnoticed, skulking as it does in the low herbage, and seldom exposing itself to view. Its song, too, by most would be taken for that of the Black Ougel; and even now it might have escaped detection had not the accurate ear and experienced eye of Mr. Robson been engaged in the pursuit.

Newcastle-on-Tyne, 15th July 1847.

On the habits of Cicada septendecim. By S. P. Hildreth, M.D.*

It is now seventeen years since, in 1829, this curious insect appeared in this portion of Ohio. Its exit from the earth, where it had remained excluded from the light of day for so long a time, was looked for with considerable interest. They were first seen to come out of the ground on the 14th of May, 1846, ascend some bush, fence, or tree, cast off their exuviæ, and become a flying insect. They had been observed, near the surface, since the beginning of April, and were turned up by the plough, and dug out of the earth by hogs, which were very fond of them, as were also birds, domestic fowls and cats. At a brick-yard in Marietta, where the clay was dug from the side of a hill, under the remains of an old orchard of apple-trees, the workmen observed the cells of this insect in 1838, in the large masses of earth broken off from the side of the bank. In 1840 I visited the spot, collected several of the *Cicadæ* and preserved them in spirit. Their cells at that time were measured, and found to be a third less than in the seventeenth year. The cells are oval and very smooth within; they are two and a quarter inches long and three-fourths of an inch in diameter, being sufficiently large for the single Cicada, which inhabits it, to move and turn round. Thus they dwell for sixteen years and ten months secluded in a grotto of their own construction.

After the eggs of the female are deposited in the tender branches

* From Silliman's American Journal for March 1847.

of trees, they remain two months or sixty days in the pith of the wood before they are hatched and ready to seek their home in the earth; and as they invariably ascend in May, soon after which the eggs are deposited, it makes their actual residence in the earth two months short of seventeen years. The perfect insect lives about thirty days, and then perishes. In 1840 the cells were found to be from two and a half to four feet below the surface, and without any tube communicating with the top of the ground. The cells are probably water-proof, as the flood of 1832 covered the surface to the depth of six or eight feet in my garden. In 1846 a large number of these insects emerged from the earth under an apple-tree, in the branches of which the parent Cicada had deposited her eggs in 1829. If the water at that time, when only in their third year, had had access to their cells, they must have perished, for it remained over them five or six days. In their cells no appearance of excrementitious matter was noticed. When their period of entombment is completed, in the seventeenth year, or perhaps earlier, they commence working out a smooth cylindrical tube towards the surface, taking care not to approach within reach of frosts, and where examined for the purpose, the tubes have been found to be usually about four feet in length. For constructing their cells and excavating these tubes, their fore-feet are admirably adapted, being much larger and stronger than those for locomotion, and formed with stout claws like the craw-fish. Each pupa is armed with a stout proboscis, one-fourth of an inch long, which usually lies between the fore-legs on a line with the body. A remarkable example of instinct was observed in some which came to the surface under a pile of boards, raised by timbers five or six inches above the earth. The ground was wet, and to enable themselves to reach the dry boards they continued their cylinders up to them, forming thus towers of damp clay in the centre of which they were concealed. These towers were five or six inches high and about an inch in diameter; they were constructed of lumps of wet earth compacted together in a firm but rough manner. A large number of these towers was found when the boards were removed; some had the top closed, and from these the Cicada had not departed. When they had reached the boards, they crawled along on the under side and came to the open air, where, fixing on a spot favourable to their purpose, they remained attached, until a rupture was made in the cuticle on the back of the thorax, and the perfect insects then with great effort extricated themselves from the armour that had so long protected them in the earth. As there was no further use for the stout claws of the fore-legs after they became denizens of the air, these legs were replaced by two that were small and delicate like the other four. In a few days after leaving the earth they had chosen their mates, and the female soon commenced depositing her eggs in the under sides of the tender branches of trees, by means of an ovipositor resembling an awl or punch, and continued at this for several days. The preceding year's growth of the branches of apple-trees is a favourite wood with them;—but in the forest, the tender branches of almost any variety of wood are used for this purpose. In a few days the leaves on the twig dry up, and the punctured parts, in many instances, break with the wind and fall to the ground.

By the 21st of May they had increased rapidly, and the woods on the side hills were vocal with their music. The male is the songster, and has vibrating air-cells at the back of and under the wings. Where they are abundant their noise is deafening in the sunny and hot portion of the day, but they are nearly silent at night. About the 6th and 7th of June the weather was quite cold, which retarded their progress very much, and during a long and continued rain many of them died. They delight in heat and sunshine, moving about with great briskness. By the last of June they had nearly all perished; and, as in 1829, numbers were seen flying short distances, after the abdomen had wasted away, and separated from the wings and thorax. By the middle of August, or about sixty days after the eggs are deposited, they are hatched, and the young Cicadas are ready to enter into the earth. They prevailed over the woody region on the north of the Ohio river, from the Alleghany mountains to the Mississippi; and were full as numerous as in 1829, but will probably diminish as the forests are cut away.

Marietta, January 5th, 1847.

In continuation of this subject, which is one of general interest, we cite the following paragraphs from the very valuable work of T. W. Harris, M.D., on the Insects of Massachusetts injurious to Vegetation (pp. 171–175), referring to the work itself for a more complete history of the Cicada*.

In those parts of Massachusetts which are subject to the visitation of this Cicada, it may be seen in forests of oak about the middle of June. Here such immense numbers are sometimes congregated as to bend and even break down the limbs of the trees by their weight, and the woods resound with the din of their discordant drums from morning to evening. After pairing, the females proceed to prepare a nest for the reception of their eggs. They select, for this purpose, branches of a moderate size, which they clasp on both sides with their legs, and then bending down the piercer at an angle of about forty-five degrees, they repeatedly thrust it obliquely into the bark and wood in the direction of the fibres, at the same time putting in motion the lateral saws; in this way they detach little splinters of the wood at one end, so as to form a kind of fibrous lid or cover to the perforation. The whole is bored obliquely to the pith, and is gradually enlarged by a repetition of the same operation, till a longitudinal fissure is formed of sufficient extent to receive from ten to twenty eggs. The side-pieces of the piercer serve as a groove to convey the eggs into the nest, where they are deposited in pairs, side by side, but separated from each other by a portion of woody fibre,

* Report on the Insects of Massachusetts injurious to Vegetation, by Thaddeus William Harris, M.D. 460 pp., 8vo. Cambridge, 1841.

and they are implanted into the limb somewhat obliquely, so that one end points upwards. When two eggs have been thus placed, the insect withdraws the piercer for a moment, and then inserts it again and drops two more eggs in a line with the first, and repeats the operation till she has filled the fissure from one end to the other, upon which she removes to a little distance, and begins to make another nest to contain two more rows of eggs. She is about fifteen minutes in preparing a single nest and filling it with eggs; but it is not unusual for her to make fifteen or twenty fissures in the same limb; and one observer counted fifty nests extending along in a line, each containing fifteen or twenty eggs in two rows, and all of them apparently the work of one insect. After one limb is thus sufficiently stocked, the Cicada goes to another, and passes from limb to limb and from tree to tree, till her store, which consists of four or five hundred eggs, is exhausted. At length she becomes so weak by her incessant labours to provide for a succession of her kind, as to falter and fall in attempting to fly, and soon dies.

Although the Cicadas abound most upon the oak, they resort occasionally to other forest trees and even to shrubs when impelled by the necessity for depositing their eggs, and not unfrequently commit them to fruit-trees when the latter are in their vicinity. Indeed there seem to be no trees or shrubs that are exempted from their attacks, except those of the pine and fir tribes, and of these even the white cedar is sometimes invaded by them. The punctured limbs languish and die soon after the eggs which were placed in them are hatched; they are broken by the winds or by their own weight, and either remain hanging by the bark alone, or fall with their withered foliage to the ground. In this way orchards have suffered severely in consequence of the injurious punctures of these insects.

The eggs are one-twelfth of an inch long, and one-sixteenth of an inch through the middle, but taper at each end to an obtuse point, and are of a pearl-white colour. The shell is so thin and delicate that the form of the included insect can be seen before the egg is hatched, which occurs, according to Dr. Potter, in fifty-two days after it is laid, but other persons say in fourteen days.

The young insect when it bursts the shell is one-sixteenth of an inch long, and is of a yellowish white colour, except the eyes and the claws of the fore-legs, which are reddish, and it is covered with little hairs. In form it is somewhat grub-like, being longer in proportion than the parent insect, and is furnished with six legs, the first pair of which are very large, shaped almost like lobster-claws, and armed with strong spines beneath. On the shoulders are little prominences in the place of wings, and under the breast is a long beak for suction. These little creatures when liberated from the shell are very lively, and their movements are nearly as quick as those of ants. After a few moments their instincts prompt them to get to the ground, but in order to reach it they do not descend the body of the tree, neither do they cast off themselves precipitately, but running to the side of the limb, they deliberately loosen their hold and fall to the earth. It seems, then, that they are not borne to the ground in the egg state by the limbs in which their nests are contained, but spontaneously make the perilous descent immediately after they are hatched, without any clue, like that of the canker-worm, to carry them in safety through the air and break the force of their fall. The instinct which impels them thus fearlessly to precipitate themselves from the trees, from heights of which they can have formed no conception, without any experience or knowledge of the result of their adventurous leap, is still more remarkable than that which carries the gosling to the water as soon as it is hatched. In those actions that are the result of foresight, of memory, or of experience, animals are controlled by their own reason; as in those to which they are led by the use of their ordinary senses or by the indulgence of their common appetites, they may be said to be governed by the laws of their organization; but in such as arise from special and extraordinary instincts, we see the most striking proofs of that creative wisdom which has implanted in them an unerring guide, where reason, the senses and the appetites would fail to direct them. The manner of the young Cicadas' descent, so different from that of other insects, and seeming to require a special instinct to this end, would be considered incredible perhaps, if it had not been ascertained and repeatedly confirmed by persons who have witnessed the proceeding. On reaching the ground the insects immediately bury themselves in the soil, burrowing by means of their broad and strong fore-feet, which, like those of the mole, are admirably adapted for digging. In their descent into the earth they seem to follow the roots of plants, and are subsequently found attached to those which are most tender and succulent, perforating them with their beaks, and thus imbibing the vegetable juices which constitute their sole nourishment.

They do not appear ordinarily to descend very deeply into the ground, but remain where roots are most abundant; and it is probable that the accounts of their having been discovered ten or twelve feet from the top of the ground have been founded on some mistake, or the occurrence of the insects at such a depth may have been the result of accident. The only alteration to which the insects are subject, during the long period of their subterranean confinement, is an increase of size, and the more complete development of the four small scale-like prominences on their backs, which represent and actually contain their future wings.

As the time of their transformation approaches, they gradually ascend towards the surface, making in their progress cylindrical passages, oftentimes very circuitous, and seldom exactly perpendicular, the sides of which, according to Dr. Potter, are firmly cemented and varnished so as to be water-proof. These burrows are about five-eighths of an inch in diameter, are filled below with earthy matter removed by the insect in its progress, and can be traced by the colour and compactness of their contents to the depth of from one to two feet, according to the nature of the soil; but the upper portion to the extent of six or eight inches is empty, and serves as a habitation for the insect till the period for its exit arrives. Here it remains during several days, ascending to the top of the hole in fine weather for the benefit of the warmth and the air, and occasionally peeping forth apparently to reconnoitre, but descending again on the occurrence of cold or wet weather.

During their temporary residence in these burrows near the surface, the Cicada grubs, or more properly pupæ, (for such they are to be considered at this period, though they still retain something of a grub-like form,) acquire strength for further efforts by exposure to the light and air, and seem then to wait for only a favourable moment to issue from their subterranean retreats. When at length this arrives, they issue from the ground in great numbers in the night, and crawl up the trunks of trees, or upon any other object in their vicinity to which they can fasten themselves securely by their claws. After having rested awhile they prepare to cast off their skins, which in the meantime have become dry and of an amber colour. By repeated exertions a longitudinal rent is made in the skin of the back, and through this the included Cicada pushes its head and body, and withdraws its wings and limbs from their separate cases, and, crawling to a little distance, it leaves its empty pupa-skin, apparently entire, still fastened to the tree. At first the wing-covers and wings are very small and opake, but, being perfectly soft and flexible, they soon stretch out to their full dimensions, and in the course of a few hours the superfluous moisture of the body evaporates, and the insect becomes strong enough to fly.

During several successive nights the pupæ continue to issue from the earth; above fifteen hundred have been found to arise beneath a single apple-tree, and in some places the whole surface of the soil, by their successive operations, has appeared as full of holes as a honeycomb. In Alabama the species under consideration leaves the ground in February and March, in Maryland and Pennsylvania in May, but in Massachusetts it does not come forth till near the middle of June. Within about a fortnight after their final transformation they begin to lay their eggs, and in the space of six weeks the whole generation becomes extinct.

Fortunately these insects are appointed to return only at periods so distant that vegetation often has time to recover from the injury they inflict; were they to appear at shorter intervals, our forest and fruit trees would soon be entirely destroyed by their ravages. They are moreover subject to many accidents, and have many enemies, which contribute to diminish their numbers. Their eggs are eaten by birds; the young, when they first issue from the shell, are preyed upon by ants, which mount the trees to feed upon them, or destroy them when they are about to enter the ground. Blackbirds eat them when turned up by the plough in fields. Hogs are also excessively fond of them, and, when suffered to go at large in the woods, root them up, and devour immense numbers just before the arrival of the period of their final transformation, when they are lodged immediately under the surface of the soil. It is stated that many perish in the egg state, by the rapid growth of the bark and wood, which closes the perforations and buries the eggs before they have hatched; and many, without doubt, are killed by their perilous descent from the trees.

Food of the Mastodon. By Prof. A. Gray.

Prof. Gray stated that there had been recently placed in his hands specimens of earthy matter, filled with finely-broken fragments of branches of trees, which were said to have been found occupying the place of the stomach in the skeleton of the Mastodon exhumed on Schooley's Mountain, N. J., and lately exhibited in Boston. As similar observations are said to have been made in several instances, Prof. Gray was induced to examine the substance brought to him. The wood evidently consisted of branchlets of one, two and three years old, broken, quite uniformly, into bits of half an inch or so in length, with only now and then traces of the bark remaining on the wood. The wood was not at all fossilized, and was but slightly decayed. From the appearance of the branchlets examined, Prof. Gray inferred that they belonged to some coniferous tree or shrub, and probably to a kind of spruce or fir, rather than to a true pine. This inference was borne out by the examination of thin slices of the wood by the microscope. The woody fibre was very beautifully and distinctly marked with the circular discs that are characteristic of all coniferous wood. The structure agreed perfectly with that in similar branchlets of the common hemlock spruce.—*Silliman's Journal for May* 1847, p. 436.

On the Moose and Carabou, and on the American Raven. By L. Agassiz.

These species differ from the European species, according to Prof. Agassiz, who consequently has named them anew, designating the Moose (*Cervus alces*) the *C. lobatus*; the Carabou (*C. tarandus*) the *C. hastalis*; the American Raven, *C. lugubris.*—*Ibid.*

Pygorhynchus Gouldii, *a new* Echinus *from the Millstone Grit of Georgia.* By M. Bouvé.

Above conico-convex, a little more sloping posteriorly than anteriorly. Margin somewhat rounded, except near and under the anus, where, by an excavation or depression, it becomes acute. Inferior surface subcircular. Mouth situated about one-third of longitudinal diameter from the anterior margin. Apex subcentral, a little anterior, but not so much so as the mouth. Ambulacra radiating at unequal angles, the interambulacral spaces dividing the three anterior from the two posterior, being wider than the rest. The pores of each diverge considerably from the apex, becoming quite dilated a short distance from it, then converge as they descend, until about two-thirds the distance from the summit to the margin, where they are very limited in width, and where the double rows become single. On the margin they again slightly dilate, and are readily traceable to their termination about the mouth, where they are prominent. The anterior ambulacrum is much narrower than the rest. Anus transverse, and situated at about one-fifth the distance from the posterior margin to the apex. Whole length, as shown by three individuals examined, $1\frac{7}{8}$ inch; greatest width $1\frac{3}{4}$ inch; height 1 inch. Locality, Baker County, Georgia.

I have named this beautiful species after my respected friend, Dr. Augustus A. Gould.—*Ibid*, p. 437.

Pyranga roseo-gularis, *a new species from Yucatan.* By Dr. Cabot.

Male:—top of head, outer edge of primaries and secondaries, and surface of greater and lesser wing-coverts, the tail and its upper coverts, bright brownish red. Under side of tail and its under coverts, throat and flexures of wings, bright rose-colour. Back and posterior part of cheeks dark brownish ash-colour; anterior part of cheeks, breast and belly bright ash-coloured. Twelve tail-feathers. Bill strongly toothed, horn-colour at top, lighter beneath. Legs and feet horn-coloured. Total length $6\frac{1}{4}$ inches; of bill $\frac{5}{8}$ inch; along the ridge $\frac{6}{8}$; along the gape $\frac{5}{16}$ inch; across at base $\frac{3}{8}$ through from above down. Tooth situated at $\frac{1}{4}$ inch from point of bill. Tarsus rather more than $\frac{3}{4}$ inch in length. Tail $2\frac{6}{8}$ inches long. Wings from flexure $3\frac{1}{8}$ inches.—*Ibid.* p. 436.

METEOROLOGICAL OBSERVATIONS FOR JUNE 1847.

Chiswick.—June 1—3. Clear and very fine. 4. Light clouds and fine. 5. Cloudy. 6. Light clouds: clear. 7. Clear: cloudy. 8. Rain: thunder-showers. 9. Clear and fine. 10. Rain: cloudy: clear. 11, 12. Clear and very fine. 13. Rain: cloudy. 14. Densely clouded: showery. 15. Rain: thunder and heavy showers. 16. Cloudy: rain. 17, 18. Rain 19. Cloudy and fine. 20. Cloudy: slight showers. 21. Cloudy: fine. 22. Very fine. 23. Very fine: heavy showers, with thunder. 24. Cloudy and fine. 25. Rain: cloudy and fine. 26. Very fine. 27. Drizzly: cloudy and fine. 28. Fine. 29. Very fine. 30. Light clouds: very fine: overcast.

Mean temperature of the month	58°·46
Mean temperature of June 1846	66 ·63
Mean temperature of June for the last twenty years	66 ·90
Average amount of rain in June	1·88 inch.

Boston.—June 1—4. Fine. 5, 6. Cloudy. 7. Fine. 8. Fine: rain early A.M. 9. Fine. 10. Cloudy: rain early A.M.: showery all day. 11, 12. Fine. 13. Cloudy: rain early A.M. 14. Cloudy: rain early A.M.: rain P.M. 15. Fine: rain P.M. 16. Fine: rain A.M. and P.M. 17. Fine. 18. Cloudy: rain early A.M.: heavy rain P.M. 19. Cloudy: rain early A.M. 20. Cloudy: rain A.M. and P.M. 21. Cloudy: rain P.M. 22, 23. Fine: rain P.M. 24. Rain: rain P.M. 25. Fine: rain P.M. 26. Fine. 27. Cloudy. 28. Fine. 29, 30. Cloudy.—This month has been the coldest since 1843, and the wettest since June 1841.

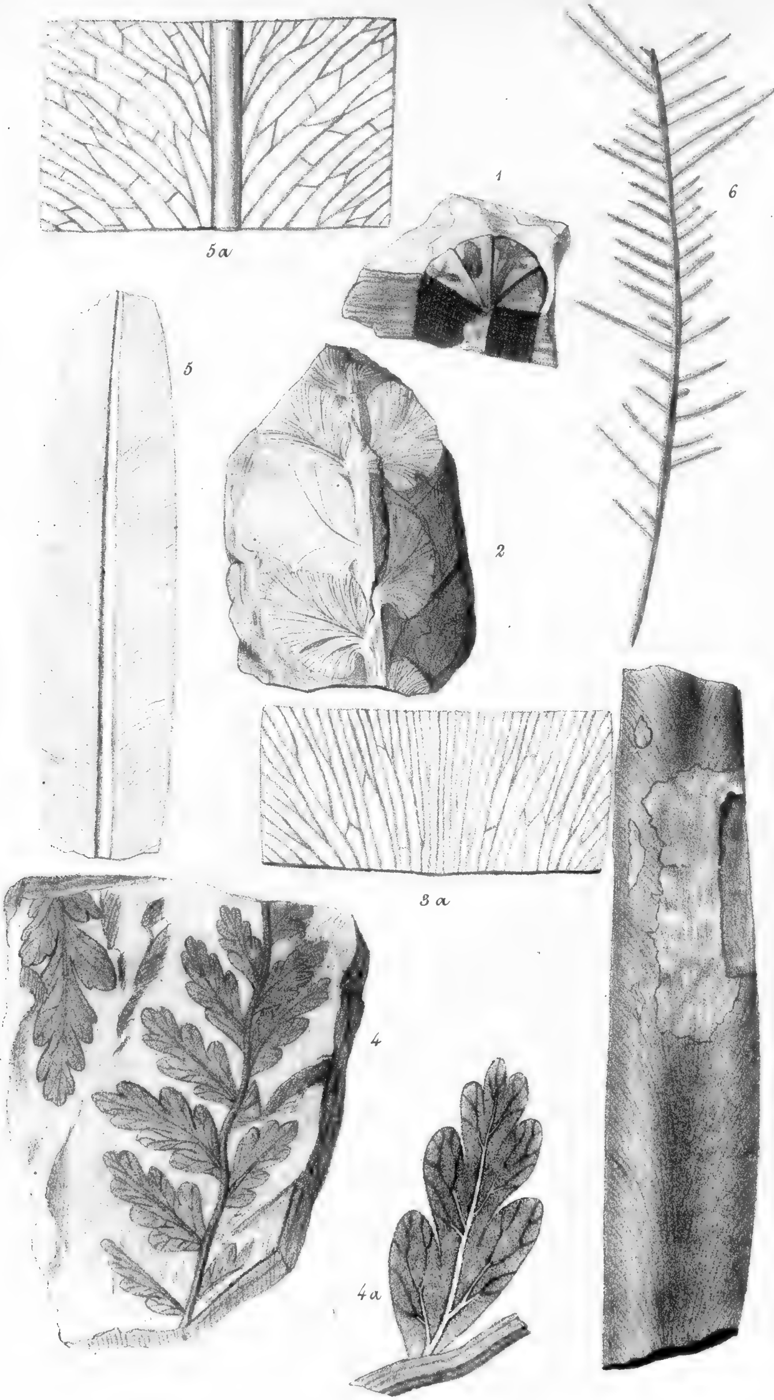
Sandwick Manse, Orkney.—June 1, 2. Clear: fine. 3. Cloudy: fog. 4. Bright: cloudy. 5. Showers: cloudy. 6. Bright: cloudy. 7. Showers. 8. Bright: drops. 9. Cloudy: rain. 10. Showers: sleet-showers. 11. Bright: cloudy. 12. Cloudy. 13. Cloudy: rain. 14. Rain: damp. 15. Cloudy: rain: cloudy. 16. Cloudy: fine. 17, 18. Bright: fine. 19. Clear: fine. 20. Bright: rain. 21. Showers: clear. 22. Bright: showers: fine. 23. Bright: showers. 24. Bright: thunder: drops. 25. Bright: thunder. 26. Clear: fine. 27. Damp. 28. Cloudy. 29. Fog: cloudy. 30. Damp: fog.

Applegarth Manse, Dumfries-shire.—June 1—3. Very fine. 4. Warm, but overcast. 5. Fair A.M.: showers P.M. 6. Fair A.M. 7. Threatening: rain P.M. 8. Slight shower. 9. Fair: thunder: rain. 10. Fair: clear. 11. Fair, but cool. 12. Cloudy: rain P.M. 13. Rain. 14. Fine: thunder: rain. 15. Drizzly: thunder. 16. Bright A.M.: rain. 17. Drizzly. 18. Fair and fine. 19. Fine: a few drops. 20. Rain P.M. 21. Wet A.M.: cleared. 22. Showery. 23. Fine, very: slight shower. 24. Showery: thunder. 25. Showers A.M.: thunder. 26. Slight shower P.M. 27. Shower A.M.: fair. 28—30. Very fine.

Mean temperature of the month	55°·2
Mean temperature of June 1846	63 ·2
Mean temperature of June for 25 years	56 ·10
Mean rain in June for 20 years...	2·32 inches.

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.
1847. June.	Max.	Min.		9 a.m.	9 p.m.	9¼ a.m.	8¾ p.m.	Max.	Min.		Max.	Min.	9¼ a.m.	8¾ p.m.								
1.	30·475	30·449	29·96	30·42	30·40	30·48	30·45	79	42	69	...	...	59	53	ne.	e.	sw.	w.	......	......	......	......
2.	30·459	30·399	29·95	30·40	30·38	30·45	30·44	78	45	69·5	...	...	54	55	ne.	e.	nw.	s.	......	......	......	......
3.	30·349	30·238	29·82	30·34	30·28	30·38	30·38	77	51	69·5	...	...	57	52	ne.	w.	nw.ne	wnw.	......	......	......	......
4.	30·244	30·222	29·77	30·30	30·29	30·40	30·32	77	50	63	...	...	53	50	ne.	ne.	e.	wnw.	......	......	......	......
5.	30·240	30·158	29·78	30·24	30·09	30·18	30·18	65	48	61	...	...	48	47½	ne.	ne.	nw.	n.	·01	......	......	·12
☾ 6.	30·073	30·046	29·62	30·09	30·00	30·12	30·04	64	36	59	...	...	47	48	n.	n.	wnw.	wnw.	......	......	......	......
7.	30·108	29·989	29·66	29·99	29·80	29·83	29·59	70	49	57	...	...	49	47	ne.	nnw.	nw.	sw.	·02	......	......	·04
8.	29·835	29·743	29·34	29·62	29·71	29·72	29·83	63	39	54	59	42	49	48	nw.	calm	nw.	n.	·06	·20	0·10	·16
9.	29·865	29·767	29·43	29·80	29·67	29·86	29·59	64	48	55	60	37	50½	48	n.	nw.	sw.	se.	·05	......	......	·03
10.	29·854	29·676	29·24	29·58	29·79	29·63	29·75	60	42	54	58	47½	49	46	nw.	w.	nw.	nw.	·02	·13	......	·30
11.	30·017	29·960	29·50	29·84	29·88	29·82	29·87	67	41	55·5	56½	42	52	49	w.	nw.	w.	w.	·03	·45	......	·09
12.	29·971	29·845	29·54	29·80	29·61	29·80	29·60	74	52	62	58	46	56	51	sw.	calm	sw.	sse.	·24	......	......	......
● 13.	29·778	29·593	29·29	29·50	29·30	29·50	29·34	64	54	60	56	51	50	51	sw.	s.	wsw.	ese.	·03	·11	......	·03
14.	30·068	29·509	29·12	29·30	29·32	29·37	29·43	67	47	61	59	49	50	51	sw.	w.	sw.	sse.	·24	·03	......	·56
15.	29·721	29·509	29·08	29·25	29·47	29·44	29·45	62	44	60	52	46	52½	49½	sw.	w.	sw.	se.	·18	·11	1·60	·15
16.	29·758	29·566	29·32	29·50	29·40	29·60	29·68	60	45	63	60½	42	53	54	sw.	calm	s.–se.	......	·10	·08	......	·70
17.	29·590	29·576	29·19	29·45	29·58	29·73	29·81	70	51	66	55	50	53	53½	sw.	calm	ne.	n.	·03	·14	......	......
18.	29·792	29·618	29·23	29·65	29·72	29·86	29·90	64	48	59·5	62½	50	56½	52	n.	e.	nnw.	......	·09	·41	......	......
19.	29·965	29·879	29·38	29·78	29·80	29·93	29·89	72	47	58	65	48	56½	55	nw.	w.	nw.	......	·01	·64	......	......
☽ 20.	29·954	29·872	29·44	29·75	29·56	29·76	29·58	67	52	59	61	50	51½	50	sw.	w.	sw.	ese.	·01	·04	......	......
21.	29·800	29·740	29·32	29·49	29·50	29·40	29·49	67	46	61	59	50	54½	50	sw.	sw.	sw.	w.	......	·01	......	·37
22.	29·717	29·637	29·18	29·42	29·39	29·43	29·34	70	41	63·5	57	49	56	52	sw.	wsw.	sw.	......	......	·04	......	......
23.	29·646	29·633	29·18	29·40	29·41	29·38	29·50	67	48	64	61	45	54	55	sw.	wsw.	s.	se.	·36	·10	0·40	·15
24.	29·623	29·580	29·14	29·37	29·32	29·43	29·42	68	52	61	59½	47	54½	52½	sw.	calm	sw.	se.	·02	·16	......	·02
25.	29·835	29·643	29·20	29·42	29·62	29·50	29·62	70	48	62	61½	50½	54	55	sw.	sw-w.	nw.w.	......	·06	·04	......	......
26.	30·192	30·014	29·49	29·82	29·99	29·88	30·01	71	50	65	63	44	56½	60½	sw.	calm	sw.	......	·01	·16	......	......
27.	30·260	30·240	29·72	30·09	30·18	30·07	30·17	76	53	62	67	53	61	56½	sw.	calm	sw.	w.	·01	......	......	......
○ 28.	30·265	30·248	29·79	30·25	30·28	30·24	30·34	76	54	65	73	53½	60½	56	ne.	nw.	w.	w.	......	......	......	......
29.	30·267	30·252	29·80	30·29	30·30	30·39	30·42	75	55	61	74	68½	58	55½	ne.	calm	ese.	nw.	......	......	......	......
30.	30·272	30·224	29·80	30·30	30·29	30·40	30·39	72	54	62	73	52	56	51	ne.	ne.	ne.	wnw.	......	......	0·22	......
Mean.	29·999	29·894	29·47	29·831	29·811	29·866	29·860	69·20	47·73	61·3	62·0	48·0	53·66	51·81					1·58	2·85	2·32	2·72



Frederick M^{c} Coy del^{t} W. Wing lith.

Hullmandel & Walton's new Process.

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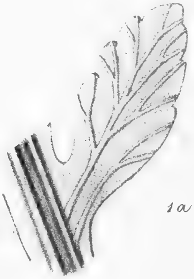

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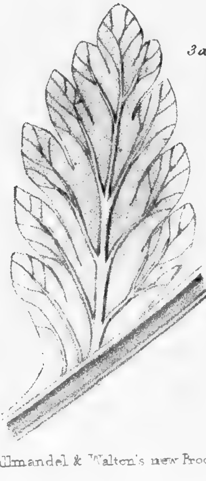

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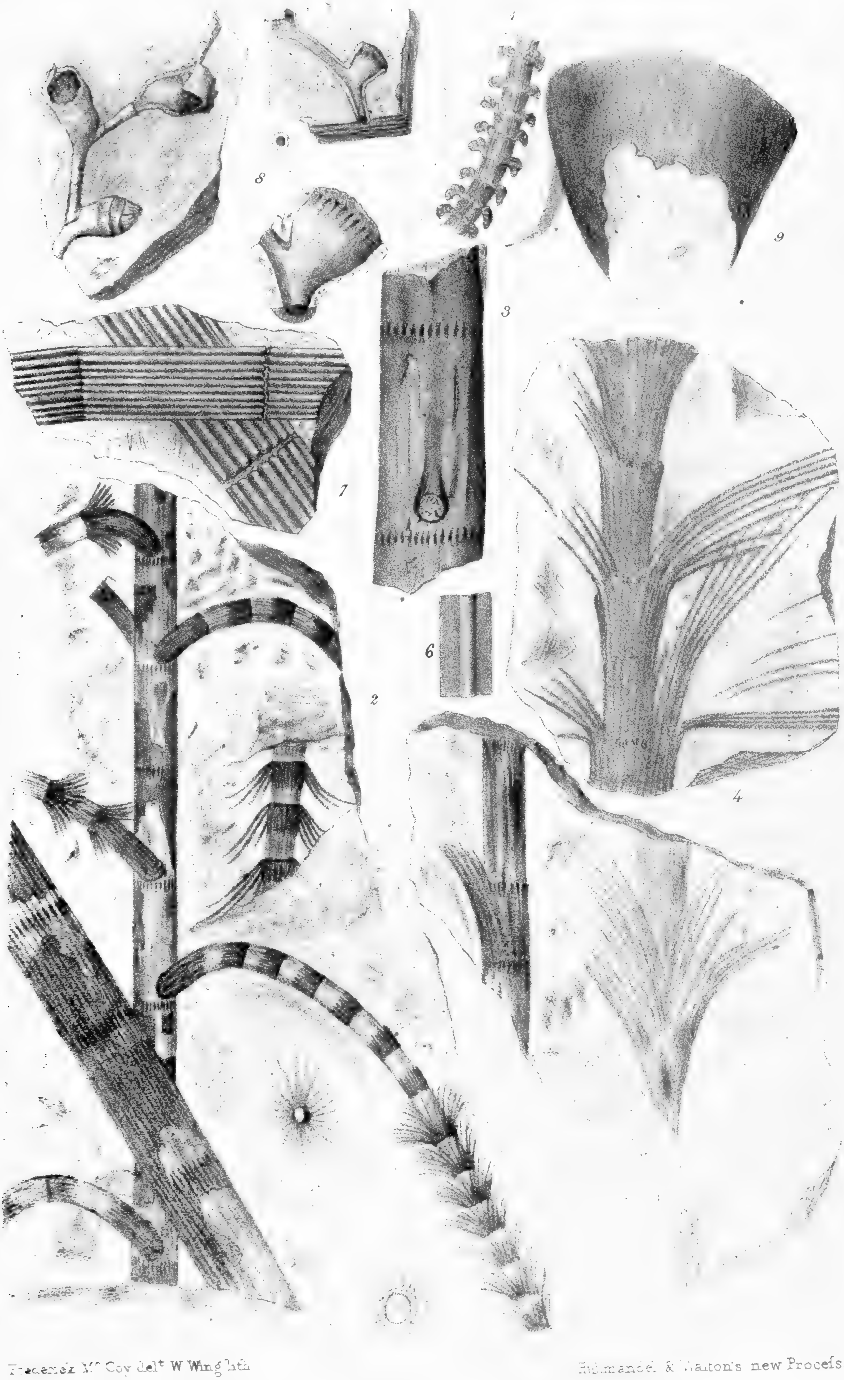

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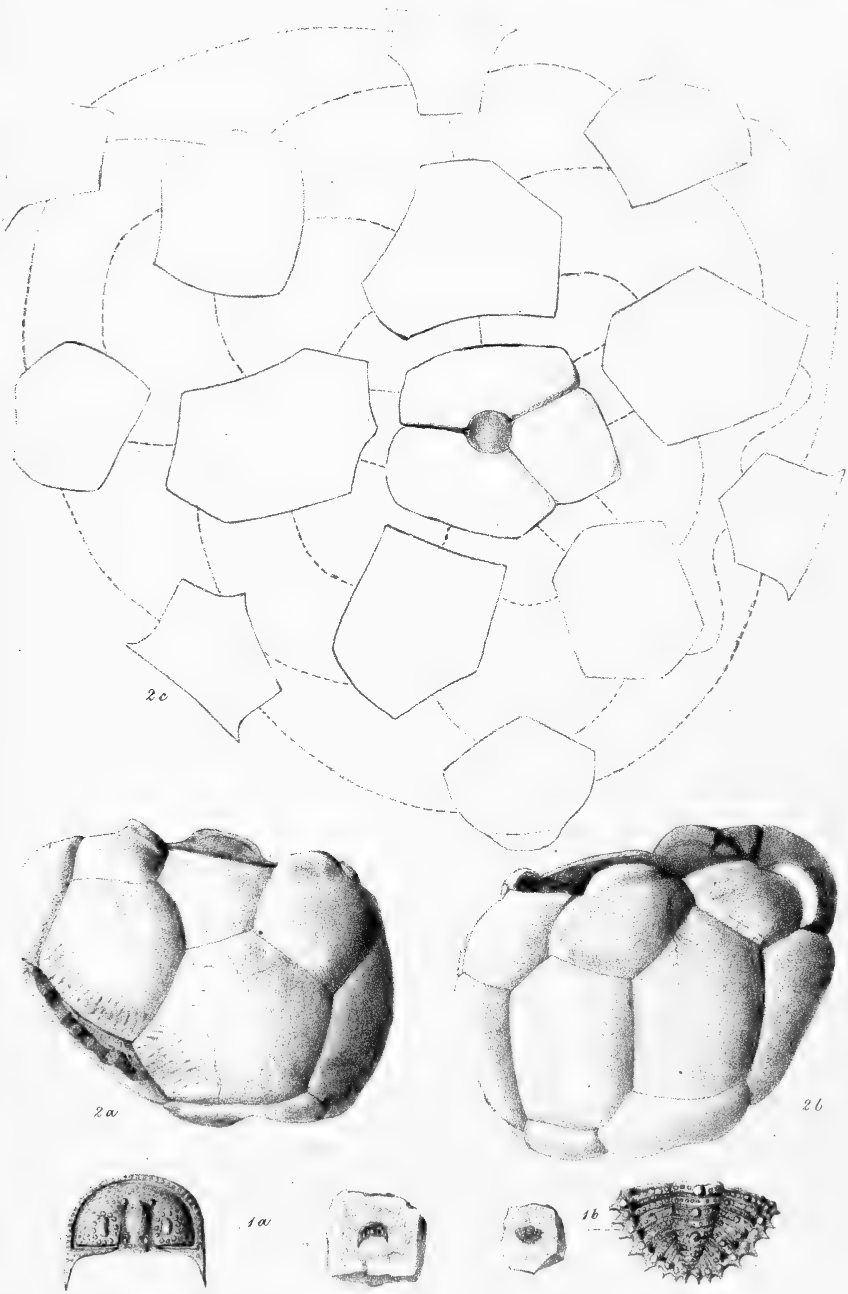

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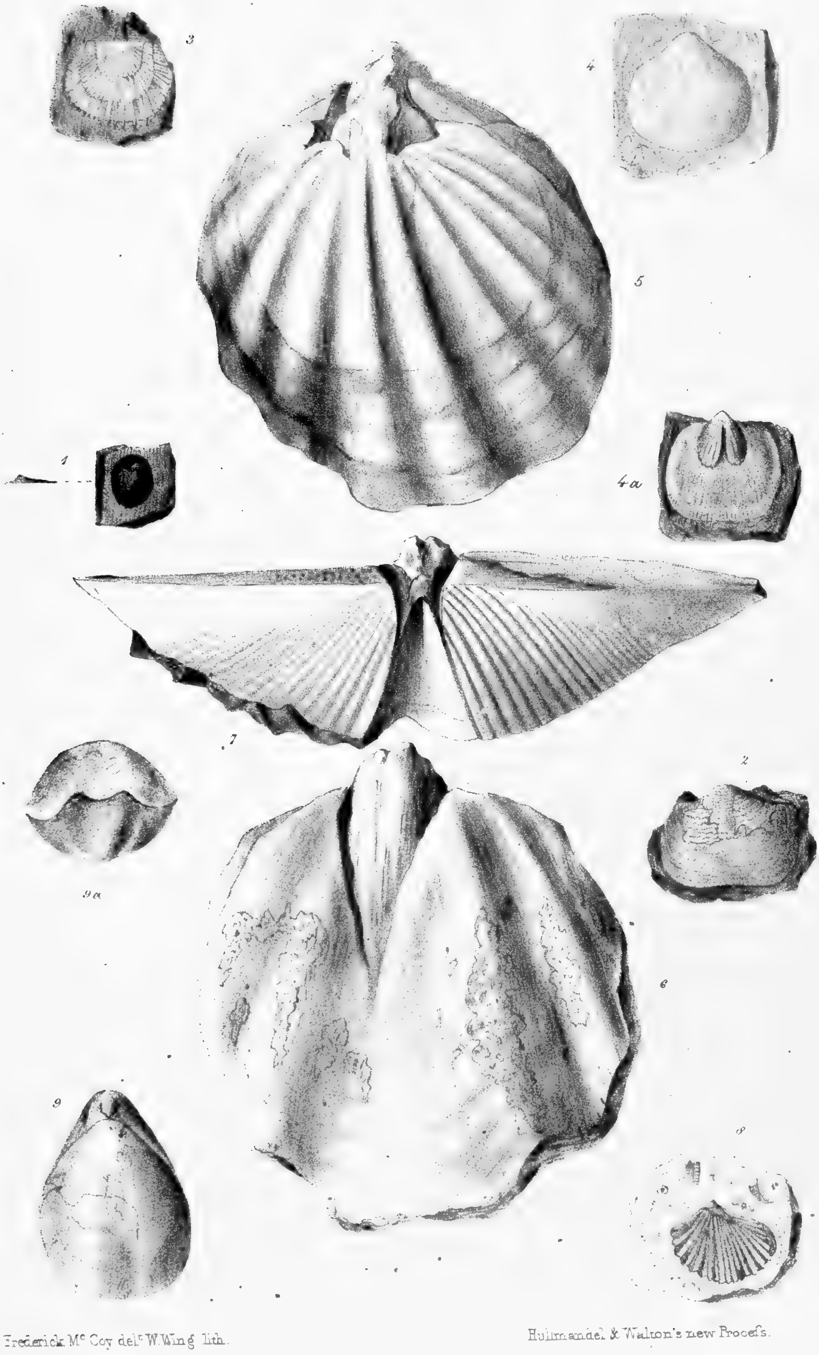

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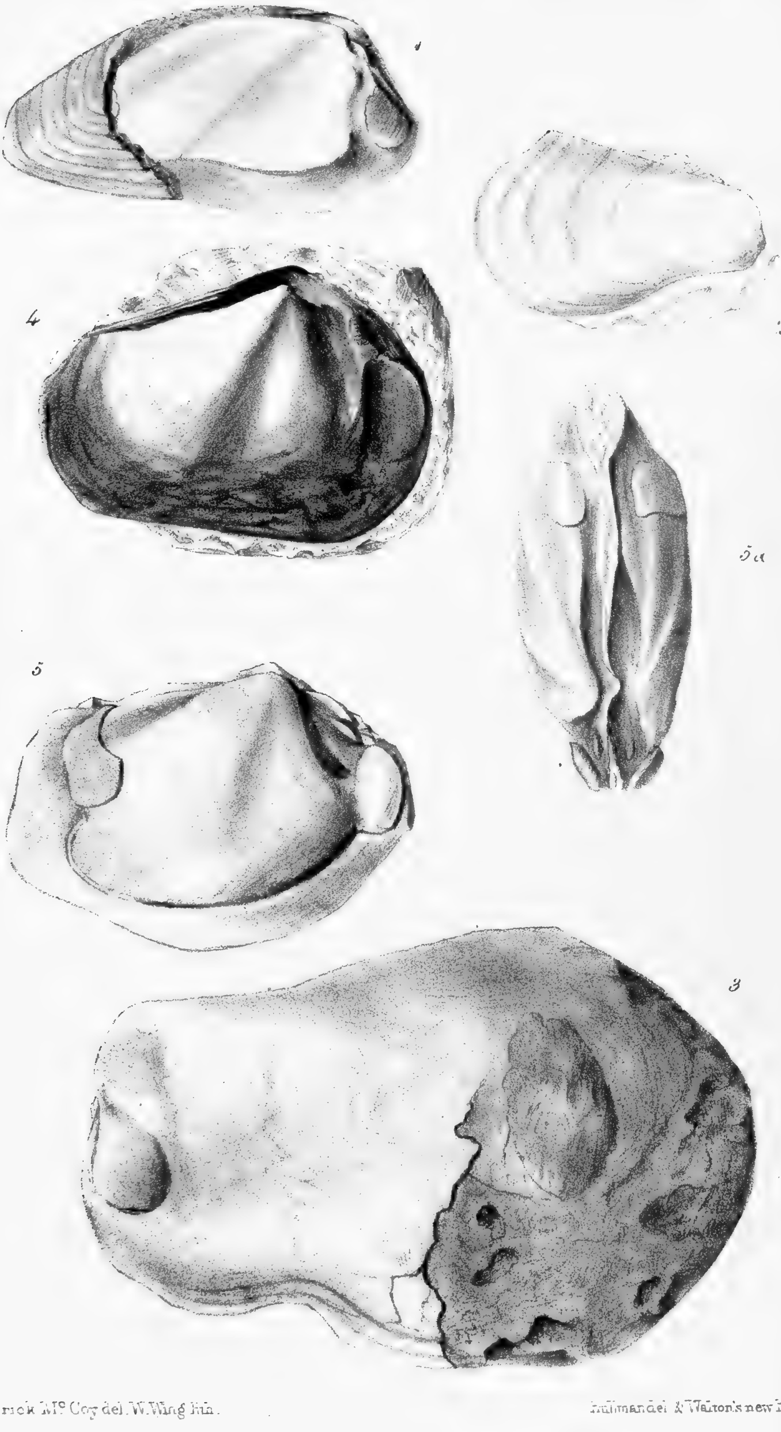

Frederick M^c Coy del. W. Wing lith.

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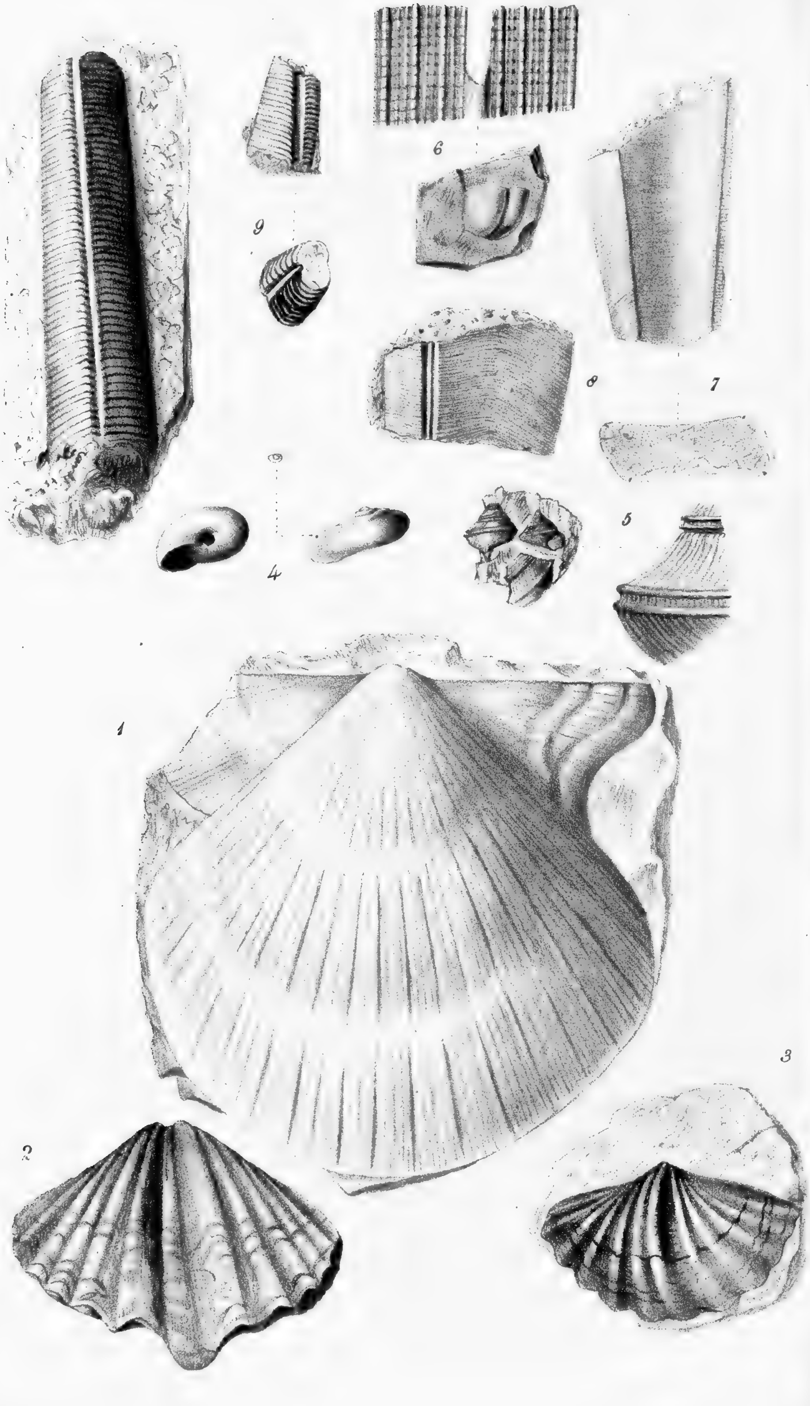
Frederick M'Coy del. W. Wing Lith.

Hullmandel & Walton's new Process



M'Coy del. W.Wing lith.   del. & Walton's new Process.

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XV.—*On the Fossil Botany and Zoology of the Rocks associated with the Coal of Australia.* By Frederick M'Coy, M.G.S. & N.H.S.D. &c.

[With nine Plates.]

The following paper has been drawn up from an examination of specimens collected by the Rev. W. B. Clark and sent to the Rev. Prof. Sedgwick, who kindly allowed the writer to make this use of them.

The species will be first noticed, and the new forms described, after which some observations will be offered on the relative ages of the Australian coal-fields, from a comparison of their organic remains with each other, and with those of other countries; premising that the extent of our materials enables this to be attempted in a more extended and precise manner than heretofore, and that several of the new forms described are calculated to throw much light on the fossils of our own country.

In this first part of my paper I wish to express my obligations to the Rev. Prof. Henslow and Mr. Babington for the kindness with which they allowed me the use of their herbaria on all occasions when I found it necessary to work out for myself points of structure in recent plants, neglected by botanists and omitted in their works, but which are of the highest importance in the investigation of fossil plants. To the facilities afforded by the former for my examination of the New Holland plants growing in the houses of the Cambridge Botanic Garden, I am mainly indebted for the maturing my views of the affinities of the genus *Phyllotheca*.

PLANTÆ.

Class Acrogens. (*Al. Lycopodales.*)

Ord. Marsileaceæ (?).

Vertebraria (Royle).

This genus has been proposed by Prof. Royle in his 'Illustrations of the Botany of the Himalaya Mountains' for two species of fossil plants from the supposed oolitic coal-field of Burdwan, but without any description or definition. Similar bodies are not uncommon in the shales and clays of the Australian coal-fields; but although the genus is noticed by Unger in his 'Conspectus Floræ Primordialis,' and Mr. Morris has noticed its occurrence in this district, no botanist has as yet given any descriptive account either of the genus or species; and so obscure are the relations to other forms, that doubts have even arisen as to what part of the plant the radiated cylindrical fossils might be supposed to represent, and how its parts should be named. A distinguished botanist has suggested to me that the cylindrical fossil might be considered a stem, the axis being the pith, the radiating divisional lines the medullary rays, and the intervening cuneiform masses the wedges of wood. I have carefully considered this opinion, but find it impossible to adopt it, from the ease with which the transverse fractures take place, and the perfection of the surfaces produced, as it is obvious that such numerous and perfect divisional planes, as we observe at right angles to the axis, would be incompatible with the above view. On the whole, after a careful study of the specimens at my disposal, I feel disposed to view the genus as closely allied to *Sphenophyllum*, in which we have a jointed stem surrounded by verticillate whorls of from six to twelve wedge-shaped leaves with dichotomous veins; and in this light *Vertebraria* becomes intelligible, for I have clearly ascertained the existence of the dichotomous neuration on each of the wedge-shaped divisions of the transverse planes, which will, according to this view, represent the surface of a whorl of verticillate leaves, and we may consider therefore the main difference between *Sphenophyllum* and *Vertebraria* to consist in the greater approximation of the whorls of leaves in the latter, the internodes being so very short that the whorls of leaves are brought in contact, or nearly so. I might therefore provisionally characterize the genus as follows:—

Gen. Char. Stem slender, surrounded by densely aggregated whorls of verticillate, cuneiform leaves, having a dichotomous neuration.

To the above we might add, that the number of leaves in a whorl depends on the species, and that from the whorls being so close as nearly to touch each other, the fossils have the appearance of lengthened cylinders, breaking readily in a horizontal and vertical direction—the former coinciding with the surfaces of the leaves, the latter coinciding with the vertical prolongations of the lines separating the leaves of each whorl—the former producible in indefinite number at distances of about a line from each other, the latter having only a small definite number depending on the number of leaves in a whorl. The leaves themselves are flat, rather thick, dilated at the tip in such proportion that there is no space left between the edges of the adjacent leaves.

It is very possible that together with *Sphenophyllum* these may have been freshwater aquatic plants allied to the recent *Marsilea,* in which we see a quaternary arrangement of cuneiform leaves with dichotomous veins, but the affinity is not very strong. The Australian species seems distinct from either of those occurring in the Indian beds by the smaller number of leaves in the whorl, which is perfectly constant in all the examples I have seen. I would propose to name and characterize our species as follows:—

Vertebraria australis (M'Coy). Pl. IX. fig. 1.

Sp. Char. Leaves constantly eight in each whorl.

The fragments are of various lengths, but with a pretty uniform diameter of about seven lines. The radiating dichotomous veins are never strongly marked, apparently from the original softness of the texture of the leaf; in many cases we observe between them an obsolete concentric plication, probably from the same cause, and which may explain the nature of certain vertical striæ visible on the perpendicular fracture, crossing the horizontal lines which mark the edges of the leaves.

This species is abundant in the whitish shales and clays of Mulubimba, N. S. Wales.

(*Al. Filices.*)

Ord. Gleicheniaceæ.

Gleichenites odontopteroides (Mor.) sp.

Syn. *Pecopteris odontopteroides* (Mor.) in Strzelecki's N. S. Wales.

Having obtained a finely preserved frond of this plant distinctly forked in the manner of *Gleichenia,* I have removed it from *Pecopteris,* in which it was placed by Mr. Morris, and transferred it to the order *Gleicheniaceæ* without hesitation; and taking the verbal characters of Göppert's genus *Gleichenites*—"Frons dichotoma pinnata. Fructificatio hucusque ignota,"—I think there can be no objection to placing it in that genus, although very distinct from his two species *G. artemisiæfolius* and *G. critmifolius.* I might also suggest its relation to the Lias and Keuper genus *Heptacarpus,* with some of the German species of which it generically coincides.

In the sandstone of Clark's Hill, N. S. Wales.

Ord. Neuropterides.

Odontopteris microphylla (M'Coy). Not figured.

Sp. Char. Bipinnate; pinnæ alternate, oblique, narrow, about three lines wide and two inches long; pinnules alternate, oblique, slightly connate at the base, obtusely elliptical, their length only equalling the width of their base; no midrib, secondary neuration indistinct.

The only *Odontopteris* approaching this elegant species by its alternate pinnæ and very short connected pinnules is the *O. Schlotheimii* (Br.), from which it is distinguished by the smaller size, much narrower and more oblique pinnæ, and by the pinnules being proportionally smaller and elliptical instead of broadly rounded. The latter character also separates it from the so-called *Pecopteris Desnoyersii* (Br.) of the 'Oolithe à Fougères' of Mamers, Sarthe.

Common in the fine sandstone of Clark's Hill, N. S. Wales.

Otopteris, Lind. and Hut.

With Messrs. Lindley and Hutton I use this term for those pinnated plants, the leaves of which agree with *Cyclopteris* in their neuration. Some of these forms were originally described by Lindley and Hutton (Fossil Flora) as *Cyclopteris*, under the impression that the rachis was a rhizoma; Brongniart (Prodrome and Hist. des Végétaux Foss.) gives several of them as *Neuropteris*, apparently neglecting the important character of want of midrib. Göppert confounds both the simple and compound fronds in his *Adiantites* (Syst. Fil. Foss. in Nova Acta Acad. Cæs. Leop. Cur. Nat.), and Unger does the same under the head *Cyclopteris* (Chloris Protogæa). I have however thought it desirable to use the term for the pinnate species for which it was proposed, and thus retain *Cyclopteris* for the simple, entire fronds, in accordance with the original view of Brongniart.

Otopteris ovata (M'Coy). Pl. IX. fig. 2.

Sp. Char. Frond pinnate; rachis very thick, slightly flexuous; leaflets little longer than wide, ovate, pointed; upper lobe of the base nearly twice the size of the under, the contracted, thickened base set obliquely on the rachis; veins fine, divaricating, very frequently dichotomizing, nearly equal, but fasciculated at the base.

The fasciculation of the nerves at the base resembles that of the *Cyclopteris flabellata*. The regular, short, semi-elliptical form of the leaflets distinguishes this from the other species of the genus. The average length of the leaflets in the examples I have seen is about 8 lines, width 7 lines, width of rachis $1\frac{1}{2}$ line. Occurs in the hard siliceous flags of Arowa, N. S. Wales.

Cyclopteris angustifolia (M'Coy). Pl. IX. fig. 3 & 3 *a*.

Sp. Char. Leaf linear, lanceolate, eight or nine times longer than wide; sides straight, nearly parallel, pointed above, contracted to a lengthened petiole below; nerves equal, those of the middle third of the frond nearly parallel, straight, rather closer than those of the sides, which gradually divaricate towards the margin at a very acute angle; all the nerves dichotomise at irregular intervals, and those of the sides occasionally anastomose and are connected by a few transverse bars.

In this curious plant we have, as it were, a connecting link between the genera *Cyclopteris* and *Glossopteris*, for although the specimen I have drawn only exhibits the middle portion of the frond, yet I have ascertained that the form is precisely that of a narrow *Glossopteris*, being elliptical or pointed at the apex, and tapering gradually to a lengthened petiole at the base, and still further agreeing in the occasional anastomosing of the lateral veins, and their being connected, though rarely, by transverse bars; yet it is impossible to refer it to that genus from the want of the strong, characteristic midrib, the place of which is occupied by numerous dichotomous nerves of nearly the same thickness as those of the sides; I am therefore obliged to refer it to *Cyclopteris* from a consideration of its more important characters, although differing remarkably in form from the other species of the genus as above restricted. The portion figured, of the middle of a frond, measuring $3\frac{1}{2}$ inches in length, and 9 lines wide at the base, only tapers 2 lines.

This species seems common in the gray shale of Guntawang, Mudgee, N. S. Wales.

Ord. Sphenopterides.

Sphenopteris lobifolia (Mor.).

Common in dark brown shale, Mulubimba, N. S. Wales.

Sphenopteris alata (Br.) sp.

Of large size in the fine gray sandstone of Mulubimba, N.S.W.

Sphenopteris hastata (M'Coy). Pl. X. figs. 1 & 1 *a*.

Sp. Char. Bipinnate; pinnæ long, acutely lanceolate, with a broad alate margin; pinnules elliptical, obscurely undulato-dentate, having three obsolete lobes on each side; nerves bipinnate, two branches reaching each lobe of the margin.

The lengthened oval form, slightly indented margin, and simple neuration of the pinnules fully distinguish this from any published species of the genus. The average length of the pinnæ is about $1\frac{1}{2}$ inch, width 4 lines, average length of leaflets 3 lines.

Not uncommon in the shale of Mulubimba, N. S. Wales.

Sphenopteris germanus (M'Coy). Pl. X. figs. 2 & 2 *a*.

Sp. Char. Bipinnate; pinnæ oblique, alternate elongate, ovate, with a narrow membranous margin; pinnules oval, deeply pinnatifid; lobes very oblique, elliptical, generally three on each side, and the apex of the pinnules three-lobed; nerves bipinnate, three branches reaching the margin of each lobe.

It is extremely difficult to distinguish this species from the *Pecopteris Murrayana* of the Yorkshire oolitic coal-fields, with which it is nearly identical in form and neuration. The oval outline of the pinnules is the most obvious character, contrasting with the trigonal, wide-based leaflets of the English plant; this, together with their more oblique setting on the rachis, more oblique, narrow and deeply-cleft lobes, and the decurrent, narrow, alate margin to the straight rachis, will I think be sufficient to distinguish the species.

In the shale of Mulubimba, N. S. Wales.

Sphenopteris plumosa (M'Coy). Pl. X. figs. 3 & 3 *a*.

Sp. Char. Bipinnate; pinnæ curved, elongate, narrow, plumose, with a scarcely alate margin to the rachis; pinnules close, oblique, ovate, pointed, deeply cleft into about four oblique mucronate lobes on each side, exclusive of the largely trilobed apex; nerves strong, much-branched, so that about six branches reach the margin of each of the lobes of the lower side, and seven to each of those of the upper margin.

The number of lobes of the leaflets and complexity of the neuration will readily distinguish this species. The average length of the leaflets 5 lines.

Rare in the shale of Mulubimba, N. S. Wales.

Sphenopteris flexuosa (M'Coy). Pl. IX. figs. 4 & 4 *a*.

Sp. Char. Bipinnate; pinnæ very long, with a strongly flexuous naked rachis; pinnules large, moderately oblique, unequal, ovate, sides cut into two very large obtusely rounded lobes on each side; apex trilobed; nerves strong, much-branched, seven branches reaching the margin of each lateral lobe, and three going into each of the three lobes of the apex.

This strongly-marked species is not sufficiently allied to any published form to render a comparison necessary. The average length of the leaflets is about 8 lines, width 4 lines.

In a brown bed of clay, Mulubimba, N. S. Wales.

Ord. Pecopterides.

Glossopteris Browniana (Br.).

I think I recognise both the Indian and Australian forms of this species (vars. *a.* and *β.* of Brongniart) in nearly equal abundance among the specimens examined, and some of the fronds are of a size far exceeding any hitherto published, some of them being six inches wide, which in the proportion of the small, perfect examples would indicate a frond of more than two feet in length. I believe I have ascertained the rhizoma of this species, which is furnished with ovate, clasping (or at least very convex) subcarinate scales, having a divaricating reticulated neuration, resembling that of the perfect frond, but much less strongly marked; these scales are of large size, some of them being nearly an inch in length, and terminating at the apex in a long flat linear appendage, about one line in width, which occasionally gives off small, lateral, flat, membranous branches nearly at right angles; the whole perfectly resembling (except in size) the rhizomal scales of *Acrostichium, Laromanes* and *Hymenodium,* as figured by M. A. Fée in his beautiful 'Mémoire sur la Fam. des Fougères,' and when combined with the great similarity in form, habit and neuration, would warrant us in presuming a strong affinity to exist between these genera.

Abundant in the soft reddish shales of Jerry's Plains, and also in the black shales and white clay beds of Mulubimba, N. S. W.

Glossopteris linearis (M'Coy). Pl. IX. figs. 5 & 5 *a.*

Sp. Char. Leaves very long, narrow, with nearly parallel sides; midrib very large; secondary veins fine, forming an angle of about 50° with the midrib, anastomosing occasionally from the midrib to the margin.

It is only with the *Glossopteris angustifolia* (Br.) from the Indian coal-fields of Rana-Gunge, near Rajemahl, that this long, parallel-sided frond could be confounded, and it is distinguished easily from that species by the fineness of the neuration, which is as remarkably delicate as that of the other is coarse; the neuration of the *G. angustifolia* is also distinguished by its great obliquity, forming an angle of about 30° with the midrib, while the nerving of the present species is not more oblique than that of the *G. Browniana* or *G. Nilsoniana.* In this species also, from the anastomosing being continued up to the margin, it results that the nerves are little closer at the margin than at the middle of the leaf, while in the *G. angustifolia* the anastomosing is confined to the central portion, and the dichotomising goes on to the margin, where in consequence the neuration is finer and closer than towards the midrib. None of the specimens are perfect at the extremities, the largest being three inches long and seven lines wide at the basal fracture, and diminishing about two lines in that length towards the distal end, being about eight lines wide in the middle. Disconnected fragments show that the base diminishes insensibly to a lengthened petiole, as in the *G. Browniana,* and that the apex is elliptical and pointed.

Very abundant in the gray shale of Wollongong; not uncommon in the hard siliceous schists of Arowa, N. S. Wales.

Pecopteris ? *tenuifolia* (M'Coy). Pl. IX. fig. 6.

Sp. Char. Bipinnatifid (?); pinnules and rachis very slender, each about half a line wide; pinnules very long, oblique, linear, apparently simply united to the rachis by their entire base, one very strong midrib running throughout; secondary nerves unknown.

If this be truly a *Pecopteris,* it is distinct from all others by its very narrow, linear leaflets. The only plant I have seen at all resembling it is the *Zamites obtusifolius* from the shale of the oolitic coal-fields of Blackheath, Richmond, United States, exhibited some weeks since by Mr. Lyell to the Geological Society. The specimens alluded to of this latter plant seem imperfectly preserved, but still show, on some portions of the pinnules, a neuration running parallel with a strong midrib. This great midrib seems to me incompatible with *Zamites,* so that although I point to the resemblance between the American and Australian plants, I prefer placing the latter provisionally in *Pecopteris,* as I have seen no trace in my imperfectly preserved specimens of a parallel neuration; and even if it should hereafter be found to exist, I conceive it would be necessary to form a new genus, intermediate in form, neuration, and (I think) mode of attachment of the pinnules to the rachis, between *Zamites* and *Pecopteris,* for the reception of those two plants.

One specimen has occurred in the fine sandstone of Clark's Hill, N. S. Wales.

Class Endogens. (*Al. Palmales.*)

Ord. Palmaceæ.

Zeugophyllites elongatus (Mor.).

Common in the shales of Mulubimba, N. S. Wales.

Class Exogens. (*Al. Amentales.*)

Ord. Casuarinaceæ (?).

Phyllotheca (Br.).

M. Brongniart, in his 'Prodrome,' founds this genus for a single species, the *P. australis,* of which he mentions having a large number of well-preserved specimens, which he describes as "des tiges simples, droites, articulées, entourées de distance en distance par des gaînes appliquées contre cette tige, comme dans les *Equisetum,* mais terminées par de longues feuilles linéaires, qui remplacent les dents courtes des gaînes des Prêles. Ces feuilles sont, ou dressées, ou plus souvent étalées, et même réfléchies ; elles sont linéaires, aiguës, sans nervure distincte, au moins deux fois plus longues que la gaîne. Les gaînes elles-mêmes présentent de légers sillons longitudinaux, qui disparaissent vèrs la base, et qui semblent correspondre à l'intervalle des feuilles, comme les sillons des gaînes des *Equisetum* correspondent à l'intervalle des dents. La tige, dans l'espace qui sépare les gaînes, paroît lisse; mais sur des fragmens de tiges un peu plus grosses, qui appartiennent probablement à des individus plus âgés, de la même plante, on voit des stries régulières, presque comme sur les Calamites." While, on the other hand, Messrs. Lindley and Hutton in their 'Fossil Flora' (article *Hippurites gigantea*) state, that having examined specimens communicated by Dr. Buckland (from whom also Brongniart received his), they found Brongniart's description inaccurate, and that the leaves, instead of springing from the edge of the sheath, arise immediately from the stem, and having in addition to the whorl of distinct leaves "a sheath originating within them and closely embracing the stem, to which it gives the appearance of the barren shoots of an *Equisetum,* with its whorls of slender branches on the outside of a toothed sheath." Unger, in his 'Chloris Protogæa,' referring both to Brongniart and Lindley and Hutton, defines the plant as "Caulis simplex, rectus, articulatus vaginatusque. Folia verticillata linearia, enervia contracta v. expansa, vaginas articulorum strictas circumdantia." Mr. Morris, I believe the latest writer on this plant, closely follows Brongniart in his observations on its structure.

I have now stated what I believe to be all the published information regarding this very interesting form, and as it has not been hitherto figured, and the published accounts are contradictory among themselves, and none of them as I find strictly applicable to the plant, it may be interesting to detail some of the observations I have been enabled to make on those specimens which have come under my notice.

I find in the whitish clay beds of Mulubimba a profusion of plants having cylindrical jointed stems, the joints surrounded by sheaths, and the free edge of each sheath terminating in a whorl of long, linear leaves. Here we have all the essential characters of *Phyllotheca,* but beyond this there is no agreement with the descriptions of those few botanists who have seen the plant. And here I may be permitted to state, that from the number of specimens which I have examined with great care, there remains not a doubt on my mind of the accuracy of M. Brongniart's view of the relation of the whorls of leaves to the sheaths: I have traced them distinctly in every instance as arising from the free edge of the sheath, and lying either straight, inclining obliquely outwards, or, as is most commonly the case, completely reflexed, as I have represented in the drawing Pl. XI. fig. 2: and their occurrence in this position may have deceived Messrs. Lindley and Hutton as to their real connexion with the sheaths; for when the long slender leaves are completely reflexed and pressed in a reversed position against the sheaths, broken specimens may easily have their inferior mistaken for their superior extremities; and if when in this position the leaves be supposed to point upwards, they will really have the appearance of originating as an independent whorl of leaves *outside of the base of the sheath*, as described in the 'Fossil Flora.' This double arrangement would be so anomalous, that it is the more important to have the means of ascertaining the true relation of those parts in accordance with Brongniart's original view.

Brongniart describes the stem as smooth, and I find the specimens before me apparently divisible into two groups, one having the stem smooth, the other having it coarsely sulcated longitudinally, as in *Calamites*. All the botanists alluded to agree in describing the stem of *Phyllotheca australis* as simple;—*all the sulcated stems* I have seen are simple, but a number of the smooth or slightly striated stems are distinctly branched, and in a manner quite distinct from *Equisetum*. In *Equisetum*, if we view with most botanists the sheaths as produced by the mere lateral union of the leaves, and thus representing the foliage of other plants, we have the extraordinary character of the branches arising, not as axillary buds originating immediately above and within the base of the leaves, but originating *below* the joints and external to the sheaths. This is not the case with the fossil before us, in which the branches originate directly over the joints, and are therefore within and axillary to the sheaths, which may thus, with their appendages, be considered as true leaves, and having the same relation to the branches as in ordinary plants. This character is of such importance, that the resemblance of *Phyllotheca* to *Equisetum* is proved by it to be of the most trifling nature, and that there can be no real affinity between them. On the other hand, when compared with *Casuarina*, the affinity seems to me to be exceedingly strong, although botanists have not, I believe, hitherto so considered it. The *Casuarinæ* are exogenous weeping trees, with slender cylindrical branches, their shoots regularly jointed, longitudinally sulcated, and surrounded at the joints with toothed sheaths as in *Equisetum*; while the branches originate either in a verticillate or irregular manner immediately above the joints and within the sheaths, showing a perfect agreement with the above-mentioned *Phyllotheca*. But a still more interesting and important proof of the relation of those plants to *Casuarina*, and removing them still farther from *Equisetum*, is to be found in their mode of inflorescence, of which I have fortunately noticed a fragment among the specimens at my disposal. The specimen alluded to is a portion of a branch (see Pl. XI. fig. 1) with the joints more approximate than on other parts of the plant, their length being scarcely equal to their diameter; the sheaths are the exact length of the internodes, and fringed on their upper margin with a dense little whorl of (I think two-celled) anthers, agreeing very closely with *the male flowers* of *Casuarina stricta* and allied species, with which (being in flower at this time in the houses of the Cambridge Botanic Garden) I have been enabled to compare it as advantageously as the state of preservation of the fossil would allow. The fructification of *Equisetum* is entirely different, forming a dilated, club-shaped mass at the end of the branches or at the extremity of a particular stem. The *Phyllotheca australis* is described as having the sheaths closely applied to the stem, the leafy appendages twice the length of the sheaths, without midribs, and having the naked portion of the stem between the sheaths smooth. Of the two species which I have seen this would best agree with the branched one, which however has a midrib, although not a very prominent one. The species which agrees with the definition in being simple-stemmed, differs in having the sheaths very loose or infundibuliform, and so long as to extend the entire way from one joint to the next, so as to leave no bare space of the stem visible; the leaves are very long and have a strong prominent midrib, and the stem when deprived of the sheaths is seen to be always coarsely sulcated. Under these circumstances the obvious course seems to be to modify the definition of the genus so as to include the two species under consideration, and to characterize them as distinct species. If the supposed affinity with *Equisetum* were borne out, I should probably have considered the loose-sheathed, simple-stemmed plant as the fertile shoot, and the branched stems with small tight sheaths as the barren shoots, following the analogy of some of our best-known recent species of *Equisetum*; but having seen that they are constructed in an essentially different manner, we cannot do better than as I have proposed. I may then briefly characterize the genus and species as follows:—

Phyllotheca.

Gen. Char. Stem slender, jointed, simple or branched; branches springing from above the joints, not arranged in the same plane; surface smooth or longitudinally sulcated; articulations surrounded by sheaths, the free edge of which terminates in long narrow leaves, having a more or less distinct midrib. Inflorescence arranged in whorls near the extremity of certain branches.

I have only to add to the above characters, that the ridges of the sulcated stems do not alternate at the joints in the regular manner of *Calamites,* nor is there any trace of the peculiar tubercles so generally seen in that genus (an additional proof, if such were wanting, that Brongniart's original explanation of those tubercles being connected with the vascular system of the sheath is not the correct one, for here we have enormously developed sheaths and no tubercles). The verticillate whorls of leaves, whenever I have seen them perfectly expanded, seemed always elliptical as in *Annularia,* the leaves of two opposite points of the circumference being considerably longer than the rest. The genus is distinct from *Annularia* by the great development of the sheath or connected base of the leaves, and by the branches being inconstant, and when present, not being arranged in pairs in the same plane.

Phyllotheca australis (Br.).

Sp. Char. Stem simple, smooth or slightly striated; sheaths tight, shorter than the internodes, terminated by narrow leaves, double the length of the sheaths, without distinct midrib. (*Condensed from Br.*)

Phyllotheca ramosa (M'Coy). Pl. XI. figs. 2 & 3.

Sp. Char. Stem branched, smooth or slightly striated; sheaths half the length of the internodes; leaves thin, linear, flat, twice to three times the length of the sheath, with a very fine indistinct midrib.

This beautiful plant has the branches weeping or hanging downwards as in *Casuarina,* about half the diameter of the stem; they do not arise from every joint, but they do nearly; I am uncertain whether more than one spring from any one joint. Most of the stems are perfectly smooth, being striated only at the articulation (see Pl. XI. fig. 3), while others have a delicate lineation down the internodes; the first I imagine to be stript of their bark, and the latter to retain it; and here again we have another proof of the stronger affinity of our fossil to *Casuarina* than to *Equisetum,* for I find by examining the living *Casuarinæ* that the lineation of the surface goes no deeper than the bark, while the elevated lines on the surface of *Equisetum* are only the edges of strong septa going towards the central hollow, and the flat spaces between those lines are only the superficial coverings of tubular hollow spaces between the aforesaid septa, so that destroy the surface of *Casuarina* and you render the stem smooth—destroy the surface of *Equisetum* and you only increase the coarseness and strength of the sulcation. I may also add (in accordance with this view) that age or size has no connexion with this lineation of the surface, as is suggested by M. Brongniart in the last few lines of the quotation from his work at the head of this subject, for I find some of the largest stems perfectly smooth and the smallest occasionally striated. The sheaths are rather coarsely striated, and terminate in thin, flattened leaves, the midrib of which is scarcely discernible. In the weeping or downward curved branches the leaves are completely reflexed so as to point upwards, and according to the position of the stem, are either reflexed, expanded, or lying straight up against the stem. The stems vary from 3 to 7 lines in diameter.

Common in the white soft shale of Mulubimba, N. S. Wales.

Phyllotheca Hookeri (M'Coy). Pl. XI. figs. 4, 5, 6, 7.

Sp. Char. Stem simple, coarsely sulcated and ridged longitudinally; sheaths very large, loose, subinfundibuliform, each sheath extending from one articulation to the next, so as to conceal the stem; leaves about twice the length of the sheaths, thick, narrow, and with a strong, prominent midrib.

This species is easily known from the two former by its great loose sac-like sheath, completely concealing the stem (see Pl. XI. figs. 4 & 5), its long, thick, strongly ribbed leaves (see Pl. XI. fig. 6), and by its stem when stripped of its sheath being coarsely and regularly sulcated, precisely as in the *Calamites Cistii* (see Pl. XI. fig. 7). Although abundant, I have never seen a trace of a branch. Some of the flattened stems attain a width of two inches.

Common in the sandstone of Clark's Hill, in the siliceous schists of Arowa, and in the shales at Mulubimba, N. S. Wales.

[To be continued.]

XVI.—*Note on the* Teredo norvegica (T. navalis, *Turton, not Linn.*), Xylophaga dorsalis, Limnoria terebrans *and* Chelura terebrans, *combined in destroying the submerged wood-work at the harbour of Ardrossan on the coast of Ayrshire.* By WILLIAM THOMPSON, Esq., Pres. Nat. Hist. and Phil. Society of Belfast*.

IN the Edinburgh 'Philosophical Journal' for January 1835, I published a memoir entitled, "On the *Teredo navalis* and *Lim-*

* Read at the Meeting of the British Association at Oxford in June last.

noria terebrans as at present existing on certain parts of the coasts of the British Islands." The chief localities commented on, were Portpatrick, on the coast of Scotland, and Donaghadee on that of Ireland, in both of which places, floating timber as well as the wood-work of the piers was destroyed to a most serious extent, the *Limnoria* being by far the more destructive of the two species. The *Teredo* was in that communication further mentioned as having attacked the wood-work of a sluice at Youghal, on the coast of Cork, and as having committed great havoc at the harbour of Dunmore, on the coast of Waterford—at the former locality the *Limnoria* was also met with. This species alone—without the addition of the *Teredo*—was noticed as destroying in 1834 the jetty at Kingstown harbour, in Dublin bay.

I am not aware of the two destructive agents—Molluscan and Crustacean—being commented on as conjoined in their evil labours, previous to the publication of that paper; nor do I remember having seen any notice of three species of these borers—and certainly not of four—having been at work in any one locality *.

Early in the month of May last, Major Martin of Ardrossan, in Ayrshire—a gentleman well-known as a lover of natural history, and as a successful collector of objects of zoological and botanical interest—sent me a piece of wood bored by the *Xylophaga dorsalis*, and labelled as from the dock-gates, Ardrossan. Not having before heard of this animal attacking the *fixed* timber of our harbours—it has been found in drift wood or portions of vessels cast ashore—I made immediate inquiry respecting it, suggesting at the same time that the *Teredo* should be looked for, and also, that the outside of the timber should be examined for very minute borings:—if such were observed, I requested to be informed whether they were of more than one size. Specimens of wood excavated by the *Limnoria* and *Chelura* were forwarded by post for my friend's guidance.

I shall here give his replies to queries on the subject generally.

The piece of wood sent was a portion of the dock-gates. The *Xylophaga* has been known to be consuming them since the docks were opened in March 1844. It has been known for a very considerable time along this coast, where there is no fresh water†. It attacks timber of all kinds: for instance, the wooden pier (the supporters of which are nearly destroyed) and other timbers that are under water about the quays, and have been

* Philippi, writing in 1839, mentions the *Teredo navalis*, Linn., being in the same timber with the *Chelura* at Trieste.

† It is perhaps twelve years since specimens from that locality were sent to me, but I imagined that they had been found in drift timber.

placed there without any preservative coating. It appears to prefer black birch to any other timber, but does not like African or American oak. The only successful preventive made use of for preserving the dock-gates against the *Teredo, Xylophaga,* &c. is Muntz's patent yellow metal sheathing, which is put on to the height of thirteen feet; it lasts for ten or twelve years. The timber that is perforated is always covered by water. The depth of water in the docks is from sixteen to eighteen feet. Red pine is the favourite timber of the Crustaceans.

On inspecting the pier, Major Martin could not observe that the *Xylophaga* had committed any destruction, but saw that the *Teredo* had been at work in some places. He cut off a piece of the wood from the outside and sent it to me. It contained in addition to the furrows of the *Teredo,* living specimens of both *Limnoria* and *Chelura.* This pier has been about eight years erected. I was also sent a portion of one of the dock-gates, consisting of a piece of pine two inches in thickness, and within the space of a few square inches containing the excavations of the whole four species. It may give some idea of the frequency of the Xylophaga's perforations in the different pieces of wood, to mention, that on an average at least one-half is occupied by its burrows. The *Xylophaga* has never, like the *Teredo,* been observed by my correspondent to form a testaceous tube or lining to its cell.

Xylophaga dorsalis,

Turton seems to have been the first to notice, and under the name of *Teredo dorsalis* it appears in his 'Conchological Dictionary,' p. 185, and in his 'British Bivalves,' p. 16; but in the 'Addenda,' p. 253, to the latter work, he constituted the genus *Xylophaga* for its reception. His first specimens are noticed as "from a piece of wood in Torbay." He subsequently obtained "magnificent specimens of the *Teredo navalis* and this shell in their most perfect state" from "fragments of a wreck known to have been buried in the ocean for nearly half a century, near Berry Head, at the entrance of Torbay." This author remarks, that "like the *Teredo,* it inhabits the interior of the wood which has been some time under salt water, penetrating to the depth of from half an inch to an inch, forming for itself an oval receptacle or cavity, and having a very small and single external orifice," p. 254. He observes, that "its habitation in wood naturally separates it from the *Pholas.*" But in this remark he forgot that at p. 11 of the same work he had noticed *Pholas striatus* as "taken from an old yard-arm on Brixham pier, and which had been drifted in from the bay." Very little would seem to be known of the *Xylophaga.* Deshayes, in the second edition of

Lamarck, t. vi. p. 47 (1835), quotes only Turton and Sowerby's 'Genera of Shells' (no. 29. tab. 101):—he calls it *Pholas xylophaga*. Broderip too in the 'Penny Cyclopædia' brings it under the genus *Pholas*, figures it in the wood, and also represents the valves separately and joined. It is there noticed as "found in cylindrical cavities eaten? in wood," but certainly there is no doubt, as there indicated, of its being the real excavator of the burrows it inhabits. Philippi does not include this species in either of his volumes on the Mollusca of the Two Sicilies; but it appears in the very lately published 'Index Molluscorum Scandinaviæ' of Lovén:—this author refers only to Turton and Deshayes for it: he notices it simply as found in Norway.

This species differs from *Teredo navalis*, Turt., by boring *against* the grain of the wood (all of which is pine), in a diagonal manner.

Within a few square inches of this wood, the perforations of both these species may be seen: they labour harmoniously together in the work of destruction, the one destroying the timber by boring it in a longitudinal direction, the other by its operations being directed against the grain. They both work *within* the outer surface of the wood, but this again is destroyed from *without* inwards by the *Limnoria* and *Chelura*. Many of the chambers of the *Xylophaga* before me are 1½ inch in length, thus exceeding by one half the longest noticed by Turton. The shells of my largest specimens are 5½ lines in length: the two valves joined at the hinge occupy a space of 5½ lines in diameter.

Specimens obtained in rotten timber in 1828 at Ringsend, Dublin bay, by W. H. Harvey, Esq., have been given to me by that gentleman, and when in Dublin in March last I saw in Mr. Warren's collection a piece of wood (sound) filled with the perforations and valves of this species, of which latter I was kindly permitted to take specimens. The wood was found by Mr. Warren on the Dublin coast, where I have little doubt that the species is committing some injury, although such may not yet have been noticed.

Chelura terebrans, Philippi *.

All that has been published on this species has already appeared in the 'Annals;' Philippi's paper, in which it was first described, having been translated and republished in the fourth volume; and Professor Allman's, introducing it as an inhabitant of the British seas, having a place in the Number for the month

* Professor Allman points out certain trivial differences between the specimens described by Philippi and those from Dublin bay. The latter are similar to those from Ardrossan, except in size.

of June last*. I have therefore only to offer a few remarks bearing on the species as found at Ardrossan.

Limnoria and *Chelura* are *both* present in a piece of wood from Kingstown pier, Dublin bay, given me in 1842 by Mr. R. Ball, as well as in the wood from Ardrossan.

Both species bore in the direction of the grain of the wood, and their cells are quite alike in character: I perceive no mark of distinction when the animals are of equal breadth. The first piece of wood pierced by the *Chelura* which I had an opportunity of examining—that from Kingstown—contained the excavations of large adult individuals. The borings of these were so considerably larger than those of the *Limnoria* which had come under my notice, as to lead me to believe that the difference in the size of the aperture would at once distinguish the working of either species. The piece of wood from Ardrossan, however, not only proved that this was no criterion, but—from the circumstance of the *Cheluræ* being small, and less in breadth than the *Limnoriæ*—that theirs were rather the smaller cells.

Both the Crustaceans, like the *Teredo* and *Xylophaga*, labour harmoniously together in the work of destruction, and are mingled in the wood as if they were all of one species.

They can be readily distinguished from each other either when alive or dead, the *Chelura* being of a reddish, the *Limnoria* of a pale grayish yellow hue resembling that of light-coloured pine or fir. As they retain their colours after death, we may even years afterwards distinguish the two species in the excavations which they had formed in timber subjected to their ravages. From this circumstance, added to that of their burrows being formed in the closest contiguity, and many of the creatures dying in them after the timber has been removed from the sea, we may in our museums display whole catacombs of them as closely packed as ever were mummies in the best-tenanted tombs of Egypt. And the Crustaceans have this advantage, that

"Each in his narrow cell for ever laid"

remains perfect as in life, without the aid of any preservative.

On first learning from my friend Professor Allman that the two species were found associated together, I re-examined—for the purpose of ascertaining whether the *Chelura* might not have

* The species (regarding Philippi's as not distinct) was however known to and named by Dr. Leach. British specimens (but from what locality is unknown) belonging to his collection are in the British Museum, and are labelled *Nemertes nesæoides*, Leach. Under this name they appear in the very carefully and elaborately compiled "List of the specimens of Crustacea in the collection of the British Museum" published this year, the work of Mr. Adam White. The name is I believe unpublished; at any rate, both *Nemertes* and *Chelura* are preoccupied as generic terms.

been overlooked—all the wood that I had preserved on account of *Limnoria* borings, but in none of it was the former species to be detected. This wood was all pine, and from Portpatrick, Donaghadee, and Belfast bay: from the first-named places obtained in 1834, and from the last in the present year. In the more marine parts of this bay I was not surprised to find that the *Limnoria* existed. I had however hoped, that where the admixture of fresh with sea-water (if such take place) should be very great even at full-tide, and where at low-water the former only prevails, wood-work would be free from its attacks, but such I regret to state is not the case. For the purpose of testing this, I requested my friend Edmund Getty, Esq.—who is officially connected with the harbour—to have all the beacons or "perches" marking the channel of the river (which they do for about two miles at the upper part of the estuary) examined, and if they proved to be injured, to favour me with specimens of the damaged wood. All this he kindly had done in the month of May last, when the beacons proved to have been all attacked, and those most under the influence of the fresh-water to have suffered equally with those nearest to the open sea. The ship-carpenter who cut the damaged portions off that were sent me, stated to my friend that some old mooring-buoys so high up as the Old Long Bridge were found on removal injured in the same manner. The *Limnoria* was the only borer of any kind found in the beacons alluded to.

It must be mentioned, that judging from the superior size of the *Chelura* borings to those of the *Limnoria* in Dublin bay, I had from that circumstance noted down the perforations in pieces of oak and black birch washed ashore at Belfast as the work of the *Limnoria*; but perceiving, on examination of the wood from Ardrossan, that the borings of the two species may not only be of equal size, but that those of the latter species may be the larger, I was taught that the presence of the Excavator himself must be essential to settle the point, and that circumstantial evidence is insufficient. The wood in question had been so long tossed about in the sea that the animals were all washed out:—both pieces had also been bored by the *Teredo norvegica* (*T. navalis*, Turt.).

In reference to the length of time that the *Chelura* will live after being removed from its native element, the following note was made. A few specimens taken from the sea on Monday morning and received by me in the afternoon of that day were alive on Thursday morning, or seventy-two hours afterwards, when, leaving home for England, I took the piece of wood containing them with me, and on examining it next day found them dead; they had probably lived out of their native element about ninety hours. A number had lived in the same wood for about sixty-five hours; they were alive on Wednesday night at 12 o'clock and dead on the next morning at 7 o'clock. The wood in which they were, was a small piece about six inches in length and an inch in thickness; it was not wetted since being received on Monday, and was kept in a warm room (about 65° Fahrenheit) all the time. The apparently simple fact of the species thus living so long out of water has a very important bearing, for it suggests to us that this species could, like the *Limnoria*, commit its devastations in wood left dry by the ebbing of every tide. Dr. Coldstream informs us that the latter species "often effects a lodgment in piles very near high-water mark, where it is left dry by the receding tide during the greater part of every twenty-four hours*," and I have very little doubt that the *Chelura* could play a similar part. I have not heard that the extent of the damage done at Ardrossan by the destructive animals noticed in this communication has yet been estimated, but on lately writing to my obliging friend and correspondent there, requesting him to procure if possible perfect specimens of the *Xylophaga* for dissection—the testaceous portions only had before been sent—he replied that the opportunity for so doing was now past, "as the damaged portions of the dock-gates had been replaced by sound timber."

This may not be an inappropriate place to add the following note on *Teredo navalis*.

A copy of Lovén's 'Index Molluscorum Scandinaviæ' lately published, having been kindly sent me by the author, I was induced, in consequence of the *Teredo navalis*, Linn., being there considered distinct from that so called by other authors, to re-examine the shells bearing that name in my cabinet from different parts of the British coasts. The result is that they are all the *T. norvegica*, Spglr. (*T. navalis*, Turt. Brit. Biv.) as distinguished from *T. navalis*, Linn. The localities from which they were obtained are Portpatrick (Scotland) and Donaghadee (co. Down), in both of which the animal was found alive—Miltown Malbay (co. Clare), in drift timber—Belfast, in the bottom of a vessel arrived from the tropics in 1846: *Teredo malleolus*, Turt., was much more numerous in this vessel—Belfast, also in blue clay (subfossil): the valves of these last are very large, being equal in size to those described in my former paper as obtained at Portpatrick. I allude here to specimens procured since that communication was published, a portion of the bough of an oak-tree a few inches in diameter, found during the excavation of a deep sewer, having

* Edin. Phil. Journ. 1834.

been kindly sent me by Edmund Getty, Esq. The wood itself is perfectly sound, but the tree is split and rived in the direction of the grain in some places almost into shreds by the boring powers of the *Teredo*.

XVII.—*On the Pliocene Deposits of the Valley of the Thames at Ilford.* By Richard Payne Cotton, M.D.

The tertiary deposits bordering on the Thames appear to be composed of materials of the same general characters, variously arranged, but formed under the same physical circumstances. The formation may be well seen at Brentford, Ilford, Grays and Erith, where beds of gravel will be found resting upon sands of various colours, sandy loam and clays, abounding in remains of mammalia and freshwater shells*. The following description refers to two cuttings in brick-fields at Ilford, one on the north of the London road, belonging to Mr. Curtis, another on the south of the same road, and the west of the Barking lane, the property of Mr. Kilverton. In the former we observe—

	feet.
Vegetable soil with gravel	2
Coarse gravel	2
Coarse yellow sand, stratified	4
Brick earth of various shades of brown, regularly stratified with nodules of carbonate of lime (race) and a few bones	5
Light brown brick earth, interstratified with layers of sand, and full of bones	3
Thin veins of fine sand of shades of yellow and brown irregularly waved	2
Coarse gravel and sand.	—
	18

In the latter the arrangement is as follows:—

	feet.
Vegetable soil with gravel	2
Coarse gravel and sand stratified	3
Brick earth of shades of brown, stratified	6
Brick earth of a light brown with wavy veins of sand, calcareous nodules (race) and bones	2
Layers of brown and yellow sand, waved, containing in its upper part an abundance of bones	4
Fine yellow and white sand, with freshwater shells	2
Coarse gravel with water.	—
	19

The stratification of the clays is generally regular and horizontal, the layers however frequently thin out or expand, but the veins of sand are irregular and waved, so that the surface of the cutting, from the changing thickness of the strata, varies extremely

* A list of the shells occurring in these mammaliferous deposits has been given by Mr. J. Morris in the 'Magazine of Natural History,' vol. ii. p. 544. —Ed.

within the distance of a few feet, although the general character is the same; in some places the sands and clay pass into each other, but they are more usually distinct. In the latter section, the upper layer of brick earth in apposition with the gravel is regular and horizontal, but in the former the same part is hollowed into basins, from which fissures extend downwards, both filled by the sand from above; the usual width of the basins is from two to five feet, and their depth from one to four feet, whilst the fissures vary from one to five feet in length, and measure several inches at their widest part. I have not been able to ascertain the thickness of these deposits, as the cutting is seldom made lower than eighteen or twenty feet, below which the brick earth is either of an inferior quality or altogether absent; but in a well lately dug in the neighbourhood, sand and gravel with irregular layers of clay were met with to a depth of fifty feet. Throughout the valley of the Thames bones of mammalia and shells are generally found, but at no place so abundantly as at Ilford. The two genera of shells, of which hundreds may often be obtained at one visit, are *Helix* and *Cyrena*, but *Unio* and *Planorbis* are not uncommon, and *Ancylus*, *Succinea*, *Valvata*, *Limnæus*, *Cyclas* and *Paludina* have been discovered. The *Helix* cannot be distinguished from the existing *H. nemoralis*, and in many specimens the colouring matter is preserved: the *Cyrena* is stated to be identical with one now living in the Nile: of the other genera it is almost impossible to determine the species, owing to their imperfect condition; they are chiefly seen in the layers of sand upon which the brick earth reposes, and beneath the bones, but are sometimes intermixed with them, and have been found even within their cavities; they appear to be partial in their distribution, and are not met with in the former cutting. The bones occur both in the clays and sands, but their most common position is the point of union of the two, or the upper layers of sand: those from clay are in excellent preservation, but all from the sand fragile and difficult to remove entire; they appear to have undergone no other change than a slight impregnation with iron and the loss of their animal matter, and for their restoration I have found gelatine answer admirably. I have obtained very perfect remains of the following animals: *Ursus*, *Elephas primigenius*, *Rhinoceros leptorhinus*, *Equus*, *Bos primigenius*, *Bison priscus*, *Cervus Elaphus*, *Castor europæus*, *Megaceros hibernicus*, Sheep, Pig, and a bird of flight of the size of a crow. Of these, the remains of the Mammoth, Ox and Rhinoceros are most common, the Aurochs, Horse and Stag less so, and the rest comparatively rare. They bear no marks of attrition, and are always placed horizontally, and in most cases the skeletons appear nearly entire; a perfect Elephant was gradually discovered by the labourers a few months back, but from the greater number of the bones being in sand, a humerus, tibia, portions of femur and tusks, some bones of the carpus, one metacarpal bone, a patella, and the teeth could only be preserved, and these are in my possession. I have obtained several bones of the *Bos primigenius,* including the head and horns, from what appeared to be the entire skeleton, and the lower and part of the upper jaw of a Rhinoceros; several teeth of the young Elephant, one of which had only just cut the gum, are in my collection, besides a canine tooth and metacarpal bone of a Bear, the lower jaw and several teeth of the Beaver, and portions of three lower jaws of the Irish Elk. The following table shows the size of three bones of the Mammoth, and a comparison with those of the Mastodon and recent Elephant:—

		Mammoth.		Elephant.		Mastodon.	
		ft.	in.	ft.	in.	ft.	in.
Humerus	Length	3	6	3	0	3	6½
	Width of condyles	1	1	0	11	1	1
	Diameter of head	0	10	0	7	0	10
Femur	Circumference of head	1	10	1	8	1	11
	Length of outer condyle	0	10	0	8	0	10½
Patella	Length	0	6	0	5½	0	7
	Width	0	4	0	3	0	6

The large Elephant in the collection at the College of Surgeons, and the Mastodon in the British Museum, were selected for comparison. It is seen from the above how much larger was the Ilford Elephant than its modern representative, and how little inferior in size to the gigantic Mastodon, which it probably even sometimes exceeded, as I have seen fragments from bones apparently much larger than those in my collection. From a similar comparison of the bones of the *Bos primigenius* with the recent Ox, I have ascertained that those in my possession belonged to an animal more than one-half as large again as the largest living species I could measure. The *Rhinoceros leptorhinus* appears to have been a small animal, not larger than the living one from Sumatra, and much inferior in size to the Indian, with both of which I have compared several fossil specimens; the *R. tichorhinus* has not yet been found at Ilford, and seems almost limited to the caves. The absence of carnivora, as the Tiger, Lion and Hyæna, in these deposits is remarkable: amongst the hundreds of bones already examined, not one belonging to these animals has yet been discovered; it is possible that they may not then have existed in such numbers, or borne the same proportion to the herbivora, as at present, or were generally able to avoid being submerged with their less active contemporaries by escaping to the hills, where their remains might soon become decomposed, or destroyed by other carnivora, or within fissures and caves, which are known to have often served them both as dwellings and tombs.

The nodules termed by the brickmakers "race" are of various sizes, from that of a marble to an orange, and occasionally very much larger, of a light brown colour, soft to the touch, smooth, and either compact or made up of concentric laminæ, in outward appearance resembling Websterite, for which I had always taken them until very recently; but a careful analysis has shown that they are composed almost entirely of carbonate of lime, with a slight addition of phosphate and sulphate of lime, a little phosphate of alumina, silica, and peroxide of iron; they are chiefly in the upper layers of clay and not intermixed with the bones. Vegetable remains are scarce, but a large bed of lignite was discovered in the brick earth some time back. Dr. Lindley has kindly examined its structure, and reports that all he can assert is, it is not coniferous, that it contains some dotted tissue resembling that seen in elm, but presents no character by which its affinity can be determined.

The circumstances under which the bones are discovered lead to the conclusion that the animals lived and died near the spot which incloses their remains; the skeletons are frequently entire, and have not suffered by attrition, and the presence of teeth of the young Elephant is opposed to the view that they may have migrated here upon some general geological change and have been subsequently destroyed. The strata were evidently quietly deposited, the shells are in general well preserved, and the stratification of the sands indicates the long continuance of causes alternating with one another and uninterrupted by violence. The freshwater origin is decided by the characters of the shells, all being of this class with the exception of the *Helix*, which, like the recent species with which it is probably identical, may have lived upon the banks of rivers and been buried with its aquatic neighbours. The arrangement of the strata does not differ from that seen in the bed of modern freshwater lakes and rivers, especially in those subject to occasional inundations; giving great probability to the idea that they were formed during the elevation of older strata, when large quantities of solid materials were washed away from the rising mass, and deposited in hollows and valleys by the agency of water.

It is not impossible that the thick layers of gravel beneath the brick earth were the result of a breaking-up of a portion of the chalk originally covering the Wealden, and that the clays and sands were supplied by the partial destruction of the Wealden itself; the similarity in the materials of the two formations is very conspicuous, and the frequent occurrence of calcareous masses adds great weight to such an hypothesis, especially as many of the nodules appear to be merely rolled pieces of chalk, with some earthy additions which may have been supplied by the clay in which they are found, and those more distinctly laminated may have been formed by a gradual separation of calcareous matter in suspension, by homogeneous attraction. If the original surface of the Wealden were irregular, or the uplifting of the strata unequal, chalk, clays and sands might simultaneously or alternately be exposed to the action of the waters, which would produce the frequently repeated layers observed in the tertiary strata.

