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PREFACE.

In bringing to a conclusion the thirty-sixth number of the new series of the Magazine of Natural History, the Editor has little to offer by way of preface to the third volume. The condition of the journal as it respects its stability, is much the same as at the close of 1838; and its conductor has only to repeat the determination which he then expressed, of not relinquishing his post, unlesss some unforeseen circumstances, or a diminution of that support hitherto tendered him by the contributors, should leave him no alternative but the adoption of that measure.

In some respects, every additional year that the present series of the Magazine stands its ground, it may be said to gather strength; and considering the large and increasing number of the cultivators of science, who have made its pages a medium for recording their observations in the different branches of Natural History, and the prospective reduction in the present rates of postage, which have hitherto pressed most heavily upon scientific periodicals, the Editor still looks to the future with sanguine anticipations.

A large number of wood-cuts illustrate the present volume; and the supplementary plates, a feature in the work, the introduction of which was attended with some little anxiety on the part of the Editor, have been extremely well received by the Subscribers.*

103, *Great Russell Street, Bloomsbury.*
Nov. 26th, 1839.

* So far as the circulation of the second number of the supplementary plates can be at present ascertained, it would seem that not more than five or six of the subscribers have declined them.

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THE MAGAZINE

OF

NATURAL HISTORY.

JANUARY, 1839.

ART. I.—*Observations upon the Fossil Jaws from the Oolitic Beds at Stonesfield, named* Didelphis Prevostii *and* Did. Bucklandii.—By M. A. VALENCIENNES.[1]

THE fossil bones of very small vertebrated animals discovered in the oolitic beds of calcareous schist at Stonesfield, have acquired great notoriety among geologists, in consequence of the opinion formed respecting them by M. Cuvier, upon a first inspection.

It will be remembered that upon examining the rather mutilated half jaw in the Oxford Museum, shown to him by Professor Buckland, Cuvier recognised the characters of a mammal, which he pronounced to be of the order *Marsupialia.*

In no other way can we explain why Cuvier applied to them the name of *Didelphis.* His ideas respecting them appear to convey precisely this meaning; not only in the note at page 359 of the second part of vol. v. of his 'Ossements Fossiles,' but in the expressions which he uses in the text of the same page. While enumerating the endless variety of fossils found in the Stonesfield slate, he says, " and even, as I am assured, two fragments of jaws, which, judging from a hasty inspection made when at Oxford in 1818, seemed to me to belong to some *Didelphis.*"

The extract from his note is as follows.—" It [the drawing] confirms me in the idea which a first inspection had given me: it is the jaw of a very small *carnassier*, the grinders of which very much resemble those of the opossums;

[1] 'Comptes Rendus,' Sept., 1838, p. 572.

but there are ten in a series, a number found in no other *carnassier* with which we are acquainted."

It is impossible to doubt that the expressions "*quelque Didelphe*" and "*celles des Sarigues*" must have been employed to intimate that the fossil animal was a pouched mammal,—in other words that it belonged to the order *Marsupialia*, Geoffroy, and undoubtedly closely related to the didelphs.—His remark upon the number of molars also shows that he believed even then that this mammal, when farther studied, would be regarded as a distinct genus.

At any rate, however, this opinion confers great importance on this small relic of a jaw, not more than nine or ten lines in length, because it indicates the presence of terrestrial mammals in rocks of more ancient deposition than the chalk.

Cuvier having never had these fossil jaws in his own cabinet,—having been unable to compare them with the skeletons of existing species which were brought together in his extensive collection of comparative anatomy, but merely having received the drawing, made by M. Constant Prevost, of the jaw in the Oxford Museum, and also that of a larger but less perfect one, preserved in the Museum of the Rev. C. Sykes,—did not treat of these remains in a special memoir, in which he might have endeavoured to establish their relations with other vertebrated animals.

From this time, geologists, confiding in the authority and judgment of the great anatomist, have cited the Stonesfield *Didelphis* as an exception to the generally-received law, that fossil mammals are not to be met with in the beds belonging to the secondary period; more recently, however, doubts have been raised by naturalists and anatomists, concerning this determination.

It has been made known that these remains of *Vertebrata* were regarded as having belonged to the class *Reptilia:* this opinion is said to have originated with Professor Grant, in the German translation of Dr. Buckland's Bridgewater Treatise, by M. Agassiz.