On the growing hills and rising valleys of the Pliocene period a gigantic race of mammalia flourished, which in its turn was swept away and entombed, just as we now find bones of the present creation in beds of rivers and lakes: I have seen several bones of Ox and Sheep inclosed in mud from the bed of the Thames, which when hardened might be easily mistaken for those from Ilford. For the support of so large a number of immense herbivora, a luxuriant vegetation must have existed; without it the Elephant and Irish Elk could not have thrived, or the Beaver made a dwelling; but indications of such are scarce, and I believe have not been found at Ilford, with the single exception to which I have alluded: this may be due to the larger trees having been drifted away by the waters, or a condition of soil unfavourable to their preservation. The presence of basins and fissures in the upper layers of clay shows the interference of time, and marks out an interesting series of events. After a long period of tranquil deposition the strata had reached the surface, from the waters having retired, or an elevation of the valley, and land succeeded water; streams and currents then hollowed out the surface into basins and disappeared; an exposure to the sun's rays followed, by which the clays became hardened and fissures formed; subsequently the whole was again submerged and rapidly covered by sand, which filled up the fissures and basins; and at last gravel was washed over the whole, and it became the resting-place of Man. The association of the remains of the Beaver, Megaceros and Red Deer with those of Mammoth and Rhinoceros is interesting, as it would show, that whatever the physical conditions were under which these animals were destroyed, they could not have been violent or universally destructive—that no grand convulsion occurred by which all were alike overwhelmed; but that during a regular and uninterrupted course of events, certain animals became extinct from some combination of circumstances unfavourable to their propagation, whilst others of different habits and necessities remained for ages later, to be destroyed only by the enterprise of Man;—the bones of the first-mentioned three are found in situations showing their existence down to a very late period, and that a race of animals once the associates of the Mammoth, Bear and Rhinoceros, have probably been the contemporaries of our race.

The strata of Ilford, although comparatively of a recent date, and the monument of but a small geological period, show that all things were not made in a moment, but were progressive, and associate the inorganic with the organic creation, in the common principle of growth and development, however differently each may be carried out; proving that the Mammoth and the Earth went on increasing gradually—both had an infancy, and both required time for their maturity.

But the operations of the Infinite are based upon benevolence, and seem to have had one great and creative act in view—to which all preceding were to be in some way subservient:—for ages did a large creation enjoy the undisturbed possession of the lands, but at length the Mammoth, Bear and Rhinoceros became extinct, whilst the Stag, Beaver, Sheep and Pig were preserved—valleys and irregularities were filled up and levelled by an accumulation of valuable materials—the action of natural laws was gradually reduced in degree—that at last Man might become the Earth's happy occupant.

4 Bolton Street, Piccadilly, June 1847.

XVIII.—*Additions to the Fauna of Ireland**. By William Thompson, Esq., Pres. Nat. Hist. and Phil. Society of Belfast.

[Continued from vol. xviii. p. 397.]

Birds.

Baillon's Crake, *Crex Bailloni*, Vieill. (sp.).

By letter from Dr. Harvey of Cork, dated January 13, 1847, I was kindly informed that he had at that time in his possession—temporarily—a specimen of this bird, which was taken in a bog at Clay Castle, near Youghal, on October 30, 1845. It was also remarked that the Spotted Crake, *Crex porzana*, was obtained in the same locality in October 1843. Dr. Harvey subsequently, at my request, favoured me with a description of the specimen of *C. Bailloni* as to dimensions and colour. On applying the description to specimens in the British Museum and in Mr. Yarrell's collection, there was a perfect agreement, except in one particular, the white markings being in

* This title is used for brevity. Species are included under it that do not belong to the fauna proper of the country, but in the making out of a general catalogue of the species obtained in Ireland, a separation will be made of the indigenous from the others.

The present communication (excepting the note on *Tadorna rutila*) was read at the Meeting of the British Association for the Advancement of Science at Oxford in June last.

some parts of the plumage of the few specimens examined disposed in the form of streaks, which they were said not to be in any part of the individual obtained in Ireland. The specimen belongs to Mr. Samuel Moss of Youghal.

The *Crex Bailloni* has occurred at various seasons in different parts of England, and is said to breed in some of the northern provinces of France, hence we should expect its occasional appearance in Ireland.

The Whiskered Tern, *Sterna leucopareia,* Natterer; Temm. Manuel, &c. p. 746 (1820).

When in Dublin in the month of March last, I saw in the collection of T. W. Warren, Esq., an adult specimen of this very rare Tern, which was shot in September 1839 "on the river Liffey, between Ringsend and the Pigeon House fort, Dublin bay," by John Hill, Esq. This gentleman, from shooting much at one period in that bay and being much interested in scarce birds, obtained some species of the greatest rarity.

The *S. leucopareia* was discovered by M. Natterer of Vienna in the south of Hungary, and inhabits chiefly the eastern portion of the south of Europe. It has very rarely occurred in the more western countries of the continent. Temminck, when first publishing the species (1820), mentioned that M. de la Motte of Abbeville had on one occasion seen several individuals, and killed three of them in a marsh on the coast of Picardy in France. But one individual—killed at the end of August 1836 at Lyme in Dorsetshire—is noticed in Yarrell's 'British Birds' as having been obtained in England. Specimens of this bird in the British Museum are labelled "*Hydrochelidon** *hybrida,* India? Hardwicke bequest," and "Cape Seas, Dr. Andrew Smith's collection." If, as quoted by Schlegel (Revue Crit. Ois. d'Eur. cxxxi.), this be *St. hybrida* of Pallas, that name has the advantage of priority.

Sterna velox, Ruppell.

In March last I had the opportunity of examining in Mr. R. Ball's possession in Dublin, a specimen of a Tern, the species of which I did not know. It was left at my friend's house early in the month of January, and evidently had been but recently skinned. Mr. Watters, jun., to whom the specimen now belongs—and who has commenced forming a collection of native birds, which comprises some of the rarest species—assured me, that he saw it in a fresh state, and that it was killed near Sutton—a place on the road between Dublin and Howth—at the end of December 1846: two others of the same species were stated by the shooter to have been in company with it. As the bird was unknown to me, I noted down the following particulars of it, which are here given that others may have an opportunity of forming their judgment upon the species:—

* Boie.

	in.	lin.
Length, total (stuffed), to end of longest tail-feathers	20	3
——— of bill above from forehead to point..................	2	6
——— of bill from rictus to point............................	3	4
——— of wing from carpus	13	9
——— of tarsus about	1	0
——— of middle toe to base of nail	0	11
——— of nail itself measured in a straight line about ...	0	4

Wing and longest tail-feathers about of equal length; outer or longest tail-feathers exceed the middle by three inches. Bill wholly yellowish horn-colour; legs and toes wholly black. Colour of entire plumage the same as that of the common Tern (*S. hirundo*), but the back is rather of a darker shade than that of the latter when adult. The black of the head does not reach within one-third of an inch of the bill; space between the termination of the black plumage and the bill, pure white. The specimen is evidently adult.

On visiting the collection of birds in the British Museum—where the utmost facility for reference and comparison has always been most kindly afforded me by George R. Gray, Esq.—I saw the same Tern labelled "*Sterna velox*, Ruppell, Red Sea." It was from this locality that Ruppell had the species, which is figured in his 'Atlas,' pl. 13 (1826). To Prince Bonaparte it is not known to have occurred farther west in the Mediterranean than Sicily, and so far, only accidentally. The *Sterna cristata* described by Swainson in his 'Birds of Western Africa,' p. 247. pl. 30, agrees in all details with my notes of *S. velox*, except in the colour of the back, which is said to be almost as white as the under parts.

Ruddy Shieldrake, *Tadorna rutila*, Pallas (sp.).

I learn by letter from T. W. Warren, Esq., of Dublin, that he has lately added to his fine collection of rare birds obtained in Ireland, an example of this species. The bird on the second day after being killed was presented to Mr. Glennon, bird-preserver, by Mr. John P. Prendergast, whose letter respecting it was kindly sent for my perusal. It was there stated that the bird was shot on the Murrogh of Wicklow* on the 7th July 1847, by Mr. John Moreton of that town. The abode of this species in Europe is in the more southern portion of the eastern countries; the individuals met with in the western parts are considered only accidental visitants: three have been obtained in England.

Fishes.

Argentine.

Scopelus borealis, Nilsson.
Argentina spyræna, Penn.

A specimen of this extremely beautiful little fish was found in a dying state on the beach at Killiney bay, near Dublin, by Professor

* This is an extensive sandy tract bordering the sea near the town of Wicklow; such a locality as is resorted to by the common Shieldrake (*T. vulpanser*) for the purpose of breeding.

Oldham on the 11th of March 1847. It was shown to me on the following morning in Dublin by that gentleman, who subsequently deposited it in the Museum of Trinity College.

This specimen is $2\frac{1}{8}$ inches in total length, and so fully agrees with that described and figured by Dr. W. B. Clarke in the 2nd volume of Charlesworth's 'Magazine of Natural History' (1838) as to render any description unnecessary. It having been dried up before being transferred to spirits, a positive enumeration of the rays in the fins is impracticable, but they are in all the fins about the number given by Dr. Clarke: the anal fin however extends considerably farther along the body (for $4\frac{1}{2}$ lines) than represented in his figure, although it there appears as extending to twice the length that it does in Pennant's fish. It *commences* in the specimen under examination as Dr. Clarke and Mr. Yarrell (B. F. vol. ii. p. 164, 2nd edit.) figure it, in a line with the last *gutta* of the upper row, but extends as far as the first gutta on the ventral line beyond the vacant space. The *guttæ* in all the series are—what I did not anticipate—precisely in number as in Dr. Clarke's specimen, and even where he remarks that one "appears to have been obliterated" in the row of the smallest guttæ extending from the commencement of the anal to that of the caudal fin, it is wanting on both sides of the specimen under examination. See Dr. Clarke's paper, p. 23, and Yarrell, p. 164, for a detailed notice of these guttæ. Some writers on the Argentine—as Dr. Clarke at p. 23, and Mr. Yarrell at p. 25 of the same volume, in his remarks on that gentleman's communication—seem inclined to believe that among the very few examples of this fish obtained on the British coasts, two species have been taken. The anal fin certainly is very short in Pennant's *figure*, but the author himself is silent respecting the fin and its number of rays, so that we have only the engraving on which to form a judgment. By making fair allowance for the injury that may have occurred to the very delicate and fragile fins of this species, and for a due want of critical accuracy in the draughtsman and engraver, there is not in my opinion sufficient reason for believing that the Argentines hitherto noticed as taken in the British seas were of more than one species, nor, judging from Nilsson's description of the specimen taken on the coast of Norway, do I see reason for considering it as distinct. This author refers Pennant's fish to his *Scopelus borealis.*

Notes.

Isinglass Sturgeon, *Acipenser huso,* Linn.

A notice of the occurrence of this species on the coast of Cork in July 1845 was communicated to the 'Annals' (vol. xvi. p. 213) by Mr. John Humphreys of the city of that name. This gentleman—as well as Dr. Harvey of Cork, who subsequently examined the specimen—assures me that it was *A. huso* as represented in Shaw's 'Zoology,' vol. v. pl. 159. Mr. Humphreys has informed me of the capture of another specimen which was taken in the second week of April 1847 "at Carrigeen, near Curriglass, on the river Bride, not far from its junction with the Blackwater. It measured 7 feet 8 inches in length, and weighed nearly 2 cwt."

In a "Note on the Irish species of *Cephaloptera* (*Pterocephala*), by Frederick M'Coy, M.G.S. and N.H.S.D. &c.," published in the 'Annals' for March last (vol. xix. p. 176), the writer seems to consider that it is not the *Ceph. Giorna*, Risso, and recommends that the genus *Pterocephala*, into which it would come, should be adopted. He remarks that :—" On examining this very interesting specimen, I found that although obviously a *Pterocephala*, yet it presented most important differences from the *C. Giorna*, both in outline, proportions, shape of the fins, and form of the wing-like appendages to the head * * *; [it] seems referable to that described many years ago * * * and figured by Lacepède under the name of *Raja Fabroniana*."

The writer then proceeds to point out in detail the various differences between *Cephaloptera Giorna* and *Raia Fabroniana*.

Before publishing a notice of the Irish *Cephaloptera* in 1835 I referred to the *R. Fabroniana* of Lacepède, and considered the specimen as having about much the same resemblance to it as to the *C. Giorna*, but preferred adopting the latter name. Müller and Henle in their great work on the "Plagiostomen," the highest authority extant on the subject (published in 1841), brought the two names together as representing but one species, and adopted for it Risso's term, *Cephaloptera Giorna*. The Prince Bonaparte has done the same in his 'Catalogo Metodico dei Pesci Europei,' published at Naples in 1846. If therefore I have been the means of the specimen being "erroneously referred to in most works on British Zoology," I err in company with the two best authorities in Europe; and if I be correct, I am indebted to the writer of the "Note, &c." under consideration for providing by his description and figure better means than I had myself done of proving the correctness of my opinion respecting the species in question.

The specimen was so imperfect, and in addition, so distorted by the preserver, that, although in possession of an accurate drawing of it previous to publishing the note in 1835, I was unwilling to have it engraved. The relative dimensions being, for the same reasons, necessarily inaccurate, I abstained also from giving them.

Mollusca.

Lacuna Montacuti, Turt. Zool. Journ. vol. iii. p. 191. *Helix lacuna*, Mont. Test. Brit. p. 428. t. 13. f. 6.

A specimen was obtained near Portaferry, Strangford Lough, in August 1837, by Mr. Hyndman and myself.

Rissoa inconspicua, Alder, Ann. Nat. Hist. vol. xiii.

One specimen found at Portmarnock, 1838, W. T.; one at Bundoran, 1840, Mrs. Hancock.

Rissoa proxima, Alder MSS. (*R. vitrea* of my Report).

Mr. Alder having lately obtained what he considers the true *R. vitrea,* Mont., separates this species from it by the name quoted. I leave to him the description of *R. proxima.* The shell is found at Magilligan (W. T.); Portmarnock (W. T); Bundoran (Mrs. Hancock); Bantry bay.

Pleurotoma coarctata, Forbes, Ann. Nat. Hist. vol. v. p. 107. pl. 2. f. 15.

Several specimens were dredged on the south-west coast about Bantry bay in 1846 by Mr. M'Andrew.

Nucula decussata, Sowerby.

Specimens of this large but not very distinctly marked *Nucula* from the Dublin coast, have been for some time in my possession, through the kindness of Mr. Warren and Dr. Farren—the latter gentleman noted them as from the deep sea, Howth.

NOTES.

The two following species, though hitherto unnoticed in the Irish Catalogue, are separated from the preceding, which are strictly *indigenous,* in consequence of the one being introduced, and the other perhaps not found living in our seas.

Testacellus Maugei, Ferussac.

Professor Allman informs me that he has found several of this species in a garden at Bandon (co. Cork), and has obtained it in one of the greenhouses at the College Botanic Garden, Dublin:—in the open ground here, it has been met with by Mr. Bain, foreman. It has doubtless been introduced to both localities along with plants.

Teredo malleolus, Turton, Brit. Bival. p. 255. pl. 2. f. 19.

I found numbers of this comparatively small species together with a few of *T. navalis,* Turt., in the timbers of a ship on her return to Belfast from a foreign voyage in 1846. Portions of the timbers were quite honeycombed by *T. malleolus,* so that the vessel had in consequence to undergo great repair. Turton described the species from specimens found in drifted timber at Torbay*.

* He describes the shell as one-fourth of an inch in diameter. My specimens are only one-sixth of an inch, or 2 lines, and the largest borings very little exceed that in diameter. In length, they extend to 2½ inches, and are both straight and diagonal. They generally exhibit only a very thin whitish coating of testaceous matter, but in a few instances this is so thick as to form a tube. The borings are as close together as possible in the piece of plank (black birch?) under examination, which is 2½ inches in thickness. They are formed like those of the *Xylophaga,* against the grain of the wood. The outer perforation is round or roundish, instead of being "rather elongated," as described by Turton.

Annelida.

Tristoma coccineum, Cuv.

Several individuals of this species (as I learn from Mr. John D. Humphreys) were found on a sun-fish, *Orthagoriscus mola*, taken in Cork harbour in Sept. 1846. To Dr. Harvey of Cork, to whom they were given, I am indebted for one of the specimens.

Foraminifera.

Having learned that Mr. Searles V. Wood had been giving some attention to the *Foraminifera* in connexion with his species from the Crag formation, and was desirous of seeing recent forms, I on a late visit to England took for his inspection as many from the Irish coast as could be obtained. That gentleman was much gratified on finding some of these identical in species with those from the Crag. I am indebted to him for naming some of the following which had not been examined by myself: he agreed with me in opinion respecting the species that I had named. As I have not attended much to the synonymy of the species, it is possible that some of the following may have before appeared under other names.

" *Rotalina communis*, D'Orb.
——— *subconica*, Soldani, syn. ?," Wood.

Bundoran, Mrs. Hancock, 1840; Mr. Warren, 1844.

Rotalia crassula, Mont. (sp.); Brown, Illust.

With last, Mrs. H.; Mr. W.

Guttulina communis, D'Orb.*

With last, Mrs. H.; Mr. W.

Quinqueloculina semilunaris, D'Orb.

Bundoran, Mr. W.

" *Quinqueloculina cora*, D'Orb.
———— *semilunaris*, var. ?"†, Wood.

Portmarnock, 1835, W. T.

Triloculina minuta, Brown (sp.) ?

Magilligan, 1833, W. T.

Globulina gibba, D'Orb.

Bundoran, Mrs. H.

Spirolina subarcuatula, Mont. (sp.), Test. Brit. t. 19. f. 1.

Bundoran, Mr. W.

* *Guttulina Plancii*, D'Orb. (his specimens were from Patagonia). *Renoidea oblonga*, Brown, Illust. pl. 1. f. 16, 17, already recorded by me as Irish (Bundoran, Mrs. H.), apparently identical with *G. Plancii*.

† See D'Orbigny, Foram. l'Amér. Mérid. p. 76—his *Q. cora* is a South American form; *Q. semilunaris* is Mediterranean.

Arethusa lactea, Mont. (sp.).

Roundstone, co. Galway, Mr. Barlee, by whom I have been favoured with a specimen thence*.

ECHINODERMATA.

Thyone raphanus, Duben and Koren†.

A specimen was dredged from between fifteen to thirty fathoms about Bantry bay by Mr. McAndrew in 1846.

ZOOPHYTA.

Alecto granulata, Edw.; Johnst. Brit. Zooph. 2nd edit. p. 280. pl. 49. f. 1, 2.

Found attached to stones and shells brought up from deep water in Belfast bay, &c.

[To be continued.]

XIX.—*On the* Ventriculidæ *of the Chalk.* By J. TOULMIN SMITH, Esq.

[Continued from p. 97.]

THE structure which has hitherto engaged our attention is, strictly, that of the polypidom only. It remains to seek the natural affinities of the group the polypidom of which is marked by these high characters of structure.

The difficulty of this task will be readily appreciated when it is considered that it involves an inquiry into the nature, in respect to fossil bodies, of the parts most perishable and most difficult of observation even in recent species, and that it becomes necessary first to remove preconceived notions, and afterwards to begin *de novo* to find out the true relations. Further than this, in the structure which I have already described, the combined process

* Mr. Wood, on looking over some species dredged at Lamlash (S. W. Scotland) from a depth of about fifteen fathoms (coralline bottom) by the Rev. D. Landsborough and Major Martin, who favoured me with them, named the following:—

Quinqueloculina semilunaris, D'Orb.
Quinqueloculina ——— ?
Spiroloculina depressa, D'Orb.
Triloculina trigonula, D'Orb.
Biloculina umbonata, Wood MSS. I have English specimens from Mr. Barlee also.
Guttulina communis, D'Orb.
——— *Plancii*, D'Orb.
Rotalina beccarii, Mont. (sp.).

† In a memoir entitled "Skandinaviens Echinodermer" (p. 311. t. 11. f. 58, 59), for a copy of which I am indebted to the kindness of Professor Lovén.

of induction and direct observation has enabled us to arrive at conclusions which, after the work has once been carefully done, are definite and positive and incapable of being disputed with any show of reason. The present inquiry must depend more entirely upon the process of induction alone, and I cannot but be conscious that conclusions thus arrived at, however satisfactory to some, will be always more open to dispute.

Late writers on zoophytes have been in the habit of treating slightingly a reference to the polypidom in determination of genus and species, and of alleging that little or no reliance can be placed upon anything but observation of the polyps themselves. I apprehend, however, that this originates in some misconception. The Mastodon and the Mylodon are creatures which are well realized to the mind, though no part of the softer tissues of either has been ever seen by their describers. In the 'British Fossil Mammals' are vivified before us hosts of animals, hardly one of which has ever been touched by the hand or seen by the eye of man in other than its harder parts. How is this? We owe it to the ever-present and strong-felt conviction of the all-prevalence of the Law of Unity, whence their describer would as soon doubt the evidence of his senses as the important truth that there are always present certain constant relations between certain parts. Now either the Law of Unity and the whole principles upon which the British Fossil Mammals have thus been vivified are mere empty words and baseless, or the same principles must apply to every part of the animal kingdom. It would be as reasonable to deny the value of comparative anatomy as applied to fossil mammals because they who first found mammoth bones immediately saw in them glorious evidence of the reality of "those days" in which "there were giants on the earth," as it is to treat as of slight value the forms and structure of the polypidoms of zoophytes because Lamouroux and others may have erred in their application of what they saw or thought they saw in them. The cause of the false deductions (they have not been real inductions) drawn from observation of polypidoms appears to me very simple. Keeping now to fossil forms and turning over the pages of Goldfuss and others, no one having any knowledge of the subject can fail to perceive that, in the hurry to name and figure as many objects as possible, the merest superficial characters of external form have been alone observed, without the least examination of the true characters of those forms or their true texture and habit. I have so fully shown already the necessary consequences of this course in treating of the folding up of the membrane of the Ventriculidæ that it is unnecessary to enlarge upon it here. The result has been that, in Goldfuss for example, we have heaped together, without order or method, under the name of *Scyphia* (for instance), an immense number of objects differing totally from one another in every character, and many of them having no one essential character in common with the definitions of the genus. From the same hurry in jumping to conclusions, and eagerness, at all risks, to name and figure, has resulted the disposition in our own country to call everything which it is found difficult to understand and troublesome to investigate either a sponge or a coprolite. We have seen that the Ventriculidæ have, like many other as widely different things, been thrown into the former category, and I have little doubt that, by others, they have been thrown, with equal correctness, into the latter.

Observation then of mere external superficial form, as it is presented in recent specimens, still more as it always must be presented in fossil bodies, whether preserved in a hard or soft matrix, can never lead to other results than we have seen to have been arrived at by the numerous band of writers already named. By such a course we can only again have, as we have had already, a soft-bodied animal gravely described and figured by even such an author as Blainville as having a central stony axis with deep tubular cells—the so-called axis being the chalk or flint which had filled the central cavity, and the so-called tubular cells being simply the folds of the membrane forming the polypidom. The same care is necessary to investigate the true structure, character and habit of the polypidom as those of the polyps. Without the nicest manipulation and observation neither can be known or understood. And as without the aid of every artificial means the very existence and nature of the whole class of recent Polyzoa could have been never known, so the polypidoms of fossil zoophytes can never be known or understood unless we go to work —to vary the words of Van Beneden applied to a kindred subject—with the hand upon the slitting-wheel and the eye upon the microscope. It is important too to remember, that even those means are vain unless we have *first* made ourselves masters of the nature and origin of the matrix itself in which the fossils are preserved. Without that preliminary, nothing but confusion and contradiction will appear in the observations. Without it, it will be sufficiently evident that the important and satisfactory results already arrived at as to the structure of the polypidom of the Ventriculidæ never could have been attained, and without it they never can be verified.

I cannot give a more conclusive or satisfactory illustration of what may be done towards attaining a correct knowledge and just classification of the polyps themselves by a careful investigation of the true nature and structure of polypidoms superficially very different, than by reference to the labours of Milne

Edwards in respect to the Tubulipores*. That writer was enabled, chiefly by this means, to correct the errors of numerous former writers, and to show the true affinities of objects theretofore grouped in most widely different relations.

If these observations are well-founded, it will follow that attention to the nature and structure of polypidoms in general is a matter of much higher importance in determining the true character and affinities of zoophytes than is generally admitted, and it will appear that a true and careful examination of the *combined* characters [not any individual points] of structure of polypidoms will afford as safe and important guides in determining the affinities, and thereby leading to a just classification, of zoophytes as is afforded by fossil bones to the comparative anatomist in his attempt to vivify the long-departed forms of mammals. No one imbued with the true idea of the Law of Unity, without which science is a mere name, can doubt but that in the one case as in the other, constant relations must exist between one part and another of the entire organization of the recent animal†.

Nor can this reasoning be in the least degree affected by any theory as to the mode of formation of the polypidom. This will be too obvious to need more than bare allusion.

The importance of the application of these principles in the investigation of a class of objects like the zoophytes, of which the polyps themselves are so perishable, will be sufficiently evident to the student either of the recent or fossil forms of this most interesting family.

To apply these principles in the present case. In the polypidom of the Ventriculidæ, to some of the principal and more striking features in the structure of which our attention has purposely been hitherto alone directed, many remarkable characters have been found which distinguish it at once from the polypidom of any zoophyte, recent or fossil, hitherto described. At the very first step of our inquiry into affinities we seem then, at first sight, to be put at fault. And this is true in so far as that it becomes obvious that we can range these bodies among those of no recent genus or even family. But that point alone is something definite. And further, the character of a difference is oftentimes a guide where points of analogy fail. In what respect does the

* Ann. des Sciences Naturelles, April 1838, p. 193.

† Thus the "affinity" named by Dr. Johnston as existing between the polypidoms of *Alcyonium* and *Alcyonidium* is only "apparent," being of the merest superficial character. Hence it is that I use, below, Dr. Farre's name of *Halodactylus* instead of that of *Alcyonidium*; not because I like the prevailing taste for Greek names, but because the two names *Alcyonium* and *Alcyonidium* are so nearly alike as almost necessarily to engender erroneous ideas of an affinity between the animals to which they have been applied.

structure of the polypidom of the Ventriculidæ differ from that of all other known fossil and from all known recent forms? It differs in the much higher character, the much greater complexity and delicacy of its organization; in the peculiar adaptation in it to the nature and purposes of polyzoic life. It has been seen that the polypidom of the Ventriculidæ exhibits, in the most marked and exquisite manner, *structure*,—in the true sense of that word and as opposed to that mere mechanical *arrangement* which is exhibited by most vegetable and many animal tissues, and which results from the forms taken, more or less regularly according to circumstances, by the mere close compression against each other of circular cells, which causes them to assume a hexagonal, square or irregularly angular form. The octahedral structure of the Ventriculidæ on the contrary must take rank with the highest forms of animal *structure*, as one of the most striking as well as the most elegant and delicate of the evidences which the animal kingdom can afford of design and adaptation.

The first conclusion then which must be drawn, if the principles above indicated be sound, is that the being for whose support this so delicate framework was organized must have belonged to a very high order; to a higher order than any *known* zoophyte recent or fossil.

With an indication of this kind before us, the next legitimate step in the inquiry seems to be to ask, are there any individual characters which distinguish any among the higher orders of zoophytes of which any traces can be found to have been preserved to us in the fossil forms of the Ventriculidæ?

And by a different process we are brought pretty nearly to the same point. It will be useful, as a confirmation of the value of the test above applied, briefly to allude to this. When it is found that the so-called (at one time) polyp-cells and (at another) absorbents are neither the one nor the other, the inquirer has lost hold of any hint or suggestion from any previous inquirer as to the true character and affinities of these bodies. He asks first, on entering on the inquiry for himself, whether there be no characters in common between these bodies and the single and simple zoophytes of the present day or the more simple of the composite zoophytes. But he finds nothing which can connect them with any of either the *Hydrozoa* or *Anthozoa* of Owen (*Anthozoa* of Johnston). The structure of the polypidom of the *Alcyonium*, which it is desirable specially to mention as these bodies have been so often referred to that affinity, is found to be essentially different. If he refer to the excellent figure and description given on p. 176 of Johnston's 'Zoophytes*,' or, still more conclu-

* Second ed. 1847. It is proper further to remark, that the characters assigned by Dr. Johnston (p. 174) as *generic* coincide with this figure and

sively, if he examine the two admirable preparations by Mr. Goadby in the Museum of the Royal College of Surgeons, and which exhibit sections, transverse and longitudinal, of the same *Alcyonium*, he will perceive an arrangement of canals or tubes bound together by an irregular network, and will at once perceive that in no one point does this resemble the structure of the Ventriculidæ, in which there are no tubes whatever*. He is thus necessarily led to the same point, to which, by another means, we have already arrived, though with less suggestiveness of the true position of the objects before him.

Starting then from that point, it must be always remembered how much has been already determined as being *essential* in contradistinction to any accidental or specific characters of these objects†. It has been shown that they formed,—though soft-bodied as distinguished from stony or from a toughly flexible sponge-like mass,—a firm and enduring body, not contractile‡, and with a peculiar structure for maintaining its normal shape. The variety of actual form under which they are found being very great, it must be particularly remembered also that any essential character dependent on any apparent tubules, external or internal, is most distinctly and unequivocally negatived. Were

description. It must be presumed that those generic characters have not been assigned without a sufficiently extended observation, not confined alone to British species.

* I would refer to note, p. 186, for another marked and characteristic difference between the polypidom of the Ventriculidæ and any of the Anthozoa.

† Some, even shrewd observers, appear to find the greatest difficulty in divesting themselves of the influence of ideas arising from mere general external shape. This is extraordinary when there is no one branch of comparative anatomy, not to say natural history, in which its little importance is not evidenced, and errors arising from it being daily exposed. They point to the cupshaped sponges as so very like the Ventriculidæ. I admit a partial superficial likeness to *some* forms of Ventriculidæ, but that is all. And it may be a relief to such objectors to remind them of the external form of several Polyzoa, e. g. *Tubulipora patina*, which is described by Johnston, p. 267, as having a "polypidom like a little saucer:—it varies a good deal in the deepness of its centre, for sometimes it is properly described as being cupped, at other times it is so shallow that a saucer or plate becomes the best object of comparison." There is a real analogy here to the external form and habit of the Ventriculidæ: and see the forms of *T. truncata*, *T. penicillata*, &c., all much more like some Ventriculidæ than any sponges are; and Milne Edwards points out a development of roots (*ut ante*, p. 211) which forcibly recalls the Ventriculitic root. In the Museum of the College of Surgeons there has been deposited, within the last few weeks, a most superb coral from the Indian Archipelago which precisely resembles in its general external form some of the more usual forms of the Ventriculidæ.

‡ In addition to the points before named, it seems obvious that the contractile theory requires that the animal should be strictly a single and not a composite one. It cannot be conceived that a polypiferous animal should have its polypiferous surface contractile over itself.

other proofs wanting, this point is established by the fact that such apparent tubules are found in some few special forms only, while in the greater number of the forms of Ventriculidæ—all marked, in common with those last-mentioned, by those characters of structure above described,—and which therefore must necessarily constitute *the essential and generic* characters of the whole group—all trace of such tubules is absent. Some characters must therefore be found common to *all* these forms,—or common to many different forms, and the apparent absence of which, if undetected in others, can be explained,—before we can hope to have got any hint pointing to the affinity of these bodies with any recent forms.

Having already investigated with every care the structure of the central polypidom, while we know that in the actual integument of recent zoophytes very peculiar characters generally reside, it seems most proper to come back, for the purpose just indicated, to the more careful examination of that which has been hitherto only cursorily mentioned,—namely, what I have called the *polyp-skin*. But I have already stated how rarely this exists in any degree of perfection: hence this investigation is attended with great difficulties. And in truth the task is one so difficult that I have frequently been on the point of relinquishing all hope of being able to effect it,—when the observation of some character which had theretofore escaped attention has renewed my hopes. But for the slitting-wheel and the microscope, coupled with a careful study of the matrix, those characters must ever have escaped me.

It will be convenient, and not in strict language incorrect, if we distinguish the parts of which we have now principally to treat, as the *epidermis, cuticle*, or *polyp-skin* already mentioned, and the *dermis, cutis*, or *under-skin*, being the delicate membrane already described as immediately underlying the polyp-skin.

It will be remembered that, in the vast majority of specimens, both in chalk and flint, the central framework of the polypidom is alone preserved*. Both polyp-skin and under-skin, owing to their delicacy and the difficulty of extraction, are usually wanting or very imperfect. But it is these latter that must now be scrutinized.

A careful examination makes it clear that the Ventriculidæ cannot be considered, as Milne Edwards describes the *Berenicea diluviana*†, as self-enveloping polyps,—one series overlying a range of the empty cells of another. Else we should find speci-

* As *Tubulipora patina* would be, stripped of its cells, and as it is actually described by Mr. Thompson. See Johnston's Zoophytes, p. 268.

† Mémoire sur les Crisies, &c., Ann. des Sciences Nat. 1838, p. 228.

mens of the same species having different degrees of thickness, and there would be no distinct under-skin such as I have described. It is quite clear that these polypidoms are true polypidoms, the living skeletons of living polyp-masses, and not the remains of dead polyps piled one tier above another.

The careful examination of a suite of the best-preserved specimens in my possession at length revealed to me a character which I immediately felt must prove of the utmost importance in the present question. I observed, in *casts* of some of the most perfectly preserved specimens, minute perforations extending from the surface which had been in apposition with the fossils inwards into the matrix of the cast. Further observation satisfied me that this was no accidental appearance, but that it owed its existence to the original of the fossil itself. I found traces of the same appearance also in the casts of specimens preserved in a fine state in flint in those cases in which the remains of the Ventriculite were found in the condition of an open network only, the phænomena of which have been above explained.

In order to arrive at any just conclusion from these observations, it was necessary to apply here again all the considerations which have been already noticed, as to the nature of the two very different matrices in which the Ventriculidæ are found. Those considerations showed it to have been a necessary condition that the substance, whatever it was, which gave origin to these perforations, was neither of the merely soft and readily decomposable nature of the substance which filled the central tissue of the polypidom, nor yet either composed of a minutely fibrous membrane like the fibrous parts of that polypidom, or being a single projecting fibre overspread with soft or mucilaginous matter, like a sponge. Were it the former, its place would be most usually filled up, in chalk specimens, by chalk, as the intermediate spaces of the squares have become filled up. Were it either of the latter, we should sometimes find in the flint traces of the fibres hermetically sealed, and in flint and chalk we should find the tubular incrustments and other conditions already stated as marking the former presence of the central fibre. But none of such conditions has been ever found. It follows that a substance differing from either formerly filled these minute perforations, a substance little if at all less durable than the skeleton fibre, far more durable than the mere soft intermediate substance. Such a substance precisely answers to the terms under which a true epidermis is properly described, which is not fibrous in texture but pretty nearly homogeneous, and so strong as to have been described by a well-known modern author as "resisting suppuration, maceration, and other modes of destruction, for a great length of time*."

I have already stated that I had previously satisfied myself of the existence of a distinct polyp-skin or epidermis. A peculiar appearance of corrugation, very difficult to describe but always present in good casts, and with a vacant space between it and the actual fossil, left this beyond a doubt, though at that time no specimen had been found showing the remains of the epidermis itself preserved on the actual fossil. In specimens since found with remains of epidermis preserved, there is, of course, no such vacant space. Attached to this epidermis and of a similar nature, and at least as durable† as itself, there evidently existed during the life of the animal hair-like processes scattered over a large part of its surface.

Plate VIII. figs. 4 and 5 show examples of the appearances of casts of two very different species of Ventriculidæ, in each of which these perforations are present. It will be seen that a different arrangement of them exists in the two cases.

It would be only tedious to the reader to carry him through the whole process of induction, by which, not through any hasty conclusion, but as the result of careful and very cautious investigation, the reality seemed to force itself upon me that the sources of these perforations corresponded to those curious moveable processes which exist on the surface of some few of the higher zoophytes, and which have been well described by Prof. Reid‡. The determination may seem obvious enough on its announcement thus in a few words, but it was not so easy to be made.

After I had satisfied myself as far as I was thus able upon this point, I determined, if possible, to test the correctness of the conclusion. Taking, therefore, a very fine specimen of *Membranipora pilosa*§, in which the processes, exhibiting every character

* Elliotson's 'Physiology,' 5th ed. p. 270; and see Todd and Bowman's 'Anatomy and Physiology,' vol. i. p. 414. The appearance of the polyp-skin, as preserved by the deposit in it of sulphuret of iron, and examined under the microscope, has been recognized by some of my friends wholly unfamiliar with these or other fossils as bearing a striking resemblance to the human epidermis examined in the same way.

† I have found by actual experiment that, at least in some species, the hair-like processes of recent polypifers are, though hollow, less easily destructible by maceration in *liq. potassæ* than are the other parts of the epidermis. And I cannot avoid noticing here, that on such maceration a granular appearance was assumed very similar to that of the Ventriculidæ. It is unnecessary to dwell on this effect of the potash contained in the same felspar rocks to whose disintegration the siliceous fluid has been ascribed.

‡ Ann. and Mag. Nat. Hist. vol. xvi. p. 385, &c.

§ In this specimen there are all the parts described by Prof. Reid as ap-described by Prof. Reid, were well-preserved, I immersed its face in very finely prepared plaster of paris. On removing it after the plaster had hardened, I found, under the microscope, an appearance identical, as to the perforations, with that presented by the casts of the Ventriculidæ.

The reader who may search for these remains of the moveable processes on the Ventriculidæ, and, as many will, may not find them, and who may therefore too hastily doubt the accuracy of my observations, will do well to refer to p. 332–3 of Johnston's 'Zoophytes,' where he will find that, in even recent specimens, "they are not present in every specimen of any of these species, and indeed are very rarely to be seen on some of them, and when present it is only upon some of the cells." If this is the case in recent specimens how much more is it to be expected in fossil specimens that the traces of the former existence of these processes will be sometimes few, sometimes altogether absent! The universal friableness of the chalk and the general solidification of the flint often almost or totally obscure them. Doubtless, moreover, the originals of many of the specimens which remain both in chalk and flint were dead when enveloped,—for the views already stated require only that the soft parts should have been yet undecomposed, not that the animal should have been alive.

I am enabled, by some specimens in an extraordinary state of preservation with which frequent personal excursions into the field have rewarded my careful search, to add some description of these processes as existing in the living Ventriculidæ and derived from other observation than that of mere casts only. When the places of all are preserved, which is very rarely the case, they are disposed not without some regularity: it would appear that one was appropriated to each polyp, whose cell's mouth it doubtless swept in the living state as the mouths of the polyp-cells of the *Cellulariæ* described by Prof. Reid are swept by the processes existing in those species. As in those cases, the process was affixed to a slight projection of the polypidom on the outer edge of each polyp-cell. As in those cases also the processes tapered off gradually to a point in the Ventriculidæ, though the base of the process was rather proportionally broader in the latter than in the former.

Any special peculiarities in these processes exhibited by any species will be noticed in the descriptions hereafter to be given of each separate species.

The discovery of these moveable processes was certainly an important and very interesting point in the anatomy, as it was an

purtenant to these processes, though Dr. Johnston does not describe the species as exhibiting them.

essential aid towards determining the proper position and true affinities, of the animal to which they belonged. It will be observed that these processes are affixed to the strict *polypidom,* not to any distinct and separable external cell, thus adding another to the many evidences afforded by the Ventriculidæ that the whole of every polyzoic polyp-mass is a true entire animal, of which the polypidom forms but one essential and inseparable part.

The last observation leads naturally to the inquiry—if the moveable processes are not attached to any distinct and separable external polyp-cells*, as in *Membranipora, Eschara,* &c., have any traces of the existence and position of the polyps been discovered? Now it is undoubtedly the fact that the surface of the vast majority of these fossils exhibits no trace of polyp-cells. And remembering that many of the most highly organized of the recent Polyzoa† present very faint external traces of cells when dead, I had little hope of ever finding absolute evidence of the presence of those cells in the Ventriculidæ. Even in the Escharidæ they are often obliterated, while in the *Halodactylus diaphanus* it is rarely that they can be traced in specimens preserved in spirits. Even in the recent animal they can only be

* The separateness, externally, of the polyp-cells is a matter more apparent than real. The Ventriculite cells were quite as individually separate, the independence of each other, therefore, of their inhabiting polyps at least as great, as in *Eschara, Flustra,* &c.; indeed more so, there being in the former a distinct extent of the under-skin between each. In the *Halodactylus diaphanus* the cells merely assume a hexagonal form " from their pressure upon each other." This is very inferior to the Ventriculidæ: see Farre's paper above-cited, p. 409, and above, p. 180. Space forbids me to enter so fully into this subject as I could wish, and as its importance might render desirable were it not that the line of argument would be thereby interrupted. I will do no more now than recall the reader's attention to the fact of the organized external integument common to the compound Ascidians, which the under-skin of the Ventriculidæ certainly resembles more than does the connecting medium of the *Eschara*; and to two quotations from Dr. Johnston (Zoophytes, p. 255—257) bearing directly on the point. "The cell," he says, " is in fact the outer tunic of the polyp analogous to the envelope of the compound mollusca, * * in organic connexion with the interior parts, and liable to organic changes;" and in *distinguishing* by a marked character the Polyzoa from the Anthozoa, he says, " In the *latter* the polyps are simply developments of the common central fleshy mass, identical with it in structure and texture; in the *former* each individual is a distinct organism, and the medium which binds them together, whether vascular or ligamentous, has its own peculiar character." If this is correct, there can be no doubt that the Ventriculidæ answer to the second description and not to the first, and that indeed in a much more marked manner than do *Eschara, Flustra,* &c.

† I use the term *Polyzoa* in preference to *Bryozoa*, first, as having a prior title, second, as having some significance, which *Bryozoa* has not. It is quite enough to perpetuate error by calling an order *animal plants*, without increasing it by calling one class of that order " *moss-animals* "!

detected by aid of the microscope. I was then fully prepared to find this part of my researches unsuccessful.

A very minute examination, however, of my most delicately preserved specimens at length threw some light even on this point. I found that, in all the most marked varieties of form of the Ventriculidæ, in that membrane which I have described as lying external to the central part of the polypidom and immediately underneath the epidermis, and which membrane is above distinguished as the *under-skin,* there were numerous spots, scattered over the surface, which that membrane did not fill. The size of these, though varying, as was to be expected, in different species, does not do so very greatly, and may be stated as ranging between the 100th and the 200th of an inch. These are arranged in some species with more, in others with less regularity. A very rigorous examination of such specimens, tested by sections, led me, after a length of time, to the conclusion, that these vacuities are the true polyp-cells*. I may observe, first, that they are found in the most different species, including the so-called *Ocellariæ*; secondly, that they correspond in mode of position and character to the polyp-cells of many of the Polyzoa and especially of the *Halodactylus diaphanus,* differing only from the latter in being circular, because implanted in a more strongly developed and highly organized connecting medium or tunic which is found regularly separating each one from its neighbours†,—a fact consistent with the higher degree of organization of these animals, and seeming again to point to the singleness of the entirety of the whole polypiferous mass; thirdly, but not least importantly, that I have since found specimens in which the polyp-skin is, through the deposit of sulphuret of iron as already explained, well-preserved, in which specimens these cells are seen marked with full as much distinctness in that polyp-skin as in any specimen of *Halodactylus diaphanus* or of many other recent polypifers. On Plate VIII. fig. 6 is a figure of this polyp-skin in a species in which there is considerable regularity in the arrangement of the polyps.

The polyp-cells are lodged in the substance of the under-skin, extending in the plane of its thickness the whole depth. They lie at distances from one another about equal, or rather more, to their own diameter. In the *V. simplex* their figure of arrange-

* It is important to observe, as again showing the absence of any analogy with the *Alcyonium,* that not in these polyp-cells or on any part of the surface of any of the Ventriculidæ is there any trace of those stellate figures which distinguish the surface of the Alcyonidæ, and indeed of all the Asteroida, and traces of which would necessarily have been preserved had they or their related objects ever existed.

† See note, p. 186.

ment has a degree of regularity partaking of the *quincuncial*, a figure so characteristic of the Polyzoa. In the convoluted varieties it is (perhaps apparently only) less generally regular.

What gave a vastly greater importance to and safety in reliance on the facts thus observed, both as to the polyp-cells and the moveable processes, was this: that I found that each of them was only present in certain cases, always absent in others; and that those places where both were always absent were *constant**. Neither polyp-cell nor process is ever found on any part of the root; nor in those varieties characterized by a head,—to which I have already alluded,—is either ever found on any part of that head†. It will be felt to be necessarily consistent with the character which I have shown to mark the roots of the Ventriculidæ that neither polyps nor processes should be found there. I consider it to be the characteristic of the head-bearing Ventriculidæ that those heads are *apolypous*. The polyp-skin and under-skin are perfect on those heads,—exactly the same in all respects, excepting in the entire absence of polyp-cells and processes, as the polyp-skin and under-skin covering the rest of the body. The examination of those heads serves therefore as an important test.

Every fact observed in less perfect specimens is consistent with the important results thus obtained.

By a section most happily made, I have obtained (Pl. VII. fig. 13) a transverse view of a few polyp-cells in flint‡. The section is somewhat oblique, which it is almost impossible in such minute structure to avoid, and hence the fibres appear irregular owing to those which lie in really different planes striking the eye in the same focus. A slight variation of the focus shows that the under-skin is closely attached to the polyp-skin,—rising where it rises, depressed where it is depressed, but without any distortion. The same variation shows, in perspective, other elevations than those most forward, lying beyond them, as faintly indicated in the engraving.

I conceive that the processes which I have mentioned, and which had been lost in this specimen before its envelopment, had

* I have sometimes thought that I could detect obscure traces of cells *under* the upper part of a root on the body of the Ventriculite. This would be quite consistent with well-known phænomena, and I will only refer to Milne Edwards' paper, already cited, p. 211, for a very apt illustration of this obliteration of cells and overgrowth of root-fibre.

† The existence of this head-bearing group is another strong evidence of the unity and entirety of the whole polypiferous mass.

‡ This section was obtained long before I had satisfied myself of the existence and character of the polyp-cells; and it was only when I had satisfied myself of those facts by other means that I re-examined this specimen and found its entire consistency with those inferences.

their places upon the more elevated parts seen in the figure. If the reader will refer either to an actual specimen of *Halodactylus diaphanus* or *hirsutus*, or to the figures of the former in Dr. Farre's paper, pl. 25. figs. 2 and 3, he will perceive that the actual place of protrusion of the polyp itself is not more plainly seen in these recent specimens than in the specimen which I am describing; and the peculiar mode of drawing-in the body which characterizes this class at once explains the reason of this apparent obliteration of the cell's mouth. I apprehend that the preservation of this fragment is owing to the circumstance of its having been suddenly torn from a living animal, the portion of polypidom attached to it having lost its soft contents in, or soon after, the rupture, and the torn fragment having thus become hermetically sealed up, according to the process already described, in solid flint. Such is the actual condition in which it is found, and in no other condition or manner can I conceive it probable that any of the polyp-skin itself would be preserved in flint*.

It will be understood from what has preceded, that in the Ventriculidæ the entire exposed surface, external as well as internal, except the roots and the heads of the head-bearing species, were covered with polyps.

Another point remains to be noticed in which the Ventriculidæ are found to agree with the *Halodactylus hirsutus*.

In describing the *Alcyonidium hirsutum* (*Halodactylus hirsutus*), Dr. Johnston (p.361) characterizes it as "marked with numerous yellowish circular spots irregularly disposed;" and informs us that "these yellowish spots are produced by clusters of ova lying *imbedded in the cellular texture*." The ovarian cells of the Ventriculidæ might best be briefly described in exactly the same terms; and this mode of development of the ova is another illustration of the singleness and entirety of the whole polyp-mass†. The ovarian cells in the Ventriculidæ lie imbedded in the substance of the polypidom, replacing, where they occur, the substance of

* It appears obvious that from the very nature of the epidermis it would never be likely to be hermetically sealed up like an isolated fibre—since, though inclosed, there would be communication between its parts, which, over such a continued extent of surface, would not be likely to be entirely destroyed. Hence, like fibre which preserved its connexion, it would in time decay away, and either leave a hollow or be subsequently filled up by calcedony. See *ante*, p. 85. The epidermis would readily separate after death, but any fragments of it in this state would form but an indistinguishable mass whether preserved in chalk or flint.

† I had prepared an extensive series of notes illustrative of the general analogy between the embryology of the Ventriculidæ and that of many recent zoophytes, but I have not embodied them above, fearing that it would tend to complicate the subject and distract attention from the connected argument which I have endeavoured to set forth demonstrative of the affinities of the Ventriculidæ.

the central polypidom, but entirely inclosed, on each surface, by the polyp-skin (Pl. VIII. fig. 3.) Their character is the same in all varieties. No polyps or processes exist on that part of the polyp-skin which overlies them. It is perhaps not unworthy to be noticed that there are generally found, on specimens having no ovarian cells, small patches, of the same shape and scattered in the same way over the surface as the ovarian cells, in which there are no polyp-cells. The suggestion naturally occurs, whether these are the spots in which, at the proper season, ova would be developed? The under-skin is entire in these places.

Sufficient it is hoped has been adduced to show that the Ventriculidæ must have been zoophytes of a very high order*; that, in point of fact, characters are found in them which belong only to the higher among the Polyzoa or Ascidian polyps; and that those characters belong to different groups among those Ascidian polyps. It has been seen that the moveable processes found in some recent Escharidæ and a few other forms were combined with some important characters found principally marked in the recent *Halodactylus*; and it is not unimportant to remark, that the *Halodactylus* is superior to most other recent Polyzoa in not being a mere aggregation of distinct cells, but in having a distinct central polypidom†, other than the membrane containing its immediate polyp-cells, and other than the remains of dead polyp-cells. The central polypidom of the *Halodactylus* is composed of a network, very irregular however, which the polyps surround on all sides. In this it approaches the Ventriculidæ, but the latter far exceeded it in the perfection of all parts of that polypidom, as they obviously did also in firmness‡ as well as in regularity and elegance of form. They thus *combined* the characters

* I use the language here of those who include *Eschara* and *Flustra* among zoophytes. If they were true Ascidians, the Ventriculidæ were true Ascidians also, only more highly developed.

† This also marks *Tubulipora patina* very beautifully, whose general likeness to many Ventriculidæ has been already noticed. I have found a remarkably fine specimen in the London clay of a polypifer, folded up after the manner of *Eschara foliacea*, but with a distinct and very regularly constructed central polypidom. The species (? genus) is undescribed. My specimen is five inches square and four inches in thickness.

‡ It will occur to the reader that the security of *Eschara*, *Flustra*, &c. was ensured either by their parasitic growth or the calcareous nature of their polypidom. The Ventriculite, having neither of those characters, had the special provisions exhibited in its polypidom to secure, still more perfectly, the same objects, while the separate and peculiar nature of its root gave to its polypiferous surface a wider range and sphere than either *Eschara* or *Flustra* enjoy—a not unimportant point. In these very facts the higher rank of the Ventriculite seems indicated. In this case, as in those, the security of the polyps was the object of the polypidom. The more elaborate the provision for securing any end, the higher that end must be conceived to be, for nature never wastes or squanders her resources.

of different members of the highest orders of recent zoophytes with the *addition* of other and very important characters present in none of the latter. And those characters are peculiarly interesting as leading perhaps to some settlement of the long-moot question both as to the nature and mode of growth of polypidoms*. Let the beautiful and delicate tissue of the central polypidom—its entire separation and distinctness both from the substance and structure of the root—its investing under-skin still again differing in structure—be considered, and it must be perfectly obvious that the polypidom of the Ventriculidæ was no transudation or excretion from the body of the polyps; and it will surely be no less evident that it owed its origin to no mere vegetative principle. In addition to the peculiar character and beautifully regular structure of the whole mass, pervaded as it is with one aspect of admirable unity†, let the special adaptations of each part, as already pointed out, to subserve the ends of the preservation and safety of the whole and of each individual polyp be considered; and can the conclusion be resisted, that the entire creature, the whole polypidom with its whole array of polyps, formed one peculiar and highly organized animal, many-headed or rather with many separate special organs of nutrition undoubtedly, but still a unity, an entire animal, of which the polypidom was one constituent and essential part, which can no more be properly considered without reference to its polyps, or its polyps without reference to it, than can the bones of a mammal be considered without reference to its soft parts, or the soft parts without reference to the bones?

* An apparent inconsistency is found on this point in Dr. Johnston's valuable work, the Asteroida being described in terms exactly opposite on pp. 140 and 255.

† In all the observations as to the unity and entirety of the polypiferous mass, the whole groups of *Eschara*, *Flustra*, &c. are necessarily included. It may be matter of discussion whether the individual polyps of these are not separately true Ascidians. There can be no question, at any rate, that it is a part of the necessity of their nature to exist *always* grouped thus, and inseparably united by an organized medium. That organized medium is clearly therefore necessary for the safety and security and existence of *each polyp*; and whether we look at the mass of an *Eschara foliacea* or of a *V. simplex*, the argument is the same. That organized medium being thus necessary for the safety, security, and existence of each individual polyp, or, if you please, Ascidian, the more perfect the provision in it for that individual safety and security—and therefore for the fulfilment of the ends of the individual existence—the higher must be the rank of the creature, whether looked at as one entirety or as an aggregation of individuals. What those provisions are in the Ventriculidæ has been seen. The octahedral structure is a special and elsewhere unapproached provision for the security of the *individual* polyps (or Ascidians).

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 25, 1847.—Harpur Gamble, Esq., M.D., in the Chair.

The following communications were made to the Meeting:—

1. NOTE ON THE EARLY GENERATIVE POWER OF THE GOAT. BY JOHN DAVY, M.D., F.R.S., INSPECTOR-GENERAL OF ARMY HOSPITALS.

In the young salmon, the par, we have the remarkable example, now well-authenticated, of the precocious development of the testes with functional activity. What I have witnessed in the young male goat in this island (Barbadoes) as regards its generative power, is hardly, it appears to me, less remarkable. I shall briefly notice the few circumstances which have come to my knowledge illustrating it; such as I can state with certainty as facts.

On the 2nd of May, 1846, a goat which belongs to me gave birth to two kids, a male and a female. When less than a month old, the former exhibited strongly the sexual propensity. When about five weeks old, the penis was protruded in his attempts to copulate. When four months old the mother was in heat, and was then covered and impregnated by her offspring. Five months after, viz. on the 2nd of February, 1847, she gave birth to four kids—three females, one male, all of the usual size and vigorous. On the 10th of February I had the male kid castrated: each testis was about the size of a French bean. A little transparent fluid was obtained from the vas deferens, which under the microscope, viewed with a high power, exhibited some granules, a few fine fibres, and one that had the appearance of a pretty well-formed spermatozoon. The fluid procured from the incised substance of the testis contained many blood-corpuscles, some dark granules and a few small spermatozoa; these were best seen after having been dried on the glass support.

The young female received the male shortly after the mother, but was not then impregnated.

It is said here that the goat breeds at six months old. It is also said that both male and female are two years in attaining their full size.

The goat of Barbadoes appears to resemble in every respect the common goat of Europe, from whence it is supposed to have been originally brought.

The precocity of the young male, as I have described it, and of the effect of which in its generative power there can be no doubt, as the female had access to no other male, is here not considered extraordinary. Whether the same function at so early an age is exercised in a cooler climate, I am ignorant. Should it be found to be so exercised, it may perhaps be considered a provision of nature to secure the preservation of the species, endangered by the localities the animal in its wild state inhabits amongst precipitous rocks, subject to the attacks of birds and beasts of prey. In accordance with this idea I may remark, that the young pair of kids when five weeks old, when they began to eat grass freely, kept constantly together, and were more frequently absent from than with the mother. The colostrum and the milk of the goat, I may add, containing an unusual proportion of nutritive matter, as indicated by their specific gravity, may also be considered in accordance with this idea. The colostrum first drawn, I have found of the high specific gravity 1088; it coagulated at about 170°. The milk drawn the following day was of the specific gravity 1041; it formed a soft coagulum at about 182°, and a firm one at about 190°. The milk drawn two days later was of specific gravity 10343. After this it underwent very little change; some drawn a week after was of specific gravity 10333, and some drawn three weeks later was of the same specific gravity.

Barbadoes, April 15th, 1847.

2. Descriptions of some New Genera and Species of Asteriadæ. By John Edward Gray, Esq., F.R.S. etc.

In the 'Annals and Magazine of Natural History' for November 1840 I published a monograph of the species of this group then known to me, and divided them into five families and several genera; since that time the British Museum has received numerous specimens further illustrative of those which we then possessed, and many other specimens, several of which are the types of new genera. Some of these I shall proceed to describe in the following communication, intending on a future occasion to send the remainder.

I may remark, that for several years before the publication of that paper, I had been engaged in the study of these animals, with the intention of publishing an illustrated monograph of the order. The preparation of the plates has occupied many years, but I hope it is now in the course of fulfilment.

In the same year in which I published my paper, Professors J. Müller and D. Troschel read at the Berlin Academy a paper on the same subject, and in 1842 they published a 4to work, with the description of various species.

M. Müller has there reduced the number of genera to eighteen, and for these has most unnecessarily changed the generic names, much to the confusion of the science. I do not know why the *Stellonia* of Forbes is not to be used for *Asterias glacialis* and its allies. If the generic name of *Asterias* is to be erased from the list, I do not see in what respect *Asterocanthion* is preferable to either of these names, or why he rejects Link's name of *Pentaceros* for *Oreaster* (he says Cuvier has used *Pentaceros* for a genus of fish, but I do not find this name in any of Cuvier's works; and if it had been so used, Link has the priority over Cuvier), or why *Astrogonium* is preferable to *Goniaster*, or *Asteropsis* to *Gymnasteria*.

The Star-fish have generally been described as having no vent. Colonel Sabine, in figuring *Asterias polaris*, represented a projecting tube near the middle of the back, and Professor Müller in his 'System' uses the presence or absence of this tube, which he regards as a vent, as a character to separate the class into two divisions; but I think his table of genera shows that this division can scarcely be considered as natural, for he has been obliged to separate species of *Astropecten* from their allies, and to place them, on this single character, in another division of the family. Secondly, it is very difficult to observe the presence or absence of this part, especially in *Astropecten*, on account of the *paxilli*, and some species, which are said to be without it, may have it; for it is to be observed, that Müller and Troschel place the genus in which Sabine first observed the vent, in the family characterized as not having one.

I must consider their work as a retrograde movement, after the publication of my paper, which they quote; for though they might not adopt the genera, yet it cannot but be allowed, that what I have considered as genera are natural groups; and it would have facilitated the making out of the species they have described, if they had used them as sections; they have done so in a few instances (thus after the publication of their paper they have divided the genus *Goniaster* into two, adopting my sections as their genera; but as in the case of *Asterias*, because they have divided it, they blot the names from the system); thus their first section of *Ophidiaster* is the same as my genus, and their second is my genus *Linkia*, and the second section of *Asterocanthion* appears to be my *Tonia*.

It has always appeared to me, that the great advantage of dividing the species into small groups (let us call them genera or sections, as we may) is, that it enables one more accurately to determine and neatly describe and distinguish the species, and prevents the necessity in each description of repeating what has been given as the character of the group, as is the case in the system of Star-fish.

Lastly, I suspect that had M. Müller had the opportunity of examining and comparing the number of specimens of this genus to be found in English collections, he would have come to the same conclusion as I have done with regard to the distinctness of several species which in the work above referred to he has regarded as mere synonyma of some well-known species. At the same time it is remarkable that it should not occur to M. Müller, that when the specimens on which a certain number of species have been established are contained in a single collection, and divided into minute groups, and arranged side by side, it is not so easy to make mistakes in this particular as when the materials are to be collected from various scattered museums; as the differences and the similarities are then more easily to be seen, and any errors which may have been made, more easily discovered.

Thus I am convinced, if he had seen the series of specimens of *Asterias Helianthus* and *Cumingii*, and *A. multiradiata*, which have passed through my hands, and the selection of them in the Museum collection, it is quite impossible that he could have confounded them into a single species. The same may be observed with regard to *Linkia Typus*, *L. Brownii*, *L. bifasciatus* and *L. unifasciatus*; with

Asterina gibbosa and *A. Burtonii*; with *Pentaceros grandis, P. gibbus* and *P. reticulatus*; with *P. turritus* and *P. Franklinii,* &c. &c.

Culcita, Agassiz.

This genus chiefly differs from *Randasia* and *Pentaceros* in having no upper series of marginal ossicules. It agrees with *Randasia* in the back being nearly flat.

Culcita Schmideliana. t a. ?

A. Schmideliana, *Retz. Dis.*; *Schmidel's Naturf.* xvi. t. 1. good. A. discoidea, *Lam.*

Body subcircular, flat above when dry (very convex subglobose when alive). The back coriaceous, without any apparent reticulations, covered with scattered, small, conical spines. The oral surface rather convex (when dry), closely and minutely granular, and with larger conical tubercles; those near the ambulacra and oral angles much the largest and ovate.

Inhab. —— ?

There are distinct indications of the lower marginal ossicules in this species, but they and the ossicules of the oral surface are not sufficiently large and close to force the dry specimen to assume the pentangular form of the following species.

Culcita pentangularis. t 2 f 2

Body pentangular; back flat when dry, convex beneath, minutely and closely granulated; back with obscure reticulations, the reticulations armed with small conical tubercles; the interspaces closely and minutely porous. The oral surface protected with distinct well-defined ossicules, defining the lower edge of the margin, covered with close and minute granules and larger round-topped tubercles, those near the ambulacra and the oral angles being largest and highest.

Inhab. Reef of Oomaga.

This species is very distinct from the former, and forms the passage to the genus *Randasia,* but there is a series of concave, minutely porous spaces in place of the upper marginal plates.

Randasia, Gray.

Body pentagonal, depressed, minutely granular; back nearly flat, minutely granular, reticulated; reticulations rather tubercular, interspaces sunken (when dry) and covered with very minute close perforations. Dorsal tubercles roundish, single, subcentral. Margins furnished with an upper and lower series of oblong ossicules, the upper one narrower internally, with a central series of tubercles, the lower ones oblong, close together and convex. The oral surface protected by close, regular, squarish, convex ossicules, covered with short crowded granules. The ambulacral spines in rounded groups; the series of tubercles nearest the ambulacra larger, crowded, and placed in groups of three or five, and those in the oral angles largest and flat-topped.

This genus differs from *Pentaceros* in the back being flat, elevated, and not angular; it is in several respects intermediate between *Culcita* and *Pentaceros*.

Randasia granulata, n. s. t 2 | 1

Body five-sided; back minutely granular, with roundish convex subconical tubercles in the reticulations; the marginal plates fourteen on each side, the upper ones with a central series of tubercles.

Inhab. Reefs of Attagor, Torres Straits.

There are two specimens of this species in the British Museum, one in a very bad state.

Randasia spinulosa, n. s.

Body five-sided; back and upper marginal plates covered with numerous small, conical, acute spines, without any larger tubercles; the upper marginal plates indistinct.

Inhab. ——?

This species is very like the former in shape, size and appearance, but is very easily known from it by the numerous mobile acute spines with which the back and upper part of the margin are covered, appearing to take the places of the small granulations, and by the absence of the tubercles on the elevated ribs of the back.

Asterodiscus.

Body pentagonal, coriaceous, depressed, covered with numerous close, flat-topped, unequal, small tubercles; back convex; dorsal wart roundish, subcentral; arms short, rounded, with a pair of large convex kidney-shaped ossicules on each side of the tip above. Margin simple, rounded, beneath concave; ambulacra with a series of short linear spines, placed in groups of four or five, each group on a separate ossicule, and with two series of larger, blunt, club-shaped spines on the outside of the ambulacral spines. The young specimens have indistinct inferior marginal ossicules.

Asterodiscus elegans.

Pale brown when dry; tubercles of the back unequal, the larger ones truncated, those nearest the mouth on the underside larger, club-shaped, rather crowded.

Inhab. ——? Brit. Mus.

Pentaceros granulosus. t 6 | 3

Five-rayed; rays as long as the diameter of the disc, rounded at the tip. Back rather convex. Ossicules convex, rounded, all covered with close rounded granules, the two or three central ones on the top of each ossicule being larger, those on the middle of the back largest and subtubercular. The marginal ossicules convex, rounded.

Inhab. Western Australia.

Young? Arms more slender, and the lower marginal ossicules near the tip of the arm each with a group of two or three spines, the one nearest the tip largest.

The dorsal surface of this species is furnished with abundance of *pedicellaria*, one arising from each hole between the ossicules.

Stellaster Incei.

Purplish, minutely granular; back with scattered, conical, convex tubercles, those down the centre of the arm largest. The lower marginal plates are flattish.

Inhab. North Australia.

This species is very like *Stellaster Childreni*, Gray, Ann. and Mag. Nat. Hist. 1840, 278; Müller, Aster. 62. 128. t. 4. f. 3; *Asterias equestris*, Retzius, Diss. 12; but it is purplish when dry; the back is tubercular; the whole surface is minutely granular; while the Japanese species is always white, the back smooth, and the granules of the surface are so minute and thin that they are very easily eroded, and the lower marginal plates are more convex and the central ones much larger than the others.

Stellaster Belcheri.

Back convex, with two or three large conical tubercles on the line extending to the centre of the arms. Arms slender, tapering, rather longer than the diameter of the disc.

Inhab. Amboina or New Guinea.

This species is intermediate between *S. Childreni* and *S. Incei*, having the white colour and the slender arms of the former, and the convex back and tubercles of the latter, but the tubercles are larger and fewer, and the arms are more slender, having only a single series of plates between the marginal ones.

There are two specimens in spirits and one dry, in the British Museum collection.

Calliderma.

Body flat, five-sided, rays rather elongated; attenuated end only formed of the marginal plates. Ossicules all minutely granulated; the dorsal ossicules flat-tipped, six-sided, some with a larger, globular, central tubercle-like granule. The marginal ossicules broad, gradually becoming smaller near the tip, short-edged, minutely granular, those of the upper and lower series alternating; the edge of the upper ones with some indistinct spines on the margin, the lower ones with scattered mobile spines on the oral surface. The ossicules of the oral surface three-, four-, or six-sided, granular, with one (rarely two) central, compressed, acute, mobile spines. The ambulacral spines very small, close, fourteen or sixteen on each ossicule, forming a rounder group, with two or three series of large, scattered, mobile, acute spines on the outer side.

This genus resembles *Stellaster*, but differs from it in the oral surface being furnished with scattered spines.

There is a fossil species very like the one here described found in the chalk, and figured in Mr. Dixon's work on the fossils of Worthing, which I propose to call *Calliderma Dixonii*. There are probably several other fossil species from the same locality; they have been referred to the genus *Tosia*, but the ossicules are granular and the oral surface spinose.

Calliderma Emma. t 4

Flat, pentangular, the sides concave, the arms elongated, produced, tapering to a fine point, about two-thirds the length of the diameter of the disc. The dorsal ossicules six-sided, regular, flat-topped, covered with minute roundish granules; the central granules of the central ossicules and those down the centre of the arms larger, globular, tubercular-like. The margin sharp-edged, concave in the centre; the ossicules of the upper and lower series alternating, minutely granular, with one or two larger subspinose granules on the middle of the upper margin. Marginal ossicules about fifty on each surface on each side, the lower series with scattered, acute, compressed spines on their oral side.

The ossicules of the oral side four- or six-sided, rather irregular, minutely granular, each armed with a central, compressed, acute, mobile spine.

Inhab. —— ?

This species most nearly resembles a fossil found in the chalk, which has hitherto been referred to the genus *Tosia,* and figured in Mr. Dixon's forthcoming work on the fossils of Worthing.

I have named this fine species in compliment to my daughter Mrs. J. P. G. Smith, who before her marriage commenced a series of plates to illustrate a monograph of this genus.

Anthenea.

This genus may be divided into two sections, one having a very large two-lipped pore on each ossiculus of the oral surface; the back netted and chaffy, as in *A. chinensis* and the following new species.

Anthenea tuberculosa. t 4' 61

Back obscurely netted, rather chaffy, with scattered, long, flat-backed tubercles. Marginal ossicules with some moderate granules, the upper ossicules with one or more large flat-topped tubercles on their upper part.

Inhab. Port Essington.

This species is very like *Anthenea chinensis,* Gray (*Asterias pentagonula,* Lam. ?), but differs from it in being more convex and netted and more distinctly tubercular, and in the upper marginal tessera being armed with tubercles.

Like the Chinese species, all the ossicules, both marginal and discal, of the oral surface, are furnished with large, elongated, two-lipped pores.

The second section contains the following species, which have one or more small two-lipped pores on some of the ossicules of the oral surface; the back subtubercular, and the ossicules all covered with arge roundish granules.

Anthenea granulifera. t 562

Both surfaces covered with small roundish granules, the back with rather convex ossicules; the arms as long as the diameter of the body; back with one or two scattered tubercles.

Var. Back with a blunt tubercle on the centre of each of the ossicules of the middle of the back.

Inhab. —— ?

This species is easily known from the former by the smaller granules on the surface, the length of the arms, and the small size of the two-lipped pores; those of the dorsal surface are very minute.

Hosia spinulosa. t462

Body flat, pentagonal, sides concave; arms not half the length of the diameter of the body; ossicules large, subequal, six-sided, very minutely granular. Marginal ossicules $\frac{10}{10}$ on each side, convex, deeply separated from each other with a series of two or three small, acute, spine-like tubercles in the centre of each. The ossicules of the oral surface flat, minutely granular, with small two-lipped pores.

Inhab. Indian Ocean; Philippines.

This species nearly resembles the shape of *Tosia australis*, but is at once known from that species by the granular ossicules, the spines on the margin, and the two-lipped pores beneath; it differs from *Hosia flavescens* in its being five-sided instead of five-armed, and in having no spines on the middle of the back.

Astrogonium (restricted).

Body pentangular, flat above and below. Back and oral surface protected by triangular ossicules, each covered with numerous erect, cylindrical, truncated tubercles or granules, those of the oral surface longest. Margin strengthened with regular, oblong, four-sided ossicules, covered with small regular granules, except on the most convex part of their centres, those of the upper and lower series opposite each other. Dorsal wart single. Ambulacra with cylindrical truncated spines, in groups of four on each ossiculus of equal size, not forming a rounded group, and with a series of similar, rather larger spines on their side, and a series of small ossicules with terminal granules on their outer sides. Bilabiate slits are on either surface.

Messrs. Müller and Troschel have proposed a genus under this name, which I have here restricted to smaller limits, to more accurately distinguish the species. I have described all we have in the Museum.

A. *Body flat, five-sided; granules short; ossicules flat-topped, not tubercled.*

Astrogonium granularis. Asterias granularis, *Retz. Dis.*; *Müller, Zool. Dan.* t. 92. f. 1. t1(4

Pentagonal, sides rather concave. Back bright crimson; oral surface yellowish; marginal ossicules oblong, $\frac{14}{14}$ on each side, rather convex, covered, except at the most convex part of the upper and lower surface, with very minute granules. Dorsal ossicules hexagonal, flat-topped, with short flat-topped granules; ossicules of oral surface similar, but granules longer.

Inhab. North Sea. British Museum.

This species is very like *Tosia australis*, but is at once known from it by the granules covering the greater part of the surface of the marginal ossicules.

Astrogonium miliare. t1f3

Flat, dark red, pentangular; rays rounded at the end, about one-third the length of the diameter of the disc. Margin rounded, ossicules $\frac{20}{20}$ or $\frac{22}{22}$ on each side, covered with uniform, close granules. Dorsal ossicules rather convex, covered with uniform granules.

Inhab. New Zealand.

Like *A. granularis* in form, but the margin is round, and the marginal plates are more numerous.

Astrogonium inæquale.

Pentagonal, sides rather concave. Arms acute. Dorsal ossicules rather convex, covered with small roundish granules. Marginal ossicules $\frac{8}{8}$ on each side, the two central ones small, narrow; four others large, convex, the two at the tip very small.

Inhab. New Guinea? or Amboina? Capt. Sir E. Belcher.

B. *Back rather convex, the marginal and dorsal ossicules with a small central convexity or rounded tubercle; the granules of the oral surface rather elongate, rounded.*

Astrogonium tuberculatum. t1f2

Body pentangular, sides concave; arms rather produced, acute, tapering; the ossicules of the dorsal surface, of the upper and lower marginal series, each furnished with a small, central, rounded tubercle. Marginal ossicules $\frac{28}{28}$ on each side, the dorsal tubercles on the middle of the back and down the centre of each arm rather larger.

Inhab. Port Natal.

C. *Body flat; ossicules of the dorsal, marginal and oral surface entirely covered with rather elongated uniform granules; marginal ossicules small, erect, rounded above.*

Astrogonium paxillosum. t1f1

Blackish (perhaps discoloured). Pentagonal, flat. Arm nearly as long as diameter of disc, rounded at the end. All the ossicules of the back, edge, and oral surface, covered with regular, uniform, rather long, erect granules, forming a level surface; granules of the oral surface longest. The marginal ossicules narrow, erect, rounded above. Ambulacral spines elongate.

Inhab. Port Essington.

This species, from the length of the granules, passes towards the *Astropectens*, the elongated tubercles having much the appearance of those which are called *paxilli* in that genus.

Pentagonaster Dübeni. t3f7

Body flat, five-rayed; rays two-thirds the length of the diameter of the disc, rounded at the end; ossicules all convex, rounded. Marginal ossicules $\frac{10}{10}$, large, round, those near the end of the arms largest and most convex.

Inhab. W. Australia.

This species differs from *P. pulchellus* in the marginal ossicules being more equal, and in the arms being much longer and more slender. The ossicules of the dorsal disc are unequal in size and rather irregularly formed; those near the margin on the middle of the sides are oblong and narrow, those of the oral surface are more regular and not so convex, those near the angles of the mouth being the largest and subtriangular.

I have named this beautiful species in memory (I regret to say) of M. W. Von Düben, who has lately published a very admirable paper on the northern species of this family.

Tosia, Gray.

The granules between the ossicules are deficient in the dead and washed specimens. It has been thought that the fossil species found in the chalk belonged to this genus, but the surface of the ossicules of most of the specimens I have seen show, from the scars with which their surface is covered, that they were covered with granules, therefore they rather belong to the restricted genus *Astrogonium*.

In some species of this genus the ossicules of the oral disc are more or less entirely covered with crowded, flat-topped granules.

Tosia grandis. E 3|1

Dorsal ossicules very unequal, flat-topped. Marginal ossicules $\frac{14}{14}$ or $\frac{16}{16}$ on each side, rather convex; the ossicules of the oral surface are furnished with two or three rows of crowded granules, and those near the ambulacra are most covered.

Inhab. Western Australia.

Link, under the name of *P. regularis*, t. 13. f. 22, 23, copied (E. M. t. 96. and *Seba*, iii. t. 8. f. 4) a species like the above, but it has only ten marginal plates. Müller, who thought he examined Link's specimen at Leipsic, describes it as having seven upper and five under marginal plates.

Tosia aurata.

Golden yellow. Dorsal ossicules flat-topped, the five in the centre, between the central lines of the arms, largest, and round; the marginal ossicules $\frac{10}{10}$, or $\frac{12}{12}$, rather convex and nearly equal (that nearest the top not being longer than the others); the ossicules of the oral disc, all except a few in the middle of each area, entirely covered with flat-topped granules.

Inhab. Australia. Brit. Mus., three spec.

In others, the ossicules of the oral surface are only edged with a single series of granules, like those of the back.

Tosia tubercularis.

Yellow, edges reddish. The dorsal ossicules convex, subtubercular, those of the centre of the arms highest, those between the arm in the centre largest, nearly flat. The marginal ossicules $\frac{6}{6}$ or $\frac{8}{8}$ on each side, convex, subtubercular, the one near the top of the arm largest and oblong, longitudinal, convex. The ossicules of the oral surface small, each surrounded with a single series of granules.

Var. ? or young ? The ossicules of the oral surface near the edges covered with granules.

Inhab. Swan River.

There is a specimen in the British Museum with six marginal ossicules very like the above, but differing from it in the dorsal ossicules being only convex and rounded; it has the same convex and large marginal plate.

Tosia rubra.

Red brown. Dorsal ossicules rather convex, rounded. Marginal ossicules $\frac{10}{10}$ on each side, rather convex, equal, that at the tip of the arms smaller, narrow. The ossicules of the oral surface flat-topped, with a single series of marginal granules.

Inhab. Australia.

Tosia australis, Gray, Ann. Nat. Hist.

Yellowish or reddish. Dorsal ossicules rather convex, rounded. Marginal ossicules $\frac{6}{6}$ on each side, rather convex, equal; the ossicules of the oral surface flat-topped, with a single series of marginal granules.

Inhab. W. Australia, Swan River.

Petricia.

Body convex, five-rayed. Skin above and below varnished and spineless. Back strengthened with numerous, sunken, moderate-sized ossicules; the margin with two series of larger oblong ossicules, but spineless; the oral surface with rather regularly disposed smaller ossicules. Ambulacral spines subulate, placed in pairs, with a second series of similar but rather larger spines on the outer side of them.

This genus is very like *Porania*, but the back does not appear to be angular, the margin is edged with spines, and the ambulacral spines are in pairs, and not single as in that genus. The ossicules of the back and oral surface are punctured, and one of them situated near the edge of the back, in the middle space between the arms, is furnished with a linear pore edged with convex lips.

Petricia punctata.

Orange, when dry.

Inhab. the Reef of Attagor. J. B. Jukes, Esq.

There is a single species of this genus in the British Museum collection.

I may here remark, that the specimen of *Porania gibbosa*, the *Asterias gibbosus* of Leach, and *Goniaster Templetoni* of Forbes, in the British Museum from Arran, are exactly like *Asterias pulvillus* of Müller, received from Norway, in the same collection.

Patiria.

The upper side, between the angles of the arms, is covered with small, roundish groups of spines.

This genus may be divided into three sections:

1. *Body pentagonal; the dorsal ossicules lunate, narrow; the edge of the arms acute.*

Patiria coccinea, Gray.

Asteriscus coccineus, *Müller & Trosch.* 43.

The roundish group of spines between the lunate ossicules are very abundant.

2. *Body five-rayed; rays thick, rounded; dorsal ossicules lunate, subtriangular; arms convex above and rounded on the sides.*

Patiria granifera.

? Asterias granifera, *Lam.* n. 24 ?; var. à petits grains, *Oudart*, t.

Brown. Back rather convex. The arms broad, rounded at the end, nearly as long as the diameter of the disc, rounded above, flat beneath; the lunate dorsal ossicules covered with short, crowded spines, and with only a few small tufts of spines between them, the ossicules of the oral surface each with a transverse line of six or eight spines.

Inhab. —— ?

Variety, the arms more slender, about one-third longer than the diameter of the disc.

Inhab. —— ? Brit. Mus.

The variety may be a distinct species, but the specimen is not in sufficiently good preservation to determine this point with accuracy.

3. *The body five-rayed, rays thick, rounded; the dorsal ossicules, especially those at the end of the arms, broad, rounded, the back covered with two or three beaked pedicellaria nearly hiding the tubercles.*

Patiria ocellifera.

Asterias ocellifera, *Lam.* 45; *Oudart*, t. . fig. .

Body five-rayed; arms thick, rounded, as long as the diameter of the disc, bluntish at the end; the dorsal ossicules broad, oblong or roundish, reddish, covered with short, crowded spines; the oral surface with transverse rows of three to five mobile spines.

Inhab. —— ?

This species much more nearly resembles Oudart's figure than the species I have described under the name of *Nectria oculifera*.

Patiria obtusa.

Brown, depressed, five- to six-rayed; rays depressed, rounded at the end; dorsal surface with lunate ossicules crowded with short spines; oral surface with circular groups of crowded spines in the middle of each ossicule.

Inhab. Panama. Sandy mud, six to ten fathoms.

Patiria? crassa.

Pale yellow (dry), five-rayed; rays thick, rather tapering, about half as long again as the diameter of the disc. Dorsal surface formed of convex, subhemispherical ossicules, covered with crowded minute spines. The oral surface with roundish groups of short, crowded spines, like *paxilli*.

Inhab. W. Australia. Mr. Gould.

Pteraster capensis.

Body subpentagonal, swollen, edge very thick, rounded; back convex, reticulated, with rounded groups of very small ossicules at the junction of the reticulations.

Inhab. Cape of Good Hope.

The spines of the ambulacra are like those of *Pteraster militaris*, but they are longer, and the series of webbed spines on their outer margins are scarcely longer than those of the ambulacra, while in the northern species they are much longer and thicker, and there is no appearance of the two long glassy spines at the angle of the mouth, so distinct and peculiar in that species.

Ganeria.

Body flat, five-rayed. Back coriaceous, strengthened with numerous small, linear and curved series of very short cylindrical spines. Margin perpendicular, with two series of narrow ossicules, each armed with a central, erect, linear series of short cylindrical spines. Oral surface covered with diverging spines, one being placed on each ossicule. Ambulacra linear, with two series of tentacles, and edged with subulate spines, two on each ossicule, and with a series of diverging spines at the angles near the mouth.

Ganeria falklandica.

Body five-rayed; rays as long as the diameter of the disc, rather blunt at the tip.

Inhab. Falkland Islands. Captain Sir James Ross.

3. Description of a new species of Fulgora. By Arthur Adams, Esq., R.N.

Fulgora (Hotinus) Sultana, Adams and White. *Fulg. thorace superiore et rostro sanguineis; elytris ad basin nigro-fuscis lineis ochreis venosis, ad apicem ochreo-fuscis; alis ad basim intensè carmineis, ad angulum analem roseis, ad apicem fuscum quatuor vel quinque maculis rotundatis albis ornatis.*

Rostrum and upper surface of thorax of a rich blood-red colour. The form of the beak intermediate between that of *H. clavatus* of Westwood and *H. pyrorhynchus* of Donovan. Elytra blackish brown at the base, traversed by ochraceous veins, with the tip ochraceous brown. The wings with the base of a deep carmine fading to pale pink towards the anal angle, the tips brown, with four or five roundish white spots. Body above straw-coloured.

Body covered, when alive, with a white mealy substance. Lantern not luminous by day or night. Remains in a torpid state during the heat of the day, and becomes more active in the evening.

Forest of Borneo near Tampasook.

4. Short Descriptions of some new species of Crustacea in the Collection of the British Museum. By Adam White, F.L.S.

Family Parthenopidæ.

Cryptopodia dorsalis, White and Adams, n.s.

Carapace narrower and wider than the same part in the *Cryptopodia fornicata*, the greater part of the back covered with slight pustules; on the posterior part of the carapace are two deep grooves placed longitudinally and slightly bent, so as to have a lyre-shaped form; posterior edge of the carapace with coarser and rounder crenations than in *C. fornicata*; the ridges on the chelæ with blunter tubercles.

This distinct and beautiful species of a singular genus was found by Mr. Adams in the Sooloo Sea, where the bottom was stony.

When alive, it is of a dirty flesh-colour, with brown markings and minute black specks; on each chela there is an orange linear spot: under surface of a dead white, on the breast reddish.

Mr. Adams informs me that the species of this genus resemble those of *Calappa* in their habit of simulating death when disturbed, folding the chelæ close to the front of the carapace and concealing their legs under the dilated sides of the carapace. They are always found in deep water, while the *Calappidæ* are found on sandy flats, sometimes buried under the sand.

Family Ocypodidæ.

Gelasimus crassipes, White, Cat. Crust. in Brit. Mus. p. 36.

Carapace very much arched, suddenly narrowed behind; four hind pair of legs thicker and stronger than in other species; front with a lobe, without narrow stalk.

Hab. Philippine Islands (Siquejor). From Mr. Cuming's collection.

Gelasimus bellator, White, l. c.

Carapace with the fore-part just behind the insertion of eye-peduncles sinuated, the front slightly dilated into a rounded lobe. Larger hand with the fingers very long, the moveable with the sides nearly parallel, two or three larger tubercles on the edge near the base; fixed finger margined on the under side; the cutting edge with a very wide shallow tubercular sinus at base; at the end of sinus beyond the middle a strong wide tooth, which gradually slopes down to the end, which curves up.

Hab. Philippine Islands. From Mr. Cuming's collection.

Gelasimus cultrimanus, White, l. c. p. 35.

Front between the eyes with a small dilated rounded lobe. Edge of lower orbit very distinctly crenated; carapace with the upper surface smooth; the lateral edges rounded, without any sharp keel from the outer orbital angle. Larger hand with the fingers wide, both at the end slightly curved outwards, the lower finger with a very wide sinus in the middle; near the end a wide lobe serrato-crenated on the edge; moveable finger with the lower edge nearly quite straight.

Hab. Philippine Islands. From Mr. Cuming's collection.

GELASIMUS PORCELLANUS, White, l. c. p. 36.

Eye-pedicels very long; the frontal portion of carapace not narrowed at base; the hind part of carapace much longer than the side. Lower finger thickened at the end, the inner margins of both fingers with four larger tubercles amongst the small crenules.

Hab. Borneo. Presented by the Lords of the Admiralty.

Family MAIADÆ.

TYCHE, Bell.

TYCHE EMARGINATA, White, l. c. p. 10.

Carapace with the dilated part behind, deeply notched in the middle; the tubercles on the sides of the depressed part with hairs.

The genus *Tyche* was established by Professor Bell in the Zoological Transactions for a species from Panama, which he has described and figured under the name of *T. lamellifrons*. The specimen from which the above brief description is taken is very much mutilated, but is clearly distinct from Mr. Bell's.

Hab. West Indies. British Museum.

Family THELPHUSIDÆ.

VALDIVIA, n. g.

Outer jaw-feet with second joint wider than long; third joint longer than wide, slightly notched at the end. Carapace depressed, rather more rounded in the outline than in *Thelphusa*; the latero-anterior edge with four sharp teeth directed forwards; legs very long, last joint very long, smooth.

This genus is closely allied to *Trichodactylus*.

VALDIVIA SERRATA, White, l. c. p. 31.

Front quite straight; a strong distinct keel from last tooth on side of carapace to hind part; the whole upper surface of carapace and legs is covered with a brownish epidermis.

Hab. ——? British Museum.

Family GRAPSIDÆ.

UTICA, White, n. g.

Carapace somewhat eight-angled, tabular, the latero-anterior margin with three teeth; the latero-posterior part of the carapace oblique; carapace behind very straight; behind the middle there is a very strong transverse ridge. Outer jaw-feet with the third joint on the outside straight, not dilated. Fore-legs small; hind-legs very long; tarsus not particularly dilated, somewhat elongated, fringed with hairs, as is the preceding joint.

This genus, which is shortly characterized above, belongs to the family *Grapsidæ*, being nearly allied to *Trichopus*, De Haan, which is synonymous with *Varuna*, M. Edwards.

Utica gracilipes, White, l. c. p. 43.

Front wide, fore-edge very straight; behind it, and extending to the middle of the carapace, there is a considerable, wide, somewhat three-sided elevation, separated from the transverse ridge by a deep lunated depression, from the ends of which a slight impressed line proceeds to the side of the ridge where it deepens; legs very slender and fringed with hair.

This species is a native of the Philippine Islands, from which it was first brought by Mr. Cuming. He found it in a freshwater rivulet among the mountains of the island of Negros. Mr. Adams found it also in the island of Mindanao, and from his journal has given me the following description, taken from the crustacean when alive:—

"Carapace dark liver-colour; legs reddish brown; under surface dark brown, on the legs with a lighter tinge; abdomen also of a lighter colour, with a yellowish line down the middle. ♀. Frequents the deep, still, muddy freshwater rivers of the island of Mindanao, hiding under weeds and rotten wood. When caught this singular crustacean feigns death, contracting its limbs and rendering them rigid, as if it were in a catalepsy."

5. Descriptions of several New Species of Spondylus. By G. B. Sowerby, Jun.

Spondylus unicolor. *Spond. testâ solidâ, obliquè ovali, rubro-violascente; costis 6 principalibus, squamis crassis, arcuatis; subtùs concavis, paululùm palmatis, propè marginem numerosis; costis interstitialibus spinis crassis, brevibus, arcuatis ornatis; inter costas sulcis nonnullis.*

Hab. ——? Mus. M. Grüner; G. B. Sowerby.

Spondylus Cumingii. *Spond. testâ liberâ, regulari, subrotundatâ, subdepressâ; areâ cardinali parvâ; costis principalibus 6 elevatis, lævibus, squamis subelongatis, lævibus, arcuatis, palmatis, ad latera palmarum undulatim fimbriatis; interstitiis imbricatim striatis; colore fusco rubescente.*

A free-growing species, with short cardinal area, in some degree resembling *S. regius* and *S. imperialis*, but most remarkable for the beautiful manner in which the arched palmated scales are frilled and fluted at the sides.

Hab. ——? Mus. H. Cuming.

Spondylus limbatus. *Spond. testâ ovali, crassâ, vix costatâ, squamis depressis, lævibus, palmatis, brevibus, irregularibus, inæ-*

qualibus, 9 *ad* 11 *dispositis; interstitiis minutissimè striatis, cardine magno; colore squamarum croceo, interstitiarum obscurè violaceo; intus limbo purpureo.*

Hab. Persian Gulf. Mus. Grüner. Brit. Mus.; G. B. Sowerby.

Spondylus sinensis. *Spond. testâ lævi, elongato-ovali, areâ cardinali plerumque elongatâ; costis* 5 *ad* 6 *principalibus, vix elevatis, squamis lævibus, depressis, palmatis; interstitiis lævibus, costis inæqualibus et squamis minoribus; colore pallidè fulvo, vel roseo, vel albo, prope umbonem fusco variegato.*

Remarkable for the smooth, depressed, palmated, spoon-shaped scales on the five or seven principal ribs, which are repeated in miniature in the interstices.

From China.

Spondylus lingua-felis. *Spond. testâ ovali, crassâ, areâ cardinali et auriculis magnis; costis numerosis, vix elevatis, spinis brevibus, æqualibus, numerosis armatis; colore fusco, subtùs croceo.*

A much more solid shell than *S. asperrimus*, with the hinge large; the colour is a uniform dark brown, which is shown in the interior by a well-defined border. The shell is covered by nearly equal ribs, which are armed by short, thick, slightly curved prickles.

Hab. ——? Mus. M. Grüner.

Spondylus digitatus. *Spond. testâ subrotundatâ, tenui, costatâ; costis* 6 *ad* 9 *principalibus, vix elevatis, squamis rectiusculis, arcuatis, ad terminos palmatis, aculeatim divisis; interstitiis spinosis; colore fusco, vel rubro, vel purpureo, ad umbones rubro variegato.*

The peculiarity of this species consists in the beautifully branched and digitated palmations which terminate the erect and arched scales.

Hab. Bermudas; Belcher. Mus. H. Cuming.

Spondylus asperrimus. *Spond. testâ subrotundatâ; costis numerosis vix elevatis, subæqualibus, aculeis brevibus, erectis, creberrimis, subtùs canaliculatis; interstitiis scabriculis et spinosis, colore valvæ superiori fusco, prope umbonem variegato; valvæ inferiori croceo.*

Hab. ——? Mus. H. Cuming.

Spondylus tenuispinosus. *Spond. testâ ovali, tenui, costis principalibus* 8 *spinis elongatis, tenuibus, erectis, numerosis, spinis interstitialibus minutis; interstitiis minutè imbricatis; laminis valvæ superioris elegantissimè foliaceis; colore pallidè cinereo, prope umbonem rubro variegato, valvæ inferioris albo, prope umbonem flavido rubro radiato.*

This species is distinguished by the thin, sharp, erect, white spines which ornament the numerous ribs. The upper valve is of a pale ashy colour, variegated with red near the umbo, and the under valve is white, with beautifully foliated laminæ and a few graceful spines.

Hab. Australia. Mus. Cuming.

MISCELLANEOUS.

Note on the Hop-fly. By Francis Walker, Esq.

The alternate generation of Aphides, or the succession of winged to wingless broods, is an interesting part of their history, and the more so, for its consequence in many species is the migration and change of food of the winged insects. Thus the Hop-fly (*Aphis Humuli*) is hatched on the sloe, and the second generation passes thence to the hop, which is much exhausted by the third and fourth broods, but these decrease in number or disappear after awhile, and then the Aphis returns to the sloe.

On the Parasitical Nature of the Rhinanthaceæ. By J. Decaisne.

Since DeCandolle established by ingenious observations and accredited by the authority of his name the separation of parasitic plants into two groups, physiologists have generally admitted it as a well-established law. It is known in fact that the phanerogamous plants which are parasitic upon the stems of other vegetables have green leaves, while those upon roots do not possess true leaves, contain no green colouring matter, but are generally of a whitish, yellowish or violet colour: in other words, they appear blanched or sickly when compared to other plants; their leaves, or the scales with which their stems are provided, are generally without epidermic pores. The absolute character of the law advanced by DeCandolle has however been recently modified by the observation of Mr. W. Mitten of a plant (*Thesium Linophyllum*) parasitic upon roots and nevertheless provided with green leaves.

The observation of Mr. Mitten immediately called to mind a fact I had long noticed, that is, the impossibility of cultivating plants belonging to the group of the true *Rhinanthaceæ.* Wishing to introduce into cultivation the purple cow-wheat (*Melampyrum arvense*), I frequently sowed the seed, which however all perished a few days after their germination without my being able to account for this want of success. The same applies to species of *Pedicularis* and *Euphrasia*: removed with care from the field and transferred with every possible caution into our gardens these plants soon dry up, in a few hours they become black and so brittle that they appear to have been scorched. Bearing in mind these facts, the question suggested itself, whether the uncultivable *Rhinanthaceæ* might not be parasitic plants; in fact, their rapid death in our gardens and their injurious effects upon the neighbouring plants, a fact well known to cultivators, led me to suspect their parasitic nature. The observation which I have the honour to bring before the Academy settles this question. The species of *Alectorolophus*, *Melampyrum* and *Odontites* are true parasitic plants which fix themselves to the roots of grasses, shrubs or even trees by numerous suckers. These suckers are arranged on the branched and delicate rootlets of *Melampyrum* in the same manner as on the filaments of *Cuscuta*; the parasitic rootlets are in close contact with the young roots of the plants upon which they feed; the point of contact is indicated by a swelling.

I regret that I have not yet been able to verify the parasitic nature upon other species than those which occur in our fields. I propose however to examine whether what I have observed in the plants of this neighbourhood will occur or not in analogous plants, or whether this phænomenon is so modified in them as to afford an explanation of the anomalies of structure I am about to point out.

In a memoir* presented to the Academy, M. Duchartre described in a parasitic plant, *Lathræa clandestina*, a peculiar ligneous structure, the most prominent character of which is the absence of medullary rays: on the other hand, M. Elie Brogniart in noticing this fact in his report on this paper wished to ascertain whether it did not occur in other plants belonging to the same class as the Clandestine, and he found it in *Melampyrum*: nevertheless in pointing out the anomalous structure in these vegetables, MM. Brogniart and Duchartre did not connect it with the fact of parasitism, but merely saw in it a relation of family. However, this peculiar organization appears to me intimately connected with the parasitic nature of the plants, judging from the uniformity of structure and the black colour of the stems of *Pedicularis*, *Castillegia*, *Cymbaria*, *Bartsia*, *Buchnera*, which are all destitute, according to my observations, of medullary rays.

If parasitic plants assume a black tint mixed with blue on drying —if the absence of medullary rays is one of their attributes—and if these characters are connected with a special absorption of the nutritive juices, I may observe that these occur without exception in a group of plants which no one has hitherto suspected of being parasites, I mean the Sundews, which are likewise uncultivable. But with regard to the species of *Drosera* there is another anomaly far more singular to be investigated, that of a dicotyledonous plant being parasitical upon a moss, if, as I suspect, the *Sphagnum* is necessary to the nutrition of the *Drosera*. There still remains to ascertain the relation of causality between these characters of structure and parasitism.

With respect to the peculiar coloration of the blackening juices which these parasitical vegetables contain, that is a question which belongs to chemistry. In conclusion, the foregoing observations upon *Melampyrum*, *Odontites* and *Alectorolophus* explain clearly why it is impossible to cultivate these plants, which do not meet in the artificial soil of our gardens with the roots of those vegetables at whose expense they live; it also throws some light in my opinion upon the fact observed by agriculturists, that the *Rhinanthaceæ* exert an injurious effect upon the grasses and Cerealia.—*Comptes Rendus*, July 12, 1847.

On the situation of the Olfactory Sense in the terrestrial tribe of the Gasteropodous Mollusca. By Joseph Leidy, M.D.

While no observer of the habits of the terrestrial Gasteropoda doubts the existence of the sense of smell in them, but, on the con-

* A translation of this memoir appeared in the 'Annals' for June 1845.

trary, asserts positively that it does exist, the anatomist has not hitherto been able to point out its precise seat.

Swammerdam, in his 'Biblia Naturæ,' speaks decidedly of the existence of this sense in *Helix pomatia*, but offers no conjecture as to its situation. Blumenbach remarks, under the head of *Vermes*, "Several animals of this class appear to have the sense of smelling, as many land-snails (*Helix pomatia*, &c.)," and afterwards adds, "But the organ of this sense is hitherto unknown; perhaps it may be the stigma thoracicum." Cuvier, in his 'Mémoire sur la Limace et le Colimaçon,' after remarking on the delicacy of this sense, thinks it probable it may reside "dans la peau toute entière, qui a beaucoup de texture d'une membrane pituitaire."

In investigating the anatomy of this tribe of Gasteropodous Mollusca, I detected an organ which appeared to have been entirely neglected, or has escaped the notice of those who have dissected these animals. It is a depression or cul-de-sac, having its orifice beneath the mouth, between the inferior lip and the anterior extremity of the podal disc, and which in many species of different genera is elongated backwards into a blind duct, more or less deep, occupying a situation just above the podal disc within the visceral cavity. In *Bulimus fasciatus* it extends backwards as far as the tail, and is several times folded upon itself; in *Glandina truncata* it extends the length of the podal disc; in the various species of *Helix* it is found from a superficial depression to a sac the length of the podal disc; in *Succinea obliqua* it is of considerable length; in *Limax* and *Arion* it is a superficial depression; in an undetermined species of *Vaginula*, hereafter to be described, I found it half an inch in length, &c.

It is composed of two laminæ; a delicate lining mucous membrane and an external layer, having a whitish or reddish glandular appearance. A large nerve on each side, from the subœsophageal ganglia, is distributed to its commencement, besides which it receives numerous smaller branches along its course from the same ganglia. Its arterial supply is derived from the cephalic branch of the aorta.

This organ, from its situation, relative size to the degree of perfection of the olfactory sense, as in the carnivorous *Glandina truncata*, &c., its structure and nervous supply, I think, is the olfactory organ*.—*Silliman's Journal for May* 1847.

A new species of Procellaria *from Florida.* By G. N. Lawrence.

Procellaria brevirostris.—Above brownish black, beneath white. Bill short; upper tail-coverts white; lower white, tipt with ash, and very long; tarsi pale yellow, marked with black at their ends for two-thirds their length. Length 16 inches, extent 39 inches.—*Ibid.*

* Since writing the above, I have had an opportunity, through the kinddess of Mr. Cassin, of examining a specimen of *Helix pomatia* from Europe, in which I find the organ in question existing as a funnel-shape depression beneath the mouth, and extending backwards along the podal disc for the distance of three-fourths of an inch. This I consider particularly interesting, as the same species has been minutely dissected and described by Swammerdam, Cuvier and others, without any reference whatever to this cul-de-sac.

Description of a New Lizard discovered by Mr. Dyson in Venezuela.
By J. E. Gray, Esq., F.R.S., F.Z.S.

In the 'Annals and Magazine of Natural History' I described a lizard, from Columbia, which Mr. Brandt sent me under the name of *Argalia marmorata*, and considered it as the type of a peculiar family. In Mr. Dyson's collection, just received at the Museum, there is a second species of this genus from Venezuela, differing from the former not only in the colouring, but in the size of the head and the comparative length of the tail.

This genus has much the appearance of the *Barisiæ*, but is at once known from them and other New World *Zonuridæ* by having femoral pores, by the position of the nostrils, and by the scales on the side of the body not being granular, though rather smaller than those of the back.

Argalia olivacea.

Olive-green; beneath pale brown; sides of neck and body yellow spotted; tail rather longer than the body and head, thick at the base. Palms of the feet bright yellow.

Inhab. Venezuela.

Mr. Dyson found a pair of these lizards on a tree in the mountains, 8000 feet above the level of the sea, near the Colonia de Tova, by a tree called *Grand Cedro*, the largest known in Venezuela, and much larger than that described by Humboldt.

They now form part of the collection of the British Museum. The sexes are quite alike in form and colour.—*From the Proceedings of the Zoological Society*, June 22, 1847.

SWARM OF LADYBIRDS (COCCINELLÆ).

As several accounts of a swarm of ladybirds have appeared in the daily papers and have excited some interest, I send you a few notes made on this somewhat extraordinary phænomenon during a stay of a few days on the Isle of Thanet. On Friday, August 8th, I was at Broadstairs. The wind was in the north-east; and a good deal of rain fell, after a drought in that district of six months' duration. On the Saturday it became fine, with a strong wind from the south-west. Early in the morning, a few ladybirds made their appearance. Their number kept increasing during the whole of Saturday, Sunday and Monday, when the esplanade and cliffs on the west side of the town were literally covered with them. They were evidently borne upon the wind, and were most numerous at the edges of the cliffs, as if they caught there as a last refuge before being carried out to sea again. The stalks of the dried plants were literally covered with these insects; and the stems of *Dipsacus*, *Centaurea* and other plants looked as if they were borne down by a crop of red berries. The white dresses of the ladies attracted them especially, and gave no little annoyance to those who were afraid of them. They are however perfectly harmless, and, excepting for their disagreeable smell, need not be avoided. These creatures are carnivorous, and, of course, could not find food in such immense quantities; and many of them I found were reduced to the sad extremity of feeding on their departed friends, whose dead bodies were strewed about the paths in all directions. They were preyed upon in great numbers by a black beetle. They were not all of one species. The common one, with a yellow body and seven black spots, was most abundant; next to that came the species with two black spots; the species with nine spots was scarcer still; and I took only a few specimens of one with a black body and orange spots. The intensity of their colouring varied from a light yellow to a deep orange.

The ladybirds continued at Broadstairs till Thursday, August 12, when a strong wind from the south setting in cleared the whole district. They however found a resting-place at Margate, where I saw them in the same profusion in which they had appeared at Broadstairs. In a line from the Fort to the railway terminus they covered everything, and the air was filled with them. Up to this time, none, or not an unusual number of these creatures, had been seen at Ramsgate; but on Saturday, the wind having got into the east on the previous evening, they began to appear there; and on that evening they appeared to me to be as numerous at Ramsgate as at Broadstairs and Margate. On the 17th and 18th of August I observed a smaller swarm of these insects at Broadstairs, the wind blowing in a north-westerly direction.

From several accounts in the *Daily News* of the 16th and 17th of August, it appears that on Friday, August 13, the same insects were observed at Southend; on the same day in great numbers in London; and on the following Saturday and Sunday at Brighton.

Large flights of these creatures are not uncommon. Various swarms of them have been recorded as occurring at Brighton, where they have been supposed to have been carried from the neighbouring hop-grounds, as the larva of the ladybird feeds on the aphides which are so destructive of the hop-plant. On the present occasion, however, it appears that these insects must have been brought by the south-west wind from the continent. That the direction of the wind determined their appearance is evident from the fact that they disappeared at Broadstairs on the day they were seen at Margate, and were not found at Margate after their appearance at Ramsgate. The cause of the swarming of these insects is probably a scarcity of their natural food during the prevalence of a strong wind, which, sweeping over a large tract of the earth's surface, carries along with it all who are disposed to go. That this is the case seems confirmed by the fact that at first these insects only appeared by degrees;—a few arriving and the number gradually increasing on a particular spot. One of the correspondents of the *Daily News* states that they came over in the form of a cloud in the direction of Calais and Ostend; but although I was on the spot at the time, I neither saw nor heard anything of this cloud. I may add, as a fact for your Folk-Lore, that in the Isle of Thanet some of the common people regarded this visitation as foreboding the death of a great personage. Such a flight occurred just before the death of George the Third.—*Athenæum for Aug.* 28, p. 912.

Description of a new species of Anser. By GEORGE N. LAWRENCE.

Anser nigricans, Black-bellied Goose. *Specific character*:—A large white patch on the middle of the neck in front, and extending on the sides; belly brownish black; bill higher than broad at the base.

Bill black; legs and toes black, tinged with flesh-colour; iris dark hazel; head black, tinged with brownish rufous adjoining the bill, with a dirty white line under the eye; neck and fore-part of the breast black; a large white patch on the centre of the neck intermixed with black, except at the lower part, where it forms a distinct band of pure white; it is nearly two inches in width, rounding on each side of the neck and almost meeting behind; belly brownish black; sides brownish ash, margined with white; back dark brown, each feather margined with a lighter shade; rump-feathers black; axillars and lower wing-coverts grayish black; tail black, consisting of sixteen feathers; upper and lower tail-coverts white; wings black, extending half an inch beyond the tail; second primary one line longer than the first; third half an inch shorter; vent white.

Length $22\frac{1}{2}$ inches; alar extent 44; bill a little higher than broad; measures along the ridge $1\frac{3}{16}$ inch; from gape $1\frac{3}{8}$; lower mandible $1\frac{1}{4}$; tarsus $2\frac{1}{4}$; middle toe 2; outer $1\frac{7}{8}$; inner $1\frac{1}{2}$; weight three pounds.

I have taken the above description and figure from an adult female procured at Egg Harbour, N. J., in January. Since then two others have been obtained at the same place, one of which I have in my possession. On dissection it proves to be a male. It agrees in markings with the female, but is evidently a younger bird, being somewhat lighter in the colour of its plumage. From this I infer they become darker by age. It is a little larger than the female, the bill being also stouter, measuring $\frac{7}{8}$ inch high at the base. When on a shooting excursion some years since, at Egg Harbour, I noticed a bird flying at some distance from us, which our gunner said was a Black Brant. This was the first intimation I had of such a bird. Upon further inquiry of him, he informed me he had seen them occasionally, but they were not common. I have learned from Mr. Philip Brasher, who has passed much time at that place, that speaking to the gunners about them, they said they were well-known there by the name of Black Brant, and one of them mentioned that he once saw a flock of five or six together.

From these facts it appears to be known to gunners, but has heretofore escaped the notice of ornithologists. With all my inquiries I have not been able to procure a specimen before this winter. I think it a good and well-marked species.—*Silliman's Journal for May* 1847.

Account of a Black and White Mottled Swan, on the water in the demesne of the Earl of Shannon, Castle Martyr, County Cork. By MAURICE GLENCON, Gamekeeper to the Earl of Shannon.

In the year 1843 a male black swan paired with a white female swan; she laid six eggs, and hatched four cygnets. Before they got to the age of six months, three of them met with untimely deaths. This bird in 1845 paired with its father, and laid four eggs, which came to nothing. It is very like the father about the head, but about the body it resembles the white swan. It lives on the water with others, black swans and white swans, and agrees with both.

The above statement may be relied on as authentic and correct, because I have witnessed it from beginning to ending.

Upon the same island where this bird was born I have seen more than eighty cormorants' nests, on Scotch fir-trees not under sixty feet in height, in which they hatched their young. This was fourteen years ago.—*From the Proceedings of the Zoological Society*, June 22, 1847.

Castle Martyr, June 1847.

METEOROLOGICAL OBSERVATIONS FOR JULY 1847.

Chiswick.—July 1. Light clouds: fine: overcast. 2. Slight drizzle: cloudy. 3. Overcast: clear. 4. Very fine: clear: cloudy. 5. Sultry. 6. Very fine. 7. Overcast: slight shower. 8. Rain: cloudy: clear. 9. Cloudy and fine. 10. Overcast: clear. 11, 12. Very fine. 13. Sultry. 14—16. Excessively hot. 17. Thunder, lightning and heavy rain all the morning: fine: cloudy. 18. Cloudy. 19. Slight showers. 20. Overcast and fine. 21. Very fine. 22. Heavy clouds: clear at night. 23, 24. Very fine. 25. Overcast. 26. Clear and fine. 27, 28. Very fine. 29. Sultry. 30, 31. Very fine.

Mean temperature of the month	65°·84
Mean temperature of July 1846	65 ·46
Mean temperature of July for the last twenty years	63 ·08
Average amount of rain in July	2·36 inches.

Boston.—July 1—3. Cloudy. 4, 5. Fine. 6. Fine: half-past 2 P.M. thermometer 76°. 7. Fine: rain early this morning. 8. Cloudy: tremendous storm of thunder, lightning and rain P.M. 9. Fine. 10, 11. Cloudy. 12. Fine: 4 P.M. thermometer 81°. 13. Fine. 14. Cloudy. 15. Cloudy: 3 P.M. thermometer 74°. 16, 17. Cloudy. 18—21. Fine. 22. Rain. 23. Cloudy. 24—27. Fine. 28, 29. Cloudy. 30, 31. Fine.

Sandwick Manse, Orkney.—July 1. Cloudy. 2, 3. Fog: fine. 4. Damp: cloudy. 5. Cloudy: fog. 6. Fog. 7. Drops. 8. Rain: clear. 9. Bright: fine. 10. Fog: bright: fine. 11. Bright: fine. 12. Clear: fine. 13. Damp: cloudy. 14. Bright: showers. 15. Clear: fine. 16. Bright: fine. 17. Cloudy. 18. Rain. 19. Drizzle: damp. 20. Drizzle: cloudy. 21. Drizzle: fog. 22. Showers: rain. 23. Cloudy: showers. 24. Cloudy: fine. 25. Fine. 26. Bright: drizzle. 27. Rain: cloudy. 28. Showers. 29. Showers: clear. 30. Bright: showers. 31. Bright: rain.

Applegarth Manse, Dumfries-shire.—July 1. Very fine: thunder. 2—4. Very fine. 5. Very fine: mackerel sky and sultry P.M. 6. Very fine. 7, 8. Heavy showers: thunder. 9. Cloudy and threatening. 10. Rain. 11. Rain: fog P.M. 12. Fine, but cloudy. 13. Very fine: fog early A.M. 14. Heavy dew: very fine. 15. Very fine: shower and thunder. 16. Cool and breezy: thunder. 17. Very fine: air elastic. 18. Very fine: drizzle P.M. 19, 20. Very fine. 21. Fine, but cloudy: shower and thunder. 22. Showers: refreshing. 23. Fair and fine. 24. Fair and fine, but dull. 25. Shower early A.M.: fine. 26. Fine bracing air. 27. Cloudy: threatening: thunder. 28. Fair, but cloudy. 29—31. Fair, but cloudy: unsettled.

Mean temperature of the month	61°·55
Mean temperature of July 1846	59 ·20
Mean temperature of July for twenty-five years	58 ·14
Average rain for twenty years	3·91 inches.

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. 8¼ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¼ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. July.	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.	30·284	30·274	29·84	30·29	30·28	30·38	30·38	72	53	59	75½	50½	56	53	ne.	calm	e.	nnw.	......	......	......	......
2.	30·269	30·189	29·80	30·29	30·18	30·34	30·25	64	51	59	68½	53½	55	60	ne.	calm	e.	calm	·01	......	......	......
3.	30·147	30·040	29·72	30·12	30·00	30·14	30·13	73	53	58·5	74	44	54½	54	ne.	calm	sw.	nw.	......	......	......	......
4.	30·011	29·949	29·46	29·95	29·85	30·05	29·98	83	43	65	76	49	52	51½	se.	w.	se.	e.	......	......	......	......
☾ 5.	29·946	29·900	29·46	29·83	29·82	29·93	29·90	87	53	70	73	54	55	54½	s.	s.	e.	se.	......	......	......	·09
6.	29·896	29·820	29·40	29·80	29·76	29·86	29·83	88	59	74	71½	59	56	54	sw.	calm	s.	ese.	·09	......	......	......
7.	29·855	29·737	29·30	29·65	29·68	29·81	29·76	75	52	73	68	54	55	55	sw.	s.	s.	ese.	·02	·06	......	......
8.	29·929	29·856	29·40	29·74	29·74	29·80	29·82	76	47	65	68	56½	58	55	s.	n.	sw.	calm	·08	......	0·50	·59
9.	30·115	30·016	29·50	29·80	29·85	29·82	29·88	77	57	68·5	66½	54	62	60½	sw.	w.	sw.	calm	·02	·68	......	......
10.	30·131	30·120	29·58	29·90	29·93	29·94	29·99	79	61	69	70	55½	59	61½	sw.	calm	se.	calm	......	......	......	......
11.	30·151	30·132	29·59	29·93	30·00	29·93	30·02	83	56	73·5	66	59	64½	63	sw.	nw.	sw.	sw.	......	......	......	......
● 12.	30·170	30·165	29·62	30·02	30·09	30·06	30·11	90	55	75	68½	59	66	60½	nw.	calm	w.	calm	......	......	......	......
13.	30·195	30·184	29·67	30·11	30·12	30·16	30·19	90	59	76·5	68½	59	62	59	w.	calm	s.	se.	......	......	......	·05
14.	30·193	30·137	29·67	30·15	30·12	30·15	30·18	93½	59	70	73	54½	69½	57	w.	calm	sw.	nw.	......	......	......	......
15.	30·140	30·112	29·64	30·10	30·03	30·21	30·20	88	58	64·5	78½	56½	58	57	e.	e.	sw–n.	calm	......	......	0·20	·21
16.	30·047	29·982	29·56	30·02	30·03	30·17	30·15	82	58	70	65½	58	57	56½	ne.	calm	ne.	calm	......	......	......	......
17.	29·984	29·946	29·54	30·05	30·00	30·12	30·11	72	58	64	69½	50	58	55½	ne.	e.	e.	w.	·56	......	......	......
18.	30·038	30·027	29·56	30·00	30·00	30·04	29·94	71	49	65	70	48	54	56	e.	calm	wsw.	s.	......	......	......	·16
19.	29·938	29·853	29·50	29·92	29·87	29·94	29·98	70	52	67	71	56	56	55	ne.	calm	sw.	nw.	·01	......	......	·10
☽ 20.	29·870	29·866	29·42	29·87	29·83	29·98	29·96	76	58	68	69	55½	55	57	ne.	calm	ene.	calm	......	......	......	......
21.	29·878	29·867	29·41	29·78	29·72	29·84	29·78	79	58	68	70½	54	57	53	w.	e.	s.	sse.	......	......	......	......
22.	30·167	30·020	29·46	29·68	29·91	29·68	29·80	73	45	64	64	58	60	57	sw.	w.	s.	wnw.	......	......	......	......
23.	30·228	30·193	29·70	30·09	30·11	30·02	30·12	74	44	65	63½	50	56½	55	nw.	nw.	nw.	w.	......	·12	0·30	·42
24.	30·149	30·016	29·62	30·08	29·98	30·08	30·08	76	53	67	66	46	59	58½	ne.	w.	w.	calm	......	......	......	·08
25.	29·947	29·906	29·47	29·94	29·91	30·06	30·02	67	46	67	70	51½	58	57	ne.	e.	wnw.	se.	......	......	......	......
26.	30 028	29·929	29·46	29·90	29·96	29·93	29·94	75	45	65·5	71	51	60	55	n.	nw.	w.	w.	......	......	......	......
○ 27.	30·075	30·064	29·54	30·00	29·90	29·81	29·74	81	50	65	67	49	53	54½	ne.	nw.	w.	w.	......	......	......	·52
28.	30·058	30·045	29·53	29·87	29·88	29·72	29·82	77	57	65	65	57½	55	54½	w.	calm	nw.	wnw.	......	......	......	·14
29.	30·076	30·052	29·55	29·95	29·98	29·87	29·88	88	54	68	69½	56	55½	56	w.	calm	wnw.	sw.	......	......	......	·05
30.	30·035	29·997	29·50	29·89	29·82	29·74	29·65	80	48	70	67	56½	61	54½	sw.	calm	wnw.	sw.	......	......	0·03	......
31.	30·058	30·050	29·54	29·88	29·83	29·75	29·56	84	48	69	65	52	57½	57	sw.	calm	sw.	sw.	......	......	......	·15
Mean.	30·068	30·014	29·54	29·954	29·941	29·978	29·972	78·82	52·87	67·3	69·3	53·8	57·90	56·37					0·79	0·86	1·03	2·56

THE ANNALS

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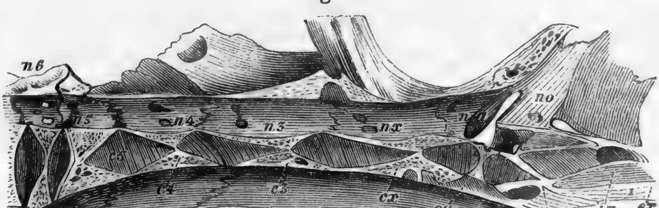
XX.—*Description of the Atlas, Axis, and Subvertebral Wedge Bones in the* Plesiosaurus, *with remarks on the homologies of those bones.* By Prof. Owen, F.R.S.

In my 'Report on British Fossil Reptiles*' two explanations are offered of the special homologies of the subvertebral wedge-bones discovered by Sir P. de M. Grey Egerton in the neck of different species of *Ichthyosaurus*†,—the one as repetitions of the 'odontoid process,' the other as of the so-called 'body of the atlas' in existing reptiles. Viewing the subvertebral wedge-bones in their wider relations, I subsequently described them as "detached developments of bone in the lower part of the capsule of the notochord" (*chorda dorsalis,* auct.); illustrating that view by reference to the condition of the corresponding part of the vertebral column in a large Siluroid fish‡. Subjoined is a figure of that remarkable structure (fig. 1); in which *c o* is the basi-

Fig. 1.



Section of anchylosed cervical or anterior abdominal vertebræ of *Bagrus tachypomus*, nat. size.

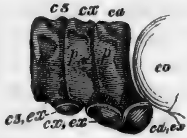
* Report of British Association, 8vo, 1839, pp. 100, 101.
† Geological Transactions, 2nd ser. vol. v. p. 187. pl. 14, 1836.
‡ Report on Vertebrate Skeleton, Rep. Brit. Assoc. 1846, p. 260.

occipital or centrum of the occipital vertebra; *i n* its internal or medullary structure; *e x* its cortical compact portion: the arrest of ossification in the posterior part of its medullary portion has left the deep concavity turned towards the atlas, and which was filled by the liquified remains of the gelatinous part of the notochord; but continuous ossification in the notochordal capsule has anchylosed the cortical part of the occipital centrum (*ex*) with that (*ca, ex*) of the centrum of the atlas. *c a* is the ossified medullary part of the centrum of the atlas; *n o* is the neural arch of the occipital vertebra; *n a* the neural arch of the atlas, separated from its centrum; *c x*, central part of the body of the axis; *c x, e x*, cortical part of ditto; *n x*, neural arch of the axis perforated by the motory and sensory roots of the nerves separately; *c* 3, central part of body of third vertebra; *c* 3, *e x*, cortical part of ditto; *n* 3, neural arch; *c* 4, central part of body of fourth vertebra; *c* 4, *e x*, cortical part of ditto; *n* 4, neural arch of ditto; *c* 5, central part of body of fifth vertebra; *c* 5, *e x*, cortical part of ditto; *n* 5, neural arch of ditto. Here the vertebræ begin to exchange their elongated figure for the ordinary short one, which is exemplified in *c* 6, where they begin to be free.

In the fish-like batrachians, the Menopome for example, the body and neural arch of the atlas have coalesced: the anterior zygapophyses descend from the fore-part of the neural arch upon the sides of the fore-part of the centrum which projects forwards between them, like an odontoid process: the articular surfaces of the zygapophyses (oblique or articular processes of human anatomy) are subcircular, slightly concave, directed forwards and a little upwards: they receive the convex zygapophyses or condyles of the coalesced exoccipitals. The posterior zygapophyses of the atlas have also large subcircular articulations directed downwards. The body of the atlas appears to have been developed at the expense of the central part of the notochord, which forms the anterior convex part which articulates with the basi-occipital plate at the bottom of the foramen magnum. A deep concavity at the back part of the atlas contains the unossified remnant of the central or gelatinous part of the notochord.

In the extent, however, to which the centrum of the atlas is ossified, the Menopome and other perennibranchians resemble the fishes. If, indeed, the persistent portion of the notochord which fills the anterior concavity of the atlas and the posterior concavity of the basi-occipital in the Siluroid or other osseous fish were ossified and anchylosed to the atlas, that vertebra would closely resemble the atlas of the Menopome, and I regard the singular modification of form which the atlas of the Menopome presents, as compared with that of the osseous fish, to be due to the above-described ossification of the anterior end of the central part of the notochord. If, on the other hand, such ossified part of the notochord were to coalesce with the basi-occipital instead of with the atlas, it would form a tubercle on the back part of the occipital centrum which would fit into the concavity left on the fore-part of the centrum of the atlas. Now this is precisely what has happened in those large extinct fish-like reptiles, the Enaliosauria (fig. 2). That is to say, the basi-occipital presents a convex condyle (*c o*) which is received into a cavity on the fore-part of the body of the atlas *c a*, completed below by the first 'wedge-bone' *c a*, *e x*. The main or central part of the body of the atlas, *c a*, as Sir P. Egerton has shown, is early anchylosed to the body of the axis, *c x*; and, in a specimen in which he succeeded in separating the two vertebræ, they were applied to one another by flat and even surfaces. Into the lower part of this speedily obliterated symphysis a second distinct ossicle (*c x*, *e x*) is wedged, a similar but smaller ossicle (*c* 3, *e x*) being situated at the inferior interspace between the axis and third vertebra.

Fig. 2.



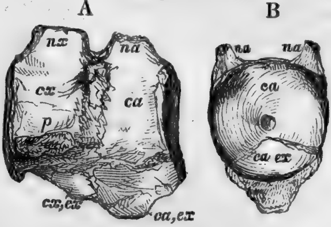
Anterior cervical vertebræ, *Ichthyosaurus*.

The condition of the anterior vertebræ of the large Siluroid fish (fig. 1), in which I found the central biconcave parts of the bodies of the atlas, axis, and three succeeding vertebræ established by distinct ossification of the central part of the notochord, whilst the whole were attached below to a continuous ossification in the capsule of the notochord, will explain what is meant by the statement that the subvertebral wedge-bones of the *Ichthyosaurus* are derived from "detached developments of bone in the lower part of the capsule of the notochord," at the inferior interspace between the occiput and atlas, and at the similar interspaces of the two or three succeeding cervical vertebræ; but varying in number in different species.

A recent opportunity of examining the atlas and axis of the *Plesiosaurus*, kindly afforded me by my friend Prof. Sedgwick, has not only strengthened this view of the general nature of the 'subvertebral wedge-bones,' but has made me incline to the second hypothesis of the special homology of the first or anterior of the wedge-bones, which is proposed in my 'Report on British Fossil Reptiles,' viz. that it answered to the part described as the body of the atlas in the existing Saurians and Chelonians; which therefore may be regarded, like the first subvertebral wedge-bone, as the cortical part only of such vertebral body, like the plate of bone beneath the biconcave central part of the body of the atlas in the Siluroid fish.

The atlas and axis in the *Plesiosaurus* (fig. 3) preserve the general proportions of the other cervical vertebræ, and are consequently longer than their homologues in the *Ichthyosaurus*; but they are similarly anchylosed together, and measure $4\frac{1}{2}$ centimeters (nearly 2 inches) in length, 3 centimeters across the anterior concave surface of the atlas, and $3\frac{1}{2}$ centimeters across the less concave posterior surface of the axis: the neural arch of each vertebra has coalesced with its centrum; and a long obtuse process is formed below by a similar coalescence of the first and second 'wedge-bones' with each other and with their respective centrums. The limits of the anterior 'wedge-bone,' *c a, e x,* are traceable: it is proportionally larger than in the *Ichthyosaurus* (fig. 2), in which it is likewise larger than the succeeding wedge-bones. It forms in the *Plesiosaurus* the lower third part of the atlantal cup for the occipital condyle B, *c a, e x*; the anchylosed bases of the neurapophyses (*n a*) form the upper border of the cup, and the intermediate part or bottom of the cavity is formed by the centrum of the atlas (*c a*), or rather by that part which, like the biconcave centrum in the Siluroid fish, is developed from the central portion of the notochord.

Fig. 3.



Anchylosed atlas and axis, *Plesiosaurus pachyomus*, reduced.

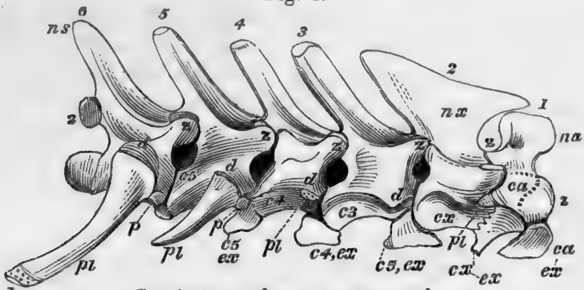
The smaller or second wedge-bone (*c x, e x*) is lodged in the inferior interspace between the atlas and axis, but has coalesced with both bones, as well as with the large anterior wedge-bone or cortical part of the body of the atlas, *c a, e x.* This anterior wedge-bone developes a thick but short rough tuberosity from its under part, but there is no distinct second tuberosity from the second wedge-bone: both, indeed, have so coalesced together as to parallel the continuous ossification of the under part of the notochordal capsule beneath the central parts of the bodies of the atlas and axis in the Siluroid fish (fig. 1, *c a e x, c x e x,* &c.). There is no transverse process from the centrum of the atlas of the *Plesiosaurus*; but the fractured base of a depressed parapophysis, *p* (lower transverse process), or anchylosed rib, projects from each side of the proper centrum of the axis.

In a large Iguanoid lizard (*Amblyrhynchus*) the part answering to that described by Cuvier as the body of the atlas in the Monitor and Crocodile* has the form of a wedge (fig. 4, *ca, e x*)

* Ossem. Foss. v. pt. 2. p. 96.

like the first wedge-bone in the *Plesiosaurus,* and forms the lower third part of the cup for the occipital condyle: it articulates be-

Fig. 4.



Cervical vertebræ, *Amblyrhynchus.*

hind to a second similarly-shaped wedge-bone (*cx, ex*); above to the part *c a,* (indicated by the dotted outline on the neural arch of the atlas which covers it,) which answers to the body of the atlas, or rather the central part of the body of the atlas, in the *Plesiosaurus* (*c a,* fig. 3); but which there also immediately supports the neural arch (*n a*), whilst in the recent Saurian the base of each neurapophysis (*n a,* fig. 4) descends to rest upon the angles of the base of the 'wedge-bone' (*c a, e x*) which represents the inferior peripheral part of the body of the atlas. The interspace between the bases of the neurapophyses is occupied by the distinct ossicle (*c a*) which adheres closely by a flat surface to the body of the axis (*c x*), and forms the bottom of the articular concavity for the occipital condyle: it is the part described by Cuvier as 'pièce analogue à l'odontoïde' in the Monitor*, and it is plainly the homologue of the part of the body of the atlas which is joined by a flat surface, and early anchylosed, to the body of the axis in the *Plesiosaurus* and *Ichthyosaurus.* In the existing Lacertians the 'odontoïde' differs, however, from the anchylosed atlas of the Enaliosauria by taking no share in the support of the neurapophyses of the atlas: the ossification of these has obviously extended deeper into the sides of the notochordal capsule, so that they articulate directly with the wedge-bone (*c a, e x*) developed in the inferior part of that capsule: and the central ossification (*c a*) adapted to the lower half of such atlantal vertebral ring is proportionally reduced. The first 'wedge-bone' or cortical part of the body of the atlas (fig. 4, *c a, e x*) is carinate below in the *Amblyrhynchus,* and the keel is produced backwards into a short spine. The second 'wedge-bone,' *c x, e x,* is similarly shaped, but rather larger than the first. Its base articulates behind with the body of the axis, *c x,* above with the odontoid piece, *c a,* and

* Ossem. Foss. v. pt. 2. p. 283.

in front with the wedge-shaped cortical part of the body of the atlas *c a, e x*. The lower part of the second wedge-bone is produced into a short spine.

There is a distinct cartilaginous rudiment of a rib (*pleurapophysis, pl,* 1) attached to the diapophysis (transverse process from the neural arch) of the atlas, and another from that of the fourth vertebra (*pl,* 4). The first ossified pleurapophysis (*pl,* 5) occurs on the fifth vertebra; and beneath the diapophysis supporting this rib, there is a cartilaginous rudiment of a parapophysis (*p*); the same is still more plainly seen in the sixth cervical vertebra, but the heads of the pleurapophyses are simple.

The odontoid piece (*c a*) is convex from side to side, concave from above downwards; is firmly attached to the fore-part of the body of the axis and to the second wedge-bone, but with visible traces of the suture remaining. The lower part of the body of the axis is carinate, but not produced into a spine. A third separate ossification in the capsule of the notochord (*c* 3, *e x*) is wedged into the inferior interspace between the axis and third vertebra; and similar but successively smaller wedge-bones (*c* 4 *e x, c* 5 *e x*) are articulated between the fourth and fifth, fifth and sixth, and also between the sixth and seventh vertebræ in the *Amblyrhynchus.* If the odontoid process be interpreted as the homologue of the anterior anchylosed body of the atlas in the *Plesiosaurus,* the first wedge-bone will stand in the same relation to it as the second wedge-bone does to the axis, the third to the third vertebra, the fourth to the fourth, and so on. These wedge-bones are plainly the special homologues of the 'subvertebral wedge-bones' discovered by Sir P. Egerton in the *Ichthyosaurus*; but their general homology is open to two interpretations. They are, no doubt, autogenous ossifications in the under part of the capsule of the notochord; but, as such, may be interpreted either as parts of the cortical layer of the centrum of their respective vertebræ, or as rudimentary hæmapophyses and imperforate homotypes in the neck of the hæmal arches and spines in the tail*. According to the latter view, what has usually been regarded as the centrum or body of the atlas in Saurians, Chelonians, and the higher Vertebrata would be the hæmapophysis of that vertebra; and the odontoid process the true centrum. But against this view militates the constant relation of the inferior wedge-shaped bone of the atlas in Saurians, Chelonians and higher Vertebrates to the neurapophyses, as immediately supporting them and completing with them the neural arch. The obvious serial homology, also, of that lower part of the atlas (*c a, e x*) with the basi-occipital and basi-sphenoid leads me to conclude that, like them, it is the

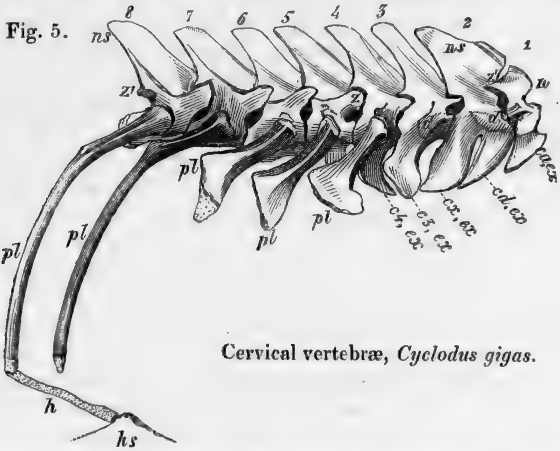
* In the *Bagrus,* in fact, the corresponding ossification of the notochordal capsule is actually perforated by the aorta.

inferior cortical part of the body of its vertebra. In the cranial vertebræ this usually depressed and expanded cortical part, exemplified by the basi-occipital, basi-sphenoid, presphenoid and vomer, is the sole representative of the centrum of such vertebræ: in the atlas the odontoid process would represent the central part also of the body of the vertebra, but detached from the cortical part.

The following facts, however, appear to oppose themselves to the determination of the 'odontoid' as the central part of the body of the atlas.

In the great Australian Skink (*Cyclodus gigas*) the second wedge-bone (fig. 5, *o d, e x*), which is developed into a long spine

Fig. 5.

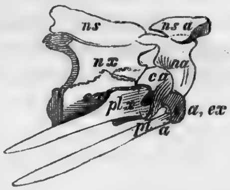


Cervical vertebræ, *Cyclodus gigas*.

and is anchylosed to the under part of the odontoid piece, is not the only inferior or hæmal spine of the axis vertebra; but a second broader and longer spine (*c x, e x*) is developed from the under part of the proper body of the axis. And the fact of the absence of any suture between this spine and the body of the axis is not enough to support the conclusion that it is a mere excess of development of the under part of the body of the axis and no true homotype of the inferior spines or wedge-bones; because, besides the anchylosis of the preceding spine (*o d, e x*) with the odontoid piece, the fourth spine (*c* 3, *e x*) is equally anchylosed with or developed from the whole under part of the third cervical vertebra of the *Cyclodus*; and the fifth spine (*c* 4, *e x*) is a similarly continuous process from the under part of the fourth vertebra. As the odontoid piece and its spine are completely anchylosed with the axis, this vertebra presents the anomalous structure of one neural spine and two consecutive hæmal spines. The above-described structure of the anterior vertebræ of the neck of the *Cyclodus gigas* gives some colour to the view of the odontoid as the rudiment of a vertebra distinct from both atlas and axis, and which in the *Cyclodus* is represented by the centrum and hæmal spine, without the neural arch.

The structure of the atlas and axis in the Crocodile (fig. 6) gives further colour to this view. The odontoid piece (*c a*) is wholly interposed between the wedge-shaped cortical part of the body of the atlas, *c a, e x,* and the body of the axis, *c x*: moreover the wedge-bone, *c a, e x,* not only supports neurapophyses, *n a,* but also pleurapophyses, *pl a*: and the odontoid, *c a,* in like manner, besides giving some support to the neurapophyses, *n x,* also supports, and that exclusively, the pleurapophyses, *pl x,* or second pair of cervical ribs.

Fig. 6.



Atlas and axis of the Gavial.

The true centrum of the axis *c x* supports no ribs, and appears like an enormous epiphysis to *c a,* extended backwards to aid in supporting the long neural arch *n x.* Neither the odontoid *c a,* nor the wedge-shaped part of the atlas *c a, e x,* are produced into inferior spines. If however, as the anatomy of the atlas and axis in Lacertian Saurians has led me to conclude, the odontoid *c a* is the homologue of the anterior (*c a,* figs. 2 & 3) of the two anchylosed vertebral centrums described as atlas and axis in the Enaliosaurs, the bifurcate pleurapophysis *pl* in the Crocodile should be the displaced homologue of that which is articulated to the posterior of those vertebral centrums in the *Ichthyosaurus,* and the articular surface of which is shown at *p, c x,* A, fig. 3, in the *Plesiosaurus,* and by Sir P. Egerton in pl. 14. fig. 2. B *d* of his Memoir above-cited, in the *Ichthyosaurus.* Whether the anterior vertebra *c a,* fig. 2, may also have supported by the surface *p,* a rib, homologous with that of the atlas of the Crocodile *pl a,* is uncertain; but, if so, the atlantal rib in the Crocodile would show, in like manner, a displacement forwards, from the central part of the body *c a,* represented by the odontoid piece in recent Saurians, to the first subvertebral wedge-bone *c a, e x,* which represents the body of the atlas in such Saurians, and takes a share in the support of the neural arch, which its homologue does not do in the *Ichthyosaurus* and *Plesiosaurus.* If, however, the hypothesis that *c a,* fig. 6, in the Crocodile is the homologue of the anchylosed atlas *c a,* figs. 2 & 3, of the Enaliosaurs, and that *c a, e x,* fig. 6, is the homologue of the first wedge-bone, *c a, e x,* fig. 2, be saved by assuming an advanced displacement of the pleurapophyses *pl x* and *pl a,* in the Crocodile, the numbers and relations of the inferior spines in the great

Cyclodus do not lend themselves so readily to the same determination of the odontoid in that lizard, as a part or complement of the body of the first vertebra.

The number of the inferior spines might be made to correspond with that of the vertebræ by supposing either *o d, e x,* or *c x, e x,* in fig. 5, to be an accessory exogenous process, and not a true homotype of the other four spines; or the spine *c x, e x,* may be held to belong properly to the third vertebra, and with the succeeding spines to be abnormally advanced and anchylosed to the vertebra anterior to the one to which it properly belongs. Yet both these suppositions appear to be equally arbitrary. The condition of the odontoid and axis in the *Cyclodus* is, nevertheless, an exceptional one in the Lacertia, and I no longer regard the distinct inferior spine *c x, e x,* in fig. 5, as a proof that the odontoid, like the atlas, is the homologue of one of the subvertebral wedge-bones. I still retain the opinion that it is not "the peculiarly developed anterior articular epiphysis of the second vertebra"*; but I return to my former idea of the special homology of the odontoid piece in Saurians, and consequently the odontoid process in mammals, with the part called the anchylosed atlas in the *Ichthyosaurus*; and the subsequently ascertained structure of the parts in the *Plesiosaurus* has confirmed the conclusion that the first subvertebral wedge-bone in the *Ichthyosaurus* and *Plesiosaurus* represents the part which has been called 'body of the atlas' in existing reptiles, but is reduced to a still more atrophied condition than in them†.

With respect to the general homology of these parts, the first wedge-bone is a detached part of the cortex of the body of the atlas, and the so-called atlas in the *Enaliosauria* or the odontoid piece in existing *Sauria* is the central ossification of the same vertebral element. The anchylosis of the atlas and axis is no longer, therefore, a peculiarity of the Enaliosauria, but a structure essentially repeated in every higher vertebrate form up to Man, in whom the anchylosed part of the atlas bears the anthropotomical name of 'odontoid process.' It might be expected that the segment immediately succeeding those of the skull would be the seat of more extensive and remarkable modifications than the succeeding vertebræ of the trunk, and each modification will be found, as the habits and mode of life of the different species become better known, to be expressly adapted to such habits. But such recognition of final causes by no means precludes the necessity for every legitimate attempt to uplift the veil which hides the type upon which all the adaptive modifications of the endoskeleton are based.

* Report on Archetype of Vertebral Skeleton, 1846, p. 261.
† Report on British Fossil Reptiles, 1839, p. 101.

XXI.—*On the Fossil Botany and Zoology of the Rocks associated with the Coal of Australia.* By Frederick M'Coy, M.G.S. & N.H.S.D. &c.

[Continued from p. 157.]

[With nine Plates.]

ZOOPHYTA.

Stenopora crinita (Lonsd.).

Very abundant, forming globose masses five inches in diameter, with a mammillated surface like that of the *Ceriopora verrucosa* (Gold.). In the sandstone of Wollongong, N. S. Wales; also in the sandstone of Darlington; more rare in calcareous beds at Black Head, N. S. Wales.

Stenopora ovata (Lonsd.).

Common in Darlington sandstone, N. S. Wales.

Stenopora Tasmaniensis (Lonsd.).

Not uncommon in the sandstone of Darlington, N. S. Wales.

Fenestella ampla (Lonsd.).

Common in the sandstones of Muree, Bell's Creek, and Loder's Creek, N. S. Wales.

Fenestella fossula (Lonsd.).

Common in the sandstone of Muree, N. S. Wales.

Fenestella internata (Lonsd.).

Common in the sandstone of Bell's Creek and Darlington, N. S. Wales.

Fenestella undulata (Phil.).

Rare in the shale of Dunvegan, N. S. Wales.

Fenestella.

Two species closely resembling the *F. antiqua* (Lonsd.) (the Devonian variety) and the *F. plebeia* (M'Coy) of the British carb. slate, but not determinable with certainty from their state of preservation: common in the shale of Korinda, N. S. Wales.

Glauconome.

A species most allied to the *G. pluma* (Phil.) of the British carboniferous rocks, and perhaps identical with it, but not in sufficiently good preservation to determine. Common in the shale of Dunvegan, N. S. Wales.

Cladochonus (M'Coy), new genus.

(Etym. *κλάδος, a branch,* and *χώνη, a funnel.*)

Gen. Char. Polypidom of very thick, straight, slender, calcareous tubes, suddenly dilating at short regular distances into large, oblique, cup-shaped terminal chambers, longitudinally striated within; from the point where the dilatation commences, a second slender tube similar to the first is given off at an angle varying with the species, and terminating at the same distance as the former in a similar cup, bent in nearly an opposite direction to the first, and giving rise at its base to a third slender tube as before. The whole polypidom erect, attached by the base only, which embraces some foreign body.

These singular and beautiful corals have some relation to *Aulopora,* but differ in their curious erect habit, regular, angular, mode of branching, slender, equal, stem-like tubes and abruptly dilated terminal cups bent in nearly opposite directions. The *Aulopores* are attached for the most part by one side; the tubes *gradually* expand to the mouths, which all open nearly in one direction; they have no regular distance for branching and frequently anastomose. The present corals have also much thicker walls to the tubes, the central hollow being proportionally very small. I formerly described some species of this group under the genus *Jania,* being uncertain where to place them; such are the *J. crassa* and *J. bacularia* of the 'Synopsis of the Irish Carb. Limestone Fossils,' which should now be removed to this genus.

Cladochonus tenuicollis (M'Coy). Pl. XI. fig. 8.

Distinguished by the slenderness of the stems. Common in the Dunvegan shale.

Strombodes? Australis (M'Coy). Pl. XI. fig. 9.

I have given the above name provisionally to a species of *Strombodes* from the calcareous shale of Wagamee, N. S. Wales, having the precise form of the *Turbinolia fungites* of British writers. It is certainly without transverse chambers, having the vertical lamellæ twisted about the centre; the lamellæ are about thirty-six in number, all reaching the centre, though grouped in irregular bundles as they approach it. The section is slightly oval, the lamellæ in the direction of the long axis being straight, those of the sides much arched. The external surface is striated longitudinally, the striæ being double the number of the lamellæ.

Turbinolopsis bina (Lonsd.).

Agreeing minutely with Devonshire specimens. Rare in the shale of Dunvegan, N. S. Wales.

Amplexus arundinaceus (Lonsd.).

Common in the gray limestone of Curradulla or Limestone Creek, N. S. Wales.

CRINOIDEA.

Tribrachyocrinus (M'Coy), new genus.

Gen. Char. Cup globose; pelvis (or dorso-central plate) large, saucer-shaped, pentagonal, tripartite; first costals (or first row of perisomic plates) five, one pentagonal, three hexagonal and one (?) heptagonal; one of the hexagonal costals is truncate above and supports one pentagonal interscapular plate; between these and the heptagonal costal is situated one large, roundish, pentagonal, intercostal plate; in the re-entering angle between this latter and the summit of the heptagonal costal is an obscurely hexagonal plate, analogous to a second costal. Scapulæ (or ray-bearing plates) three, rhomboidal or obscurely pentagonal, upper margin rounded, lower margin pointed; two of those in the re-entering angles between the first costals and one in the angle between the intercostal plate and the second costal. Interscapular plates three, shield-shaped, pentagonal; upper margin broad, straight, truncate, with the two upper lateral angles horizontally extended into short angular processes.

The singular Crinoid for which I propose this genus is very differently constructed from any other of the generic groups with which I am acquainted. The cup is not symmetrical in form, like that of other Crinoids, but is as it were humped on one side by the interpolation of the large irregular intercostal (marked *h* in the diagram) and the second costal (*i*). The only specimen found is slightly crushed laterally, so as to render this inequality of the sides very remarkable. The arm-bearing plates or scapulæ, which are so generally five in the other genera, are only three in the present animal, forming a strong peculiarity which it shares only with the genus *Triacrinus* of Count Münster (Beiträge zur Petrefactenkunde), a little Crinoid of the Eifel differing in every other respect from the Australian form. The general disposition of the plates is most analogous to that of *Poteriocrinus*, from which it differs in the number of the scapulæ and every point of detail. I am as yet only acquainted with one species of the genus, which it is not possible therefore to characterize specifically: I have dedicated it to the Rev. W. B. Clark, to whose zeal we owe the specimens described in this paper.

Tribrachyocrinus Clarkii (M'Coy). Pl. XII. fig .2.

The surface is smooth, with the exception of a few irregular radiating plicæ at the margin of some of the plates, which seem in some cases to overlap each other—an appearance however which may be deceptive. Length of the cup 1 inch 7 lines, width about $1\frac{1}{2}$ inch.

From the soft gray shale of Darlington, N. S. Wales.

Actinocrinus.

Fragments of pelvic plate of this genus occur in the Dunvegan shale, and large columns apparently of *Cyathocrinus* are common in the limestone of Wagamee, N. S. Wales, and also in the limestone of Wollamhoola, N. S. Wales.

CRUSTACEA.

(*Entomostraca.*)

Bairdia curtus (M'Coy), Synop. C. L. Foss. pl. 23. fig. 6.

This little creature is perfectly identical with those I have described and figured, from the lower limestone of Kildare, in the 'Synopsis of the Carb. Limestone Fossils of Ireland.'

Mr. Morris, in Count Strzelecki's work, has noticed a *Bairdia* which he says is intermediate between my *B. gracilis* and *B. curtus*, being more slender than the latter; but his figure is greatly more gibbose, so that I am uncertain whether his *B. affinis* be really distinct or not. At any rate there can be no doubt with regard to the present examples, which are from the shale of Dunvegan, N. S. Wales.

Cythere impressa (M'Coy), Synop. C. L. Foss. pl. 23. fig. 16.

This is another species which I have described from the shales at the base of the carboniferous series in Ireland, and from the complexity of its form is, if possible, a still more positive identification than the last; the agreement in outline, central hollow and its little marginal tubercle, &c. being absolutely perfect, and admitting of no doubt. It is certainly very curious to see those two genera and species of minute Crustaceans occurring together in the shales at the Antipodes just as we see them in our own lower carboniferous beds.

Occurs with the *B. curtus* in the shale of Dunvegan, N. S. Wales.

(*Trilobita.*)

Brachymetopus (M'Coy), new genus.

(Etym. *βραχὺς, short,* and *μέτωπον, the forehead or glabella.*)

Gen. Char. Cephalothorax truncato-orbicular; limb narrow, produced backwards into flattened spines; glabella smooth, cylindrical or ovate, about twice as long as wide, not reaching within about its own diameter of the front margin; one pair of small, basal, cephalothoracic furrows, or none. Eyes reniform, in the midst of the cheeks (? smooth); eye-lines unknown. Surface strongly granulated; one tubercle on each side of the anterior end of the glabella, the marginal row and a circle round each eye being larger than the rest. Body-segments unknown. Pygidium nearly resembling the cephalothorax in size and form, rather more pointed, strongly trilobed, and with a thickened prominent margin; axal lobe about as wide as the lateral lobes, of about seventeen narrow segments; lateral segments about seven, divided from their origin, each terminating in a large tubercle at the margin.

The minute Trilobites for which I propose the present genus are very distinct in habit from those of other genera, and as two or three species are now known, it seems desirable to place them together under one name. They are the smallest perfect Trilobites known, from two to three lines being the greatest width they have been seen to attain. The *Phillipsia Maccoyi* of Capt. Portlock's Geol. Report on Londonderry, &c. certainly belongs to this genus, and is at first sight difficult to distinguish specifically from the Australian species. The Irish species alluded to was collected by the writer from the lower carboniferous limestone of Kildare, and sent to Capt. Portlock for his monograph of Irish Trilobites, under the impression that it formed the type of a new genus and species, but probably from there being but one specimen it was placed provisionally by that author in his genus *Phillipsia*, from which it differs in its small, short glabella, smooth eyes, want of cephalothoracic furrows, &c. Having now examined numerous specimens of the Australian species, there can be no longer any doubt of the distinctness of the group from *Phillipsia* from the characters of the cephalothorax, and the pygidium is still more distinct. From those materials I have therefore drawn up the above characters, which it is believed will distinguish them easily from the other generic types. From the general similarity in the structure of the pygidium, I am inclined to refer the fossil which I have named *Phillipsia* (?) *discors* (Synopsis of the Carb. Limestone Foss. of Ireland, pl. 4. fig. 7. p. 161) to the same genus. This is also a very small Trilobite, the length of the pygidium being only three lines; and although referring it provisionally to *Phillipsia*, I suggested in the above work that it should when better known form the type of a distinct genus, which however it was not possible to frame until now. I have dedicated the present species to Count Strzelecki, whose fine work on the physical features of New South Wales and Van Diemen's Land has so materially advanced our knowledge of that country, and who has recorded the existence of minute Trilobites (undetermined) in the limestone of Yass Plains, which probably belong to this group if not to this species.

Brachymetopus Strzeleckii (M'Coy). Pl. XII. fig. 1.

Sp. Char. Glabella widest at the base, with one very minute obscurely marked cephalothoracic furrow at the base on each side; all the segments of the pygidium with an irregularly tuberculated ridge along the middle; lateral segments forming large tubercles where they join the thickened limb, opposite each of which is a short slender spine projecting from the margin.

The greater size of the glabella and its being widest at the base will distinguish the head from that of the *P. Maccoyi* (Portk.), and the granulation extending entirely across the segments and the spinose margin will distinguish the pygidium from that of the *P. discors* (M'Coy).

Width one and a half line.

Common in the shale of Dunvegan, N. S. Wales.

Phillipsia.

A species closely resembling the *P. gemmulifera* (Phil. sp.), but not distinctly preserved, occurs in the shale of Dunvegan, N. S. Wales.

MOLLUSCA.

(*Brachiopoda.*)

Atrypa cymbæformis (Mor.).

Very common in the sandstone of Muree, N. S. Wales, and in the impure limestone of Black Head, N. S. Wales.

Atrypa biundata (M'Coy). Pl. XIII. figs. 9 & 9 *a*.

Sp. Char. Longitudinally ovate, gibbose, smooth; front narrow; margin raised in two rounded waves, from which two obsolete rounded ridges extend a short way towards the beak on the ventral valve, and one obscure rounded mesial ridge extends nearly to the beak on the dorsal valve.

This species closely resembles the *A. hastata* (Sow.) of the British mountain limestone, and may have been confounded with it; it is however perfectly well distinguished by the character of the front margin, which in *A. hastata* is straight and even, but is elevated and bent into a double fold in the Australian species, somewhat as in the less exaggerated varieties of the *Terebratula biplicata* (Sow.) of the oolites (from which it is known by its imperforate beak, &c.); also *both* valves of the *A. hastata* are plano-concave towards the front margin, while the dorsal valve of the present species presents an obtuse mesial convexity. Length 1 inch 1 line, width 10 lines, thickness 7 lines.

Common in the dark limestone of Black Head, N. S. Wales, in the coarse conglomerate of Korinda, N. S. Wales, and in the gray schists of Lewin's Brook, N. S. Wales.

Atrypa Jukesii (M'Coy). Pl. XIII. fig. 8.

Sp. Char. Transversely oval, length two-thirds the width; sides with eight or nine large, acutely angular, simple plaits, extending from the beak to the margin, which they deeply indent; mesial elevation moderate, square, of five slightly angular simple plaits, much smaller than those of the sides.

This species is closely allied to the *A. pleurodon* (Phil.) of the carb. limestone of Britain, and the *A. fallax* (Sow.) of the upper Devonian and lower carboniferous shales of England and Ireland, but is distinguished by the dissimilarity in size and angulation between the mesial and lateral plaits; the mesial plaits are if anything a little larger than those of the sides in the British forms alluded to. Length $4\frac{1}{2}$ lines, width 7 lines.

Common in the Dunvegan shale.

I have dedicated this species to my friend Mr. Jukes, who has geologically examined a considerable portion of the country and collected many fossils, which I have not as yet seen.

Spirifera (*Reticularia*) *crebristria* (Mor.).

This species has got a distinct cardinal area, and could not therefore belong either to *Terebratula* or *Athyris* as suggested by Mr. Morris; it is in fact a typical example of that little group of *Spirifers* for which I have suggested the name *Reticularia* in the 'Synop. Carb. Foss.' &c., distinguished by their small size, area and hinge-line as in *Martinia* (M'Coy), (that is, the former shorter than the width, and the latter moderately large,) in addition to a reticulated surface and *parallel dental lamellæ*. Is this really distinct from the *Spirifera* (*Ret.*) *microgemma* (Phil.) of the Devonian and lower Irish carboniferous shales? On comparison I scarcely think it is.

Rather rare in the schists of Dunvegan, and in the fine sandstone forming the summit of a hill one mile south of Trevallyn, N. S. Wales.

Spirifera vespertilio (Sow.).

Not uncommon in the impure limestone of Black Head, N. S. Wales, and abundant in the dark calcareous schists of Eagle Hawk's-neck, Van Diemen's Land.

Spirifera calcarata (Sow.).

I cannot in the slightest particular distinguish examples from the sandy shales of Dunvegan, N. S. Wales, from those so abundant in Devonshire and in the lower carboniferous shales and sandstones of Ireland.

Spirifera avicula (Sow.).

Abundant in the sandstones of Korinda, also occasionally in the limestone of Black Head, N. S. Wales.

Spirifera Darwinii (Mor.).

Common in the sandy schists of Loder's Creek and Barraba; more rare in the arenaceous limestone of Black Head, N. S. Wales.

Spirifera subradiata (Sow.).

Common in the sandstone of Muree, in the arenaceous limestone of Black Head, in the schists of Wollongong, and in the fine sandstones of Darlington, N. S. Wales.

Spirifera subradiata (? var. resembling *S. glabra*).

Common in the sandstone of Maitland, and in the arenaceous limestone of Irrawang, N. S. Wales.

Spirifera attenuata (Sow.).

Specimens perfectly undistinguishable from the *larger variety* so abundant in the lower carboniferous shales of Ireland (as at Hook Point, co. Wexford), are common in the arenaceous shales of Dunvegan, N. S. Wales.

Spirifera Tasmaniensis (Mor.).

Common in the hardened schists of Lewin's Brook, N. S. Wales.

Spirifera lata (M'Coy). Pl. XIII. fig. 7.

Sp. Char. Transversely rhomboidal, moderately gibbose, width four times the length; sides flattened, regularly attenuating to the very acute cardinal angles; cardinal area broad, flat; mesial fold wide, defined, angular, smooth; about sixteen to eighteen slightly convex, simple, smooth ribs on each side of the mesial fold, becoming indistinct as they approach the cardinal angles, so as to leave nearly a third of the length of the sides smooth.

This differs from the widest varieties of the *S. disjuncta* (Sow.) by its defined and smooth mesial hollow, extent of the smooth space at the end of the sides, and the smaller number and greater width of the radiating ridges, which are also much less prominent; the smoothness of the mesial fold and width of the cardinal area separate it from the *S. convoluta* (Phil.); and from the *S. Rœmerianus* (Kon.) it is known by its size, greater width, smooth cardinal extremities and flatter and wider lateral ridges. Length 1 inch 1 line, width 4 inches.

From the hard schists of Lewin's Brook, N. S. Wales.

Spirifera duodecimcostata (M'Coy). Pl. XVII. figs. 2 & 3.

Sp. Char. Transversely oval or subrhomboidal, gibbose; sides rounded; hinge-line shorter than the width of the shell; cardinal area wide, triangular, curved; mesial ridge prominent, deeply divided by a mesial sulcus; mesial hollow wide, deep, defined, and showing a mesial ridge corresponding to the mesial sulcus of the ridge of the ventral valve; five or six strong, subangular, simple ridges on each side of the mesial fold.

Length of dorsal valve 1 inch 3 lines, width 1 inch 9 lines. Not uncommon in the calcareous grit of Wollongong and in the sandstone of Muree, N. S. Wales.

Spirifera oviformis (M'Coy). Pl. XIII. figs. 5 & 6.

Sp. Char. Longitudinally ovate, longer than wide; hinge-line much shorter than the width of the shell; sides rounded, gibbose; mesial ridge large, rounded, divided by a deep furrow; mesial hollow very wide, flat, undefined; three or four large rounded prominent ribs on each side of the mesial fold, rendered obscurely nodulose by the obtuse concentric undulations of growth.

This is one of the very few *Spirifers* in which the length exceeds the width, by which character it may be known from all the varieties of the *S. subradiata*. The figures on the plate are from two different specimens. Length 2 inches 6 lines, width 2 inches 3 lines.

Not uncommon in the sandstone of Barraba, N. S. Wales.

This species and the last belong to the subgenus *Brachythyris* (M'Coy).

Orthis striatula (Schlot.).

On the most careful comparison I find nothing to distinguish the Australian specimens from those so common in the Eifel and lower Irish carboniferous shales.

Abundant in the hard rock of Lewin's Brook, N. S. Wales.

Orthis Australis (M'Coy). Pl. XIII. figs. 4 & 4 *a*.

Sp. Char. Longitudinally obovate, very depressed, uniformly convex, length nearly equalling the width; width greatest towards the front margin, narrowing towards the hinge-line, which slightly exceeds half the width of the shell; sides and front margin nearly straight, slightly convex; surface with very numerous, fine, nearly equal dichotomous striæ radiating from the beak.

This is closely allied to the upper Devonian and lower carboniferous fossil to which Prof. Phillips restricts the name *O. inter-*

lineata, and to the carboniferous *O. Michelini* (Lév.), (*O. filiaria*, Phil.). From the former it is distinguished by its narrow, longitudinally obovate figure, and from the latter by its wider hinge-line and much finer striæ; and from both it differs in the form of its muscular impressions. Length 7 lines, width $7\frac{1}{2}$ lines.

Abundant in the shales of Lewin's Brook, N. S. Wales.

Orthis spinigera (M'Coy). Pl. XIII. fig. 3.

Sp. Char. Longitudinally obovate, gently convex; length of ventral valve two-thirds the width, width greatest near the front margin, narrowing rapidly towards the hinge-line, the length of which is little more than half the width towards the front; cardinal area triangular, flat, half as high as wide; sides of the shell much rounded; front margin without sinus, slightly convex; surface with two or three strong distant imbrications of growth, crossed by numerous small, strong, angular, radiating ridges (about twenty-two at two lines from the beak); they are nearly equal in thickness, but shorter ones are interpolated, chiefly at the concentric imbrications of growth, between each pair of the primary ones as they approach the margin, beyond which, when well preserved, they are produced into slender conical spines; they are about their own diameter apart, the intervening flat spaces being coarsely striated across.

Somewhat allied to the Russian *O. plana* (Pand. sp.), but very distinct by the character of the striation and by the short hinge-line and comparative width of the front. Length of ventral valve 5 lines, width 7 lines; height of cardinal area 2 lines, width of hinge-line 4 lines.

Rare in the shale of Dunvegan, N. S. Wales.

Productus antiquatus (Sow.).

Reticulated rostral portions well preserved and perfectly undistinguishable from the British carboniferous specimens.

Common in the hard schist of Lewin's Brook, N. S. Wales.

Productus brachythærus (Sow.).

Very common in the calcareous grit of Loder's Creek, and also at Korinda, N. S. Wales.

Productus setosus (Phil.).

I find the Australian species undistinguishable when minutely compared with our common British mountain limestone species above-named. In the dark indurated schist of Lewin's Brook, N. S. Wales.

Productus scabriculus (Sow.).

In the calcareous flags and dark limestone of Hall's quarry, Hobart Town: associated with this there is abundance of a flatter species, concentrically wrinkled and with more irregularly placed, blunt, round spines, which may, or may not, be distinct from the *P. fragaria* and *P. caperata* of the upper Devonian and lower Irish carboniferous shales, but from the state of preservation I cannot satisfy myself of the species.

Productus undulatus (M'Coy). Pl. XIII. fig. 2.

Sp. Char. Subquadrangular, one-third wider than long, gibbose, front slightly concave at the margin; sides nearly rectangular, obtusely rounded; beak large, tumid; surface with fine, close, short, undulating transverse wrinkles; a few obscure traces of oblong spines towards the margin.

This species is slightly allied to the *Leptæna lepis* of the Eifel, and the *L. membranacea* and *L. mesoloba* (Phil. Pal. Foss.), but is distinguished from the two first by its gibbose quadrangular form, concave front and large tumid beak; and from the latter by its want of mesial ridge and spines, and by the fine transverse plication of the surface. Length 7 lines, width 10 lines.

Rare in the sandstone of Loder's Creek, N. S. Wales.

Leptæna —— ?

A species closely resembling the *L. Hardrensis* (Phil.), but more square in outline, not so wide, and more coarsely striated, is common in the shale of Dunvegan, N. S. Wales; it also resembles the *Chonites Laguesianus* of the Belgian carb. shale and the *Chonites Falklandica* of the Falkland Islands, but as I have not examined either of those latter species, I prefer leaving the determination of the Australian form uncertain.

Orbicula affinis (M'Coy). Pl. XIII. fig. 1.

Sp. Char. Longitudinally ovate, very much depressed; margin slightly undulated; apex acute, excentric towards the right side, one-third of the length from the anterior edge; surface with fine, sharp, irregular concentric plicæ.

This is only to be distinguished from the *Orbicula Davreuxiana* (Kon.) of the Tournay carb. shale by the fine sharp concentric plication of the surface. Length 3 lines, width $2\frac{1}{2}$ lines, height three-fourths of a line.

From the shale of Dunvegan, N. S. Wales.

[To be continued.]

XXII.—*Additions to the Fauna of Ireland.* By WILLIAM THOMPSON, Esq., Pres. Nat. Hist. and Phil. Society of Belfast*.

[Continued from p. 176.]

CRUSTACEA.

Order *Decapoda.*

1. *Stenorhynchus tenuirostris,* Leach.

On examining some fine *Stenorhynchi* dredged in Belfast bay from a depth of twenty to twenty-three fathoms (shelly sand) in Oct. 1846 by Mr. Hyndman, I found that like specimens obtained there, but from a much less depth, some years before, had more characters in common with this species than with *S. phalangium.* The rostrum, though longer than in the latter—three lines in length in a specimen whose carapace from its base to the hinder extremity is ten lines—is not of the extreme length of that of *S. tenuirostris* :—instead of being "longer than the peduncle of the external antennæ," it is not so long. But "the series of minute spines on the inner part of the arm, the body altogether more elongated, and the spines more acute" than in *S. phalangium,* mark my specimens as *S. tenuirostris.*

The preceding notes were made on a comparison of these examples with the descriptions of Leach and Bell. Having subsequently taken specimens to London and compared them with those in the British Museum described by Leach, the result was the same. I therefore look upon *S. tenuirostris* and *S. phalangium*—although extreme forms are very distinctly marked—to be in reality but one species. It may be added, that in one of the two Irish examples of what I have called *S. tenuirostris* taken to the British Museum, the wrist has the form attributed to that species, and in the other, that attributed to *S. phalangium.* Both of these individuals were added to that collection. The *Sten. Egyptius,* Edw., it need hardly be remarked, is quite different from those under consideration ; it is alluded to in consequence of being the only other species of the genus.

* *Teredo malleolus.* I hasten to correct an error respecting the species so called at p. 163 and p. 174. The opercula or pallets having since been found, prove that it is not *T. malleolus.* They are quite similar to those of the *T. bipalmulata* of Delle Chiaje, Mem. iv. t. 54. f. 22 and 23, and approximate those of the species (*T. palmulatus,* Lam.) considered the same by Philippi, in the first vol. of his 'Enum. Moll. Siciliæ,' t. 1. f. 8 ; but if the *shells* there figured represent perfect specimens, my species differs from his. The genus *Teredo* seems to require a rigid revision. Having sent specimens to Professor E. Forbes and Mr. Hanley, who possess in London much better means of working out the subject than I have, the positive identification of the species is left to them. The genus *Teredo* will I believe be included in the 1st part of their 'History of British Mollusca,' to appear in November. Mine is at all events a form now noticed for the first time as introduced by shipping to any port of the United Kingdom.

Erratum in note to p. 161.—Instead of "The name is I believe unpublished," it should be—The name was I believe left unpublished by Dr. Leach.

The questions occur :—is the *S. tenuirostris* a deep-water, a local, or a geographical variety? The following remarks, though all that can be given, have not any very definite bearing on these points. Leach mentions it as a very common inhabitant of all the deep water off the coast of South Devon. Couch in his 'Cornish Fauna,' part 1. p. 64, states that it is "common at the depth of from two to twenty fathoms *." M. Edwards says of *S. longirostris* †, Fabr. (sp.), which he makes synonymous with *S. tenuirostris*, Leach—but Mr. Bell thinks that they may be distinct—that it inhabits the Manche and the Mediterranean.

S. phalangium is noted by Leach as "very common in the mouths of rivers and in estuaries." Couch has never met with it on the coast of Cornwall. M. Edwards notes it as very common on the coasts of the Manche and the Ocean.

2. *Eurynome scutellata,* Risso.

A specimen of *Eurynome* dredged on the same occasion as the last species having exhibited the tubercles on the cardiac region—the ten noticed by Bell, p. 47, as ranged round the central one—massed together in the form of a shield or escutcheon, and the series anterior to them on the central line (longitudinally) of the carapace having presented a similar appearance, suggested the specimens being the *E. scutellata*, Risso. This indeed was rather indicated by the *name* of the species than by any particular definition in the description of it :—"De petits écussons arrondis, rouge et jaune pâle, couvrent le test de ce joli crustacé ‡." On examining other specimens in my collection and finding great diversity as to the isolation and approximation of the tubercles so as to form shields in the different individuals, I became certain that the *E. aspera* and *E. scutellata* are but one species, the latter being a state of the former with the tubercles drawn together so as to form shield-like patterns. The shields in all the specimens examined, except the first-mentioned, show that they are formed by the junction of the tubercles: in it however no trace of the separate tubercles is visible, but instead, the five on either side the central one on the cardiac region are all fused together. Those forming the smaller shield anterior to it are likewise fused together so as to leave no trace of the number of tubercles forming it.

Having understood that my friend Professor Bell had authentic specimens of *E. scutellata* from the Mediterranean, I compared my specimens with them, and found a perfect identity as to species. He had considered the *E. scutellata* as distinct, but when my reasons

* *S. phalangium* proper is taken in the north of Ireland within this range of depth.

† The only character given for this species in M. Edw. 'Hist. Crust.' vol. i. p. 280, is that the rostrum exceeds in length the peduncle of the external antennæ.

‡ Risso, 'Hist. Nat. de l'Eur. Mérid.' vol. v. p. 21. M. Edwards considered the *E. scutellata* to be so unsatisfactorily described that he could make nothing of it. (Hist. Crust. vol. i. p. 352.) The figure too is execrable.

for considering *E. aspera* and it but as one species were explained, he at once on examination of the specimens coincided in my opinion. The reduction of these two supposed species to one, leaves *E. aspera* the only representative of the genus *Eurynome*.

3. *Gebia deltura*, Leach, Malac. t. 31. f. 9, 10; Bell, Brit. Crust. p. 225 (part 5); Edw. vol. ii. p. 314.

In the stomach of a Haddock (*Gadus Æglefinus*) taken off Newcastle (co. Down) on the 6th March 1847, I was interested in finding two perfect arms of this rare fossorial species, hitherto known to have been obtained only on the coast of Devonshire*. They are just of the size represented by the authors quoted. The stomach of the fish was with the exception of them filled with the remains of *Ophiura texturata*. It was from the same locality that I obtained the arms—and these only—of the two other fossorial genera *Callianassa* and *Calocaris* in March 1839. The reason of these parts alone of the animal being taken may perhaps be owing to their being above the surface of the bank, ready to lay hold of any food within their reach, while the body remains concealed, and the ground-feeding fish seizing on them, the Crustacean sacrifices its exposed members rather than give up its whole body to its assailant.

Professor Bell remarks:—" The difference of the depth which the various species of this fossorial family inhabit is very remarkable; the present species [*Gebia stellata*] with *Callianassa subterranea* being found in a sand-bank, when digging for *Solenes*, whilst *Calocaris Macandreæ* was dredged from the astonishing depth of 180 fathoms." (Hist. Brit. Crust. p. 224.)

The difference here noticed is interesting insofar as the facts narrated, but can scarcely be considered characteristic of the respective species. My specimens of *Callianassa* and *Calocaris*, if not taken from the stomach of the same individual fish, a *Platessa pola*, Cuv., were procured from two fishes of that species taken at the same sweep of the trawl-net on the same bank at a depth of ten fathoms. The *Gebia* was probably taken at a similar depth.

Note.

? *Alauna rostrata*, Goodsir, Edin. New Phil. Journ. vol. xxxiv. p. 130. pl. 4?

The occurrence of an individual of this species to me at Newcastle (co. Down) in Aug. 1836 was noticed in the 'Annals,' vol. xiii. p. 435, accompanied by a mark of doubt as to the species. When lately looking over some Crustacea dredged from five fathoms at the Skerries on the Dublin coast, in the autumn of 1845, by Mr. R. Ball and Professor Edw. Forbes, I was gratified to see several specimens quite similar to the one that I had myself taken. They are about

* No observation of this kind is hazarded with respect to any species, without reference having been made to the general 'Hist. des Crust.' of M. Edwards. It has supplied the data with respect to continental works, on which all such remarks are made in this communication.

six lines in length, and agree in all respects with Goodsir's description, but present at the same time a striking character which he has not noticed—in the carapace being almost wholly covered by series of minute granular spines (if such an expression may be used) with the points directed forward, and hence my "?" as to species. The describer of *Alauna* obtained but the one specimen.

Order *Stomapoda.*

4. *Cynthia* —— ? Thomp. (J. V.), Zool. Res., Memoir 3, p. 55; Edw. vol. ii. p. 462.

Among some of the more minute Crustacea taken at Strangford lough in May 1840 by Mr. R. Patterson is a *Cynthia*, but hardly sufficiently perfect to be determined. The species on which the genus was founded was taken between Madeira and Barbadoes. Mr. H. Goodsir added the genus to the British fauna from examples obtained on the east coast of Scotland.

5. *Themisto* * *brevispinosa*, Goodsir, Edin. New Phil. Journ. vol. xxxiii. p. 177. pl. 2. f. 9.

In September 1835 I obtained an individual of this species in rock-pools between tide-marks at Bangor, co. Down.

Note.

Mysis chamæleon, Thomp. (J. V.), Zool. Res., Memoir 2, pl. 2. f. 1—10.

The first examples described under this name were obtained in the harbour of Cork. Specimens from each side of the island have come under my notice. At Bangor, within the entrance of Belfast bay; Ballywalter, on the open coast of Down (both strictly marine localities); in Dundrum bay, same county (in brackish water); and in the tidal river Lagan at Belfast; I found them common in the summer or autumn of 1835 and 1836. In the three first-named places they were taken between tide-marks; in rock-pools in the two first, and in a sandy bay in the last. I have seen it among Crustacea brought up in the dredge in water five fathoms deep off the Dublin coast by Mr. R. Ball; have received it from the west coast of Cork (Professor G. J. Allman), and have taken it myself along the shores of Connaught. A detailed note of June 22, 1846, is as follows. When in company with Mr. Hyndman today at Strangford lough, I took a number of this species (which is admirably figured in the work quoted) in brackish water at Ardmillan. They were in extraordinary profusion, and viewed in the water were at first sight mistaken for the fry of fish †. They appeared to be all about the same size, and

* This was used as a generic name by Guérin previous to its publication as such by Goodsir. Guérin's genus belongs to the order *Amphipoda* and family *Hyperiadæ*. *Macromysis* is substituted by Mr. Adam White for Goodsir's *Themisto* in the Catalogue of the Crustacea in the British Museum, p. 81.

† I have generally remarked the *Mysis* to be much more numerous where fresh-water enters the sea than in pure sea-water.

adult, as were the specimens taken, the largest exceeding 1¼ inch in length from point of anterior scales to end of the caudal plates.

Mr. J. V. Thompson remarks that *M. chamæleon* "has never been observed like the other species in any great numbers together, but scattered and solitary, often associated with *M. vulgaris*," p. 29. But where they came under my observation in this instance, a small arm of the lough a few feet in depth presented the extraordinary spectacle of being quite alive with them. They were all swimming in one direction, towards the sea, and moving regularly and horizontally onward.

It is difficult, owing to the figure being deficient in elaboration, to judge whether or not Montagu's *Cancer astacus multipes*, Linn. Trans. ix. (p. 90) pl. 5. f. 3, be this species, but I agree with Mr. J. V. Thompson that the *Cancer flexuosus*, Müll. Zool. Dan. vol. ii. p. 34. pl. 66, is so. M. Edwards (Hist. Crust. vol. ii. p. 458) observes, that spines are represented on the sides of the abdomen in Müller's figure of *M. flexuosus*, but although such an appearance is presented in the plate, surely it is the mere setæ of the subabdominal fins which are intended to be represented. The specimens taken on this occasion were all of one hue, as the millions in the water seemed to be; this was a very pale olive or "pellucid cinereous," as ascribed to the *M. Leachii* by Mr. J. V. Thompson, from which they differed only in having black instead of "reddish rust-coloured" spots. Each segment of the body in every specimen examined (about thirty in number) is marked with a round black spot, whence, in some, arborescent arms branch off; in others there is no arborescent appearance, but the segment is dotted regularly over with extremely minute points. To

Mysis vulgaris, J. V. Thomp. *ibid.* p. 30. pl. 1,

my attention was first directed by remarking among those captured, individuals wanting the black spot on the segments of the body, when, singling out three of these, they proved to be of this species—all the others were *M. chamæleon.* The segments however exhibit an arborescent veining, though wanting the black central spot. These specimens are one inch in length, or one-fifth less than the largest *M. chamæleon* taken with them. If the proportion of the one species to the other in the myriads seen were as in those taken, the numbers of *M. vulgaris* to the other were but as one to ten. Some of these (*M. vulgaris*) produced young in the phial, like those represented by Müller in the 'Zoologia Danica,' pl. 66, and by Kroyer in the 'Voyages Scandin. et Lapon. Crustaces,' pl. 9.

Ballyhome, Belfast bay, July 4, 1846. From the rocks at the entrance of this bay I captured in pure sea-water a number of the *Mysis* of various sizes, all of which proved to be *M. chamæleon.* The extraordinary difference in colour of these specimens, all taken together within the space of a few yards, well justified the specific name. They were brown, green, pink, red, and hyaline, some as transparent in colour as the water itself: a few displayed a whitish longitudinal stripe down the back. With the view to a more particular examination of the colours at home, they were placed in a phial of sea-water, but were all dead on my arrival there a few hours afterwards. Of the many species of the more minute forms of Crustacea which I have preserved in spirits, the *Mysidæ* were always among the first to become soft and to decay. The specimens under consideration, when examined in spirits, exhibited on each segment of the body a black spot, whence more or less of an arborescent appearance was manifest.

M. chamæleon has occurred to me much more frequently as well as in greater numbers on the Irish coast than *M. vulgaris*. In very shallow pools between tide-marks at Lahinch (co. Clare) the latter was procured by Professor E. Forbes and myself. It frequents the tidal river Lagan at Belfast.

Order *Amphipoda.*

6. *Orchestia*, sp.

Bangor, co. Down, 1835, W. T.; distinct from *O. littorea*.

7. *Amphithöe fucicola*, Leach (sp.); Edw. vol. iii. p. 32. *Pherusa fucicola*, Leach, Linn. Trans. xi. p. 360.

Obtained many years ago at Youghal by Mr. R. Ball. Leach only appears to have noticed this species: he remarks, "Habitat inter fucos in Damnoniæ australis mari rarius."

8. *Amphithöe rubricata*, Mont. (sp.); Edw. vol. iii. p. 33.

Procured in Strangford lough in Oct. 1839 by Mr. Hyndman and myself. In shallow rock-pools between tide-marks on the open coast at Springvale, co. Down, I obtained several specimens in July 1846. Previously noticed only as found on the south coast of Devon by Montagu.

9. *Amphithöe*, sp.

Bangor, co. Down, 1835, W. T.; distinct from the preceding and *A. obtusata*, on comparison with the specimens in the British Museum.

10. *Gammarus marinus*, Leach; Edw. vol. iii. p. 46.

Strangford lough, 1837, Mr. Hyndman and W. T; Ballysodare, co. Sligo, Mrs. Hancock.

Noticed by Leach as found on the south coast of Devonshire and by M. Edwards on the coast of France.

11. *Gammarus campylops*, Leach; Edw. vol. iii. p. 48.

Taken at high water in the tidal river Lagan, above the bridge at Belfast, May 1836, Mr. Hyndman and W. T.

Shore of Loch-Ranza, Isle of Arran, where the species was discovered by Leach, the only locality hitherto noticed.

12. *Gammarus longimanus*, Leach (sp.). *Mæra longimana*, Leach MSS.

A single one taken with last:—same as Leach's unique specimen in the British Museum.

13. *Gammarus punctatus,* Johnst. Zool. Journ. vol. iii. pp. 177, 490,

I found in a case formed by itself among the branches of *Corallina officinalis* growing in pools between tide-marks at Springvale, co. Down, in July 1846. The species was determined by comparison of mine with those from Berwick presented by Dr. Johnston to the British Museum.

14. *Opis typica,* Kroyer, Voy. Scandinavie et Laponie Crust. pl. 17. f. 1.

Dredged in Strangford lough, Oct. 1839 and June 1846; on the latter occasion picked off Algæ brought up from a depth of fifteen to twenty-three fathoms, where they grew on soft sandy ground—several specimens procured on each occasion.

A description of this species appears in Kroyer's 'Naturhist. Tidssk.' 2nd binds, 1st hæfte, 1846, p. 46.

15. *Anonyx* (Kroyer), sp.

Several specimens of an *Anonyx* of various sizes were dredged from five to six fathoms' depth—pure sandy bottom—off Bangor, Belfast bay, in July 1846, by Mr. Hyndman and myself. They are distinct from and more elegant in form, colour and markings than any of the seven species—*A. nanus, littoralis, ampulla, holbollii, plautus, Edwardsii, tumidus*—represented by Kroyer in such parts of the 'Scandinav. et Lapon.' as were in the British Museum library in July 1847*.

They are all plain or uniform in colour, while mine has conspicuous stellate markings; it is also of a somewhat deeper tint generally, and has the antennæ longer than any of those named.

Although a proper description cannot (on account of the state of my eyes) be drawn up, some idea may be given of this *Anonyx*—(which is well worthy of the name of *elegans*)—by the following note:—length of body 6 lines; of upper antennæ 1 line; of lower antennæ 4 lines; general colour yellowish pink; eyes red; lateral or abdominal plates adorned with scarlet stellate markings, of which there are five or six on those nearest the head: they become gradually fewer on those towards the tail, so that not more than one appears on the hinder plates. These markings render it very beautiful. My *Anonyx* is distinct from a British species (locality unknown) in the collection of the British Museum. As this is not included in the lately published Catalogue of the Crustacea therein contained, the present is the first notice of the genus as British.

16. *Anonyx,* genus ?,

or rather a form between it and *Stegocephalus,* Kroyer, was dredged from a depth of twenty-three fathoms (shelly sand) in Belfast bay in Oct. 1846 by Mr. Hyndman.

* Since the above was written, Kroyer's 'Naturhist. Tidssk.' for 1846 has come under my notice, and in it ten species of *Anonyx,* including the seven already named, are described (in *Latin*): the additional species are *A. gulosus, A. minutus,* and *A. Vahlii.*

17. *Cerapus falcatus,* Mont. (sp.), Linn. Trans. vol. ix. t. 5. f. 2.
Jassa pelagica, Leach.

I agree with M. Edwards (vol. iii. p. 61) in considering the forms bearing these two names as one species: Leach looked upon them as different. Both, as distinguished by the form of the claw, are among my specimens, of which a number were dredged in Strangford lough in Oct. 1839 by Mr. Hyndman and myself. Among the roots of a large plant of the tangle (*Laminaria digitata*) brought me from Donaghadee by Edmund Getty, Esq., in Aug. 1846, were several specimens.

Devonshire (Mont.) and the Bell Rock (Leach) are the only published localities I have seen for this species.

18. *Hyperia galba,* Mont. (sp.); Edw. vol. iii. p. 77.
Cancer Gammarus galba, Mont.

Found in the pouches of *Rhizostoma Cuvieri* on the Dublin coast in the autumn of 1838 by Mr. Hyndman.

Only noticed by Montagu as found on the south coast of Devon.

19. *Hyperia Latreillii,* Edw. vol. iii. p. 76.

Obtained at Youghal by Mr. R. Ball nearly thirty years ago ("about 1818") in great numbers in the cavities of a *Rhizostoma.* This species has not been noticed by any English author, but specimens of Leach's marked "British coast" are in the British Museum. M. Edwards mentions it as found on the coast of France*.

20. *Lestrigonus,* sp.

An individual of this genus is in the same phial with the last, and was probably obtained from the cavities of the same *Rhizostoma* with them. It has become so soft in the spirits from incipient decay as barely to admit of specific description. With respect to the genus, I have the opinion of Mr. Bell in addition to my own. Of the two species of this genus described, one is from India, the other from Greenland. (Edw. Hist. Crust. vol. iii. p. 82.)

Order *Læmodipoda.*

21. "*Caprella lobata,* Müll.," Kroyer, Voy. Scand. et Lapon. Crust. pl. 25. f. 3*a*†.

Specimens attached to zoophytes (*Sertulariæ* chiefly) dredged from about ten fathoms on sand near Portaferry, Strangford lough, Oct. 1839, Mr. Hyndman and W. T.

22. *Caprella tuberculata,* Goodsir, Edin. New Phil. Journ. vol. xxxiii. p. 188. pl. 3. f. 6.

Specimens taken with the last.

* The species of these *Hyperiæ* were determined as above by Mr. Adam White. On my subsequent examination of *H. galba* insofar as I dare magnify the specimen, it seemed to be a *Metœcus,* Kroyer (which Montagu's may likewise be), but whether *M. medusarum* I had not the means of determining. The subject must be further examined into.

† 3 *b.* presents a very different form, but is considered a variety only.

Guérin, in his 'Iconographie,' &c. pl. 28. f. 1, represents a species which he calls by this name; it is from the Mauritius (Texte Descrip. Crust. p. 24).

23. *Caprella acuminifera,* Leach; Edw. vol. iii. p. 107. pl. 33. f. 21—26.

I found a few examples of this species living among *Corallina officinalis* in shallow rock-pools between tide-marks at Springvale, co. Down, in July 1846.

24. *Ægina? longispina,* Kroyer, Voy. Scand. &c. Crust. pl. 19. f. 3*.

A single individual of this very fine, large and spinous form was taken with the two first-noticed *Caprellæ.* My specimen differs only from that represented by Kroyer in having one or two more spines retrally on the body: it is wholly red like his, and has retained this colour in spirits to the present time. Goodsir's *Caprella spinosa* (Edin. New Phil. Journ. vol. xxxiii. p. 187. pl. 3. f. 1) approaches very near to this species, if it be not the same; it is described as having "the whole body of a pale white colour." *Caprella linearis* of authors (already recorded as Irish) was taken with this as well as *C. lobata* and *C. tuberculata.*

I have merely identified my *Caprellæ* with the species described, and without any attention being bestowed on the variety of form that the same species may assume. Indeed the only attempt to investigate this subject known to me is that of Kroyer with respect to *C. lobata*:—see my note under this species.

Order *Isopoda.*

25. *Tanais Dulongii,* Audouin (sp.); Edw. vol. iii. p. 142.

Two Crustaceans which I found on *Alaria esculenta* washed ashore at the Giant's Causeway in July 1839, seem so like this species as figured in the great French work on Egypt, that I am disposed (in which Mr. Adam White agrees with me) to consider them the same. They do not exhibit any point of difference, but are not quite perfect. The second species of *Tanais* described by M. Edwards is from Naples. M. Kroyer has described three species in the 'Isis,' one of which is from Bahia, and the other two from Madeira.

26. *Jæra albifrons,* Mont. (sp.); Leach; Edw. vol. iii. p. 150.

Common under stones in shallow rock-pools between tide-marks at Bangor, Belfast bay (1834, W. T.), and in Strangford lough, both strictly marine localities—also obtained in the tidal river Lagan at Belfast. Known only hitherto as found on the coast of Great Britain.

27. *Sphæroma Prideauxiana,* Leach.

An example of this species, taken in a towing-net where the water

* Described in Kroyer's 'Naturhist. Tidssk.' 1st binde, 5th hæfte, 1845, p. 476.

was several fathoms in depth in Belfast bay in August 1846 by Mr. R. Patterson, was brought to me alive. Its colour was pale brown with dark brown markings ; its motions when undisturbed were lively —when touched, it rolled itself into a ball.

My specimen, which on comparison with the original one from "Devon" (where only it has yet been noticed) in the British Museum, must be considered this species, at the same time cannot be said to differ from *S. curtum* (a view in which Mr. Adam White coincides) : —it is intermediate in size, form, &c. between the individual examples of the two species in that collection. M. Edwards offers some remarks on the difficulty of distinguishing *S. curtum* from Leach's description (Hist. Crust. vol. iii. p. 209).

28. *Sphæroma Griffithsii,* Leach MSS.? Brit. Museum Catal. p. 103.

Three *Sphæromæ* obtained in Belfast bay and Strangford lough (1835, &c.) are similar to the two poor original specimens from Torbay, so named in the British Museum, excepting in the caudal plate being rather more rounded in my specimens *.

29. *Cymodocea truncata,* Mont. (sp.); Edw. vol. iii. p. 214.

Two examples procured between tide-marks at Cultra and Rockport, Belfast bay, Mr. Hyndman and W. T., 1837. Leach remarks that the species is found amongst Fuci and is very rare : Edin. Ency. vii. 433. Mine agree with his specimen from Devon (the only known locality) in the British Museum.

30. *Cirolana hirtipes,* Edw. vol. iii. p. 236. pl. 31. f. 25.

My specimens are similar to those so named in the British Museum (but whence these were obtained is unknown), and agree with the description and figure of M. Edwards, whose only locality indicated for the species is the Cape of Good Hope ! The first individuals which came under my notice were found in the midst of a mass of ova in a boiled cod-fish sent me from Portpatrick about ten years since by Lieut. Little, R.N. In September 1841, several found adhering to a skate (*Raia batis*) taken in Belfast bay, were brought to me by Mr. Hyndman. I have also procured it on the gills and once alive in the stomach of a holibut (*Hippoglossus*) from the last-named locality. It was enumerated in my 'Report' under the name of *Cirolana Cranchii,* the only known British form of the genus.

31. *Eurydice pulchra,* Leach; Edw. vol. iii. p. 238.

This pretty species has been taken at Larne by Mr. R. Patterson (1838) and at Carrickfergus, between tide-marks, by Mr. Hyndman (March and April). Bantham, Devon, the original locality (Leach, Linn. Trans. xi. 370), appears to be the only one yet noticed for *E. pulchra.*

* See Guérin, Iconog. Règne Anim. Crust. texte descriptif, p. 27, for remarks on *Sphæroma serratum,* Fabr. (sp.), and *S. globator,* Pall. (sp.) as two distinct species.

32. *Munna Kroyeri,* Goodsir, Edin. New Phil. Journ. vol. xxxiii. p. 365. pl. 6. f. 2.

Taken in a towing-net on the surface of Strangford lough in May 1840 by Mr. R. Patterson.

The genus *Munna* was described by Kroyer in 1841, and Mr. Goodsir's *M. Kroyeri* was obtained in July 1842 in the Firth of Forth.

Legion *Entomostraca.* Order *Copepoda.*

33. *Cetochilus septentrionalis,* Goodsir, Edin. New Phil. Journ. vol. xxxv. p. 336. pl. 6. f. 1—11.

Many of this species were taken with the last in May 1840 :—in October 1843 this *Cetochilus* was described by Mr. Goodsir.

34. *Canthocarpus minuticornis,* Müll. (sp.) *Cyclops minuticornis,* Müll.

Obtained in Strangford lough, Oct. 1839, Mr. Hyndman and W. T.

Order *Siphonostomata.*

35. "*Caligus minutus,* Otto, Nordm. ;" Edw. vol. iii. p. 450, and Règ. Anim. pl. 77. f. 2.

I obtained a specimen off a holibut in Belfast market in February 1837. It differs very little—hardly in species—from *C. hippoglossi,* Kroyer, Tidssk. bind i. p. 625. pl. 6. f. 3 (1st series).

M. Edwards notes the species as found on the coast of Bretagne in the branchial cavity of the "Bars" [Basse. *Labrax lupus,* Cuv.].

36. *Caligus curtus,* Kroyer, Tidssk. 2 bind, tab. 104. pl. 1. f. 1 *m.*

On *Raia maculata* taken in Belfast bay, April 1839, W. T. See M. Edwards, 'Hist. Crust.' vol. iii. p. 451, for remarks on *C. curtus,* Müll. &c.

37. *Caligus diaphanus,* Nordm., Kroyer, bind ii. pl. 1. f. 3. (Reference to pl. 1 at p. 104.)

Nordmann obtained this species off *Trigla hirundo.* I have procured it not only on that fish but on the following, purchased in Belfast market :—*Trigla pini, Pagellus centrodontus, Scomber scombrus, Caranx trachurus, Merlangus carbonarius, Merlucius vulgaris, Lota molva, Platessa vulgaris* and *Pleuronectes maximus.* The specimens were taken in March, August, October and December (1837).

M. Edwards (vol. iii. p. 452) refers only to the above-cited authors for this species.

38. *Caligus pectoralis,* Kroyer, Tidssk. bind i. p. 628. pl. 6. f. 4.

M. Edwards notices this as found on turbot, plaice and other flatfishes (vol. iii. p. 454). I have procured it on *Platessa flesus, P. limanda, Solea vulgaris, Scomber scombrus, Zeus faber* and *Conger vulgaris,* brought to Belfast market in March 1837 : they adhered to all the exposed parts of the body of the various fishes, and not to the gills, &c.

This species is brought under the genus *Lepeophtheirus* by Nordmann (Mikrog. Beitrage, p. 30), but Kroyer writing on it subsequently calls it *Caligus*. M. Edwards marks Müller's *Lernea pectoralis*, Zool. Dan. tab. 33. f. 7, with doubt as being identical with that of the two authors quoted.

39. *Caligus Nordmanni*, Edw. vol. iii. p. 455. and Règ. Anim. pl. 77. f. 1,

I have procured on *Gadus morrhua* brought to Belfast market in March, November and December 1837. M. Edwards notes this species as found at Nice on the skin of a "Mole" [*Orthagoriscus mola*].

40. *Caligus vespa*, Edw. vol. iii. p. 456,

I have found on *Salmo trutta* taken in Dundrum bay (co. Down), Aug. 1836, and on the same species captured in the sea at Donaghadee in March; on *Salmo eriox* from the latter locality in Dec.; on *Salmo salar* taken on ascending two of the co. Antrim rivers from the sea in June and July. M. Edwards indicates this species merely as found in the gills of a salmon. *C. vespa* was noticed this year for the first time as found on the English coast. See British Museum Crust. p. 118.

41. *Caligus sturionis*, Kroyer, Tidssk. bind i. tab. 6. f. 6. ("Explication" of tab. p. 628); Edw. vol. iii. p. 457*—

I obtained on *Trigla hirundo* and *T. pini* brought to Belfast market in November 1839.

42. *Trebius caudatus*, Kroyer, Tidssk. bind ii. p. 30. tab. 1. f. 4. (Explication of tab. p. 104); Edw. vol. iii. p. 458*.

This truly generic form was obtained by Kroyer on a *Squalus galeus* taken in the Kattegat. My specimens—both male and female—were found adhering externally over both sides of the body of a *Raia batis* captured in Belfast bay in September 1838.

Order *Lerneada*.

43. *Chondracanthus gibbosus*, Kroyer, Tidssk. bind i. p. 252. tab. 2. f. 4.

Taken in the pouches of a *Lophius piscatorius* in Dublin, December 1839 (W. T.), and from pouches of three individuals captured in Belfast bay, November 1841. M. Edwards brings this species with doubt under *C. Delarochiana* (Cuv. Règ. Anim.), which has been found on the tunny, *Thynnus vulgaris*. *C. Lophii*, Johnston, Loudon's 'Mag. Nat. Hist.' ix. 81. f. 16, already recorded in the 'Annals' (vol. v. p. 257) as Irish, seems to me identical with *C. gibbosus*, Kroyer.

44. *Lernæopoda galei*, Kroyer, Tidssk. bind i. tab. 3. f. 5, *a—f*; Edw. vol. iii. p. 516*—

was found by its describer on the fin of a *Squalus galeus*, Linn.;

* Kroyer only quoted.

on which species from Belfast bay I likewise obtained my specimen in December 1839 :—it was adherent to the cavity posterior to the vent of the fish.

Order *Pycnogonida.*

45. *Nymphon femoratum,* Leach, Zool. Misc. vol. i. p. 45. tab. 19. f. 2.

Dredged from eight to ten fathoms at Donaghadee in May 1843 by Dr. J. L. Drummond.

Leach only is quoted by M. Edwards, vol. iii. p. 534, for this species, who notes it however as inhabiting "La Manche."

46. *Phoxichilidium globosum,* Goodsir, Edin. New Phil. Journ. vol. xxxii. p. 136. pl. 3. f. 1, January 1842,

I obtained among zoophytes thrown ashore at Portmarnock, on the Dublin coast, in Aug. 1840. This species was only known to its describer as taken in Orkney by Mr. Edw. Forbes and Mr. John Goodsir.

The following brief summary of the *Crustacea* contained in the preceding list may be desirable.

There are introduced for the first time to the fauna of the British seas, the *generic* forms of *Opis, Anonyx**, and allied genus, *Lestrigonus, Ægina ?, Tanais, Trebius, Lernæopoda*; and the *specific* forms of *Eurynome scutellata, Cirolana hirtipes, Caligus minutus, C. curtus, C. diaphanus, C. pectoralis, C. Nordmanni* and *C. sturionis.* A number of undetermined species, and some of them certainly non-descript, are still in my possession.

Of *generic* forms added to the Irish fauna (but all included in the British) there are *Amphithöe, Cerapus, Themisto (Macromysis), Cynthia, Jæra, Eurydice, Cymodocea, Munna, Cetochilus, Canthocarpus* and *Phoxichilidium.*

The mere *species* added to the Irish fauna possess various interest, as indicated in noticing them respectively. My specimens of several forms were the first obtained, having been procured some years before those from which the original descriptions were drawn up by M. Kroyer and Mr. H. Goodsir.

Some of the species here brought forward have hitherto been noticed only as found in the Mediterranean†, others in the seas of Denmark, and several as met with only at a single locality on the English or Scottish coast; all information of this kind possesses much interest as exhibiting insofar the geographical range of the species.

Without the kind aid of Mr. Adam White and Dr. Baird of the British Museum, who assisted me in the determination of the species from comparison with those contained in the national collection and otherwise, I should not have ventured to publish this communication.

* See *ante.*

† One (*Cirolana hirtipes*) as from the Cape of Good Hope! but further information is desiderated respecting it.

Without the confirmation of stronger eyes and better knowledge than I myself possess, I could not feel satisfied in recording any species of *Crustacea* that can only be determined by microscopic power. All those preceding the *Entomostraca* in arrangement came under the notice of the former gentleman, and all of these (using the term in its widest sense) under that of the latter. To both, my warmest thanks are due, as they also are to John Edward Gray, Esq., for his extreme kindness and liberality on this, as on all former occasions, when I required to make use of the great national collection of zoology placed under his most zealous and effective superintendence.

XXIII.—*Descriptions of some species of* Brachiopoda. By Mr. T. Davidson, Mem. Geol. Soc. France, and Mr. J. Morris, F.G.S.