If this new determination could have been applied without contradiction to the half jaw examined by Cuvier, it would have had the advantage of restoring to the order of hitherto-observed phenomena, the nature of the animals from the Stonesfield beds; but M. de Blainville has again rendered the opinion uncertain, in the elaborate memoir lately read by him before the Academy, and published in the eighth number of the 'Comptes Rendus' for 1838,[2] under the title of

[2] For a translation of M. de Blainville's Memoir, see 'Mag. Nat. Hist.' 1838, p. 639.—*Ed.*

"Doubts concerning the supposed fossil *Didelphis* from Stonesfield, &c."

This celebrated anatomist having had at his disposal only the drawings of these interesting fossils, which are more or less faithful representations, has nevertheless, with his usual precise method of comparison, scrutinised the different parts of these jaws; he has put forward in succession all the difficulties to be overcome; and placed us in possession of the doubts which the previous opinions had left in his mind: and finishes by coming to this conclusion.

First.—That it is not probable that the two solitary fossil fragments from Stonesfield can belong to a mammal of the genus *Didelphis*, or to a *carnassier* allied to the *Insectivora*.

Secondly.—That if we ought to regard them as belonging to the class of mammals, their molar dentition would bring them nearer to the family of the seals than to any other.

Thirdly.—That it is more probable that they should be referred to a genus of the sub-order of saurians.

Fourthly.—That in the present state of the case he proposes to distinguish them under a distinct generic name,—that of *Amphitherium*.

We thus perceive that this distinguished professor of comparative anatomy is inclined to regard these vertebrated animals as more nearly allied to the *Reptilia* than to any other class; and he cites, in support of his conjectures, the opinion of M. Agassiz, whom he believes to entertain the same views of the matter as himself.

I ought here to observe that the note extracted from a letter of M. Agassiz which is placed at the head of No. 10 of the 'Comptes Rendus de l'Academy,' seems in favour of this opinion, since it says,—"M. Agassiz, on the occasion of a recent communication from M. de Blainville, writes word that subsequently to the year 1835, he has expressed, in Bronn and Leonhard's Journal, (p. 186, *anno* 1835), an opinion perfectly agreeing with that of M. de Blainville concerning the supposed *Didelphis*." In referring however to this quotation I find that in this note M. Agassiz establishes, in a very clear manner, the opinion that the Stonesfield animals are undoubtedly mammals, but that their affinity with the marsupials does not appear to him to be so certain;—that their teeth resemble more those of the *Insectivora*, and also have some resemblance to those of the seals.

The object of M. Agassiz therefore in this note, is to show that these bones are those of a mammal, which he considers rather as belonging to the order *Insectivora* than to any other.

M. de Blainville concludes his task by an invitation for fresh observations, which may furnish new elements to the argument, for or against the opinion hitherto admitted.

The memoir of M. de Blainville proves, that if he had had the advantage of examining the fragments themselves, he would have left no doubt upon the subject.

Having myself been more fortunate, I hastened in some sort, to reply to the appeal which he made, in the name of the Academy, and it is this which has determined me to request to-day, permission to read the memoir which I now submit to your approval.

Dr. Buckland has just brought over, among other very valuable geological specimens, the two jaws found in the schist at Stonesfield, and preserved in the Oxford Museum. He very willingly entrusted them to me during his stay at Paris, and allowed me to have models of them taken, which I have presented to the Academy. I have compared the originals with the different mammals and reptiles in the cabinet of the *Jardin des Plantes*, and I believe that I have arrived, by this comparison, at a confirmation of the justice of Cuvier's opinion.

One of the two jaws submitted to my examination is the very one which Cuvier for a short time inspected; the *Didelphis Prevostii*. The other, subsequently discovered, is of the same species as that described and figured by Mr. Broderip, his *Didelphis Bucklandii*.

Another jaw, which I believe to be of this latter species, makes a part of Mr. Sykes's collection. It is this specimen which Messrs. Phillips and Lyell allude to when speaking of the fossils in their works.

This specimen, which I am able to refer to, from the drawing sent by Mr. Phillips to M. Cuvier, and which M. Laurillard has had the goodness to lend me, is less complete than the two others, for the angle is wanting, as well as the condyle, and the largest part of the ascending *ramus*; the latter however has left its impression upon the stone, which serves as a matrix.

This proves that we now have four of these jaws belonging to two distinct species of vertebrated animals; and so far I perfectly agree with M. Agassiz, who appears to have seen a fifth, and who remarks, it is singular that we have never yet discovered any bone belonging to any other part of the skeleton.

The jaw first known has been so fully described by M. C. Prevost, in his memoir upon the Stonesfield fossils, that it will be needless to recapitulate here any details of its general form.

I have observed however, in the bone itself, that the molar teeth, which are, as you are aware, ten in number, are all pressed closely one against another; that the five or six anterior teeth have two visible roots; a triangular and pointed crown, with a little "talon" on each side, the anterior being more acute, the posterior more obtuse; that these latter, when their outer side is shown, present a crown terminating in two nearly equal conical points, with a little "talon" behind.