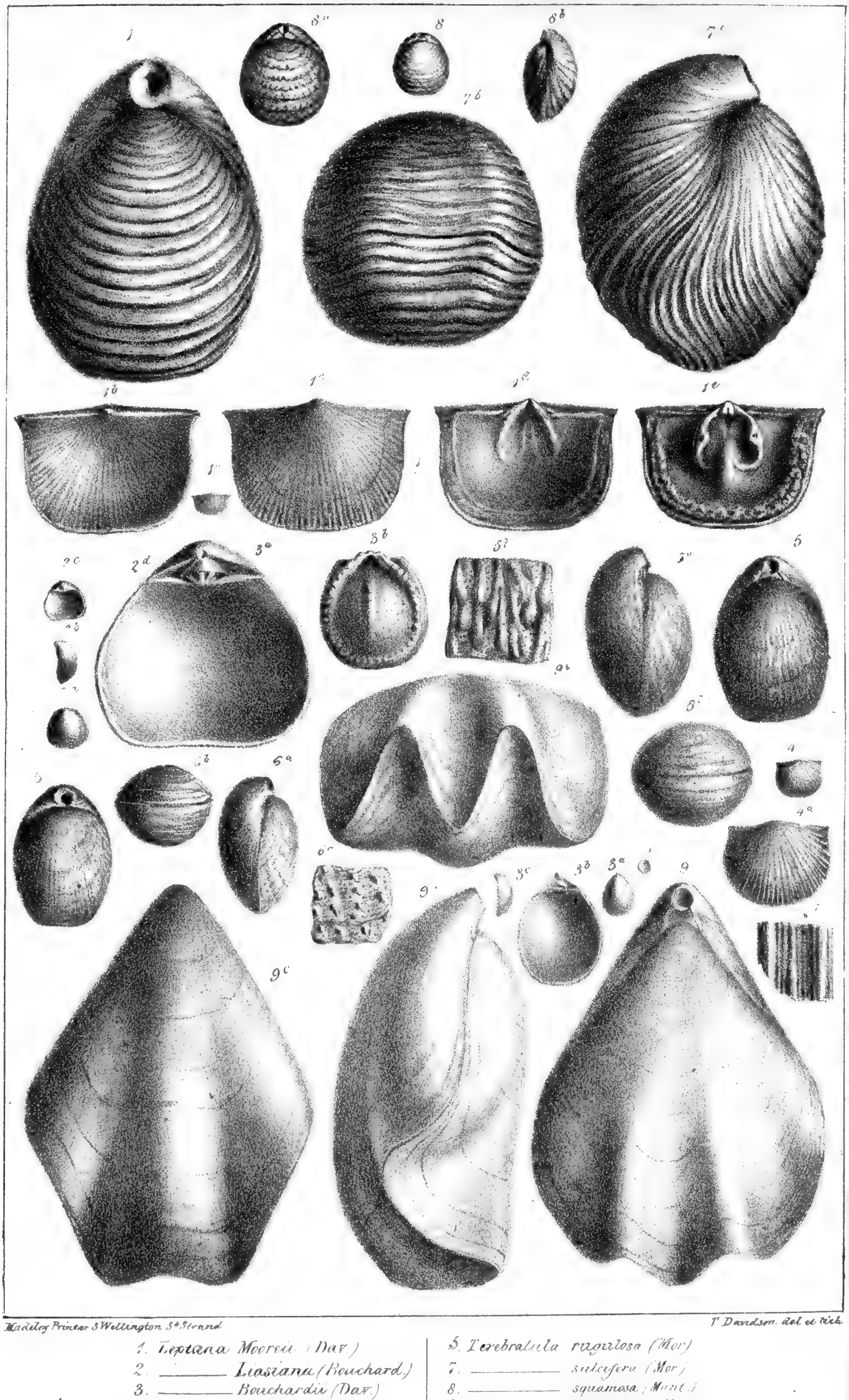
[With two Plates.]

The following notice includes descriptions of a few new or little-known Brachiopoda, some of which are interesting from their localities and associations, more especially the *Leptænæ,* of which three species have lately been found in the liassic group of England and one in that of France. For the description of the French species we are indebted to M. Bouchard, whose collection contains good specimens of this shell.

Leptæna liasiana, Bouchard. Pl. XVIII. fig. 2 *a—d.*

Shell rounded, inequivalved, equilateral, smooth; dorsal valve gibbose posteriorly, becoming flatter anteriorly, with a slight longitudinal groove ending in a notch on the front margin of the shell. Beak small, slightly incurved, truncated at the apex by a minute circular foramen, similar to that which occurs in many other *Leptænæ,* for instance, *L. alternata* of Indiana, North America; this truncation may also be observed in some species of *Orthis* from Russia. Area double, interrupted on the dorsal valve by a large and slightly convex deltidium, which arises at the apical opening and gradually enlarges towards the base, and occupies one-third of the width of the area. The deltidium is slightly notched, the notch being partly closed by the large median tooth of the ventral valve, the exterior face of which is grooved by four furrows which afforded a passage for the muscular fibres of attachment arranged in four bundles. The ventral valve is deeply concave, following the contour of the dorsal valve, so that little space remained between them for the body of the animal. Cardinal margin about half the width of the shell. Length 6, width 5 millimetres.

Locality: the lias of Pic de Saint Loup, near Montpellier, Herault.



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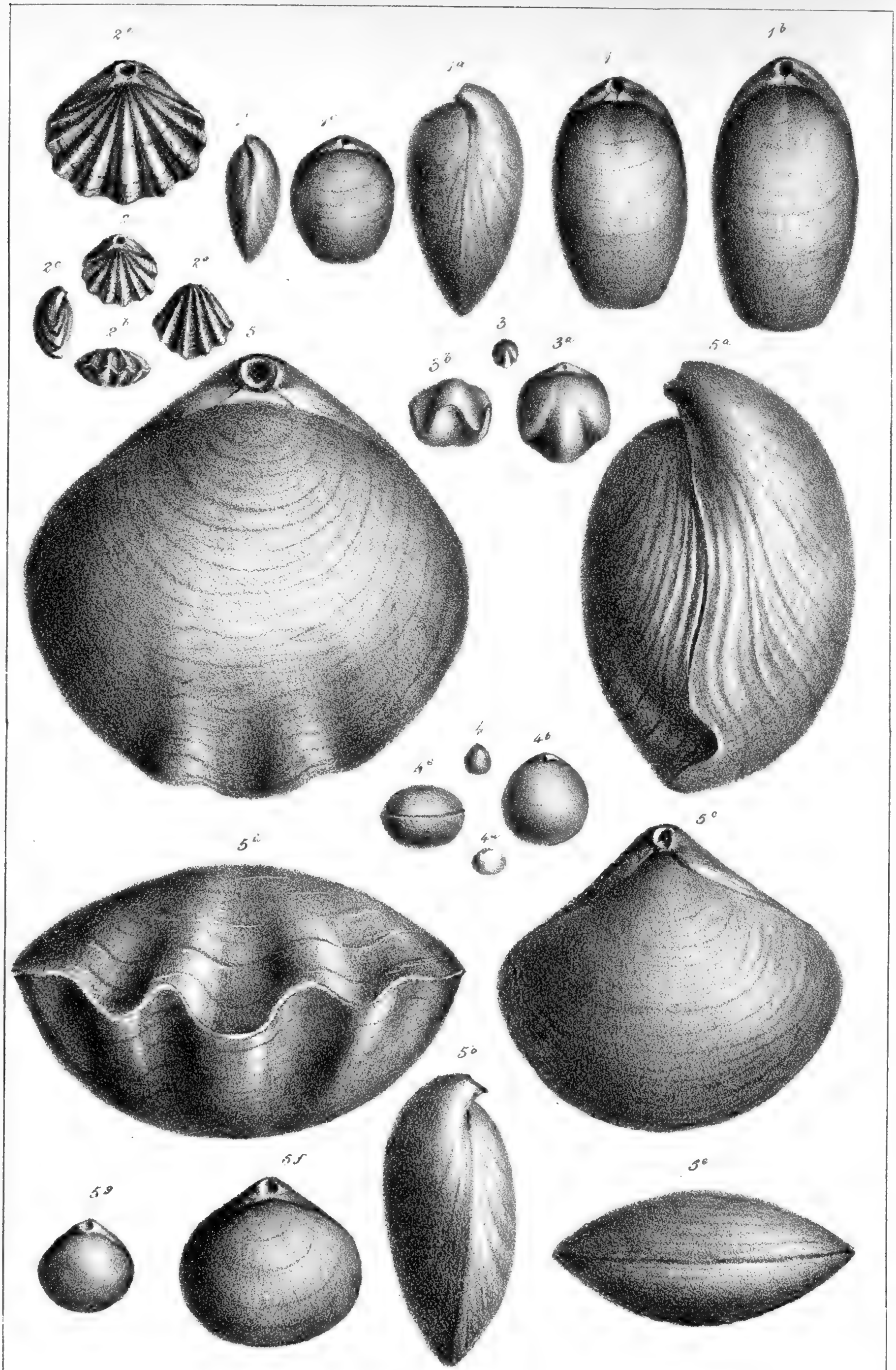
1. Leptæna Moorei (Dav.)
2. ——— Liasiana (Bouchard.)
3. ——— Bouchardii (Dav.)
4. ——— Pearcei (Dav.)
6. Terebratula spinulosa (Mor.)

5. Terebratula rugulosa (Mor.)
7. ——— sulcifera (Mor.)
8. ——— squamosa (Mant.)
9. ——— Phillipsii (Mor.)



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T. Davidson del et lith

1. *Terebratula longa* (Rœmer)
2. ——— *flabellum* (Defr.)
3. ——— *pygmæa* (Mor.)
4. *Terebratula* (Nov. Spec.ⁿ)
5. ——— *Maxillata* (Sow.)

The general form of this *Leptæna* approaches that of *Productus,* the species which it most closely resembles being the *L. oblonga,* Pander. It has the same convexity and smoothness, and the beak is similarly truncated by an apical opening; the area and pedicular opening has also some analogy to the Russian species, but it differs in the contour of the dorsal valve, and the notch in the front margin. (Bouchard MSS.)

Leptæna Moorei, Davidson. Pl. XVIII. fig. 1 *a—e.*

Shell small, depressed, transversely quadrangular, ornamented by numerous fine costæ scarcely visible without a lens. Dorsal valve slightly convex; area double, as wide or wider than the shell. Deltidium small, chiefly filled by the median tooth of the ventral valve; tooth with four depressions by which the muscular fibres of attachment passed outwards. Length $1\frac{1}{2}$ line, width 2 lines.

The muscular impressions in the interior of both valves are very peculiar to this species, and indicate that it did not attain larger dimensions than those above assigned to it.

This elegant small species was first discovered in the marlstone beds near Ilminster by Charles Moore, Esq., to whom it is dedicated; and I trust ere long this gentleman will enrich science by a detailed account of this interesting locality, which he has so carefully investigated. The following section, forwarded by Mr. Moore, shows the position of the bed containing the *Leptænæ*:—

1. Rubbly beds 6 to 10 feet with numerous *Ammonites.*
2. Clay 8 inches.
3. Yellow limestone 3 to 4 inches.
4. Layers of clay 18 inches, *Leptæna Pearcei.*
5. Leptæna bed 1 inch, *Leptæna Moorei* and *L. Bouchardii.*
6. Marlstone $2\frac{1}{2}$ inches.
7. Greenish sand 4 inches, containing numerous *Belemnites.*
8. Marlstone.

The discovery of four species of *Leptæna* in the lias is rather an interesting fact, as proving that this genus, so abundant in the palæozoic period, existed also at the liassic epoch, although the forms are considerably reduced in size from those of their precursors. The existence of *Leptæna* at the early part of the secondary period teaches also how cautious we should be in assigning to any genus a limited duration in time, or that the lines of demarcation between successive periods are not so arbitrary regarding certain typical forms as our first investigations would lead us to infer.

Leptæna Bouchardii, Davidson. Pl. XVIII. fig. 3 *a, b, c.*

Shell very small, almost a perfect oval, surface smooth; dorsal valve very convex, ventral valve very concave, leaving only a small space for the animal; beak small, not much recurved, entire, and not perforated at the extremity; area smaller than the greatest width of the shell; deltidium very large.

The interior of the ventral valve presents some characters resembling *Chonetes*, but it has no tubes on the cardinal area, which are considered by M. de Verneuil and others as characteristic of that genus. Round the internal edge of the ventral valve is a row of tubercles, which diminish in size towards the front of the shell, and the centre has a ridge also tuberculated, the remaining space, interiorly, being covered by a fine irregular punctuation, which in this respect has some analogy to *Chonetes*; but in that genus the median tooth is terminated by a point; in our shell this tooth presents externally three or four grooves, as in the genus *Leptæna*: this and other characters have induced us to place the species under *Leptæna*, although it possesses so many characters common to both genera, that it may be considered as forming a connecting link between them.

This species is readily distinguished from *Leptæna liasiana* by its more elegant form, the ventral valve of *L. Bouchardii* is more regularly concave, and the dorsal valve more convex; in this species also the beak of the dorsal valve is entire, in *L. liasiana* it is always truncated and perforated, and the front is indented and not so regularly rounded as in *L. Bouchardii*.

Rather more than a line in width and one and a half in length.

This species never attained a very large size, as the internal characters presented by the ventral valve appear to be those belonging to a full-grown shell.

Found by Mr. Moore, associated with *L. Moorei*, in the Leptæna bed previously described under that species.

It is dedicated to M. Bouchard of Boulogne, who has kindly examined the species and assisted in defining the characters which distinguish it from *L. liasiana*, to which it bears the greatest resemblance.

Leptæna Pearcei, Davidson. Pl. XVIII. fig. 4 *a*, *b*.

Of this small species the dorsal valve is only known, which shows that it differed materially from *L. Moorei* by this valve being much more convex, and the striæ which ornament its surface having two or three smaller ones between each larger one, as seen in fig. 4 *b*, while in *L. Moorei* the costæ appear of the same size; the shape of the shell is also more rounded and larger than *L. Moorei*. Rather more than 2 lines long and 3 broad.

This species occurs in a clay stratum above the Leptæna bed containing *L. Moorei*, and not associated with it.

Also discovered by Mr. Moore, and dedicated at his request to his late friend Mr. C. Pearce of Bath.

Terebratula rugulosa, Morris. Pl. XVIII. fig. 5, 5 *a—c*.

Shell ovate; valves nearly equally convex, somewhat truncated anteriorly, dorsal valve more gibbose than the ventral, with a produced, rather obtuse and enlarged beak, but slightly recurved; foramen rather large; deltidium wider than high, bordered by elevated lateral ridges. Cardinal area smooth, lateral ridges moderately distinct. The whole surface is covered by minute rugæ disposed as follows: those which cover the middle portion of each valve are longitudinal and but little interrupted; those on the sides diverge and have a slight tendency to break into small oblong tubercles, especially towards the beak of the dorsal valve; the intervening spaces are distinctly and thickly punctured (fig. 5 *c*).

A fine series of this interesting species are in the collections of Mr. Moore, Mr. Bunbury and Mr. Pratt. It is found in the chalk marl at Chard, Somerset, and also occurs at Rouen.

The following notice of the locality is communicated by Mr. Moore. The bottom beds of the quarry are alternating layers of chert and fine sand having a height of about twenty feet, but are no doubt thicker, as the lower beds are not worked; teeth of fishes are occasionally found in it and a few corals; above this is a thin band of chalk marl, exceedingly fossiliferous; it contains several species of *Ammonites, Nautilus, Hamites, Scaphites, Turrilites*; *Cerithium, Pleurotomaria* and *Trochus*; *Inoceramus, Arca, Cardium, Echini*, &c., mostly in a beautiful state of preservation. This bed is overlaid by the white chalk containing but few fossils.

Terebratula spinulosa, Morris. Pl. XVIII. fig. 6, 6 *a—c*.

Subovate, but with the broadest part rather behind the middle and the front subtruncated; dorsal valve rather more convex than the ventral; beak incurved, foramen tolerably large, the anterior portion touching the apex of the ventral valve; cardinal area concave, minutely tuberculated, with distinct lateral ridges, diverging almost at right angles from the foramen. Surface of both valves covered with minute prickly tubercles (fig. 6 *c*) and fine radiating striæ; lines of growth distinct.

This is a very interesting and readily distinguished species, by its form and peculiar structure. The prickly tubercles have a tendency to a linear arrangement, and between them are numerous small raised puncta, and fine or almost obsolete striæ; the minutely tuberculated cardinal area is also a well-marked character. The specimen figured is from the collection of A. Lewis, Esq., of Wolverhampton, and Mr. Waterhouse has also pointed out the existence of a species nearly resembling this, but in which the radiating striæ are wanting, in the British Museum, as having been received from the gray chalk marl of Dover.

M. le Vicomte d'Archiac, in the very interesting memoir* "Sur les Fossiles du Tourtia," has pointed out a very natural group of the *Terebratulæ*, to which the two last-described species evidently belong. They are well-characterized by having the surface ornamented with numerous small rugæ, which are more or less prominent, very short, puckered, squamous, arcuate or diverging either from the centre or the beaks towards the margin, where they are always visible. The *Ter. Verneuilli*, d'Archiac, is the typical form, and the allied species are the *T. Murchisoni*, *Keyserlingi*, *Tchihatcheffi*, *Gravesi* and *Leveillei*, d'Archiac; the *T. arcuata*, Roemer, and our *T. spinulosa* and *T. rugulosa*.

Terebratula sulcifera, Morris. Pl. XVIII. fig. 7, 7 *a*, *b*.

Shell obovate, somewhat pentagonal, ventricose; valves nearly equally convex, dorsal valve convex towards the beak, which is produced and incurved; foramen large, oblique; deltidium wide, transversely furrowed and margined by a slightly elevated ridge, but generally almost concealed beneath the anterior part of the foramen which nearly touches the ventral valve. The greatest thickness of the dorsal valve is about the middle, from which extends a broad, flat, and not very deep sinus with a straight frontal margin; lateral margins sinuous; the lateral margins near the cardinal line of the ventral valve overlap those of the dorsal. Both valves marked with concentric, somewhat imbricated ridges with broader interspaces, and numerous radiating, nearly obsolete striæ, only visible in some specimens near the sides.

Of this species there are many varieties in form, the extreme one being that given in our fig. 7; others are much less gibbose and even depressed, sometimes having a triangular shape, at others being very much elongated or compressed laterally; but the concentric ridges, although distinct in all of them, are more or less elevated according to age, the intervening furrows being marked (when viewed under a strong lens) by slightly raised granules.

From the lower chalk near Cambridge, in the collection of Mr. Bunbury, whose specimen is figured, and from Hockwold, Norfolk, by Mr. W. Flower of Croydon.

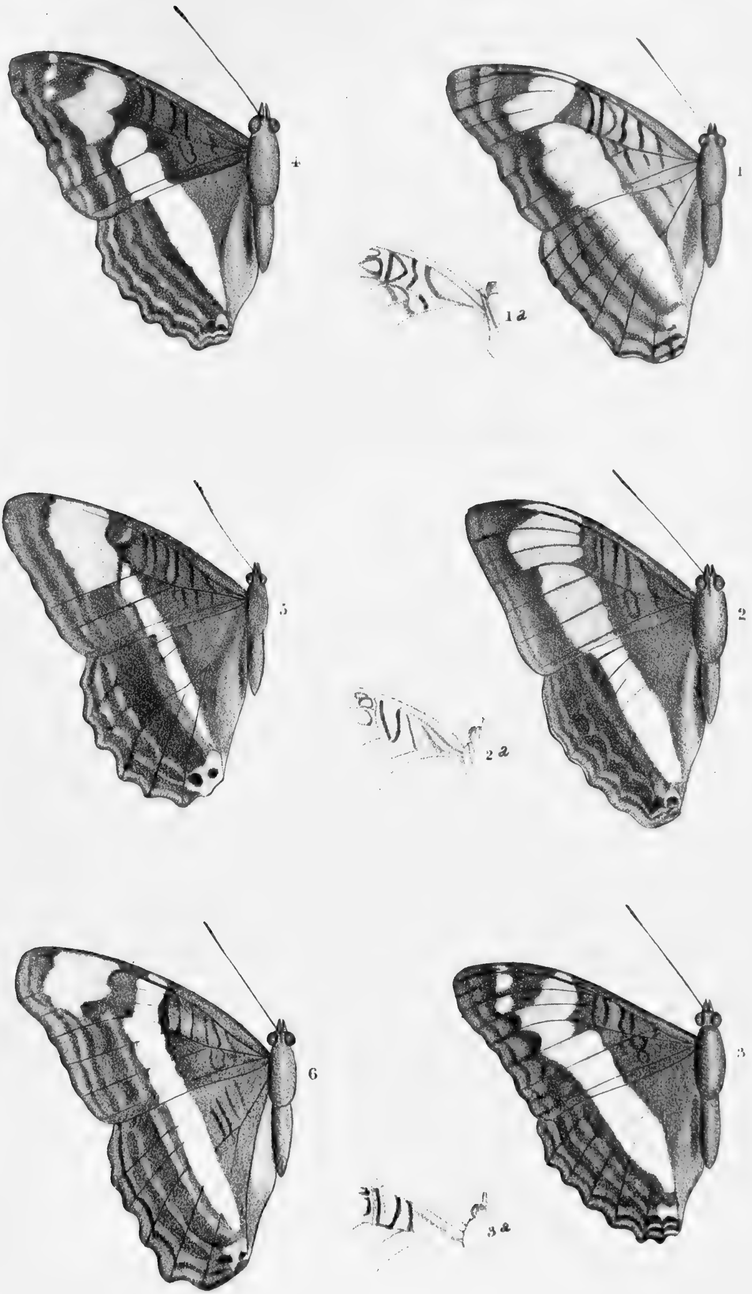
Terebratula squamosa, Mantell. Pl. XVIII. fig. 8, *a*, *b*.

Shell orbicular, or sometimes longitudinally ovate, valves nearly equally convex; foramen circular, entire; deltidium rather large, dilated at the base; surface marked with concentric squamose

* Mémoires de la Société Géologique de France, 2nd ser. vol. ii. p. 295.

W. C. Hewitson del et lith

Hullmandel & Walton Lithographers



W. C Hewitson del et lith.

Hullmandel & Walton Lithographers.

ridges crossed by numerous radiating raised striæ, more visible on the lateral margins, giving to the squamæ a rather serrated appearance; puncta distinct and rather widely separated.

Locality: the chalk marl of Hamsey (*Mantell*), and also from Dover.

This species was first described by Dr. Mantell in 'The Fossils of the South Downs,' p. 132, but not figured; it does not appear to attain a large size, as the dimensions given by Dr. Mantell agree with some of our specimens, "length 0·5 inch, width 0·4 inch; the greatest convexity of the united valves 0·3 inch;" and as remarked by Dr. Mantell, the shells are in a good state of preservation and generally of a bluish hue.

Terebratula Phillipsii, Morris. Pl. XVIII. fig. 9 *a, b, c*.

Shell compressed, of an elongated pentagonal form, the superior angle being rather sharp; longer than wide, the width being greatest below the middle; dorsal valve more convex than the ventral, with a somewhat produced and incurved beak; ventral valve with two rounded costæ commencing about the middle and continued to the margin, with a broad mesial furrow and two lateral ones; front deeply sinuous; cardinal area small, concave, with very obtuse and indistinct lateral ridges; foramen moderately large, round, and rather oblique; deltidium wider than high; lines of growth distant.

This species has some resemblance to *Ter. perovalis*, Sow., but it is easily recognized by its more elongated pentagonal and depressed form, the greater width of the sinus and lobes, the more sinuated front, and the greater prominence of the dorsal ridge. It is also separated from *T. sella*, Sow., by its elongate form, the greatest width being nearer the frontal margin than in that species, where it is central.

Locality: from the inferior oolite of Dinnington near Ilminster; also at Burton near Bridport, and in Normandy.

Mr. Moore, Mr. Bunbury and Mr. Walton possess a fine series of this shell.

Terebratula longa, Roemer. Pl. XIX. fig. 1 *a, b, c, d*. Roemer, Verst. Norddeutschen Oolithen-Gebirges, pl. 2. fig. 11.

Shell ovate-elongate, ventricose posteriorly, becoming rather attenuate anteriorly and subtruncate, smooth or only presenting the concentric lines of growth; dorsal valve with a somewhat obtuse keel and a slightly produced but not much recurved beak; foramen small; cardinal area flat, bounded by moderately distinct lateral ridges; ventral valve most inflated near the cardinal area; deltidium obtusely triangular.

This appears to be the species cited by M. Roemer, as it agrees tolerably well with his description and figure; the deltidium is much smaller (according to his figure) than in our shell.

Found rather abundantly in the lower greensand near Shanklin, Isle of Wight, by Dr. Fitton and myself (J. M.). Roemer's specimens are from the Hilsthon of Elligser Brinkes.

Terebratula flabellum, Defrance. Pl. XIX. fig. 2 *a—c*. Dict. des Sci. Nat. vol. liii. p. 160, 1828.

Shell somewhat transversely oval, costated, costæ round, imbricated, increasing in size but not in number towards the margin; dorsal valve more convex than the ventral, with a produced beak truncated by a rather large circular foramen; cardinal area concave, nearly smooth. Shell punctated.

This species belongs to the *Loricatæ* of Von Buch, in which the ribs of the ventral valve envelope those of the dorsal. It was first described by Defrance, who cites it from the Calcaire à Polypiers near Caen, Normandy; in England it is rare. Mr. Walton and Mr. Pearce obtained it from the Bradford clay near Bradford, and it also occurs in the same bed at Corsham, Wilts.

Terebratula pygmæa, Morris. Pl. XIX. fig. 3 *a, b*.

Shell very small, of a somewhat hexagonal form, moderately convex; beak acute, recurved; foramen small; area small, obtusely triangular with distinct lateral ridges; ventral valve with rounded costæ, which arising very near the cardinal area become much larger towards the margin; interspaces deeply concave; dorsal valve with furrows corresponding in number to the lobes of the ventral valve; front deeply sinuous, the central sinus by far the largest.

Locality: the Leptæna bed of the marlstone near Ilminster, from Mr. Moore's collection.

Associated with this species is another equally minute *Terebratula* (Pl. XIX. fig. 4 *a—d*): it is of a rounded form, moderately convex and perfectly smooth; the beak small and scarcely prominent.

No specific name has been assigned to this species, as it probably may be a very young state even of a plicated shell.

Terebratula maxillata, Sow. Pl. XIX. fig. 5 *a—g*.

Shell subquadrangular, fully as broad as long; valves nearly equally convex; beak produced, narrow and strongly recurved; foramen large, oblique; deltidium obtusely triangular; cardinal area slightly depressed with obtuse lateral ridges; ventral valve with a mesial sinus and two broader lateral ones, corresponding to the lobes of the dorsal valve, and which only extend one-third inwards from the margin; front strongly sinuated.

The young state of this species and for a considerable period of growth scarcely presents any trace of the sinuated margin.

This shell, which cannot be separated from *Ter. maxillata,* Sow., has lately been found of large dimensions; we have specimens attaining more than two inches in length and the same in breadth; thus it would appear that under favourable conditions this species attained a much larger size than that figured by Mr. Sowerby before it exhibited the strongly sinuous front.

In reference to this shell Mr. Walton states, that it is the same as *Ter. maxillata,* and this assurance is founded on that experience which is attained by the examination of thousands of specimens. This *Terebratula* varies much in size and form, its greatest diameter being sometimes in the longitudinal and sometimes in the transverse direction of the shell. Some varieties are deeply plicated, others have no plicæ at all; it is found quite small at Hampton Cliff and very large at Pickwick, and is distributed plentifully through the forest marble, Bradford clay and great oolite around Bath; it is also abundant near Sapperton and Hailey Wood.

XXIV.—*Descriptions of new species of Butterflies.* By William C. Hewitson.

[With two Plates.]

Family NYMPHALIDÆ.

Genus Heterochroa, *Boisduval.*

The genus *Heterochroa* of Boisduval is remarkable amongst butterflies for the close affinity which its species bear to one another, and yet also for the great beauty and variety of design which it presents and with colours so simple and so few.

The twelve species which I have figured, most of them new and all hitherto undescribed, are but half of the genus. They are all inhabitants of the New World.

Some of them, *H. Nea, Melona, Erotia* and *Lerna,* are much more robust than the rest. *H. Fessonia* and *Cestus,* besides the unbroken and conspicuous band of white, have other characters peculiar to themselves. The cell is shorter and the disco-cellular meets the median nervure somewhat nearer to the body.

The outlines on the plates show portions of the underside of the wings characteristic of each species.

Heterochroa Nea. Pl. XX. fig. 1.

Wings dark brown with a central band common to both, commencing at the third median nervule of the upper wing, and extending to the anal angle of the lower, on the upper wing broad and fulvous, on the lower white. On the upper wing between the commencement of the band and the anterior margin and at nearly right angles with it is a large oblong fulvous spot separated from it only by a black nervule, but so deeply sinuated on each side at its junction as to touch it only at the apex; parallel to the posterior margin is a double line of light brown, the inner line wanting on the space between the second and third median nervules; on the lower wing are three similar lines, and between the end of the inner one and the anal angle a small triangular fulvous spot sinuated on its lower margin.

On the upper wing between the central band and the body, and at right angles with the anterior margin, are six black lines, five within the cell, the first and second on each side of the discocellular and nearly straight, *the third so much arched as to form a triangle with the second,* the three inner ones curved and equidistant and prolonged beyond the cell.

Underside very light; the central band, the discoidal spot, and the submarginal lines are all cream-coloured; the inner line on the lower wing is beautifully iridescent. On the upper wing between the cell and the discoidal spot is a small irregular spot of a clear bluish white: with the exception of the upper part of the space between the fourth and fifth black line which is red, the space within the cell is pure white; the lines are deep black; there are also spots of white below the cell. On the lower wing the inner margin of the white band is dark brown, and parallel to it and between it and the humeral angle are two rufous bands, the space between the first and the white band rufous, the rest cream-colour. Expansion 2 inches 8 lines.

In the British Museum, from Para.

Heterochroa Melona. Pl. XX. fig. 2.

Wings dark brown with a central band reaching from the anterior margin of the upper wing to the anal angle of the lower, intersected by black nervules on the upper and anterior portion of the lower wings; on the upper wing fulvous, broadest between the discoidal nervules; the inner margin deeply sinuated at the third median nervule; on the lower wing white. On the upper wing are two very indistinct marginal lines of light brown; on the lower wing four, one close to the margin, three equidistant between it and the white band; the red spot at the anal angle is small with a central round spot of deep black. On the upper wing across the disc are five indistinct black lines, four within the cell straight and nearly parallel, the fifth and inside one oblique. Underside vinous brown, the central band on both wings white; the widest portion of it on the disc of the upper wing clouded with brown; at the tip are four or five small white spots, and at the anal angle of the lower wing three narrow lunules of white; half-way between the central band and the body is a band of yellowish white common to both wings; on the disc of the upper wing between the disco-cellular and the white band are three small spots of blue, and within the cell a *triangular V-like spot* of lilac; the humeral angle of the upper wing is light yellow, that of the lower wing reddish brown. Expansion 2 inches 6 lines.

In the British Museum, from Colombia.

Heterochroa Erotia. Pl. XX. fig. 3.

Wings dark brown with a central band common to both, commencing at the anterior margin of the upper wing and extending to the anal angle of the lower; on the upper wing fulvous except towards the interior margin, where it becomes gradually white; on the lower wing white; the first three segments of the band on the disc of the upper wing short, the fourth twice as long, the fifth between the second and third median nervures short and cordate, the remainder broad. On the upper wing half-way between the margin of the central band and the tip of the wing are three small fulvous spots. Parallel to the margins of both wings are undulating lines of light brown as in the last species, and at the anal angle two narrow lunular lines of white, and above them two lunules of deep black, and between them a small triangular fulvous spot. The black lines across the cell as in the last species. The arrangement of the underside is the same as the upper side of the next species. The broad central band which is all white commences only at the second median nervule; that portion of it which crosses the disc is divided into five distinct yellowish spots, the lowest cordate, the rest oblong, three of them connected by black lines with the three spots near the tip of the wing, which are also yellowish; the light linear bands of both wings are broken and form chains of white spots; within the cell of the upper wing are three cross-lines of deep black, the space between the outer two is *oblong* and pure white, that between the second and third rufous, that within it white, divided longitudinally by a black line; on the lower wing between the white band and the body are two bands of white, the first short. Expansion 2 inches 7 lines.

In the British Museum, from Bolivia.

Heterochroa Lerna. Pl. XX. fig. 4.

Very nearly allied to the last-described species (*H. Erotia*), of which it may possibly be only a remarkable variety. The central band, which is entirely white, commences only at the second median nervule in a semicircular form broadly separated from the fulvous discoidal portion of the band. The three fulvous spots near the tip of the wing are smaller. In all other respects it is the same. The undersides of both species are alike. Expansion 2 inches 7 lines.

In the British Museum, from Bolivia.

Heterochroa Donysa. Pl. XX. fig. 5.

Wings deep purple-brown, with a narrow central band of white common to both, intersected by black nervules: commencing at the third median nervule of the upper wing and extending to the anal angle of the lower, its first segment small and indefinite, it gradually tends, though very slightly, towards the anal angle of the wing, and thus forms a very obtuse angle with its continuation on the lower. Between its commencement and the tip of the wing is a large, broad, oblong fulvous spot, curved in the direction of the posterior margin of the wing, extending from the extreme anterior margin, where it is broadest, to the second median nervule, where it is only separated by a wide line of brown from the first segment of the white band. On the upper wing are two submarginal lines of light brown and a portion of a third, on the lower wing three; at the anal angle of the lower wing is a rather large fulvous patch and two small deep black spots; across the cell are the usual black lines.

Underside rufous; the white band is continuous from the anterior margin of the upper wing, indistinct at first and deeply sinuated before it reaches the median nervule; the fulvous spot is lighter, especially at its edges; the marginal lines are white, and between two of them at the anal angle of the upper wing is a round black spot; the disco-cellular of the upper wing is marked by a rufous band, within which is one of lilac, then white, then again rufous. Expansion 2 inches 7 lines.

From Mexico. In the British Museum and my own collection.

Heterochroa Fessonia. Pl. XX. fig. 6.

Wings brown with a central band of white, of nearly equal breadth, common to both, extending from the anterior margin of the upper wing to the anal angle of the lower, slightly arched outwards on the upper wing; half-way between it and the tip of the upper wing is a large irregular fulvous spot, rounded outwardly, sinuated on its inner margin; below it, parallel to the margin of both wings, are three indistinct bands of light brown of unequal breadth; at the anal angle are two small deep black spots, and between them an irregular fulvous patch. Across the cell of the upper wing are fine indistinct lines of black, some of which are prolonged beyond; across the cell of the lower wing are also four similar black lines. Underside, the outline only of the fulvous spot is indicated by indistinct lines of white; parallel to the margin of both wings are also several whitish lunules; within the central band, crossing the cells of both wings, is a rufous band edged with black and surrounded with white; between it and the central band on the lower wing across the cell is a second short band of the same colour. Expansion 2 inches 8 lines.

In the British Museum, from Honduras.

Heterochroa Cestus. Pl. XXI. fig. 7.

Wings light brown with a broad central band of white common to both and extending from the anterior margin of the upper wing to the anal angle of the lower and of nearly equal breadth, curved slightly outwards on the upper wing, rounded at the anal angle of the lower. Between the white band and the tip of the upper wing is an oblong irregular fulvous spot trifid by black nervures, the two lower portions the largest and cordate, surrounded by dark brown, which is continued in three equidistant zigzag lines parallel to the posterior margin till they reach the anal angle of the lower wing, where the middle one terminates in two lunular spots, between which is a T-shaped fulvous mark; the space between the two outermost of these zigzag lines is of the lightest brown, especially on the lower wing, where it is almost white. On the upper wing between the white band and the body are the usual black lines, two of which cross the cell and are prolonged beyond; the space within them is tinged with red; on the lower wing four similar lines in pairs cross the cell.

Underneath much lighter; instead of the trifid fulvous spot are five white spots, two of which are red in the middle, two brown; the lightest zigzag marginal line is quite white, and between it and the margin is another broken white line; across the cells of both wings, as in the last species, is a continuous rufous band edged with black and broadly margined with white. Expansion 2 inches 2 lines.

In the British Museum and my own collection, from Venezuela.

Heterochroa Alala. Pl. XXI. fig. 8.

Wings dark brown with a central narrow band of white intersected by black nervules; common to both, commencing at the third median nervule of the upper wing by a nearly *round* distinct spot, and extending to the anal angle of the lower, where bending slightly inwards it terminates in a point. On the upper wing between the commencement of the white band and the subcostal nervure are *two small oval white spots,* and between them and the tip of the wing an oblong fulvous band divided by black nervules into five distinct parts, the anterior small and hastate, the next three larger and cordate, the *fifth small and lunular* followed by two lunules of light brown sometimes tinged with red. Parallel to the posterior margin of both wings are two narrow lines of light brown and between them and the white band on the lower wing a third zigzag line of the same colour; at the anal angle are two round deep black spots of unequal size, the larger crowned with bright fulvous, the smaller surrounded by it; the cells of both wings are crossed by the usual black lines.

The underside is chiefly of a light reddish brown; the fulvous spots of the upper wing are nearly white; between them and the tip are several small spots of white; the space between the black lines which inclose the disco-cellular nervule of the upper wing is red-brown, that between the second pair of lines is white; on the lower wing a zigzag line of reddish brown runs along the outer margin of the white band. Expansion 2 inches 1 line.

In the British Museum and my own collection, from Venezuela.

Heterochroa Corcyra. Pl. XXI. fig. 9.

Wings dark brown with a narrow central band of white intersected by black nervules; common to both, commencing at the third median nervule of the upper wing by a *cordate* spot and extending to near the anal angle of the lower wing, where it terminates in a fine point scarcely connected with a small triangular spot of the same colour, joined upwards from its commencement to the subcostal nervure by an *indistinct* trifid whitish spot deeply *sinuated on its inner margin* where it touches the median nervule; between it and the tip of the wing is a slightly curved band of fine fulvous spots, the first and exterior one smallest and hastate, the next three cordate, the *fifth large and oblong*; outside of this and parallel to the posterior margin of both wings are two lines of light brown, and between them and the central band on the lower wing are six fulvous lunules, and at the anal angle a large spot of the same colour, and two small deep black spots. On the cells of both wings are the usual black lines. The underside is of various shades of red-brown and pink; the inner edge of the white band is clearly defined by a dark margin of red-brown which connects with it in one band the indistinct spots above the median nervule, marking clearly the bend on the inner margin, by which it is easily known from the next species; the fulvous band of the upper wing is but slightly indicated by light reddish brown. Expansion 2 inches 2 lines.

In the British Museum, from New Grenada.

Heterochroa Collina. Pl. XXI. fig. 10.

Closely allied to the last-described species (*H. Corcyra*), from which it differs in that the white band is widest in the middle, from which it tapers to a point at each end, commencing at the median nervure of the upper wing by an *oblong narrow* spot; that the trifid spot between it and the subcostal nervure is whiter and more distinct; that the portion of it which touches the median nervure, which in the last species is deeply sinuated and crescent-shaped, is here round and entire; that the fulvous band near the tip of the upper wing is composed of *six* divisions, the two lower of which are large, forming together a triangle which is only separated from the first two segments of the white band by a black line; and that the fulvous lunular spots of the under wing are wanting. Expansion 2 inches 4 lines.

In the British Museum and my own collection, from Quito.

Heterochroa Aricia. Pl. XXI. fig. 11.

Also closely allied to *H. Corcyra,* but differs from it in that the white band commences on the upper wing by an *oval* spot, does not meet equally at its edges in passing from one wing to the other, and is curved inwards on the lower wing, where it terminates at the anal angle in the form of a hook; that in the place of the fulvous spots of the upper wing is a broad red band of equal breadth, which crosses the whole wing parallel to the posterior margin and the white band, from which it is only separated by a line of brown; that the fulvous lunular spots of the lower wing are wanting, and that the underside is much lighter. Expansion 2 inches 2 lines.

In the British Museum and my own collection, from Bolivia.

Heterochroa Arecosa. Pl. XXI. fig. 12.

Upper wings long and slightly sinuated, under wings deeply dentated with a short tail, light brown with a central band of white common to both, commencing at the subcostal nervure of the upper wing—between which and the margin is a small oblong white spot—and extending to the anal angle of the lower; broken at its commencement into four distinct spots, the first oval and distant from the rest, the second rounded and nearer, the third and fourth oblong and touching, the rest distinctly intersected by black nervules, the last segment at the anal angle triangular and divided from the rest. Parallel to the margin of the upper wing are two waved lines of dark brown, and also the five black lines across the cell; the space between the middle line which is very straight, and the next within it which is curved, is red as well as the humeral angle. Parallel to the margin of the lower wing is a waved dark brown line, and within it six large nearly round spots of the same colour; at the anal angle is a large irregular rufous patch, and in its centre two indistinct dark spots.

Underside light and indistinct; the central band crosses the entire wing unbroken; the marginal lines are white; a rufous band crosses the cell of the upper wing, and another marks the position of the disco-cellular, each bordered by white; at the anal angle of the lower wing are three round black spots, one large. Expansion 2 inches 7 lines.

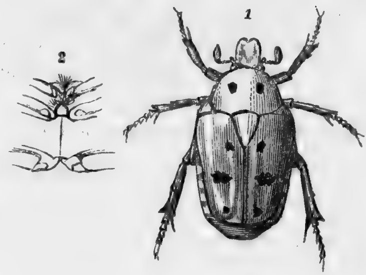
In my own collection, from Mexico and the West Indies.

XXV.—*Remarks on some* Cetoniadæ, *with the description of a new Australian species.* By Adam White, F.L.S., M.E.S. Stettin, and Assistant in the Zoological Department British Museum.

Schizorhina, *Kirby.*

S. (Diaphonia) Bassii, *White.*

Yellow; with a black spot inclosing the eye, two roundish black spots on the middle of the *thorax* placed transversely. *Elytra* of a deeper and somewhat brownish yellow, with a sericeous tinge; three black spots on each elytron, one near the scutellum, a larger transverse one beyond the middle and nearer the side than the suture, and one small subapical one: *antennæ* and legs yellow; *pygidium* yellow, with extremely short, scattered, bristly hairs, the surface "quasi squamiformiter acudacta;" the metathorax and greater part of the abdomen beneath shining black; edges of the segments smooth, the bases punctured; two largish yellow spots placed on the middle of the abdomen; four yellow triangular spots on the edge of the segments on each side.



Hab. Australia. British Museum: from the collection of the Entomological Club.

The figure by Mr. William Wing gives its correct size and form; in general form this species approaches the *S. atropunctata,* Kirby, Linn. Trans. vol. xii. p. 464 (found first by Robert Brown, F.R.S., on Mimosas near Port Jackson), more than any other *Cetonia*; and I must confess that until Dr. Schaum attracted my notice to it, it was placed with that species in the collection of the British Museum, being regarded as a variety of the female: it certainly seems to be in some sort the connecting link between *Diaphonia,* Newman, and *Schizorhina,* Kirby, as restricted by Dr. Burmeister.

The head, as in the subgenus *Diaphonia,* very slightly cleft in front; the sides nearly parallel, upper surface flat, rather coarsely punctured. Thorax with the sides very slightly, if at all, sinuated posteriorly, the posterior angles rounded and not sharp, so as to leave visible part of the mesothorax: the front edge of thorax nearly straight; the puncturing very indistinct; the scutellum proportionally larger than in other species of the genus. Elytra much longer and narrower, the segments of the body projecting considerably beyond them; the sutural edge more ridged; near the suture is a longitudinal somewhat raised costa, the elytra are punctured, the punctures generally running in longitudinal lines. The specimen is a female, and excepting in the legs being *much less stout* and hairy, they have a considerable resemblance to those of the *D. dorsalis*; the tarsi of the first pair of legs are wanting.

Note.—The name *Bassii* is intended as a small compliment to the bold and great discoverer, whose name will be ever commemorated in the wide ocean-strait which separates Van Diemen's Land from the great Australian continent. The name and discoveries of George Bass, surgeon of the 'Reliance,' are well related in the pages of Capt. Flinders: "he was a man whose ardour for discovery was not to be repressed by any obstacles, nor deterred by danger."—*Flinders' Voyage to Terra Australis*, I. xcvii. By botanists he is commemorated in the genus Bassia.

It is not out of place here to make a few remarks in correction of, and addition to, the lately published 'Nomenclature of Coleopterous Insects in the Collection of the British Museum, Part I. *Cetoniadæ*,' which was issued before Dr. Schaum had an opportunity of seeing the national collection. This eminently scientific entomologist has acquired, by purchase, the very specimens of Messrs. Gory and Percheron's 'Monographie des Cétoines;' he has had the advantage of Mr. Macleay's and Dr. Burmeister's (still more extensive) labours; and having had that "learned leisure," which so few of the desc ibing naturalists of this country can share even in the smallest portion, he has seen and studied the collections in Berlin, Paris and other places.

The results of his assiduous researches he has communicated in the 'Zeitschrift für die Entomologie' of his uncle, Dr. Germar, and in the 'Annales de la Société Entomologique de France.' A still further revision of this group may now be expected, since his visit to the British Islands.

On p. 2 add B.M. to *Mycteristes rhinophyllus* from Java, as we have lately acquired it.

Page 3: Dr. Schaum tells me that *Compsocephalus Galinieri*, Reiche, notwithstanding what M. Reiche has written in the 'Revue Zoologique Cuviérienne,' is after all, what I suspected, only synonymous with *C. Horsfieldianus*, White, described and roughly figured in the Ann. and Mag. of Nat. Hist. for 1845, vol. xv. p. 40.

Aphelorrhina simillima, Westw., which, led by the name and authority of Dr. Schaum, I placed after *Dymusia*, should be placed after *Stephanorhina guttata*, and may after all prove, like many pseudo-called species of *Onthophagus*, only a starved variety of the male of *Stephanorhina guttata*, or at least of a closely allied species. It would be well for naturalists to read the admirable remarks of M. Mulsant of Lyons, at pp. 103 and 104 of the volume of the 'Hist. Nat. des Coléoptères de France,' describing the Lamellicorn Beetles (Paris, 1842).

The *Rhomborhina dives* of Westw., as Dr. Schaum pointed out, is the *R. Mellii* of Gory and Percheron, but not of Burmeister.

On p. 6 add B.M. to *Anomalocera Parrii*, as we have lately received a specimen. This genus seemed hardly separable from *Coryphocera*.

At p. 7, and after *C. amœna*, add *Coryphocera tibialis*, Westw., India, lately acquired; and *Coryphocera glaberrima*, Westw., India, also lately added.

At p. 9, *Allorrhina affinis* and *A. confinis* are regarded by Dr. Schaum as only local varieties of *Allorrhina scabriuscula*, and as he has seen more specimens than myself, I believe he is right.

At p. 10 add B.M. Honduras to *Cotinis cavifrons*, Dup., Burm., which I had regarded as a new species of *Allorrhina*, and named *A. trisulcata*. I question whether the genera *Tiarocera* and *Allorrhina* are distinct enough from *Cotinis*, and this remark would extend to other genera of *Cetoniadæ*.

Page 11: *Gymnetis Vigorsii*, Dr. Schaum regards as only a variety of the preceding species, *G. undulata*, Vigors; there are some other alterations he would make in the genus *Gymnetis*, but from not having many specimens, I can neither confirm nor resist these changes. The genus, or rather group, wants revision very much.

Page 14: between *Gymnetis strigosa* and *G. hieroglyphica* is placed *Gymnetis Dysoni*, White, a species with the head, thorax above and elytra of a yellowish rhubarb or rather tile-colour (elytris, thoraceque supra flavescenti-lateritiis), spotted and marked with black, differing in different specimens, the head margined with black and with a black spot on the middle, the legs and under parts deep shining black, the sternum projecting, somewhat curved downwards, and very blunt and widened at the end.

As Dr. Schaum has a specimen, an elaborate description may be expected from him. I may merely say that it was found in Venezuela at Curiaña, twenty-four miles from La Guayra. Mr. David Dyson told me as a curious circumstance, that when shooting a humming-bird, he brought down his bird, a large *Sphinx*, and this pretty species of *Gymnetis*, at the same shot; our specimen has still the mark where the shot struck it.

I have named it in compliment to Mr. Dyson, who has been a most assiduous collector of zoological specimens in Honduras and Venezuela. Mr. Doubleday has named a very striking species of Butterfly, *Euterpe Dysoni* (Ann. and Mag. of Nat. Hist. vol. xix. p. 385), after him. There has not been a more active or intelligent collector in this country than Mr. Dyson.

On p. 15, as Dr. Schaum pointed out to me, remove *Clinteria flavomarginata*, and put it as a variety of *C. atra*; we have lately acquired two specimens of this pretty variety.

At p. 15 add *Clinteria Hoffmeisteri*, White, a very distinct hairy species from Northern India, lately acquired by the Museum.

[To be continued.]

XXVI.—*The Classification of the British Mollusca.* By W. E. Leach, M.D.

To Richard Taylor, Esq.

My dear Sir, September 9th, 1847.

In a late visit to the North I observed that several British conchologists were much interested in knowing what was the arrangement of British Mollusca proposed by my late excellent friend and first teacher in zoology Dr. Leach, and that some of them had even taken the trouble to copy the proof sheets of his work which were in the possession of one or two persons.

Knowing that several copies of Dr. Leach's list were in circulation, his names being in common use in several cabinets at the time he was at work on the subject, I applied to Mr. James Francis Stephens, who was in constant communication with Dr. Leach, and he at once produced me the list which I herewith send, with the heading it now bears, and a former one not so complete; but as this list contains a few names not inserted in the latter one, I have added them in their places, marking them with an asterisk and with the date of the first list, 1816.

It is much to be regretted that Dr. Leach's MSS., which I am aware were prepared with the characters of his genera in detail, have not been printed, that his extensive labours on this part of the animal kingdom should not be lost to the world. To make the list more easily understood, I have added the genus to which Montagu or Lamarck has referred the species, after the name used by Dr. Leach.

I am much inclined, as these names were for years exhibited in the Museum collection and in the cabinets of Mr. Stephens, the late Mr. James Sowerby, my own and others, to regard them as published and having priority from 1818. Risso, Capt. Brown and others have published several of them in their works.

I am, dear Sir, yours truly,
J. E. Gray.

"Classification of the British Mollusca by W. E. Leach, M.D., 1818."

1. CEPHALOPODA.

1. Octopoda.

1. *Sepioladæ.*

1. Polypus antiquorum.

2. Decapoda.

2. *Sepiadæ.*

2. Sepiola Rondeletii.
3. Sepia officinalis.

3. *Loliginidæ.*

4. Loligo magna.
   parva.

2. GASTEROPODA.

1. Gymnobranchia.

1. *Dorididæ.*

5. Doris Montagui.
   Britannica.
   vulgaris.
   Rocinella.
   Elfortiana.
   Leachii.
   marginata.
   nodosa.
   coccinea.
6. Cufæa plana.

2. *Eolidiadæ.*

7. Eolidia —— ?

3. *Tritoniadæ.*

8. Tritonia Hombergii.
9. Idalia maculata.

2. Stegobranchia.

1. *Pleurobranchidæ.*

10. Cleanthus Montagui. Bulla plumula, *Mont.*
11. Osanius argentatus. (B. membranaceus, *Mont.*)

2. *Aplysiadæ.*

12. Aplysia varians.
13. Esmia Griffithsiana.

3. *Marseniadæ.*

14. Marsenia producta. Bulla haliotoidea, *Mont.*
    complanata. Bulla, *Mont.*

4. *Bulladæ.*

15. Bullæa planciana. Bulla aperta, *Linn.*
    catena. Bulla, *Mont.*
16. Scaphander lignarius. Bulla, *Linn.*
    catenatus.
    Brownii.
17. Haminæa Cuvieri. B. hydatis, *Mont.* B. Lamarckii, *Leach,* 1816.
    dilatata.
    elegans. Bulla eleg., *Gray.*
18. Eucampe Donovani. Bulla akera, *Mont.*
19. Roxania Cranchii.

3. Saccobranchia.

1. *Limacidæ.*

20. Arion Empiricorum.
    hortensis.
21. Limax antiquorum.
    maculatus.
    variegatus.
    carinatus.
    agrestis.

2. *Helicidæ.*

22. Succinea Mulleri. H. putris, *Mont.*
23. Vitrina Draparnaldi.
24. Helix aspersa. Helix —— ?
25. Tachæa nemoralis.
    hortensis.

26. Arianta arbustorum.
27. Pomatia antiquorum.
28. Teba cingenda.
    virgata.
    cantiana.
    carthusianella. H. Gibbsii.
    rufescens.
    caperata.
    (fulva). H. trochiformis, *M.*
    (hispida).
    aculeata.
    (spinulosa), *Mont.*
29. Zonites ericetorum.
    radiatus.
    rupestris.
    nitidus.
    crystallinus.
30. Chilotrema Lapicida. Helix, *Linn.*
31. Zurama pulchella. Helix, *L.*
32. Elismia fasciata. Turbo, *M.*
33. Ena montana. H. Lackhamensis, *Mont.*
    obscura. Helix, *Mont.*
34. Zua lubrica. Helix, *Mont.*
35. Balæa fragilis. Turbo perversus, *Linn.*
36. Clausilia laminata. Turbo, *Mont.*
    Rolphii.
    biplicata. Turbo, *Mont.*
    rugosa. T. bidens, *Mont.*
37. Azeca Matoni.
38. Abida secale. T. juniperi, *M.*
39. Pupilla Draparnaldi.
    marginata. Turbo, *Turt.*
40. Vertigo palustris.
    vulgaris.
    heterostropha. T. vertigo, *Mont.*

(40*. Acicula pellucida. Buc. terrestre, *Mont.*) Left out apparently by mistake.

3. *Carychiadæ.*

41. Carychium minimum. Turbo C., *Mont.*
42. Jaminia bidentata. Voluta, *Mont.*
43. Alexia denticulata. Voluta, *Mont.*

4. *Lymnadæ.*

44. Stagnicola *octonfracta. Helix, *Mont.*
    *communis (palustris).
    minuta, var.
    *elegans. (stagnalis, var.)
    vulgaris (stagnalis).
45. Gulnaria peregra. Helix, *M.*
    lacustris.
    auricularia. Helix, *M.*
46. Myxas Mulleri (glutinosa).
47. Physa fontinalis. Bulla, *M.*
48. Nauta Hypnorum.
49. Planorbis *corneus.
    *albus.
    carinatus.
    marginatus.
    Sheppardi.
    *imbricatus.
    *contortus.
    *Vortex.
    spinorbis.
50. Hemithalamus nitidus. Nautilus lacustris, *Mont.*

5. *Ancylidæ.*

51. Ancylus lacustris. Patella, *Mont.*
    fluviatilis.

4. Phyllobranchia.

1. *Iodeidæ.*

52. Iodes angulatus. —— ?
    Norrisii. —— ?

2. *Cypræadæ.*

53. Cypræa europæa.
54. Simia Pennantiana. Bulla patula. B. Blainvillii, 1816.
55. Marginella anglica. Cyprea Voluta, *Mont.*

3. *Purpuridæ.*

56. Acteon tornatilis. Voluta, *Mont.*
57. Ocenebra erinacea. Murex, *Mont.*
58. Purpura lapillus. Buc., *M.*
59. Hinia *minuta. Nassa.
    reticulata.
    *lævigata. Planaxis mollis, *Sow.*

60. Buccinum *Puxleianum.
 undatum. Buc., *M.*
 antiquatum. Murex, *M.*
 *corneum. Murex, *M.*
 Bamfium. Murex, *M.*
 Turricula. Murex, *M.*
 *B. Leachii, *Leach*, 1816.
61. Fusus muricatus. Murex, *Mont.*
 asperrimus.
62. Mangelia gracilis. Murex, *Mont.* Pleurotoma, *Leach*, 1816.
 purpurea. Murex, *Mont.*
 elegans.
 linearis. Murex, *Mont.*
 costata. Murex. M. Bela Donovani, *Leach*, 1816.
 Goodallii.
 lineata.
63. Bela nebula. Murex, *Mont.*
 rufa.
 Cranchii.
 minima. Bucc., *Mont.*
 septangularis. Murex, *M.*
 attenuata. Murex, *M.*
64. Aphorais Pes-pelecani. Strombus, *M.*
65. Bittium reticulatum. Murex.
 tuberculare. Murex.
 adversum. Murex.
 elegantissimum.
 Spenceri.

4. *Turbonidæ.*

66. Sabanæa eburnea.
 ventrosa. Turbo, *Mont.*
 rubra. Turbo, *Mont.*
 interrupta. Turbo, *Mont.*
 cingilla. Turbo, *Mont.*
 "*Var.* T. semistriata, *M.*"
 unifasciata. Turbo, *Mont.*
 ulvæ. Turbo, *Mont.*
 unidentata.
 plicata.
 paucicostata.
67. Assiminea Grayana.
68. Scalaria clathrus. Turbo, *Linn.*
 Prideauxiana.
 Scalaria Trevellyana.
 clathratulus. Turbo, *M.*
69. Turritella terebra. Turbo, *Mont.*
 unica. Turbo, *Mont.*
 nitidissima. Turbo, *Mont.*
 vitrea.
 punctura.
 truncatula.
 elegantissima. Turbo, *M.*
 Ebala eleg. *Leach*, 1816.
 *E. crenata, *Leach*, 1816.
70. Turbonilla varians.
 Montagui.
 costata.
 decussata.
 striata.
 pallida.
 transparens.
 angusta.
 nivosa.
 vitrea.
71. Alvania striata.
 Cranchii.
 costata.
("71*. Alvania zetlandica. Turbo perforatus.")
72. Zippora Drummondii.
73. Trochus tenuis, *Mont.*
 irregularis.
 *T. Lyonsii, *Leach*, 1816.
 ziziphinus, *Mont.*
 Clelandi.
 Cranchii.
 Montagui, *Leach MSS.*; *Gray*; *Wood, Sup.* f.
74. Trochius crassus. Trochus, *Mont.*
75. Gibbula tumida. Trochus, *Mont.*
 striata.
 lineata. Trochus, *M. & R.*
 magus. Trochus, *Linn.*
76. Natica Britannica. N. glaucina, *Mont.*
 Lamarckii. N. Alderi, *Forbes.*
77. Nerita littoralis, *Linn.*
78. Neritina europæa.
79. Temana pallidula. Nerita, *M*

Temana lacuna. Helix, *Mont.*
T. Flemingii, *Leach*, 1816.
variabilis.
puteolus.
80. Turbo littoreus, *Linn.*
striatus.
rudis, *Mont.*
tenebrosus, *Mont.*
petricola. H. petrea, *M.*
striatulus.
81. Turboella rufilabris, *Risso.*
scotica.
Goodalliana.
calathriscus.
punctata.
zetlandica.
Hutchingsiana.
brevis.
82. Epheria Bulveri. Turbo canalis, *Mont.*
vincta. Turbo, *Mont.*
quadrifasciata. Turbo, *M.*
E. Goodallii, *Leach*, 1816.
83. Turbona reticulata.
semicostata.
84. Littorelæa Pultneyii.
85. Medoria crassior. Turbo, *M.*
Damnoniensis.
tenebrosa.
86. Margarites diaphana. Helix Marg. *Mont.* Margarita, *Leach*, 1816.
87. Truncatula truncata. Truncatella, *Risso.*
subtruncata.
88. Thicolia varians. Turbo pullus, *Mont.*
89. Balcis Montagui. Helix polita, *Mont.*
testacea.
arcuata.

5. *Paludinidæ.*

90. Valvata Mulleri.
fontinalis.
91. Paludina vulgaris.
achatina.
92. Bithinia jaculator.
ventricosa.

5. Antrobranchia.

1. *Cyclostomiadæ.*

93. Cyclostoma elegans.

6. Aspidobranchia.

1. *Fissurellidæ.*

94. Fissurella græca. Patella, *M.*
95. Cemoria Montagui. P. apertura, *Mont.*
Flemingii. P. Naochina.
96. Emarginula vulgaris. P. fissura, *Mont.*

2. *Capulidæ.*

97. Capulus hungaricus. Patella, *Mont.*
98. Mitella sinensis. Patella, *M.*

7. Cyclobranchia.

1. *Patelladæ.*

99. Patella vulgata.
parva.
Clelandi.
100. Patina lævis. Patella, *M.*
pellucida.

2. *Chitonidæ.*

101. Lepidopleura punctulatus.
carinatus.
albus.
102. Acanthochætes vulgaris.
103. Chiton cinereus.
Flemingii.
ruber.
Cranchii.
tuberculatus.
fuscatus.
lævis.
latus.
scoticus.
variegatus.

3. *Ascidiæ.*

1. *Tethydes.* 1. *Tethyadæ.*

104. Botryllus Leachii.
Schlosseri.
Savignii.
Gærtneri.

2. *Ascidiadæ.*

105. Ascidia Britannica.
papillosa.

Pholadiadæ.

Teredo 1. navalis.
Pholas 1. crispata.
2. parva.
3. dactylus.
—— ? 1. —— ?
Barnia 1. candida.
Gastrochæna 1. fulva.
Biapholus 1. spinosus.
2. rugosus.

Soleniadæ.

Solen 1. marginata.
2. siliqua.
(β. novacula.)
3. ensis.
4. pellucidus.
Pharus 1. legumen.
Azor 1. antiquatus.
2. variabilis.

Myadæ.

Magdala (striata).
Mya 1. arenaria.
2. truncata.
Thracia 1. prætenuis.
2. declivis.
3. (Montagui).
4. distorta.
Lutraria 1. elliptica.
2. solenoides.
Abra 1. Listeri. (compressa.)
2. tenuis.
3. Boysii.
4. prismatica.

Mactraädæ.

Mactra 1. stultorum.
2. subtruncata.
3. truncata.
4. solida.
Lembulus 1. minutus.
Nucula 1. margaritacea.

Veneriadæ.

Cyclas 1. rivicola.
2. cornea.
3. (stagnicola).
4. amnica.
Lasæa 1. rubra.
Tellina 1. solidula.
2. tenuis.
Tellina 3. fabula.
4. squalida.
5. donacina.
Psammobia 1. feroensis.
Donax 1. complanata.
2. trunculus.
Capsa 1. Irus.
2. perforans.
3. pullastra.
4. reticulata.
5. virgo.
6. crocea.
Venus 1. Chione.
2. verrucosa.
3. laminosa. Cassina.
4. gallina.
5. Prideauxii.
6. fasciata.
7. Damnoniensis.
8. scotica.
9. minima.
10. compressa.
11. mercenaria. (Islandica.)
12. ovata.
Asa 1. exoleta.
2. lincta.
Thyatira 1. lactea.
(Loripes) 2. radula.
3. flexuosa.
Mysia 1. undata.
2. Montagui.
Cyrachæa 1. spinifera.
Arcopagia 1. crassa.
Cardium 1. aculeatum.
2. echinatum.
β. ciliare.
3. tuberculatum.
β. nodosum.
4. edule.
β. rusticum.
5. zonatum.
6. exiguum.
7. lævigatum.
Isocardia 1. Cor.

Arcadæ.

Arca 1. fusca.
2. Pennantii.

Unionidæ.

Unio 1. pictorum.
2. ovalis.

Anodonta 1. cygnea.
β. stagnalis.
γ. anatinus.
δ. avonenis.
Damalis 1. margaritifera.

Pectunculidæ.

Pectunculus 1. pilosus.

Aviculadæ.

Avicula 1. —— ?

Pinnadæ.

Pinna 1. fragilis.
2. elegans.
Mytilus 1. edulis.
2. pellucidus.
3. elegans.
Modiola 1. papuana.
2. Gibbsii.
3. Prideauxii.
4. discrepans.
5. discors.

Pectenidæ.

Lima 1. Goodallii.
2. bisulcata.
Pecten 1. maximus.
2. vulgaris.
3. varians.
4. distortus.
5. obsoletus.
6. (lævis).

Ostreadæ.

Ostrea 1. edulis.
Anomia 1. striata.
2. cymbiformis.
3. ephippium.

Terebratuladæ.

Terebratula 1. cranium.
2. —— ?

Incerta sedes.

Mya ferruginea.
inæquivalvis.
bidentata.
Solen squamosus.
pinna.
Mactra triangularis.

N.B. The names of the bivalves were copied by Mr. Stevens from a catalogue prepared at another time, and hence the difference in the position of the numbers.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 17, 1847.—"On the Structure and Development of the Liver." By C. Handfield Jones, M.B., Cantab. Communicated by Sir Benjamin C. Brodie, Bart., F.R.S., &c.

The author gives a detailed description of the structure of the liver in animals belonging to various classes of the animal kingdom. He states that in the Bryozoon, a highly organized polype, it is clearly of the follicular type; and that in the Asterias, the function of the liver is probably shared between the closed appendage of the stomach and the terminal cæca of the large ramifying prolongations of the digestive sac contained in the several rays. Among the Annulosa, the earthworm presents an arrangement of the elements of the hepatic organ, corresponding in simplicity with the general configuration of the body, a single layer of large biliary cells being applied as a kind of coating over the greater part of the intestinal canal. In another member of the same class, the Leech, in which the digestive cavity is much less simple, and presents a number of sacculi on each side, these elements have a very different disposition; and the secreting cells, although some remain isolated, for the most part coalesce to form tubes, having a succession of dilatations and constrictions, and finally uniting and opening into the intestine. In Insects, the usual arrangement is that of long curved filamentary tubes, which wind about the intestine; these, in the meat fly, are sacculated throughout the greater part of their course, till they arrive quite close to the pylorus, where they open; near their origin they appear to consist of separate vesicles, which become gradually fused together, but occasionally they are seen quite separate. The basement membrane of the tubes is strongly marked, and encloses a large quantity of granular matter of a yellowish tinge, with secreting cells; another portion of the liver consists of separate cells lying in a granular blastema, which cells, in a later stage of development, are seen to be included in vesicles or short tubes of homogeneous membrane, often coalescing and exhibiting a more or less manifestly plexiform arrangement; this portion of the liver is regarded by Mr. Newport as really adipose tissue. The author has termed it the *parenchymatous portion* of the liver, on account of its general appearance and mode of development, though he has not been able to determine whether the tubes always originate from it. Among the Arachnida, the follicular type of arrangement prevails; and the same is the case with the Crustacea, the follicles in these last being distinctly visible to the naked eye. In Mollusca also, we find the follicular arrangement universally to obtain; yet in certain cases the limiting membrane of the follicles cannot be shown to exist, and the author therefore thinks that its importance is probably not great, but that it serves chiefly to fulfil the mechanical function which its synonym "*basement*" indicates. The quantity of retained secretion in the liver of molluscs seems clearly to imply that the bile in them is not an excrementitious fluid; it is used slowly on account of the imperfect character of the respiration.

In passing from the Invertebrata to the Vertebrate division of the animal kingdom, and beginning with the class of Fishes, a great change is immediately manifest in the form and character of the biliary organ; it is now a gland of solid texture, to which the term *parenchymal* is justly applied. Two portions may be distinguished in it, namely, the secreting parenchyma, consisting of delicate cells, or very often of nuclei, granular and elaborated matters in great part, and the excreting ducts, which, though completely obscured by the surrounding bulky parenchyma, may yet be satisfactorily demonstrated, and traced often to their terminal extremities in the following manner. If a branch of the hepatic duct be taken up in the forceps, it may be dissected out without much difficulty from the surrounding substance, which is very soft and yields readily to gentle manipulation; when a trunk is in this way removed and placed under the microscope, a multitude of minute ramifications are seen adhering to it; among these not a few may be discovered, which do not appear to have suffered injury; some are occasionally seen terminating by distinctly closed extremities; more usually the duct becomes very minute and gradually loses all definite structure, appearing at last like a mere tract of granular matter; in either case there is no communication by continuity with the surrounding parenchyma. Large yellow corpuscles, peculiar cells, and a considerable quantity of free oily matter usually existing in the liver of various fishes, seem generally to indicate a great superiority in the amount of secretory over that of excretory action, and to betoken clearly the feeble intensity of the aërating function.

In Reptiles, there is the same arrangement in the liver, namely, a secreting parenchyma of cells and an apparatus of excretory ducts, which have the same essential characters as those of fishes; but there exists very frequently in the parenchyma remarkable dark corpuscles, which appear to be masses of retained biliary matter, the import of which, in the situation they occupy, is doubtless the same as that of the similar masses existing in fishes.

In Birds, the parenchyma of the liver is remarkably free from oily or retained biliary matters; it often consists almost wholly of free nuclei and granular matter, with scarcely a single perfect cell; the excretory ducts often greatly resemble those of reptiles, sometimes rather those of mammalia; the essential character is, however, always the same, namely, that they terminate without forming any important connexion with the parenchyma.

In Mammalia, the parenchyma of the liver consists usually of perfect cells, which are arranged often in linear series of considerable length, radiating from the axis of each lobule; these unite at various points with each other, so as to present a more or less decidedly plexiform appearance. Each lobule, as described by Mr. Kiernan, is separated from the adjacent ones by the terminal twigs of the portal vein, and to a greater or less extent by a "fissure," though in most animals the lobules are continuous with each other both above and below the fissure. The elaboration of the secreted product seems to be most completely effected in the cells adjoining the margins of the lobules, which are often seen to contain a larger quantity of biliary matter than those in the interior, and to be apparently in the act of discharging it into the fissure; the margin of the lobule then presents an irregular surface with large globules of the secretion clustering together all over it. The capsule of Glisson surrounding the vessels in the portal canals gives a fibrous investment to those surfaces of the lobules which are towards the canal; but when it has arrived in the fissures, it forms a continuous membrane lining the surfaces of opposite lobules; this membrane is often truly homogeneous, and closely resembles the basement tissue: there appears occasionally to be a delicate epithelium on its free surface; but this, as well as the membrane itself, is often absent, when the margin of the lobules is in that condition which has just been described and which may be termed *active*. The minute branches of the hepatic duct as they approach their termination undergo a remarkable alteration in their structure; they lose their fibrous coat, which blends itself with the membranous expansions of the capsule of Glisson; their basement membrane becomes gradually indistinct, and at last ceases to exist, and the epithelial particles no longer retain their individuality, but appear to be reduced to mere nuclei, set very close together in a faintly granular basis substance. The mode of their termination is not uniformly the same; frequently they present distinctly closed rounded extremities, between one and two thousandths of an inch in diameter; at other times they seem to cease gradually in the midst of fibrous tissue, the nuclei alone being disposed for some little way in such a manner as to convey the idea of a continuation of the duct. These ducts can seldom be discerned in the fissures, but have several times been seen in the "spaces," where several fissures unite; they do not form anything like a plexus between the lobules. From the anatomical relation of the ducts to the parenchyma, and from the circumstance that a distinct vessel conveying a different kind of blood is distributed to the hepatic duct, as soon as the liver assumes the parenchymal form, it seems probable that the mode in which the secreted bile is conveyed out of the organ, is by its permeating the coats of the minute ducts in obedience to an endosmotic attraction, which takes place between the bile in which the ducts may be said to be bathed, and a denser (perhaps mucous) fluid formed in their interior. The large quantity of oily matter frequently existing in a free state in the secreting parenchyma of the liver, which must be regarded as a product of secretory action, seems to suggest the idea, that a certain quantity of the biliary secretion may be directly absorbed into the blood, and in this manner conveyed away from the organs, just as occurs in the thyroid body, suprarenal capsules, and other glands unprovided with efferent ducts.

With respect to the development of the liver, the author considers the opinion of Reichart to be decidedly the correct one, namely, that its formation commences by a cellular growth from the germinal membrane, independently of any protrusion of the intestinal canal. On the morning of the fifth day, the œsophagus and stomach are clearly discernible, the liver lying between the heart, which is in front, and the stomach which is behind; it is manifestly a parenchymal mass, and its border is quite distinct and separate from the digestive canal; at this period, the vitelline duct is wide, it does not open into the abdominal cavity, but its canal is continued into an anterior and posterior division, which are tubes of homogeneous membrane, filled, like the duct, with opaque oily contents; the anterior one runs forwards, and forms behind the liver a terminal expanded cavity, from which then passes one offset, which, gradually dilating, opens into the stomach; a second, which runs in a direction upwards and backwards, and forms apparently a cæcal prolongation; and a third and fourth, which are of smaller size, arise from the anterior part of the cavity and run to the liver, though they cannot be seen to ramify in its substance; at a somewhat later period, these offsets waste away, excepting the one which is continued into the stomach, and then the mass of the liver is completely free and unconnected with any part of the intestine. As the vitelline duct contracts, the anterior and posterior prolongations of it become fairly continuous and form a loop of intestine, the posterior division being evidently destined to form the cloaca and lower part of the canal. The final development of the hepatic duct takes place about the ninth day by a growth proceeding from the liver itself, and consisting of exactly similar material; this growth extends towards the lower part of the loop of duodenum, which is now distinct, and appears to blend with the coats of the intestine; around it, at its lower part, the structure of the pancreas is seen to be in process of formation. The further progress of development of the hepatic duct will, the author thinks, require to be carefully examined, but the details he has given in this paper have satisfied him of the correctness of the statement that the structure of the liver is essentially parenchymal.

ZOOLOGICAL SOCIETY.

June 8, 1847.—Harpur Gamble, Esq., M.D., in the Chair.

The following papers were read:—

1. On the Finner Whales, with the description of a new species. By J. E. Gray, Esq., F.R.S. etc.

Sibbald has described and figured two specimens of Finner Whale. Artedi, and after him Linnæus, regarded these figures as representations of separate species, but the characters which they gave for the species appear to depend solely on the state the specimens were in when described and figured. These species have been generally adopted in the Fauna of this country.

The Whales appear to differ greatly from one another in the degree of mobility of the neck, as is well-shown in the union or separation of the cervical vertebræ, and in the variations in the development of their lateral and spinous processes.

The union or separation of the cervical vertebræ appears to afford good generic distinctions.

Duvernoy, in the second edition of Cuvier's 'Comparative Anatomy,' has observed, "In the Cetacea the seven cervical vertebræ of the genus *Balæna* are all soldered together, and sometimes the first dorsal is equally soldered to the cervical.

"In the genus *Physeter* the atlas is distinct, and the six other vertebræ are soldered.

"In the *Delphinus* the atlas and axis only are united, and the five other vertebræ remain separate, but they are very thin.

"Lastly, in the Rorquals (Pike Whales), *Delphinus gangeticus* (the genus *Platanista*), the Dugong and Lamantin, they are all or nearly all separate."—Duvernoy in *Cuv. Anat. Comp.* ed. 2. i. 195.

I may further observe, that in *Balænoptera rostrata*, which I have considered as the type of *Balænoptera*, the second and third cervical vertebræ are united by their spinous processes, while the fourth, fifth, sixth and seventh vertebræ are separate and well-developed; while in *Physalus Boops*, *antiquorum* and *Sibbaldii*, and in *Megapteron longimanus* they are all well-developed, and separate from one another. In the Grampus (*Orca gladiator*) the first five cervical vertebræ are united together into one body, and the sixth and seventh are very thin, rudimentary and separate. In *Hyperoodon* all the cervical vertebræ are rudimentary and united, as in *Balæna*. In *Monoceros* the first and second cervical vertebræ are separate and large, and the remainder are very thin, separate, and nearly rudimentary.

M. Cuvier (*Oss. Foss.* v. 378, 380) has observed that the second and third cervical vertebræ of the Cape *Megapteron* are united together by their bodies: this does not appear to be the case with the Greenland *Megapteron longimanus*.

The union of the vertebræ in the different genera appears to take place at an early period in the life of the animal, for in the skeleton of a young *Balænoptera rostrata* which has the epiphysis of the vertebræ and arm-bones quite separate, the vertebræ were firmly united.

Cuvier, in his researches on the Whales (*Oss. Foss.* v. i. 378, 380. t. 26. f. 13 and 18), observes that the two kinds of true Whale (*Balæna*) might be distinguished by the form of the lateral processes; and Professor Eschricht of Copenhagen has made the same observation with respect to the Finner or Pike Whales (*Balænoptera*); and from what I have observed, they appear to present the best character for the distinction of the species, for there can be no doubt that the expanded lateral processes of the *Physalus antiquorum* must be for a very different purpose, and require very different muscles for their movements than the short lateral processes of *Physalus Boops* and *Sibbaldii*.

In my Essay on the Cetaceous animals published in the 'Zoology of H.M.S. Erebus and Terror,' from the examination of several skeletons and their fragments and the descriptions of different authors, I attempted to establish that there were three distinct British species, distinguished by good zoological and osteological characters. Having lately had occasion to examine other specimens, and being enabled to make more minute comparison, I am now satisfied that there is a fourth species which inhabits our coast, and the re-examination of these specimens has enabled me to correct some inaccuracies in my former account.

In the paper above referred to I proposed to divide the genus *Balænoptera* into three subgenera; but on reconsideration I think it preferable that it should be divided into two genera, retaining the name *Balænoptera* for one of the species, and using the old generic name of *Physalus* for the other three, the genera being established on both zoological and osteological characters.

Genus Balænoptera, Piked Whales.

The pectoral fin one-third and the dorsal fin two-thirds the length of the body from the end of the nose. The second and third cervical vertebræ united by the spinous process. The lateral process of the second cervical vertebra rather expanded, united, wing-like. Vertebræ 46 to 48. The pectoral fin moderate, about one-eighth the length of the body. Dorsal fin behind the orifice of generation. Chest with longitudinal folds.

Balænoptera rostrata, Gray, Zool. Voy. H.M.S. Erebus and Terror, 50. t. 2.

Balæna rostrata, *Müller, Hunter, &c.*
Rorqualus minor, *Knox, Jardine N.L.* 142. t. 7.
Inhabits the British coast, North Seas, Greenland.

There is a skeleton of this species in the British Museum, and a skull in the museum of the Hull Philosophical Society.

In this species the first cervical vertebra is rather broader than long; the central hole is half as high again as broad. The second and third cervical vertebræ are united together by the upper edge. The second cervical vertebra has a broad, much-expanded, lateral process, with an oblong central hole near the body of the vertebra, reaching rather more than half its length. The third, fourth, fifth and sixth cervical vertebræ have two (upper and lower) lateral processes; the upper process of the third is the shortest and least developed, and these processes increase in length to the sixth. The lower process of the third is the thickest; the fourth and fifth rather small, and in the sixth the basal part of the process is shorter, and the upper part much-elongated and thinner. The seventh has only the upper process, which resembles that of the first dorsal in form, but is smaller.

This species is the smallest of the family, and rarely if ever exceeds twenty-five or thirty feet in length. It is easily known by the white spot on the base of the upper side of the pectoral fin.

Genus Physalus, Finner Whales.

The pectoral fin one-fourth, the dorsal fin three-fourths the length of the body from the end of the nose. The cervical vertebræ all separate and free. Vertebræ 54 to 64. Pectoral fin moderate, about one-eighth the length of the body. Dorsal fin behind the orifice of generation. Chest with longitudinal folds.

This genus may be divided into two sections, according to the form of the transverse apophyses of the cervical vertebræ.

* *The transverse apophyses of the cervical vertebræ much-expanded, united, forming a ring in the second to the sixth vertebræ.* Physalus.

1. Physalus antiquorum.

Balæna Physalus, *Scoresby.*
Balænoptera antiquorum, *Fischer, Syn.* 325; *Gray, Z. E. & T.* 50.
Rorqual de la Mediterranée, *Cuvier, Os. Foss.*
Inhabits British Ocean, Mediterranean.

Skeleton at Black-Gang Chine, from Isle of Wight, and in Mr. Patch's show, from Plymouth.

The transverse apophyses are as broad as the body of the vertebra, and the latter is oblong, half as broad again as high. Vertebræ 54, viz. 7 cervical, 13 dorsal, 17 lumbar, and 17 caudal. The ribs are simple.

The lateral processes of the cervical vertebræ are much longer than the width of the body of the vertebra; the lateral process of the second cervical has a small, nearly central perforation, and this perforation gradually becomes larger on each succeeding vertebra, until in the sixth it nearly occupies the whole disc of the lateral process, the seventh being only found with a narrow elongated process from the upper edge, the lower process being reduced into the form of a small tubercle.

The Plymouth specimen is travelling the country, curiously mounted in three caravans (the first containing the head, the second the thorax, and the third the middle of the tail), so as to exhibit the parts of the skeleton in their proper situations when the caravans are placed one after the other with their ends removed, and the cervical, lumbar, and caudal vertebræ suspended between or beyond them.

This specimen was found floating on the sea in a decomposed state on the 20th of October, 1831, in Plymouth Sound, and is said to have been 102 feet long and 75 feet in circumference, but most likely the abdominal cavity was distended by internal decomposition.

The lumbar vertebræ are thick and large; both these characters must render this Finner much more powerful and active in the water than any of its allies. The lower jaw 17 feet long; the blade-bone 32 inches by 51; the upper arm-bone 20 inches long by $10\frac{1}{2}$ wide; the lower arm-bone 31 inches long. The lumbar vertebræ are 11 inches long and 14 inches wide; the first rib 59 inches long and $10\frac{1}{2}$ inches wide at the sternal end. The chest-bone is 28 inches wide and 18 inches long.

In this skeleton the proprietor has placed a blade of Greenland whalebone (*Balæna mysticetus*) on one side, and several of South Sea whalebone (*Balæna australis*) on the other side of the upper jaw, in the place of the true baleen of *Physalus*.

There is a second skeleton, which most probably belongs, or is very nearly allied to this species, exhibited at Black-Gang Chine, on the south side of the Isle of Wight, which was caught near the Needles. It was 75 feet long, of a greyish colour.

The skull is 16 feet 7 inches long, 5 feet wide at the orbital notch; the lower jaw 16 feet 9 inches long; the sternum 26 inches wide and 14 long; the upper arm-bone 24 inches long, the lower 33 inches long.

This skeleton chiefly differs from the former in the bones of the arms being rather longer, though the body is one-third shorter; but the length of the Plymouth specimen may be over-estimated.

** *The transverse apophyses of the cervical vertebræ short, of the third, fourth, fifth and sixth separate.* Rorqualus.

2. Physalus (Rorqualus) Boops.

The transverse apophysis of the second cervical vertebra thick, short, converging, but separate at the end; of the other cervical vertebræ slender, rather longer, far apart. The upper apophysis of the sixth bent down, rather elongate, the lower one thicker, shorter, and bent up at the end.

Skeleton in the British Muséum. Taken on the coast of Wales and towed into Liverpool in 1846.

The length of the skeleton of the Liverpool specimen is 38 feet; the head is 9 feet long. The vertebræ are 60 in number, and there are 15 pairs of simple ribs.

The cervical vertebræ are all separate, and nearly equally developed; the body of the cervical vertebræ is squarish oblong, about one-fourth broader than high. The spinal canal is oblong, depressed, twice as wide as high. The second vertebra is twice as thick as the other, with two large broad lateral processes scarcely as long as half the width of the vertebra, coming together at the end, but separate, and leaving an oblong hole between them. The third, fourth, fifth and sixth each with superior and inferior narrower lateral processes, the upper one of the third being the narrowest, and gradually increasing in thickness to the sixth; the lower of the fourth rather the broadest, and of the sixth the thickest and most tapering at the end.

The third, fourth, fifth, sixth and seventh have only two rather short processes on each side, the upper process being the most slender, compressed and bent down, and the lower one conical, stronger, compressed; the processes of the third vertebra are the thinnest, and they gradually increase in thickness and strength to the seventh or last.

The specimen here described was mentioned in the papers of the day as a *spermaceti whale !*

3. Physalus (Rorqualus) Sibbaldii.

The transverse apophyses of the second cervical vertebra rather elongated, united, leaving only a small subcentral hole; of the other cervical vertebræ slender, shorter and far apart, nearly straight, directed out laterally.

Inhab. Coast of Yorkshire.

There is in the museum of the Hull Literary and Philosophical Society a very perfect skeleton of this species, taken in the Humber, which is fifty feet long. It has 64 vertebræ, as follows: cervical 7, thoracic 16, lumbar and caudal 41; and the arms and paddles are 6 feet 9 inches long; the ribs 16 pair, all simple. The baleen is black.

This specimen is said to have been eight years old, but on what authority I cannot learn.

I have to thank my friend Mr. Pearshall, the curator of the above museum, for his kindness in sending me a detailed drawing of the natural size of the cervical vertebræ of this interesting species.

For the purpose of comparison with the foregoing description, I here add the following account of the cervical vertebræ of *Megapteron longimanus*, or *Hunchback Whale*, from a fine skeleton in the collection of the British Museum.

The second cervical has two very large, thick, converging, lateral processes, as long as half the diameter of the body of the vertebra. The third, fourth, fifth, sixth and seventh have elongated, slender, superior lateral processes, which bend rather downwards, and the sixth and seventh rather forwards. The fourth and fifth have a very short, rudimentary, inferior lateral process, which is smaller on the left side. The other vertebræ are without any process. The cervical vertebræ are all free.

The upper part of the spinous process of the second vertebra is very large and convex, covering this part of the next vertebra.

I may here remark that Professor Eschricht informed me that he could find no difference between the *Megapteron* of the North Sea and the Cape specimen in the Paris Museum. I may also observe that Cuvier (*Oss. Foss.* v. 381) described the Cape specimen as having the second and third cervical vertebræ united by the upper part of their body, which is not the case with our Northern specimen, and that Cuvier's figures of the lateral process of the Cape specimen are very different from the Northern one here described.

2. On a new species of Apteryx. By John Gould, Esq., F.R.S. etc.

We have abundant evidence that at some former period New Zealand, and probably the Polynesian Islands, have been inhabited by a remarkable group of Birds, of which the *Dinornis*, so ably described by Professor Owen, formed a part, and of which the genus *Apteryx* is the only form at present known to exist; this form, so different from all others, has been, and will ever be, regarded with great interest, as the sole remnant of a race of which every other genus is believed to be extinct. Hitherto a single species only of this genus has been recorded; I have therefore no ordinary degree of pleasure in introducing to the notice of this Meeting a second, and if possible a still more extraordinary one than that previously described, and as I reported to the meeting held on the 13th of April, I have intelligence of the existence of a third and much larger species than either of them.

The bird I am now about to describe has just arrived from New Zealand by way of Sydney, but unaccompanied by any information as to the locality in which it was procured, or any particulars of its habits and economy.

It appears to be fully adult, and is about the same size as the *Apteryx Australis*, from which it is rendered conspicuously different by the irregular transverse barring of the entire plumage, which, with its extreme density and hair-like appearance, more closely resembles the covering of a mammal than that of a bird; it also differs in having a shorter, more slender, and more curved bill, and in the structure of the feathers, which are much broader throughout, especially at the tip, and of a loose, decomposed, and hair-like texture. I propose to characterize this new species under the name of *Apteryx Owenii*, feeling assured that it can only be considered as a just compliment to Professor Owen, who has so ably investigated the group to which I believe it pertains.

Apteryx Owenii. *Ap. corpus superius fusco et fulvo transversim radiatum; plumis singulis, ad basim argenteo-fuscis, in medio saturatius fuscis, deinde fasciâ semilunari transversâ fulvâ, cui macula succedit informis nigra, ad apicem fulvis. Corpus inferius superiore pallidius, pluma enim quæque inferioris corporis tribus radiis fulvis, superioris tantum duobus ornatur; fulvus quoque color inferiore longius quam superiore corpore in apicibus plumarum extendit.*

Face, head and neck dull yellowish brown; throat somewhat paler; all the upper surface transversely rayed with blackish brown and fulvous; each individual feather being silvery brown at the base, darker brown in the middle, then crossed by a lunate mark of fulvous, to which succeeds an irregular mark of black, and terminated with fulvous; under surface paler than the upper, caused by each feather being crossed by three rays of fulvous instead of two, and more largely tipped with that colour; the feathers of the thighs resemble those of the back; bill dull yellowish horn-colour; feet and claws fleshy-brown.

Total length, from the tip of the bill to the extremity of the body, 18 inches; bill, from the gape to the tip, $3\frac{5}{8}$; bill, $\frac{7}{8}$ broad at the gape; tarsi, $2\frac{1}{4}$; middle toe and nail, $2\frac{1}{2}$.

Hab. New Zealand.

Remark.—In this species the wing is even more rudimentary than in the *Apteryx Australis.*

3. Drafts for a new arrangement of the Trochilidæ. By John Gould, Esq., F.R.S. (continued*), with the characters of two new genera and descriptions of three new species.

Metallura, gen. nov.

Char. gen.—*Rostrum* rectum, sublongum. *Plumæ* molles sericeæ. *Cauda* subgrandis, rotundata. *Gula* et *rectrices infrà* tanquam metallum expolitum luminosæ. *Alæ* subgrandes. *Tarsi* nudi. *Pedes* subgrandes. *Digitus* et *unguis* postici digitum et unguem medios longitudine æquantes vel superantes.

Gen. char.—Bill straight, moderately long; plumage soft and silky; tail rather large and rounded; throat and under surface of the tail-feathers very luminous, like shining metal; wings moderately large and apparently adapted for an easy mode of flight; tarsi bare; feet rather large; hind-toe and nail as long or longer than the middle toe and nail.

Females.—Much less brilliant than the males in every respect, and in most of the species wanting the luminous mark on the throat.

The species are—

Trochilus cupreocauda, Gould.
Trochilus æneocauda, Gould.
Trochilus Alardi, Bourc.
Trochilus smaragdinicollis, D'Orb.
Trochilus Williami, Bourc.

Doryfera, gen. nov.

Char. gen.—*Rostrum* forte, ad tertiam partem apicalem, quæ sursum curvatur, rectum. *Alæ* subgrandes. *Cauda* rotundata, subrigida, rectricibus singulis mucronatis. *Tarsi* aliquâ parte vestiti. *Pedes* magnitudine mediocri. *Digitus* et *unguis postico* digito et ungui medio longitudine æquales.

Gen. char.—Bill long, straight for three-fourths of its length, and inclining upwards to the extremity; wings moderately large; tail

* See vol. xix. pp. 401, 408, 421.

rounded, rather rigid, each feather ending in a point; tarsi partly clothed; feet moderate in size; hind-toe and nail as long as the middle toe and nail.

The species are—

Trochilus (*Doryfera*) *Louise.*

TROCHILUS (DORYFERA) VIOLIFRONS. *Troch. fronte maculâ rotundâ metallicè violaceâ notatâ; occipite, collo, et dorso superiore æneo-viridibus; dorso inferiore, et tectricibus caudæ superioribus, sordidè griseo-cæruleis; gulâ, et abdomine, nigris viride splendentibus; tectricibus caudæ inferioribus intensè violaceis; caudâ ipsâ nigrâ violaceo subnitente.*

On the forehead a round spot of beautiful metallic violet; back of the head, neck and upper part of the back bronzy green, passing into purer green on the back and shoulders; lower part and upper tail-coverts dull greyish blue; throat and abdomen black, with green reflexions; under tail-coverts deep violet-blue; wings purplish brown; tail black, slightly glossed with green; bill black; feet brown.

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

Remark.—This most interesting addition to the *Trochilidæ* is precisely of the same form in every respect as *T. Louise,* but differs most remarkably in the colouring of its plumage, the forehead being violet instead of green, and the under surface black instead of golden green.

LOPHORNIS REGINÆ. *Loph. vertice, et cristâ, ferrugineo-rubris, plumis singulis maculâ viride ad apicem ornatis; loro, gulâ et colli lateribus, viridibus, candentibus; maculâ plumarum lanceolatarum subviride albâ; nuchâ, et dorso superiore, fulgente viridibus; dorso inferiore, uropygio, et tectricibus caudæ superioribus, æneo-fuscis; uropygio lineâ albâ transversim fasciatâ; caudâ castaneo-fuscâ, rectricibus duabus intermediis ad apicem et margines, rectricibus etiam duabus externis ad margines, æneo-viridibus.*

Crown of the head and crest bright rusty red, each feather with a beautiful dark green spot at the tip; lores, throat and sides of the neck resplendent metallic green, beneath which is a patch of white lanceolate feathers; back of the neck and upper part of the back lustrous green; lower part, rump and upper tail-coverts bronzy brown; rump crossed by a distinct line of white; tail chestnut-brown, the tips and margins of the two middle and the margins of the external feathers rich bronzy green; abdomen light metallic green; wings purplish brown; bill reddish brown at the base, dark brown at the tip; feet brown.

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

Remark.—Nearly allied to *Lophornis Regulus* and *ornatus,* but differing from the former in having the crest-feathers broader and the green spots on the tips much larger. It is a very beautiful species.

TROCHILUS (GLAUCIS?) CÆRULEOGASTER. *Troch. vertice, nuchâ, uropygio, et tectricibus caudæ superioribus, æneo-viridibus; mento, colli lateribus, et dorso viridibus; gulâ, et abdomine, cyaneis; tectricibus caudæ inferioribus magnis, albis; caudâ nigrâ pallidè cyaneo nitente.*

Crown of the head and back of the neck dull bronzy green; back green, passing into bronzy green on the rump and upper tail-coverts; chin and sides of the neck green, gradually passing into the beautiful blue of the throat and abdomen; under tail-coverts largely developed and of a pure white; tail black, with steel-blue reflexions; wings purplish brown; bill black; feet brown.

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

Remark.—About the same size as, and similar in every respect to, *T. Buffonii*, Lesson, but differs from it in the throat and abdomen being beautiful blue instead of green.

MISCELLANEOUS.

EGGS OF THE MOA OR DINORNIS OF NEW ZEALAND.

Dr. Mantell has just received from his son, Mr. Walter Mantell of Wellington, New Zealand, fragments of several eggs found imbedded with the bones of the Moa; these are the first relics of this kind hitherto discovered. The portions in Dr. Mantell's possession evidently belong to several eggs, and apparently to different species of the Moa. In their general aspect they resemble the eggs of the Ostrich, but the external surface of the shell, instead of being marked with small circular pits, is covered with short, interrupted, linear grooves, and which are variously disposed in different specimens. The shell is relatively thinner than that of the Ostrich, and the egg must have been much larger, for the fragments have but a very slight degree of convexity. Mr. Mantell succeeded in collecting an extensive series of bones (between 700 and 800) of different parts of the skeleton; among which are specimens of the mandibles, which have not previously been obtained. This collection is on its way to England, and will doubtless furnish some interesting additions to our knowledge of the remarkable gigantic birds of the Ostrich tribe which once trod the soil of New Zealand.

FOSSIL TREE.

At Wettin, near Halle, in Prussian Saxony, a fossil tree with its roots has lately been found in a quarry, and is completely denudated from the surrounding stone. It is fourteen feet high, it reaches the surface, where it is cut off, and its roots run out several feet in a nearly horizontal direction. It is an *Araucaria*, and the wood is partially transformed into Hornstein and partially into claystone (Thonstein). The stone consists of a sandstone with a cement of claystone, in which many fragments of feldspar are lying, and it rests upon a conglomerate of the formation of pit-coal (Steinkohle). The stratum of this stone-formation, in which the tree extends its roots, has an angle of inclination of 10°, and the tree stands perpendicularly upon it; while the strata lie nearly horizontally over the roots, though the stone-formation is the same. In the stratum of the root there are numerous leaves of a *Borassites*, of which a complete fan has also been found.—J. O. W. *in the Gardener's Chronicle for Sept.* 11, 1847.

Description of a new species of Antelope from West Africa. By J. E. Gray, Esq., F.R.S.

Mr. Whitfield last year brought with him from the Gambia, along with other most interesting mammalia and birds, some horns of a very large species of Antelope, called by the natives *Gingi-ganga*, which very nearly resemble those of the *Eland* from South Africa, but are larger, longer and much heavier than those of the large male *Eland* from South Africa, which the Earl of Derby presented to the British Museum on the return of Mr. Burke.

This season Mr. Whitfield succeeded in procuring the upper part of the skull and horns of a male, and the flat skin (but unfortunately without head or feet) of an adult male and female of this animal, which proves to be perfectly distinct from the Cape species; and as it is by far the finest Antelope known, I propose to dedicate it to the Earl of Derby, who has done so much to illustrate the species of this group, and has been so successful in importing and breeding the various kinds.

This species is distinguished from the *Cape Eland* by the neck and front part of the underside, and a large spot on the front and hinder side of the upper part of the fore-legs (and the fetlock) as well as the dorsal line being black, and by the side being ornamented with fourteen or fifteen narrow, rather waved, perpendicular white lines, and the lower part of the neck nearly surrounded with a broad white half-collar which narrows above.

The species may be thus described:—

Boselaphus Derbianus. The Black-necked Eland or *Gingi-ganga*.

Pale reddish brown; neck, front part of the underside, the dorsal line, a spot on the front and hinder part of the upper part of the fore-leg ("and fetlock") black; broad half-collar on lower part of the neck, and fourteen or fifteen narrow perpendicular lines on each side of the body white; belly and front and hinder side of thighs whitish; crown reddish brown; withers variegated with black hairs.

Female? Neck blackish brown; rest like male.

Inhab. Western Africa, Gambia.

September 3, 1847.

NEW ORANG-OUTANG.

The Rev. T. S. Savage, who has been resident several years at Cape Palmas, Western Africa, informs me that he has obtained a new species of Orang at the Gaboon River; he has several crania and portions of the skeleton. These, together with a notice of its habits, will shortly appear in the 'Journal of the Boston Society of Natural History.'—J. O. W.

Preparing for Publication.

A Popular Introduction to the Study and Classification of Spiders *and* Mites. By Adam White, F.L.S.

The author, during the last eight years, has been accumulating notes on the above subject from books, manuscripts and personal observation. Spiders, "from the cradle to the grave," are paradoxical creatures; though naturally shy, they command attention by their works; their nests, webs and tunnels are not only

"Curiously made from their curious brains,"

but are fabricated also from their own resources. Spiders, from the Gossamer and Water-diver to the Tunneling Trapdoor family, have curious histories, and are endowed with instincts, which approach *reason* more closely than the instincts of perhaps any other class of animals:

"Weaving spiders, *come* ye here,
Come ye long-leg'd spinners, come,"

is to be one of the mottoes of the book.

Should a sufficient number of subscribers be found, it is proposed to publish the above work in five or six monthly parts at 2*s*. 6*d*. each, illustrated with cuts.

METEOROLOGICAL OBSERVATIONS FOR AUG. 1847.

Chiswick.—August 1, 2. Very fine: sultry. 3. Very fine: clear. 4. Very fine: densely overcast. 5. Rain. 6. Overcast. 7. Very fine. 8. Very fine: cloudy. 9. Cloudy: shower: clear. 10. Rain: showery. 11. Very fine. 12. Light clouds, with bright sun at intervals: clear at night. 13. Overcast: very fine. 14. Very fine: cloudy. 15. Cloudy: clear: lightning at night. 16. Rain. 17. Overcast. 18. Heavy rain. 19. Overcast: lightning at night. 20. Uniformly overcast: slight fog. 21. Slight fog: fine. 22. Overcast: rain: cloudy. 23. Cloudy: rain. 24. Cloudy: clear at night. 25. Very fine. 26. Overcast: very fine. 27, 28. Very fine. 29. Rain: very fine. 30. Very fine: cloudy. 31. Very fine: clear at night.

Mean temperature of the month	62°·68
Mean temperature of Aug. 1846	64 ·16
Mean temperature of Aug. for the last twenty years	62 ·32
Average amount of rain in Aug.	2·41 inches.

Boston.—Aug. 1. Fine: 2 o'clock P.M. thermometer 83°. 2. Fine: rain P.M. 3, 4. Fine. 5. Cloudy: rain P.M. 6. Fine. 7. Fine: rain P.M. 8. Fine. 9, 10. Cloudy. 11. Cloudy: rain early A.M. 12. Cloudy. 13, 14. Fine. 15. Cloudy. 16. Cloudy: rain A.M. and P.M. 17. Cloudy: rain P.M. 18, 19. Cloudy. 20—25. Fine. 26. Cloudy. 27. Fine. 28. Rain. 29. Cloudy: rain early A.M.: rain P.M. 30, 31. Cloudy.

Sandwick Manse, Orkney.—Aug. 1, 2. Bright: clear. 3. Bright: cloudy. 4. Cloudy: drops. 5. Bright: cloudy. 6. Cloudy: fine. 7. Rain: fine. 8. Cloudy: rain. 9. Cloudy: fine. 10. Cloudy: rain. 11. Clear: showers. 12. Cloudy. 13. Clear: cloudy. 14. Cloudy: fine. 15. Bright: fine. 16, 17. Clear: fine. 18. Cloudy: fine. 19, 20. Cloudy. 21. Showers: rain. 22. Cloudy: showers. 23. Clear: showers: cloudy. 24. Cloudy: rain. 25. Cloudy. 26. Cloudy: rain. 27. Cloudy: clear. 28. Bright: showers: clear. 29. Showers. 30. Rain: showers. 31. Bright: rain.

Applegarth Manse, Dumfries-shire.—Aug. 1. Fair, but cloudy. 2. Fair and fine: shower early A.M. 3. One slight shower. 4. Rain early A.M. 5. Rain nearly all day. 6. Frequent showers. 7. Heavy showers and sun. 8. Rain. 9. Cloudy: cool: dry. 10. Heavy rain. 11. Fine A.M.: rain P.M. 12. Rain nearly all day. 13. Fair and fine. 14. Very fine. 15, 16. Very fine: heavy dew. 17. Fine, though cloudy. 18. Very fine. 19. Still fine, but dull. 20. Heavy showers. 21. Slight showers. 22, 23. Fine: clear. 24. Rain P.M. 25, 26. Fine, though cloudy. 27. Fine, though cloudy: a few drops. 28. Fine, though cloudy: one slight shower. 29. Fair and fine. 30. Fine: one slight shower. 31. Fine harvest day.

Mean temperature of the month	57°·15
Mean temperature of Aug. 1846	61 ·2
Mean temperature of Aug. for twenty-five years...........	57 ·14
Average rain for twenty years	3·16 inches.

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. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. Aug.	Max.	Min.		9 a.m.	9 p.m.	9¼ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9¼ a.m.	8½ p.m.								
1.	30·018	29·944	29·50	29·82	29·81	29·71	29·74	91½	46	70	67	59	63	55	s.	calm	ssw.	wsw.	......	......	......	·25
2.	30·044	29·827	29·36	29·80	29·85	29·81	29·86	89	46	73	66½	52½	56	55	nw.	w.	wsw.	calm	......	......	......	......
☾ 3.	30·009	30·003	29·48	29·86	29·88	29·82	29·82	77	38	62	64½	41½	55½	53	n.	nw.	w.	w.	......	·15	......	......
4.	29·945	29·741	29·47	29·70	29·50	29·70	29·56	80	51	63·5	59	44	57	55	sw.	calm	s.	se.	·02	......	......	......
5.	29·640	29·504	29·17	29·41	29·39	29·44	29·47	72	54	59	59	51½	58	56	sw.	s.	sw.	se.	·28	......	......	·06
6.	29·733	29·505	29·10	29·49	29·63	29·62	29·66	69	47	63	67	50	59½	56	nw.	wnw.	sw.	calm	......	·09	......	......
7.	29·773	29·723	29·27	29·50	29·43	29·41	29·41	76	49	66	61	53	56½	55	sw.	w.	s.	calm	......	......	......	·17
8.	29·731	29·700	29·20	29·25	29·44	29·53	29·68	76	49	63	56	51	57	49½	sw.	wsw.	sw.	n.	·10	·10	1·40	......
9.	29·876	29·751	29·23	29·61	29·63	29·72	29·69	66	44	58	61	49	52½	53	w.	n.	sw.	calm	·02	......	......	·22
10.	29·881	29·808	29·40	29·60	29·63	29·58	29·60	65	48	55	60	43	55½	53	sw.	sw.	sw.	w.	·05	......	......	......
● 11.	30·112	30·072	29·57	29·85	29·80	29·82	29·76	79	61	59·5	65	46	59	56	sw.	s.	sw.	s.	......	·09	......	·27
12.	30·110	30·088	29·54	29·78	29·94	29·69	29·83	86	58	68	61	56	59½	56	sw.	sw.	sw.	wsw.	......	......	......	·30
13.	30·253	30·189	29·68	30·14	30·28	30·11	30·27	81	49	68	66	44½	57	54	ne.	nw.	w.	wsw.	......	......	......	......
14.	30·316	30·276	29·84	30·32	30·30	30·37	30·40	79	52	65	68½	41	58	55½	ne.	ne.	s—e.	s.	......	......	......	......
15.	30·222	30·163	29·78	30·31	30·24	30·35	30·32	80	56	66	66½	45½	57½	54	ne.	e.	e.	s.	·32	......	0·60	......
16.	30·088	30·040	29·67	30·21	30·15	30·24	30·17	68	61	63	68½	46½	59	56	ne.	nnw.	ne.	w.	·05	......	......	......
17.	30·044	30·040	29·58	30·09	30·18	30·27	30·31	71	60	63	71	46	56	52½	ne.	n.	ne.	w.	·34	·79	......	·13
18.	30·101	30·082	29·63	30·20	30·18	30·32	30·26	85	62	65	66	55	58½	55	ne.	nne.	n—s.	w.	·10	·02	......	......
☽ 19.	30·119	30·016	29·67	30·14	30·01	30·14	29·95	69	55	64	71	47½	56½	57	ne.	n.	sw.	wsw.	·05	......	......	......
20.	29·971	29·895	29·54	29·90	29·80	29·75	29·68	72	49	65·5	70½	46	56½	53	ne.	calm	sw.	w.	......	......	......	......
21.	29·911	29·749	29·43	29·78	29·40	29·72	29·31	82	54	66·5	62	49	55	54	sw.	e.	sw.w.	ese.	......	......	......	·08
22.	29·763	29·666	29·17	29·34	29·66	29·06	29·66	68	43	66	61	51	55½	46	sw.	calm	w.	n.	·09	......	......	·49
23.	30·060	29·886	29·48	29·97	30·05	29·98	30·07	61	46	56	62½	41	51	50	ne.	calm	sw.	w.	·01	......	0·07	·13
24.	30·124	30·075	29·70	30·10	30·07	30·07	29·96	65	49	59	61½	37½	56	54	ne.	n.	w.	se.	......	......	......	·09
25.	30·113	30·071	29·68	29·95	30·02	30·00	30·07	74	50	59	61½	50	56½	55	ne.	calm	sw.	w.	......	......	......	·11
○ 26.	30·227	30·146	29·69	30·10	30·12	30·11	30·06	72	43	62	63½	48	60	57	w.	calm	sw.	calm	......	......	......	·03
27.	30·297	30·254	29·75	30·11	30·11	29·97	30·01	81	46	67	69	56½	63½	56½	n.	calm	sw.	wsw.	......	......	......	·41
28.	30·305	30·197	29·77	30·20	30·12	30·09	30·10	81	55	63	69	49	57½	54	ne.	calm	sw.	w.	......	......	......	......
29.	30·145	30·097	29·64	30·10	30·09	30·07	29·98	75	44	62	65	50½	55	54	nw.	e.	sw.	w.	·06	·16	......	·04
30.	30·065	29·976	29·49	29·90	29·78	29·80	29·73	69	53	57	59½	51	55	54	w.	calm	nw.w.	w.	·01	·06	0·16	·35
31.	30·009	29·951	29·48	29·88	29·83	29·81	29·56	67	42	61·5	65½	51	54½	53	nw.	nw.	w.	s.	......	......	......	·07
Mean.	30·064	29·949	29·51	29·884	29·881	29·873	29·869	75·04	50·32	63·1	64·3	50·1	57·00	54·09					1·50	1·46	2·23	3·20

THE ANNALS

AND

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No. 134. NOVEMBER 1847.

XXVII.—*Notes on the Habits of certain Exotic Spiders.* By ARTHUR ADAMS, late Assistant Surgeon of H.M.S. Samarang.

"Ut araneoli, tenuem formavimus orsum."—Virgil, Culex, v. 2.

SPIDERS are among the most artful of created creatures; their whole life consists of one continued course of craft and stratagem, whether they sneak about on the surface of leaves, as green as their own emerald bodies, and surprise the poor flies that venture to approach within the range of their fatal spring; whether they gloomily lurk in holes, "specus ipsa qua concameratur architectura!"—or under the shade of dingy tents, "contra frigora quanto villosior!"—and spring upon insects that chance to pass their door, "cum vero captura incidit, quam vigilans et paratus ad cursum!"—whether they lie supine in the broad daylight, motionless in their wide-spread treacherous toils, and, having seen their victim fairly entangled, wrap him up in a winding-sheet of their own manufacture; or whether, simulating the surface of the ground on which they live, they course their prey with untiring assiduity, and, having run it down, suck its blood with tiger-like ferocity. Spiders are the originators of spinning and weaving, and have been pressed into the service of the manufacturers of silk and satin, together with those

"Spinning worms
That in their green shops weave the smooth-hair'd silk,"

and, more particularly on account of their habits, deserve to excite more interest than they meet with. Unheeded, or regarded with repulsive loathing by the "cui bono?" people of the present generation, spiders have adorned the page of the poet and philosopher in more ancient times. Has not Ovid sung the misfortunes of that Lydian maiden, daughter of Idmon, who, proud of her talent in the art of weaving, dared to challenge even Minerva herself, and who for her presumption was changed by the jealous goddess into a spider—ARACHNE?

> "Fitque caput minimum; toto quoque corpore parva est;
> In latere exiles digiti pro cruribus hærent;
> Cetera venter habet; de quo tamen illa remittit
> Stamen, et antiquas exercet aranea telas *."

Virgil, in enumerating the depredators of the bee-hives, such as lizards, cockroaches, hornets and moths, has mentioned the curious fact that

> "......... invisa Minervæ
> Laxos in foribus suspendit aranea casses †."

Another poet no less distinguished, Lucretius, in alluding to the minute objects which our senses fail to detect on ordinary occasions, enumerates among other things the slight aërial films of the gossamer spider:—

> "......... neque aranei tenuia fila
> Obvia sentimus, quando obretimur euntes ‡."

Julius Obsequens, in his work on Portents and Prodigies, observes that the standards of the legion, which had been left by Pansa for the protection of Rome, seemed to have been bound round or "netted over" with spiders' webs, which, in that age of superstitious credulity, was regarded as an evil omen. In the days of Pliny the motions of spiders were watched as being sure prognostics of the state of the weather, as they are indeed in our own day,—

> "Multa aranea imbrium signa sunt."

Pliny speaks admiringly of the astute cunning of the spider when he observes his craft in keeping a little aloof from the centre of his toil, "quam remotus a medio aliudque agentis similis!" and concealed in such a manner "ut sit necne intus aliquis, cerni non possit!" The Roman naturalist doubtless here alludes to those sedentary Arachnidans to which Walckenaer has given the name of "Tapitèles." Pliny considers these insects well-worthy to be studied: "Araneorum natura, digna vel *præcipue* admiratione."

In the woods of Singapore I made a capture of a very large and handsome species of *Nephila* which I do not find described. The thorax is covered with a rich golden pubescence; the terminal half of the palpi is deep black, the penultimate half red above and yellow beneath; the chelicera are large and shining black; the abdomen has a black band at the anterior part, and posteriorly, and on the sides, large bright patches of yellow; the cephalothorax, where not hid by the silky hairs, is dark green

* Ovid, Metamorph. lib. vi. v. 142.

† Georg. lib. iv. v. 246.

‡ Lib. iii. v. 384.

with yellow striæ; the legs are black, with bright yellow rings at the joints, and the thighs, on the under surface, are bright yellow; the eyes are black and shining. This species, which, from its beauty, might be named *Nephila ornata,* constructs a very large, strong, geometrical web, stretched vertically between low bushes.

At the island of Ternati I made a capture of a large and splendid undescribed species of *Nephila,* which spins a very large strong web among the bamboos. The body is liver-coloured, with a silver horse-shoe mark; the thorax is covered with a downy, hoary, pubescence; the shanks of the tibiæ of the two first pairs of legs have a broad yellowish white band; the other legs are black.

In the island of Panagatan I made a capture of another species of *Nephila,* which I also consider as undescribed. The head is blackish; thorax silvery with black spots, and covered with a downy pubescence; legs chestnut-red, with the last joints black. The body is of a light emerald green with numerous bright yellow spots; the under surface is dull black. It forms a large, strong, geometrical web, spreading from bush to bush, in the centre of which it remains motionless with legs stretched out and the head downwards.

Among the Bashees or Batani group of islands, spiders of the genera *Nephila* and *Acrosoma* are numerous. There is one very large and showy species of the latter genus, which has a very strange habit when alarmed of suddenly erecting the second pair of legs with a rapid jerking motion, while, at the same time, he gathers together all the other members, and shakes his web violently, in order, apparently, to intimidate his adversary, or perhaps to ascertain the strength of his position. If, however, the cause of alarm be continued, he coils himself up, while all his extremities become rigid, as in death, and then, falling to the ground, he remains like a small inanimate brown ball until the enemy has departed. His cunning never forsakes him even in his greatest emergency, for he continues all this while actually to maintain a communication between himself and his web by means of a fine thread, fixed at one end to the centre of his cunningly wrought toil, and at the other attached to the spinneret at the extremity of his abdomen. By means of this attenuated and invisible cord he will climb up again when the danger is over, and resume his old-established pastime of rapine and bloodsucking. Like some unfledged animals with no more than two legs, these spiders are the veriest cowards when menaced by those stronger than themselves, and the most unsparing tyrants when those of a weaker nature are within their power.

Among the islands of the Maiacoshima group I observed a spider, belonging to the genus *Attus,* among the thousands of dead

Truncatellæ that fill the holes and corners of the rocks in every part of these islands, which forms a convenient abode in these small shells, lining them carefully with a fine silken tapetum. Near the sea-coast a minute species of *Pagurus* was found occupying these little truncated univalve shells, crawling about by thousands. Our spider, however, is unable to move about with its borrowed house in the manner of those pirate crabs, but either sits sedentary in his den, or ventures forth at intervals on his predatory hunting excursions.

Among the rocks of a small islet near Quelpaart, the largest of the Korean islands, there is a species of spider which forms a very ingenious dwelling which may be compared to that of the swallow, whose nest affords such an important article in the gastronomy of wealthy Mandarines, the *Hirundo esculenta*, but adhering to the rough surface of the rock in a reversed position, resembling a watch-pocket upside down. It is composed of a substantially woven silky material, and firmly secured by means of a glutinous secretion. The ingenious little builder and proprietor of this strange castle in the air lets himself down by a rope-ladder, or to speak less fancifully, by a fine spun web, which he manufactures for the purpose out of the substance of his body as required, he himself serving the purpose of a weight, "deducit stamina, ipso se pondere usus," as Pliny observes in his chapter 'De Araneis.'

The spiders of the Maiacoshima islands exhibit some very remarkable forms. There is a curious *Epeira* with the dorsal surface of the abdomen furnished with a radiated crown of hard pointed processes, and the epidermis richly painted with brown and gold. It spins a large and regular web in every brake and bush. Another large and singular spider, with long slender legs and an elongated body, black, and marked with yellow lunules and patches, crawls among the foliage of the trees in the low woods that occur in some parts of Pa-tchung-San. Another species of the same genus is altogether black. I noticed this kind also in the Bashee group.

The *Thelyphonus caudatus*, or a closely-allied species, a curious osculating link between the Scorpions and Tarantulas, is not uncommon in the islands of the Maiacoshimas. It remains generally concealed under logs of wood and under stones, and seems to love dark damp forests as the seat of its depredations, living in the society of the larvæ of glow-worms, the scorpions, the *Scolopendræ*, and a dingy-coloured species of *Blatta*. It is slow in its movements, and when alarmed raises its stingless tail in a threatening manner, but never attempts to use its cheliceræ either as organs of aggression or of defence.

Never have I been better amused than when observing in the forests of Mindanao the habits of the extraordinary spiders that abound there, to figure and describe the varied forms of which would require the pencil of Abbot, and many years of unwearied application.

The bodies of the *Epeiræ* seen in the tropics are often most splendidly ornamented, I might almost say illuminated, for many of them remind you of the gaudy ancient missals painted by monks in the dark ages. You may have white figures on a red ground; red, yellow and black, in alternate streaks; orange marbled with brown; light green with white ocelli; yellow with light brown festoons, or ash-coloured and chestnut bodies with crescents, horse-shoes, Chinese characters, and grotesque hieroglyphics of every description. Then again the shape of their bodies is endless in variety; they are round or oval, flattened or globular, angular, tuberculated, lobed, spined, or furnished with hairy tufts. These examples,

> "Whose shapes would make them, had they bulk and size,
> More hideous foes than fancy can devise,"

taken at random during one or two excursions in the woods, will tend to show what a wide field is open to the naturalist in these regions of the sun, provided he has nothing of more importance to engage his attention than the investigation of apterous insects.

In the forests about Calderos in Mindanao, I collected some splendid species of gold- and silver-marked *Tetragnatha.* One, which might be named *T. nitens,* has a dark, shining brown thorax, and a glittering silver body with five black spots; the legs banded with dark brown, and the under side light black. It constructs a large, ingenious, symmetrical web, and drops, when touched, to the ground, taking care, however, at the same time, to suspend itself by a web, by means of which it ascends again when the enemy has departed. In the centre of its web it spins concentric circles and thick mazes of a fine yellow colour, and often of very complicated devices. When it falls to the ground it folds up its legs and feigns death, all its members being perfectly rigid.

The *Tetragnatha* all have a remarkable habit of dividing their eight legs, as they cling, head downwards, to the centre of their toils, throwing out four directly forwards and four directly backwards. Some species however have the third pair of legs extended straight out in a lateral direction. Another common species had a body mottled with dark brown and covered with white markings; legs brown, banded; the thorax burnished bright green with darker markings. I have named it provisionally *T. refulgens.* Numbers of the genus *Theridion,* of a black colour, were running actively about among the dry dead leaves that strewed the ground, and some handsomely-coloured species were discovered crouching among the foliage of the trees. One was marked like the *T. Sisyphus* of Hahn (tab. 58. fig. 132), and another large-sized species was of a bright emerald green. The *Attus formicoides*, Walckenaer, or an allied species, was basking on the dead leaves in the sunny spots; and numerous pretty species of *Salticus*, allied to *S. crux* (Hahn, tab. 17. fig. 52), but of much larger dimensions, were common spiders. A species of *Attus*, allied to *formicoides*, which may be called *splendens*, was taken here: it was of a brilliant metallic green gold with the under surface fine metallic purple; the legs banded with light brown and burnished green. It was springing about the foliage of the low trees.

Another *Attus* was of a shining black, with several bright ultramarine spots on the abdomen, and light brown legs banded with darker brown. Numbers of black-coloured *Theridia* were running about over the dead leaves, simulating, at a little distance, so many odd-shaped ants: numerous other species of this genus, which were seen living among the flowers and foliage of the trees, had their abdomens variegated with beautiful colours. One species, with a hairy body and legs, and shining chestnut-coloured chelicera, runs quickly when pursued, and uses those organs in self-defence. Its body is of a dark olive-brown, and it appears to love dark nooks and holes of the bark of trees, and frequently hangs suspended from the under surface of the leaves.

I observed another species, which knew it was watched, place itself upon a diseased leaf, where it remained quite stationary until after I had taken my departure; and had I not seen the sidelong movement of the cunning little creature in the first instance, I should not have been able to distinguish its body from the eroded surface of the partially decayed leaf. Those that live among the foliage and flowers are vividly coloured, and many flies and other insects are no doubt attracted towards the treacherous forms of these spiders by reason of their bright and gaudily-tinted bodies. I have seen the abdomen of one marked with black, yellow and crimson, three powerfully-contrasted colours. Others are green and actually reticulated like the veined surface of a leaf, with the midrib running down the centre and the secondary nervures proceeding outwards from each side; the bodies of others resemble the splendid variegated blossoms of the different sorts of Calceolarias grown in our gardens.

Several timid, soft, retiring, long-legged *Pholci*, with fawn-coloured bodies and semitransparent red-brown legs covered with long hairs, formed in many parts large loose webs among the rotten wood and leaves that strewed the ground. The legs of these Arachnidans appear too weak to support their bodies in running, therefore they resemble their aquatic marine analogues the *Pycnogonidæ,* which remain stationary among the tangled and thread-like Keratophytes, which constitute the webs of those spider-like Crustaceans, and thus watch cautiously for prey, and, when it is caught in their toils, consume it at their leisure, so making up by cunning and persevering watching for the want of that strength and force possessed by some of their consimilars. Most of the Arachnidans would appear on a careful comparison to have very distinct analogies with the families of Crustaceans*.

The nimble-limbed *Dolomedes,* that run after their prey and catch them by swiftness of foot rather than by stratagem, have slender legs, and living on the ground, are generally of dingy colours; with the exception, however, of those very large and powerful species, which, if not rendered somewhat conspicuous to the sight of other insects, might do too much damage to the tribes they are destined to keep in check. Most of these, therefore, have the thorax and abdomen margined with a light colour that contrasts strongly with that of their bodies. The *Saltici* generally resemble more or less the colour of the places they inhabit. I noticed a species, among the dense thickets, formed by *Abrus precatorius* and other trees, with a black abdomen, marked on each side with dull scarlet,—curious as being the colours of the seeds of *Abrus,* which are called by children "blackamoor beauties;" those species that live on the barks of trees are mottled gray and brown, and those which you find upon the ground are altogether black and dingy-coloured. How admirably, in these examples, is shown the fitness of things, maintained even between organisms usually deemed so abject, and the domains they owe to ever-careful Nature! It matters not much whether we say the place determines the nature of the animal, or whether the animal is adapted to the place, although it is more pleasing to an observer of nature to trace the harmonies and adaptations to an intelligent foresight, like the good St. Pierre, than to make them merely the necessary results of a physical arrangement of the earth's surface, like the ingenious author of the 'Vestiges of the Natural History of Creation.'

In a beautiful wood behind Calderos in Mindanao, I observed a dingy little species of spider of the genus *Clubiona,* concealing itself in very snug retreats, formed out of a dead leaf rolled round

* The Baron Walckenaer has even compared one family of *Philodromi* to "Crabes longipèdes," and has named a subdivision of *Thomisus* "Crustacéides," because their bodies are covered with rugosities like those of some Crustaceans. To men fond of "quinary" theories the Arachnidans would offer a rich treat, and innumerable analogies might be traced with much amusement, if not with much instruction.

in the shape of a cylinder, lined with a soft silken tissue, and closed at one end by means of a strong-woven felt door. When hunted it was amusing to see the frightened little creatures run for protection into their tiny castles, where they would doubtless be saved from the attacks of birds owing to the leaves not being distinguishable from others that strew the ground.

During an excursion I made into the interior of the island of Basilan, I observed the ground in one part of the forest near Passan literally overrun with a small, black, agile species of *Lycosa,* many of which had a white, flattened, globose cocoon affixed to the ends of their abdomens. It was most amusing to watch the earnest solicitude with which these jealous mothers protected the cradles of their little ones, allowing themselves to fall into the hands of the enemy rather than be robbed of the silken nests that contained their helpless progeny. All spiders are gifted with the same "storge," or maternal instinct, and resort to various methods for the purpose of securing their cocoons. The *Theridion,* when a seizure of the precious burden is threatened, tumbles together with it to the ground and remains motionless, guarding it with solicitous anxiety; and the *Thomisus* covers the receptacle of its offspring with its body, and when robbed of it wanders about disconsolate. Did the minute size of these poor spiders admit of the same psychological dissertations, anecdotes as interesting, no doubt, as those told of the she-bear when robbed of her cubs, or the violent emotions of the lioness when disturbed in her maternal duties by the hunters in the jungle, might be recorded, proving how strong is the love of offspring even in animals the most insignificant.

In Borneo, as among the islands of the Philippine Archipelago, spiders are also very numerous. In consideration of their apparently helpless condition and the soft nature of their integuments, nature, always inclined to protect the weak and helpless, has given the spiders a multitude of wonderful instincts, by means of which they are enabled to defend themselves from injury, provide themselves with food, and furnish safe retreats for their tender progeny. They spin their toils of cunning device, and even powerful insects, armed with formidable stings, are made captives with impunity, despite their struggles to escape the captor. These spiders' webs generally attract the attention of travellers, and certainly, in some parts of the forests of Mindanao, Borneo and Celebes, there is great and wonderful diversity in the form and construction of these ingenious and delicately-woven nets. Many have black webs, some have white, others brown, and in Mindanao I have observed toils formed of perfectly yellow threads. The nets of the great species of *Nephila* which abound in equatorial regions frequently stretch across the path from bush to bush, and prove very troublesome to the naturalist while threading the thickets where they are numerous.

The imagination can scarcely conceive the bizarre and fantastic shapes with which it has pleased nature to invest those hard-bodied spiders called by naturalists *Acrosoma*. They have large angular spines sticking out of their bodies, in every kind of fashion, perhaps intended as some sort of defence against the soft-billed birds, which doubtless would otherwise make dainty meals of these Arachnidans, exposed as they are, temptingly suspended in mid-air, on their transparent webs in the forest glades. Some are protected by these long spines to such a degree that their bodies resemble a miniature "chevaux de frise," and could not by any possibility be swallowed by a bird without producing a very unpleasant sensation in his throat. One very remarkable species (*Gasteracantha arcuata*, Koch) has two enormous, recurved, conical spines, proceeding upwards from the posterior part of the body, several times longer than the entire spider.

The *Drassi* are gloomy spiders, haunting obscure places, and their garb is dark-coloured and dingy, in accordance with their habits: they are mostly pale brown, black, dull red or gray.

The *Thomisi* are varied in their colour, in harmony with their usual abiding-places: thus those that spend their lives among the flowers and foliage of the trees are delicately and beautifully marked with green and orange, black and yellow. One species, which I have named *T. virescens*, simulates the vegetation among which it lives, is not agile in its movements, but drops, when alarmed, among the foliage. It is of a pale, delicate, semitransparent sap-green, with the eyes and chelicera red. There is a large mark on the surface of the abdomen, beautifully variegated with yellow, pink, and black, and margined with dead-white spots. The under surface is green in the middle and dead-white on either side, and the spinneret is pink.

I remember one day while living at Sarāwak in Borneo, I was much amused with a struggle between a house-lizard (*Ptyodactylus Gecko*), a little domestic reptile which frequents the dwellings of the Malays, and a large species of *Lycosa*; the "Chichak," as the natives term their familiar Gecko, proved victorious, and succeeded in swallowing the spider, whose enormous legs, protruding from the lizard's mouth, gave this strange compound animal the aspect of some wondrous Octopod. Pliny records the fact however that spiders are in the habit of capturing small lizards, first entangling them in their webs and afterwards destroying them with their jaws,—a spectacle, he observes, worthy of the amphitheatre!

XXVIII.—*On the Fossil Botany and Zoology of the Rocks associated with the Coal of Australia.* By Frederick M'Coy, M.G.S. & N.H.S.D. &c.

[Continued from p. 236.]

[With nine Plates.]

(*Lamellibranchiata.*)

Pecten squamuliferus (Mor.).

Common in the fine, olive-coloured schists of Wollongong, N. S. Wales.

Pecten ptychotis (M'Coy). Pl. XIV. fig. 2.

Sp. Char. Ovato-orbicular, width very slightly exceeding the length, convex, smooth; ears unequal, posterior one obtuse-angled, undefined, anterior ear narrow, square at its extremity, divided by a deep, acutely angular sinus, from the body of the shell; surface smooth, except the extremity of the anterior ear, which is longitudinally plicated.

It is only by the plication of the extremity of the anterior ear that this can be known from the *P. variabilis* (M'Coy) so abundant in some of the carboniferous shales of Ireland. Length 4 lines, width one-fourth of a line more.

Common in the shale of Dunvegan, N. S. Wales.

Pecten sub-5-lineatus (M'Coy). Pl. XVII. fig. 1.

Sp. Char. Truncato-orbicular, convex, equilateral, beaks tumid; ears large, nearly equal, flattened, the posterior one slightly pointed and separated at the margin from the body of the shell by a deep rounded sinus; anterior ear broad, nearly square, with a slightly convex margin; surface of both ears and body of the shell marked with a few obtuse concentric waves of growth, and radiated with rather coarse narrow rounded ridges, those of the ears being close and equal, while those of the body are rather distant from each other, the interspaces being flat; about twenty-five proceeding directly from the beak to the margin, where they are about two lines apart; between those at a short distance from the beak are interpolated an equal number of rather thinner ones, which again receive nearer the margin two fine striæ between each of them and the adjoining primary ridge.

The striation of this fine species resembles that of the *P. quinquelineatus* (M'Coy, Syn. Carb. L. Foss.); that is to say, near the margin and towards the middle of the shell there are five striæ between each pair of primary ones, the middle or odd one of the five nearly equalling the primary ridges in thickness. The present fossil has however much finer striæ than the Irish species alluded to, and the arrangement is much less definite, becoming confused in size and number towards the sides; it is also distinguished by its greater convexity. Length 2 inches 9 lines, width the same.

Rare in the greenish, fine sandy, beds of Harper's Hill, N. S. Wales.

Avicula tessellata (Phil.).

I cannot distinguish the specimens occurring in the soft greenish schists of Dunvegan, N. S. Wales, from those in the precisely similar shale at the base of the carboniferous series at Lisnapaste in the north of Ireland.

Pterinea macroptera (Mor.).

Rare in the white rock of Port Arthur, V. D. Land.

Eurydesma cordata (Mor.).

Common in the arenaceous limestone of Arthur's Hill, N. S. Wales.

Inoceramus Mitchellii (M'Coy). Pl. XIV. fig. 1.

Sp. Char. Longitudinally ovate, one-fifth longer than wide, slightly oblique, inflated; hinge-line oblique, nearly equalling the width of the shell, forming a slightly compressed wing; beaks pointed, prominent, incurved, close to the anterior end; anterior side nearly straight, abruptly subtruncate; surface with numerous strong, concentric, irregular wrinkles of growth.

The hinge-margin of this species is much thickened, which removes it from *Posidonia,* while, as in many of the German cretaceous *Inocerami,* it is not possible to observe any traces of the transverse ligamentary pits, nor can we be sure whether those species possessed them or not; meanwhile I shall leave the present species in the same genus as its obvious allies alluded to; and even if future research should prove that ligamentary pits did not exist, we should form a distinct genus for those species, which, like the present and the *I. vetustus* (Sow.) of the mountain limestone, are distinguished from the true semimembranous *Posidoniæ* of the lias and palæozoic shales with which they have been confounded, by their thick shells, general form, and thickened hinge-margin. Length 2 inches 3 lines, width 1 inch 9 lines, thickness about $1\frac{1}{2}$ inches.

Common in the sandstones of Glendon and Wollongong, N. S. Wales.

Dedicated to Sir T. Mitchell, one of the first to make known the existence of fossils in those rocks.

Pleurorhynchus australis (M'Coy). Pl. XVI. fig. 4.

Sp. Char. Alæform or transversely subtrigonal, gibbose, length nearly two-thirds the width; posterior side forming a compressed narrow wing; anterior face obliquely subtruncate, convex, divided into three nearly equal tumid compartments by two impressed furrows from the beak; body of the shell and posterior side radiated with rather coarse irregular ridges from the beak; anterior face finely striated longitudinally.

This resembles the *P. minax* (Phil.) in the striation of the anterior face being so much finer than that of the middle or posterior parts of the surface; it differs in having the anterior face not only much more finely striated, but divided into three parts by distinct furrows; while from the *Cardium irregulare* and *C. strangulatum* (Kon.), which have the anterior face so divided, but smooth, it is distinguished by this latter character, and also by wanting the mesial strangulation of those species. Length of small specimen 8 lines, width 1 inch.

Not uncommon of larger size in the sandy schists of Wollongong, N. S. Wales.

Allorisma curvatum (Mor.).

Common in the sandstones of Darlington, Wollongong and Glendon, N. S. Wales.

Orthonota compressa (Mor.).

In the calcareous schists of Harper's Hill, N. S. Wales.

Orthonota costata (Mor.).

Common in the sandstone of Wollongong, N. S. Wales.

Modiola crassissima (M'Coy). Pl. XV. figs. 2 & 3.

Sp. Char. Transversely ovate, very gibbose; beaks small, nearly terminal; anterior side forming a small rounded lobe beneath the beaks, separated from the body of the shell by a strong sinus in the ventral margin, from which a shallow concavity runs towards the beak; posterior side wide; hinge-margin elevated, four-fifths the width of the shell in length, compressed, angulated, posterior end broadly rounded; ventral margin convex; shell very thick; surface with a few concentric waves of growth, and marked towards the posterior inferior angle with a few distant obsolete ridges extending obliquely from the beaks.

Length 5 lines, width 1 inch 7 lines, height of cardinal angle 11 lines (occasionally $3\frac{1}{2}$ inches wide).

Not uncommon in the schists of Harper's Hill, N. S. Wales.

Pachydomus carinatus (Mor.).

Abundant in the fine sandy schists of Wollongong, N. S. Wales; more rare in the white rock of Port Arthur, V. D. Land.

Pachydomus globosus (Sow. sp.).

Common in the sandstone of Wollongong, N. S. Wales.

Pachydomus gigas (M'Coy). Pl. XVI. fig. 3.

Sp. Char. Transversely oval, length two-thirds of the width, very gibbose, inflated; beaks very large, incurved, placed in about the anterior third of the shell; posterior side obliquely truncated, the angles rounded; posterior slopes compressed, flattened; posterior ridge obtusely rounded, almost disappearing before reaching the posterior inferior angle; anterior side small, narrowed, with a slightly marked sinus between it and the convex ventral margin; surface marked with small concentric cord-like sulci and ridges.

This is distinguished from the *P. globosus* (with which Mr. Morris seems to include it) by its greater width in proportion to the length, by the flattened, compressed sides of the posterior slopes and the more oblique truncation of the posterior end, and the smallness and narrowed appearance of the anterior side, arising from a slight, but always perceptible, sinus between it and the convexity of the ventral margin. The shell is very thin in this species, which makes a near approach to *Leptodomus* (M'Coy) in all its characters. Length $4\frac{1}{2}$ inches, width 6 inches 3 lines (often much larger).

Common in the fine sandstone of Wollongong, N. S. Wales.

Pachydomus sacculus (M'Coy). Pl. XIV. fig. 5.

Sp. Char. Subquadrate or satchel-shaped, length nearly equalling the width, thickness two-thirds the length; gibbose towards the beak, compressed towards the ventral margin; beaks large, nearly central, strongly incurved towards the anterior side; posterior side forming a short, compressed, rectangular wing; anterior side very obliquely truncated; anterior and posterior slopes abruptly rounded, and the angles formed by their junction with the ventral margin equal, broadly rounded and nearly equidistant from the beak; abdominal margin broadly concave, giving the middle of the valves a flattened, slightly hollowed appearance; shell very thick, foliaceous; surface with a few obtuse concentric elevations and numerous irregular concentric lines of growth.

Length $4\frac{1}{2}$ inches, width 4 inches 9 lines. I am uncertain whether the specimen figured is from Black Head or Wollongong, N. S. Wales.

Pachydomus ovalis (M'Coy). Pl. XIV. fig. 4.

Sp. Char. Transversely oval, length five-sixths of the width, compressed, thickness rather more than two-thirds of the length; beaks tumid, nearest the anterior end; anterior and posterior ends oval, rounded, the latter obscurely angulated at end of hinge-line; ventral margin regularly convex; surface marked with thick, unequal, cord-like concentric striæ; lunette deep ovate; ligament external, large.

The anterior and posterior adductor impressions are large and oval; the impression of the retractor of the foot very small, lunate, just over the anterior adductor; pallial impression with a small rounded sinus before joining the posterior adductor. Distinguished from the *P. lævis* (Sow.) by the coarse concentric lineation of the surface. Length 1 inch 8 lines, width 2 inches.

Very common in the sandstone of Wollongong, N. S. Wales.

Pachydomus? pusillus (M'Coy). Pl. XVI. figs. 1 & 2.

Sp. Char. Small, ovato-orbicular, width slightly exceeding the length, globose, thickness four-fifths the length; beaks very large, tumid, much incurved into the anterior cordiform space, which is unusually deep; anterior side short, rounded; posterior end rounded; ventral margin very convex; ligament very large, external; muscular impressions large, anterior deep oval, posterior impression shallow, lunate, pallial impression entire; shell thick, surface rough with strong concentric imbricating lines of growth.

This curious little species resembles an *Isocardia*, but from the great size of the external ligament, thick shell and general habit, I have placed it in the present genus, but not without doubt, from its diminutive size and peculiar proportions. Length 10 lines, width 11 lines.

Common in the sandy schists of Wollongong, N. S. Wales.

Cardinia (?) *exilis* (M'Coy). Pl. XV. fig. 1.

Sp. Char. Transversely ovate, compressed, cuneiform, slender, twice as wide as long; dorsal margin convex; beaks small, one-sixth of the width from the anterior end; posterior end attenuated, obtusely pointed; anterior side small, rounded; anterior half of the ventral margin convex, posterior half slightly concave; surface with strong irregular imbricating laminæ of growth and close intervening imbricating striæ.

This reminds us of the *Unio* (*Cardinia*) *acuta* (Sow. sp.) of the European coal-fields, but is distinguished by its greater thickness, more clavate form and arched dorsal margin. The muscular and pallial impressions correspond with those of the lias species of the genus generally, but the dental impressions are obscure. Length 1 inch 1 line, width 2 inches 2 lines.

From the sandstone of Wollongong, N. S. Wales.

Notomya (M'Coy), new genus. (Etym. *νότος, auster*, and *Mya*.)

Gen. Char. Shell transversely ovate, equivalve, inequilateral, compressed, greatest thickness behind the middle of the shell; gaping slightly at both ends; beaks small, compressed; cardinal slope not distinguished from the sides of the shell; shell thick, surface concentrically lineated; ligament external, large. Cast: a wide shallow furrow runs obliquely from the beak about half-way towards the ventral margin; a shallow spoon-shaped hollow extends from the beak to the impression of the posterior adductor muscle, bounded by a low ridge on each side in each valve; traces of a simple cardinal tooth beneath the beak of the right valve; muscular impressions deep; anterior adductor large ovate, not attenuated above; posterior adductor broadly lunate; retractor of the foot small, oval, immediately over the anterior adductor; pallial impression with a small rounded sinus before joining the posterior adductor.

It is with those Muschelkalk *Myacites* of Schlotheim and Bronn, and such like forms, of which M. Agassiz, in his 'Etudes Critiques sur les Mollusques Fossiles,' has composed his genus *Pleuromya*, and with those forming his genus *Gresslya*, that the present fossils have the strongest affinity. They are however perfectly distinct from those essentially Jurassic and Triassic types, by the small size of the sinus in the pallial impression. In minor characters it differs from the *Gresslyas* in the small size of the beaks, and the more compressed form of the sides (the greatest thickness in *Gresslya* being always before the beaks, and gradually diminishing towards the posterior end, while the greatest thickness in *Notomya* is *behind* the beaks, depriving them of the characteristic wedge-like form of *Gresslya*). The present genus is destitute of the cardinal ridge in the right valve, so remarkable in *Gresslya*, having in its place a shallow, attenuated, ovate hollow, bounded by two obscure ridges in each valve, thus approaching *Pleuromya*. The shell also is much thicker than in the above genera, and the impressions of the muscular and pallial scars much deeper and more strongly marked in consequence; the impression of the anterior adductor is pear-shaped, pointed and attenuated above in *Gresslya*, but simply oval in *Notomya*. The *Pleuromyæ* differ in nearly all the same points as *Gresslya* from the present genus (except the cardinal ridge), and differ besides in the elevation or upward curvature of the cardinal line and the convexity of the posterior two-thirds of the ventral margin corresponding with it, those parts being oppositely inclined in *Notomya*. The oblique mesial or post-mesial furrow from the beak in the cast of *Notomya* does not exist in the other two genera, but in *Pleuromya* there exists a somewhat similar furrow, but different in position, arising *in front* of the beaks, and extending directly to the ventral margin close to the anterior end. *Cardinia* (Ag.), which somewhat resembles the present genus, is distinguished by its entire pallial impression and dental characters.

Notomya securiformis (M'Coy). Pl. XV. figs. 5 & 5 *a*.

Sp. Char. Transversely ovate, flattened; length two-thirds the width, thickness rather less than half the length; beaks small, flattened, rather more than one-third the width from the anterior end; anterior end narrowed, rounded; posterior end narrow, subtruncate, nearly square; anterior two-thirds of the ventral margin very convex, a shallow concavity in the posterior third; muscular impressions very large, anterior one deepest, ovate, posterior one shallow, broad, reniform; pallial scar strongly marked, parallel with the ventral margin as far as the anal angle, then a small subangular sinus before joining the adductor impression; retractor impression small, deep, narrow, oval; in the cast the oblique furrow from the beak towards the ventral sinus wide, shallow; remains of a cardinal tooth under the beak of the right valve.

Length 1 inch 6 lines, width 2 inches 2 lines, thickness 11 lines. The figures of this species display most of the generic characters. Sandstone of Wollongong, N. S. Wales.

Notomya clavata (M'Coy). Pl. XV. fig. 4.

Sp. Char. Transversely clavate; length two-thirds the width, evenly convex, greatest thickness towards the posterior half; beaks very small, compressed, rather more than one-fifth the width from the anterior end; anterior end very broad, evenly rounded; anterior third of the ventral margin very convex, middle portion widely concave; posterior end narrowed, obliquely subtruncate, rounded; muscular impression shallow, anterior large ovate, posterior broad lunate; retractor small, broad, oval; oblique longitudinal furrow from the beak deep, narrow above, widening nearly to the marginal concavity; impression of one simple cardinal tooth beneath the beak of the right valve; the long spoon-shaped hollow extending from the beaks to the posterior muscular impressions, and its lateral bounding ridges obscurely marked.

Distinguished from the *N. securiformis* by its broadly rounded anterior side, smaller beaks, thinner shell, and consequently more faintly marked ridges and impressions on the cast, and by the middle of the ventral margin being concave instead of very convex, and the sides evenly convex instead of flattened. Length 1 inch 6 lines, width 2 inches 2 lines. Common in the sandstone of Wollongong, N. S. Wales.

Besides the above, there is a third species of *Notomya* equally common in the sandstone of Loder's Creek, but of which none of the specimens were good enough to figure or describe; it has the strong mesial oblique furrow from the beak of the cast, small sinus in the mantle scar, and other characters of the genus, but differs from the preceding species in its regular oval outline, &c. It might be named *N. ovalis*.

Pullastra? striato-costata (M'Coy). Pl. XIV. fig. 3.

Sp. Char. Transversely oblong, depressed, nearly twice as wide as long, dorsal and ventral margins nearly parallel, anterior and posterior ends elliptically rounded; beaks rather large, one-third of the width from the anterior end; surface with about twelve strong angular ridges parallel with the margin; those ridges are finely striated in the direction of their length.

The striation parallel with the ridging distinguishes this from the *Pullastra bistriata* (Portk.) of the Irish carb. shale, and there being no flat space between the angular ridges, and its less width and straight ventral margin, distinguish it from the *M. scalaris* (Phil.) of Devonshire. Length 2 lines, width 3½ lines. Common in the shale of Dunvegan, N. S. Wales.

Venus? gregaria (M'Coy). Pl. XVI. fig. 5.

Sp. Char. Orbicular, compressed, evenly convex; beaks prominent, slightly nearer the anterior side; lunette deep ovate, smooth; external ligament short, prominent; surface covered with coarse rounded concentric striæ; margin crenulated within.

This pretty little species occurs gregariously in great numbers in some spots in the sandstone of Wollongong, N. S. Wales, principally as hollow casts, which at first sight resemble impressions of the *Atrypa decussata*. Length 4 lines.

(*Gasteropoda.*)

Euomphalus minimus (M'Coy). Pl. XVII. fig. 4.

Sp. Char. Greatest diameter one line; spire depressed, of three small whorls; basal whorl deeper than the spire, rounded, mouth wider than long; umbilicus small, rounded; surface smooth.

Common in the shale of Dunvegan, N. S. Wales.

Pleurotomaria subcancellata (Mor.).

In the fine calcareous sandstone of Loder's Creek, N. S. Wales.

Pleurotomaria Strzeleckiana (Mor.).

Common in the fine calcareous grits of Wollongong, N. S. Wales.

Pleurotomaria Morrisiana (M'Coy). Pl. XVII. fig. 5.

Sp. Char. Acutely conical, width four-fifths of the length; volutions four or five, each having a small double keel below the middle, and a slightly tumid margin to the sutures; no umbilicus; surface with fine close unequal striæ arched backwards from the suture to the keel. Width 4 lines, length scarcely 5 lines.

As the characters of this little species seem to have been already recognized and slightly alluded to by my friend Mr. Morris (in Count Strzelecki's work), I dedicate it to him. It is, as he observes, something like the *P. conica* (Phil.), but smaller and more elongate.

Abounds in some parts of the limestone of Black Head, N. S. Wales, and rare in the sandstone of Muree, N. S. Wales.

Platyschisma rotundatum (Mor.).

Abundant in the dark arenaceous limestone of Harper's Hill, N. S. Wales.

Platyschisma oculus (Mor.).

Common in the arenaceous limestone of Harper's Hill.

(*Pteropoda.*)

Theca lanceolata (Mor.).

Abundant in the dark arenaceous limestone of Black Head, N. S. Wales. I observe that, at the longitudinal furrows, the ends of the transverse sulci alternate with each other as in *Conularia*. Those longitudinal furrows are not noticed by Mr. Morris in his description of the genus and above-named species; but they exist, of the same number as in *Conularia*, one coinciding with the principal (? dorsal) ridge, two being placed a little on the (? posterior) side of the lateral angles, and one in the middle of the flat (? anterior) side. It is of importance to notice those obscurely marked furrows, as bringing more clearly to view the relations of the genus *Theca* with *Conularia*. The transverse sulci are crossed by very minute longitudinal striæ.

Conularia lævigata (Mor.).

Common in the fine gray micaceous sandstone of Black Creek, N. S. Wales, and in the limestone of Harper's Hill, N. S. Wales.

Conularia torta (M'Coy). Pl. XVII. figs. 9 & 10.

Very elongate-conic, diminishing in diameter at the rate of one line in two inches; section oval; lateral longitudinal channels only two (?), placed with a slight obliquity to the long axis of the shell, giving it a twisted appearance, being placed at the sides (or extremities of the short axis) of the oval section at the base, and being at the ends (or extremities of the long axis) of the oval section near the small end; sides very convex, without mesial furrow; transverse sulci coarse (about fifteen in half an inch), continued uninterruptedly across from one side-furrow to the opposite.

This extraordinary fossil seems to differ from all known *Conulariæ* in having but two instead of four longitudinal furrows (for although MM. D'Archiac and Verneuil give an oval section of their *C. Brongniartii* showing but two furrows, I suppose this to be erroneous, as it neither agrees with their description nor larger figure). This is distinctly seen in the small fragment here figured, as well as the uninterrupted passage of the transverse ridges from one oblique sulcus to that on the opposite side, and the undivided nature of the intermediate faces. The larger specimen figured is not so perfect, but shows the slow rate of increase. The transverse sulci are about as numerous as in the *C. lævigata*, but that species has four unequal, divided faces, and is, together with all the described species, so different as not to require a particular comparison. The oblique or twisted direction of the longitudinal sulci above-noticed, I find also to exist in the recent *Creseis spinifera* of the Mediterranean, so that what would otherwise seem an anomalous character of the present fossil, tends rather to strengthen the affinity between *Conularia* and the recent *Pteropoda*.

Not uncommon in the sandstone of Muree, N. S. Wales.

Conularia tenuistriata (M'Coy). Pl. XVII. figs. 7 & 8.

Sp. Char. Quadrangular, pyramidal, section rhomboidal, tapering at the rate of two lines in one inch; sides unequal, two narrow sides flat or slightly convex, about half the width of the two wide ones, which are slightly concave; a strong longitudinal furrow down each of the lateral angles, and a faintly marked one in the middle of each of the broad faces; transverse striæ very fine, twenty-seven to twenty-nine in the space of half an inch, passing uninterruptedly, with a slight upward curve, across the broad faces, more nearly straight on the two narrow ones.

This species equals or even exceeds the *Conularia Gerolsteinensis* in the fineness of its transverse striation, while it is distinguished from that and all other species with which I am acquainted by the great disproportion in the width of the sides. One specimen, imperfect at both ends, measuring $1\frac{1}{2}$ inch long, had the long diameter at the base 9 lines, the short diameter at base $4\frac{1}{2}$ lines; long diameter at smaller end $6\frac{1}{2}$ lines, short diameter at ditto 3 lines.

Not uncommon in the sandstone of Muree, N. S. Wales.

(*Cephalopoda.*)

Bellerophon micromphalus (Mor.).

Common in the impure calcareous beds of Wollongong, N. S. Wales; rare in the sandstone of Muree, N. S. Wales.

Bellerophon interstrialis (M'Coy). Pl. XVII. fig. 6.

Sp. Char. Globose; keel obtuse, rounded; surface with sharp spiral striæ, each pair having two or three finer lines between them, and the whole reticulated by sharp transverse elevated striæ, which form little tubercles at the intersections.

Closely allied to the Irish carboniferous *B. interlineatus* (Portk.), from which it is known by the strong reticulation of its surface.

Rare in the Dunvegan shale, N. S. Wales. Width 4 lines.

Nautilus.

A species resembling the carboniferous *N. sulcatus*, but too imperfect for specific determination, occurs in the Dunvegan shale, N. S. Wales.

Conclusion.

Having far exceeded the limits I had originally intended for the preceding part of this paper, I find it only possible to give a brief outline of those general topics on which I intended to have dwelt. First, as to what has been already done: geologists are familiar, from the labours of M. de Strzelecki and others, with the fact that there exists a series of stratified deposits, consisting of siliceous and argillaceous slates, limestones and sandstones, stretching at irregular intervals from the Liverpool range of mountains in New South Wales to the extremity of Van Diemen's Land, and forming detached masses, probably at one period continuous; those contain abundant fossil remains of animals referable to the palæozoic period.

Above these we have a series of clays, shales and sandstones, with remains of fossil plants and beds of coal, occupying three great basin-shaped hollows; one in the district about the Hawkesbury River in New South Wales, and called the Newcastle basin, and the two others in Van Diemen's Land, called respectively the South Esk and the Jerusalem basins. The animal beds containing the palæozoic remains are found, with one doubtful exception, to dip constantly under the coal-bearing strata, at every point of observation; for the most part at the same angle as that at which the coal crops out: the exception alluded to is a point near Spring Hill, Van Diemen's Land, where masses of clay containing *Pachydomus globosus* seem to rest on a sandstone containing remains of plants, and which is known to belong to the top of the coal series: Count Strzelecki, who made this observation, doubts its correctness himself, and expressly states that it needs re-examination to establish the fact of those *Pachydomus* clays really existing in this position. Nevertheless the inference has been drawn from this observation, that the Jerusalem coal-basin was much older than that at Newcastle, N. S. Wales, where the sandstones containing the *Pachydomi* were always seen to dip distinctly under the coal-measures: countenance was apparently given to this supposition by the few plants which were collected from Jerusalem coal-field proving to be all specifically and some generically distinct from those known to exist in the Newcastle basin. When to this we add, that the beds containing the fossil animal remains rest on a siliceous breccia, the age of which is unknown, and that the coal strata are overlaid by variegated sandstone and yellow limestone, supposed from its few organic remains to belong to the pleiocene period, we have I believe stated all that is known on the geological relation of those deposits.

With regard to their palæontology*, we have seven species of plants noticed in M. de Strzelecki's work by Mr. Morris, one of which is identical with a species from the Indian coal-field of Burdwan; and the general resemblance to the oolitic plants of Britain is noticed, as well as the absence of the characteristic forms of the older genuine coal-fields of Europe. In the inferior strata there are forty-eight species of animal remains noticed, one of which is supposed to be identical with a species of the British mountain limestone; the remainder are all (except two new types) of palæozoic genera; but the absence is remarked of *Nautilus*, the true *Leptænæ* and *Orthidæ*, all of which however I have now been able to add.

In the above notice I have given seventeen species of fossil plants from the Mulubimba district, which is a portion of the great Newcastle and Hawkesbury basin, twelve of which are considered new. Those plants belong to ten genera, two of which (*Vertebraria* and *Zeugophyllites*) are only known here and in the supposed oolitic coal-fields of India: one genus (*Gleichenites*) I have provisionally used for the *Pecopteris odontopteroides* of Morris, from the verbal characters given by Göppert for that genus,

* Since the above was printed, I learn from a letter of Mr. Dana's that he is just putting to press his account of the palæontology of this district, which, as naturalist to the United States exploring expedition, he has recently investigated under more favourable circumstances than any of his predecessors; we may soon therefore expect from this accomplished naturalist a great addition to our knowledge on this subject.

the species of which are found only in the palæozoic coal; the plant however agrees much better with the species of the Keuper genus *Heptacarpus* than with those of the carboniferous *Gleichenites*, and if we look rather to the plants themselves than to the definitions given of the genera, I should certainly place it there: all the other genera (with the exception of *Phyllotheca*, which is confined to the locality) are well-known in the oolitic coal deposits of Yorkshire, and one species, the *Sphenopteris germana* (M'Coy), is scarcely to be distinguished from the common *Pecopteris Murrayana* (Br.) of the Scarborough shales. Several of those genera are common both to the carboniferous and oolitic periods, but the most abundant and characteristic plants of the Australian beds belong to a genus (*Glossopteris*) never found in the old coal-fields, but several species of which are, on the other hand, well-known in coal-beds of the oolitic age in various parts of the world. I am therefore strongly of opinion, from the evidence of more than double the number of species of plants known before, that the coal deposits of Australia should be referred to the oolitic period; and this opinion derives much additional weight from the negative fact, that among the large quantity of remains of plants which I have examined from this district, not a trace has been observed of any of the characteristic carboniferous genera—not a trace of *Lepidodendron* or any allied plant—not a trace of *Sigillaria, Favularia, Stigmaria,* or even of true *Calamites*. I might further add, that the list of plants I have given destroys any negative arguments formerly based on the fossil evidence, for considering the Jerusalem coal-basin to be of a different age from the Newcastle one, as I have detected the most characteristic plants of the former abundantly in the latter beds, so that the fossil evidence now would go, with the admitted identity of the walls of the basins and the general analogy of the sections, to prove them all of one age.

In the underlying rocks I have been able to determine 83 species of animal remains, of which 14 are *Zoophyta*, 3 *Crinoidea*, 4 *Crustacea*, 25 *Brachiopoda*, 24 *Lamellibranchiata*, 6 *Gasteropoda*, 4 *Pteropoda* and 3 *Cephalopoda* (including *Bellerophon*). Of these, 4 genera and 32 species are figured and described as new. Those 83 species belong to 39 genera, all of which (with the exception of the genera *Tribrachyocrinus, Pachydomus, Notomya* and *Eurydesma*,—new forms at present only known in Australia) are abundant in the carboniferous rocks of Britain, many of them not being found in any higher series, and several of them not being known in any older deposits, so that the age, even if *we only look to the genera of the fossils*, is clearly limited to the carboniferous period; but when we descend to the critical examination of species, we find so extraordinary and unexpected an amount of agreement between those beds and the similar shales, sandstones and impure limestones forming the base of the carboniferous system in Ireland, that it is impossible not to believe them to be nearly on the same parallel, and there is equal difficulty in imagining them to be either younger or older than those deposits. Of those species no less than eleven are believed to be positively identical, on the most careful comparison of the Australian and Irish specimens, and nine more are so closely allied that it has been found impossible to detect any difference of character, but which, either from imperfect preservation or want of sufficient specimens to display all the characters, have not been specifically identified. With such evidence as I have mentioned, I do not think it improbable that a wide geological interval occurred between the consolidation of the fossiliferous beds which underlie the coal, and the deposition of the coal-measures themselves; that there is no real connexion between them, but that they belong to widely different geological systems, the former referable to the base of the carboniferous system, the latter to the oolitic, and neither showing the slightest tendency to a confusion of type.

EXPLANATION OF PLATES IX. TO XVII.

PLATE IX.

Fig. 1. Vertebraria australis (*M'Coy*).
Fig. 2. Otopteris ovata (*M'Coy*).
Fig. 3. Cyclopteris angustifolia (*M'Coy*).
Fig. 3 *a*. Neuration of ditto magnified.
Fig. 4. Sphenopteris flexuosa (*M'Coy*).
Fig. 4 *a*. Pinnule of ditto magnified to show the neuration.
Fig. 5. Glossopteris linearis (*M'Coy*).
Fig. 5 *a*. Neuration of ditto magnified.
Fig. 6. Pecopteris (?) tenuifolia (*M'Coy*).

PLATE X.

Fig. 1. Sphenopteris hastata (*M'Coy*).
Fig. 1 *a*. Pinnule of ditto magnified.
Fig. 2. Sphenopteris germana (*M'Coy*).
Fig. 2 *a*. Pinnule of ditto magnified.
Fig. 3. Sphenopteris plumosa (*M'Coy*).
Fig. 3 *a*. Pinnule of ditto magnified.

PLATE XI.

Fig. 1. Inflorescence of Phyllotheca.
Fig. 2. Phyllotheca ramosa (*M'Coy*).
Fig. 3. Decorticated stem with scar of branch.
Figs. 4 & 5. Phyllotheca Hookeri (*M'Coy*).
Fig. 6. Magnified part of leaf of ditto to show the midrib.
Fig. 7. Stems of ditto, without their sheath, to show their sulcation.
Fig. 8. Cladochonus tenuicollis (*M'Coy*). Lower figure magnified.
Fig. 9. Strombodes, (?) australis (*M'Coy*).

Plate XII.

Fig. 1 *a*. Brachymetopus Strzeleckii (*M'Coy*): head natural size and magnified.
Fig. 1 *b*. Ditto, pygidium natural size and magnified.
Fig. 2 *a & b*. Tribrachyocrinus Clarkii (*M'Coy*).
Fig. 2 *c*. Plates of ditto expanded.

Plate XIII.

Fig. 1. Orbicula affinis (*M'Coy*).
Fig. 2. Producta undulata (*M'Coy*).
Fig. 3. Orthis spinigera (*M'Coy*).
Fig. 4. Orthis australis (*M'Coy*).
Fig. 4 *a*. Ditto, internal cast.
Figs. 5 & 6. Spirifera (Brachythyris) oviformis (*M'Coy*).
Fig. 7. Spirifera lata (*M'Coy*).
Fig. 8. Atrypa Jukesii (*M'Coy*).
Figs. 9 & 9 *a*. Atrypa biundata (*M'Coy*).

Plate XIV.

Fig. 1. Inoceramus Mitchellii (*M'Coy*).
Fig. 2. Pecten ptychotis (*M'Coy*).
Fig. 3. Pullastra (?) striato-costata (*M'Coy*).
Fig. 4. Pachydomus ovalis (*M'Coy*).
Fig. 5. Pachydomus sacculus (*M'Coy*).

Plate XV.

Fig. 1. Cardinia (?) exilis (*M'Coy*).
Figs. 2 & 3. Modiola crassissima (*M'Coy*).
Fig. 4. Notomya clavata (*M'Coy*).
Figs. 5 & 5 *a*. Notomya securiformis (*M'Coy*).

Plate XVI.

Fig. 1. Pachydomus (?) pusillus (*M'Coy*): internal cast.
Fig. 2. Ditto, surface.
Fig. 3. Pachydomus gigas (*M'Coy*).
Fig. 4. Pleurorhynchus australis (*M'Coy*).
Fig. 5. Venus (?) gregaria (*M'Coy*).

Plate XVII.

Fig. 1. Pecten subquinquelineatus (*M'Coy*).
Fig. 2. Spirifera (Brachythyris) duodecimcostata, dorsal valve.
Fig. 3. Ditto, ventral valve.
Fig. 4. Euomphalus minimus (*M'Coy*).
Fig. 5. Pleurotomaria Morrisiana (*M'Coy*).
Fig. 6. Bellerophon interstrialis (*M'Coy*).
Fig. 7. Conularia tenuistriata (*M'Coy*).
Fig. 8. Ditto.
Figs. 9 & 10. Conularia torta (*M'Coy*).

[We have to acknowledge the kindness of the Rev. Prof. Sedgwick in contributing liberally to the cost of the large number of Plates required for the illustration of Mr. M'Coy's paper; as it is from the aid which he has thus afforded us that we have been enabled to present our readers with so valuable a contribution to our knowledge of a highly interesting and important subject.—Ed.]

XXIX.—*Critical Remarks upon* Mr. J. E. Gray's *published Catalogue of the specimens of Mammalia and Birds presented by* B. H. Hodgson, Esq., *to the British Museum.* By Ed. Blyth, Curator to the Museum of the Asiatic Society, Calcutta, &c.

By the politeness of Mr. J. E. Gray, I have just been favoured with a copy of his published Catalogue of Mr. Hodgson's specimens presented to the British Museum; and as I have sundry emendations of nomenclature and corrections of synonyms to offer relative to the species enumerated in that Catalogue, I shall proceed to do so without delay, in hope of checking the diffusion of error so far as my present information suffices for the purpose.

Page 1. *Presbytis schistaceus,* Hodgson: erroneously referred to *Pr. entellus* of Bengal; and all the synonyms incorrect, except the MS. synonyms of Mr. Hodgson. *Pr. hypoleucos,* nobis (noticed as a variety of *Pr. Johnii* by Mr. Martin, and since named *Dussumieri* by M. Schinz), is a conspicuously different species peculiar to Malabar and Travancore; and the *Pr. anchises,* Elliot, quoted with a mark of doubt, is more nearly allied to the Himalayan *Lungoor* (judging from several elaborate descriptions of the latter which I have received) than is *Pr. hypoleucos,* but is doubtless also quite distinct, as is likewise *Pr. priamus* of the Coromandel coast and Ceylon *. Gentlemen in Europe, who derive their knowledge of exotic species chiefly or solely from a few museum specimens, may be pardoned for such occasional mal-identifications; which cultivators of zoology who study the species in their indigenous abodes, as I have the *Pr. entellus,*—of which I have repeatedly seen troops of many dozens as tame as domestic animals, and permitting of the closest observation and examination short of actually handling them,—could scarcely fall into. The true *Pr. entellus* I have never observed to vary.

P. 2. *Macacus assamensis,* M'Clelland and Horsfield, P. Z. S. 1839, p. 148, if identical with *M. pelops,* Hodgson, as might easily be ascertained by reference to the India-house specimen of the former, would of course bear the name by which it was first described.

P. 6. To the well-known small Cat termed *Leopardus Ellioti* by Mr. Gray, must be referred, as an occasional variety merely, the *Felis Charltoni,* Gray, Ann. & Mag. Nat. Hist. 1846, p. 211. This variety has been received by the Asiatic Society from Assam; and intermediate specimens occur which prove the specifical identity here asserted beyond all question.

P. 7. The Tibetan Lynx does not appear to me to be identical with the species to which Mr. Gray refers it. I have examined several specimens.

P. 11. *Canis lupus,* apud Elliot, is strangely enough given as a dubious synonym of *C. aureus.* A naturalist and sportsman of Mr. Elliot's experience and discernment would about as soon mistake a

* Mr. Jerdon informs me that both *Pr. priamus* and *Pr. hypoleucos* are common in the vicinity of Tellicherry, on the Malabar coast, where he now resides.

jackal for a wolf as Mr. Gray would mistake a leopard for a royal tiger!—*Canis corsac*, Blyth, is quoted as a synonym of *Vulpes bengalensis*. I merely followed Mr. Ogilby in so referring it. Vide 'Mammalogy of the Himalaya' in Royle's 'Botany,' &c.

P. 15. *Helarctos malayanus* (*verus*), if it does not occur in the Nepal Terai, assuredly does in Assam, Arracan, the Tenasserim provinces and Malayan peninsula. I have had two living specimens from Assam; and have likewise seen the *Ursus tibetanus* (erroneously so named) alive.

P. 16. *Sorex pygmæus*, Hodgson. Is not this *S. Perrotellii*, Guerin? It occurs in the Neilgherries as well as in the Himalaya, and has even been obtained in a cellar in Madras.

P. 20. *Lepus orientalis*, Brown, 1836, surely takes precedence of *L. macrotis*, Hodgson, 1840; but the species was rightly referred by Mr. Ogilby to *L. rufocaudatus*, Is. Geoffroy.

P. 22. *Pteromys nobilis*, Gray, v. *chrysothrix*, Hodgson, is merely an occasional variety of *Pt. nobilis*.

Sciurus macruroides, Hodgson (1841, *not* described) *is* described by M'Clelland as *Sc. giganteus* in Proc. Zool. Soc. 1839, p. 151, so that if really different from *Sc. bicolor* (verus), which I doubt exceedingly, the latter name should have the preference, only that Raffles had long previously bestowed the name *affinis* on a pale variety *of the same species* since termed *Sc. aureiventris* by Is. Geoffroy. Should it not therefore (*i. e.* the dark or ordinarily coloured variety) in this case rank as *Sc. affinis*? albeit Raffles alludes evidently to this dark race by the name *Sc. maximus* of Schreber. With regard to the name *bicolor*, it is certain that Sparrman founded it upon a Javan specimen; and the question therefore turns upon the fact whether the dark Malacca race inhabits Java? Schinz correctly describes the latter, and gives Java, Sumatra and Borneo as the habitats; but Mr. Gray, assuming (it would seem) the contrary, refers *bicolor* to *javensis*, Schreber, and adopts *macruroides*, Hodgson, for the common dark race abundant from the S. E. Himalaya and Assam, southward to the Straits of Malacca at least, if not further. These great Squirrels are extremely puzzling, more especially in the Malay countries. On the continent I know three well-marked races, viz. the dark one already noticed with its pale Malayan variety, the *purpureus* of the Indian peninsula, and *macrourus* (verus) of Travancore and Ceylon, of which last I am now publishing a coloured figure.

P. 29. *Ovis burrhel*, Blyth, is now acknowledged by Mr. Hodgson to be distinct from *O. nahoor*. And I consider *O. ammonoides*, Hodgson, to be identical with *O. ammon*, Pallas: if distinct, it should bear the name *O. Hodgsonii*, nobis. *O. Vignei*, nobis, placed as a synonym of *O. ammonoides* by Mr. Gray, is a widely different species, appertaining to quite a different section of the group of Wild Sheep. Mr. Gray might as well identify *Cervus dama* with *C. hippelaphus*!

P. 32. The *Bara Sing'ha* of India (or "twelve-antlered" Stag) is the *Cervus Duvaucelei*, not *C. Wallichii*, which has but a dubious claim to be regarded as an Indian animal, though I suspect that to it must be referred the great truly elaphine Stag of Kashmir.

P. 34. I do not agree with Mr. Gray in identifying *Cervus Aristotelis* (the *Jerrow* of the Himalaya) with *C. hippelaphus* (the *Sambur* or *Saumer* of Bengal, the Indian peninsula, Arracan, Tenasserim, &c.).

In conclusion of the Mammalia, I am glad to observe that Mr. Gray, now that he has specimens to form a legitimate opinion upon, recognises (as a matter of course) the distinctness of the Gaour and Gayal, *Bos gaurus* and *B. frontalis*, which, in his Catalogue of the specimens of Mammalia in the British Museum, he united as one and the same animal: just as he still " lumps together " the various Indian Monkeys of the type of *Presbytis entellus*, in opposition to the opinion of myself and scientific co-labourers in this country, who assuredly possess much better data to judge from.

P. 36. *Gypaëtos hemachalanus* (nec *hemalayanus*) is a name bestowed by Capt. Hutton, not by Mr. Pearson.

P. 38. *Gyps tenuirostris*, v. *tenuiceps*, Hodgson, is *Vultur indicus* of Scopoli and Latham, nec Temminck.

P. 41. *Falco caligatus*, Raffles, v. *Spizaëtus alboniger*, nobis, from Malacca, is quite distinct from *Nisaëtus pallidus*, Hodgson, which I presume to be the *Falco cirratus*, auctorum. *Morphnus hastatus*, Lesson, is an aberrant species of true *Aquila*. Very different species were also sent by Mr. Hodgson to the Asiatic Society as his *Sp. nipalensis* and *Sp. pulcher*.

P. 42. *Circaëtus undulatus* is the *Falco cheela* of Latham, which specific name claims the priority.—*Ictinaëtus*, Jerdon (nec Kaup), must stand as the divisional appellation of *Falco malaiensis*, Reinwardt.

P. 45. *Tinnunculus interstinctus* (M'Clelland and Horsfield). An exceedingly doubtful species, from all that I have seen (at least of specimens so designated), as distinct from the common British Kestrel.—*Ierax eutolmus*, Hodgson, can scarcely be referred safely to *F. bengalensis*, Brisson.

P. 46. The common Indian Kite, in the opinion of Mr. H. E. Strickland, is *M. ater* (verus), as distinct from *M. parasiticus* of Africa. Mr. Gould's Australian *M. affinis* does not appear to differ in any respect.

P. 51. With abundance of specimens of both before me, I consider *Ephialtes lettia* (Hodgson) of the Himalaya, Assam, Sylhet and Arracan to be quite distinct from *Eph. lempiji* of the Malay countries, Ceylon and Malabar.

P. 53. The name for *Caprimulgus nipalensis*, Hodgson, will be *C. albonotatus*, Tickell.

P. 54. *Hirundo rustica* (vera). Several Nepalese specimens of this bird were presented by Mr. Hodgson to the Asiatic Society exactly according with specimens from England; and I recently obtained one in the vicinity of Midnapore flying with *H. daurica* and *H. gutturalis*, Scopoli. The latter name holds precedence of *H. javanica*, Sparrman, for the common Indian species termed *H. jewan* by Sykes; and *H. panayana*, Lath., is another synonym.

P. 55. Mr. Gray is right (in his Appendix) in referring *H. subsoc-*

cata and *H. minuta*, Hodgson, to the common little Indian Bank Martin, *H. sinensis*, badly figured in Hardwicke's 'Illustrations;' *H. brevicaudata*, M'Clelland and Horsfield, refers to the same.

P. 56. *Halcyon amauropterus* (Pearson) is not, as stated in the Appendix, the *H. capensis*, apud Jerdon. The former is very rare in the Indian peninsula, but far from being so in the vicinity of Calcutta, and along the eastern coast of the bay of Bengal, in Arracan and the Tenasserim provinces it is extremely common. The latter appears to be abundant throughout India, and will now stand as *H. gurial*, Pearson, v. *brunniceps*, Jerdon, as distinguished from the nearly-allied *H. leucocephalus* (Gm., very badly so named) of the Malay countries. The voice of *H. amauropterus* is extremely harsh, and remarkably unlike that of *H. gurial*.

P. 57. *H. smyrnensis* (L.). Mr. Gray unites with this the *H. gularis*, Kuhl, v. *smyrnensis*, var. *albogularis*, nobis, which is peculiar to eastern Malasia. He also identifies *Ceryle varia*, Strickland, with *C. rudis*. Both the Indian species referred to are extremely common, and never vary so as to exhibit the distinguishing characters of their respective near affines, which I therefore quite agree with Mr. Strickland in separating.—*A. meninting*, Horsfield, vel *asiatica*, Swainson, is a distinct species from *A. bengalensis*. Both occur in the Malayan peninsula, but the latter is there comparatively rare.

P. 58. *Merops torquatus*, and the *Merops* referred doubtfully to *M. viridis*. I have no doubt whatever that what Mr. Gray says, in in the Appendix, of these being mere varieties of *M. viridis*, is correct. Specimens of this bird, from Arracan, are remarkable for the great development of the rufous hue on the crown and nape; and there is one in the museum of the Asiatic Society (locality unknown) equally remarkable for the bright verditer-blue of the throat, more especially on its sides: but to regard these as separate species seems to me to be altogether unwarrantable; that last noticed accords with the description of *M. torquatus*.

P. 59. *Nectarinia saturata* (Hodgson), and also *N. assamensis*, M'Clelland and Horsfield, claim precedence of *N. Hodgsoni*, Jardine; and I consider (with Mr. Jerdon) *N. mahrattensis*, Sykes, to be *Certhia asiatica*, auct.

P. 60. Specimens which I have examined, marked *Myzanthe inornata* by Mr. Hodgson, are of the species termed *Nectarinia minima* by Capt. Tickell, and *Certhia erythrorhynchos*, Lath., which latter name is founded on error, or at least can only be applied to the nestling, so that I now designate this bird *Dicæum minimum* (Tickell). The species occurs throughout India, even in Ceylon, where it would appear to be very common. It also inhabits Arracan.

P. 61. *Chloropsis cæsmarhynchos*, Tickell (a misprint for *gampsorhynchos*, Jardine and Selby), refers to *Phyllornis Jerdoni*, nobis. —*Certhia himalayana*, Vigors, is assuredly assigned incorrectly to *C. spilonota*, Franklin*.—*Sitta cinnamoventris*, nobis, is probably *S. himalayana*, Jardine and Selby.

* I now see that Mr. Gray has verified *Certhia spilonota* from a specimen

P. 62. *Tesia concolor* is a mere variety of *Pnoëpyga squamata* (Gould), v. *albiventer* et *rufiventer*, Hodgson. *Pnoëpyga pusilla*, Hodgson, is I think distinct.—*Troglodytes subhimalayanus* is described as *Tr. nipalensis*, Hodgson, in J. A. S. B. xiv. 589.

P. 63. *Orthotomus edela*, Temm., v. *Edela ruficeps*, Lesson, is distinct from *O. longicauda* v. *Bennettii*, &c., which together with *O. edela* and *O. cineraceus*, nobis, occurs at Malacca. *O. sepium*, Horsfield, is distinct again.

P. 64. *Acrocephalus arundinaceus* of India will stand as *Acr. brunnescens* (Jerdon), being distinct from the large European species.

Salicaria affinis, Hodgson, is described as *Dumeticola thoracica* in J. A. S. B. xiv. 583; also *Tribura luteoventris*, *Horornis flaviventris*, *H. fortipes*, *Horeites brunnifrons*, *H. pollicaris* and *H. schistilata* (which I could not distinguish from *H. brunnifrons*) under Mr. Hodgson's name *Nivicola schistilata*.

P. 65. "*Phyllopneuste affinis*, Hodgson, Gray, Zool. Misc. 1844; *Phylloscopus lugubris*, Jerdon; *Ph. affinis*, Blyth." I presume this to mean *Ph. lugubris*, nobis (nec Jerdon), J. A. S. B. xii. 968 (1843). *Ph. affinis* is the *Sylvia indica*, Jerdon, referred to *Motacilla affinis*, Tickell, J. A. S. B. ii. 576 (1833).—*Phyllopneuste xanthoschistos*, Hodgson, is *Ph. schisticeps*, J. A. S. B. xiv. 592: nearly allied to which is *Abrornis poliogenys*, nobis.—*Ph. magnirostris*, nobis (the *Ph. trochilus*? Hodg.), I take to be *Sylvia javanica* of Horsfield. It is commoner on the eastern side of the bay of Bengal.

P. 66. *Phylloscopus nitidus*, nobis, *Ph. reguloides*, nobis, and *Ph. modestus* (Gould), nobis—vide Mr. Gray's Appendix—are three conspicuously distinct species, of which *Ph. reguloides* must now stand as *Ph. trochiloides* (Sundevall). *Ph. flaveolus*, Blyth, is no *published* synonym of mine.—*Neornis flavolivacea* is described in J. A. S. B. xiv. 590. It is not the *Sylvia indica*, Jerdon, which is *Phylloscopus affinis* (Tickell).

P. 67. *Abrornis schisticeps*, Hodgson, is identical with *Motacilla cantator*, Tickell, J. A. S. B. ii. 576. I have once obtained it near Calcutta.—N.B. Add *Acanthiza arrogans*, Sundevall, to the synonyms of *Culicipeta Burkii* (Burton).

Copsychus mindanensis (Gm.), v. *Lanius musicus*, Raffles, and *Gryllivora magnirostra*, Sw., though very closely allied, seems distinct from *Copsychus saularis* of India*.

procured by Hodgson from *Behar*, and made it into a new genus, *Salpornis*, and with this he has been describing a *Caulodromus Gracei* (Ann. Mag. Nat. Hist., May 1847), which is my *Rimator malacoptilus*, J. A. S. B., February 1847; founded on the identical specimen described by Mr. Gray, which was lent me for the purpose of being described by Mr. Grace, and was so labelled by me when I returned it to him. I labelled the whole of Mr. Grace's collection for him, with a view to prevent *doubles emplois*. I have now three distinct and well-marked Himalayan species of true *Certhia*, viz. *C. himalayana*, Vigors, vel *asiatica*, Swainson, with a very distinctly-banded tail, from the Deyra Doon; *C. nipalensis*, Hodgson, from Nepal; and *C. discolor*, nobis, common about Darjeeling. That of Gray's list will doubtless be *C. nipalensis*.

* In a letter recently received from Dr. Horsfield, that gentleman re-

P. 69. Is not *Muscisylvia leucura* a true *Notodela* of Lesson ?—*Nemura* (*Ianthia*, nobis) *flavolivacea* is quite distinct from *N. rufilatus*, of which *cyanura* is the female.

P. 70. *Calliope* ? *cruralis*, nobis, is a typical *Brachypteryx*.—*Thamnobia fulicata* of S. India and Ceylon is distinct from *Th. cambaiensis* (Lath.), of which *Saxicoloides erythrurus*, Lesson, is the female.—*Bradypterus phœnicuroides* is described as *Sylvania phœnicuroides* in J. A. S. B. xvi. 136.

P. 71. *Saxicola rubicola*. Is not this *Pratincola indica*, nobis, J. A. S. B. xvi. 129 ?—*Accentor variegatus*, Blyth (to which I formerly put the name *himalayanus* with a query, being doubtful whether an *Accentor* had not been thus described), is distinct from *A. nipalensis*, Hodgson: but Mr. Hodgson's specimen labelled *immaculatus*, which he sent to the Asiatic Society, was merely *A. nipalensis* with abraded plumage.

P. 72. *Parus nipalensis*, Hodgson, as forwarded by that gentleman to the Asiatic Society, is identical with *P. cinereus*, Vieillot, v. *atriceps*, Horsfield: specimens from the Himalaya, Central and Southern India, Ceylon and Java, being absolutely alike.

P. 73. I have little doubt that *Parus seriophrys* (an *sericophrys* ?), Hodgson, is the *Sylviparus modestus*, Burton, and I think fairly separable from *Parus*.—*Suthora nipalensis* and *S. fulvifrons* will, I suspect, prove to have been rightly distinguished by Mr. Hodgson, judging from specimens before me.

P. 74. The name *Ixulus*, Hodgson, I now adopt for *I. flavicollis* and *I.* (olim *Siva*) *occipitalis*, nobis, J. A. S. B. xiii. 937; for these two species are too nearly allied to be ranged otherwise than together, while the bill of *I. occipitalis* quite precludes its being referred to *Yuhina*.—*Y. nigrimentum* is also described in J. A. S. B. xiv. 562.

P. 77. *Anthus striolatus*, Blyth, is placed as a synonym of *A. rufescens*; the said *A. striolatus* not having been yet described by me, neither has it been forwarded by me to Europe: Mr. Jerdon barely mentions the name in one of his catalogues; and he is the only person, I believe, besides myself, who can know to what the MS. name *striolatus* refers. But even if correctly assigned, I think it necessary to protest against any *unpublished* names of my coining being thus cited to swell the list of empty synonyms* !—The species sent by Mr. Hodgson to the Asiatic Society as his *A. hortulanus* was the common Indian variety (?) of *A. arboreus*.

P. 79. "*Petrocossyphus pandoo*:" quære *P. affinis*, nobis ?

P. 80. *Oreocincla micropus*, Hodgson, is the female of *Merula Wardii* (Jerdon).

P. 81. *Merula pœciloptera* (Vig.) is the *Lanius boulboul* of Latham.

P. 84. *Trochalopteron* ? *setifer*, Hodgson. Is not this *Cinclosoma lineatum*, Vigors ?—*Actinodura Egertoni*, apud nos, is placed as a syn-

marks, "The *Copsychus amœnus* described by me is commonly given as a synonym of *C. saularis*, but is decidedly distinct. It has always a *black abdomen* in maturity."

* Except that the tarsi of *A. striolatus* measure full an inch, this species seems to agree with Mr. Gray's description of *A. pelopus*, Hodgson.

onym of *Ixops nipalensis*, Hodgson. I have no recollection of having ever made this mal-identification, much less committed it to print.

P. 85. *Mixornis chloris*, Hodgson, is not satisfactorily referable to *M. gularis* (Horsf.), although undoubtedly very nearly allied.—*Erpornis xanthochlora* (it should be *xantholeuca*) is decidedly not a *Timalia*, nor are its affinities easy of determination. The range of this bird extends to Arracan and Malacca.—*Timalia? nipalensis* (v. *leucotis*) and *T.? pellotis*. Are not these identical?

P. 86. *Chrysomma hypoleucos* (Franklin), J. A. S. B. xiv. 602, v. *Pyctoris* apud Hodgson, Proc. Zool. Soc. 1845, p. 24. This bird is the *Parus sinensis*, Lath.; also *Gotah Finch* and *Emberiza calfat*, var. A, of Latham. It should therefore bear the specific name *sinensis*, if really an inhabitant of China.—*Malacocercus griseus* (Gm.), peculiar to the south of India, is a distinct species from *M. terricolor*, Hodgson, the "Brown Indian Thrush" of Edwards, on which is founded *Merula bengalensis* of Brisson, which specific name must be retained. —*Malacocercus geochrous*, Hodgson, is identical with *M. Earlei*, nobis. —*Iora typhia* (L.), *I. zeylonica* (Lath.), and *I. scapularis*, Horsfield, are three distinct species. *I. typhia*, one of the commonest birds of Bengal, is alike at all seasons of the year.

P. 87. *Oriolus Hodgsoni*, Sw. All the Black-headed Orioles which I have seen from Nepal were referable to the common *O. melanocephalus*.

P. 88. *Hypsipetes M'Clellandii*, Horsf., is identical with, and the name takes precedence of, *H. viridis*, Hodgson.

P. 89. "*Hæmatornis cafer*." This is *Pycnonotus bengalensis*, nobis; but why it should be called the "White Hæmatornis" requires explanation, it being the *blackest* species of the genus known to me (whence *atratus* would have been a better name for it). A case of *lucus a non lucendo*!—"*Hæmatornis striata*" is the *Alcurus* (nec *Alcopus**) *nipalensis*, Hodg., v. *A. striatus*, nobis.

P. 90. Instead of "*Hemipus flavula*," read *Hemixos flavala* (*flavala*, i. e. *chrysopterus*), Hodgson. *Hemipus*, Hodgson, is a genus of Flycatchers (vide p. 93 of Mr. Gray's Catalogue).—*Muscicapa acormus*, Hodgson (a *Muscicapula* apud nos), is quite distinct from *M. poonensis*, Sykes (apud Jerdon), which I refer to *Butalis latirostris* (Raffles, Swainson).—Mr. Gray follows Sundevall in referring *M. leucura*, Gm., to *M. parva*, Bechst. This can scarcely be, if Stephens's description of the latter, or that in the 'Dict. Class. d'Hist. Nat.' be correct; neither does *M. leucura* accord exactly with my recollections of *M. parva*.—*M. albogularis* must be referred to *M. superciliaris*, Jerdon; a species very common in the N.-W. Himalaya.

P. 91. *Bainopus grandis*. Is not this the most typical species of *Niltava*? To which genus the only other species that I know of are *N. sundava* and *N. M'Gregoriæ*, the female of which latter is *Leiothrix signata*, M'Clelland and Horsfield, and *N. auricularis*, Hodgson.—*Phœnicura rubeculoides* is the type of my genus *Cyornis*; and *Musc. melanops* that of my genus *Staparola*; both comprising several species, though the two mentioned are confounded in the genus *Niltava*,

* *Alcopus* is a name which Mr. Hodgson proposed to substitute for *Sibia*.

Hodg., by Mr. Gray: vide J. A. S. B. xvi. 125, 128.—*Siphia superciliaris* is decidedly congeneric with *Musc. superciliaris*, Jerdon, and must therefore bear my subsequent name *hyperythra* rather than *rubecula*, which was afterwards applied by an unlucky oversight on my part.

P. 93. *Hemipus picæcolor*, Hodgson, is *Muscicapa capitalis*, M'Clelland and Horsfield, and is, I think, distinct from *Musc. picata*, Sykes, v. *tyrannides*, Tickell.—Some *Darjeeling* specimens of *Tchitrea* lately received are referable to *Tch. affinis*, A. Hay.—*Leucocerca pectoralis*, Jerdon, is distinct from *L. fuscoventris* (Franklin).—*Chelidorhynx* is typical *Rhipidura*.—*Cryptolopha ceylonensis* will rank as *Cr. cinereocapilla* (Vieillot).

P. 94. *Proparus chrysotis*. This specific name must have been a slip of the pen for *leucotis* or *chrysopterus*.

P. 95. *Siva nipalensis* I now refer to my genus *Alcippe*. It is nearly allied to *Brachypteryx sepiaria*, Horsfield, which I also refer to *Alcippe*.

P. 97. The *Pericrocotus* (unnamed) is *Pr. solaris*, nobis, J. A. S. B. xv. 310.—*P. rubritinctus*, nobis, mentioned in the Appendix, may be cancelled, as I have never *published P. roseus* by this name; Mr. Jerdon having favoured me with his identification of the species with *Muscicapa rosea*, Vieillot.—*Campephaga lugubris*, according to Mr. Strickland (*in epistolâ*), is *C. fimbriata* (Temm.).

P. 98. *Dicrurus pyrrhops*, Hodgson, v. *longicaudatus*, A. Hay, is very distinct from the Malayan species which I refer to *D. cineraceus*, Horsf.: vide J. A. S. B. xv. 279.

P. 99. *Tephrodornis indica* is the *Muscicapa pondiceriana*, Gm., which specific name claims the priority. Mr. Jerdon first ascertained this.—*T. sylvicola*, Jerdon, is distinct from *T. pelvica*, Hodgson.

P. 100. *Lanius erythronotus*, Jerdon, is my *L. caniceps*; distinct from the Himalayan species figured by this name in Gould's 'Century.'—*L. cristatus*, Linn. As this bird is not crested, it must rank as *L. phœnicurus*, Pallas.

P. 101. There are three species of *Psilorhinus* in the Himalaya, all, I suspect, distinct from *Ps. sinensis*: vide J. A. S. B. xv. 27, 284.—I also suspect that *Cissa venatoria*, Gray, is distinct from *C. sinensis*: in Bengal this is only known as a cage bird, whence M. Lesson's name, *bengalensis*, is inapplicable.—*Dendrocitta vagabunda*: should not this stand as *D. rufa* (Scop., Sw.)?

P. 102. *Corvus macrorhynchos* of the neighbourhood of the Straits of Malacca is a distinct species from *C. culminatus* of India, which however also extends its range to the Straits of Malacca.

P. 103. *Gracula religiosa*. The Nepal species is *Gr. intermedia*, A. Hay: vide J. A. S. B. xv. 32.—*Maina cristelloides*, Hodg., will stand as *Acridotheres griseus*, Horsf. (nec *mahrattensis*, Sykes).—*Pastor* (or *Sturnia*) *pagodarum*. Add as a synonym *Turdus melanocephalus*, Vahl.

P. 104. I consider Mr. Hodgson's *Pastor caniceps* to be *Sturnia malabarica* (vera). It is very distinct from *St. Blythii* (Jerdon).

P. 105. *Euplectes striatus*, nobis, is rightly assigned to *Eu. flaviceps* (Sw.); and both must be referred as synonyms to *Ploceus man-*

yar, Horsf. We have three species in Bengal, *Pl. philippinus*, *Pl. bengalensis* and *Pl. manyar*; but I cannot affirm with certainty which are the two mentioned in Mr. Gray's Catalogue. Judging from Mr. Hodgson's names, it is not improbable that *atrigula* refers to the male in breeding dress, and *flavigula* to the female or male in non-breeding dress, of *Pl. manyar*.

P. 106. For the species of *Amadina* (v. *Munia*), vide J. A. S. B. xv. 36, 285.

P. 108. *Emberiza sordida*, Hodgson, judging from a female sent to the Asiatic Society, I consider to be *E. pusilla*, Pallas, identical with *Emb. sinops*, Hodgson.

P. 109. *Alauda dulcivox*, Hodgson. From several specimens sent by Mr. Hodgson to the Asiatic Society, this seems perfectly identical with *A. arvensis*, Linn.—The *Plocealauda typica*, Hodgson, is *Mirafra assamica*, M'Clelland and Horsfield, according to specimens which Mr. Hodgson so labelled; certainly a distinct species from *M. javanica*, Horsfield.

P. 112. *Buceros albirostris*, Shaw, is distinct from *B. pica*, Scopoli. Vide Mr. Gray's Appendix.

P. 113. The Asiatic Society possess a *Palæornis* from the Mauritius which I consider to be *P. bitorquatus* (verus). It is very distinct from *P. torquatus*.

P. 114. The Nepal Barbet referred to *Bucco caniceps*, Franklin, is *B. lineatus*, Vieillot, distinct from *B. zeylanicus* v. *caniceps*.

P. 115. *Picus majoroides* is *P. darjellensis*, nobis.—For "*P. cathphorius*" read *cathpharius*.

P. 116. *Dendrocopus moluccensis*, apud Hodgson. This is *P. pygmæus*, Vigors; distinct from several nearly allied species: vide J. A. S. B. xiv. 197, xv. 14, 52.—*Gecinus xanthoderus*. This I consider to be *Picus chloropus*, Vieillot.—*P. affinis*, Raffles, v. *dimidiatus*, Temm., and *viridanus*, nobis, is distinct from *Gecinus occipitalis*.

P. 117. *Meiglyptes brachyurus*, Hodgson, is *Micropternus phæoceps*, nobis, one of three nearly allied species.

P. 118. The Himalayan Sirkeer is *Taccocua infuscata*, nobis, distinct from three other Indian species that have been confounded under *T. sirkee*: vide J. A. S. B. xiv. 200, xv. 19, xvi. 118.—*Centropus lepidus*, Horsf., will stand as *C. Lathami* (Shaw).—The South African species which I refer to *Oxylophus ater*, Gm., and which is figured by Shaw, is very distinct from the Indian *O. serratus*.

P. 119. *Cuculus poliocephalus*, Lath., v. *himalayanus*, Vigors, is not *C. saturatus*, Hodgson.

P. 120. *C. striatus*, Drapiez, v. *micropterus*, Gould, must also not be confounded with *C. himalayanus*, Vigors.—For "*C. nivicolor*," read *nisicolor*.—*Chrysococcyx xanthorhynchos* I have only seen from the Tenasserim provinces and Malayan peninsula and Archipelago. Is not Mr. Gray's species referred to this the *Chr. smaragdinus*, nobis, J. A. S. B. xv. 53?

P. 121. *Treron Sti. Thomæ* can scarcely be *Tr. militaris* of Northern India.—*Tr. cantillans*, nobis, I may remark, seems (as I am informed by Capt. Hutton) to be but a caged example of *Tr. sphenura*, which had moulted in confinement! Mr. Hodgson, I think, termed it *Ptilinopus maroneus.*

P. 122. I consider *Alsocomus,* Tickell, vel *Dendrotreron,* Hodgson, to be a good group, embracing the *Carpophaga*-like species of true *Columba,* with twelve tail-feathers only, instead of fourteen as in the *Carpophagæ.* The species have of late been variously classed, some in *Carpophaga* and others in restricted *Columba*; and the following are among those which are referable to it:—*C. Hodgsonii* and *C. punicea** of India, *C. arquatrix* and *C. guinea* of Africa, and *C. leucomela* of Australia; while *Lopholaimus antarcticus* is immediately allied, indeed scarcely separable. *Palumbus,* Kaup, seems another natural group, comprising *C. palumbus,* L., *C. Elphinstonii,* and I would refer to it *C. œnas,* L.—Mr. Gray identifies *C. pulchricollis,* Hodgson, with *C. Elphinstonii,* in which case the total length given by Sykes of nearly sixteen inches must be erroneous; especially as the length of tail assigned by him ($5\frac{1}{2}$ inches) is the same as in the Himalayan bird.

P. 123. For *Columba pulchrara,* Hodgson, read *pulchr-ala.*—*Columba chinensis,* Scopoli, is a distinct species from *C. suratensis,* Gmelin.—*Turtur humilis.* What I have described as the old and young prove to be the adult male and female of this species, as was first intimated to me by Capt. Hutton.

P. 124. *Gallophasis leucomelanos* (Lath.), the *Káledge* Pheasant of Nepal, seems to me to be a bastard race between *G. albocristatus* of the N.-W. Himalaya, and *G. melanotus,* nobis, of Sikim. In like manner, every possible gradation of plumage is exhibited between *G. Cuvieri* (v. *Horsfieldi,* G. R. Gray) of Assam and Sylhet, and *G. lineatus* of Arracan and Tenasserim.

P. 125. Should not the common Jungle-fowl or wild Common Fowl, so very abundant throughout the northern half of India and in the Indo-Chinese and Malay countries, be now designated *Gallus ferrugineus* (Gm.), instead of *bankiva,* Temminck? *G. alector* should have been the name for it. The hen is the *Hackled Partridge* of Latham.

P. 126. *Francolinus gularis* and *Fr. pondicerianus* should, in my opinion, be referred to restricted *Perdix*; a very different group from that exemplified by *Fr. vulgaris* and *Fr. pictus.*—*Arboriphila,* Hodgson. There are two Himalayan species of this type, and a third in the Assam hills, and those of Sylhet and Arracan.

P. 128. *Perdicula,* Hodgson. This is also, I think, properly distinguished, for the Pigmy true Partridges, *P. rubiginosa* and *P. cambaiensis,* or *Coturnix argoondah* and *C. pentah* of Sykes.—Of *Turnix,* the common Himalayan species is undistinguishable from *T. ocellatus* of the Malay countries, represented in Bengal by the nearly allied *T. bengalensis,* nobis, and in South India and Ceylon by the equally allied *T. taigoor,* Sykes: *T. Dussumieri* extends throughout India and in Arracan; and the *T. joudera* (Hodgson) is, I suspect, the same as *T. Sykesi* (A. Smith, 1838), described with *T. lepurana*

* This also inhabits Arracan and the Tenasserim provinces.

in the 'Zoology of South Africa;' a species also generally distributed over the country.

P. 133. *Hiaticula subrufina.* This I take to be *H. Leschenaultii* (Lesson), and *Charadrius cirripedesmos*, Wagler, apud Sundevall.—*Ardea nobilis*, nobis. Is not this *A. goliath*, Rüppell?

P. 134. *Herodias orientalis*, Gray, is an old specimen of *H. garzetta*, having dropped its crest. I have seen many like the figure in Hardwicke's 'Illustrations,' both crested and uncrested.—*H. modesta* I consider to be *H. alba* (Linn.). There are three species of purely white Egrets exceedingly common throughout India in suitable localities; and the two larger of these have the bill black during and towards the breeding season, yellow at other times. These are *H. alba* and *H. intermedia*. The seasonal changes of these birds I shall elsewhere explain in detail. Mr. Gould has lately figured two Australian Egrets, which would not appear to differ in any respect from *H. alba* and *H. garzetta*, represented from dry skins.

P. 136. *Argala immigratoria*, Hodgson, refers to *Leptoptilus javanicus*, vel *Ciconia nudifrons*, M'Clelland, and *C. calva*, Jerdon: *C. nudifrons*, Jerdon, appears to me to refer to the young of *L. argala*, v. *A. migratoria*, Hodgson.

P. 137. The common Curlew (*Numenius arquata*) varies in size to a very extraordinary degree, and so does the *Limosa ægocephala*; but I have satisfied myself that the large, small, and intermediate are all of one species, respectively. Mr. Gould has lately figured a new Godwit, as he thinks, from Australia; but it appears to me to be no other than the *L. ægocephala*.

P. 143. The Indian *Porphyrio* is *P. poliocephalus*, Lath., distinct from *P. smaragdinus*, Temm., v. *indicus*, Horsfield, of Malacca and Java.

P. 144. *Anser rubrirostris*? Is not this *A. cinereus*, the common Gray-lag Goose, now rare in England, but extremely common in India? It is not well known to the generality of British ornithologists.

P. 149. *Carbo albiventer*, Tickell, refers to the young of *Graculus carbo*; *Phalacrocorax leucotis*, Blyth, to a much smaller species, which I have been considering as the *C. graculus*, apud Temminck. *Gr. carbo* (verus) is common in various parts of India; but I have only obtained *Gr. pygmæus* in Lower Bengal.

The foregoing is a hastily written commentary on Mr. Gray's 'Catalogue,' which embodies the results of my study of the species enumerated, so far as relates to their nomenclature and synonymy. I think that it would have been much better if the very numerous synonyms previously unpublished had been suppressed; but as the evil appears together with its antidote, there seems no necessity for encumbering future catalogues or descriptions with this host of superfluous names, that could have been meant only as provisional appellations. Mr. Hodgson's merits, as the accumulator of such stores, contributing so largely to diffuse an acquaintance with Himalayan mammalia and birds, can never fail of being fully and deservedly appreciated.

Calcutta, April 14, 1847.

XXX.—*Note on* Dr. Meigs's *Memoir on the Reproduction of the Opossum.* By Prof. Owen, F.R.S.

To the Editors of the Annals of Natural History.

Gentlemen,

I have been favoured by Mr. Everett, the late highly-respected Minister of the United States in this country, with the following extract from the Proceedings of the 'American Philosophical Society' for April 16th, 1847; which, as it contributes to elucidate one of the most singular subjects in the animal œconomy, will no doubt be acceptable to your readers:—

"The Committee (Drs. Hays, Bache and Condie), to whom had been referred the memoir of Dr. Charles D. Meigs, upon the reproduction of *Didelphys virginiana*, read 19th March 1847, reported, recommending its publication in the Transactions of the Society, which was ordered accordingly.

"Professor Owen's paper on the reproduction of the Kangaroo and the Wombat has left certain points still unsettled as to the reproduction of the marsupials; and MM. Milne Edwards and Pouchet, in their works, have left uncleared several points, which it is the object of Dr. M.'s paper to explain.

"The terms *fœtus* and *embryo* cannot properly be applied to the young of the Didelphys while in the pouch; since, when first placed in the marsupium, the young opossum is endowed with all the attributes of a mammiferous quadruped in the full enjoyment of a real warm-blooded respiratory and digestive existence. None of the authors on this subject appear to have investigated the state of the early young; and the most vague and incorrect notions still prevail as to their condition.

"On the 18th of February 1847, a light snow having fallen, the tracks of two opossums were followed on the 19th over the snow to the trunk of a hollow tree, wherein they had concealed themselves, and from which were taken a full-grown male and female Didelphys. It was supposed, from the appearance of the testes in the male, and the monotrem of the female, that the animals had retired for the rut, as they are rarely found in company at other seasons.