The second piece of jaw is a horizontal left *ramus*, with its inner side visible. This fragment, which is curved like the jaw of the *Did. murina* has a high coronoid process, enlarged, rounded, and bent a little backward. The condyle, which is very distinctly seen, is placed a little above the dental line. The angle of the jaw is prolonged into a "*languette mience*," making an obtuse angle with the inferior line and the horizontal *ramus*. One thing very important to point out, because it is a fact not previously verified, is, that this *ramus* shows the opening of the dental canal, which is a small circular *foramen*, pierced a little forwarder than that of the *D. murina*. The *symphysis* is entire and distinctly apparent. It has a rough, oval, oblong surface, which equals in width a quarter of the jaw, and which is obliquely truncated inferiorly, as we observe in the *Mammalia*.

The teeth remaining upon the dental arch, are three anterior grinders, exactly in their right place; they are shaped like those left in the other fossil jaw; that is to say, they are compressed, triangular, and with two small "talons" on each side. At the base of the ascending *ramus* we observe a posterior, imperfect molar tooth, out of its place, and displaying two very distinct pointed tubercles. There is upon the matrix and in front of the three teeth, an impression which appears to have been caused by a fallen tooth. By measuring with a pair of compasses the void space comprised between the base of the ascending *ramus*, and the teeth which are still in their places, and also that occupied by the same three teeth, it is easy to convince ourselves that the interval ought to be occupied by five teeth; which brings the total number of the grinders to ten, as in the other jaw.

The anatomists who are my auditors, will be able to perceive from what I have just observed of the presence of the condyle, of the form of the teeth, of the aspect of the ascending *ramus* and of the *symphysis*, the opening of the dental canal, and the prolongation of the angle of the jaw into an *apophysis* which is slender and compressed into the form of a tongue,—that the animal which exhibits these characters is a *Mammal*. But that which will complete the description and remove all doubts, is, that this jaw, like that of the *Didelphis Prevostii*, is formed of a single bone; while in the saurians, it is well known that each half is formed of five osseous pieces.

The inductions which have been drawn from the lobulated character of the teeth in these animals, appear to me to prove that this configuration has been greatly exaggerated. Let us only examine the false molars of a carnivorous animal, a panther for instance—and we perceive that they are also formed of a middle tubercle, compressed and triangular, having on each side a little "talon" or tubercle. There is nothing more in the teeth of the Stonesfield fossil. This sort of palmated appearance is not at all similar to the flattened and triangular teeth of some of the saurians, which have, as in the *Iguanas*, their edges notched in very fine regular indentations.

This comparison leads me back to the osseous fragment possessed by Mr. Sykes. This jaw, belonging to the right side, has its external surface visible; its ascending *ramus* and symphysary portion are wanting. We perceive in it nine distinct teeth, and the socket for a tenth. The artist, who was not an anatomist, has represented the teeth as with crowns divided into lobes, to the number of five, and forming a sort of "*rosace*", which never exists either in the *Mammalia* or *Reptilia*. It appears to me that these organs have not been properly detached from their matrix, and that persons have been led into error as to the palmated division of these teeth.

Having thus given the reasons which prove to me that the animal to which the fossil jaws discussed in this memoir have belonged, must have been a mammal, let us examine to what order it ought to be referred.

I apprehend that what has led us from the truth has been the comparison made between these fossil animals and the common opossum (*Didelphis Virginiana*). We see, in fact, in this animal, that the second false molar is much higher than those next to it, and that it differs from them. But let us take, as a point of comparison, the *D. murina*, which is a small didelph of about the same size; and we shall find the resemblance more striking, and shall no longer wonder at the affinity indicated by M. Cuvier. In this animal the false molars are of the same height, and are equally pressed one against another; they are, like nearly all the false molars of the true *carnassiers*, triangular, and have on each side a small supplementary tubercle. The posterior molars, like those of the fossil which I have in view, have two points, succeeded by a small "talon," upon the outer edge, and three conical and pointed tubercles upon the inner edge. Those specimens of this fossil which are completely disengaged from their matrix probably exhibit a similar conformation of their molar teeth; for M. Agassiz says in his note, that the grinders have five points, disposed like those of the *Insectivora*. The curve of the horizontal *ramus* of the *Didelphis Bucklandii*, and the form and direction of the ascending one, present a perfect agreement with that of the *D. murina;* the differences consist in the fossil having the condyle less elevated, the tongue-shaped process of the angle more external, and the opening of the dental canal more anterior.