"On the 27th February they were brought to me, and I carefully examined the marsupium, but could discover no trace of any mammary development of the base of the delicate nipples. February 28th, no change was discovered by inspection or careful palpation of the pouch. On Monday, March 1st, and on Tuesday the 2nd, there was not the least sign of change in the pouch. On Wednesday the 3rd, the mammary glands were visibly and palpably enlarged. On Thursday, 4th, still larger. On Friday, 5th, hard and swollen. Saturday, 6th, passed without my inspection; but my servant examined the pouch and discovered no young ones at the teats. At 3 p.m. on Sunday, 7th March, I opened the pouch, and discovered the young animals adhering to the nipples.

"Here then was a manifest preparation for the reception of the marsupial young, begun on Wednesday the 3rd of March, and completed by Sunday the 7th, which is four days. Hence it is clear that the notion heretofore entertained, that the embryo makes the teat wherever it happens to take hold, is unfounded, the preparation being as complete as in any other mammal.

"The uterine gestation probably terminated on the night of Saturday March the 6th, or the morning of Sunday the 7th. The rut probably continued as late as the 18th or 19th February, which is seventeen or eighteen days; possibly the impregnations may have been a few days earlier than the said dates.

"The observation settles at least the question as to one of the reproductive seasons, which in this case was February.

"In Mr. Owen's observation on the kangaroo, the uterine gestation lasted thirty-nine days; but the kangaroo is a large animal in comparison; the opossum rarely being more than fifteen or sixteen pounds in weight.

"Mr. Owen does not mention the preliminary condition of the mammary glands in the kangaroo.

"Thirteen young opossums were attached to as many nipples, all strongly adhering, and busily employed in sucking the milk.

"They moved the fore-arms, and paws, and heads, very freely; so that to open the sphincter marsupii was to disclose a very lively scene.

"They were of a deep rose tint, and without hair.

"They were of equal size. I pulled one off from the nipple; and the attachment was so strong, that I expected to tear the body in two before I disengaged the mammilla from the stomal pore in which it was engaged. There was no bulb at the end of the nipple after the detachment of the young one.

"No blood about the mouth or on the nipple followed the separation.

"It was removed at 40 minutes past 7 P.M. It weighed exactly three grains and a half.

"From the snout to the end of the tail it was eight-tenths of an inch long.

"Laid in a watch-glass, it moved freely round and round the glass, and turned over on one side and the other.

"Examined by a lens, it respired by two nostrils and by the mouth. It died at ten minutes past nine o'clock, which was one hour and twenty-nine minutes after its separation, though exposed for some time to the cold air of the street.

"The tongue was apparently equal to one-third the magnitude of the head—milk-white, grooved so as to embrace half the cylindrical circumference of the teat, which was pressed, as to its other half, against the vault of the palate. The mouth was a pore, which I could not distinctly discern without a lens; the cavity of the mouth spacious. The diaphragm strong.

"The heart, in its pericardium, large and powerful. The liver very large. The stomach filled with milk vesicles, examined under the microscope; the intestinal convolutions distended with milk and chyle, stained yellow with bile; the bladder of urine filled with fluid.

"Two lungs, each consisting of minute transparent vesicles resembling small soap-bubbles.

"Such is the anatomy of the young opossum of three and a half grains, destined to attain a weight of fifteen or sixteen pounds.

"While lying on the watch-glass, I put the smooth point of a pencil to its stomal pore. The animal sucked at the pencil, and held on so firmly, that I could lift it partly off the glass by it.

"Does this fact show that twenty-four hours earlier it could draw the delicate teat into the orifice?

"The young, having the teat once in the mouth, cannot let it go; nor does it abandon it for many days.

"I could discover no trace of an umbilicus. I sought for it with a good doublet. But it is not to be believed that a breathing, sanguiferous, digesting mammifer can be developed independently of a placenta.

"On Monday March 12th, an animal being removed for dissection weighed twelve grains; it breathed thirty-two times per minute.

"March 18th. A young one weighed eighteen grains. The tail very prehensile.

"I immersed it in a cup of alcohol to kill it for dissection. It did not die in the fluid until it had been immersed in it for sixteen minutes.

"The observations show the marsupial young to have a chylopoietic, warm-blooded, oxidating, innervating, and free-willing life, being as fully endowed with all the means of an independent existence, as the young of the elephant at the teat.

"If this be so, all mystery as to the nature of the life of the marsupial young is at an end."

With regard to the statement, that I omitted to "mention the preliminary condition of the mammary glands in the Kangaroo," I beg to refer to my article *Marsupialia*, 'Cyclopædia of Anatomy,' t. iii. p. 321, where, in reference to the female kangaroo experimented on, I state,—"The right superior nipple was the one in use; it was nearly two inches long and one-third of an inch in diameter; the mammary gland formed a large swelling at its base. The other three nipples were everted and about half an inch in length."—"Sept. 11th, fifteenth day of gestation, nipples in the same condition."—"Sept. 30th, thirty-fourth day, the nipple in use by the young kangaroo (which has died) is diminished in size." And again: "Oct. 4th, the nipple formerly in use has diminished one-third in size; the other nipples indicate no appearance of approaching parturition." The following day (thirty-ninth of gestation) "the new-born kangaroo was in the pouch and attached to the left superior nipple." Having specified the particular mammary gland which was enlarged, I presumed it would be understood that the others were not enlarged, and formed no swelling at the base of the smaller nipples.

The phænomena observed and described by Dr. Meigs are highly valuable additions to the physiology of the marsupial œconomy, but I must demur to the hypothetical statement, "it is not to be believed that a breathing, sanguiferous, digesting mammifer can be developed independently of a placenta." The young Viper is born alive, breathing, circulating its blood, capable of digestion, and was developed independently of a placenta. Nay, this body is not even essential to the development of an organism in which respiration and circulation go on so vigorously as to maintain a high degree of temperature, as, for example, in the Bird. The infinite variety, in the works of Creation, of the means by which similar ends are attained, should teach us to subordinate faith in what seems to be a general rule, to observation, wherever observation can be made. One of the most valuable facts in Dr. Meigs' memoir is the determination of the period of gestation in the *Didelphys virginiana*, viz. from the 18th of February to the 7th of March, with probably a range of a few days more or less.

In order to determine *ex visu* the nature of the embryonic membranes and appendages, and their degree of correspondence with those of the embryo of the kangaroo, which has no placenta, the female opossums should be sought after in the interval of the dates given by Dr. Meigs, or between the 10th of February and the 10th of March, and the state of the uterus carefully examined. Few series of preparations would be of more importance in elucidating the physiology of marsupial generation than the embryos and membranes of the opossum at different stages of its brief intra-uterine life. Whilst trespassing on your columns, permit me to add the following in reference to a former communication.

My much-esteemed and learned friend Professor Rymer Jones having intimated to me that he had been in the habit of regarding the odontoid process as the body of the atlas; which, in fact, was the opinion of Cuvier in respect of the odontoid of the *Chelys*; I beg, in order to prevent misapprehension, to disclaim any title to originality in the conclusions to which my comparisons of the cervical wedge-bones in recent and extinct Reptilia have led me, beyond the distinction of the body of the atlas into its peripheral and central parts, and the recognition of the so-called body of the atlas in Man and Mammalia, as still being a part of such element of the atlas, and the odontoid as the complementary (central) part, and not the representative of the entire body of the atlas.

My attention being directed more to the question of the homology of the 'wedge-bones' than of the 'odontoid,' in the paper which I transmitted to you in August last, and which was favoured by a place in the last number of the 'Annals,' I omitted to refer, as I ought to have done, to the passage in the 'Ossemens Fossiles:'

it is as follows:—"Ce qui prouve que cette pièce, analogue à l'odontoïde, est dans le fait le corps de l'atlas, c'est que dans la Matamata elle se soude aux trois premières, et prend toute la forme d'une vertèbre, s'articulant avec l'axis, et pourvue, comme lui, en dessous d'une crète longitudinale, et sur les côtés de petites apophyses transverses."—Tome v. part ii. p. 207.

In the Matamata (*Chelys fimbriata*) I find the piece answering to the first wedge-bone in *Enaliosauria*, and to that which Cuvier (*l. c.* p. 96) describes as representing the body of the atlas in the Crocodile, articulating but not confluent with the large odontoid, and articulating also with the fore-part of the base of the neural arch of the atlas. Traces of the suture still exist between the rest of the neural arch of the atlas and the 'odontoid.' The *Emys* (*Cimochelys*) *longicollis* resembles the *Chelys* in the size and shape of the central part of the body of the atlas. The difference between these and other *Chelonia* in respect to the odontoid, relates essentially to the greater proportion of the neural arch of the atlas which it supports, concurrently with its larger size.

I have the honour to be, Gentlemen,

Your obedient servant,

RICHARD OWEN.

London, October 16, 1847.

XXXI.—*Horæ Zoologicæ.* By Sir WILLIAM JARDINE, Bart., F.R.S.E. & F.L.S.

[Continued from vol. xix. p. 83.]

Birds of Tobago.

VIREO GILVUS, *Vieill.* N.*

MR. KIRK has appended no note to this species, which from the small number of specimens received does not appear to be very plentiful.

SIURUS AQUATICUS, *Swain.* Gray-throated Wagtail. N.

"Very little is known of this active and restless little bird; they are in general to be found in the bed or channel of rocky rivers, or by waterfalls, and when surprised will fly to a considerable distance, making a noise similar to that of the European 'Stonechatter.' After alighting they continue to bob up and down the heads, uttering a 'chirk' at every motion, at other times running along the sand nimbly in the manner of the Sandpipers. Feeds on small insects like gnats and ants." We have also received this species from Jamaica.

* Species marked N. are also found in North America; S. in South America; and N. S. in both.

MIMUS GILVUS, *Vieill.* (Mocking-bird.) S.

Apparently a common species on the island and the only one found in Tobago. From Jamaica again we receive the North American species, which seems to take its place there, and according to Mr. Gosse it is common and probably not migratory, as it is stated to be vocal at all seasons. "Frequents our dwellings and builds on fences, &c. It is to be heard every morning at the very earliest dawn of day by those who have trees around their dwellings pouring forth the sweetest notes imaginable, resembling the mavis, although imitating the most of our feathered tribes. They may be easily tamed, and hop along the ground with the rapidity of the magpie in quest of food, which is grasshoppers and worms."

TURDUS JAMAICENSIS, *Linn.* (Mavis.) S.

Utters "a 'chuck chuck' while hopping along the ground, is particularly shy and restless, feeds upon small berries and upon the seeds of the cabbage-tree."

TURDUS XANTHOSCELUS, *Jard.* (Black yellow-legged Thrush.)

"Remarkably shy: a rich mellow note all this month (April) and until July." This species we have been unable to find described or to see in any collection, and three specimens only have been received. The skin of the male somewhat stretched is $9\frac{2}{10}$, though perhaps from $8\frac{1}{2}$ to 9 inches will be nearer the natural dimensions. Length of wing to end of longest feather $4\frac{1}{2}$. The plumage is of a uniform black; the feathers of the vent and under tail-covers tipped with grayish white; bill and legs have been bright yellow. The female is above of a dull olive or oil green, beneath paler and more tinted with ochraceous, the chin indistinctly striated with a darker shade; the under wing-covers and axillary feathers ochraceous; bill and legs brownish yellow, apparently not so brilliant as in the male. A young male has many of the feathers tipped with a triangular spot of yellowish brown, and according to age would be no doubt more or less thus marked.

TYRANNUS CRUDELIS, *Swain.* N.

"A native: begin to build about the 1st of April. On pulling down a decayed building some time ago originally constructed of common pine, in which the carpenter-bee had constructed thousands of cells, and which on being disturbed literally covered the place like the casting of bees in Europe, I was amusing myself looking at the workmen and the bees over my head, when suddenly my attention was drawn to an adjoining roof, where the shrill voice of some twenty or thirty Tyrants bursting forth simultaneously showed that their harvest was already begun. I have often been delighted to see a number of them ranged along like so many sportsmen on one of our roofs, watching with eager eye for every straggling insect or fly which the calmness of the evening had induced out, and to see twenty of them darting off in different directions with their combined twitter, some twenty, some twelve yards, and returning again to the same place. I could observe nothing they were catching, yet they never miss their aim, as I could distinctly see from the circumstance of two adults as regularly as they returned putting before alighting whatever they brought into the mouth of a young one which awaited their return with open mouth, although to all appearance as big as the parent. I have often been surprised to see with what ease this tribe can turn the head right behind them, as if acting upon some double swivel. Without moving the body the eye goes all round the compass, in the same moment as it were, and without any preparatory symptom it leaps upon its prey, giving the shrill twitter just before rising."

TYRANNUS CRINITUS, *Linn.* (Yellow-belly.) N.

"This bird differs entirely in his manners from the Arkansaw flycatcher, although a good deal like it in appearance; feeds on insects and larvæ; has none of the twitter belonging or peculiar to the flycatcher tribe. If it catches its prey on the wing it must be done about the roots of the trees, and not in the bold style of the tyrant flycatcher." The Tobago specimens are all rather less than the dimensions given by Wilson, or those of a North American specimen before us, being from $7\frac{5}{10}$ to $7\frac{8}{10}$ in length. A specimen marked ♀ has little rufous on the wings, and entirely wants all trace of that colour on the inner webs of the tail-feathers. We have not received this species from Jamaica, the bird mentioned by Mr. Gosse under the name being apparently referable to one sent to us from that island of a larger size, and having much more rufous on the wings and tail.

TYRANNUS AUDAX, *Gmel.* (Shrike or Butcher-bird.) S.

"Native: very noisy on the approach of any person, and keeps up a continual chatter like the European magpie: feeds on insects, seeds and berries." We receive this species also from Trinidad.

TYRANNULA TRAILII, *Aud.*? N.

"Feeds about the roots of trees and lives on insects."

TYRANNULA OLEAGINEA, *Lichten.*? (Green-bird.) S.

"Native; little known; feeds upon insects and grass seeds or blossoms, and frequents the roots of trees in the woods."

MILVULUS SAVANNA. N.

PLATYRHYNCHUS CANCROMUS, *Temm.* (Yellow-crested Flat-bill. Duck-bill.) S.

PLATYRHYNCHUS FLAVIVENTRIS, *Spix* ? S.

Approaches near to the figure of Spix under the name above quoted, but the uncertainty of identifying those closely allied small fly-catching species without actual comparison is very great.

SETOPHAGA RUTICILLA, *Linn.* (Yellow Start, or Red Start.) N.
Found also in Jamaica.

ELANIA PAGANA, *Spix.* (Clear, or Day Clear.) S.

"A strong emphasis put upon the word *clear* will give a pretty accurate idea of their note. Feed upon fruit, fiddle-wood berries, &c. Begin to build about the 1st of April, and make a very neat nest of lichen, laying three or four eggs of a white ground dotted with irregular rust-coloured spots at the large end." Mr. Kirk was indebted to John MacDonald, Esq. for a curious albino variety of this bird killed in 1833 near the sea-shore.

This species approaches nearly to Spix's figure, though in making the comparison we added a? The Tobago species is of considerable interest, exhibiting the form and colouring of the small Tyrants, but having the bill less depressed, more rounded, and the rictus furnished with a less-developed array of bristles. The food fruits and berries; the nest showing great neatness of structure. Among the *Ampelidæ* then may be its proper station, though wherever placed it will recede from any typical form.

PACHYRHYNCHUS NIGER, *Swain.* S.

THAMNOPHILUS DOLIATUS, *Linn.* (Qua Qua, or Cata-bird.) S.

"A native: always in pairs. I trust I can convey a perfect idea of the note of this bird, although it possesses two, the one resembling the *craw* of the rook, but more hollow, and although close by, appearing as if at a great distance; but the most common note it possesses and is responded by both, is a repetition of *cac, ac, ac, ac, ac, ic, ic, ic, ic, ic, ic, ic, ic, ic, ic, ca, ca*; while performing this note being destitute of all shyness. The crest stands erect, while the tail and every feather in the body seems in violent agitation. Builds upon low bushes and lays three eggs. A slave called this bird 'Carpenter-bird's water-fetcher,' an attendant on the woodpecker."

MYIOTHERA SCAPULARIS, *Vieill.* (Black and White Creeper.) S.

"A native: feeds on insects; their general manner of feeding is low down, not like the Woodpecker tribe, but flying from one tree root to another with a low 'chirp,' and carefully examining every crevice in the bark, picking from thence insects and larvæ, ants, &c."

METOPIA PAREOLA, *Swain.* (Manakins.) s.

"Birds of the first year are destitute of the scarlet crest, when they afterwards gradually assume the light blue back and black belly; feeds upon seeds and berries."

TANAGRA CANA*, *Swain.* (Blue Bird.) s.

TACHYPHONUS LEUCOPTERUS, *Gmel.* (Tanager.) s.

"Native. This bird is related in some degree to Wilson's Red-winged Starling. As far as his description regarding the destruction of corn goes, it strictly applies to this bird, and the only difference is, that the 'Tanager' can scarcely be called gregarious. Although I have seen them assembled in considerable numbers among the corn about the same place, yet the flight or departure of one seemed to be entirely independent of the other."

TIARIS JACARINA, *Linn.* (Blue-throat Grass-bird.) s.

"Native: gregarious, found in small flocks of twenty or thirty; feed on the ground on grass seeds, &c. A beautiful warbler, and sprightly in appearance as well as in song: although a grass bird, it may frequently be found pouring forth his song from the top of a tree." A white variety has also been received.

TIARIS OMISSA, *Jard.* (Grass-birds.)

"Feed upon the guinea grass." The species which we have named as above appears to be distinct from the *Fringilla bicolor* of Linn., which agrees with Jamaica birds and with the figure of Catesby, which we believe is the foundation of that bird as well as of Brisson's *Chloris bahamensis.* There is a bird figured in

* We are indebted to Mr. Strickland for the following note to this species:—"Much confusion exists among the blue species of *Tanagra* commonly called 'Bishop Tanagers.' These birds appear to constitute at least three species:

"1. *Tanagra episcopus*, Linn., founded on Brisson, Orn. vol. iii. pl. 1. f. 2. Its synonyms are, *Gracula glauca*, Sparrm., *Tanagra cœlestis*, Spix, *T. sayaca*, Linn., and *T. serioptera*, Sw. Lesser wing-covers light gray with a violet tinge. Length of wing $3\frac{4}{10}$ inches. Guiana.

"2. *T. virens*, Linn.—Syn. *Sayacu*, Edw. Birds, pl. 351. f. 1; *Loxia virens*, Linn.; *Tanagra prælatus*, Less. Tr. Orn.; *T. episcopus*, Sw. Orn. Drawings, pl. 39. Lesser wing-covers deep blue, back and flanks more or less greenish. Wing $3\frac{8}{10}$ inches. Brazil.

"3. *T. cana*, Sw. Orn. Drawings, pl. 37. The *T. cœlestis*, Sw. Orn. Dr. pl. 41, seems to be the female. Lesser wing-covers deep blue, back and flanks cærulean gray. Wing $3\frac{6}{10}$ inches. Swainson refers this bird to Brazil; my specimens are from Bogota. The Tobago bird agrees with the latter except in being of a more vivid blue on the back, upper tail-covers, outer margin of remiges and flanks, but I would hardly venture to separate it as a species."

Edwards's 'Gleanings,' iii. pl. 362. f. 2, which although mentioned as received from Africa agrees with our Tobago bird, and of which we cannot help thinking that the locality may have been incorrectly given; and it is remarkable that although the other figures on this plate are quoted by Linnæus and by Gmelin, this little bird seems to have been overlooked or omitted both by them and subsequent authors.

♂ Forehead dull greenish black, shading backwards into oil-green on the whole upper parts, wings and tail; chin, throat and breast black, shaded into pale brownish gray on the belly and under parts. Entire length 4 inches, of wing 2 inches.

Spermophila fusciventris, *Bodd.* s.

Spermophila ignobilis, *Spix.* s.

"Builds on the grass: beautiful warblers."

Spermophila misya, *Vieill.* s.

"A native." The name of "*grass-bird*" seems generally to be applied to the small Tobago Finches; the three last being all so marked without any distinguishing epithet.

Cassicus cristatus, *Gmel.* (Yellow Tail.) s.

Sturnella guianensis, *Linn.* s.

Chrysoptilus rubiginosus, *Swain.* (Woodpecker, Golden-winged.) s.

"Native: feeds like all the tribe on insects and larvæ. With a shrill piercing note it flies from tree to tree, and although often found low it will ascend from the root spirally to a great height, examining with surprising dexterity every crevice as it moves along. I have seldom observed this species tapping the dead limbs of trees so much as the spotted and red-tailed woodpecker." We have also received this species from Trinidad.

Chrysoptilus kirkii, *Malh.* (Woodpecker, Red-tailed.)

"Native. The note of this species is three syllables, sounding like the words 'click, click, click,' pronounced very sharply towards the end."

This species was submitted to the examination of M. Malherbe while in London last year collecting materials for a monograph of the family; he considered it undescribed, and suggested the specific name which we have adopted above. The most nearly allied to this is the "petit pic de S. Domingue" of Brisson, on which is founded the *Picus passerinus*, Linn.; but it differs from it, as well as the *P. affinis* of Sw., in the markings of the wings and tail, and in the rump and upper tail-covers being red, whereas in the others they are olive or yellowish.

Centurus tricolor, *Gmel.* (Woodpecker, Spotted.) s.

"Native, and the most domestic of its tribe; I have lately shot them tapping at the facings around the corners of this dwelling-house. Feed like all the tribe upon insects; but this species is particularly noted for destruction to the Indian corn when in a soft and milky state, and may then often be found with the celebrated corn thief the Tanager (*Tachyphonus leucopterus*). In making this accusation against this species, I am inclined to think that while tearing the ears of corn and exposing them to the rain, &c., it is more with a view to secure ants than to destroy corn, as a great many ants are in general collected around the ears once exposed in that soft state. They have two different notes, the regular response being a prolonged whistle, sharp, strong and piercing, at first slow, about sixteen times repeated, quick towards the middle and again prolonged towards the conclusion."

[To be continued.]

XXXII.—*On the different Beds of the White Chalk, and on the Faults and Dislocations which they exhibit.* By J. Toulmin Smith, Esq.

It is certainly no less true of geology than of any other branch of natural science, that it is endangered as much by "false facts as false theories." Such "false facts" are not merely neutrally mischievous: they are fertile sources of positive error and erroneous induction. Even if the true character of the "false fact" is perceived, it will often not be till it has added much to that labour which every true naturalist must oftentimes undergo of "laboriously groping about in the dense labyrinth of facts *."

I called attention some months ago to an important instance of such a "false fact" very authoritatively put forth as to the existence in one geological æra of one of the most extraordinary creatures which geological research has yielded—the Pterodactyle†. It is important to my present purpose to repeat this instance, as it originated in a very common source of such false facts, and one against which the most able inquirer has no defence if he depend for his material on the dealer instead of obtaining it as the reward of the personal exploration in the field of himself or of a confidential collaborator. Many other instances might be cited of positive error which has in this way been promulgated, or in which the danger of promulgating still greater and more sweep-

* Oken's preface to the Ray Society's ed. of his 'Elements of Physiophilosophy.'

† See vol. xix. of this Journal, p. 295, *note*.

ing error has been only averted by the acuteness of a practised and able palæontologist. In immediate connexion with the chalk beds I will name one other instance which is at the present time drawing forth frequent expressions of interest and surprise from geologists,—I mean the alleged discovery of a bed of Ammonites and allied forms in the upper part of the chalk;—a discovery which, without expressing a positive opinion as to the absolute fact implied in it, I can safely say is at present unsustained by any facts in my own collection (in which is a large series of the specimens) or in any other which I have seen, and I shall presently show why the allegation (which implies an induction) has, at present, no necessary basis of absolute fact, even admitting the alleged localities to be correctly stated.

That the interest and importance of geology as a science, in all its branches and applications, mainly depend upon that stratigraphical exactness on which I have before insisted*, must be admitted equally by the palæontologist, the engineer and the surveyor. I propose therefore, very briefly, to call attention now to some points:—I. As to the different and differing beds of the white chalk, by which I mean, that which lies above the chalk marl: and II. As to the causes of the frequent confusion which exists in the determination of the true position of chalk fossils;—which will lead us directly to another interesting question, namely the faults and dislocations which have taken place in the chalk itself, and the time or times at which these have taken place.

I. There is so much external resemblance between hand specimens of the chalk from any of the beds above included, that it is little surprising if those not familiar with actual sections generalize the whole together.

Dr. Mantell divides the beds of which I am speaking into "upper or flinty chalk" and "lower chalk." This division, which was made in his 'South Downs' (pp. 79 & 139), is retained in his 'Medals of Creation' (p. 33). The same division is made by Mr. Lyell (under different names) in his 'Elements,' vol. i. p. 386 (ed. 1841), and, though with even less distinctness, in vol. ii. p. 180. Mr. Morris, in his 'Catalogue' (p. ix), makes a similar division, and in Mr. Tennant's 'Stratigraphical List' just published by the "Society for Promoting Christian Knowledge" a like division is made (p. 37).

In all these cases the presence or absence of flints is made the ground of division of the beds. I do not deny that in one part of the white chalk flints are common, in another part absent or rare. But I altogether demur to this being assumed as any basis for a natural division, believing that presence or absence to be,

* In *loc. cit.*

in the proper sense of the word, a mere accident, in no way *necessarily* indicative of any change in geological deposit, and one which might happen, and in fact has happened, during the course of very different formations, and, as indeed the flinty chalk itself proves, at varying periods during the course of any one deposit*.

We may however find other characters, sufficiently well-marked, which lead to positive and well-defined divisions of the white chalk. Passing over minor subdivisions, three great divisions force themselves upon the observer's attention where the chalk is fully developed, as in the hills and valleys of Kent. These divisions may be stated as—1. the *upper chalk*, which happens to coincide pretty exactly [though by no necessity, as above indicated] with the chalk having horizontal layers of flint, and may therefore be readily distinguished at a glance; 2. the middle chalk, a chalk as white as the upper chalk and lying immediately beneath it; and 3. the lower chalk, which, when wet, has a slightly grayer tinge, though, when dry, not thus distinguishable from either of the above. It is not unimportant to notice, that the distinction drawn by Mr. Lyell (p. 386) between *soft* white chalk and *hard* white chalk is a distinction which will not hold. The upper, middle, and lower chalk is, quite indifferently, hard or soft in different places. There are places in which the middle chalk is so extremely rotten that it is almost impossible to extract any fossil entire. This very chalk, again, by long exposure to the atmosphere, becomes so extremely hard that it will turn the edge of any tool, and is, from its extreme hardness, as impracticable as before from its rottenness.

These three beds are to be distinguished by their organic contents. It is not my present purpose to enter in detail into these; it is sufficient to call attention to the divisions by a few broad instances. The most unpractised eye will at once perceive the difference in the groups of *Terebratulæ* found in the three several beds. The distinctions, not merely modifications, but in marked characters, between the *Echinites* is very great; while the *Inocerami* offer the means of no less broad comparison. These last abound, in extraordinary number and variety, in the middle chalk. The abundance and character of the remains of the vertebrate animals afford no less important means of marking these divisions. I am however for the present content to rest the distinction between the three beds upon the differences presented

* Mr. Lyell states (as above, p. 386) these layers to be "from two to four feet distant from each other." It will, however, be found, in fact, that the differences are much more striking. I am acquainted with localities in which several successive beds are found varying from one to two feet apart, or less,—underlying which is a mass of chalk, without any layers of flints, at least fifteen or twenty feet thick, but below which last other regular layers of flints are found. See vol. xix. of this Journal, p. 15, *note*.

by the *Ventriculidæ* found respectively in each, and which—as I shall particularly show when detailing the species of that family,—belong, in the three beds, to three distinct and strongly-marked groups, a fact which illustrates the importance of the careful investigation of any single family, to whatever class it may belong. Of the three groups into which I shall show that that family must be divided, the first (*Ventriculites*) is found in the upper chalk; extremely rarely any species of it, and then very doubtfully, in the middle chalk: the second (*Kephalites*) is very rarely, and then also doubtfully, found in the upper chalk: I have never seen a single specimen of either from the lower chalk. Of the third group (*Brachiolites*), while some species are perhaps found in the upper chalk and the same are found in the middle, some of the most marked species—differing, with one exception, and even in that with a modification of character, from those last named—are found in the lower chalk and even greensand.

I have remarked that some species of *Ventriculidæ* are found *doubtfully* in one or the other bed. This leads me to notice,

II. The causes of the doubt and confusion which exist as to the true position of many fossils from the chalk, and consequently as to the character of the respective geological æras.

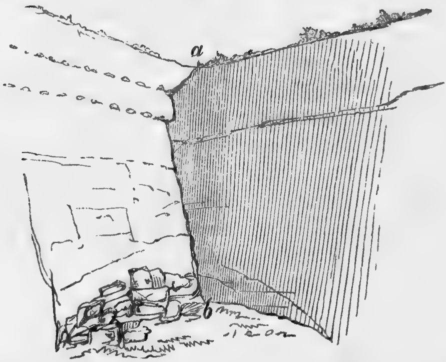
From the particular mode in which the denudation of the chalk has taken place, it happens that, in many pits, in many parts of Kent, the upper part of the same pit exhibits the upper chalk, the lower part the middle chalk, while, within five minutes' walk, lies the deep lower chalk. Now whether fossils be picked up on the floor of such a pit or out of blasted blocks, it will, generally, be equally impossible, from the mere hand specimen, to determine to which bed it belonged. It is in such pits as these that the problematical Ammonites, &c. have been found; and it is in such pits as these that I have picked up the specimens of Ventriculidæ which I have above assigned as doubtful. It is only by very careful and personal examination of individual sites, and not merely of localities, that the exact and accurate determination can be made.

Another important source of error is the faults and dislocations which have taken place in the chalk*. These, in rocks so similar as the different beds of the white chalk, escape any but the closest attention. The following instance is instructive. In the course of the last spring I visited, in company with Mr. Morris, the collection of Mr. Harris at Charing. I learned that there had long been a friendly dispute between Mr. Harris

* I do not allude to such faults as Mr. Lyell figures, p. 27. vol. ii. of the 'Elements,' and which can never mislead, but to cases where white chalk only is seen on both sides, with nothing to distinguish the two to the superficial observer.

and Mr. Morris (whose stratigraphical skill is probably unrivaled) as to whether the pits whence the collection was mainly derived were upper or lower chalk, and my own impression was asked. I unhesitatingly pointed out a large number as from the upper chalk, but presently came to some which I was equally clear were from a lower bed *. I was somewhat startled by the information that both groups were from the *same pit*. A personal inspection could alone be satisfactory. On reaching the pit I found,—and it was fully admitted by both gentlemen,—that it exhibited, exactly in its centre, a clear line of fault, of which the following outline, from a sketch made on the spot, may give some

Fig. 1.

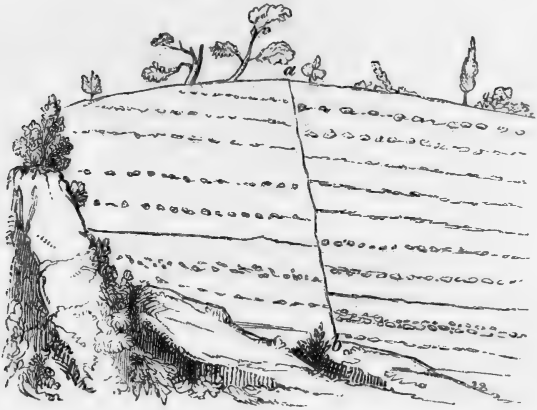


idea. I immediately pointed out to Mr. Harris that all his fossils of the one group came from the upper part of the chalk on the left hand of the line *a*—*b*; all those of the other group from the chalk on the right hand of that line. As far as could be ascertained from his personal knowledge and from exact inquiry among the workmen, this was found to be the case, and he has since informed me that the suggestion thus made has been of material assistance to him in his subsequent observations. The fact was, that the former side exhibited the upper chalk, the latter much lower beds. Here had been a great fault, so great that these so different beds lay side by side with one another. The whole exposed and unbroken surface of the right-hand side, shaded in the accompanying sketch, was polished and glistening, —as true a case of *slickensides* as could be found. The attrition had been with such force that several large flints were found actually crushed in the exact line of fault. The band on the upper part of that side is a thin layer of marl to which I cannot now further allude. The rows of flints on the other side are seen in the sketch.

* I am not, at this time, quite certain whether these were strictly *lower chalk* or *middle chalk* forms, and it is immaterial to the present point.

It is unimportant to the present question whether this is a case of fault in the ordinary sense, originating in upheaval or depression due to causes acting from below, or whether it is a case of sliding towards the valley. In either case it is equally important that it and all such cases should be noted and known; though I have little doubt that it is a true fault. I have since met with another case of undoubted true fault—the direction of the fault being transverse to the valley—at a distance of about twenty miles from the last. Of this also an outline is here given, in which *a*—*b* will be seen to be the line of fault. Both sides exhibit the upper chalk only, but the fault is well seen owing to the displacement of the layers of flint*.

Fig. 2.



Another phænomenon, which is found especially in the middle chalk, is well-worthy of being here noted,—a phænomenon not of fault, but of *dislocation*. In pits which externally appear smooth and unbroken, and lying underneath thick beds which are wholly undisturbed, the chalk will sometimes be found not to lie in unbroken or merely jointed strata, but to be made up of huge masses, each many tons in weight, and each of the faces of every one of which is smooth and polished†. There is no rubbish: all is massive: but there has clearly been very much dislocation and disturbance, and which must have taken place before the beds lying above were solidified.

But beyond each of these evidences of motive force in the beds of the white chalk another is sometimes found, which also is

* Many other instances of faults in the chalk have come under my notice, to which I shall probably take a future opportunity of alluding more in detail.

† Something of this kind must explain the case cited by Dr. Mantell, 'South Downs,' p. 149, but the "brown" colour is not present in the instances I have before me.

most frequently exhibited in the middle chalk, and may often mislead or puzzle the observer. In this case the dislocation may best be explained by describing the chalk as *knotty*. One of the huge masses before named, when broken up, occasionally (by no means always) presents a very remarkable appearance. It is full of extremely hard lumps which separate readily from each other and which seem as if made up of bundles of threads,—a character which is often more than merely superficial. It will be clear that, as the dislocation last-named could not take place without some of the masses being violently compressed and distorted, when that compression and distortion took place, the component parts of the mass, according to the tenacity or cohesion of its various organic contents and the varying degrees of its partial consolidation, would necessarily assume the characters which are thus exhibited. I have collected many interesting illustrations of these phænomena,—having found many organic remains quite perfect as to condition, but divided in the middle by one of these knots. In one instance an unfortunate fish has had the fore part of his head driven from its place by a knot, which, while pushing it three inches forward horizontally, has pushed it two inches vertically down. The striæ caused by the friction are usually very clear in such cases.

Sometimes the knots assume very peculiar forms. Specimens, very regularly striated, are often sold by dealers as fossil wood, and the specimen here figured might easily be placed in that convenient group—the Coprolites. The knots in this instance are unusually regular. Several were found, one above the other, like the joints of a stem. I brought away the two figured.

Fig. 3.

Two-thirds nat. size.

As to the time at which these forces acted upon the chalk, it would seem that they have not been confined to any one age. As far as my observations extend, the *dislocations* above-noticed have been temporary and are principally confined to one bed and æra,—the middle chalk. The *faults*, on the contrary, have been more extensive through the beds. The former therefore took place before the close of the secondary period and before the superposition of the upper chalk. The latter must have taken place at a much later period*, and we are not altogether without evidence that it was comparatively recent. Some time ago I obtained, from the solid chalk, the well-preserved tooth of a fossil horse. Without entering into any nice question as to whether this belongs to the species

* It is unnecessary to allude now to the cases of shivered flints in beds,

distinguished by Professor Owen as characteristic of the Miocene or of the Drift*, it is sufficient that his eye at once recognized it as a fossil form. I was careful to ascertain the exact details of the spot wherein it was imbedded. The pit was near the top of one of the highest hills in Kent, on or near which was no diluvium whatever, and a vegetable soil of hardly appreciable thickness. There was no fissure, nor would any disturbance of the bed have been noticed without very close inspection. That inspection however showed that there had been some displacement, which, though the two walls were then so close that the blade of a knife could not be inserted, had doubtless once yawned, and thus enabled this mammalian fossil of the tertiary beds to lodge deep down in what it might be hard to persuade many was not solid undisturbed chalk. It was middle chalk on each side of the line, so that the amount of relative displacement could not be ascertained. The tooth was found about twenty feet from the present surface.

I have thus endeavoured to call the attention of observers to some of the conditions which should be borne in mind by those who, in investigating the chalk formation, geologically or palæontologically, would avoid the danger of making the "labyrinth" of their fellow-labourers more "dense" by the accumulation of "false facts."

XXXIII.—*Description of* Clinteria Hoffmeisteri, *a new species of the family* Cetoniadæ, *from North India.* By Adam White, F.L.S., Assistant Zool. Dep. British Museum.

Cetonia (Clinteria) Hoffmeisteri.

C. viridescenti-fusca supra obscura, subtus nitida; pilosa; thorace albo-marginato, lineaque media alba; scutello albo; elytris albo-marginatis margine interna linea alba, ramulos 2 aut 3 emittente, vitta submarginali rubra, et linea subinterrupta subobliqua mediana; margine suturæ postica vitta alba interrupta; pygidio albo, brunneo marginato.

Hab. in India. Mus. Brit. et "E. India House." *Dr. Horsfield.*

Head cupreous; antennæ reddish; legs and the under parts of a dark purplish coppery red, without spots, clothed with longish ochrey gray hairs; the hairs similar in colour on the upper

as, though they are shivered, the strata have not been dislocated and do not therefore affect the present point. They are of course evidence of some powerful agitation, which was probably the same which, in other spots, produced these faults.

* Brit. Foss. Mammals, pp. 383, 392.

parts, but shorter and giving a yellowish gray tinge to the white parts.

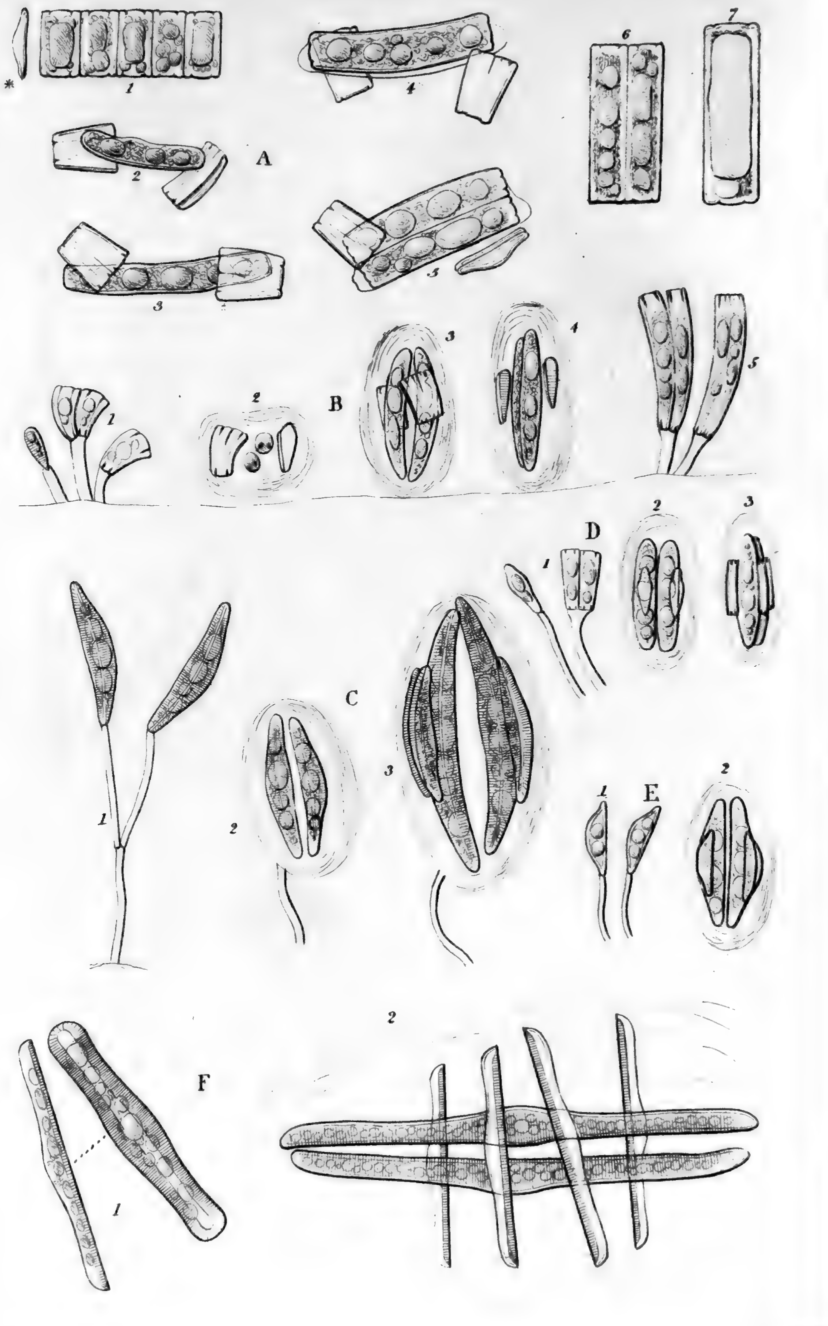
The figure represents the insect magnified twice its natural size. I might have given a more elaborate description; but as there did not occur to me in its examination any very remarkable difference in structure between this and the allied species mentioned beneath, the above may suffice.

C. Hoffmeisteri, White.

In general form and look this species has considerable resemblance to *C. spilota*, Hope, Gray's Zool. Misc. p. 25, of which the *C. himalayensis* figured by Gory and Percheron may be considered a local variety, and perhaps also the *C. confinis*, Hope, Zool. Misc. 25, Gory and Perch. t. 77. f. 5, Burm. Handb. iii. p. 304; but its shortness, hairiness, markings and other characters specified above, will at once distinguish it; and better still the accompanying woodcut, carefully drawn by Mr. William Wing from the Museum specimen, will at once establish the difference.

Dr. W. Hoffmeister, in memory of whom this very distinct and charming species of *Cetonia* is named, passed through London on his way to India. His amiability, earnestness and intelligence would have soon, had he lived, gained him a reputation like that of his uncle Prof. Lichtenstein of Berlin. In India he was attached as physician to the suite of Prince Waldemar of Prussia, and at the battle of Ferozeshah was killed while attending on the prince, who insisted on sharing with Lord Hardinge the honourable danger of advancing in front of the line to encourage the British troops. Dr. Hoffmeister was much attached to the study of insects, and seemed well acquainted with the European forms. In his letters to his friends from the East Indies, published after his death by Dr. A. Hoffmeister, he has given good proof of his powers, his shrewd observations and his affectionate disposition.

In the next number of the 'Annals' will be given a continuation of remarks on, and additions to, "the list of Cetoniadous insects in the collection of the British Museum."



G.H.K.T. del.

J. De C. Sowerby. sc.

XXXIV.—*On Conjugation in the* Diatomaceæ. By G. H. K. Thwaites, Lecturer on Botany and Vegetable Physiology at the Bristol Medical School.

[With a Plate.]

To the Editors of the Annals of Natural History.

Gentlemen, 2 Kingsdown Parade, Bristol, Oct. 6, 1847.

I am now enabled to make some interesting additions to my previous papers on Conjugation in the *Diatomaceæ,* the result of a very attentive examination of the species therein referred to, as well as of others which it has since been my good fortune to detect with conjugated frustules.

In my last communication I stated that the sporangia of the four species there named bore a close resemblance to the frustules of *Cocconema,* and that the sporangia of *Cocconema lanceolatum* differed apparently in no respect but in size from the frustules of that species. At that time I suspected, but had not evidence sufficient to prove it with certainty, that in the other three species adverted to the sporangia became eventually similar in form to their parent frustules, and that the Cocconema-like appearance was merely that of their immature condition: such I can now state positively to be the fact as respects the seven species which have occurred to me with mature sporangia, as I have succeeded in tracing the change to the form of the frustule so satisfactorily as to leave not the shadow of a doubt in my own mind as to the fact; and not only can I venture to state thus much, but also can with equal certainty affirm that the sporangia, like the frustules, undergo fissiparous division; and that in the two species of *Gomphonema* mentioned in this paper, they become stalked like the latter, so as to make their mutual resemblance still more striking. This circumstance lessens the probability of frustules and their sporangia being described as distinct species, especially as it is also the fact that, although sporangia far exceed in size their identical parent frustules, they may not be at all or but very slightly larger than ordinary frustules of the same species do sometimes become. It seems to me likely, however, that Kützing's "*Epithemia Vertagus*" is the sporangium of *Eunotia turgida,* Ehr.

It will be seen by the accompanying Plate, that in most of the species there figured the conjugated frustules become divided into two separate halves to allow of the escape of their contained endochrome; in *Gomphonema minutissimum* and *Fragilaria pectinalis,* however, the endochrome escapes by a slit at one end of the frustule. *Fragilaria pectinalis* differs too, it will be observed, from all the others in one sporangium only, instead of two, being produced from the pair of conjugated frustules. This sporangium, which is at first cylindrical, soon assumes a flattened somewhat quadrangular form, and in many, but not in all cases, undergoes fissiparous division before it has put on the exact appearance of a frustule of the *Fragilaria*.

It cannot be doubted that in a physiological point of view the phænomena here brought forward are of great value, and there are many questions relating to impregnation in plants and animals upon which they may have an important bearing. I purpose in an early communication sending some observations on this subject for insertion in your valuable periodical.

I am, Gentlemen, your very obedient servant,

G. H. K. THWAITES.

P.S. October 23, 1847. My valued correspondent, the Rev. William Smith of Wareham, has recently sent me specimens of a new and very beautiful species of *Schizonema* (which I purpose figuring and describing under the name of *S. subcohærens*), some of the frustules of which I was fortunate enough to detect in a conjugated state: the sporangia are produced in a similar way to those of *Cocconema*. I am indebted to the same gentleman for the opportunity of discovering the conjugated frustules of *Eunotia zebra*, Ehr. (which a good deal resemble those of *E. turgida*), *Epithemia gibba*, Kütz., and *Fragilaria pectinalis*, sent amongst other interesting Algæ from his neighbourhood.

EXPLANATION OF PLATE XXII.

Fig. A. 1. Filament of *Fragilaria pectinalis*, Lyng.: *, side view of frustule.
— 2 to 5 inclusive. The same species in conjugation, exhibiting the sporangium in various stages of development.
— 6 and 7. Mature sporangia of *Fragilaria pectinalis*.
Fig. B. 1. Frustules of *Gomphonema minutissimum*, Ag.
— 2, 3 and 4. The same species in conjugation.
— 5. Mature sporangia, become stalked like the frustules.
Fig. C. 1. *Cocconema lanceolatum*, Ehr.
— 2 and 3. The same in conjugation.
Fig. D. 1. *Gomphonema*, n. s.?
— 2 and 3. Different views of the same in conjugation.
Fig. E. 1. *Cocconema Cistula*, Ehr.
— 2. The same species in conjugation.
Fig. F. 1. *Epithemia gibba*, Kützing.
— 2. The same in conjugation.

BIBLIOGRAPHICAL NOTICES.

Monographia Heliceorum Viventium. Auctore Ludovico Pfeiffer, Dr. Leipsic: London, Williams and Norgate.

After the lapse of many years, this long-announced publication has at length made its appearance. The well-known lengthened researches of the author, and his personal inspection of the typical specimens in the chief museums and more important private collections of Europe, have excited a more than ordinary feeling of interest respecting it,—a sentiment which the profound knowledge of his subject displayed by him in his intercourse with conchologists during his recent visit to England has by no means tended to allay. It is solely by that undivided attention to one particular branch of natural history, which has been devoted to the investigation of the Snails by Dr. Pfeiffer, that the unravelling of that tangled mass of synonyms, which the presumptuous ignorance of tyros and the careless indolence of compilers have alike generated and fostered, can successfully be attempted; and the author's comparison of types and frequent correspondence with other writers upon conchology combine in giving a stamp of authority to his labours. The first part only of this monograph of Helices is as yet before the public: we learn however from the accompanying prospectus that the remainder will be issued at no distant interval, and that the entire work will occupy two octavo volumes. In 160 pages are contained diagnoses of between four and five hundred species of shells; the total number intended to be described is 2100. This is an immense increase to our knowledge of this family, the aggregate species of the several genera included by our author under *Helix* amounting in the pages of Lamarck to 224, of the second edition of the 'Animaux sans Vertèbres' by Deshayes to 536, and in Férussac's great work to 573. The following genera are regarded by Dr. Pfeiffer as coming within the limits of his work: *Anostoma, Tomigerus, Streptaxis, Odontostoma* (*Proserpina*), *Helix* (including *Carocolla* and *Nanina*), *Bulimus, Achatina, Pupa, Cylindrella, Daudebardia, Vitrina, Succinea, Balea, Tornatellina,* and *Clausilia.* As no less than 1132 species belong to *Helix* proper, a very elaborate sectional arrangement is proposed for facilitating their determination; without which assistance indeed, the toil of searching through some hundreds of descriptions in ascertaining the name of a single specimen, would be insufferably tedious. And yet this praiseworthy subdivision is neglected in the majority of conchological monographs which are annually appearing!

The language in which the results of the author's observation and reflection during a period of ten years (as he informs us) is communicated to his readers, is that universal medium of communication among naturalists, the Latin tongue; not sparingly used for brief diagnoses, betraying too often the writer's inability to express himself satisfactorily and lucidly in it, followed by longer notes in his vernacular explanatory of his meaning, but written throughout in that classic dialect, without the interpolation of a single word of his native speech. This will doubtlessly ensure it a widely extended circulation; the practice of each individual writer describing his supposed new species in his own particular language, of course limiting the perusal of his work to those conversant with that tongue, and entailing great confusion (where the work is not illustrated) through foreigners reproducing the species under other appellations through a justifiable ignorance (since a knowledge of all the tongues of Europe cannot be expected from any man, and their acquisition would leave but little leisure to be devoted to the study of nature) of their prior publication.

It is perhaps to be regretted that no plates accompany the letter-press, the references being frequently to unpublished (at least they have not as yet reached us in England) figures in Kuster's costly and bulky edition of Chemnitz's 'Conchylien Cabinet,' a book, whose protracted periodical issue and the rudeness of execution in its earlier plates, combined with the comparative want of research displayed by the editor in the earlier portion of it, have almost excluded it from our libraries in England, and rendered us ignorant how much valuable matter is engulfed in the more recent numbers, wherein indeed a very considerable number of hitherto unpublished species have of late appeared. An atlas of engravings after the fashion of Rossmäsler's 'Iconography of the European Land and Freshwater Shells,' and produced at a similar moderate charge, would prove a most valuable companion to Dr. Pfeiffer's text, and would not (we believe) be unappreciated by the public.

In conclusion we may state, that there is throughout exhibited a sound and practical acquaintance with conchological literature, particularly with that of England; and with a singular frankness, such species as the author has himself been unable to recognize are indicated by a symbolic mark. This latter proceeding may appear unimportant, yet how many difficulties could be solved, were we thus enabled to ascertain the exact extent of an author's acquaintance with the established species previous to his constitution of new ones!

Fauna littoralis Norvegiæ, oder Beschreibung und Abbildungen neuer oder wenig bekannten Seethiere, nebst Beobachtungen über die Organisation, Lebensweise u. Entwickelung derselben von M. Sars, Doctor der Philosophie, &c. Erstes Heft, mit 10 Kupfertafeln. Christiania, 1846.

The first number of a very interesting work which we are anxious to recommend to the support of British zoologists. It is written in the German language with the characters of the new genera and species in Latin: it is in folio, and this number contains 94 pages and 10 plates, well-engraved and uncoloured. The species illustrated are—

1. *Syncoryna Sarsii*, Löv.

2. Podocoryna, a new genus, = *Hydractinia* of Van Beneden; and the *P. carnea*, Sars, is very probably the same as the *Hydractinia rosea*, Van Beneden.

3. Perigonimus (nov. gen.). "Polypi pallio membranaceo, tubuloso, gemmis matri similibus imperfectis ramoso, capitulo molliori non retractili, affixi; tentaculis sub ore verticillatis, biserialibus. Gemmæ matri dissimiles et ovis carentes non in capitulis, sed in caule ramulisque sparsæ, campanulatæ, cirris marginalibus quatuor." *P. muscoides* is the only species: it seems related to the *Campanularia dumosa* of British authors.

4. *Cytæis octopunctata*; a new species without a Latin diagnosis, but well-figured.

5. *Pennatula borealis*, "16 ad 31 pollicaris, valde elongata, rubra; pinnulis breviusculis, semilunaribus, apicem versus longioribus et imbricatis, basin versus minoribus et magis distantibus, cellulis polyporum in seriebus 2—3 irregularibus dispositis; rhachide angusto; stipite (sterili) tertiam ad quintam totius partem æquante, fusiformi, parte bulbosa antice margine elevato et supra papillis sanguineis. Polypi albidi, tentaculis 8 pinnatis apice acuminatis, pinnulis longioribus setaceis." A very fine species.

6. *Lucernaria quadricornis*, Müll. = *L. fascicularis*, Flem.

7. *Lucernaria auricula*, Rathke.

8. *Lucernaria cyathiformis*, nov. sp.

9. Arachnactis (nov. gen.). "Animal liberum, molle, natans; corpus breviter cylindricum, parvum, basi rotundata, disco suctorio carente; os seriebus tentaculorum non retractilium duabus circumdatum, exterioribus longissimis, interioribus brevibus." One species is known, which M. Sars calls *A. albida*. It may be compared to a detached head of a *Tubularia* floating at freedom in the sea.

10. Agalmopsis (nov. gen.). "Partes cartilagineæ superiores seu natatoriæ ut in *Agalmate*; inferiores numerosæ, solidæ, triangulares, sparsæ, non tubum componentes, sed modo una earum extremitate canali reproductorio affixæ cæterumque liberæ, pro emissione tubulorum suctoriorum ac tentaculorum ubicunque fissuras præbentes. Canalis reproductorius longissimus, tubulos suctorios, vesiculas variæ formæ et tentacula offerens. Tentacula ramulis clavatis (clava variæ formæ) obsita." The only species is named *A. elegans*, and well it is entitled to its designation. It is described and figured in the best manner of the author.

11. *Diphyes truncata* (nov. sp.), "partibus utrisque cartilagineis corporis pentagonis: anteriori pyramidali, postice truncata absque appendicibus; posteriori utraque extremitate truncata, postice infra appendice horizontali foliacea margine inciso; cavitatibus natatoriis æqualibus. Squamis in canali reproductorio cartilagineis fornicatis margine integro."

12. *Diphyes biloba* (nov. sp.), "partibus utrisque cartilagineis corporis fere ut in præcedenti specie, sed anteriori postice supra cavitatem natatoriam appendice horizontali foliacea biloba, lobis rotundatis; posteriori quam priori multo minori; squamis in canali reproductorio cartilagineis fornicatis margine quadridentato."

13. *Echinaster sanguinolentus* = *Asterias sanguinolenta*, Müll. = *Echinaster Sarsii*, Müll. and Trosch. The development of the species is minutely traced and elaborately described and figured.

14. *Asteracanthion Mülleri*, Sars.

15. *Salpa runcinata*, Chamisso. A very elaborate history of the species.

16. *Salpa spinosa*, Otto. Described with fullness equal to the preceding.

17. *Filograna implexa*, Berk.

18. OLIGOBRANCHUS (nov. gen.). "Corpus teres arenicoliforme cauda attenuata, segmentorum quodque ex annulis quatuor compositum. Caput distinctum, antice truncatum, tentaculis duobus brevibus; os subtus proboscide brevissima inerme; anus terminalis cirris quatuor. Pinnæ in segmento quoque utrinque duæ discretæ ex mammillis cum fasciculis setarum capillarium constantes, in segmentis anticis 14—15 absque appendicibus, in reliquis vero et cirro superiori et inferiori conico seu fusiformi ornatæ. Branchiarum arbusculæformium ramosissimarum paria quatuor in segmentis anticis corporis supra et pone pinnas in dorso." This genus, as Sars afterwards learned, is the same as the *Scalibregma* of H. Rathke instituted in 1843; but it is doubtful whether Sars' species—*Oligobranchus roseus*—is the same as the *Scalibregma inflatum* of Rathke; the probability is that they are distinct. There is reason to believe that the genus *Travisia* of Dr. Johnston (1840) will have to merge also in *Scalibregma*; the *Travisia* apparently having been imperfectly and erroneously characterized from the bad condition of the specimen in the Doctor's possession: see Ann. Nat. Hist. iv. p. 375. An examination of a living individual of *Travisia* is required to clear up all doubts.

In the Press.

We are glad to learn that a new work on the British Shells and Mollusca, the joint production of Prof. E. Forbes and Mr. Sylvanus Hanley, which is intended to appear in Van Voorst's series of British Zoology, is considerably advanced. All the known species are proposed to be delineated, and seventeen of the copper plates are already engraved by Mr. Sowerby, jun.

Professor Daubeny of Oxford has in the press, and nearly ready for publication, a new and much enlarged edition of his Description of Active and Extinct Volcanos.

The present Edition will be found to contain nearly twice the amount of matter included in the preceding one, embracing not only such new facts and observations with respect to volcanos as have been brought to light since its first appearance in 1826, but likewise the allied phænomena of Earthquakes and Thermal Springs, as well as a fuller discussion of the theories connected with those subjects.

A work is in preparation by Mr. H. E. Strickland and Dr. A. G. Melville on the Natural History and Osteology of the Dodo, the Solitaire, and other extinct birds of Mauritius, Bourbon and Rodriguez. It will be published in 4to by Mr. Lovell Reeve, and will be illustrated by numerous lithographic plates, woodcuts and other engravings.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

June 22, 1847.—Harpur Gamble, Esq., M.D., in the Chair.

On the Porcupines of the Older or Eastern Continent, with descriptions of some new species. By J. E. Gray, Esq., F.R.S., F.Z.S. etc.

This genus, on account of the similarity of the appearance of the species, has been very imperfectly examined. M. F. Cuvier, in the eleventh volume of the 'Mémoires du Muséum,' has given a paper on the crania and teeth of the family, and divided them into genera, forming those of the old world, which alone came within the scope of this communication, into two: the first he calls *Hystrix*, and figures as the type a skull which he considers as that of the *Porcupine of Italy*; and formed a second genus under the name of *Acanthion* for a skull brought by Leschenault from Java, and a skeleton described by Daubenton (Buffon, H. N. xii. t. 53) in the Paris Museum. He gives a general description and some observations on the relative size of the face and brain-cavity, rather than a character for these genera, and no distinctive character by which the two species of the genus *Acanthion* can be recognized.

The Baron Cuvier does not take any notice of the genus *Acanthion* in the second edition of the 'Règne Animal' (i. 215), but merely observes that the Indian and African species have their heads less swolien; but he formed for the *fasciculated Porcupine* (*H. fasciculata*) a genus under the name of *Atherura*, characterized by the muzzle not being swollen, and the tail elongated and not prehensile. Some authors, as Fischer (Synopsis Mam. i. 267, ii. 602), have considered this animal as the one on which F. Cuvier established his genus *Acanthion*. See on this subject the excellent remarks of Mr. Bennett on the gardens and menageries of the Zoological Society, i. 176.

J. F. Brandt, in the 'Mémoires de l'Académie Impériale des Sciences de Saint Pétersbourg' for 1835, on the Rodent in the museum of that Academy, has also overlooked M. F. Cuvier's genus, and he observes, "The genus *Acanthion* of F. Cuvier I add to the genus *Hystrix*, on account of the resemblance of the cranium of *H. hernitorostris* with that of *Acanthion Daubentonii*. G. Cuvier, although he proposed the new genus *Atherura*, does not say a word respecting *Acanthion* in the new edition of the 'Règne Animal'; and I should almost conclude from his words under the genus *Hystrix* (i. 215),—'there are (in the genus *Hystrix*) species with the head less swollen;' that he himself regarded the quotation *Acanthion* and *Hystrix* as one and the same."—*Mém. Acad. Pétersb.* 1835, 267, *note*.

I may here remark, that the skull figured by M. F. Cuvier as that of the *Italian Porcupine* does not agree with our specimen of the skull of the European species, and belongs to what I have considered the genus *Acanthion*, as I keep the name of *Hystrix* for the old Linnæan species *H. cristata*: that the skull figured by Brandt as a new species, under the name of *Hystrix hernitorostris*, does agree with our specimen from Xanthus, which I regard as the European species; and though he compares it in the note above quoted with F. Cuvier's figure of the genus *Acanthion*, it differs from that figure in most important characters; while the skull which Brandt figures for that of *Hystrix cristata* very nearly resembles F. Cuvier's figure above referred to, which represents, according to the characters pointed out in this communication, what I regard as the genus *Acanthion*.

Having had the opportunity of comparing the various skulls and skeletons of the species of this genus contained in the British Museum with the skulls of the Indian species in the collection of Colonel Cautley, and with the three skulls in the collections of the Zoological Society, I have been induced to make the following communication to the Meeting, as containing the results of this examination, and with the hope of calling the attention of the Members to the necessity of further attention to this hitherto neglected genus. These skulls form themselves into three groups, and that I may not encumber science with new names, I have used the three already proposed by the brothers Cuvier, though the characters I have given for the genus *Acanthion* may not be such as M. F. Cuvier had in his mind when he formed the division.

Synopsis of the Genera.

I. *Tail short; skull convex above; the nasal and intermaxillary bones large to (or to behind) the front edge of the orbit; the (upper) grinders all with a fold on the inner side.*

1. HYSTRIX. The intermaxillary broad and truncated, and as wide behind as before. The grinders oblong, longer than broad, with one very distinct fold on the inner and three or four on the outer side.

2. ACANTHION. The intermaxillary triangular, tapering behind; the grinders subcylindrical, not longer than broad, with a distinct fold on the inner and two or three on the outer side.

II. *Tail elongate, tufted at the end; skull nearly flat above; the nasal and intermaxillary bones short, not nearly reaching to the front of the orbits. Intermaxillary narrow, truncated behind; the front (upper) grinders (and perhaps all but the last) without any fold on the inner side.*

3. ATHERURA.

1. HYSTRIX.

Tail short; crown and nape crested; spines subcylindrical, striated; the skull very wide, swollen, convex above; the nasal and intermaxillaries large, reaching to the line even with the front edge of the orbit. The intermaxillaries very large, broad, oblong, as wide behind as before, and truncated behind; the palate wide between the grinders; the grinders oblong, longer than broad. The development of the face is produced by the dilatations of the hinder part of the intermaxillary bones.

1. HYSTRIX CRISTATA, Linn., &c. (*Crested Porcupine*).

H. hirsutirostris, *Brandt, Mém. Pétersb.* 1835, 375, t. 8. f. 3—6.

Black; spines of the sides greyish, softish, subcylindrical; of the back thick, tapering, with several black rings and a moderate white tip. The upper part of the intermaxillary wider than the width of the nasal. Skull very convex and wide, the palate wider than the width of the teeth.

Inhab. South Europe and Africa.

The spines are described from a specimen from South Africa, presented to the Museum by Dr. W. Burchell, and the skull, from that of an Italian specimen, received from a menagerie, and a young skull with only three grinders, brought from Xanthus and presented to the British Museum by G. Scharff, Esq.

The skull figured by Brandt, Mém. Acad. Pétersb. 1835, t. 8. f. 3, 4, 5, 6, as that of his *Hystrix hirsutirostris*, well represents the skull of the young *H. cristata* from Xanthus.

The skull of the Italian porcupine figured by F. Cuvier, and of *H. cristata* figured by Brandt, do not belong to the species above described.

2. Hystrix leucurus, Sykes, *Proc. Zool. Soc.*, (*Indian Porcupine*).

Hystrix cristata, *Bennett, Gard. & Menag. Zool. Soc.* 171 : fig. good.

Black; spines of the throat white-tipped (forming a half-collar); of the sides rigid, angular, of the back very long, slender, with several black rings, and a very long, slender, white tip. Skull elongate, rather narrow; the hinder part of the intermaxillary as wide as the nasal. The palate narrow, not wider than the width of the teeth.

Inhab. Bombay. Dukhun, Colonel Sykes. Nepal, B. H. Hodgson, Esq., N. India.

The above description is taken from two adult and one young specimens in the British Museum,—one presented by Colonel Sykes and the others by B. H. Hodgson, Esq.,—two skulls from Mr. Hodgson's specimens, three skulls from Colonel Cautley's collection, and a skull in the museum of the Zoological Society.

The young skull, which has three well-developed and worn grinders, is the same length as the young skull of *H. cristata* from Xanthus, which has the third grinder partly developed. The Nepal skull is much less swollen, less convex above, and nearly one-third narrower, and the teeth are smaller, occupying about one-fourth less space than the three teeth in the European skull.

I may observe, that though these skulls preserve a very distinct character, yet they vary so much amongst themselves as to show that skulls afford no better character for the distinction of species than any other single character, such as colour, but can only be depended on when taken in connexion with the rest of the organization.

In Colonel Cautley's collection there are three adult skulls (nos. 32, 34, 35) of this species from Northern India; they agree nearly in size and in the comparative width of the intermaxillary and nasal bones; one differs from the other two considerably in the width between the orbits, and slightly in the convexity of the frontal line. They are all much larger than Mr. Hodgson's specimen from Nepal.

No. 34 is peculiar for having a fifth grinder appearing behind the fourth on the left side above.

This species is easily known by the very elongate slender spines of the back and by the form of the intermaxillary, though they are subject to some variation.

The figures by Harvey published by Mr. Bennett above-quoted well represent the elongated drooping dorsal spines of this species.

Measurement of the Skulls in inches and lines.

	H. cristata.		H. cristata.		H. leucurus.		H. leucurus.		H. leucurus.		H. leucurus.		H. leucurus.	
	Adult.		Junior.		No. 32.		No. 34.		No. 35.		Adult.		Junior.	
Length of skull above	5	7	4	0	5	10	5	8	5	11	5	0	4	0
Length of nasal	2	8½	1	9	3	0½	2	8½	2	11	2	5½	1	9½
Width at middle of orbits	2	3	1	11	2	5	2	3	2	6	2	1	1	7
Width of nose in middle	1	10	1	4½	1	10	1	9	2	0	1	11	1	2½
Width of lower edge of zygoma	2	7	2	2	2	11	2	11	2	9	2	7	2	0
Lower edge of zygoma to central suture	......		......		2	11	2	7	2	10	2	4		
Palate to middle of crown end of nasal	......		......		2	7	2	2½	2	5	2	1		
Length of skull beneath	5	10	4	2	6	2	5	7½	6	0	5	3	4	1
Length of palates	3	2	2	2	3	3	3	0½	3	2	2	10	2	0½
Length of grinder series	1	5	1	5	1	4½	1	3½	1	5	1	3	0	10½
Length of lower jaw	3	10	2	11	4	2	4	2½	......		3	8	2	11
Width at ear-bones	2	1	1	11	2	3	2	1	2	2	1	11	1	8
Width at condyles	1	2	1	0	1	2	1	2½	1	2	1	3	1	0
Height of occiput from foramen	......		......		1	3½	1	2	1	3	1	2		

2. Acanthion.

Tail short; crown and nape not crested. Spikes short, flattened and channeled above. Skull rather elongate, convex above; the nasal and intermaxillary reaching to the line even with the front, or even to the middle of the orbit; the intermaxillaries triangular, narrowed behind; the palate moderately wide between the grinders; the grinders subcylindrical, not longer than broad.

F. Cuvier established his genus *Acanthion* on a skull and skeleton in the Paris Museum. He gave as the character the less convexity of the head and the smaller size of the nose; but he takes no notice of the size and form of the intermaxillary, which appears to be the best character of the group.

M. G. Cuvier and Brandt have not adopted M. F.Cuvier's genus.

This genus presents two very distinct sections:—

* *The nasal very long, broad to the middle of the orbit.* Acanthion.

† *Malar bone simple. Palatine opening parallel.*

1. Acanthion Hodgsonii, n. s. *Lesser Indian Porcupine.*

Crown and nape without any crest. Blackish brown, neck with a very narrow indistinct white collar. Spines of the head and neck slender, bristle-like; of the front half of the body short, angular, acute, with a deep groove; of the hinder part of the back longer, with a very small pale tip and some white ones; some of the latter are moderately long and thick, with a black end; and others are longer and slenderer, with a subcentral black band. Skull rather elongate, narrowed before the orbit; the intermaxillaries very narrow, and rather acute behind. Palatine opening narrow and nearly parallel. Malar bone moderately wide, and rather gradually narrowed behind. The nasal holes large; the front end of the nasal over the base of the upper cutting-teeth.

Inhab. India. Nepal; B. H. Hodgson, Esq.

The spinous process of the second cervical vertebra is very large and recurved; of the first dorsal is shorter than the second or others; the ribs are 15·15, very broad and large. The caudal vertebræ are deficient.

This species is described from a half-grown specimen and its skull, and a skeleton of an adult animal from Nepal, presented to the British Museum by B. H. Hodgson, Esq.

†† *Malar bone with a deep notch behind. Palatine opening diverging.*

2. Acanthion Cuvieri, n. s.

Porc epic d'Italie, *F. Cuv. Mém. Mus.* ix. t. 20*. f. 1. Skull.

Hystrix cristata, *Brandt. Mém. Pétersb.* 1835, t. 8. f. 1, 2. Skull.

Black? Spines? Skull very convex above, very wide over and before the orbits. The hinder part of the intermaxillary rather broad, and rounded at the end. The palatine openings wide, and diverging from each other behind. The malar bone very broad in front, narrow behind. The nasal hole very large; the front edge of the nasal far back behind the base of the cutting-teeth.

Inhab. ——? Mus. Zool. Soc.

This species is described from an adult skull, with the hinder part of the upper surface cut away, which is contained in the museum of the Zoological Society. It agrees in almost every particular with the skull figured by Brandt and F. Cuvier as that of the *European Porcupine*. Brandt's figure is just half, and Cuvier's rather more than half the size of this specimen. Brandt's figure is most characteristic, both in the posterior position of the nasal bone and the notch in the lower edge of the orbit produced by the sudden narrowing of the malar bone.

** *Skull narrower in front. Nasal bone moderate to the front edge of the orbits. Malar bone with an obtuse post-orbital process.* Acantherium.

3. Acanthion javanicum. *Short-spine Porcupine.*

Acanthion javanicum, *F. Cuvier, Mém. Mus.* ix. t. 1. f. 3, 4. From a skull; and Mus. Leyden.

Hystrix brevispinosus, *Wagner.*

H. torquatus. Mus. ——?

Greyish black, throat with a large square white spot. Spines of the head elongate setaceous; of the front half of the body short, dark, with a deep groove and a white tip; of the hinder part of the back longer, more cylindrical, white, with a black tip and bands; of the under-side of the tail white; the sides with a few scattered, very slender, white spines. The palate narrowed behind. Condyles of the skull small. Dorsal vertebræ thirteen, with thirteen pair of rather elongate slender ribs; the spinous process of the first dorsal vertebra as long as the second and following ones. The caudal vertebræ fifteen.

Inhab. India? Java?

There is a skin and skeleton of this species in the collection of the British Museum: it is a male which lived in the Surrey Zoological Gardens for ten or twelve years.

M. F. Cuvier established a species under the name of *Acanthion javanicum* on a skull from Java in the Paris Museum. In the Leyden Museum there are several specimens of this or the next species, which they regard as M. F. Cuvier's species. Neither M. Cuvier's nor my notes on the Leyden specimens enable me to distinguish to which the names belong.

While living in the Surrey Zoological Gardens it bred with a female of the Common Crested Porcupine, and produced a hybrid specimen, which, with its skeleton, is now in the British Museum collection. The animal is intermediate between the two species, having only a short compressed crest; and the skull is equally intermediate in character, having the broad palate and oblong teeth of *H. cristata*, and the more elongated form of the skull and the triangular intermaxillaries of the male parent.

4. Acanthion Flemingii. *Square-spined Porcupine.*

The palate between the grinders narrow ($2\frac{1}{2}$ lines), and rather wider behind between the last grinders. Condyle of skull large.

The dorsal vertebræ fourteen, with fourteen pair of rather wide ribs; the spinous process of the first dorsal is nearly as long as the second and third; and of the second cervical is large and recurved. Caudal vertebræ seventeen.

Inhab. —— ? Skull in British Museum.

Measurement of Skulls in inches and lines.

	Acanthion Hodgsonii.		Acanthion Cuvieri.	Acanthion javanicum.	Acanthion Flemingii.	
	Adult.	Junior.	Adult.			Hybrid.
Length of skull above	4 7½	4 2	5 6	4 6	4 6	4 6
Length of nasals	2 6	2 3½	2 9½	1 10	2 1	1 10
Width over middle of orbits	1 8	1 6	2 3	1 7	1 7	1 8
Width of nose in middle	1 3	1 1	1 1½	1 1½	1 1½	1 2½
Width of lower edge of zygoma	2 3	2 0½	2 11	2 0½	2 0	2 1
Width of lower edge of zygoma to central suture	......	1 9	2 5	......	......	1 10½
Width of palate to middle of crown end of nasals	......	1 6½	2 3	......	......	1 8
Length of skull beneath	4 8	......	5 4	4 5	4 5	4 5
Length of palate	2 5½	2 1½	2 11	2 3	2 3	2 3
Length of lines of grinders	1 0	1 0	1 4	1 0	1 0	1 0½
Length of lower jaw	3 0	2 10	3 10	2 10	3 0	3 0½
Width at ear bulla	1 9	1 9	2 1½	1 10	1 10	1 11
Width of the condyles	0 11½	......	1 1½	0 11½	1 1½	1 0

We have a skeleton of this species, which was purchased of Mr. Bartlett as "*the Square-spined, not Crested Porcupine,*" but unfortunately the skin was not preserved.

I ought in justice here to remark, that Edward Gerrard, who has the preparation and the care of the skeletons in the British Museum collection, and Mr. Bartlett both informed me there were osteological distinctions between these very distinct species.

3. Atherura, *Cuvier.*

Tail elongate, tapering, ending in a tuft of peduncled, compressed spines. Skull elongate, rather suddenly narrowed in front, rather depressed and flattened above. The nasal moderate, not reaching to the front edge of the orbit. The intermaxillary rather narrowed behind, square at the hinder end. The malar bone broad in front, subtriangular, very narrow behind. The palatine foramen rather far apart, linear and rather diverging behind. The grinder subcylindrical. The upper front one with two large folds on the outer side, reaching nearly to the inner edge, and with a smaller fold on middle of the outer, and three similar folds on the hinder edge; the other upper grinder with two grooves or folds on outer edge, and one on the middle of the inner: these grooves become isolated, oblong rings of enamel as the teeth become more worn: the fold on the inner side of the last grinder is most distinct. Palate truncate behind.

1. Atherura fasciculata, *Cuv.*

Landak, *Marsden,* Hist. Sumatra. *Raffles.*
Hystrix macroura, *Linn.* From *Seba.*
Hystrix fasciculata, *Shaw.* From *Buffon.*
Inhab. Sumatra, *Raffles*; Malacca, *Buffon*; Celebes, *Seba.*

2. Atherura africana. Ath. fasciculata, "*Cuv.,*" *Bennett, Garden and Menag. Zool. Soc.* 175.

Inhab. Fernando Po, Lieut. Vidal; Sierra Leone, Mr. Frazer.
Skull, without lower jaw, in collection of Zool. Soc.

	in.	lin.
Length of skull above	3	9
Length of nasal	0	11
Length of palate	2	2
Length of teeth-line	0	10
Width at orbit	1	3½
Width at zygoma beneath	1	9
Width of valve	0	4
Width at ear bulla	1	6½
Width of condyles	0	11

"The animals are found in such plenty (in the colony of Fernando Po) as to afford a staple article of food to the inhabitants."—*Bennett, l. c.* 175.

MISCELLANEOUS.

Description of a new rapacious Bird in the Museum of the Academy of Natural Sciences of Philadelphia. By JOHN CASSIN.

Cymindis Wilsonii, nobis. ♂. Body above entirely dark brown, palest on the head, beneath white; every feather from chin to under tail-coverts crossed by several bars of bright rufous chestnut, and these colours extending upwards into a collar around the neck; fourth, fifth and sixth primaries longest and nearly equal, external webs nearly black, internal webs of outer primaries white at base and for nearly half their length, the remaining part reddish inclining to chestnut, every primary (on its inner web) having two irregularly-shaped black marks and tipped with black. Tail of the same colour as the back but paler, white at base, and crossed by about four broad bars which are nearly black, the second bar from the tip accompanied by a narrow, rather indistinct bar of rufous; tip of tail narrowly edged with white. Bill very large, (larger than in any other species of this genus,) yellowish white, inclining to bluish horn-colour at base.

♀. Body above entirely slate-colour, palest on the head, beneath barred with the same, the bars having a ferruginous tinge.

Total length of mounted specimen, from tip of bill to end of tail, 17 inches.

Hab. Island of Cuba.

The two specimens here described were presented to the Academy by its esteemed member, Richard C. Taylor, Esq.

The bill in this species is very large in proportion to the size of the bird, and it agrees moreover tolerably well with the *written* description of *Falco magnirostris*, Gmelin; so does the young *Cymindis uncinatus*, Illig. All authors however, except Dr. Latham, clearly understand the *F. magnirostris* to be the bird figured in Enl. 464, which is a common South American species of the genus *Astur*.

Dr. Latham, in his article on *F. magnirostris*, Gen. Hist. vol. l. p. 282, gives a description of a bird suspected by him to be the species intended by Gmelin, which applies very well to *Cymindis cayanensis*, Gm., in young plumage, but not to *C. Wilsonii*.

I have named this species in honour of Dr. Thomas B. Wilson, as a slight tribute to his merits as a man, and his munificence as a patron of zoological science.—*Silliman's Journal for Sept.* 1847.

On the Development of the Echinidæ. By Dr. DUFOSSÉ.

The author adds some further facts to the observations previously communicated* relative to the development of the *Echinus* during the second period of its embryonal life, that is to say, from the moment of the escape of the larva from the egg to that when it becomes fixed. Between the sixth and twelfth day after its escape from the egg, a considerable quantity of agglomerated globules, forming a conical mass around the mouth, become apparent. A cavity is soon produced in the centre of this mass, and shortly afterwards the intestinal canal becomes evident and is seen to grow gradually longer. At the same

* See p. 282 of the April Number for this year.

time the entire body is elongated in the same direction and becomes perfectly pyriform. The digestive canal when it has reached four-fifths of its length curves back, the teguments of this side are slightly depressed, and an aperture is formed there which is the anus. At this period a small body formed of three branches, united at one extremity, begins to appear beneath the teguments on each side of the mouth; each branch of these organs, which may be called *spurs*, subsequently elongates and divides on the surface of the teguments into two or three small spines. The body however of the larva of the *Echinus* does not long remain pyriform, it soon assumes the appearance of a thimble, the aperture being replaced by a simple depression. The digestive canal becomes more and more regular, and then exhibits three portions well defined by restrictions: the first opens into the mouth, and may be called the œsophagus; the second, which is of considerable size, must be regarded as the stomach; the third, which is short and comparatively very narrow, is the intestine.—*Comptes Rendus, Aug.* 23, 1847.

On the Range of the Beaver in the United States. By S. B. Buckley.

In DeKay's 'Zoology of the State of New York' it is erroneously stated that the most southern limit of the beaver within the United States is the northern part of the State of New York. There were beavers living among the mountains of North Carolina in the year 1842, where I saw trees newly cut down by them, and I was informed by my guide that he had seen the beaver. This was in Haywood County, a few miles from Waynesville, on the Big Pigeon River,—a wild, rough region, abounding in grand scenery and rarely visited by man, being little known even to the hunters.—*Silliman's Journal for May* 1847.

ENEMIES TO SCIENCE AMONG THE NOBLES.

A great sensation has everywhere been excited by the fact, that men of science in the pursuit of knowledge have been obstructed in their peaceful investigations by certain peers and landed proprietors. The public press has indignantly protested against the right of these noblemen to shut up the highways and byways, and to depopulate whole districts of the country for the purpose of converting them into wild deer forests. With these, and many other grievous subjects of complaint, however, it is out of our province to speak. It is not as hunters and deer-stalkers we have to do with them. Neither can we dwell on the mortifications and hardships which the tourist in search of pleasure or health has experienced. What we are desirous of alluding to is the circumstance, that certain sporting lords and gentlemen, by obstructing the observations of naturalists, and by discourteously treating learned men in their botanical, geological, and mineralogical investigations as common trespassers on their estates, have earned for themselves the unenviable title of the Enemies of Science.

It is monstrous to suppose that the Braemar mountains, the Grampians, and Glen Tilt, are to be shut out from scientific investigation by certain noble dukes and sporting gentlemen. These districts represent the alpine vegetation of Britain, and it is in them that the botanist finds illustrations of this region. It is there that we meet with such rare plants as—

Luzula arcuata (characteristic of the summits of the highest hills in Braemar).
Stellaria cerastoides.
Astragalus alpinus.
Saxifraga cæspitosa (Benaven, Braemar, only known locality in Britain).
Saxifraga rivularis.
Carex leporina.
Vahlii.
rariflora.
rupestris.
aquatilis.
vaginata.
Grahami (Glen Phu, Clova, only spot in Britain).
Salix lanata.
arenaria.
reticulata.
Sonchus alpinus (Mulgedium alpinum).
Oxytropis campestris (Glen Phu, Clova, only known British station).
Woodsia hyperborea.
Erigeron alpinum.
Gentiana nivalis.
Juncus castaneus.
Alopecurus alpinus.
Phleum commutatum.
Lychnis alpina (on a single hill in the Grampians, only British station).
Besides a number of other rare species.

If then botanists are excluded from these districts, they are cut off from the study of alpine plants; and what renders the outrage to science more glaring is the fact, that many of these are found nowhere else in Britain except on the Braemar and Grampian range, and several are confined to single spots on these hills.

Again, it is in these districts that the geologist finds the most perfect illustrations of those theories which have enabled him in modern times to explain the past revolutions on the surface of the earth, and to trace the changes it has undergone from the most distant ages. It is in Glen Tilt that Hutton, in 1785, discovered the junction of the granite with mica-slate and limestone, whereby he offered the first positive fact in opposition to the Wernerian doctrines. This striking proof of the correctness of those views now admitted by the scientific world, nature has placed in the property of the Duke of Athol, and until lately it has been freely visited by naturalists from every civilized land. But now, that nobleman not only threatens to prosecute every gentleman anxious to confirm his notions by the personal inspection of this natural formation, but offers them direct molestation, on the plea that they are disturbing his deer. More than one foreign professor of eminence has in consequence been obliged to return to his country, with the belief that the present Dukes of Scotland are even more uncivilized than their barbarous ancestors. It is at least certain that they are ready to sacrifice for the empty pleasures of the chase, not only the solid benefits which the study of science and intellectual pursuits confer on mankind, but that courtesy and readiness to oblige, which, more than rank, win for the noble and titled the regards of men.

It is singular to reflect, that at a period when Government is encouraging scientific expeditions in Australia, Van Diemen's Land, the Arctic Regions, and other districts at the limits of the empire, our

Highland glens and mountains in its centre are shut out from investigation. It is curious to know, that whilst the Marquis of Northampton is, as President of the Royal Society, at the head of science in England, and Prince Albert visits annually the British Association for the Advancement of Science, other noble lords are altogether insensible to the honour and gratification to be derived from favouring the cause of knowledge. We can only regret that birth should have bestowed upon the latter, riches which they have not minds to appreciate; or that fortune should have been so provoking as to render the ignorant and churlish, possessors of objects of interest to the enlightened and polite. We trust, however, that the educated and civilized of their own class will be struck with the injury done to their order by the titled enemies of science, and that they will in this manner be forced in very shame to concede the privilege its cultivators require of them.—*From the Edinburgh Monthly Journal of Medical Science for October* 1847.

METEOROLOGICAL OBSERVATIONS FOR SEPT. 1847.

Chiswick.—September 1. Clear: cloudy: clear. 2. Cloudy: boisterous. 3. Cold rain: overcast. 4. Fine. 5. Clear: shower: clear. 6. Very fine. 7. Clear and cold: cloudy: rain at night. 8. Rain. 9. Very fine. 10. Overcast: very fine. 11, 12. Very fine. 13. Densely overcast: rain. 14. Very fine: slight shower: clear and cold at night. 15. Fine: boisterous, with rain at night. 16. Boisterous. 17. Rain. 18. Cloudy, with very clear intervals. 19. Cloudy: heavy rain at night. 20. Fine: slight showers. 21. Rain. 22. Cloudy: fine. 23. Cloudy and mild. 24. Foggy: very fine. 25, 26. Fine. 27. Frosty: clear: very fine: clear and frosty at night. 28. Slight fog: overcast. 29. Slight fog: very fine. 30. Dry haze: overcast.

Mean temperature of the month	53°·40
Mean temperature of Sept. 1846	60 ·79
Mean temperature of Sept. for the last twenty years	52 ·77
Average amount of rain in Sept.	2·73 inches.

Boston.—Sept. 1. Fine. 2. Windy. 3. Cloudy: rain P.M. 4. Fine. 5. Fine: rain P.M. 6, 7. Fine. 8. Cloudy. 9—11. Fine. 12. Windy. 13. Rain: rain A.M. and P.M. 14. Fine. 15. Fine: rain P.M. 16. Fine: stormy from 10 A.M. 17. Cloudy. 18—20. Fine. 21. Fine: rain P.M. 22. Cloudy: rain A.M. 23. Cloudy. 24—28. Fine. 29. Cloudy. 30. Fine.

Sandwick Manse, Orkney.—Sept. 1, 2. Showers. 3. Bright: showers: sleet. 4—6. Showers. 7, 8. Cloudy: showers. 9. Drizzle: showers. 10. Cloudy. 11. Cloudy: rain. 12. Showers. 13. Cloudy: clear. 14. Cloudy. 15, 16. Bright: rain. 17. Cloudy: showers. 18. Showers. 19. Clear: showers: sleet. 20. Showers: rain: cloudy. 21. Bright: fine. 22. Damp: rain. 23. Showers. 24. Showers: cloudy. 25. Rain: clear. 26. Bright: clear. 27, 28. Clear. 29. Clear: aurora. 30. Clear.

Applegarth Manse, Dumfries-shire.—Sept. 1. Sharp showers and high wind. 2. Clear and fine harvest day. 3. Rain. 4. Fine clear sharp weather. 5. Fine harvest day. 6. Clear and bracing. 7. Rain, though not heavy. 8. Fair, but cloudy. 9. Close rain. 10. Fine: some drops P.M. 11. Fair A.M.: rain P.M. 12. Fair, but threatening. 13. Fine. 14. Bracing day: flying showers. 15. Fine A.M.: heavy rain P.M. 16. Rain and high wind. 17. Few drops of rain. 18. Fair, but dull. 19. Frequent showers. 20. A few drops. 21. Rain P.M. 22, 23. Showery. 24. Fair and fine. 25. Slight drizzle. 26. Very fine day. 27. Very fine day: frost A.M. 28, 29. Very fine days: no frost. 30. Fair, but cold.

Mean temperature of the month	50°·9
Mean temperature of Sept. 1846	59 ·6
Mean temperature of Sept. for 25 years	53 ·2
Mean rain in Sept. for 20 years	3·13 inches.

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. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. Sept.	Max.	Min.		9 a.m.	9 p.m.	9¼ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9¼ a.m.	8½ p.m.								
☾ 1.	29·896	29·723	29·36	29·52	29·45	29·12	29·30	66	45	57	59½	52½	53	53	sw.	w.	w.	nnw.	·01	......	......	·40
2.	29·967	29·768	29·30	29·71	29·88	29·76	29·86	65	39	59	60½	50	49	44½	w.	nw.	nw.	nnw.	......	......	......	·22
3.	29·967	29·698	29·50	29·70	29·69	29·77	29·77	60	41	51·5	54	42	47	43½	sw.	w.	n.-ne.	nnw.	·03	......	......	·11
4.	29·879	29·827	29·42	29·76	29·73	29·77	29·75	63	34	52	58½	38	47	45	nw.	n.	nne.	nnw.	......	·23	......	·16
5.	29·878	29·849	29·39	29·72	29·68	29·66	29·66	66	39	52	56	36½	45	46	nw.	calm	nw.	nnw.	·01	......	......	·10
6.	29·924	29·845	29·39	29·76	29·82	29·78	29·84	66	31	51	58½	44½	48	45	w.	nw.	nw.	wnw.	·01	·08	......	·54
7.	29·984	29·870	29·54	29·76	29·63	29·69	29·63	67	44	51	56½	35	51½	53	sw.	calm	nw.sw	sw.	·10	......	......	·04
8.	29·977	29·807	29·40	29·74	29·82	29·81	29·60	66	39	57	59	51	51½	51	nw.	calm	nw.	se.	·08	......	0·30	......
● 9.	30·099	30·053	29·58	29·76	29·82	29·56	29·73	71	43	55·5	63	51	55	51	w.	calm	sw.	nw.	......	......	......	·25
10.	30·123	30·085	29·60	29·95	29·98	29·80	29·94	75	43	62	63	50½	51	46	w.	calm	sw.	w.	......	......	......	·17
11.	30·122	30·010	29·67	29·98	29·55	29·75	28·80	72	47	56	55½	37½	52	52	w.	calm	sw.	w.	......	......	......	·05
12.	29·917	29·884	29·35	29·51	29·51	28·80	29·30	69	58	65	60½	54	52	49	sw.	w.	sw.	w.	......	......	......	·24
13.	29·788	29·762	29·32	29·65	29·67	29·60	29·71	64	41	58	62	41	50½	42	nw.	calm	sw.	calm	·27	·33	......	·32
14.	29·911	29·863	29·37	29·69	29·69	29·71	29·71	64	39	53	57½	43½	49	43	w.	n.	w.sw.	calm	·01	·22	......	·08
15.	29·889	29·708	29·40	29·68	29·14	29·67	29·04	65	51	52	57½	38	52	45½	w.	sw.	sw.-s.	s.	·16	......	0·07	·16
16.	29·472	29·391	28·90	28·87	29·08	28·88	29·00	64	46	58·5	59	49	51½	50	w.	w.	sw.nw	ne.	·01	·15	......	·79
☽ 17.	29·553	29·389	29·02	29·22	29·15	29·19	29·16	61	42	57	56	48½	49½	45	sw.	w.	w.	nw.	·22	......	......	·30
18.	29·707	29·455	29·00	29·26	29·53	29·21	29·47	58	36	52	55	38	48	45	w.	w.	nw.	nw.	·03	......	......	·24
19.	29·957	29·757	29·48	29·64	29·51	29·55	29·37	60	48	52	51½	40	46	44½	sw.	w.	sw.	sw.	·50	......	......	·08
20.	29·934	29·729	29·23	29·46	29·78	29·33	29·64	64	35	54	52	37	46	45	w.	w.	w.	wnw.	·03	......	......	·60
21.	30·108	30·011	29·65	29·88	29·75	29·84	29·71	62	53	49	55	36	48	47	sw.	calm	sse.	se.	·19	......	......	·21
22.	30·058	30·023	29·50	29·77	29·78	29·72	29·64	70	47	51	60½	48	53	54½	w.	w.	sw.	s.	......	......	......	·03
23.	30·008	29·935	29·46	29·57	29·80	29·27	29·53	69	47	57	60	53½	54½	50	sw.	wsw.	sw.	w.	......	·53	......	·03
○ 24.	30·199	30·141	29·65	30·00	30·02	29·90	29·94	65	34	55	60½	49	48	50	n.	wsw.	w.	w.	......	......	0·75	·13
25.	30·088	29·954	29·53	29·69	29·90	29·65	30·01	65	51	50	60	51	52	45	w.	w.	w.	w.	......	......	......	·12
26.	30·237	30·130	29·67	30·10	30·15	30·18	30·26	62	30	56·5	58½	45½	47	43	ne.	n.	w.-n.	n.	......	......	......	·70
27.	30·276	30·260	29·83	30·18	30·18	30·24	30·23	60	28	46	58½	33	47	46	e.	n.	ne.-s.	se.	......	......	......	·01
28.	30·323	30·297	29·92	30·22	30·22	30·30	30·33	59	33	49	62	48	53½	50	e.	n.	ne.	se.	......	......	......	......
29.	30·310	30·235	29·84	30·27	30·26	30·33	30·34	63	49	54	59	39	50	48½	e.	e.	e.	se.	......	......	......	......
30.	30·241	30·117	29·81	30·23	30·23	30·43	30·43	63	47	58	57	42	53	47	ne.	ene.	e.	ese.	......	......	0·1	......
Mean.	30·005	29·885	29·47	29·741	29·746	29·675	29·690	64·80	42·00	54·3	58·2	44·0	50·01	47·33					1·66	1·54	1·22	6·05

THE ANNALS

AND

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XXXV.—*Observations on the Structure of the Fruit of the* Cruciferæ. By L. C. Treviranus*.

Among the Cruciferæ some years since introduced into German gardens, *Æthionema heterocarpum*, Gay. is remarkable from the fact that in certain individuals occur two-celled many-seeded and one-celled single-seeded silicles. The former are flat upon the upper side and somewhat vaulted on the under, and in correspondence with this the upper border of the septum is straight, while the under has a convex form. In the latter the under side is strongly excavated, rendering the whole silicle almost globular; the keel is wanting on this deepened under side, and the solitary seed lies, as in *Isatis* and *Tauscheria*, directly in the middle of the silicle, being attached at the summit of its cavity. This species therefore connects certainly the genus *Æthionema* with *Tauscheria*, only in *Tauscheria* the enlargement of the silicle is above, while that of *Æthionema heterocarpum* occurs on the under side. If however *Tauscheria* is to stand, another genus, namely *Campyloptera*, Boiss.†, cannot I think be retained, since the plants on which it is founded appear to be specimens of *Æthionema heterocarpum*, bearing no other fruit than the one-seeded kind above described.

It is difficult to say what causes this remarkable deviation in some silicles from the normal structure of the others. It cannot be called a monstrosity, since the seed of the one-celled silicle is just as perfect as those which the two-celled yield; the flowers also which produce the former are not less perfectly organized than those from which the two-celled fruits come. I have been induced therefore to institute some researches into the structure of the fruit of the Cruciferæ, and albeit these have not led to the wished-for elucidation, I will nevertheless publish some of the results, which may perhaps possess more general interest.

* From the Botanische Zeitung, June 11th and 18th, 1847. Translated by Arthur Henfrey, F.L.S.

† Ann. d. Sc. Nat. 2 sér. xvii. 194.

It is well known that the two-celled rudimentary fruit of the Cruciferæ is distinctly characterized by the fact that the septum is not directed transversely toward the rachis or the centre of the floral whorl as in other two-celled ovaries of Dicotyledons, *e.g.* of Scrophulariaceæ, Gentianeæ, &c., but lies in the radius of it, and that notwithstanding this, the same position of the two lobes of the stigma occurs as in the families just named, that is, one is curved outward and the other inward, consequently their relative position corresponds with the direction of the septum. If we examine the framework of this fruit in reference to the vascular bundles of which it is composed, we usually perceive four, which spring from the receptacle where it becomes somewhat expanded to receive the fruit, namely two which ascend in the thickened border of the septum on the anterior and posterior sides, and two, one of which enters the middle of each valve. The former give off in their course, in many-seeded silicles, branches passing inward which serve as funiculi to the ovules; they must consequently, according to the division established by Mirbel, be called the trunks of the placental vessels. On the other side also large and numerous lateral branches proceed from them into the valves, there anastomosing with those presently to be mentioned as specially belonging to the valves. Each trunk of the placental vessels is considered by DeCandolle as composed of two cords united together*, and according to the theory which regards the placenta as the border of the valve, agreeing with the double row of ovules on each side, it might be so; but, if I except *Biscutella*, where the vascular trunk appears divided on each side, I have hitherto found it simple in all the ovaries of Cruciferæ I have examined, without trace of division or combination, and the same observation has been made by others†. When the aforesaid cord reaches the apex of the fruit, that is, the place where the valves terminate, it is continued further in the style and ends beneath the stigma in that remarkable manner which I described as occurring in *Primula* and some other genera‡, and have since discovered to be general; namely it spreads out into numerous radiating large and small branches which are of equal height and have thickened clavate terminations. The branches from both sides are collected here, but although they are very closely approximated they by no means unite.

With regard to the two vascular trunks, one of which passes into each valve, and which, following Mirbel, are to be called pericarpial or valvular vessels, these also are apparently never wanting, at all events they are by no means absent in the genus

* Mém. du Mus. d'Hist. Nat. vii. 190.

† Trécul, Ann. d. Sc. Nat. 2 sér. xx. t. 17. f. 3.

‡ Zeitschrift. f. Physiol. iv. 128. t. 9. f. 4.

Cardamine, though they are so small here that they escaped the sharp-sighted eyes of Brown and DeCandolle *. They are most distinct in the boat-shaped valves, for example in those of *Thlaspi arvense* and still more in those of *Megacarpæa,* where each describes a circle in its course and marks the origin of the broad wing, into which numerous branches are given off from it. In flat or slightly elevated valves also they generally give off many branches at right angles which anastomose with those also coming out at right angles from the placental trunks; in its further course however the main trunk becomes more and more attenuated, till finally it terminates in a very minute process inside the apex of the valve of each side without reaching or going beyond the apex itself, which is most striking when this forms a tooth-like projection, often of considerable length, as in the genera *Notoceras* and *Parolinia* †.

The genus *Camelina,* however, as Koch rightly observes ‡, forms an exception to this structure. Here the style is a prolongation of the two valves of the silique, the vessels of which pass into it, so that on the separation of the valves it splits into two halves, each half having in it the end of one trunk of valvular vessels. But in *Cardamine* this trunk is always slender, without distinctly branching, and it is quite lost at two-thirds of the height of the valve.

This course of the two kinds of vessels of the fruit compared with their mode of distribution in other families, as in Primulaceæ, Gentianeæ, Scrophulariaceæ, Saxifrageæ, Caryophylleæ,&c., differs from them in so far, that in the last-mentioned families the pericarpial vessels alone are continued from the ovary into the style, or pass through the style as far as the base of the stigma, while the placental vessels, which in the Cruciferæ exclusively supply the style or the stigma with vessels, do not take the least part in it.

As to the septum, leaving out of the question the funiculi which mostly cohere with it, it has no vessels of its own in the silique; at least it does not possess them in the sense in which this expression is usually taken, as signifying fibrous and spiral tubes, but has a structure wholly cellular, and this of a peculiar kind. It consists of two substances which I will name epidermis

* *L. c.* 201.

† "Mr. Webb has published an account of a Canary shrub named *Parolinia,* in which the valves are constantly extended into stigmas" (J. Lindley, Veget. Kingdom, 352). Anything but that; Webb's descriptions and illustrations rather show in the most distinct manner that these processes of the valves are not stigmata, but unusually large horn-like appendages, in which the mid-nerve of the valve is continued to the very apex, which is split. (Ann. d. Sc. Nat. 2 sér. xiii. 136. t. 3.)

‡ Deutschl. Flora, iv. 570.

and parenchyma, as these agree in their general peculiarities with those which are so called in leaves. The epidermis forms two lamellæ, whether the septum be thick or thin, between which the parenchyma, which however is often at least partly wanting, is inclosed and distributed in different degrees and abundance. The cells of the first-named substance differ much in their form, position and mode of union. Very often their circumference is more or less drawn out lengthways, as in *Cheiranthus Cheiri*, *Lunaria annua*, *rediviva*, *Farsetia clypeata*, *Vesicaria utriculata*, *sinuata*, &c., and the longer diameter is then never parallel with the axis of the silique, but at a sharp angle to it. The direction however is different in the two lamellæ, and therefore the reticulations, which from the transparency of the septum are visible at the same time, never correspond, but cross one another, a circumstance which Brown* has remarked, and which appears to favour the view taken by DeCandolle†, that the two lamellæ belong to different carpels. In the very thin septa of *Draba*, *Capsella*, *Æthionema* and *Camelina*, the borders of the cells resemble those of the epidermis of delicate leaves, being undulated, which Brown‡ calls amorphous; in those of a firmer structure, on the contrary, for instance in *Cheiranthus* and *Lunaria*, they have a straight course, and are then more or less knotty. This knotty structure, which is not observable in the earliest state of the septum, but is formed subsequently, depends upon a thickening of the cell-walls with a simultaneous perforation of them by canals, which run from within outward in a manner resembling that which Meyen delineates as the structure of the punctated cells of some plants§; but usually the pore-like marks, lying in long rows, are only observable when the wall of a cell is seen from the side, where it is united with another. Several observers have also remarked pores upon the septum usually similar to the pores of epidermis, for example Hartig and Schleiden in *Capsella Bursa-pastoris*, Trécul in *Cheiranthus Cheiri*; I also have perceived the same in the last-named plant, and most clearly in *Octadenia lybica*, Br.; in most of the Cruciferæ however I have sought them in vain, and hitherto have only observed them in the vicinity of the border of the septum, never in the middle of it. Here in the middle the two lamellæ lie pretty close together, while at the borders they inclose, in common with the placental nerves of each side, a space filled with a parenchyma which from thence spreads out further into the septum. This has some affinity to the parenchyma of the under side of a leaf, consisting of anastomosing rows of elongated cells, which sometimes even contain granular

* Observ. on the Pl. of Central Africa, 13.

† *L. c.* 190.

‡ *L. c.*

§ Physiol. i. t. 1. f. 2, 5, 10, 11.

matter; and the delicacy of this cellular tissue is the cause why (which sometimes even occurs spontaneously, for instance in *Iberis*) the layers are so easily separable, which is impossible in those cases where it has a firmer consistence, as in *Thlaspi cochleariforme*, M. B. Brown first observed what he has called nerves in the septum. "In some cases," he says, "the axis of the septum displays itself either as a single nerve or as two separate parallel nerves, and from this axis tubes often pass off which have the aspect and ramification of the veins of leaves and commonly terminate within the border. This is most distinctly the case in *Farsetia*. The central vessels are here very closely approximated, so that they form a single cord; they extend from the apex of the septum to its base, and the veins are as numerous as unusually distinct. Approximations to this structure of *Farsetia*, more or less evident, occur in some other genera, as *Parrya*, *Savignya* and *Koniga*. But in the last-mentioned genus, the nerve which, as in all cases, arises at the apex, runs scarcely, even in the many-seeded species, beyond the middle of the septum, and the far less distinct veins are decurrent *." Of the plants here named I have been able to examine *Farsetia ægyptiaca* only dried, but *Koniga* (*Octadenia*) *maritima* as well as *K.* (*Octad.*) *lybica* (if *Draba nummularia*, Eb., be the same plant) in a fresh condition. In the *Farsetia* the septum certainly has something which looks very like a central nerve, about as it is represented by Desfontaines †, and I observe the same condition of the part in *Octadenia maritima*, except that the veins running out to the side have a somewhat different, that is, a curved course. In *Oct. lybica* each mid-nerve descends to about opposite the insertion of the ovule on the border; but ramifications go from it to all sides and are distributed over the whole of the septum; they form an intricate network by their regular anastomoses, and are often distinguishable by a reddish colour. In *Cochlearia anglica* also, likewise in *Vesicaria grandiflora* and *V. gracilis*, B.M., a nerve may be observed in the septum descending from the style. In *Cochlearia* it loses itself in the lowest parts of the septum where the funiculi arise, but in the two Vesicarias it only goes to the middle, and by no means gives off branches, but after becoming gradually attenuated suddenly terminates. In all these cases it was evident that the said nerve took its origin where the style ended, appearing to be an immediate prolongation of the central substance of that organ; it reached also either only to the middle or beyond the middle, but never to the base of the septum. Dr. C. A. Meyer, in his important work on the Cruciferæ of Altaï ‡, has devoted particular attention to the septum and found

* *L. c.* 13, 14.
† Fl. Atlant. ii. t. 160, f. 6.
‡ Ledebour, Fl. Alt. iii. 1–219.

it mostly nerveless; in *Draba grandiflora*, however, and *confusa*, *Syrenia siliculosa*, *Smeloskia integrifolia*, &c., with one nerve; in *Parrya exscapa*, *Macropodium nivale* and *Sisymbrium Sophia*, furnished with two of them. In his 'Catalogue of Plants found in the Caucasus, &c. in 1829 and 1830, Petersb. 1831,' he gives also to *Sisymbrium binerve* "dissepimentum hyalinum, fasciis binis longitudinalibus insignitum" (p. 189). Of the plants herenamed I had at my disposal good specimens only of *Macropodium nivale*, *Sisymbrium Sophia* and *S. binerve*, and in these I remarked the following points:—In *Macropodium* there extended through the middle of the whole septum a brighter streak free from the tissue of rows of anastomosing cells which occupied the sides, and which, above, where it originated from the base of the style, had on each side a border of rows of more thickened cells, and these borders appear to have been described by Meyer as two nerves. In *Sisymbrium Sophia* also a tolerably broad band runs through the whole length of the septum; it is not however brighter but less transparent than the remaining substance, at the same time it is more transparent in the middle than on the two lateral borders, and these borders have undoubtedly been taken for the two nerves by Meyer. *Sisymbrium binerve*, C. A. M., has much the same condition, only the band is not so broad here as in *S. Sophia*. If we understand by nerves, cords of fibrous tubes and vessels, there is no trace of such in that which appears as a nerve of the septum; they are rather only bundles of long-jointed cellular filaments, like those of which the central cellular tissue of the style, the so-called conducting tissue, is composed, as a prolongation of which, therefore, I do not hesitate to consider those nerves, though unable at present to say in what kind of relation to fertilization they stand in their distribution through the septum. It is true that we observe no distinct nerves in the septum of the majority of the Cruciferæ, which however must exist if these had the important destination alluded to; but in all siliques and silicles, if I am not mistaken, cellular filaments may be discovered, which are distributed in a reticulated manner between the two lamellæ of the septum, and mostly toward their borders where they retreat from one another, while in the middle portion they are usually in close contact. The idea which, on account of their distribution in a descending direction, is the first that must present itself, that they are pollen-tubes, is opposed by their being evidently composed of single elongated utricles, and I have never succeeded in making out a continuation of them to the ovules like that which Hartig figures from *Capsella**.

If we seek to trace back the formation of the silique according

* N. Theorie, 39. f. 26, 27.

to the general mode of origin of fruit, and if we regard, with Brown and DeCandolle, the many-celled fruits as originally composed of as many carpels as they have chambers, we must assume that the silique also consists regularly of two, very rarely, as in *Tetrapoma,* of four carpels, united in an apparently simple manner. But the question then arises, whether the placenta is an appendage of these carpels or an independent part, that is, a member of an inner whorl, the members of which alternate with the carpels as belonging to a more external whorl;—whether therefore it is, as some like to express themselves, an appendicular organ or a product of the axis. Assuming the former, the greatest difficulty is found in attempting to explain the production of the septum in the silique. De-Candolle regarded it as an expansion of the two placentas, and he sought to support this view by pointing out that the septum is always found to be thinner in the middle; that here it is readily torn in the direction of its length as in *Thlaspi arvense,* or is actually slit as in *Cheiranthus Cheiri,* or has a hole in the middle as in *Farsetia ægyptiaca, Octadenia lybica, Vesicaria gracilis,* &c., or is wanting in the middle and only present along the placentas as in *Tetrapoma.* But leaving out of the question that this by no means justifies such a conclusion, such an expansion would not agree with the original assumption, which settles the placenta to be a marginal production of the mere carpels. A. Brongniart* has described a monstrous form of the silique of *Cheiranthus Cheiri,* where instead of ovules small leaflets and indeed free leaves were produced. But how the formation of the silique is to be conceived so as to agree with this observation has not been stated by the author, who also holds that the theory of the production of the ovules from marginal teeth of the carpels is not applicable to all fruits, for instance not to the Primulaceæ, Myrsinaceæ, &c. Kunth has set forth the opinion that the silique is a structure composed of four leaves grown together at their margins, two of which have been perfectly developed outwards, but two are only developed inwards, because their growth outward is prevented by the pressure arising from the crowded position upon the axis, so that they produce seeds and may easily become united and form a septum†. Bernhardi also, citing a remarkable malformation of the fruit of *Ricotia* observed by himself, considered the silique as the product of four leaves grown together, two of which are arrested in their development‡. But more recently he has given up this theory, since perfectly formed siliques are found with four

* Ann. d. Sc. Nat. 3 sér. i. 29.

† Abhandl. d. K. Acad. d. W. zu Berlin f., 132; Lehrb. d. Botanik, i. 397, 458.

‡ Ueb. den Begriff d. Pflanzen, art. 47.

valves and four septa*, and in fact the genus *Tetrapoma* is of this kind, in which the number of parts which the silicule usually possesses is exactly doubled. Bernhardi therefore in his latest memoir on the subject† regards the perfect ovary of Cruciferæ as composed of four pieces with the same number of septa, cells and placentas, but two of which are usually suppressed; not explaining himself definitely as to the origin of the septum, that is, whether it is a prolongation of the valves of the fruit or of the axis. The latter view however seems to be most favoured by Bernhardi, and in fact it is also in my opinion that alone which is sufficient to explain the structure of the fruit of the Cruciferæ. In them, says Aug. St. Hilaire, the axis divides into two branches which traverse the ovary and again unite at the point to form the style. These are the two pistillary cords which bear the ovules, and the carpellary leaves, which when ripe separate from them, are independent of them. The ovary has therefore the simplest possible structure here; it consists of two carpels and two parietal placentas ‡. According to this view the septum must be regarded as the substance of the axis compressed to a mere plate, in and on which the cellular tissue, conducting the fertilizing matter, is prolonged from the style, and which in fact is itself only a modification thereof for this particular purpose. The double lamellæ of the septum can as little be made an objection to this view, as the often remarkable attenuation, slits or opening in the middle of it, or even the total absence of a septum; since, as to the first, each of the two cavities should be formed independently; and with regard to the second, it is well known that it does not occur more frequently than cavities in the middle of the pith, which may reach to a total disappearance of the same.

From this point of view also I hold the anomalous forms which occur in the silique to be most satisfactorily explicable. Assuming as the normal structure, that a silique is two-celled with a perpendicular septum, it will become one-celled and single-seeded either by the total absence of a septum, the place of which is occupied by the cavity with the single seed, or by only one remaining in the ripe fruit of two one- or more-seeded cavities, since generally only one seed becomes developed. The first case occurs in *Isatis, Clypeola, Tauscheria*; here there is in reality no trace of a septum, and the single seed hangs down therefore from the apex of the cavity, which usually occupies the centre of the silicule. It is the same condition that we meet with in the anomalous fruits of *Æthionema heterocarpum*, with the difference that

* Flora 1838, no. 9.

† Ueb. d. Metamorphose d. Pflanzen; Flora 1843, Nos. 3, 4.

‡ Leçons de Botan. 493, 494.

the cord of the umbilical vessels is wanting on the depressed lower side of the much-inflated silicle, the other alone being present, running over the elevated side. The second occurs, for instance, in *Neslia paniculata, Rapistrum rugosum, Crambe orientalis*; and indeed in the two last-named the silicles are only two-celled in the upper joints, from the presence there of a perpendicular septum which is wanting in the lower. In *Myagrum perfoliatum* and *Erucaria aleppica* no seed is developed in either of the two chambers which occupy the uppermost part of the silicle. This absence of the septum in the lower part of the fruit has its analogue in the slit or opening which exists in the septum in that situation in *Farsetia* and other genera, in the whole central part in *Tetrapoma,* and it indicates the necessity of an uninterrupted union between it and the style or the stigma; while on the other hand an interruption at the other end, namely the lower, appears to be attended with no detriment to the formation of the fruit.

If this be the correct view of the septum, it will then always, at least originally, have a perpendicular position in the silicle. In *Bunias orientale* indeed, where the ripe fruit is two-celled and two-seeded, one cell with its seed lies over the other with an almost horizontal septum *, but this is a consequence of development. For in the earliest state of the fruit, when the stamens have scarcely fallen off, the septum here is vertical as usual, and the cells therefore originally lie side by side and not one above the other. In *Bunias Erucago,* DeCandolle finds the silicles two-celled in the young state, in a certain measure four-celled in the fully developed, as each cell is frequently again divided into two by a transverse septum †. But if a perpendicular section is made through the somewhat oblique silicle, at the period when the calyx, corolla and stamens fall off, in such a manner that the section crosses that oblique position, the four cavities are already visible. A membranous septum descends obliquely from above downwards, which by projecting in and out forms two curves, from each of which a fleshy transverse process runs to the outer wall. The septa of both kinds are present therefore when the fertilization is yet scarcely complete, so that we certainly cannot consider the production of any of them an after-growth.

In the genera *Cakile, Crambe* and *Rapistrum,* the silicle is divided into two joints by an apparent articulation in the middle, the upper being commonly externally of a different structure from the lower. By this means its cavity is indeed divided into an upper and lower cell, but the two cells are never perfectly separated, for there always remains an actual, though very narrow, communication between them, as the apparent articulation con-

* Gärtn. d. Fruct. ii. t. 142.

† Syst. Natural. ii. 670.

sists merely of a projection inward of the substance without an actual growing together or formation of a cross septum. That a longitudinal septum however occurs in the upper joint, at least in *Crambe* and *Rapistrum*, with the two cavities, one alone of which is perfected, has already been noted. An ovule is present both in the upper and the under cell, but in the upper it is erect, in the lower suspended: the two funiculi arise at about the same height, but on opposite sides of the cavity. Frequently the upper ovule alone is developed into a seed here, while the lower is often, and in the genus *Crambe* pretty constantly, abortive.

However great therefore the multiformity of nature appears in the silique, it may still be expected that we shall be able to trace back the aberrant structures to simple typical forms when we shall have discovered the transitional modifications. It would be in the highest degree interesting to examine more closely many cases of unusual forms of the fruit. Thus for example in *Stenopetalum robustum*, Endl., the seeds grow upon the base of the septum, in which a tripartite nerve is visible*. In *Pugionum cornutum*, G.,—a plant found, apparently, by no one but J. G. Gmelin,—Gärtner found an "arillus chartaceus" which completely inclosed the solitary seed†; but Ledebour has ascertained, from the examination of fruit in good condition in the collection of A. W. Martini, who was Gmelin's companion, that the part which Gärtner took for an arillus was nothing else but the inner layer of the pericarp, which had become so detached from the outer that it was only connected by some fibres ‡.

XXXVI.—*Horæ Zoologicæ.* By Sir William Jardine, Bart., F.R.S.E. & F.L.S.

[Continued from p. 334.]

Birds of Tobago.

Crotophaga rugirostris, *Swain.* s.§

For our observations on this species we would refer our readers to the 'Annals' of 1839, p. 160; and in a letter received from Mr. Kirk since these observations were made, we have the following remarks on the incubation of this curious species:—"On a reperusal of your 'Horæ Zoologicæ' of 1839, in regard to the incubation of *Crotophaga*, I have now my doubts, and although

* Enum. Pl. Huegel. 4.

† De Fruct. ii. 292. t. 142. f. 3.

‡ Math. physical. Abhandl. der Münchener Acad. d. W. iv. Bd. 3 Abtheil.

§ Species marked n. are also found in North America; s. in South America; and n. s. in both.

I have been silent on these subjects for some time past, I have not been an inattentive observer; I shall therefore give you a fair statement of my observations and allow you to draw your own inferences. In September 1843 my attention was drawn to a nest of the *Crotophaga* by the ranger of Buccoo, an estate under my charge; he told me that there was generally one bird in the nest, but that they frequently came in great numbers perching around it, and were particularly noisy. I examined the nest to which he alluded; it was built upon a cocoa-nut tree, about thirty feet from the ground, and the tree being about forty feet from the dwelling-house door, afforded an excellent opportunity to watch their habits. The result was that there never did appear to be more than one bird in the nest during the day, but on sundry occasions, especially mornings and afternoons, they came in flocks of from twenty to thirty, alighting on the tree and crowding round the nest making a considerable noise, on which occasions I generally observed the occupier of the nest at the time left her place; but whether for fear, or rather to give place to others, I could not ascertain; I think most probably the former. I never saw more than one bird sitting in the nest at a time except during those turbulent visits, and then it was quite impossible to tell how many might have been in it. The branches of the cocoa-nut tree spring from the stem in a cluster, ascending at an angle of from 45° to 50°, forming very deep and irregular interstices between the branches, and in one of these the nest in question was commenced; the interstice was then deep and the nest not large, but contained five eggs, which seemed to be covered by one bird. I was absent from that district for several weeks, and on my return I observed that the nest appeared much larger, and was told it contained four birds; I did not disturb them on that occasion, but on returning about ten days thereafter I sent a servant up to examine the nest, which he reported empty; not being quite satisfied with his report and wishing to ascertain the cause of the increase of bulk, I went up myself and brought down the nest entire. On the upper surface lay one rotten egg, partially concealed by the sticks, grass and leaves of which the nest was composed; on removing another stratum of the same materials, but chiefly leaves, I discovered seven eggs; and on repeating the search farther, after removing fully four inches of leaves, I found first ten and then four eggs, making a total of twenty-two addled eggs after the young birds had taken flight.

"From what I have witnessed on the above occasion, I am quite satisfied that the community added to the general stock of eggs and also to the building, much to the inconvenience and annoyance of the original architect, who seemed at first perfectly satisfied with her own fabrication. A question now arises, viz.

has Tobago two species of *Crotophaga*, or does the difference of locality change or affect their habits?

"I have formerly watched the habits of these birds during the period of incubation where they seemed to lay and hatch their own eggs without the aid of others; true, the opportunities afforded on former occasions were twenty-five miles distant from the scene of the present observations; nor have I yet sent you a specimen from the leeward side of the island. In the windward district of Tobago, which is the chief locality of my investigations, our savannahs and swamps abound with underwood, shrubs and creepers, in the leeward part, especially about Buccoo, the spot where the nest which gives rise to the present letter was found; there is scarcely a shrub or bush beyond a pigeon pea-tree within a mile of the spot; it might therefore be argued that necessity had driven them to the cocoa-nut trees; but on the other hand, why therefore use a general nest? From these reflections I think we may conclude that they sometimes make a common nest, especially in the more cultivated spots."

Coccyzus erythropthalmus, *Vieill.* (Cuckoo.) n.

"Arrives here in October; shot on the sea-coast apparently much exhausted."

Certhiola flaveola, *Linn.* (Creeper.) s.

Cereba spiza, *Linn.* s.

Cereba cyanea, *Linn.* (Creepers.) s.

Apparently not common; in all our collections from the island a single specimen only has been received.

"Native; were until lately a rare bird in Tobago, and only partially known; they feed on the galba and dog-wood trees."

Cereba cærulea, *Linn.* s.

Phaëthornis hirsutus, *Gmel.* (Doctor Humming-bird.) s.

"Native. This little bird is the most restless of all the Humming-bird tribe; it can scarcely be said to be seen at rest, but darting right and left, zigzag; at times when suddenly surprised feeding, uttering a sharp squeak, it will dart off and disappear like a meteor; at other times will seem as if suspended for several seconds by the point of the bill within three feet of a person's face, after which it is sure to disappear like lightning; in these cases it truly assumes an attitude which a stranger might construe into a meditated attack upon his person; I have often been induced to strike at them with my fowling-piece from their proximity." We also receive this species from Trinidad.

Campylopterus ensipennis, *Swain.* (Mexican Humming-bird or Sabre Wing.) s.

"Feeds on ants, small flies and sweets, and are particularly fond of the blossoms of the wild and common plantain tree; but whether from the circumstance that these blossoms are generally attended by numerous herds of ants, which form the principal part of their food, or for the purpose of extracting sweets, or perhaps both, I am at present unable to determine; but in all I have dissected, I have found the stomach to contain ants and portions of small gnats. They are found principally in the woods by rivulets and in low marshy places."

Trochilus mellivorus, *Linn.* (White-necked Humming-bird.) s.

"I am not able to decide as to this bird being 'native;' it is only at certain seasons to be met with; but whether it leaves the island or retires to the interior, I am not at present prepared to say. They are seldom to be found in open sunshine; the mornings and evenings are their principal time of feeding, and their evolutions at that time are truly pleasing. At one instant suspended, immoveable to the eye (although alternately showing the purest white and green), at the very top of our tallest bamboo, guava or other tree, and the next moment at their root, with two or three zigzags right and left, up and down, dipping either into the river or snapping a fly from the surface and then disappearing, but without the twitter the doctor-bird generally utters at departure. I think in all probability this bird feeds more upon winged insects than most of the others, which may account for its being seen so early in the calm mornings, retiring generally into the thick wild plantain bushes as soon as the sun begins to spread his rays upon them, and appearing again in the evening when he is going down, or when his rays cease to act on their spot of pleasure. A female shot on the 19th of April contained an egg almost perfect."

Trochilus mango, *Linn.* s.

This species is not found in Jamaica, as generally said to be; the *T. porphyrurus* of Shaw seems to hold its place there.

Trochilus moschitus, *Linn.* (Ruby Topaz Humming-bird.) s.

"Migratory. This pretty little species arrives here in the end of January or about the 1st of February; they begin to build about the 10th, sit fourteen days, and lay two pure white eggs. They feed on ants as well as flowers, and on dissection I could distinctly number 115 small ants in the stomach of one. One of these birds having attached its nest to the trunk of a cog-wood tree close by a window at my residence, I found an opportunity of observing their manners during incubation, and I can assert, that although I confined the young by means of some coarse wire cloth through which the parent could feed them for upwards of three weeks after they were ready to leave the nest, and although she evinced the greatest distress by her chirping note when flying around me often within three feet, I never but twice from the laying until the period I mention saw the appearance of a male near the nest; and whether they pair seems to be disputed, as on both these occasions he was hotly pursued by the female to a considerable distance with all that bickering violence so peculiar to the tribe." We receive *T. moschitus* from Trinidad.

TROCHILUS AUDEBERTI, *Less.* s.

TROCHILUS ERYTHRONOTUS, *Less.* (Emerald Humming-bird.) s.

"Native; begins to build about the 10th of February, generally on a small stalk or on the upper side of some twig, sometimes so hid from the eye by a large leaf as to preclude all possibility of seeing it from above, and often so near the ground as to remain undiscovered. Makes a small neat nest in which it lays two pure white eggs."

COLUMBA RUFINA, *Temm.* (Blue Pigeon.) s.

"Excellent for the table." Received also from Jamaica.

PERISTERA JAMAICENSIS, *Gmel.* (Ground Dove.) s.

"Native; are fond of sequestered places, go in pairs, feed on the ground, build a coarse nest with two or three cross sticks, easily domesticated. Excellent for the table. The natives catch great numbers of them by traps made of sticks and shaped like a triangle." Received also from Jamaica.

PERISTERA FRENATA, *Tschudi?* (Ground Dove.) s.

CHAMÆPELIA TALPICOTI, *Temm.* (Ground Dove.) s.

ORTALIDA RUFICAUDA, *Jard.* (Cockricko or Partridge.)

Unable to compare this bird with the species described in the 'Isis,' we cannot decidedly assert that it is undescribed, and the name above is given provisionally. Its nearest ally is the *P. katraka*, which it resembles in size and form. It however differs from it in the head and upper part of the neck *not* being "roux foncé," and in having *all* the feathers of the tail except the two centre broadly tipped with dull reddish. The young birds we believe are not white below. They appear to be tolerably common on the island and are "native," breeding there; they are easily tamed and become very familiar. The trachea in the male has one external convolution.

The head, upper parts of the neck and centre of the throat blackish gray, shading into the olive which is the colour of the whole upper parts and wings. The lower part of the neck and breast also olive, of a paler tint and shading into a yellowish brown on the belly and vent, which again shades into dull reddish brown on the axillæ, flanks and under tail-covers. The tail is entirely of a dark olive with green reflections, all the feathers except the two in the centre being tipped for an inch and a quarter with reddish brown, very conspicuous when the tail is thrown up, but nearly concealed from above when it is closed. The feathers on the throat extend in a central line, the sides exhibiting a narrow streak of bare livid skin.

Charadrius virginiacus, *Borkh.* (Plover, Golden Plover.) n. s.

"Migratory, arrive here in September," is the note to this species, and our specimens of both exhibit the intermediate state of plumage after having bred and putting on the dress of winter, which season would be partially spent by them in Tobago and the adjacent islands.

Charadrius semipalmatus, *Bonap.* n.

"Migratory: feeds on small bivalve shells; runs with a zigzag course, according to the flowing and receding of the waves, very nimbly along the beach, running ten or fifteen yards at a time, halting a second and then resuming the course as before. Not common; shot in March."

Strepsilas interpres, *Linn.* (Rock Plover.) n. s.

"Migratory and very rare; shot in January; times of its arrival and departure not known."

Catatrophorus semipalmatus, *Gmel.* (Curlew.) n.

"Shot in October, a solitary bird on the beach." Another bird was shot out of "a flock of several hundreds which coursed for a whole day on the sea-coast near my residence without coming to land above five minutes."

Totanus flavipes, *Vieill.* (Long-legs.) n.

"Migratory, arriving here in July and August and departing in October or November."

Totanus chloropygius, *Vieill.* (Sandpiper, Solitary.) n.

"Migratory: feeds upon small shells."

Totanus macularius, *Linn.* (Sandpiper, Little.) n. s.

"Migratory: feeds on small crabs and small bivalve shells."

Tringa pectoralis, *Bonap.* (Sandpiper.) n.

Tringa pusilla, *Leisl.* (Heath Sandpiper.) n.

Scolopax Wilsonii, *Ord.* (Snipe.) n.

"Migratory. They arrive in small numbers in October and continue until January. They are never seen or heard sporting on wing on a calm day or evening as in Britain, but they utter when suddenly surprised the same feeble squeak."

Rallus variegatus, *Gmel.* (Rail.) s.

"Eyes bright scarlet," is the only note to this species: apparently not common. We receive it also from Jamaica.

Porzana carolina, *Linn.* (Water Rail.) n.

"Native; inhabit our marshes."

Gallinula galeata, *Licht.* n.

Porphyrio martinicus, *Gmel.* (Purple Gallinule.) n. s.

"Native; inhabits our swamps and marshes among the wild plantain."

Ardea herodias, *Linn.* n.

Egretta cerulea, *Linn.* (Blue Crane, or Gray Heron.) n. s.

"Native: begin to build about the middle of April on small islands detached from mainland. They are abundant on Roxbro Rock in April, May and June, where they build a coarse nest of sticks lined with leaves upon low bushes, which can only be approached with difficulty, surrounded in such a degree by the *Cactus erectus* as to render it almost impossible to penetrate; lay two eggs of a blue colour. All the cranes are white when first fledged and get blue as they grow old; I have seen fifty young sitting on the tops of the highest bushes, and these invariably white. The stomachs contained lizards, crabs, cray-fish and worms."

Ardeola virescens, *Linn.* (Bittern.) n. s.

Nycticorax cayenensis, *Gmel.* (Night Galding, or Crabcatcher.) s.

"Native. This species also breeds on Roxbro Rock or other detached islands on low thorny bushes often within two or three feet of the ground. It is not so common on the mainland as the others, and when there is not so shy; I have often been surprised by their starting up within ten yards as a hare would in Europe; whether being busily engaged in satisfying the cravings of nature and not observing my approach, or conceiving itself securely hid among the long grass, I am unable to say; I think the latter most probable, as I have myself frequently surprised them in this state after making sufficient noise by frequent discharges of my gun to warn them of my near approach. The young bird sent I have had alive for three weeks, feeding upon young crabs, thirty of which it would devour in twenty-four hours, of average size, or an inch by an inch and a half without the claws, which are very sharp, and which it generally took care to separate from the body before swallowing. The food was generally soon disgorged, which showed the power of digestion, being reduced to the consistence of coarse snuff in a very short time. This bird died from neglect, but not until I had satisfied myself of their utility to the sugar-cane planter. I know some estates in this island where several people are employed labouring to destroy this destructive little creature ('the crab'), which although used in various ways for the table, yet when they annoy the sugar-cane to such a degree as to call for human aid to extirpate them, and where one man does well if he succeeds in killing twenty or thirty,—a number be it remembered that one of these birds will devour in the same time,—it will be sufficient to say that this bird is invaluable to the sugar-cane planter in low marshy lands, and it is only in such places that this bird is to be found or wanted. Its usefulness is a fine subject for moralising, and one which poor Wilson would have used to advantage."

NYCTICORAX GARDENII, *Gmel.* N. S.

MYCTERIA AMERICANA, *Linn.* S.

A single specimen obtained; a straggler.

FULIGULA MARILA, *Linn.* (Saup Duck.) N.

"Very rare in the island." This specimen is of a smaller size with the markings on the back larger, and possesses all those marks which are considered to separate the European and American birds.

QUERQUEDULA CAROLINENSIS, *Jard. & Selby.* (Green-winged TEAL.) N. S.

"Arrives in October and November, and departs in March or April." A single specimen in immature plumage was received, but we have little doubt of its being the bird of North America.

PODICEPS CAROLINENSIS, *Gmel.* (Grebe.) N.

SULA FUSCA, *Gmel.* (Booby.) N. S.

"Lay at least twice in the season, sometimes on the ground, but generally on a low shrub or thorny tree on a small island to the eastward of Tobago called 'St. Giles.' The island I should judge to be about eight acres in extent; I visited it in June, when it presented a disgusting appearance; the fishy smell combined with the mass of filth in some places to the depth of several feet, although rendered dry by the parching and insufferable heat which is always about it, makes it almost suffocating. Judging from appearance, I should think that every square yard contained a nest and a bird as large as the mother, and the sky is literally darkened above by the old boobys and man-o'-war-birds (*Fregata*). The island abounds with the prickly pear and the *Cactus erectus*, and it becomes dangerous to walk among them at times, from the snapping of the young birds at the eyes. The negroes on some of the adjacent estates bring them home in boat-loads, and the young are said to be excellent food."

Sula piscator, *Linn.* (White Booby.) s.

Fregata aquila, *Linn.* (Man-o'-war-bird.) n. s.

"Inhabits the same island with the booby, lays one white egg, are natives, and are never seen to alight except on St. Giles. At earliest dawn of day they go straight out to sea and then drop to leeward; we seldom or ever see any passing down, but from ten until two or three P.M. they may be shot in great numbers about our headlands as they soar up along our coasts. Sometimes too at certain seasons of the year they frequent our fresh river mouths to drink, which they do without alighting by sweeping along the surface."

Phaëton æthereus, *Linn.* (Tropic Bird.) s.

"Abounds on some small islands or rocks to the east of Tobago, which can only be approached in smooth weather."

Anous stolidus, *Linn.* (Noddy.) n. s.

"Sea-pigeon: breeds on detached islands, particularly St. Giles."

Sterna fuliginosa, *Gmel.* (Tern.) n.

"Lay without building any nest on shelves of rock among *Cactus erectus*, on Roxbro Rock among the herons." Some specimens of this very pretty tern had the nape pure white shading into brownish gray on the back, which with the back and wings was much lighter than the others; the black upon the head was quite insulated, forming a cowl or cap.

Sterna dougallii, *Mont.* (Tern.) n.

Sterna cayana, *Gmel.* (Tern.) n. s.

Xema atricilla, *Linn.* n.

Puffinus obscurus, *Gmel.* n.

"Taken off an egg on a rock at sea, where it was a solitary bird."

XXXVII.—*Description of two new Mosses from Jamaica.* By William Wilson, Esq.*

Pilotrichum, *Beauv.*

P. funale (nov. sp.?); surculo pendulo vel procumbente vage ramoso, ramis simplicibus foliis ovatis acuminatis concaviusculis, plicato-striatis serrulatis iranidenerviis siccitate erectis.

Hab. in arborum cortice? Port Royal, Ins. Jamaicæ; legit G. M'Nab, M.D.

* Read before the Botanical Society of Edinburgh, 11th Nov, 1847.

Surculus biuncialis et ultra. Rami subsecundi, semiunciales. Folia nitida, lutescentia, tenuissime areolata, siccitate haud tortilia. Fructus et flores desunt.

Very much like *Pterigynandrum nigrescens β. illecebrum* (Bridel, Br. Un. ii. 193), but differing thus: leaves more acuminate, serrulate; areolæ smaller and narrower; the foliage too, when dry, is somewhat glossy.

The typical *Pt. nigrescens* (Swartz) is distinguished from these two forms thus: leaves narrower, of thinner texture, more lax, pale green. Still it is doubtful, in the absence of fruit, whether the three forms should not be referred to one species.

Pilotrichum may (for the present) be considered as a subgenus of the Bridelian genus *Neckera*, with hairy calyptræ. It is adopted as a genus by Hornschuch in the 'Flora Brasiliensis,' and was first proposed by Pal. de Beauvois.

OMALIA, *Brid.*

O. lentula (nov. sp.); caule distiche sub-bipinnatim ramoso, foliis distichis ovato-falciformibus acuminatis serrulatis enervibus, perichætialibus lanceolato-attenuatis.

Hab. in arborum cortice? Port Royal; legit G. M'Nab, M.D.

Caules bi-triunciales. Rami complanati, breves. Folia nitidissima, læte-viridia, tenuissime areolata, superne serrulata. Florescentia dioica?

Evidently allied to our British *Omalia trichomanoides* (Bridel), *Hypnum trichomanoides* (Hooker and Taylor), but readily distinguished by its nerveless, acuminated and more falciform leaves and more shining habit. It has still greater resemblance to *Neckera* (*Distichia*) *glabella* (Bridel), which probably belongs to the genus *Omalia* (the true *Distichiæ* having the leaves rugose or undulated). From the last-named moss, ours differs in its smaller size and ovate-acuminate leaves.

XXXVIII.—*Diagnostic Characters of five new species of Cryptogamic Plants from Jamaica.* By THOMAS TAYLOR, M.D.*

LESKEA, *Hedw.*

1. *L. angustifolia* (Tayl.); caule exiguo erecto subramoso, surculis flexuosis, foliis laxis distichis ex angusta basi lineari-oblongis obtusis apiculatis apice dentatis ruptinervibus substriatis surculorum ad apices arcte compressis ad basin minutis vel subnullis.

On *Danæa alata* (Sm.), Jamaica. In *Dr. R. K. Greville's* Herbarium.

Three to four lines high, pale yellowish green, shining. Leaves

* Read before the Botanical Society of Edinburgh, 11th Nov. 1847.

in eight to ten pairs, those at the top adpressed into a spike; their inferior margin incurved at the base. This species is strongly allied to *L. Novæ-Hollandiæ* (Schwaeg.), and may well be supposed to belong to the same genus even in the absence of fructification. It may be distinguished by its far smaller size, its more obtuse leaves, and by their shorter nerve. In one instance the stem is prolonged at the top into a flagelliform shoot, destitute of all but minute rudimentary leaves.

PHRAGMICOMA, *Dumort.*

1. *P. affixa* (Tayl.); caule debili repente vage ramoso seu subdichotomo, foliis laxe imbricatis erecto-patentibus oblongo-rotundatis margine subundulatis apice parce denticulatis lobulo minuto vel subnullo, stipulis rotundatis integerrimis, calyce demum axillari oblongo-obcordato compresso ore integerrimo.

On *Danæa alata* (Sm.), Jamaica. In *Dr. R. K. Greville's* Herbarium.

Five or six lines long; very pale olive, nearly whitish: a female flower and a branch issuing from near the top of the past year's shoot. Leaves flaccid, often entire, sometimes with three or four obtuse teeth; the perichætial erect, oblong, subdentate. Capsule pale, splitting half-way down; its valves broadly ovate. The leaves by no means imbricated, flaccid, irregular in outline, variously twisted: the indistinct lobules and the large cells serve to keep the present distinct from all described species.

RADULA, *Nees.*

1. *R. Grevilleana* (Tayl.); caule implexo repente subpinnato, ramis patentibus, foliis imbricatis erecto-patentibus integerrimis lobo superiori obovato-rotundato, inferiori minuto trapezoideo, calyce demum axillari elongato ovato-oblongo apice compresso truncato, basi angustato pedicelliformi, perigoniis minutis linearibus ramorum fere ad apices usque productis lobulo monandro.

On *Danæa alata* (Sm.), Jamaica. In *Dr. R. K. Greville's* Herbarium.

Very minute, three to four lines long, olive-coloured, closely adhering to the subjacent fern; a calyx and an innovating branch terminating the preceding year's shoot. Leaves touching, more patent than erect; the perichætial broadly elliptical, short. Capsule linear, very narrow. Perigonia on short lateral branches with ten or twelve pairs of minute imbricated ventricose leaves, each containing a spherical anther. The exserted part of the pedicel about as long as the calyx; this is on a narrow pedicel or nearly cylindrical opake base contained within the perichætium; it is nearly as long as the shoots. This species differs from *R. buccinifera* (Tayl.) by the smaller size, more imbricated leaves, whose tops are not so rounded, and by the calyx bulging at the base, and so by no means obconical.

PLAGIOCHILA, *Nees et Mont.*

1. *P. sub-bidentata* (Tayl.); caule repente laxe cæspitoso, surculis decumbentibus subflexuosis, foliis basi imbricatis erecto-patentibus margine ventrali basi gibboso oblique ovatis acutis apice subbiciliatis, calyce oblongo ore oblique subtruncato dentato.

On *Schlotheimia cirrosa* (Hook.), Jamaica. *Dr. J. M'Nab.*

Shoots one or two inches long, scarcely one line wide, brown, attenuated above. Perigonial spikes one or two in the course of the shoots. Perichætial leaves upright, adpressed to the base of the calyx; this has a marginate angle on the upper side, and the mouth roundly truncate and split on one side. Pedicel just exposing the capsule out of the calyx. This differs from *P. abrupta* (Lindl.) by the procumbent shoots, which are longer and more attenuated above; by the wider bases of the leaves, which at the ventral margin form a crest below the stem; by the teeth of the leaves being so slender as to be mere cilia, and by the minuter cells of the leaves.

PARMELIA, *Ach.*

1. *P. ochroleuca* (Tayl.); thallo laciniato-lobato, lobulis ultimis brevibus sinuato-divaricatis præmorsis retusisve albo-cinereo madore immutato tenuissime albo-reticulato subtus albido-fibrilloso, apotheciis submarginalibus concavis margine incurvo demum gemmis planis subrotundis coronato, disco castaneo subtus nudo.

Port Royal, Jamaica. *Dr. J. M'Nab.*

Thallus three to four inches wide, when dry waved on the surface; sinus of the lobes oblong: margin brownish; surface pale ash-coloured, whiter beneath, where the pale fibrils resemble those of a *Peltidea*. Disc of the apothecia concave when dry, flat or slightly convex when moistened and then assuming a lighter colour. The disc is naked beneath, that is, it is destitute of a thallodal layer, hence the apothecia seen by transmitted light are pellucid in the centre. Allied to *Sticta Leylandii* (Tayl.), which however differs by the upper surface being covered with closely set clusters of buds, by the smaller size and darker colour, by the shorter fibrils beneath the thallus, and by the apothecia receiving at length a short podetium from the thallus. The genus *Sticta* seems scarcely separable by a decisive character from *Parmelia*, and this again in another direction passes into *Lecanora*.

XXXIX.—*A few Critical Remarks on* M. Carl J. Sundevall's *Paper on the Birds of Calcutta, as republished by* H. E. Strickland, Esq. By Ed. Blyth, Curator to the Museum of the Asiatic Society, Calcutta, &c.

Commencing with the remarks on the Bengal Soonderbuns (vide Ann. & Mag. Nat. Hist. xviii. 103), it may be as well to observe, that the animal inhabitants of this notoriously baleful region are far from being so little known as is commonly supposed, nor are the lower alluvia of the numerous anastomosing outlets of the Ganges so utterly unhealthy during great part of the year: viz. nearly throughout the dry season, divided into cold and hot; or from the end of November to that of June, when the rains have fairly set in. When the latter break up, the malaria becomes deadly to casual visitors, whether European or native; and even the Bengalee inhabitants are obliged to leave certain districts for a while; though a Mugh population, from Arracan, which, until recently, came to supply their place, seemed proof against the deleterious miasmata. Considerable tracts are under cultivation; and the belts of impenetrable dense jungle facing the network of broad river channels in many instances conceal from view a wide extent of productive rice cultivation within. Of the zoology, I doubt much whether more discoveries remain to be made there, at least among the terrene Vertebrata, than in other parts of Bengal; and even the Fishes have been so far investigated, that novelties among them are by no means to be reckoned upon in the course of an excursion.

Next, I am constrained to disagree with M. Sundevall in his estimation of the feathered musicians of Lower Bengal, which I cannot think are comparable to those of his native land, the latter being much the same as in Britain. Our finest song-bird in this part of the world, beyond all comparison, is the 'Shâmah' (*Kittacincla macroura*, Lath.), which is never heard in the wild state upon the river alluvium, to which M. Sundevall's peregrinations here were confined. The 'Agghin' (*Mirafra cantillans*, Jerdon) is a tolerably good songster, but excessively rare in the same broad tract of country, where it can be regarded merely as a casual visitant: and the best song-bird which M. Sundevall could have heard wild is the common Bengal lark (*Alauda gulgula*, Franklin), the notes of which very closely resemble those of the British skylark. Of arboreal songsters, the 'Dhyal' (*Copsychus saularis*) has a pleasing, desultory, robin-like ditty, delivered in short snatches, but without much variety; and the Bulbuls and a few other small birds have, at most, a few musical chirrups, which the common Black Bulbul (*Pycnonotus bengalensis*, nobis) connects into a continuous warble sometimes, during its breeding season only. Some of the Drongos have agreeable loud notes, especially the 'Bhuchanga' (*Chaptia ænea,* Vieillot), but there is too much repetition of the same stave: and, lastly, the Mynahs, or 'Mainas,' and other *Sturnidæ,* and also the 'Bayas' (*Ploceus*), very commonly indulge in a loud screeching chatter, which, if song, can only by courtesy be termed musical. The *tout ensemble* is sufficiently humble, even though eked out by the melodious cooing of different kinds of Dove, and the more or less pleasing voices of sundry other tribes of birds, which may harmonize with the scenery around or derive interest from their associations.

M. Sundevall begins his list with *Oriolus melanocephalus,* L., respecting which I have only to remark that I can make nothing of the native name he assigns to it, unless it can mean *Huldea Bulbul* (*i. e.* 'Turmeric-coloured Bulbul'), which is not impossible. The bird is as familiar to every Bengalee as the blackbird and thrush are to the inhabitants of England; and seems to be universally known to Hindoos as the *Bānay-bo,oo,* or *Bania-ba,oo,* of the Musselmans, signifying 'goldsmith's wife,' but at the same time a sort of imitation of the bird's note. Adult females differ in no respect from adult males, except in not being quite so bright on the back: the black hood is alike in both, extending for some distance beyond the ear-coverts; whereas in the African *O. monachus* (Gm.), v. *larvatus,* Licht., v. *capensis,* Sw., it terminates in a line with the ear-coverts,—this being one of several constant differences by which the two species may be readily distinguished.

Turdus cafer apud Sundevall is my *Pycnonotus bengalensis,* being distinct from the allied African species, or *P. cafer* (verus), L.—*P. jocosus* is called *Sipahi Bulbul* about Calcutta, *Kurra Bulbul* at Chandernagore: the name *Sonna* (*sona*? 'golden') I never heard applied to it.

Dendrocitta rufa, No. 7 (p. 168). The Bengalee name of this bird should be spelt *Háricháchá*: it is also called *Takka-chôr,* or 'Rupee-thief.'

Dicrurus macrocercus, Vieillot, No. 9. The name *Bhúchanga,* or *Boojoonga,* as M. Sundevall spells it, refers to the next species upon his list, the *Chaptia ænea.*

Tchitrea paradisi (No. 11) is the *Shah Bulbul* of the natives, which name M. Sundevall assigns erroneously to their *Chák-Dhyal* (*Leucocerca fuscoventris,* which is quite distinct from Mr. Jerdon's *L. pectoralis*).

Muscicapa parva apud Sundevall (No. 15), the *Turra* of the Bengalees, is the *M. leucura,* Gm.; a closely allied, but I believe a distinct species from the European *M. parva.* The rufous throat is obtained by the males only, at the commencement of the hot weather. The name *Toontoonu,* which he cites, belongs properly to the little tailor-bird (*Orthotomus longicauda*), but is popularly applied to various other small birds, as especially the different species of *Phylloscopus*, which are probably mistaken for the tailor-bird.

Pericrocotus peregrinus (L.), No. 16. The name *Páwi* appertains to *Sturnia malabarica*. M. Sundevall's *Phœnicornis flammea*, No. 17 (p. 251), is *Per. speciosus* (Lath.), distinct from *P. flammeus* of South India and Ceylon, which again differs from *P. igneus*, nobis, of the Malay countries.

Acanthiza trochiloides, Sund., has been since named by me *Phylloscopus reguloides*; and his *A. arrogans* is rightly assigned by himself to *Culicipeta Burkii* (Burton), the *Cryptolopha auricapilla*, Sw., &c. &c.

Orthotomus longicauda (No. 20) extends its range to Malacca, where however it is rather of a deeper colour, and it occurs there together with two other well-marked species, *O. edela*, Temm. (v. *Motacilla sepium*, Raffles), and *O. cineraceus*, nobis; both distinct from *O. sepium*, Horsf., of Java.

Iora typhia (distinct from *I. zeylonica* and *I. scapularis*) is known here by the names *Tas-feek* and *Phooteek-jol*; both imitative of certain of its notes, which much resemble those of the *Pari*. The affinity of this genus is with *Phyllornis*.

Malacocercus griseus (Gm.), No. 22, is peculiar to South India, being represented in Bengal by the *Merula bengalensis*, Brisson, which specific name should now stand, in preference to *M. terricolor*, Hodgson. Besides its common name *Chatarrhæa*, it is often called *Sát-bhyeá* (or 'seven brothers,' from its always associating in small troops).

Motacilla boarula is common here; also in the Malay countries, and it occurs even in Australia. M. Sundevall's *M. flava* agrees best with *Budytes cinereocapilla* of South Europe; and his *M. alba* is *M. luzoniensis*, Scopoli.

The Bengalee name *Tjorta* (meant for *Chawta*), which he assigns to *Anthus arboreus*, belongs properly to the common sparrow, but is often vaguely applied to any small brownish bird of about the size of a sparrow. His supposed *Anthus pallescens* is *A. malayensis*, Eyton. The described lark (No. 28) is *Alauda gulgula*, Franklin: and the common name here of *Pyrrhalauda grisea* (Scop.), No. 29, is *Dhoolo-chorai* (or 'Sand Sparrow'). *Fringilla bengalensis* apud Sundevall refers to *Ploceus philippensis* (L.), the well-known Baya; *P. bengalensis* and *P. manyar* occurring likewise.

Acridotheres tristis (L.), No. 32. The Bengalee name *Sálik* is generic, though often applied to this species without an adjunct: it is more distinctively termed *Ghór Sálik* ('House Mynah'), and sometimes *Bhátta Sálik*. *A. grisea* (Horsf.), the *Gracula crista-*

tella apud Sundevall (but quite distinct from *Acr. cristatellus* (Linn.) of China), is the *Jhônt Sálik,* or *Jhontee Maina* of the Musselmans (meaning 'Crested Mynah'). *Acr. ginginianus* is the *Gáng Sálik* (or 'Ganges Mynah,' from its inhabiting the river-banks). *Gracula intermedia* (p. 305) is the *Páháreá Maina* (or 'Hill Mynah'); and it is very rarely that the smaller species of South India and Ceylon, for which M. Sundevall mistakes it, is obtainable in the Calcutta bird bazaar. *Sturnus contra* is the *Ablacáh* ('Pied') of the Musselmans, and *Guay-lackrá* (or 'Dirt-eater') of the Hindoos. I have never heard it termed *Kalickia.*

The doubtfully cited *Corvus enca* (No. 38) is the *C. culminatus,* Sykes, the common Indian black crow, distinct from *C. macrorhynchus,* Vieillot: both of these occur at Malacca.

The supposed *Hirundo rustica* (No. 39) must have been *H. gutturalis,* Scopoli, v. *H. jewan,* Sykes, &c. The other swallow seen was probably *H. daurica.*

The native name for Woodpeckers in general is *Kát-tôkrá* (or literally, 'Woodpecker').

Bucco indicus, Lath., No. 44 (p. 397). Probably distinct from *B. philippensis* (verus). Its name is not "*Benebo,*" which is a way of spelling the native appellation of the oriole; but *Bussuntbooree* is the equivalent for Barbet, the present species bearing the prefix of *chota* (or 'small'), and *B. asiaticus* (Lath.), v. *cyanicollis,* Vieillot, that of *Burra* (or 'large'). Both, as M. Sundevall remarks, are exceedingly common, and they are exclusively frugivorous.

Cuculus varius, Vahl (No. 46), is termed *Chôk-gallo*; not *Sikkrea,* which means *Shikra* (or Hawk, *Chicquera,* auct.), for which a native will very commonly mistake a dead cuckoo, as I have observed repeatedly. And a living *Chôk-gallo* in a cage will generally, by a dealer, be called *Bo,oo-cotáko,* in the hope of passing it off for that more highly-prized species, the *C. micropterus,* Gould.

Eudynamys orientalis (L.), No. 47, does not construct a nest, but lays its egg in that of a crow; the 'Kokeel's' (or female 'Coël's') egg much resembling a crow's egg in its colouring, being however considerably smaller. The name *Bhát Sálik* refers to *Acridotheres tristis.*

Centropus philippensis, Cuv. (No. 48), is known as the 'Kooká.' It is identical with *C. bubutus,* Horsfield, but not with *Cuculus bubutus* of Raffles, which is *Cent. eurycercus,* A. Hay. The latter is not Indian; but both species occur at Malacca, together with a third which is common to India and the Malay countries, *C. Lathami* (Shaw), v. *lepidus,* Horsfield, and the adult of which was termed by me *C. dimidiatus,* and more recently *C. rectunguis* by

Mr. Strickland (p. 134 *ante*). The three seem to be equally common at Malacca.

Merops viridis, L. (p. 50). Termed *Bans-puttee* (or 'Bamboo-leaf') from the look of the bird as it sits with its wings closed. Very few remain in Lower Bengal after the hot season commences.

Halcyon gurial, Pearson, v. *brunniceps*, Jerdon (No. 51). This and *H. amauropterus*, Pearson, are alike called *Ghôrel*. *H. smyrnensis* is generally known as *Sádá-book Mátch-rángá* (*i. e.* 'White-breasted Kingfisher'). *Ceryle varia*, Strickland (No. 54) is the *Photká Mátch-rángá* (or 'Spotted Kingfisher'). I have seen this bird alight on the ground, but never *walk*; though it might creep a step or two. For some months past, I have had two individuals alive in a tolerably spacious aviary: they feed on shrimps and small fishes, and will at once descend to pick up a cockroach from the ground without alighting. In fact, I find that cockroaches, which are procurable here in profusion with the utmost facility, are favourite morsels with a great variety of birds, including especially all *Gallinaceæ* above the size of a quail. The Collared Pratincole runs up to receive one, and catches it in his mouth, sometimes springing up a few inches to do so; and even the *Porphyrio*, after disabling a cockroach with the beak, will take it up with his awkward-looking foot, and pick and eat it at his leisure. The Roller will live entirely upon them.

Palæornis torquatus (No. 55). 'Teah' is the Hindoo name, and 'Totah' the Musselman name. *P. cyanocephalus* (No. 56) is the 'Furreedee' of the Musselmans: and of *P. pondicerianus*, the red-billed male is called *Mudná*, and the black-billed female 'Kujlá.' The 'Heeráman' is *Eclectus polychloros*; and *E. grandis* is well known as the 'Lálman': both are common in the Calcutta bird shops; and they are grain-feeding birds, which have been improperly classed with the Lories. Several species of the latter are brought in some abundance, but nevertheless sell at a high price.

Falco tinnunculus (No. 58). The name *Shikra* is currently bestowed on any small hawk, but seems to belong properly to *Nisastur badius* (v. *F. Dussumieri*, Temm.); and larger hawks are generally styled *Báz*, which belongs properly to *Astur palumbarius*. Eagles with plumed tarsi are generally termed *Shah-báz*: and *Cheel* denotes 'Kite' (this name being evidently imitative of the *squeal* of the common *Milvus ater**), but it is also applied to other birds of smooth sailing flight, as the Harriers, and even the Gulls, which latter are called *Gáng Cheel* (i. e. *Gunga-* or

* Which, again, resembles that of the British Kite.

Ganges-Cheel). The *Haliastur pondicerianus* is commonly termed *Sankar-cheel*, and not unfrequently *Dhobeá-Cheel* (from its aquatic propensity, hovering over or sitting near a party of *Dhobees* or washermen.) The *Milvus ater* is distinctively termed *Pariah-Cheel*. No. 63 refers evidently to *Pontaëtus ichthyaëtus*, and this with other fishing eagles is called *Mátchál* or *Mátch-Kôrôl*.

M. Sundevall's doubtfully cited *Falco buteo* was, in all probability, *Buteo rufinus* (Ruppell), v. *B. canescens*, Hodgson: the next species noticed was probably *Blagrus dimidiatus* (Raffles): and the third was certainly not *Astur palumbarius*.—I have never heard *Leptoptilus argala* "called Eagle by the English," though it rarely is Pelican! Although the true Golden Eagle (*Aquila chrysaëtos*) inhabits the Himalaya, the so-called "Golden Eagle" of the residents at the hill stations refers always to the Lammergeyer (*Gypaëtos*).

Vultures are called *Shooknee* by the Hindoos, and *Gid* by the Musselmans. *Otogyps pondicerianus* is the *Lál Shooknee* of the former, and the *Môlnah Gid* of the latter. Neither of them distinguish the *Gyps indicus* (Scopoli and Latham, nec Temminck, which is the *G. tenuiceps* and *tenuirostris*, Hodgson and G. R. Gray), although this species is also common, keeping however more away from crowded towns.

Gallus ferrugineus (Gm.), No. 69, p. 87 *ante*. M. Sundevall is quite wrong in stating that any Hindoos ever breed fowls: the mere touch of one, or of an egg, is pollution even to the lowest caste of them. It should also be remarked, with reference to his note on the Indo-Portuguese population, that although, for the most part, much darker-skinned than the generality of Bengal Hindoos, excepting some of the lowest castes (in which the blood of the indigenes of the country greatly preponderates), these so-called Portuguese cannot justly be termed quite "as black as negroes;" and to me it appears obvious that they have derived their exceedingly dark complexion, not from the permanent influence of climate, but from intermixture and re-intermixture of blood with the lowest class of natives, till little indeed of the European stock remains in them. When I say *permanent* influence of climate, I mean that we must take into consideration that individual tanning produced by exposure, which does not become ingrained into the race, so as to be transmissible from parent to offspring. The prevalent belief here is, that the colour of the modern Indo-Portuguese illustrates the accumulative effect of an Indian climate during a long series of generations born in the country; but it is my thorough conviction that the foregoing explanation suffices. Indeed there is a current statement to the effect that no instance has been hitherto known of a continuous unmixed descent of any European race, born and brought up in this country, to the third generation; but I doubt altogether, whatever may be the probability one way or the other, of our having sufficient data for arriving at so conclusive an opinion. As Jacquemont and others have remarked, the natives of India draw a wide distinction between the *Sahib logue* or European gentry, and the *Goras* or plebeian Europeans (the term *Gora* merely signifying 'fair,' and being applied by them to people of fair complexion, whether native or European; but as applied to the latter, in general referring exclusively to the class of sailors and private soldiers, and by no means in a complimentary sense, any more than 'Feringhee' is*). The *Sahib logue* are much respected by them as a class; the *Gora logue* considerably the reverse. Now, the children of the former, born in India, are, with extremely few exceptions, sent home when very young to be educated, which of course invalidates their claim for consideration in this question; though even if it did not, the influx of new European blood into this country is so great, that upon their return to India by far the greater proportion of them become united in marriage to individuals born in Europe, whence it would certainly be no easy matter to find a series of three generations of unmixed Indian-born Europeans of the *Sahib* class. As for the lower class of Europeans, it would be equally difficult to find such a series unmingled with country blood, besides that the sad prevalence of intemperance interferes materially with any conclusions that might otherwise be deduced.

M. Sundevall might well have sought in vain for traces of the wild *Gallus Sonneratii* in the domestic poultry of India, inasmuch as,—though, curiously enough, I have found that species of South India far more easily domesticable than the Bengal Jungle-fowl,—the latter is, beyond all question, the exclusive aboriginal stock from which the whole of our domestic varieties of common poultry have descended. However different these may be, whether the silky fowl of China, the gigantic Chittagong race, or the feather-legged bantams of Burmah, &c., their *voice* at once and unmistakeably proclaims their origin, and is as different as can be, in every cry, from that of *G. Sonneratii*: besides that we continually meet with common domestic cocks which correspond, feather by feather, with the wild bird; the peculiar notched comb of which is again retained invariably, even when the comb is double or compound: this much premised, however, it is remarkable that the domestic poultry of India do not approximate the wild race in any respect more closely than the common fowls of Europe, and I have sought in vain for traces of intermixture of Jungle-fowl blood in districts where the species abounds in a state of nature.

* Thus, at least, in Calcutta and its vicinity.

It is a curious instance of how little is currently known of the zoology of India, that, to this day, authors who write on the history of the common fowl generally repeat the statement that "its original stock is very uncertain; but it is supposed to be descended from a wild species still met with in the island of Java!" The truth being, that the genuine wild common fowl is familiarly known to every sportsman in all Northern India, and is with justice highly prized as a game-bird: abounding in all suitable localities from the sub-Himalayan region on the north, to the Vindhyan range on the south, and spreading farther southward along the eastern coast of the peninsula to some distance beyond Vizagapatam (in the 'Northern Circars'); while to the eastward it likewise abounds in Assam, and all along the eastern side of the Bay of Bengal throughout the Burmese countries, the Malayan peninsula, Java and Sumatra*. *G. Sonneratii* begins to replace it on the Vindhyan range of hills, bordering the great table-land of the peninsula of India to the northward, and wholly replaces it in Southern India generally; while in Ceylon two other wild species occur, the hen of one of these being figured by the name of *G. Stanleyi* in Hardwicke's 'Illustrations' †.

The different species of Jungle-fowl have hitherto been caricatured in the figures that have been meant to represent them, the types of which are alone to be met with in the poultry-yard. The general figure is remarkably pheasant-like, and the tail commonly droops, and I have never seen it more elevated than that of a pheasant sometimes is (though it is more raised in *G. Sonneratii*). A very characteristic feature of the Bengal bird, and which I have seen in all Indian examples of the species, including some from Tipperah, did not occur in such as I have had alive from Assam and from Arracan, nor have I ever seen it well shown in a domestic fowl: this consists in the vivid whiteness of the large round lappet of naked skin below the ear-coverts, which thus forms a well-defined and very conspicuous auricle-like patch, contrasting strongly with the crimson of the comb and other naked parts, and with the deep red-orange of the adjoining feathers. This lappet is of a bright dead-white tinged with blue in the hen; and it certainly helps much to ornament those which possess it. The only other variation which I have observed in many dozens of skins, from the most various localities, is that Himalayan specimens, both cocks and hens, are slightly paler,

* In Irwin's memoir on Afghanistan, J. A. S. B. viii. p. 1007, it is stated that this bird is found in the wild state in the whole of Turkistan, especially Balkh. This is a considerable extension of its range, as generally understood.—E. B.

† One of the Ceylon species has been named *G. Lafayettii*, but I do not know by whom.

while those from Malacca and Java are in general deeper-coloured than the Jungle-fowl of Bengal. The latter are as true to their normal colouring as any other wild species; and it is strange that the peculiar minute mottling of the feathers of the wild hen can scarcely ever be matched in the plumage of the domestic hens, at least in this part of the country.

Capt. Hutton assures me that the Jungle-fowl is strictly monogamous; and I have been told the same by several Shikárees; though others maintain that it resembles domestic poultry in this particular. In the former case an analogy might be traced with the common duck (*Anas boschas*), which regularly pairs when wild, and is polygamous (or indiscriminate is perhaps a better word) in a state of domestication. The British pheasant on the contrary is undoubtedly polygamous in a wild state, being well known even to extend his attentions sometimes to the inmates of the poultry-yard. A Sonnerat's fowl in my possession, which is as tame as any barn-door cock, and breeds as freely with common hens, certainly paired with one for some time, and would take not the least notice of other hens; but to induce him to do so, I cooped up his partner for a few days, when he soon took to another, and upon my releasing the former he seemed to think it best to remain lord of both, and has continued so ever since, while he exhibits a considerable aversion to some Burmese bantam hens that are likewise kept with him*.

Although the range of the wild common fowl does not extend westward, that I am aware of, beyond the mountains that form the natural boundary of India in that direction, the domestic bird appears to have been common among the western nations from the remotest traceable antiquity; and this Indian bird is raised even in Iceland. Among the old Egyptian paintings, it is very remarkable that no representation of a fowl has yet been found; notwithstanding all that has come down to us of the wholesale system of egg-hatching practised to this day in Egypt; and al-

* I have already, from the middle of February to that of June, had upwards of seventy hybrid chickens *hatched* (besides failures) from this Sonnerat's fowl and his two hens; putting the eggs of course under other sitting hens: and if fewer eggs have been produced of late, it is because the hens (which were selected with much care, and are difficult to match) are now getting exhausted. The young hybrids are much more delicate than common poultry, and I have had the misfortune to lose nearly all of them by a malignant *variola*; though some are now nearly grown up, which are already showing symptoms of a disposition to breed; and hence I doubt not that I shall be able to ascertain from them whether species so nearly allied as are their parents might not produce a fertile race of hybrids, i. e. *per se et inter se*, or hybrid with hybrid. The *Pavo indicus* and *P. muticus* would also suit well for such an experiment: and I may remark, that I have now a female Axis Deer pregnant by a Hog Deer; and a pair of hybrids thus produced are likely to be again mutually prolific, if any would be so.

though so many other kinds of animals, both wild and tame (including flocks of domestic geese very commonly), are represented again and again. The camel forms another such exception. In the frescos of the Etruscan tombs the domestic fowl is often represented; and also the eating of eggs; while egg-shells, the remains of the funeral feast, are generally observed strewed about the floor upon opening a previously unviolated sepulchre. As in the case of the bull, cow, ox, calf, &c., so in that of the bird under consideration, there is no *exclusive* general name applicable to all individuals of the species, of whatever sex or age, in at least the generality of European languages. *Fowl* applies, of course, to any bird, as *cock* and *hen* apply to the sexes of other species; and this general absence of a vernacular specific appellation of itself indicates how familiar were our remote ancestors with an exotic species, which they must ultimately have derived or perhaps even brought with them from the far East. I must close however this long digression, but in the hope of having awakened some interest in a subject which assuredly is well worthy of further inquiry.

A word or two may be added on the Turkeys now raised in this country. They are called 'Pérú,' evidently from the common cry of a turkey; and are regarded as unclean by the Musselmans, though it is very clear that the indicter of the Koran could not have prohibited to his followers this American bird: the tuft of bristles upon its breast indicates, as they fancy, a certain affinity to the unclean beast; and perhaps the bald head and neck may suggest some sort of relationship to the Vultures (especially *Otogyps pondicerianus*), which would scarcely be recommendatory of this noble bird as an article of diet. Those brought to Calcutta are chiefly, if not wholly, raised in Chittagong, and most of them are bought up by people of French descent to be fattened at Chandernagore, when they are resold at considerable profit for the table. All are of a black colour, and very degenerate from the race of tame turkeys in England. They are small, with the naked wattles and long pendulous appendage over the beak enormously developed: poor helpless creatures, utterly incapable of rising upon the wing; and if suffered to drink their fill, they will greatly incommode themselves by filling out the immense craw. Nevertheless they fatten well and are excellent eating; and one at least is sacrificed for every dinner party.

M. Sundevall's Partridge (No. 70 of his list) is *Perdix pondiceriana*, Gm., a very abundant species. Wild peafowls inhabit all suitable localities, and where protected become extremely numerous and far from timid. They differ in no respect from the ordinarily coloured tame peafowl of Europe.

The *Pavo bicalcaratus*, L., apud Sundevall, is without doubt *Polyplectron bicalcaratum*, Temm., of Mr. G. R. Gray's list of the British Museum collection; but I suspect this is the true *Pavo tibetanus*, auct., which, though assuredly not a Tibetan species, is common in the hill regions of Assam, Sylhet, Arracan, and I believe the Tenasserim provinces: while its representative, equally abundant in the Malayan peninsula, I take to be *P. bicalcaratum* (L.), the *P. Hardwickii*, Gray, of Hardwicke's 'Illustrations' (his *P. lineatum* being the female of the preceding species). The former is occasionally brought alive to Calcutta; but I have never seen the Malayan species alive.

No. 75. That the 'Hargilah' (*Leptoptilos argala*) lives "chiefly" on human corpses, does not at all comport with my observation. Many frequent the provision-bazaars, and particularly a large abattoir in the vicinity of Calcutta; and they pick up quantities of refuse thrown into the streets: not but that they do attack human bodies of course; but this I have rarely happened to witness, and the latter constitute an article of food that certainly forms but an insignificant item of their weekly diet. A much greater number than M. Sundevall intimates may commonly be seen of an evening perched on the top of Government House, and upon other eminences which command an extensive view: they continue as tame in Fort William as he describes, but would certainly not make resistance if attacked unless wounded and unable to rise.

No. 78. I have seen no Indian specimen of a heron according with Dr. Horsfield's figure and description of his *Ardea speciosa*. The species meant is *Ardeola leucoptera* apud Gray, which in breeding dress is *A. Grayi*, Sykes, and in non-breeding dress *A. malaccensis*, auctorum.

No. 86. It is clear to me that M. Sundevall did not distinguish between *Gallinago media* and *G. stenura*. At the commencement and close of the cold season, the latter is the more abundant species; in the intermediate period the former. *G. major* does not occur, and the woodcock very rarely. *G. stenura* is the prevalent Malayan species, and extends to China and Australia.

Charadrius cirripedesmos, Wagler (No. 90). This common little Indian plover I take to be *Hiaticula Leschenaultii* (Lesson).

Larus ridibundus, var. (No. 91). This is *L. brunnicephalus*, Jerdon. The true *L. ridibundus* also occurs, but less numerously. I have never chanced to see either of them upon a dead body, and they certainly exhibit no peculiar predilection for the maggots there found; though, like other gulls, they would of course readily take to such food, especially when hungry. The general mode of life does not differ from that of *Larus ridibundus* in England. The large gull alluded to was probably *L. ichthyaëtus*, Pallas, which abounds at the mouth of the river, and has a jet-black hood in the breeding season.

The small cormorant (No. 92) is *Graculus pygmæus*, the only species of the genus I have met with in Lower Bengal.

No. 94 is *Casarca rutila* (Pallas); here commonly termed *Chuckwá-chuckwee*. *Ráj-háns* applies exclusively to the true Geese.

With M. Sundevall I consider the domestic geese of Bengal to be a hybrid race between *A. cygnoides* of China and the European tame goose, *A. cinereus*, which latter is here a regular cold-weather visitant. *Anas boschas* does not occur here wild; though it is found up the country.

No. 97 is *Dendrocygna awsuree* (Sykes), and I believe identical with *Anas arcuata*, Horsfield; more especially as this common Indian species is equally abundant at Malacca.

In the foregoing remarks upon M. Sundevall's paper, I have been particular to correct some of the native names assigned to various species, that they should not in future be quoted wrongly in systematic works. That gentleman undoubtedly made good use of the opportunities afforded by his brief sojourn in this vicinity.

June 24, 1847.

P.S. I avail myself of this occasion to remark on a few other oriental species of birds, descriptions of which have lately appeared in the 'Annals.'

Mr. Strickland's *Centropus rectunguis* (vol. xix. p. 134) I have already referred to *C. Lathami* (Shaw), v. *dimidiatus*, nobis.—His *Phyllornis moluccensis*, Gray (p. 130), is surely the *Turdus cochinchinensis*, Gm., founded on *le Verdin de la Cochinchine* of Buffon. Arracan specimens merely differ in having the crown yellower, while the breast, immediately below the black throat, is scarcely tinged with yellow as in the Malacca specimens; but the two cannot be separated, nor are probably these differences constant. *Ph. cæsmarynchus* of Tickell is my *Ph. Jerdoni*; the former name being evidently a misprint for *casmarhynchus* (vide Griffith's version of Cuvier's 'Animal Kingdom'), which again is a misprint for *gampsorhynchus* of Jardine and Selby.—*Turdus modestus*, Eyton, must be referred to *T. rufulus*, Drapiez, in the 'Dict. Class. d'Hist. Nat.'—P. 132. I recognise three well-marked species of Shrike in the synonyms which Mr. Strickland has brought together: viz. *L. phœnicurus*, Pallas, common to India and the Malay countries; *L. superciliosus*, Lath., which with the next is never found in India; and *L. tigrinus*, Drapiez, v. *mag-*

nirostris, Lesson, and *strigatus*, Eyton, the adults of which are very dissimilar from those of the two other species.

In the reprint from Capt. Begbie's work (xvii. 395), the *Buceros lugubris* of that gentleman is the only species which I shall here refer to, it being the adult male of *B. sumatranus*, Raffles. There are numerous errors of identification in that paper which I shall have another opportunity of correcting. The reduction of nearly all of Mr. Eyton's "apparently new species of birds from Malacca" (xvi. 227) has been effected partly by myself in the 'Journn. As. Soc. Bengal,' xv. 10 and 52, and the rest by Mr. Strickland, *vide* p. 129, &c. *ante*.

XL.—*Description of a new species of Hymenopterous Insect belonging to the family* Sphegidæ. By Frederick Smith.

[With a Plate.]

Section ACULEATA.

Family Sphegidæ.

Genus *Stethorectus*, Smith.

Head large, as wide as the thorax, subquadrate, attenuated posteriorly; eyes large, oval; the stemmata placed in a triangle at the vertex; the antennæ gradually attenuated, inserted near the base of the clypeus, which is quadridentate in front, the two exterior teeth largest. Mandibles large, stout, arcuate, smooth exteriorly; the maxillary palpi six-jointed, the terminal joint very minute; the labial palpi four-jointed, the terminal joints conical. Thorax elongate, the collar elongate, of a pyramidal form above; the superior wings with one marginal and three submarginal cells, the first as long as the two following, the second nearly quadrate, slightly narrowed towards the marginal, receiving the first and second recurrent nervures. The posterior legs elongate. Abdomen ovato-conical, abruptly petiolated.

Sp. *ingens*. Female (length 2 inches 2 lines). Black, very smooth and shining. Head slightly attenuated posteriorly, a little black pubescence on the face above the base of the antennæ, a smooth depression on each side of the posterior stemmata running a little way backwards, a thin pubescence on the cheeks. Thorax slightly pubescent at the sides, a strongly marked epaulet passing over each tegula and reaching as far as the scutellum, which is very smooth and shining; the wings dark metallic blue; the metathorax opake, having above a deep longitudinal channel, which is, as well as on each side of it, transversely wrinkled; the apex transversely sulcate; towards the apex, laterally, is a smooth space

Stethorectus ingens, Smith.

subtuberculate at its lateral margin. The legs long and stout, the tarsi strongly ciliated beneath. Abdomen highly polished and shining, the petiole slightly pubescent at the base.

Male (length 2 inches 4 lines). Black, the head quadrate above, slightly narrowed posteriorly; the mandibles have a stout tooth within, nearly in the middle; the clypeus porrect, emarginate in front; the thorax as in the female; the wings of a metallic brown; the posterior legs have the femora club-shaped, being greatly swollen at their apex above, and having a stout obtuse tooth or spine at the apex within; the tibia rugged beneath with deep indentations; all the tarsi ciliated beneath. Abdomen more rotundate than in the female; beneath, the third, fourth, fifth and sixth segments are of an opake black, except at their extreme lateral margins; the basal margins of the segments depressed, the apical somewhat swollen or rounded.

This fine insect, of which both sexes are in the cabinet of the British Museum, was captured at Pernambuco, Brazil, by T. P. George Smith, Esq. of Liverpool, a gentleman to whom naturalists are greatly indebted for his grand discoveries of new and beautiful species in all branches of natural history. The specimens figured are I believe the only ones yet captured; and are consequently unique in the national collection. The situation of this genus is I think next to *Podium*, some of the species of which genus it closely resembles in general aspect; the neuration of the wings is however different, the second submarginal cell receiving two recurrent nervures.

The habits of the insects of the family to which our new species belongs are highly interesting, the provision stored up for their young consisting in the majority of cases of spiders; and I have been informed that the large Brazilian species readily master spiders of the largest kind, such as *Mygale*, rendering them powerless by their formidable sting; the spiders thus attacked die a lingering death, in some cases surviving five or six days. An egg is deposited on the first insect stored up, so that the larva is hatched by the time the cells in some instances are provisioned; but I have observed in this country that our common sand-wasp, *Ammophila vulgaris*, deposits the food at intervals, so that it is fresh and suited to the young larva, which lives principally on the juices and softer parts, leaving the head, legs and wings untouched. Although *Arachnida* are the usual prey of the majority of these insects, still I have observed a species which at one time preys upon spiders, at another choosing caterpillars, and then again storing up grasshoppers when each kind of food was equally at its command. Endless indeed are the variations of habit in the Hymenoptera; the more they are investigated the greater will be our admiration of their wonderful instinct and tact in adapting their operations according to circumstances, and when unimpeded in them, of the beauty and fitness of their architectural elevations.

EXPLANATION OF PLATE XXIII.

Fig. 1. *Stethorectus ingens*, female, natural size.
Fig. 2. Ditto male ditto: *a*, wing, natural size. The following are magnified: *b*, labial palpi; *c*, maxillary palpi; *d*, mandible of the female; *e*, mandible of male; *f*, antennæ of the male.

XLI.—*Description of some Grasses and Sedges from the East Coast of Demerara, with Remarks on the Geographical Distribution of the Species.* By Sir Robert Schomburgk, Ph.D., Member of the Imperial Academy Nat. Curios. &c.

The grasses and sedges are to a flat alluvial soil what the forests are to a hill-side; their interlacing roots render the soil firm and prevent it from being carried away by the surface waters, which chiefly during freshets under the tropics commit such ravages upon low lands. The grassy sward protects besides the ground beneath from the direct rays of the sun, which possess such increased power in the equatorial regions. As great as the benefit derived from these circumstances may have proved to certain localities on our globe, if the use which the grasses afford to mankind rested only upon these circumstances, they would never have been considered of that vast importance which is attached to this natural family. If we set aside that their seeds afford nourishment to millions of human beings, their herbage serves as food to millions of cattle which in their turn contribute to the support of mankind. It is not my object to dwell here on these important points, but merely to give an enumeration of some grasses and a few of the sedges which occur in the intermediate neighbourhood of the sea-coast in Demerara, and the greater number of which are used as fodder. It must not be considered that this list contains all the Graminaceæ of that locality,—their number might be tripled; they were merely the result of short botanical excursions in the neighbourhood of Georgetown and to Mon Repos, a sugar-plantation on the east coast of Demerara; a few I received from Mr. Garnett at Cuming's Lodge, about six miles east from Georgetown. This small collection was submitted to the examination of Professor Nees von Esenbeck, the great illustrator of Graminaceæ and Cyperaceæ, who with his usual kindness has described those peculiarities in which the Demerara specimens deviate from former descriptions of species. It is worthy of observation that these deviations amounted in no instance to specific differences.

I have added the vernacular names under which the species and varieties are known among the labouring population. The grasses appear sometimes, where the soil differs in greater dryness or composition, under such different forms that the common people bestow various names upon the same species, and in no instance is this more the case than in *Leptochloa virgata,* of which I have given merely the most common vernacular names. This peculiar appearance repeats itself where the plant meets similar soil, dryness or humidity, which chiefly affect the seeds, and give it a white, red, or purplish colour.

The geographical distribution of grasses is a very remarkable point: some species seem to follow man; and scarcely has he cleared the ground from the virgin wood which he selected in the far west of the United States, in the tropical forests of Guiana and Brazil, in the plains of South Australia or other parts of the world, for his settlement, when certain species of grasses show themselves among his cultivation which he recognises as acquaintances from the country he left behind.

In the West Indies and South America, African species of grass are cultivated for the sake of fodder, while the indigenous species are entirely neglected. The planter follows the custom of his ancestor as a prescribed rule, and changes, even where they would prove for the better, are eschewed as a transgression upon the good old times. Hence I am not astonished that so fine a grass as the indigenous *Paspalus virgatus* is neglected, and the preference is given to the cultivation of the guinea-grass (*Panicum maximum*).

The collection of grasses from Demerara consisted of the following:—

Paspalus conjugatus, Flügge; Nees ab Esenbeck in Martius Flora Brasiliensis, ii. 44; Meyer, Prim. Flora Essequiboensis, p. 49; Flügge, Graminum Monographiæ, p. 102; Raddi, Agrostographia Brasiliensis, p. 23.

Paspalum conjugatum, Bergius in Nova Acta Helvetica, vii. 129; Swartz, Flora Indiæ Occidentalis, i. 133; Kunth, Enumerat. Plant. i. 51.

Sour-grass; Broad-leaved Savannah-grass.

It is one of the most abundant species of grasses in Mexico, on the banks of the Orinoco and Essequibo in Peru, New Granada and the West Indies. It grows in moist shady places, and often reaches a height of from two to three feet. In favourable situations it is in blossom almost throughout the year. As a fodder-grass it does not stand in high esteem; the cattle refuse it in its green state; it is however useful as hay. According to Browne, "the roots and leaves of this grass, pounded and applied externally, are observed to cure sores and ulcers of all sorts with more certainty than most other things used for that purpose." (History of Jamaica.) The following varieties occur on the sea-coast of Demerara:—

Paspalus conjugatus, var. *distachya minor*, N. ab E. in lit.

Paspalus conjugatus, var. *tristachyus*, N. ab E. in lit. From the sugar-plantation, Mon Repos, on the east coast of Demerara.

Paspalus conjugatus, var. *major, di-tristachyus*, N. ab E. in lit. Collected in the neighbourhood of Georgetown.

Paspalus vaginatus, Flügge in Pasp. p. 108; Raddi, *l. c.* p. 24; Nuttall, Gen. Americ. [The genera of North American Plants], i. 57.

Paspalum vaginatum, Swartz, *l. c.* i. 135; Humboldt et Kunth, Nov. Gen. et Spec. i. 91; Elliot, Sketch of the Botany of South Carolina and Georgia; Trinius, Species Gram. Icon. et Descr. v. t. 1 (from Martinique), t. 2 from the West Indies.

Water-grass; Crab-grass.

The geographical distribution of this grass is very extensive. Humboldt found it in New Granada, Siebers in Mauritius, Sellow in Monte Video, Rothery in Cayenne*. Robert Brown describes a variety from New Holland, Swartz from Jamaica, Nuttall from New Orleans; according to Elliot, Dr. Baldwin found it in humid soils near Savannah; in Trinius's herbarium is a specimen from North America, and two are pictured in his work, one from Martinique, and the second from some other island in the West Indies. Kunth gives Tranquebar and Equinoctial Africa as additional localities. I found it growing at the plantation Mon Repos on dams near trenches; likewise in Georgetown on Eve Leary Parade ground; and Mr. A. Garnett sent me some specimens from Cuming's Lodge which differ from the others and form a variety. It propagates most rapidly by sending roots into the ground from its numerous joints. It soon destroys cultivated plants by spreading its shoots with an almost inconceivable rapidity in every direction like a thickly-laced mat. It is an excellent fodder for sheep, and cattle are generally fond of it. Nuttall observes that it has been recommended to agriculturists in North America, and he thinks that in warm maritime situations it would continue growing and flowering and prove productive, but in Europe the early frosts would destroy it. Professor Nees von Esenbeck describes the two following varieties from Demerara as follows:—

Paspalus vaginatus, var. *α. spiculis glabris*, Flügge, Pasp. p. 108. From Mon Repos, Eve Leary, &c.

Paspalus vaginatus, var. in culmo valde repente firmo, ramis dense stipato. From Cuming's Lodge.

* Vidi in Mus. Brit.—R. H. S.

Paspalus pusillus, Flügge, *l. c.* p. 100 ; Presl in Reliquiæ Hænkeanæ, i. 210.
Paspalum pusillum, Venten.; Kunth, Gram. 2. t. 108; Enumerat. Plant. i. 51.
P. pusillus, var. foliis subtus plus minus pubescentibus, ad var. *β. serpens* (*P. serpens,* N. ab E. in Mart. Fl. Bras. ii. 50) *transiens,* N. ab E. in lit.

Kunth, in his Enumerat. Plant. i. 50, gives St. Thomas and Porto Rico in the West Indies, and Mexico as habitats. The above variety was gathered on the savannahs near Georgetown. It is a small elegant grass, and is esteemed by agriculturists as a good fodder-grass.

Paspalus virgatus, N. ab E. in *l. c.* ii. 73 ; Meyer in *l. c.* p. 49.
Paspalum virgatum, Linn.; Kunth, *l. c.* i. 61 ; Trinius, Ic. t. 131, 132 ; Jacquin, Icones Plantarum Rariorum, 2. t. 11 ; Sloane, History of Jamaica, p. 112. t. 69. f. 2.
P. virgatus, var. *β. Schreberianus,* spicis circiter triginta, rachi margine subpilosa glumis undique glabris, *Flügge, l. c.*

Lamaha-grass.

This excellent grass, which Mr. Garnett informs me is esteemed for fodder equal to guinea-grass, grows on the banks of rivulets, and reaches frequently a height of from three to four feet and sometimes even six feet, the culms having the thickness of a hen's quill. The distribution of the true species, although not so widely spread as *P. vaginatus,* is nevertheless very extensive. Linnæus gives its habitat as Jamaica, and Sloane pictures a tolerable representation from the same island ; Humboldt describes it from Virginia de la Popa.

The specimens from Demerara are Flügge's variety *β. Schreberianus,* which Ledru found in Porto Rico, Sellow in Monte Video and on the banks of the Rio Grande do Sul, and Von Martius on the banks of rivers in the neighbourhood of Villa Ricca and Tejuco in the province of Minaes Geraes. I collected it on the road which leads to the Grand Etang in the island of Grenada. Jacquin gives an excellent figure of the true species ; Trinius's representation (t. 131) resembles the Guiana variety.

Helopus punctatus, N. ab E. in *l. c.* ii. 16.
Paspalus punctatus, Flügge, Monogr. 127.
Eriochloa punctata, Kunth, *l. c.* i. 72 (excl. syn. *Helopus annulatus,* N. ab E.).
Milum punctatum, Linn.; Swartz, Observat. 37.

Black-seed grass ; Long-seed grass ; Coarse grass.

A perennial grass growing on dams and along trenches in

Demerara, and likewise in cultivated fields among the sugar-canes. Cattle are fond of it, and it is generally considered a good fodder-grass. Sellow found it in Brazil, and Kunth states that it occurs likewise in Mexico, New Holland and Senegal.

Panicum (*Digitaria*) *horizontale,* Meyer; N. ab E. in *l. c.* ii. 99; Meyer, *l. c.* 54; Jacquin, Observationes Botanicæ, iii. 18. t. 70.
Digitaria horizontalis, Willd. Enum. 92.

Fine White-seed grass.

This is a very slender and graceful annual grass which is to be met with in several of the West India islands as well as on the continent of South America. Von Martius found it in the provinces of Bahia and Parà, and Raddi in Rio Janeiro. If we except the latter locality, it does not appear to extend beyond tropical America. The jockeys in Demerara consider this the best fodder for race-horses.

Panicum (*Digitaria*) *fimbriatum,* Presl in Rel. Hænk. i. 298; Kunth, *l. c.* i. 81.
Digitaria fimbriata, Link.

Lony-grass.

A creeping annual grass which is considered good fodder in Demerara. It has been found in Brazil, Mexico and California. The Demerara species are from Mon Repos; it is not very abundant, and seldom to be found in extensive tufts.

Panicum affine, N. ab E. in *l. c.* ii. 113.
P. fluitans, Meyer, *l. c.* 51 (excl. syn., teste N. ab E.).
P. paspaloides, Kunth, *l. c.* i. 77; Lam. Ill. Gen. i. 176.

Pipe-grass; Vine-grass.

The culms of this grass are hollow and of the size of the tube of a clay tobacco-pipe, from which circumstance it has received its vernacular name of Pipe-grass. It is found growing in trenches where the culms are floating on the water, for which it is particularly qualified in consequence of its hollow culms. Small islands formed of this grass are sometimes seen to come floating down the Demerara river, and arriving at its mouth they are driven backwards and forwards by the tides, and collect sometimes during the rainy season in large numbers about the anchorage before Georgetown. It has frequently occurred that large snakes of the Boa kind, and even alligators, have come down the river upon these floating islands. I have observed whole patches of this grass along the banks of the rivers in the interior, the stems matted together and interlaced with *Ponthederia* and other water plants.

Panicum colonum, Linn.
Var. γ. *polysetum*, N. ab E. in Herb. Lindl. rhachibus basi et ad originem spicularum setosis: spicis 9—15 approximatis, mediis subinde geminatis.—Differt hæc forma a *P. frumentaceo*, Rottb., foliis angustioribus, spiculis minoribus, glumis flosculisque minus cuspidatis ejusdemque omnino structura ac in *P. colono*, N. ab E. in lit.

Rice-grass; Black-seed grass; Purple Panic-grass (in Barbados).

The Rice or Black-seed grass is considered the best for fodder, and grows most luxuriantly in new soils. The true *P. colonum* of Linnæus, or *Oplismenus colonus* of Humb. and Kunth, is more frequent in the West India islands than in the coast regions of Guiana. Von Martius found it in the Brazilian provinces of Bahia and Piauhy, Sellow in Monte Video, and Kunth observes that it likewise occurs in the East Indies, in the Marianas, Luçonia and Guaham. I have gathered it in Tortola (Sage Mountain), Porto Rico (Sierra de Luguillo), Barbados and Grenada; Sloane pictures it from Jamaica (Hist. Jam. i. t. 64. f. 3), and Jacquin in his Eclogæ Gram. in vol. iv. t. 32.

In consequence of its superiority as a fodder-grass, it ought to be cultivated for agricultural purposes like the guinea-grass, which no doubt would greatly improve its quality.

Panicum tenuiculmum, Meyer, *l. c.* 58; N. ab E. in *l. c.* ii. 186; Kunth, *l. c.* 95; Trin. Ic. 18. t. 215.
P. agrostidiforme, Raddi, *l. c.* 48.

A kind of White-seed grass.

An annual plant with creeping roots and slender upright culms. The specimens which I collected near Georgetown in Demerara are about twelve inches high; it differs however much in stature, according to the soil in which it grows, whether dry or humid. It is much esteemed as a fodder-grass.

Von Martius found it on the Rio Negro in Bahia, Nees von Esenbeck saw it in Willdenow's herbarium from Jamaica, and Meyer describes it among his Essequibo plants.

Panicum maximum, Jacq.; N. ab E. in *l. c.* ii. 166; Swartz, Fl. Occid. i. 70; Jacq. Ic. Rar. i. t. 13.
Panicum jumentorum, Pers. Syn. i. 83; Kunth, *l. c.* i. 101.
Panicum polygamum, Swartz, Prodr. Fl. Ind. Occid. p. 24.
Holcus assurgens, &c., Browne, Jam. p. 366. no. 2.

Guinea-grass.

This useful grass was introduced by accident into Jamaica from Africa. The Chief Justice of that island received about 1744 a present of some African birds and a parcel of seeds from their native place to feed them with. The birds died, and the remainder of the seeds were thrown within a fence where they grew, and the eagerness of the cattle to eat this grass suggested the idea of cultivating it.

It is now cultivated in the West India islands and South America generally. I collected in the neighbourhood of Georgetown a variety described as *P. maximum β. læve* by Nees von Esenbeck in Martius's Brazilian Plants (*l. c.* ii. 167).

Panicum (*Echinochloa*) *spectabile,* N. ab E. in *l. c.* ii. 262.
Oplismenus spectabilis, Kunth, *l. c.* i. 145.
Panicum majus, &c., Browne, Hist. Jam. p. 133. no. 2.

Scotch-grass ; Water-grass.

This species, which has been introduced from Angola, is most extensively cultivated in Brazil under the name of Capim de Angola. Browne, in his 'History of Jamaica,' observes, that it is cultivated near the towns in Jamaica with great care (and sold as green fodder), and found to be one of the most beneficial productions of the island. An acre of good land, well-stocked with this plant in a seasonable part near either Kingston or Spanish Town, is computed by him to bring in above a hundred and twenty pounds of their currency a year. It appears to have been formerly cultivated in Demerara; however, at present the guinea-grass is preferred as a green fodder. I collected near Georgetown a variety which Nees von Esenbeck has designated as *P. spectabile,* var. vaginis glabris rarissimisve setulis conspersis, N. ab E. in lit.

Hymenachne amplexicaulis, N. ab E. in *l. c.* ii. 276.
Panicum amplexicaule, Rudge, Plant. Guianæ rariorum icones et descr. i. 21. t. 27.
PanicumMyurus, Lam. Ill. i. t. 172; Kunth, *l. c.* i. 86 ; Meyer, *l. c.* 50.

Broad-leaf grass.

It grows in trenches and is used as fodder. My specimens were from Mon Repos; Meyer gives the small island Aruabisi in the mouth of the Essequibo as a locality, and Rudge possessed it among his Guiana plants ; but it does not appear to be very extensively distributed.

Cenchrus echinatus, Linn. Spec. 1488; Kunth, *l. c.* i. 166; Humb. et Kunth, Nov. Gen. i. 114; Meyer, *l. c.* 66.

Bur-grass.

The hardened and bristly involucrum of this plant, so common in the pastures, attaches itself very firmly to the clothes of persons walking through the grass. The horses appear to be fond of it, but it is considered injurious to their stomach. The West Indies in general, Mexico, Cumana, the coast of Guiana, Brazil, Arabia, the Philippines, Barbary, and the Southern States of

North America, have been named as localities where it has been found growing.

Cenchrus tribuloides, Linn. Spec. 1489; Michaux, Fl. Bor. Am. i. 61; Pursh, Fl. Am. Sept. i. 60.

This plant resembles the former in its general appearance; it is however more restricted to the sea-shore and sandy places, and extends to a more northern latitude than the former. I collected it in Demerara on the east coast, and more recently in Barbados. Sellow found it in Monte Video, and the American authorities above-cited prove its occurrence in the United States.

Andropogon (*Anatherum*) *bicornis*, Linn.; Meyer, *l. c.* 70; Swartz, Obs. 382.
Anatherum bicorne, N. ab E. in *l. c.* ii. 321; Browne, Jamaica, p. 365; Sloane, Jamaica, i. 42. t. 13; Pursh, Fl. Am. Sept. i. 75.

Fox-tail; Deer's-tail.

The culm of this grass, which grows on savannahs and at the sides of mountains, reaches a height of from four to five feet, and is of the thickness of a goose-quill. The tufts of hair upon the flowers are long, white, soft, and much finer than cotton; they are sometimes of a reddish or purplish colour. The blades are too coarse to serve as fodder, but the negroes used the halms formerly to thatch their houses with. Piso was informed by the Indians that an infusion of the root was an antidote against poison. It occurs in Brazil, Guiana, the Caribbee and Virgin Islands, Jamaica (where, according to Browne, it is called Mountain-grass), and Pursh enumerates it among his North American plants from Virginia.

Sporobolus virginicus, Kunth, *l. c.* i. 210.
Vilfa virginica, Pal. de Beauv. Agrost. 16.
Agrostis virginica, Torrey, Fl. Am. Conf. Bor. et Med. i. 89.
Agrostis pungens, Pursh, *l. c.* i. 64 (excl. syn. Schreb.).

Crab-grass of Browne.

This elegant little grass, which is very extensively distributed, resembles in its habit of creeping along the soil *Paspalus vaginatus*, from which circumstance Browne has named it Crab-grass in his 'History of Jamaica.' It is generally found on the skirts of brackish water, and those specimens which have come under my observation were scarcely above five or six inches in height. Some specimens which I collected near the steamboat wharf in Georgetown are designated by Nees von Esenbeck as *S. virginicus*, var. *minor, minus glaucus*. Humboldt found it near Callao, Truxillo and Gnamang, on the shores of the Southern Pacific, and near Punta Araya and Cumana, on the Atlantic Ocean; Kunth observes that it occurs in Martinique, the Sandwich Islands and the Cape of Good Hope; Labillardière found it in New Holland, and Browne gives Hunt's Bay in Jamaica as a locality. Von Martius found it in the province of Bahia on the sea-shore; Pursh describes it from Virginia.

Cynodon Dactylum, Pers. Syn. i. 85 ; Browne, Prodr. i. 187 ; Nees ab E. Gram. Afr. Austr. 241 ; Pursh, *l. c.* i. 70.
Agrostis linearis, Retz. ; Jones in Asiat. Res. iv. 248.
Panicum lineare, Burm. Ind. 25. t. 10. f. 2 ; Roxb. Fl. Ind. i. 294 (?).
Agrostis bermudiana, Tussac in Herb. Juss.
Durva, Dub or *Doob-grass* of the Hindoos, Lambert in Linn. Trans. vi.

Bahama or Yard-grass.

This is a very elegant grass in appearance, but one of the most injurious in cultivated grounds. It sends its roots deep into the soil and increases with great rapidity. If it make its appearance among the sugar-cane plants, it requires great care to have it exterminated*. This grass has been found in every part of the world: Knapp pictures it in his 'Gramina Britannica' (tab. 13) under the name of Creeping Dog's-tooth grass, and observes that it was discovered upon the sands of Marazion in Cornwall in the days of Ray, where it has been found since; Penzance is another locality mentioned in Hooker's 'Flora Britannica,' and it appears to be common in Southern Europe. It occurs likewise in the Caucasus, East Indies, North and South America, Southern Africa, Cape of Good Hope, Luçonia, Otaheite, New Holland, &c.

It is considered in Demerara a good fodder-grass, and grows generally on dams, and in the yards attached to the buildings on sugar-estates. Nuttall calls it a remarkable creeping-grass, growing very luxuriantly on the sands of the sea-coast as well as on the poorest loose soil, and were not its extirpation so difficult, it might be of importance in establishing pastures where scarcely any other vegetable would exist. It forms so thick a turf as to suffer few other plants near it, and the variety β. would look as pretty in lawns under the tropics as the *Festuca ovina* in our temperate climates.

I collected two varieties in Demerara; the first is from the neighbourhood of Georgetown, and the second from Mon Repos; Nees von Esenbeck designates them as follows:—

α. *C. Dactylum*, var. foliis angustioribus viridibus lævioribus, flosculi accessorii setiformis capitulo compresso truncatoque.
β. *C. Dactylum*, var. pumila, foliis angustioribus viridibus, capitulo setulæ accessoriæ truncato compresso.

* It is called Devil's-grass in Barbados, and is said to have received its name from the difficulty of eradicating it; according to others, it was introduced by a person of the name of De Durville, which the negroes corrupted into the one by which it is now known in that island.

Leptochloa virgata, Pal. de Beauv. Agrost. 71; Kunth, En. Pl. i. 269.
Cynosurus virgatus, Linn.
Eleusina virgata, Pers. Syn. i. 87.
Leptostachys virgata, Meyer, *l. c.* 74; Sloane, Hist. Jam. t. 70. f. 2; N. ab E. in *l. c.* ii. 432.
Var. *α*. Purple-head grass; Black-seed grass; Seed-grass.
Var. *β*. White-head; White-seed grass.

The numerous names under which this grass is known in Demerara point out how frequently it differs in its general appearance, which has led the common people to consider it a different plant and to give it a separate name. The caryopsis or seed is generally of a pale reddish colour, and in some instances, as in the variety called Purple-head, the glumes are of a darker colour. It is a perennial grass, and reaches in favourable soil to a height of from three to four feet. It blossoms after the vernal and autumnal rains, and its pretty fasciculated spikes are frequently from five to six inches in length. It is esteemed a very good fodder for all kinds of cattle, and if some attention were paid to its cultivation, it might offer great advantages as a stable fodder.

The Demerara varieties are described by Nees von Esenbeck as follows:—

Leptochloa virgata (Nees ab Esenbeck in Mart. Fl. Bras. ii. 432).
α. communis, spiculis 5–6 floris distichis. From the neighbourhood of Georgetown, Cuming's Lodge, &c.
β. spiculis 3–4 floris subhomomallis. From Mon Repos.

Eleusina indica, Gaertner; N. ab E. in *l. c.* ii. 439; Kunth, *l. c.* i. 272; Lam. Ill. Gen. t. 48. f. 3; Meyer, *l. c.* 75; Trin. Icon. 6. t. 71; Michaux, Fl. Bor. Am. i. 64; Elliot, Sketch of the Botany of South Carolina and Georgia, i. 175.
Eleusina domingensis, Sieber, Fl. Martin.
Cynosurus indicus, Linn.
Kanara Pullu, Rheede, Malab. xii. 131. t. 69.
Browne, Hist. Jam. 137. No. 4; Sloane, Hist. Jam. i. 111.

*Man-grass**.

Excepting Europe, we have in this species another instance of almost a universal distribution; it has been found growing at least over three-quarters of the globe. It is an annual, and grows in moist shady soils to a height of from two to three feet. Although it is none of the best fodder-grasses, cows eat it very readily, and it makes very good hay. For this purpose it is almost better calculated than any other tropical grass. Elliot calls it Crowfoot-grass, and observes that it is found in rich cultivated grounds very abundantly, and is considered in Carolina

* In Jamaica and Barbados it is called Dutch-grass.

one of the best grasses, growing more luxuriantly than the American crab-grass. Pursh is of a different opinion, and observing that it is known in Virginia under the name of Wire-grass, he considers it a weed noxious to cultivation. Dogs are frequently seen to eat it when sick*, from which circumstance it is sometimes called Dog's-grass. Humboldt found it in Cumana and in Quito; Raddi near Rio de Janeiro; in Sir George Staunton's herbarium are specimens from Maranham, Bahia, Para; Sellow collected it at Monte Video, and Kunth gives the following additional localities: East Indies, Japan, Egypt, Mauritius, Luçonia, Society Islands, Southern States of North America, West Indies, Guiana, &c.

Spartina fasciculata, Pal. de Beauv. Agrost. 25. t. 7. f. 6; Kunth, *l. c.* i. 279; Lam. Ill. Gen. i. 180; N. ab E. in Herb. Lindl.

I collected this plant near brackish water in the neighbourhood of Georgetown; my specimens are from two to two and a half feet in length. It is by no means abundant, and I am not aware whether in agricultural respect it is of any use in Guiana and the West Indies. Elliot observes (*l. c.* p. 94), that a species of *Spartina* is greedily eaten by horses and cattle, and that it is remarkable for a strong rancid and peculiar smell, affecting the breath, the milk and butter, and even the flesh of the cattle that feed upon it. It affords however good pasturage for out-door stock, and becomes valuable as manure. Kunth gives South America as locality.

Dactyloctenium mucronatum, Willd. En. i. No. 1029; N. ab E. *l. c.* ii. 436.

D. ægyptiacum, Humb. et Kunth, Nov. Gen. i. 170; Kunth, En. Pl. i. 261.

Eleusina cruciata, Lam. Ill. Gen. t. 48. f. 2.

Chloris mucronata, Mich. Fl. Bor. Am. i. 59; Pursh, *l. c.* i. 88.

Cynosurus ægyptiacus, Linn. Sp. Pl. 106.

Sloane, Catal. 33; Hist. Jam. i. 110.—Gramen dactylon americanum cruciatum Barbadensibus nostratibus "Dutch-grass" dictum, Pluck. Alm. 175. t. 189. f. 7.—Gramen cruciatum Zeylanicum humi repens, Burm. Thes. Zeyl. 106.—Goddam; Rumph. Amb. vi. 10. t. 4. f. 1. The short-shanked cruciated Grass, Browne, Hist. Jam.

The Cruciated grass.

The spikes of this pretty grass are fingered, from two to five in number, mucronate, and where there are four, cruciated, from which it has received its vernacular name. The leaves are ciliated, the stem ascending, and in my specimens from five to six inches

* *Poa ciliaris* (*Eragrostis ciliaris*, N. ab E.) is called Dog's-grass in Barbados, and the canine race seem to give the preference to this species where they have a choice.

high, and the spikelets, which are one-sided, about six-tenths of an inch in length. They are not entirely erect; although this is the case where there are merely two, and in the middle spikelet where there are three, the lateral ones are nearly horizontally disposed. It has spread over a great part of the habitable globe. Von Martius found it at Bahia, Pernambuco and Piauhy; Humboldt near Cumana and in Mexico, near the port of Acapulco, and at the lake of Cuizeo at a height of upwards of 5000 feet. It is described from almost all warm countries, as *e. g.* from Northern Africa, the East and West Indies, the Moluccas, and it has likewise been found in North America* and even in Sicily in Europe.

CYPERACEA. SEDGES.

Cyperus Luzulæ, N. ab E. in Mart. et Endl. Fl. Bras. Fasc. iii.—v. 20; Kunth, En. Pl. ii. 43; Meyer, *l. c.* 30 (var. *δ. glomeratus*); Humb. et Kunth, Nov. Gen. i. 209.

I collected this specimen in the neighbourhood of Georgetown, where it grows near trenches. It does not appear that its geographical distribution extends beyond the tropical regions of America; Humboldt collected it on the banks of the Cassiquiare.

Cyperus nemorosus, Meyer, *l. c.* 31; Kunth, *l. c.* 60.

This sedge, which stands intermediate between *C. rotundus* and *C. tenuiflorus*, is very common along the trenches and dams in Georgetown. Guiana appears to be the only locality where it has hitherto been found. Meyer describes it from Aruabisi (Tiger Island), a small island in the mouth of the Essequibo.

Cyperus ferax, Rich.; Kunth, En. Pl. ii. 89.
Cyperus distans, Meyer, nec Rottb.
Cyperus stellatus, Rudge, Guian. 17. t. 20.

Savannah or Razor-grass.

The edges of the leaves of this species are so sharp, that coming in contact with the hand or any other fleshy part of the body they inflict a wound as if by the edge of a knife, which has besides the disadvantage of healing with more difficulty than if caused by a sharp-edged instrument. Thevet, in his curious work, 'Les Singularités de la France Antarctique, Paris, 1558,' describes this sharp-edged sedge, and observes that the Indian females use it to shave off the hair on the eye-brows of their husbands, and that the blades are as sharp as a razor. It grows generally on savannahs, from which and the sharpness of its edges it has received the vernacular names. Pöppig collected it at Peru: New Granada and Montserrat are given as other lo-

* Trinius figures a species from North America in the first vol. of his 'Spec. Gramin. Icon. et Descr.'

calities. It grows in Demerara on savannahs near trenches, and is considered a great nuisance upon the pasturage.

Cyperus rotundus, Linn.; Kunth, *l. c.* ii. 58.
C. Hydra, Meyer, *l. c.* 31.
C. hexastachyus, Rottb. var. umbella laxa, radiis longis tri–tetrastachyis.

Nut-grass.

This is of all Cyperaceous plants the most universally distributed, and the one which is most injurious to cultivation. It requires unwearied care to eradicate it where it has once shown itself. The round tubercles of its roots increase rapidly in number, each of which forms hereafter an individual plant if left in the ground. Numerous fibres shoot from the base of the stem, which descend where it finds a fertile soil from ten to twelve inches into the ground, almost every one of which produces a small tuber, from which spring horizontal fibres in every direction, forming additional tubers at a distance of six to ten inches asunder. From each of the tubers rises a stem upwards which becomes ultimately an individual plant, and which in its turn throws out lateral fibres like the parent plant. In that manner a single plant soon increases and spreads over the ground in a short time. If a spot of a couple of square feet is dug up where the nut-grass has been propagated, the interlacing of the roots affords a most remarkable appearance, and the great number of fibres resemble an elaborated network. The only means of eradicating it with success where it has spread over cultivated ground, is to dig up the soil repeatedly and to destroy the tubers by burning them. Those which remain in the ground no doubt will sprout, but by being exposed to the light the young shoots bleach and perish, and the power of the tubers to reproduce new shoots becomes ultimately exhausted. Almost every colony has its own account how this great scourge to cultivation was introduced. It is related in Barbados that the nut-grass was first brought there in a pot of flowers sent to a Mr. Lillington in St. Thomas's parish, and the earth being turned out of it the tuber took root, and spreading over the adjacent fields it ultimately propagated over the whole island. Such cases explain the otherwise almost incredible distribution of a single species over the whole habitable world. As localities where the nut-grass has been found growing, I will name England, France, Italy, Virginia, Carolina, the West Indies, Mexico and South America, Ceylon, Bourbon, Mauritius, East Indies, the Philippine Islands, the Marianas, New Holland, China, Java, Guinea, Teneriffe, Egypt, Algiers, Arabia, Caucasus; indeed this list proves satisfactorily that it has spread over the whole world; but it deserves particularly to be mentioned, that it follows in tropical and warm regions the cultivation of the sugar-cane closely. The cattle eat it only when young. General Hardwicke, as mentioned by Lindley in his 'Vegetable Kingdom,' reports that the tubers of this sedge are administered successfully in cases of cholera by Hindoo practitioners, who call the plant Mootha. It is a very pretty sedge, and would form a nice appearance on lawns did it not spread so rapidly and prove so injurious to the soil, which it exhausts in a very short time.

Hypoporum nutans, β. hirsutum, N. ab E. in Mart. et Endl. Fl. Bras. Fasc. iv. v. p. 170.

The roots of nearly all the sedges possess more or less tonic and aromatic principles, but none more than the above species, in which that property is not alone restricted to the roots, but is likewise possessed by the stems and leaves. The Macusi Indians call it Cumi or Wanarappa, and it is used in child-bed, likewise for pains in the stomach, in fevers, and in aromatic baths by the Indians. I have collected it on the savannahs near the Tapocoma lake in the regions of the sea-coast, and observed it abundantly on the great savannahs of the rivers Rupununi and Branco.

XLII.—*Note on* Petasida ephippigera, *a Grasshopper found in the interior of the Northern part of Australia by* Mr. Dring *and* Dr. Leichhardt. By Adam White, F.L.S., Assist. Zool. Dep. British Museum.

The amount of nondescript subjects in the animal kingdom, noted in recently published books of travel and voyage in this country, is very considerable; and if we include the animals figured and described in the zoological works, the result of the voyages of H.M.SS. Beagle, Sulphur, the Erebus and Terror, and Samarang, the number would be very great. A systematic list of these accessions, carefully drawn up and digested, would form a most important addition to zoological bibliography, and would be hailed by naturalists abroad and at home as a most timely and useful assistant. Were foreign naturalists to do the same with the voyages and travels which appear in their respective countries great service would be rendered; for notwithstanding the able reviews of Müller, Erichson, Lovèn, Schaum, and M. Guerin-Méneville, such lists systematically arranged would prove singularly useful, and would often prevent collision and a worse than useless synonymia, many of these books not being obtained by these reviewers. Out of five books on Australia published by Mr. Boone, and one on New Zealand by Mr. Murray, the descriptions of new species and genera are numerous, and *must be* referred to by the zoologist; besides, in many cases there are very accurate figures. In the lately published Narrative of Dr. Leichhardt's Journey,—so interesting in a geographical point of view, as to have earned for its enterprising author the medals of the Geographical Societies of London and Paris,—there are various curious natural-history notices; amongst these we may mention the occurrence of "a Grasshopper" found by Dr. Leichhardt and his party on the 17th November near the South Alligator: he says, "Whilst on this expedition we observed a great number of grasshoppers, of a bright brick colour dotted with blue: the posterior part of the corselet and the wings were blue; it was two inches long, and its antennæ three-quarters of an inch." (P. 481 of a Journal of an Overland Expedition from Moreton Bay to Port Essington, a distance of upwards of 3000 miles: 1844–45: by Dr. Ludwig Leichhardt.)

By the great kindness of Mr. Boone of Bond Street, I am enabled to add a wood engraving of this interesting grasshopper, that gentleman having given me the loan of the wood block which accompanies Dr. Leichhardt's notice.

The grasshopper was described in 1845 in Eyre's 'Journals of Expeditions of Discovery into Central Australia,' and a very excellent lithographic figure by Mr. William Wing accompanied it. I subjoin the description:—

PETASIDA, White, *l. c.* i. 432.

Petasida ephippigera, White, *l. c.* t. 4. f. 1.

"Grasshopper," Leichhardt's Narrative, p. 481: with woodcut.

Petasida ephippigera.

Thorax much dilated behind, depressed and rounded at the end; the side deeply sinuated behind; head pointed; antennæ long, of a yellowish orange colour with a few greenish rings; cheek below the eye with a greenish line; head above with a longitudinal greenish line. Thorax with a slight keel down the middle, wrinkled behind, of a dusky bluish green, a large patch of an orange colour on each side in front, and a small spot of the same colour on each edge of the produced part at the base. Elytra orange with numerous black spots, and black at the tip; lower wings pale orange at the base, clouded with black at the tip; abdomen orange, slightly ringed with green; legs orange, with three greenish spots on the outside of the femora of the hind legs. Length 1 inch 9 lines.

A specimen found by Dr. Leichhardt was presented to the British Museum by Sir Charles Lemon, Bart.; the other was found on the expedition of the Beagle, and is also in the British Museum.

XLIII.—*On the Indian Archipelago.**

The first and most general consideration, in a physical review of the Archipelago, is its relation to the continent of Asia. In the platform, on which the largest and most important lands are distributed, we see a great root which the stupendous mass of Asia has sent forth from its south-eastern side, and which, spreading far to the south beneath the waters of the Indian and Pacific Oceans, and there expanding and shooting up by its plutonic and volcanic energy, has covered them, and marked its tract with innumerable islands. That there is a real and not merely a fanciful connexion between the Archipelago and Asia is demonstrable, although, when we endeavour to trace its history, we are soon lost in the region of speculation. So obvious is this connexion that it has been a constant source of excitement to the imagination, which, in the traditions of the natives and in the hypotheses of Europeans, has sought its origin in an earlier geographical unity. Certainly, if, in the progress of the elevatory and depressing movements which the region is probably undergoing even now, the land were raised but a little, we should see shallow seas dried up, the mountain ranges of Sumatra, Borneo, and Java become continental like those of the Peninsula, and great rivers flowing not only in the Straits of Malacca, whose current early navigators mistook for that of an inland stream, but through the wide valley of the China Sea, and by the deep and narrow Strait of Sunda into the Indian Ocean. Thus the unity would become geographical, which is now only geological. That the great platform from which only mountains and hills rose above the sea level, till the materials drawn from them by the rains were rolled out into the present alluvial plains, is really an extension of the Asiatic mass, appears evident from the facts, amongst many others which require a separate geological paper for their discussion, and would be less readily appreciated by the general reader,—that its direction, as a whole, is that which a continuation of south-eastern Asia, under the same plutonic action which produced it, would possess;—the mountain ranges which form the latter sink into it irregularly in the lines of their longitudinal axes;—in one zone, that of the Peninsula, the connexion is an actual geographical one;—the Peninsula is obviously continued in the dense clusters of islands and rocks, stretching on the

* From the Journal of the Indian Archipelago and Eastern Asia, for July 1847.

parallel of its elevation and of the strike of its sedimentary rocks, from Singapore to Banka, and almost touches Sumatra, the mountain ranges of which are, notwithstanding, parallel to it;—Borneo and Celebes appear to represent the broader or eastern branch of the Indo-Chinese Peninsula, from which they are separated by the area of the China Sea, supposed to be sinking;—and, finally, nearly the whole Archipelago is surrounded by a great volcanic curve rooted in Asia itself, and the continuity of which demonstrates that the platform and the continental projection with which it is geographically connected are really united, at this day, into one geological region by a still vigorous power of plutonic expansiveness, no longer, to appearance, forming hypogene elevations, but expending itself chiefly in the numerous volcanic vents along the borders where it sinks into the depths of the ocean.

Whether the present platform ever rose above the level of the sea and surrounded the now insular eminences with vast undulating plains of vegetation, instead of a level expanse of water, we shall not here seek to decide, although we think that Raffles and others who have followed in his steps too hastily connected the supposed subsidence with the existing geological configuration of the region, and neglected the all-important evidence of the comparative distribution of the living flora and fauna, which seems to prove that the ancient southern continent, if such there was, had subsided before they came into existence. No conclusive reasons have yet been adduced why we should consider the islands of the Archipelago as the summits of a partially submerged, instead of a partially emerged, continent. But whether it was the sinking of the continent that deluged all the southern lowlands of Asia, leaving only the mountain summits visible, or its elevation that was arrested by the exhaustion of the plutonic energy, or the conversion of its upheaving into an ejecting action, on the opening of fractures along the outskirts of the region, before the feebler action there had brought the sea bed into contact with the atmosphere, the result has been to form an expanse of shallow seas and islands elsewhere unequalled in the world, but perhaps not greater in proportion to the wide continental shores, and the vast bulk of dry land in front of which it is spread out, than other archipelagos are to the particular countries, or continental sections, with which they are connected.

The forms and positions of these islands bear an older date than that of any limited subsidence or elevation of the region after its formation. They were determined by the same forces which originally caused the platform itself to swell up above the deep floor of the southern ocean: and it was one prolonged act of the subterranean power to raise the Himalayas into the aërial level of perpetual snow, to spread out the submarine bed on which the rivers were afterwards to pile the hot plains of Bengal, and to mould the surface of the southern region, so that when it rose above, or sunk into the sea to certain levels, the mutual influences of air and sea and land should be so balanced, that while the last drew from the first a perennial ripeness and beauty of summer, it owed to the second a perennial freshness and fecundity of spring. Hence it is, that in the Archipelago, while the bank of black mud daily overflowed by the tides is hidden beneath a dense forest, and the polypifer has scarcely reared its tower to the sea's surface before it is converted into a green islet, the granitic rocks of the highest plutonic summits, and the smoke of the volcanic peaks, rise from amidst equally luxuriant, and more varied, vegetation. Certainly, the most powerfully impressive of all the characteristics of the Archipelago is its botanical exuberance, which has exercised the greatest influence on the history and habits of its human inhabitants, and which, as the most obvious, first excites the admiration of the voyager, and from its never growing stale, because ever renewing itself in fresh and changeful beauty, retains its hold upon our feelings to the last.

When we enter the seas of the Archipelago we are in a new world. Land and ocean are strangely intermingled. Great islands are disjoined by narrow straits, which, in the case of those of Sunda, lead at once into the smooth waters and green level shores of the interior from the rugged and turbulent outer coast, which would otherwise have opposed to us an unbroken wall more than two thousand miles in length. We pass from one mediterranean sea to another, now through groups of islets so small that we encounter many in an hour, and presently along the coasts of those so large that we might be months in circumnavigating them. Even in crossing the widest of the Eastern seas, when the last green speck has sunk beneath the horizon, the mariner knows that a circle drawn with a radius of two days' sail would touch more land than water, and even that, if the eye were raised to a sufficient height, while the islands he had left would reappear on the one side, new shores would be seen on almost every other. But it is the wonderful freshness and greenness in which, go where he will, each new island is enveloped, that impresses itself on his senses as the great distinctive character of the region. The equinoctial warmth of the air, tempered and moistened by a constant evaporation, and purified by periodical winds, seems to be imbued with penetrating life-giving virtue, under the influence of which even the most barren rock becomes fertile. Hence those groups of small islands which sometimes environ the larger ones like clusters of satellites, or mark where their ranges pursue their course beneath the sea, often appear, in particular states of the atmosphere, when a zone of white quivering light surrounds them and obliterates their coasts, to be dark umbrageous gardens floating on a wide lake, whose gleaming surface would be too dazzling were it not traversed by the shadows of the clouds, and covered by the breeze with an incessant play of light and shade. Far different from the placid beauty of such scenes is the effect of the mountain domes and peaks which elsewhere rise against the sky. In these the voyager sees the grandeur of European mountains repeated, but with all that is austere or savage transformed into softness and beauty. The snow and glaciers are replaced by a mighty forest, which fills every ravine with dark shade, and arrays every peak and ridge in glancing light. Even the peculiar beauties which the summits of the Alps borrow from the atmosphere are sometimes displayed. The Swiss, gazing on the lofty and majestic form of a volcanic mountain, is astonished to behold, at the rising of the sun, the peaks inflamed with the same rose-red glow which the snowy summits of Mont Rosa and Mont Blanc reflect at its setting, and the smoke wreaths, as they ascend from the crater into mid-air, shining in golden hues like the clouds of heaven*.

But serene in their beauty and magnificence as these mountains generally appear, they hide in their bosoms elements of the highest terrestrial sublimity and awe, compared with whose appalling energy, not only the bursten lakes and the rushing avalanches of the Alps, but the most devastating explosions of Vesuvius or Etna, cease to terrify the imagination. When we look upon the ordinary aspects of these mountains, it is almost impossible to believe the geological story of their origin, and if our senses yield to science, they tacitly revenge themselves by placing in the remotest past the æra of such convulsions as it relates. But the nether powers though imprisoned are not subdued. The same telluric energy which piled the mountain from the ocean to the clouds, even while we gaze in silent worship on its glorious form, is silently gathering in its dark womb, and time speeds on to the day, whose coming science can neither foretell nor prevent, when the mountain is rent; the solid foundations of the whole region are shaken; the earth is opened to vomit forth destroying fires upon the living beings who dwell upon its surface, or closed to engulf them; the forests are deluged by lava, or withered by sulphureous vapours; the sun sets at noonday behind the black smoke which thickens over the sky, and spreads far and wide, raining ashes throughout a circuit hundreds of miles in diameter; till it seems to the superstitious native that the fiery abodes of the volcanic dewas are disemboweling themselves, possessing the earth, and blotting out the heavens. The living remnants of the generation whose doom it was to inhabit Sumbawa in 1815 could tell us that this picture is but a faint transcript of the reality, and that our imagination can never conceive the dreadful spectacle which still appals their memories. Fortunately these awful explosions of the earth, which to man convert nature into the supernatural, occur at rare intervals; and though scarcely a year elapse without some volcano bursting into action, the greater portion of the Archipelago being more than once shaken, and even the ancient granitic floor of the Peninsula trembling beneath us, this terrestrial instability has ordinarily no worse effect than to dispel the illusion that we tread upon a solid globe, to convert the physical romance of geological history into the familiar associations of our own lives, and to unite the events of the passing hour with those which first fitted the world for the habitation of man.

We have spoken of the impression which the exterior beauty of the Archipelago makes upon the voyager, and the fearful change which sometimes comes over it, when the sea around him is hidden

* M. Zollinger in describing Mount Semírú in Java notices this singular resemblance to the mountains of his native country.

beneath floating ashes mingled with the charred wrecks of the noble forests which had clothed the mountain sides; but, hurried though we are from one part of our slight sketch to another, we cannot leave the vegetation of this great region without looking upon it more closely. To recall the full charms, however, of the forests of the Archipelago,—which is to speak of the Archipelago itself, for the greater portion of it is at this moment, as the whole of it once was, clothed to the water's edge with trees,—we must animate their solitudes with the tribes which dwell there in freedom, ranging through their boundless shade as unconscious of the presence of man, and as unwitting of his dominion, as they were thousands of years ago, when he did not dream that the world held such lands and such creatures.

When we pass from the open sea of the Archipelago into the deep shade of its mountain forests, we have realized all that, in Europe, our fancies ever pictured of the wildness and beauty of primæval nature. Trees of gigantic forms and exuberant foliage rise on every side; each species shooting up its trunk to its utmost measure of development, and striving, as it seems, to escape from the dense crowd. Others, as if no room were left for them to grow in the ordinary way, emulate the shapes and motions of serpents, enwrap their less pliant neighbours in their folds, twine their branches into one connected canopy, or hang down, here loose and swaying in the air, or in festoons from tree to tree, and there stiff and rooted like the yards which support the mast of a ship. No sooner has decay diminished the green array of a branch, than its place is supplied by epiphytes, chiefly fragrant Orchidaceæ, of singular and beautiful forms. While the eye in vain seeks to familiarize itself with the exuberance and diversity of the forest vegetation, the ear drinks in the sounds of life which break the silence and deepen the solitude. Of these, while the interrupted notes of birds, loud or low, rapid or long-drawn, cheerful or plaintive, and ranging over a greater or less musical compass, are the most pleasing, the most constant are those of insects, which sometimes rise into a shrill and deafening clangor; and the most impressive, and those which bring out all the wildness and loneliness of the scene, are the prolonged complaining cries of the únkas, which rise, loud and more loud, till the twilight air is filled with the clear, powerful and melancholy sounds. As we penetrate deeper into the forest, its animals, few at any one place, are soon seen to be, in reality, numerous and varied. Green and harmless snakes hang like tender branches. Others of deeper and mingled colours, but less innocuous, lie coiled up, or, disturbed by the human intruder, assume an angry and dangerous look, but glide out of sight. Insects in their shapes and hues imitate leaves, twigs and flowers. Monkeys, of all sizes and colours, spring from branch to branch, or, in long trains, rapidly steal up the trunks. Deer, and amongst them the graceful palandoh, no bigger than a hare and celebrated in Malayan poetry, on our approach fly startled from the pools which they and the wild hog most frequent. Lively squirrels, of different species, are everywhere met with. Amongst a great variety of other remarkable animals which range the forest, we may, according to our locality, encounter herds of elephants, the rhinoceros, tigers of several sorts, the tapir, the bábírúsa, the orang-útan, the sloth; and, of the winged tribes, the gorgeously beautiful birds of paradise, the loris, the peacock, and the argus pheasant. The mangrove rivers and creeks are haunted by huge alligators. An endless variety of fragile and richly coloured shells not only lie empty on the sandy beaches, but are tenanted by pagurian crabs, which, in clusters, batten on every morsel of fat seaweed that has been left by the retiring waves. The coasts are fringed with living rocks of beautiful colours, and shaped like stars, flowers, bushes and other symmetrical forms. Of multitudes of peculiar fishes which inhabit the seas, the dugong, or Malayan mermaid, most attracts our wonder.

Before we leave this part of our subject, we would assure any European reader who may suspect that we have in aught written too warmly of the physical beauty of the Archipelago, that the same Nature which, in the West, only reveals her highest and most prodigal terrestrial beauty to the imagination of the poet, has here ungirdled herself, and given her wild and glowing charms, in all their fullness, to the eye of day. The ideal has here passed into the real. The few botanists who have visited this region declare, that from the multitude of its noble trees, odorous and beautiful flowers, and wonderful vegetable forms of all sorts, it is inconceivable in its magnificence, luxuriance and variety. The zoologists, in their turn, bear testimony to the rare, curious, varied and important animals which inhabit it, and the number and character of those already known is such as to justify one of the most distinguished of the day in expressing his belief, that "no region on the face of the earth would furnish more novel, splendid, or extraordinary forms than the unexplored islands in the eastern range of the Indian Archipelago."

Hitherto we have faintly traced the permanent influence of the physical configuration of the Archipelago in tempering the intertropical heat, regulating the monsoons, determining the distribution of plants and animals, and giving to the whole region its peculiar character of softness and exuberant beauty. But when its rock foundations were laid, the shadow of its future human, as well as natural, history spread over them. Its primal physical architecture, in diminishing the extent of dry land, has increased the variety in the races who inhabit it; while the mineralogical constitution of the insulated elevations, the manner in which they are dispersed throughout its seas, and all the meteoric and botanical consequences, have affected them in innumerable modes. Again, as we saw that the platform of the Archipelago is but an extension of the great central mass of Asia, and that the direction of the subterranean forces had determined the ranges of the land, so we find that its population is but an extension of the Asiatic families, and that the direction of migration was marked out by the same forces. But, separated by the sea from the great plains and valleys of the continent, having the grand routes of communication covered by mountains and dense and difficultly penetrable forests, the Archipelago could not be peopled by hordes, but must have owed its aborigines to the occasional wandering of small parties or single families. The migrations from one island to another were probably equally limited and accidental; and the small and scattered communities in such as were inhabited, must for a long period have remained secluded from all others, save when a repetition of similar accidents added a few more units to the human denizens of the forests.

We cannot here attempt to retrace in the most concise manner the deeply interesting history of the tribes of the Archipelago, so exciting from the variety of its elements, and its frequent, though not impenetrable, mystery. We can but distinguish the two great æras into which it divides itself:—that, at the commencement of which some of the inhabitants of the table-land of Asia, having slowly traversed the south-eastern valleys and ranges, a work perhaps of centuries, appear on the confines of the Archipelago, no longer nomades of the plains but of the jungles, with all the changes in ideas, habits and language which such transformation implies, and prepared by their habits to give rise, under the influences of their new position, to the nomades of the sea;—and the second æra, that, at the commencement of which the forest and pelagic nomades, scattered over the interior and along the shores of the islands of the Archipelago, in numerous petty tribes, each with some peculiarities in its habits and language, but all bearing a family resemblance, were discovered in their solitudes by the earliest navigators from the civilized nations of the continent.

The ensuing, or what, although extending over a period of about two thousand years, we may term the modern history of the Archipelago, first exhibits the Klings from southern India,—who were a civilized maritime people probably three thousand years ago,—frequenting the islands for their peculiar productions, awakening a taste for their manufactures in the inhabitants, settling amongst them, introducing their arts and religion, partially communicating these and a little of their manners and habits to their disciples, but neither by much intermarriage altering their general physical character, nor by moral influence obliterating their ancient superstitions, their comparative simplicity and robustness of character, and their freedom from the effeminate vanity which probably then, as in later times, distinguished their teachers. At a comparatively recent period, Islamism supplanted Hinduism in most of the communities which had grown up under the influence of the latter, but it had still less modifying operation; and amongst the great bulk of the people, the conversion from a semi-Hindu condition to that of Mahomedanism was merely formal. Their intellects, essentially simple and impatient of discipline and abstract contemplation, could as little appreciate the scholastic refinements of the one religion, as the complex and elaborate mythological machinery and psychological subtleties of the other. While the Malay of the nineteenth century exhibits in his manner, and in many of his formal usages and habits, the influence which Indians and Arabs have exerted on his race, he remains, physically and morally, in all the broader and deeper traits of nature, what he was when he first entered the Archipelago; and even on his manners, usages and habits, influenced as they have been, his distinctive original character is still very obviously impressed.

We cannot do more than allude to the growth of population and civilization in those localities which, from their extent of fertile soil or favourable commercial position, rose into eminence, and became the seats of powerful nations. But it must be borne in mind, that, although these localities were varied and wide-spread, they occupied but a small portion of the entire surface of the Archipelago, and that the remainder continued to be thinly inhabited by uncivilized tribes, communities, or wandering families.

Prevented, until a very recent date, by stubborn prejudices and an overweening sense of superiority from understanding and influencing the people of the Archipelago, the European dominations have not directly affected them at all; and the indirect operation of the new power, and mercantile and political policies which they introduced, has been productive of much evil and very little good. While, on the one hand, the native industry and trade have been stimulated by increased demand and by the freedom enjoyed in the English ports, they have, on the other hand, been subjected by the Portuguese, English and Dutch to a series of despotic restraints, extending over a period of three hundred years; and, within the range of the last nation's influence, continued, however modified, to this hour: which far more than counterbalance all the advantages that can be placed in the opposite scale.

The effect of the successive immigrations, revolutions and admixtures which we have indicated or alluded to, has been, that there are now in the Archipelago an extraordinary number of races, differing in colour, habits, civilization and language, and living under forms of government and laws, or customs, exhibiting the greatest variety. The same cause which isolated the aborigines into numerous distinct tribes and kept them separate,—the exuberant vegetation of the islands,—has resisted the influence, so far as it was originally amalgamating, of every successive foreign civilization that has dominated; and the aboriginal nomades of the jungle and the sea, in their unchanged habits and mode of life, reveal to their European contemporary the condition of their race at a time when his own forefathers were as rude and far more savage. The more civilized races, after attaining a certain measure of advancement, have been separated by their acquired habits from the unaltered races, and have too often turned their superiority into the means of oppressing, and thereby more completely imprisoning in the barbarism of the jungles, such of them as lived in their proximity. So great is the diversity of tribes, that if a dry catalogue of names suited the purpose of this sketch, we could not afford space to enumerate them. But, viewing human life in the Archipelago as a general contemplation, we may recall a few of the broader peculiarities which would be most likely to dwell on the memory after leaving the region.

In the hearts of the forests we meet man scantily covered with the bark of a tree, and living on wild fruits, which he seeks with the agility of the monkey, and wild animals, which he tracks with the keen eye and scent of a beast of prey, and slays with a poisoned arrow projected from a hollow bambú by his breath. In lonely creeks and straits we see him in a small boat, which is his cradle, his house, and his bed of death; which gives him all the shelter he ever needs, and enables him to seize the food which always surrounds him. On plains, and on the banks of rivers, we see the civilized planter converting the moist flats into rice-fields, overshadowing his neat cottage of bambú, níbong and palm leaves with the graceful and bounteous cocoa-nut, and surrounding it with fruits, the variety and flavour of which European luxury might envy, and often with fragrant flowering trees and shrubs which the greenhouses of the West do not possess. Where the land is not adapted for wet rice, he pursues a system of husbandry which the farmer of Europe would view with astonishment. Too indolent to collect fertilizing appliances, and well-aware that the soil will not yield two successive crops of rice, he takes but *one*, after having felled and burnt the forest; and he then leaves nature, during a ten years' fallow, to accumulate manure for his second crop in the vegetable matter elaborated by the new forest that springs up. Relieved from the care of his crop, he searches the forests for ratans, canes, timber, fragrant woods, oils, wax, gums, caoutchouc, gutta-percha, dyes, camphor, wild nutmegs, the tusks of the elephant, the horn and hide of the rhinoceros, the skin of the tiger, parrots, birds of paradise, argus pheasants, and materials for mats, roofs, baskets and receptacles of various kinds. If he lives near the coast, he collects fish, fish maws, fish roes, slugs (trepang), seaweed (agaragar), tortoiseshell, rare corals and mother-of-pearl. To the eastward, great fishing voyages are annually made to the shores of Australia for trepang. In many parts, pepper, coffee, or betel-nut, to a large, and tobacco, ginger, and other articles, to a considerable extent, are cultivated. Where the *Hirundo esculenta* is found, the rocks are climbed and the caves explored for its costly edible nest. In different parts of the Archipelago the soil is dug for tin, antimony, iron, gold, or diamonds. The more civilized nations make cloths and weapons, not only for their own use but for exportation. The traders, including the Rajahs, purchase the commodities which we have mentioned, dispose of them to the European, Chinese, Arab, or Kling navigator who visits their shores, or send them in their own vessels to the markets of Singapore, Batavia, Samarang, Manilla, and Macassar. In these are gathered all the products of the Archipelago, whether such as the native inhabitants procure by their unassisted industry, or such as demand the skill and capital of the European or Chinese for their cultivation or manufacture; and amongst the latter, nutmegs, cloves, sugar, indigo, sago, gambier, tea, and the partially cultivated cinnamon and cotton. To these busy marts, the vessels of the first maritime people of the Archipelago, the Bugis, and those of many Malayan communities, bring the produce of their own countries, and that which they have collected from neighbouring lands, or from the wild tribes, to furnish cargoes for the ships of Europe, America, Arabia, India, Siam, China, and Australia. To the bazaar of the Eastern Seas, commerce brings representatives of every industrious nation of the Archipelago, and of every maritime people in the civilized world.

Although, therefore, cultivation has made comparatively little impression on the vast natural vegetation, and the inhabitants are devoid of that unremitting laboriousness which distinguishes the Chinese and European, the Archipelago, in its industrial aspect, presents an animated and varied scene. The industry of man, when civilization or over-population has not destroyed the natural balance of life, must ever be the complement of the bounty of nature. The inhabitant of the Archipelago is as energetic and laborious as nature requires him to be; and he does not convert the world into a workshop, as the Chinese, and the Kling immigrants do, because his world is not, like theirs, darkened with the pressure of crowded population and over-competition, nor is his desire to accumulate wealth excited and goaded by the contrast of splendour and luxury on the one hand and penury on the other, by the pride and assumptions of wealth and station, and the humiliations of poverty and dependence.

While in the volcanic soils of Java, Menangkabaú and Celebes, and many other parts of the Archipelago, population has increased, an industry suited to the locality and habits of each people prevails, and distinct civilizations, on the peculiar features of which we cannot touch, have been nurtured and developed; other islands, less favoured by nature, or under the influence of particular historical circumstances, have become the seats of great piratical communities, which periodically send forth large fleets to sweep the seas, and lurk along the shores of the Archipelago, despoiling the seafaring trader of the fruits of his industry and his personal liberty, and carrying off, from their very homes, the wives and children of the villagers. From the creeks and rivers of Borneo and Johore, from the numerous islands between Singapore and Banka, and from other parts of the Archipelago, piratical expeditions, less formidable than those of the Lanuns of Sulu, are year after year fitted out. No coast is so thickly peopled, and no harbour so well protected, as to be secure from all molestation, for where open force would be useless, recourse is had to stealth and stratagem. Men have been kidnapped in broad day in the harbours of Pinang and Singapore. Several inhabitants of Province Wellesley, who had been carried away from their houses through the harbour of Pinang and down the Straits of Malacca to the southward, were recently discovered by the Dutch authorities living in a state of slavery, and restored to their homes. But the ordinary abodes of the pirates themselves are not always at a distance from the European settlements. As the thug of Bengal is only known in his own village as a peaceful peasant, so the pirate, when not absent on an expedition, appears in the river, and along the shores and islands of Singapore, as an honest boatman or fisherman.

When we turn from this brief review of the industry of the Archipelago, and its great internal enemy, to the personal and social condition of the inhabitants, we are struck by the mixture of simplicity and art, of rudeness and refinement, which characterises all the principal nations. No European has ever entered into free and kindly intercourse with them, without being much more impressed by their virtues than their faults. They contrast most favourably with the Chinese and the Klings in their moral characters; and although they do not, like those pliant races, readily adapt themselves to the requirements of foreigners, in their proper sphere they are intelligent, shrewd, active, and, when need is, laborious. Comparing them even with the general condition of many civilized nations of far higher pretensions, our estimate must be favourable. Their manners are distinguished by a mixture of courtesy and freedom which is very attractive. Even the poorest while frank are well-bred, and, excluding the communities that are corrupted by piracy or a mixture with European seamen and low Chinese and Klings, we never see an impudent air, an insolent look, or any exhibition of immodesty, or hear coarse, abusive or indecent language. In their mutual intercourse they are respectful, and while good-humoured and open, habitually reflective and considerate. They are much given to amusements of various kinds, fond of music, poetry and romances, and in their common conversation addicted to sententious remarks, proverbs, and metrical sentiments or allusions. To the first impression of the European, the inhabitants, like the vegetation and animals of the Archipelago, are altogether strange, because the characteristics in which they differ from those to which we are habituated, affect the senses more vividly than those in which they agree. For a time the colour, features, dress, manners and habits which we see and the languages which we hear are those of a new world. But with the fresh charms, the exaggerated impressions also of novelty wear away; and then, retracing our steps, we wonder that people so widely separated from the nations of the West, both geographically and historically, and really differing so much in their outward aspect, should, in their more latent traits, so much resemble them. The nearer we come to the inner spirit of humanity, the more points of agreement appear, and this not merely in the possession of the universal attributes of human nature, but in specific habits, usages, and superstitions.

What at first seems stranger still is, that when we seek the native of the Archipelago in the mountains of the interior, where he has lived for probably more than two thousand years secluded from all foreign influence, and where we expect to find all the differences at their maximum, we are sometimes astonished to find him approximating most closely of all to the European. In the Jakún, for instance, girded though his loins are with *terap* bark, and armed as he is with his sumpitan and poisoned arrows, we recognise the plain and clownish manners and simple ideas of the uneducated peasant in the more secluded parts of European countries; and when he describes how, at his merry-makings, his neighbours assemble, the arrack tampúi flows around, and the dance, in which both sexes mingle, is prolonged, till each seats himself on the ground with his partner on his knee and his bambú of arrack by his side, when the dance gives place to song, we are forcibly reminded of the free and jovial, if rude, manners of the lower rural classes of the West. Freed from the repellant prejudices and artificial trappings of Hindu and Mahomedan civilization, we see in the man of the Archipelago more that is akin than the reverse to the unpolished man of Europe.

When we turn to the present political condition of the Archipelago, we are struck by the contrast which it presents to that which characterized it three or four centuries ago. The mass of the people, it is true, in all their private relations, remain in nearly the same state in which they were found by the earliest European voyagers, and in which they had existed for many centuries previously. But, as nations, they have withered in the presence of the uncongenial, greedy and relentless spirit of European policy. They have been subdued by the hard and determined will of Europeans, who in general have pursued the purposes for which they have come into the Archipelago without giving any sympathy to the inhabitants. The nomadic spirit, never extinguished during all the changes which they underwent, had made them adventurous and warlike when they rose into nations. But now, long overawed and restrained by the power of Europeans, the national habits of action have, in most parts of the Archipelago, been lost, or are only faintly maintained in the piratical expeditions of some. Their pride has fallen. Their living literature is gone, with the power, the wars, and the glory which inspired it. The day has departed when Singapore could be invaded by Javanese,—when Johore could extend its dominion to Borneo on the one side and Sumatra on the other,—when the fleets of Acheen and Malacca could encounter each other in the Straits to dispute the dominion of the Eastern Seas,—when the warrants of the Sultan of Menangkabaú were as potent over the Malayan nations as the bulls of Rome ever were over those of Christendom,—when a champion of Malacca could make his name be known all over the Archipelago,—and when the kings of the Peninsula sent their sons, escorted by celebrated warriors, to demand the daughters of the emperors of Majapahit in marriage. The Malayan princes of the present day, retaining all the feudal attachment and homage of their subjects, and finding no more honourable vent for the assertion of their freedom from restraint and the gratification of their self-will, have almost everywhere sunk into indolent debauchees and greedy monopolists, and, incited by their own rapacity and that of the courtiers who surround them, drain and paralyse the industry of their people.

BIBLIOGRAPHICAL NOTICES.

The Journal of the Indian Archipelago and Eastern Asia.—Singapore.

We have received from the Editor with much satisfaction the first and second numbers of a publication which promises to be of great interest and value, "the Journal of the Indian Archipelago and Eastern Asia." The contents of these numbers, and the design of the publication, are such as to excite our cordial wishes for its success, in which we doubt not our readers will fully participate. We have transferred to our own pages a considerable portion of an interesting article from the first number; and we subjoin some extracts from the Prospectus, with a view to give a general idea of the objects to which the Journal will be devoted. The interest of the work will be much increased by the manner in which the attention of the public has been drawn to the achievements of Mr. Commissioner Brooke, Rajah of Sarāwak, as these are of no less importance in their scientific than in their commercial and philanthropic relations.

"*Plan of the Journal.*

"The bulk of the Journal will consist of articles, chiefly translated from the Dutch and Spanish, relating to Sumatra, Java, Borneo, Celebes, the Philippines and the Moluccas, Bali and other islands of the Archipelago. These will be very varied in their nature, embracing as they will, the history, language, literature, and ethnography of the various races who inhabit this great region, and contributions to almost every department of natural history and physical science, as well as topographical, agricultural, œconomical and miscellaneous subjects. Original papers of a similar nature, but more limited range, will from time to time be given on the countries of the Malay Peninsula, Siam, Borneo, and occasionally we hope on Cochin China, &c. In particular, papers on the physical geography and geology of the Peninsula and the adjacent islands, on the history, language, literature, manners and customs of the Malays, and on the aboriginal mountain races, will be frequently, although not regularly given. The best Malayan prose and poetical works will be printed, accompanied by translations and explanatory and critical notes. We are prepared to commence a series of these works and translations in the first number of the Journal, and to continue it uninterruptedly till we have published all the productions of Malayan writers that deserve to be preserved. The British Settlements, with their motley population, and great diversity of ethnographical riches, will furnish abundant interesting matter. We do not venture to promise that China, Australia and the farther East will regularly contribute to our stores, but the centrical position of Singapore, relatively to intercourse by steam with Europe, leads us to entertain a strong hope that we shall not want original communications from these countries when the objects of the Journal become known to our countrymen and other foreigners resident there.

"The extension of the commerce and influence of the British and Dutch in the Archipelago, the character and tendency of their respective policies, the condition of the British Settlements, their influence on the Asiatics around us, and the prospects and progress of education and Christianity in these regions, will from time to time be reviewed, but, we think we may give assurance, in a spirit free from national or sectarian bias, and regarding only the advancement of the Archipelago."

In the Press.

The History of Barbados; comprising a geographical and statistical description of the island; a sketch of the historical events since the settlement; and an account of its geology and natural productions. By Sir Robert H. Schomburgk, Ph.D., &c.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

June 22, 1847.—Harpur Gamble, Esq., M.D., in the Chair.

Note on the Spermatozoa of the Indian Elephant. By George Gulliver, F.R.S.

In the testicle of the elephant that died on the 7th of this month in the menagerie of the Society, there was scarcely any semen. The seminal tubes measured from the $\frac{1}{109}$th to the $\frac{1}{85}$th of an English inch in diameter; they contained a brownish pulpy matter, which, under the microscope, appeared to be composed of a liquid loaded with a multitude of minute, shining, oil-like molecules, either free or aggregated into roundish and shapeless corpuscles. There were also a few objects like altered epithelial corpuscles; but not a single spermatozoon, either free or in a cell, could be discovered.

Within the tube of the epididymis, however, a few distinct spermatozoa were found; and the drawing of them now shown is on a scale of $\frac{1}{4000}$th of an inch, the objects being magnified between 700 and 800 times, linear admeasurement.

It will be seen that there is nothing peculiar either in the form or size of these spermatozoa of the elephant. They resemble generally those of numerous other mammalia. For the sake of comparison I exhibit drawings, made on the same scale, of spermatozoa from the *Cervidæ, Camelidæ, Ursidæ, Mustelidæ, Soricidæ* and *Sciuridæ*, all of which are noticed more or less in my papers in the Proceedings of the Society, July 26, 1842, April 11, 1843, and February 24, 1846.

The elephant was supposed to be about forty years old.

I may mention, that while engaged in looking for the testicles of the elephant, we exposed two large muscles arising from the pubes, and inserted into the dorsum of the corpora cavernosa penis. Each of these muscles was quite as large as the biceps muscle of the human arm.

The use of these muscles in the elephant, to elevate, retract and suspend his immense penis, is indicated by their attachments. Under the microscope the fibre of these muscles of the penis was found to possess all the characters of common voluntary muscle.

Brief notes on the habits of Noctilio mastivus. By P. H. Gosse, Esq.

The following notes are extracted from a journal kept in Jamaica during a residence there in the years 1845 and 1846:—

"Being out on a shooting excursion on the 18th of October, 1845, round Crabpond Point, on the southern coast, about the middle of the day I looked about for a seat on which to rest while I ate some refreshment. A gigantic cotton-tree (*Eriodendron anfractuosum*) in the grass-piece of Mount Edgecumbe seemed to promise in its long root-spurs the seat I was seeking. On arriving at it I found the tree was hollow, the trunk forming a wide chimney of unknown height, as being closed at the top, the darkness prevented my seeing more than a few yards up. I remarked to my servant that it was a likely locality for bats; but the appearance of a large Gecko drew off my attention, and I attempted to capture it. The reptile darted however within the cavity, and I then noticed that beneath the hollow was piled a heap, several feet in diameter, and at least a foot in height, of a soft granular substance, which on examination I found to be the dung of some insectivorous animals, with a very rank peculiar odour. I had now no doubt of the tree being the abode of bats, but had little expectation of being able to ascertain the fact. While peering carefully up, however, I distinctly heard the flapping of wings and some shrill squeakings, and this determined me to fire my fowling-piece at random up the cavity. This I did twice, and though I brought down nothing but a little rotten wood, yet presently, when the smoke had a little subsided, on looking up again I discerned amidst the darkness one or two heads, which seemed those of rats, and immediately another just above them, evidently crawling downwards. I pointed them out to my negro lad, who saw two or three more, and presently, as it became more clear of smoke, the whole sides of the cavity appeared full of curious round faces. I now fired, no longer at random, and had the pleasure of bringing down this beautiful bat, which fell dead. The smoke of this discharge made the others more anxious to come down to the fresh air, and we could see them descending fast, head downwards. As the shot lacerated the membranes considerably, I bethought myself of another plan: cutting a long switch with a few twigs at its extremity, I stood at the bottom and *whipped* one down; he came sprawling with expanded wings on the ground, apparently with but little notion of flight, although unwounded. On being taken up by the wings he displayed uncommon fierceness, biting savagely and powerfully anything within his reach. Three or four more I obtained in the same manner and brought home.

"When thrown up into the air in a room, they would not fly, but merely opened the volar membranes to break their fall, as with a parachute. Two, which I kept alive, hung themselves up by the hind-feet from the side of a cage into which I put them, and would not move, except to shift an inch or two; nor did the approach and arrival of night excite them to activity. One, however, which had contrived to secrete himself in the room, when, having taken both out of the cage, I turned my back for a moment, and which I had vainly searched for, I found at night, by going into the room with a candle: hearing a scrambling, I looked up to the top of the wall, where was my lost bat, endeavouring to suspend himself. On being touched he flew off, but immediately alighted, and so repeatedly; sometimes, when he failed of taking a hold of the wall, he came to the floor, whence he readily rose, though very obliquely. I was struck with his expanse of wing when performing his noiseless flight around the room, and with his resemblance to a bird, aided by the enormous interfemoral membrane, which being expanded by the hind-legs and *depressed*, looked like the broad tail of a flying bird, and appeared to guide the motion in like manner.

"While taking some drawings of one, as it hung from the immense hind-feet, I was amused to see how it would thrust its nose into every part of the volar membranes, apparently searching for parasites (of which several were briskly crawling among the hair); and now and then it brought down one hind-foot, and scratched itself with exactly the motion of a monkey; and once I observed, after scratching its breast, it delivered something into its mouth. The flexibility of the ankle-joint was extreme, so that the foot could reach with ease any part of the body.

"I presented to one a large cockroach, which he seized greedily and munched up, moving the jaws only vertically. The eating was attended with a loud and very harsh *cranching* of the teeth—not produced by crushing the horny parts of the insect, for it was equally perceptible when munching a bit of soft flesh. The jaws moved rapidly, but yet the mastication was a long operation, *for it appeared to me to be performed almost wholly by the canines.* As the insect was progressively masticated, portions were allowed to fall into the cheek-pouches (the one being pretty well filled before the other was used), which when full hung down on each side of the lower jaw, to the depth of three or four lines, like distended bags, displaying a warted surface. When the whole of one cockroach had been masticated, and deposited in the pouches, it would take another, which was gradually disposed of in the same receptacles; then, after a few moments' intermission, by a contortion of the jaw, aided by the motion of the muscles of the pouch, a portion was returned to the mouth, and again masticated. This was repeated till all was swallowed, and the pouches appeared empty and contracted up out of sight. The whole process was much like rumination. Small portions of the muscle of a bird, which were presented to one, he chewed up and deposited in the pouches; but after being regurgitated, and a second time masticated, they were expelled instead of being swallowed. The process of eating seemed an awkward one; it was a rapid succession of choppings with the long canines, through which the tongue was thrust about so nimbly that it appeared a wonder it was not impaled perpetually.

"In order to rest, like other bats they crawled upwards and backwards by means of the hind-feet, seeking the greatest elevation they could attain which afforded a hold for the claws. They were social, though both were males; usually hanging side by side, or sometimes with the leg of one crossing the leg of the other, or even one upon the other. Sometimes they brought their faces together, and licked each other's open mouths in a singular manner; and this appeared grateful to them. I did not hear either of them click or squeak.

"Pressed by numerous engagements, I was prevented from again visiting the tree until about ten days after. I then went thither in the afternoon, wishing to see the bats emerge for the night; but though I waited till after sunset, not one appeared. The next morning I smoked the cavity again, using the fumes of burning nitre and sulphur, but entirely without success. I hence inferred that they had deserted the tree as a dwelling on the first molestation. After some months, however, I again found it tenanted by the same species, if not the same individuals, and succeeded in obtaining another specimen, whose manners in captivity were identical with those recorded above.

"I have never seen the species abroad (so as to identify it), but my intelligent negro lad, Sam, observed two about noon on the 16th of April, the sun shining vertically. It was at a provision-ground at Belmont, where they were clinging to the limb of a young Avoçada Pear (*Persea*). A Banana-bird (*Icterus leucopteryx*) was flying towards them, apparently with the intention of pecking them, on whose approach they flew away in different directions. The lad did not perceive them until the very moment of separation and flight, but he noticed that they were in actual contact, though he could not tell their position. No hole or hollow tree was near. Could they have been *in copulâ*?"

I conjecture that it is the present species to which reference is made in the following paragraph, which appeared in the Salisbury Journal of February 6th, 1847:—'Mr. Thomas Dickon, an eminent farmer in Lincolnshire, had been induced to go to Jamaica, as manager of some extensive estates there, with the intention of introducing the best systems of farming where they had been hitherto unknown. Accounts have been received, that there is already every probability of a considerable increase of sugar being produced by applying a new guano as tillage. It is the dung of large bats. The bats are said to amount to myriads; and Mr. D. having observed many of these singular animals entering the crevices of one of the numerous rocks, caused an opening to be made and the place explored. The cave was found to be 250 feet long, 20 feet broad, and from 20 to 30 feet high. The interior contained thousands of these animals, and appeared to have been their dwelling for ages. At the bottom of the cave, bats' dung, at least four feet in thickness, and amounting to about 600 tons in weight, was discovered, and found to be equal to the best Ichaboe guano.'

I sent a copy of the above notice to my esteemed friend Richard Hill, Esq., of Spanish Town, who thus replied: 'I know Mr. Dickon, to whom your newspaper paragraph relates. He details his experience in the parish of Westmoreland [the same part of Jamaica as that in which my own observations were made.—P.H.G.]; I will however endeavour to ascertain the precise locality in which he had discovered his extraordinary colony of bats. The Council of the Royal Agricultural Society of Jamaica, of which I am a member, had had its attention called to the manure to be obtained from fæcal deposits in caves frequented by bats, and they had analysed the material, but found it so largely charged with the comminuted wing-cases of insects, and so little acted upon by decomposition, that the azotized ingredients combined but slowly as a fertilizer. Several similar accounts were given to us of cave-deposits, to that furnished by Mr. Dickon. His discovery however being made in an unopened cavern, into which the bats had penetrated through crevices in the rock, has special recommendations to notice.

'My attention was some time ago drawn to a similar harbouring-place of our *Cheiroptera*. One evening, as I was crossing the marshes between Spanish Town and Kingston, by the high-road, I was surprised at sundown at the sudden rushing out of a stream of bats from the face of a cliffy hill that rises precipitously from the swamp. They continued pouring out for some quarter of an hour or twenty minutes; they stretched like a string for some hundred yards, in consequence of the one-by-one file in which they came forth from the crevice, and then dispersed themselves up and down and all about, covering the whole expanse of the contiguous marsh. The long highway perspective across the swamp; the level bed of rushes bending in wavelets to the evening wind; the distant mountains with beetling summits and broken declivities, lighted in angular patches by the setting sun, exhibited a wide, dilated and diversified scene, in which no object rose to interrupt the line made by the flitting swarms as they streamed out from the face of the cliff, and spread their myriad numbers over the plain. I have myself noticed the great depth of the rejectamenta of bats in these caverned recesses, but a great deal of it consisted of *undecayed down*, as well as fæcal mutings, and undevoured fragments of insects.'

In a subsequent communication my friend favoured me with a sample of the excremental deposits from a bat-cavern on Swansea estate in the Vale of Luidas; and I forward it, with this paper, to the Zoological Society.

I close this article with a few particulars of description, some of which are better observed on the living animal than on specimens dried or in spirit. A male measured as follows:—" Muzzle to insertion of tail, $4\frac{1}{10}$ inches; expanse of volar membranes, $24\frac{3}{4}$; ear, from posterior base of tragus to tip, $1\frac{3}{20}$; ditto, from anterior base to tip, 1; tragus, longest side, $\frac{3}{10}$; shortest, $\frac{3}{20}$; nose to front angle of eye, $\frac{5}{10}$; nose to front of tragus, $\frac{19}{20}$. Colour varying; upper parts yellow-brown, more or less bright; a well-defined narrow line of pale fulvous runs medially down the back from the head to the tail; under parts pale fawn, bright fulvous or orange; face purplish; the muzzle and chin are much corrugated; face warty; the ears fall into elegant curves. The volar membranes are delicately thin, transparent and glossy; studded with minute, white, papillary glands, which for the most part follow the course of the blood-vessels, but are largest and most numerous in the vicinity of the trunk. The membranes being attached along each side of the spine, with an interval in the middle of the back of but $\frac{7}{10}$ths of an inch, the body is, to a great extent, free. The wing, when at rest, has but a single fold, the ultimate joint of the second and third fingers being brought back upon the penultimate. The reproductive organs are large and prominent. At the base of the penis are two follicles, secreting a dark brown substance, dry and lumpy, but friable between the fingers, most insufferably musky, the odour from which is strongly diffused by the animal during life."

From the width of the gape, the length of the teeth, and the power of the jaws in this species, together with the ferocious eagerness with which my captive specimens snatched at large cockroaches, I conjecture that its insect-prey is large; probably nocturnal beetles and the larger moths and sphinges.

July 13.—William Yarrell, Esq., Vice-President, in the Chair.

The following papers were read:—

Observations on the distinction between the Cervical and Dorsal Vertebræ in the Class Mammalia. By H. N. Turner, Jun.

Doubtless it will be remembered that in many Mammalia the last cervical vertebra has a transverse process of simple form, wanting the perforation for the passage of the vertebral artery, so characteristic of the remaining vertebræ in this region of the spine, and which, together with the absence of articulated ribs, has been considered as the definite character by which such a vertebra may be distinguished. However, it is now well known that the existence of this foramen in the transverse process of the seventh cervical vertebra is rather the exception than the rule among the mammalian class, since it is wanting in most of the lower Quadrumana, as the Cebi and Lemurs*, in nearly all the Carnivora and the Rodentia (except the Hares), in the Ruminantia, and several of the Pachydermata and Edentata; but as its presence or absence has but little importance either in a zoological or physiological point of view, it is needless to enter minutely into that question.

It is perhaps scarcely necessary to add, that in the six upper cervicals this foramen is formed by the existence of two exogenous processes, the diapophysis and parapophysis, and the junction of their extremities through the intervention of a small autogenous element, a pleurapophysis or vertebral rib, which becomes anchylosed to them, in the warm-blooded animals, at an early period of existence. One of the cervical vertebræ of a whale, described by Mr. Gray in a paper

* As some of the exceptions to this generalization possess some interest, it is perhaps as well to notice them. We need not descend lower than the Chimpanzee to witness the disappearance of the foramen, as in this animal its existence is only indicated by a minute process thrown out from the transverse process, and another from the body of the vertebra, but they do not meet; this would render it most probable that the stylet enclosing the foramen beneath is exogenous. In the skeleton of a half-grown *Cynocephalus leucophæus* in my own collection, the foramen is wanting on one side; on the other it is very small, and the stylet enclosing it shows no trace of separation from the other parts. But the most remarkable peculiarity is that occurring in the Orang-Utan, whose neck is short, and usually hangs forward. In the skeleton of this species presented by Sir Stamford Raffles to the College of Surgeons, not only does the transverse process of the seventh cervical vertebra show no foramen, but even that of the sixth has it very small on one side and quite obliterated on the other. On the other hand, in the *Indri brevicaudatus*, a rather long-necked Lemur, the foramen is very distinct in the seventh.

recently read, affords a very interesting example of the existence of both the processes, but without the little element which would unite their extremities.

In the seventh cervical vertebra the upper transverse process only exists, and the small rib is generally also absent. When the foramen is present in this vertebra, it appears to be enclosed beneath simply by the extension of a little osseous stylet from the under side of the diapophysis to the body of the vertebra, just as the neck of one of the true ribs extends between the points where its head and tubercle are articulated; but whether this stylet be autogenous or exogenous, that is, developed from a separate point of ossification or not, I have at present no means of ascertaining.

I was led to remark on this subject through the accidental discovery in the skeleton of a Polecat (*Mustela putorius*) of a pair of rudimental ribs, or rather portions of ribs, moveably articulated to the extremities of the transverse processes of the seventh cervical vertebra; their length is exactly one-fourth of an inch of true bone, besides a little cartilaginous appendage at the tip. In a second specimen I searched for a similar peculiarity, but was unable to perceive its existence. The two specimens were both males, of mature age and robust dimensions, resembling each other in every particular. This circumstance naturally led me to observe with considerable minuteness the skeleton of the Three-toed Sloth (*Bradypus tridactylus*), in which the existence of nine vertebræ anterior to those forming part of the thorax has long been known; and the discovery by Professor Bell of rudimental ribs articulated to the eighth and ninth of the series renders that exceptional instance additionally interesting. I therefore attentively perused the paper contributed by that learned naturalist to the first volume of the Society's Transactions.

It may indeed appear presumptuous on my part to dissent from the conclusions which so eminent a professor has drawn from his discovery, but my observations led me irresistibly to the conclusion, that if there is any essential distinction between the vertebræ of the cervical and dorsal regions, the eighth and ninth vertebræ of the *Bradypus tridactylus* must be classed among the former.

The skeleton upon which my notes have been made is that contained in the Museum of the Royal College of Surgeons; it must be perfectly mature, although the epiphyses at the distal extremities of the ulna and radius still remain distinct, for *every* other epiphysis has lost all trace of separation from the bone to which it belongs, and the characteristic anchylosis which unites most of the bones of the foot is completely effected. The sternal ribs are all perfectly ossified; the first four of them are anchylosed to their corresponding vertebral ribs, and the first one also to the manubrium sterni;—so small, comparatively, is the amount of respiratory action required by this slow-moving quadruped.

The differences existing between the eighth and ninth vertebræ and those immediately above them are most clearly and accurately described by Professor Bell; surely it can hardly be necessary here to quote his words; but on comparing either the description that he has given, or the skeleton itself, with the cervical vertebræ of almost any other mammiferous quadruped, it is most easy to perceive that the *eighth* and *ninth* vertebræ of the Sloth differ from the other cervical vertebræ in precisely the same manner as do the *sixth* and *seventh* vertebræ of other Mammalia from those preceding them in the series. He observes, in describing the *eighth* vertebra, "In the first dorsal each transverse is completely divided into an anterior flattened process, which is turned forwards, and a true lateral or transverse one, which supports the little articulated rib. The transverse process is smaller, but considerably longer, than those of the true cervical, and stands more in a lateral or transverse direction." These characters are precisely the same, excepting that the little articulated rib is wanting, in the *sixth* vertebra of nearly all Mammalia, and in most of them still more distinctly and strikingly manifested. But in the excellent description given by the learned professor, one point at least has been omitted, and that is the existence of the foramen for the vertebral artery in the *eighth* vertebra of the Sloth: no doubt the coexistence of the same foramen in the upper vertebræ will account for its not being mentioned, but its presence tells strongly in favour of the cervical nature of the vertebra.

The transverse process of the *seventh* cervical of the Sloth, also so carefully described by Professor Bell, accords exactly with that of the *fifth* of other Mammalia, in presenting a character intermediate between that which precedes and that which follows it. In speaking of the *ninth* vertebra of the Sloth, he proceeds, "In the second dorsal vertebra the anterior processes do not exist, and the body assumes the form of the succeeding ones. The transverse processes are simple and obtuse, and the articular surface is slightly excavated." I have already pointed out the character presented by the seventh cervical in most Mammalia, which will be seen to agree well with that just cited of the ninth in the Sloth.

In the skeleton examined by myself, the upper pair of rudimental ribs, that is, those attached to the *eighth* vertebra, are wanting—no doubt accidentally lost, and therefore in no way influencing the present argument; but the second pair, attached to the *ninth* vertebra in a manner just similar to that which I have noticed as occurring abnormally in the Polecat, have contracted a complete anchylosis with the extremities of the transverse processes to which they are connected, thus showing, what it seems that Professor Bell's specimen did not exhibit, that this rib is not permanently moveable, but at some period of life becomes a fixture. The figure given by Professor Bell in illustration of his most valuable paper does not show any indication of the existence in the transverse process of the *ninth* vertebra of the foramen for the passage of the vertebral artery; but as this foramen is but small, and the position in which the figure is taken not a very favourable one for exhibiting it, it may nevertheless have existed in his specimen; the minute foramen which he mentions, "for the passage of intercostal vessels," must be one pierced in the rib itself. In the specimen which I examined however, we have the *ninth* vertebra presenting the foramen for the vertebral artery, enclosed, as I have already shown in the *seventh* of other Mammalia, by a little osseous stylet extending between the under side of the transverse process and the body of the vertebra, imitating the neck of a true rib; and as this is coexisting with the rudiment discovered by Professor Bell, but here anchylosed with the end of the transverse process, it really presents the appearance of the upper portion of a true rib, merely having the neck a little thinner than usual. This circumstance may perhaps seem to weaken my position; but when I consider that this vertebra presents the same general characters as the *seventh* cervical of most Mammalia, where, although the rib be wanting, the foramen is generally wanting also; and also the existence of the rib together with the absence of the foramen in the Polecat, I think the balance of evidence will still be in my favour. And Professor Owen has shown to me, in the College of Surgeons' Museum, a preparation from the human subject, showing a pair of ribs articulated to the *seventh* cervical vertebra by head and tubercle, just as are those of the true dorsal series.

But it yet remains for me to notice one point of resemblance between the *ninth* vertebra of the Sloth and the *seventh* of other Mammalia, which seems to have escaped the scrutiny of Professor Bell: that is, that the body of the vertebra is not rounded beneath, as are those of the true dorsal series, but flat and square; this flatness resulting from the presence of a longitudinal ridge along each side of its under surface, and seeming to represent in a rudimental form the anterior flattened processes of the preceding vertebræ of the series, and whose absence, noticed by Professor Bell in the *ninth* vertebra of the Sloth, is equally characteristic of the *seventh* throughout the rest of the class.

At all events I think I have adduced, from the consideration of the mammalian class alone, proofs of that truth which other departments of Comparative Anatomy have before so well established, that Nature does not rigorously confine herself to those precise rules which we lay down to account for her phænomena; and also, that if we do find it necessary to subdivide the spine into distinct regions for convenience of description, we cannot do so by simply defining characters taken from the peculiarities of a single species, but must compare the characters which the vertebræ present throughout the scale of beings, to ascertain which of them are the most constant and most truly essential in their nature. We may at the same time perceive, that the same artificial subdivision of the spine which answers our convenience so nicely in one class, may be only partially, or not at all, applicable in another; since in Birds there are no lumbar vertebræ, and one vertebra partakes both of the dorsal and sacral character, while in Fishes we find no cervicals, and as ribs are appended to all those of the abdominal series, neither lumbar nor sacral vertebræ can be said to exist.

However, with regard to the distinction between cervical and dorsal vertebræ, as we see them in the class Mammalia, it follows, from the remarks which I have made, that we can define it neither by specifying any particular number as constituting the cervical series, nor by the presence or absence of articulated ribs, nor of a foramen in the transverse process for the passage of the vertebral artery, but must diligently compare them with those of others of the class, to ascertain with which they really correspond in their essential characters; and then we may draw the line of demarcation wherever suits us best, only remembering that under whichever series we place a vertebra in one species, the corresponding one in another must be reckoned under the same category. This is the view I have endeavoured to carry out in my examination of the Sloth; and being of opinion that the *eighth* and *ninth* vertebræ of that animal correspond as essentially to the *sixth* and *seventh* in the rest of the class, as do the atlas and the axis to those of other animals, and knowing that the intervening vertebræ differ in number by two, I feel bound to believe, notwithstanding the interesting fact which Professor Bell has discovered, that the cervical vertebræ of the *Bradypus tridactylus* are nine in number.

Fig. 2.

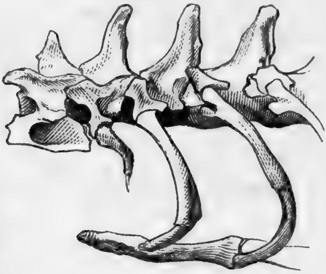


Fig. 1.

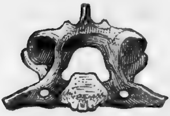


Fig. 4.

Fig. 3.

Fig. 1. A view from behind of the seventh cervical vertebra of an Opossum (*Didelphys Virginiana*), as an example of the existence of the foramen for the passage of the vertebral artery, and showing the manner of its enclosure beneath.

Fig. 2. The sixth and seventh cervical, and the first two dorsal vertebræ of a Polecat, showing the rudimental rib attached to the last cervical.

Fig. 3. The series of seven cervical vertebræ of a second specimen of the Polecat, showing the absence of the rib, and the *difference of form in the transverse processes*.

Fig. 4. A perspective view (from behind) of the last cervical vertebra of the same animal, showing the absence of the foramen for the vertebral artery, and the *flattened* form of the under surface of the vertebra.

Description of a new species of Bat. By Charles Lucien Bonaparte, Prince of Canino and Musignano, etc.

Arctibius Floresii.

Sp. Ch.—Grey brown; beneath paler, with pale tips to the hair; two broad streaks on the face, and a narrow streak on the centre of the back, white. Arm-bone rather foliated, one inch four lines in length. Heel-bone very short. Second thumb-joint elongate, slender. Nose-leaf with a distinct central rib.

This new species inhabits the unexplored region of the Republic of Equatoria, which borders on the wilds of Brazil. It was collected there in company with *Anoura Geoffroyi*, *Phyllostoma nigrum*, and *Molossus ater*, by the intrepid traveller M. Delattre, from whom I received it through M. Bourcier, the eminent Trochilidist.

I dedicate it to our common friend the high-minded General Flores, the companion of Bolivar, and once the worthy President of the Republic, to whose civilization his thoughts are still constantly directed, and where he still occupies a distinguished place in the hearts of his fellow-citizens.

On a new genus of Suidæ and a new species of Taxidea. By B. H. Hodgson, Esq., Corr. Memb. etc.

Genus Porcula, mihi.

Gen. Ch.—Teeth $\frac{6}{6} \cdot \frac{1\cdot1}{1\cdot1} \cdot \frac{6\cdot6}{6\cdot6} = 40$. Canines small, straight, severely cutting, but not exserted from the lips. Fourth toe on all the feet small and unequal. Tail very short, but distinct. Type,

Porcula Salvania, mihi.

Sp. Ch.—Pigmy Hog of a brown-black colour, slightly and irregularly shaded with sordid amber. Iris hazel. Nude skin dirty flesh-colour. Hoofs glossy-brown. Length from snout to vent 18 to 20 inches; height 8 to 10 in.; head 6 in.; tail $\frac{7}{8}$ or less than 1 in. Weight 8 to 10, rarely 12lbs.

Hab. Saul Forest.

Remark.—The Pigmy Hog of the Saul Forest is almost equally allied to the true Hogs and the Peccaries, agreeing with the former in the absence of any peculiar organs, such as the gular flaps of *larvatus* and the pelvic sac of *torquatus* and *labiatus*; also in the number and form of the incisor teeth, and in having a perfect tail and four toes to each foot; but differing from the true Hogs and agreeing with the Peccaries in the number of the molar teeth, in the style of the laniaries, in the diminished elongation of the jaws, and in the absence of the nasal cartilage, and showing yet further leaning towards the same type (*Dicotyles*) by the extreme smallness of the tail, and by the tendency of the fourth toe to disappearance.

Our proposed genus should have a place in a natural system between *Sus* and *Dicotyles*; its positive characters being the presence of a tail and of a fourth toe, the limited number of molar teeth, and the straightness of the unexserted laniaries. The species is most rare; its flesh excellent; its manners resemble those of *Sus* in general, but with some marked differences.

Genus Taxidea, Waterh.

Taxidea Leucurus, mihi. Tibetan Badger.—Head laterally and above whitish, divided by a blackish line through the eye. Body above and laterally yellowish grey, paling towards the flanks. Below, from chin to vent exclusive, black; and limbs the same. Tail unmixed yellowish white. Ears black basally, white apically. Snout to vent 27 in.; head $5\frac{1}{2}$ in.; tail 10 in.; palma and nails $3\frac{1}{8}$ in.; planta and nails 4 in.; ear, with tuft, 2 in.

Hab. Plains of Tibet.

July 27.—William Yarrell, Esq., Vice-President, in the Chair.

The following papers were read:—

Note of the Circulation of Crocodilus lucius. By Edward Fry.

In a recent dissection of a spemcien of the *Crocodilus lucius*, measuring about five feet four inches, I discovered an arrangement of the arterial system which is, as far as I am aware, anomalous, and which may perhaps be therefore worth recording.

In all the drawings of the Saurian circulation with which I have met, the left ventricle is represented as giving off, in addition to the right aortic arch, a common trunk, which divides into two arteries for the supply of the fore-part of the body, which for a short course are to be considered as arteriæ innominatæ, when they give origin to the subclavian arteries and pass upwards, one on either side, as carotids, for the supply of the head and face. In the individual in question, however, the arrangement was this: beside the right aortic arch, two trunks are given off from the bulbus of the left ventricle; of which, one passes immediately to the supply of the right fore-limb, and the other proceeds upwards, shortly gives off a considerable branch as a left subclavian, and then continues its upward course on the mesial line lying immediately on the under side of the bodies of the vertebræ, in a channel between the longitudinal muscles of either side, and above the trachea, until it almost reaches the posterior nares, where it subdivides, its branches passing over the under side of the temporal muscles, and going to feed the lower jaw, as well as supplying the sides of the head.

The parts which this singular artery supplies prove it to be the analogue of the carotids, whilst the consideration of its origin, course and termination induces me to believe that its homological relation is with the inferior pharyngeal.

The absence of any such arrangement in the whole subkingdom of the Vertebrata is to be remarked; and in conjunction with the fact that the figure of the Saurian circulation given in Müller's 'Physiology' (by Baly, vol. i. p. 174) is stated to be from an individual of the same species, viz. *Crocodilus lucius*, induces me to suppose the anomaly above recorded to have been an individual peculiarity.

Additional Observations on the Cetacea of the British Islands. By J. E. Gray, Esq., F.R.S. etc.

1. Since my former paper was read, I have been enabled, by the kindness of Professor Goodsir, to examine the specimens of Cetacea which were prepared by Dr. Knox, and which now form part of the anatomical collection of the Edinburgh University.

The large male whale which came ashore on the 5th of October 1831, and was seventy-eight feet long, which Dr. Knox in his Catalogue calls *Balæna maximus borealis,* and of which he made many most interesting preparations of the soft parts, is one of the most beautiful and perfect skeletons I have yet seen. The latter is for the present exhibited in the elephant-house at the Zoological Gardens of Edinburgh, but unfortunately it is suspended so high that I could not take any measurements. It is a *Physalus,* very nearly allied to what I have called *Physalus antiquorum*; but it differs from the specimen taken at Plymouth in the lateral processes of the cervical vertebræ being higher compared with their length, and more truncated at the end; in the third and fourth cervical vertebræ not being so much expanded beyond the aperture; in the fifth being still thinner; and in the sixth, instead of a complete ring, having only an elongated, arched, upper lateral process, and a very short, rather depressed lower one; and the seventh only an upper one. Should this species prove distinct, it might be distinguished as *Physalus borealis.*

Dr. Spittal, who saw it when first cast ashore, informs me it was slate or grey, and the tail white (probably beneath). The baleen appeared at the distance black.

2. In the anatomical museum there is the skeleton and soft part of a Dolphin or Bottle-nose, which was sent to Dr. Knox from Orkney in May 1825. It was a female and weighed fourteen stone. It is described in Dr. Knox's 'Catalogue of the Anatomical Preparations of Whales,' Edinburgh 1838, as No. 84, *Delphinus Tursio.*

It is a nearly adult specimen of *Delphinus leucopleurus,* lately described by Rasch, Mag. Zool. 1843, p. 369, from a specimen taken at Christiania in Norway, figured by me from a Norwegian specimen in the 'Zoology of H.M.S. Erebus and Terror,' under the name of *Lagenorhynchus leucopleurus.*

Dr. Knox gives the following measurements: entire length 9 ft. 6 in.; circumference 3 ft. 2 in. Pectoral 10 inches long; tail 1 ft. 2 in. wide; and the gape 9 inches.

It is a most interesting addition to the British fauna, being the second of this genus added within the last year.

3. I may remark, that *Balæna minor borealis* of Dr. Knox in the same collection is the *Balænoptera rostrata* of my papers.

4. In the same collection there is a stuffed skin of a fœtus of a Northern or Right Whale (*Balæna Mysticetus*), two feet four inches long, showing the large flap near the edge of the lower lip, "destined to cover in the baleen," and a most beautiful skeleton of the same specimen. The bones of the head are distinctly ossified, but the

rest of the skeleton is only cartilaginous. There are also (No. 36) "the teeth of the fœtal *Mysticete* preserved in alcohol;" and Dr. Knox observes, "they never cut the gums, but become gradually reabsorbed," which agrees with Professor Eschricht's account of the teeth of *Megapteron*; and further, Dr. Knox remarks, "The integumentary system furnish the baleen, which is evidently a modified form of hair and cuticle." (p. 22.)

5. I may here add, as determining the synonyma, that the *Phoca Leopardina* of Professor Jameson in Weddel's 'Voyage,' from the specimen preserved in the museum of the Edinburgh University, is the same animal as I described under the name of *Leptonyx Weddelii*, figured in the 'Zool. Ereb. and Terror.'

A fœtus extracted from a specimen of the Pilot Whale (*Globiocephalus Svieval*) was six feet long.

In *Lagenorhynchus leucopleurus* the first, second and third cervical vertebræ are united by their spinous process, the rest free.

In *Globiocephalus Svieval* the second and third cervical vertebræ are united, the rest free.

In *Monodon monoceros* the second and third cervical vertebræ are united by the spinous process, not by the body, and the rest are free.

In *Delphinus Tursio* the atlas and the second cervical vertebra are united by the body, the spinous and lateral processes, and the rest are free and thin.

There is a perfect specimen of *Hyperoodon latifrons*, brought from Greenland by Capt. Wareham, in the museum at Newcastle, rather smaller (seven feet long) than the one from Orkney in the British Museum. There is the skeleton of an adult *Hyperoodon* from the Firth of Forth in the anatomical museum of Edinburgh University with the skull sixty inches long; the crests are very thick, but quite separate, and with flat perpendicular walls on the inner side.

There is another skull of the same species, from a specimen stranded on the coast of Lancashire, in a garden near Newly Bridge.

MISCELLANEOUS.

THE ROSE CADDICE SAW-FLY.

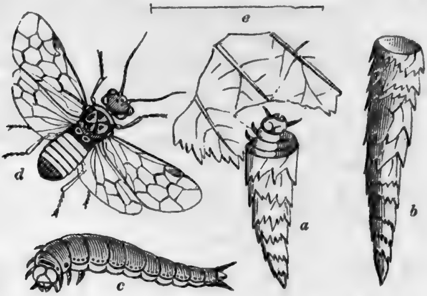
A work devoted to the investigation of the manners and œconomy of the species of insects which feed upon the Rose-tree would extend to several volumes; there is, in fact, scarcely any one kind of vegetable, the Oak, perhaps, excepted, which supports so many distinct kinds of insects, the natural history of many of which is still unrecorded: and we know no more interesting subject of garden-leisure than the examination and publication of the details of their habits, as many of them furnish remarkable details which could not fail to be highly instructive.

The insect which is the subject of the present communication is one of these Rose-feeding insects whose singular œconomy renders it very worthy of attention. For many years we have regularly noticed in our garden at Hammersmith, during the last week of May and the first of June, a remarkably brilliant, golden-winged fly settling on the leaves in the hot sunshine, and darting off with great velocity on being approached. This insect is one of the saw-flies (*Lyda inanita*), a very rare British species, which we were, of course, glad to perceive to be a native of our own locality, more especially as from its regular appearance we had no doubt of ascertaining its habits; the larvæ of the genus to which it belongs being the only ones in the family Tenthredinidæ which are destitute of the false legs along the ventral parts of the body.

The perfect insect is represented in the accompanying woodcut, fig. *d*, rather larger than life, the extent of the real expansion of the wings being indicated by the straight line (fig. *e*). We have unfortunately never been able to see this fly deposit its eggs, but as we have found its larva of a very small size upon the rose-trees, we have no doubt that it is upon the leaves or stems of those trees that they are laid. Towards the end of June and through the month of July we have observed, upon different varieties of the Rose, some curious cases formed of bits of rose-leaves cut into strips, and carefully rolled up into a long cylinder, or rather a very elongated cone, one end of which remains attached to the leaf, whilst from the wider orifice there issued forth the head and fore-part of the body of a caterpillar, which we at once recognized as that of a species of *Lyda*, and which there can be no doubt is that of the species which we find in the winged state.

The mode in which these terrestrial caddice insects form their cases is very remarkable. The larvæ by degrees cut off one edge of the leaf, thereby forming a strip about one-eighth of an inch wide, at the same time eating a portion of the leaf immediately adjoining the slit which they make. The strip of the leaf is gradually lengthened as the insect proceeds upwards or downwards along the edge of the leaf. Its mode of action will however be best learned by our fig. *a*, which represents part of the underside of a leaf with its attached case and inclosed insect. One end of the strip is, in fact, rolled round the insect's body (the roll being fastened by silken threads of great delicacy, which the insect spins), whilst the other end of the strip is only detached from the leaf when the larva has arrived at its extremity. As however the insect would be very liable to the attacks of ichneumon-flies and other insects, if the strip were bent upwards, the insect has the singular instinct to roll it downwards, so that the insect whilst feeding is entirely protected from being seen from above by the part of the strip nearest to the body of the leaf, seen in our fig. *a*, to the left of the head of the insect, the uneven edge of the leaf above its head being the part from which it has already detached a portion of the strip which it has wrapped round its body; it will also be seen that it has the further instinct to arrange the serrated edge of the leaf outside of its case, so that wet is thrown off just as by the tiles of the roof of a house. There is a still farther display of instinct in the strip being rolled *spirally*, so as to form a long case.

The roll or case when the larva is full-grown is two inches long (fig. *b*); this however is formed by the addition of strips cut off several leaves. This it effects by fastening the tip of a fresh leaf to



the top of its half-formed case, and then thrusting its head and fore-part of its body out of its case, it commences biting off the fresh strip, bending it downwards and twisting it round in the same direction as the part already formed.

The full-grown larva is nearly an inch long, of a green dirty colour, with two six-jointed antennæ, two moderate-sized globose black eyes, three pairs of thoracic legs, and a pair of laterally porrected slender three-jointed feeler-like organs attached to the extremity of the underside of the last segment of the body, which is flattened beneath. Fig. *c*. represents the larva taken out of its case and magnified. When taken out of their cases they appear for a considerable time very uneasy, writhing about without any regularity, but spinning a number of very delicate silken threads on the underside of the leaves, pushing themselves by degrees between the under surface of the leaves and this bundle of threads; they then draw the threads more tightly at the edges of the leaves, causing them to curl a little, this being effected by passing the head from side to side, and then returning, fastening the thread, spun from the mouth, at each extremity.

We have been particular in describing the proceedings of this insect, as it is the only instance we have ever met with in which a case-making larva does not at once detach the particles of which it constructs its case from the leaves or twigs, previous to attaching them to its case, thereby rendering the case portable. In the present instance, of course, the case is only strictly portable when the entire strip is detached from the leaf. Moreover this insect differs very greatly in its habits from those of the previously noticed species of the genus to which it belongs*.

As the larva disappears at the end of July and the imago does not appear till the following May, there is no doubt that the intervening time is passed in the pupa state, most probably underground.—I. O. W.—*Gardeners' Chronicle for Oct*. 16.

* A Memoir, by Huber, on a species with precisely similar habits, but which forms its roll of hazel-leaves, is given in the 'Mémoires de la Société de Physique et d'Histoire Naturelle de Genève,' tom. ix. 1842, of which a

On the Organogeny of the Irregular Corollas. By F. Barnéoud.

In the memoir which I have the honour of submitting to the Academy, I have described the results of further researches on the organogeny of the irregular corollas. I shall briefly indicate the principle in this abstract. In the monocotyledons the study of the development of the flower of the *Canneæ* afforded direct proof that it is the stamina only metamorphosed into petals in a more or less complete manner from their first appearance, which impart to the corolla its irregular aspect. The two outer ternary verticils are always developed *one after the other*, precisely as the calyx and corolla of dicotyledons. This law, which I have verified in more than ten families, appears to be very general among monocotyledonous plants. In the dicotyledons the adult corolla of the *Acanthaceæ, Globulariæ, Gesneriaceæ, Bignoniaceæ* and *Goodeniaceæ,* which is frequently far from regular, presents itself on its first appearance in the form of a small cupule with five very equal and rounded teeth at the border, but this state is more or less ephemeral according to the genera and species. Very soon the unequal elongation of the divisions of the corolla, their different degrees of adhesion or their partial atrophy, determine a very marked irregularity. The same applies with respect to the flower of *Centranthus* in the *Valerianeæ,* to that of the *Lobeliaceæ* and of the *Scrophulariaceæ.* In this last family the corolla of the *Calceolariæ,* one of the most anomalous of the vegetable kingdom, is reduced at its origin to a scooped-out cupola, which is very regular and furnished with four equal minute teeth; the nascent calyx likewise presents but four divisions.

The highly remarkable floral envelope of *Begoniaceæ* likewise appears at the period of its formation, as regards both male and female flowers, in the form of a continuous ring, and exhibits at its circumference five very equal small segments; but there are some of them, especially in the male flowers, which disappear entirely or which become in part atrophied, so as to give to the coloured envelope that peculiar structure which forms its principal character.

From the facts detailed in my two memoirs and derived from the study of genera with irregular flowers from twenty-five natural families, I feel justified in deducing the following consequences:—

1. The simple theory announced by DeCandolle as early as 1813, according to which the irregular flowers should be referred to regular types from which they appear to have degenerated, must be admitted as true, although conceived *à priori,* and solely from the attentive examination of some cases of peloria, or of flowers which have become regular at the adult age. But if in the actual state of science, organogeny affords us a direct demonstration of this important principle of botanical philosophy, I must add, that the symmetry of an irregular flower even at its very origin does not always strictly exist; it is fre-

translation appeared in the 'Annals of Natural History,' vol. xi. 1843. The memoir chiefly details the mode in which the leaf is fastened into a spiral coil by the larva. The author was unaware to what species or genus it belonged.

quently merely indicated by empty places where the absent organs are never developed, as is very readily seen with respect to the stamina of those plants. We may therefore infer among the ordinary causes of disturbance in the floral symmetry, such as abortion, multiplication, degenerescence and adhesion, likewise that of the non-development of organs.

2. With respect to the origin of the union of the stamina called monadelphous, diadelphous, polyadelphous and synantherous, their adhesion is always subsequent to their first formation. The family of the *Stylidiæ* (*Stylidium adnatum*) alone appears to me to furnish a remarkable exception to this rule as regards the adhesion of the styles.

I shall here enumerate three principal kinds of irregularity among all the irregular corollas which I have examined :—

1. Irregularity by simple inequality of development among the several segments of the corolla, with complication of adhesion or complete atrophy or arrest of growth ; this is the most common.

2. Irregularity by deviation, where the segments although equal turn all of the same side ; for instance, the corolla of *Scævola lævigata* (*Goodeniaceæ*), and the genera with ligulate florets of the *Compositæ*.

3. Irregularity by simple metamorphosis of the stamina, as in the family of the *Canneæ*, and probably that of the *Zingiberaceæ*.—*Comptes Rendus, Aug*. 16, 1847.

Chamæa, *a new genus of Birds allied to* Parus. By Wm. Gambel.

Bill short, tapering to the point, acute and compressed. Both mandibles entire, ridge of upper elevated, and curving nearly from the base ; the depression for the nostrils large, oval and exposed ; the nostrils opening beneath a membrane in the depression. Wings very short and much rounded. Tail very long and graduated. Tarsus long.

Chamæa fasciata, nobis. Ground Tit.

Parus fasciatus, nobis, Proceed. Acad. Nat. Sci. vol. ii. p. 265.

This interesting bird, placed provisionally among the Titmice, I have now made the type of a new genus, not being able as yet to find a suitable place for it among those already described.

For several months before discovering the bird, I chased among the fields of dead mustard stalks, the weedy margins of streams, low thickets and bushy places, a continued, loud, crepitant, grating scold, which I took for that of some species of wren, but at last found to proceed from this wren-tit, if it might so be called. It is always difficult to be seen, and keeps in such places as I have described, close to the ground ; eluding pursuit by diving into the thickest bunches of weeds and tall grass, or tangling bushes, uttering its grating wren-like note whenever an approach is made towards it.

But if quietly watched, it may be seen, when searching for insects, to mount the twigs and dried stalks of grass sideways, jerking its long tail, and keeping it erect like a wren, which, with its short wings, in such a position it so much resembles ; at the same time uttering a very slow, monotonous, singing, chickadee note, like *pee pee pee pee peep*; at other times its notes are varied, and a slow, whistling, continued *pwit, pwit, pwit, pwit, pwit, pwit,* may be heard. Again, in pleasant weather towards spring, I have heard them answering one another, sitting upon a low twig, and singing in a less solemn strain, not unlike a sparrow, a lively *pit, pit, pit, tr r r r r r r,* but if disturbed, at once resuming their grating scold.—*Silliman's Journal for Sept.* 1847.

METEOROLOGICAL OBSERVATIONS FOR OCT. 1847.

Chiswick.—October 1. Hazy: cloudy. 2. Cloudy. 3. Light clouds and fine: overcast. 4. Foggy: fine. 5. Fine: light clouds: clear at night. 6. Dense fog: very fine: lightning and rain at night. 7. Fine: rain: lightning at night: clear. 8. Very fine. 9, 10. Rain. 11. Rain in forenoon: clear at night. 12. Slight fog: very fine. 13. Foggy: hazy: cloudy at night. 14. Hazy and drizzly: cloudy. 15. Hazy and cold: slight rain. 16. Foggy: very fine. 17. Foggy, with slight drizzle: very fine. 18. Slight fog: rain. 19. Exceedingly fine: rain. 20. Very fine: rain at night. 21. Rain: clear at night. 22. Fine. 23. Densely clouded and boisterous: rain. 24. Slight showers. 25. Very clear: fine: clear and frosty. 26. Frosty: uniformly overcast. 27. Fine: rain. 28. Hazy and mild. 29. Exceedingly fine. 30. Overcast and mild. 31. Cloudy and mild.

Mean temperature of the month	52°·14
Mean temperature of Oct. 1846	50 ·37
Mean temperature of Oct. for the last twenty years	50 ·42
Average amount of rain in Oct.	2·60 inches.

Boston.—Oct. 1—5. Cloudy. 6. Rain. 7. Fine: rain P.M. 8. Fine. 9. Fog: eclipse of the sun invisible until three-quarters over: fog. 10. Rain: rain A.M. 11—13. Fine. 14, 15. Cloudy. 16. Fine. 17, 18. Fog. 19, 20. Fine. 21. Cloudy: rain A.M. 22. Fine. 23. Cloudy: rain P.M. 24—26. Fine. 27. Rain: rain A.M. and P.M. 28. Fog. 29. Rain: rain A.M. 30. Fine: rain A.M. 31. Cloudy.

Sandwick Manse, Orkney.—Oct. 1. Clear: cloudy. 2. Cloudy: clear. 3. Cloudy. 4. Cloudy: drops. 5. Bright: showers. 6. Showers. 7. Drizzle. 8. Drizzle: clear: aurora. 9. Clear: cloudy. 10. Cloudy: drizzle. 11. Clear: fog. 12. Fog. 13. Cloudy: clear: aurora. 14. Cloudy: clear. 15, 16. Clear: cloudy. 17. Showers: drizzle. 18. Rain. 19. Damp: rain. 20, 21. Showers: clear. 22. Showers: rain. 23. Showers: sleet-showers. 24. Sleet-showers. 25. Clear. 26. Drops: showers. 27. Bright: drops. 28. Cloudy. 29. Cloudy: shower: lightning. 30. Showers: rain. 31. Bright: cloudy.

Applegarth Manse, Dumfries-shire.—Oct. 1, 2. Chill and droughty. 3, 4. Dull, but fair. 5. Fair A.M.: showery P.M. 6. Heavy rain A.M. 7. Heavy rain A.M.: flood. 8. Frequent showers. 9. Fine A.M.: rain P.M. 10. Heavy rain. 11. Fair: rain in the night preceding. 12. Fair and fine. 13. Fair, but raw and cloudy. 14, 15. Fair, though chilly. 16. Very fine clear day. 17. Dull and cloudy. 18. Dull and cloudy: rain P.M. 19. Heavy rain. 20, 21. Occasional showers. 22. Rain A.M.: very heavy P.M. 23. Rain early A.M.: fine day. 24. Heavy showers. 25. Fair: fine: clear. 26. Rain nearly all day. 27. Heavy rain and flood. 28. Fog: cleared P.M. 29. Fair and fine. 30. Fair A.M.: heavy rain P.M. 31. Rain early A.M.: cleared.

Mean temperature of the month	49°·5
Mean temperature of Oct. 1846	49 ·5
Mean temperature of Oct. for twenty-five years	49 ·6
Average rain in Oct. for twenty years	3·56 inches.
Rain in Oct. 1847	5·09 „

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. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Dumfries-shire.		Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Dumfries-shire.	Orkney, Sandwick.	Chiswick.	Boston.	Dumfries-shire.	Orkney, Sandwick.
1847. Oct.	Max.	Min.		9 a.m.	9 p.m.	9¼ a.m.	8½ p.m.	Max.	Min.		Max.	Min.	9¼ a.m.	8½ p.m.								
1.	30·050	29·995	29·64	30·15	30·15	30·43	30·41	65	52	56	59½	42	50	48½	ne.	calm	ene.	ne.	......	......	......	......
☾ 2.	30·110	30·039	29·64	30·16	30·13	30·35	30·34	60	42	53·5	55	48	50	45½	ne.	n.	ene.	ne.	......	......	......	......
3.	30·164	30·124	29·72	30·16	30·12	30·34	30·30	59	48	52·5	52½	47½	49	46	ne.	n.	ne.	calm	......	......	......	......
4.	30·039	29·886	29·64	30·03	29·90	30·17	30·07	62	39	51	53	46	49	44	e.	ne.	ne.	ne.	......	......	......	......
5.	29·750	29·647	29·35	29·76	29·63	29·98	29·89	60	33	49	50½	53½	45	47	ne.	n.	ne.	ne.	......	......	......	......
6.	29·637	29·548	29·30	29·60	29·40	29·96	29·93	63	52	50	53	43½	49½	46	se.	e.	e.	e.	·15	......	......	·16
7.	29·645	29·460	29·11	29·27	29·40	29·64	29·62	64	37	57	53½	48	48	51	sw.	se.	s.	se.	·22	·05	......	·07
8.	29·885	29·763	29·30	29·40	29·65	29·66	29·79	63	53	50	52½	45½	50½	46½	sw.	w.	s.	se.	·03	·47	1·85	·17
● 9.	29·897	29·880	29·46	29·75	29·63	29·90	29·82	62	52	49	56	38	50½	50½	sw.	w.	e.	se.	·23	......	......	......
10.	29·851	29·804	29·36	29·53	29·60	29·76	29·68	65	48	57	59½	51½	53	52½	s.	ese.	se.	se.	·02	·34	......	......
11.	29·846	29·839	29·43	29·68	29·73	29·83	29·88	66	46	57	61	54½	54½	52	se.	se.	e.	se.	·03	·14	......	·05
12.	29·886	29·844	29·44	29·77	29·86	29·95	30·08	72	52	55	67	52½	51½	50	s.	se.	ne.	e.	......	......	......	......
13.	29·919	29·793	29·50	29·95	29·97	30·16	30·13	64	49	55	54½	49½	49½	40½	e.	ene.	ne.	calm.	......	......	......	......
14.	29·864	29·739	29·50	29·88	29·80	30·01	29·79	54	48	51	52½	45	46	46	e.	ne.	ne.	se.	·01	......	......	......
15.	29·865	29·695	29·38	29·83	29·90	30·00	30·04	56	40	52	55	43½	47½	49½	e.	e.	ne.	nw.	·01	......	0·60	......
16.	29·960	29·944	29·56	29·95	29·88	30·03	29·83	62	52	51	56	46	50	50½	e.	e.	e.	sw.	·01	......	......	......
☽ 17.	29·986	29·843	29·54	29·80	29·68	29·60	29·49	61	46	50	55	37½	52	52	e.	calm	sw.	sw.	·01	......	......	·18
18.	29·718	29·598	29·30	29·48	29·33	29·30	29·23	62	49	49	55	52½	53½	52½	w.	calm	sw.	s.	·08	......	......	·33
19.	29·476	29·382	29·05	29·17	29·18	29·11	29·11	67	42	55	56	53	53	49	s.	s.	sw.	w.	·07	......	......	·75
20.	29·856	29·708	29·25	29·47	29·45	29·38	29·48	57	39	46	54	42½	45	45	w.	wsw.	sw.	sw.	·20	......	......	·29
21.	30·036	29·748	29·30	29·52	29·78	29·52	29·68	58	32	50	51	42½	45	40½	w.	w.	wnw.	s.	·01	·29	......	·11
22.	30·155	29·932	29·60	29·67	29·37	29·46	28·94	59	44	46	54	41½	49	51	sw.	sw.	ssw.	ssw.	·01	......	......	·15
○ 23.	29·699	29·452	29·15	29·34	29·34	29·14	29·18	60	38	57	53½	47	45	44	sw.	sw.	sw.	w.	·44	......	1·24	·76
24.	29·728	29·700	29·24	29·38	29·48	29·16	29·24	53	35	45	50½	38	45	44	sw.	sw.	sw.	nw.	·01	·97	......	·66
25.	30·283	29·939	29·50	29·77	30·06	29·73	30·10	53	26	44	52	37	45	41	w.	w.	sw.	n.	......	......	......	·07
26.	30·366	30·343	29·93	30·10	30·00	30·04	29·82	56	34	40	53	36	46	50	s.	w.	sse.	se.	......	......	......	·01
27.	30·341	30·331	29·88	29·90	30·11	29·73	29·99	57	47	49	55½	51½	52½	50	s.	s.	w.	wsw.	·22	......	......	·18
28.	30·315	30·273	29·85	30·19	30·10	30·10	29·98	57	43	51	53	41	50	51	sw.	calm	w.	calm	......	·15	......	·01
29.	30·207	30·167	29·73	29·97	30·04	29·89	29·84	62	38	53·5	55	40½	49½	46	sw.	calm	w.	w.	......	·03	......	·07
☾ 30.	30·282	30·106	29·77	30·04	29·70	29·84	29·78	58	48	46	53	42	47½	45	s.	sw.	s.	wnw.	......	·03	......	·30
31.	30·239	30·085	29·57	29·88	29·99	30·03	30·08	61	51	56	54½	48	45	44	sw.	sw.	ne.	se.	......	·05	1·40	·38
Mean.	29·969	29·857	29·48	29·760	29·753	29·812	29·797	60·58	43·71	51·0	54·7	45·0	48·91	47·45					1·76	2·52	5·09	4·70

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Jan. 1853.