The *Didelphis Prevostii* has the *ramus* of the jaw straighter, but the form of its molars, and the great number of these teeth, bring it nearer to the didelphs than to any other marsupial animal.

If we compare the fossil animal with the *Insectivora*, we perceive in the latter the coronoid process carried more forward, and separated from the condyle by a deeper space; the angular process of the jaw is shorter, forming a less obtuse angle with the horizontal *ramus;* the commencement of the horizontal *ramus* is more convex, the rest of the bone straighter, and the number of teeth always less.

Nevertheless, if we admit that the fossil animal is of the order of *Marsupialia*, we must not wonder at the resemblance which may exist between it and the *Insectivora*, for we know that the pouched animals form a kind of sub-class, as Cuvier says, of which the series is parallel with that of the placental *Mammalia;* and we can thus distinguish insectivorous marsupials, carnivorous marsupials, and rodent marsupials; &c. But the animals of this order [*Marsupialia*] are the only the *Cetacea* excepted, which are furnished with so large a number of teeth.

It was also thought that this fossil animal might be referred to the family of the seals, on account of the subdivision of the teeth into lobules. I shall first observe, that in the *Phocæ* properly so called, the common seal is the only one which has five tubercles upon the dental crown;—that the others have only three;—and that in the *Phoca cristata* there even appears to be nothing more than a simple, blunt, conical crown, furrowed upon its surface, and without any supplementary tubercles.

Thus, a lobulated form of tooth cannot be looked upon as a constant characteristic of the seals, and consequently is not a distinction of importance. But it must be observed that among the *Amphibia* the angle of the jaw is not produced into the tongue-shaped process which exists among the *car-*

nassiers and the carnivorous marsupials. In the common seal we find a simple tubercle at the maxillary angle; in the *Phoca cristata* this process is more obtuse; and in the *Phoca leptonyx*, de Blainville, it is quite obsolete.

We see indeed that this process re-appears and becomes a character of more importance in the genus *Otaria*, in which it constitutes a strong, trihedral projection, obtuse, and prolonged into a prominent ridge below the jaw. But there is one characteristic mark in the species of this genus, which quite removes all affinity to the fossil jaw;—their molar teeth have but a single root.

Thus the supposed *Didelphis* does not appear to be referable to the family of the seals.

As we never see this angular process disappear in the *carnassiers*, I think we may therefore conclude that the fossil bones found at Stonesfield belong to a terrestrial carnivorous mammal; and on account of the great number of its teeth, that it is more closely related to the didelphs than to any other known mammiferous animal.

The present investigation furnishes a fresh proof that the attentive study of even the smallest parts of organic structure leads to very curious general results, since they become characters, the importance of which we did not in the least anticipate.

The prolonged tongue-shaped process is absent in man, in the *Quadrumana*, and in the frugivorous bats, animals in which the articulation of the jaw does not require that fixedness which is a necessary condition in the existence of the *carnassiers*. This process in the last furnishes a strong insertion for the ligaments or sets of muscles which regulate the lateral movements of the jaw; when it closes, they fix it in its articulation, and produce that action of the teeth necessary for the proper mastication of the food. This process is obsolete, or nearly so, in those seals which are placed in the order *carnassiers*, because these seize their prey in the water, and transfix it with their pointed teeth rather than masticate it, and do not therefore require so much fixedness of articulation.

If we observe it to become projecting among the *Otariæ*, it is easy to account for this by a simple examination of their slightly pointed teeth, inserted obliquely and across the dental arch, and which would have been less fitted for retaining living prey, if the lower jaw had been capable of making a lateral movement below the upper one.

Were I not afraid of wandering from my subject, it would be easy for me to demonstrate that the prolongation of the angle of the jaw is just as well adapted in the *Rodentia* for the action of their teeth.

Thus the form of this process, and that of the teeth and of the condyle, are always combined in such a manner that the study of these parts becomes of very great importance in ascertaining the natural relations of animals.

I think, therefore, to return to our subject, that the bones from the Stonesfield slate, published under the names of *Didelphis Prevostii* and *Did. Bucklandii*, have belonged to mammiferous animals, very nearly approaching the didelphs, but of a distinct genus.

Not having had the advantage of inspecting the portion of a jaw preserved at "l'Ecole des Mines," I have been unable to treat of that fossil in this memoir.

M. Agassiz, who regarded these animals as of an ambiguous nature among *Vertebrata*, has proposed for a generic name that of *Amphigonus*.

M. de Blainville, adopting the same views, without being aware of the name proposed by M. Agassiz, which is not cited in his note in Bronn and Leonhard's Journal, has proposed that of *Amphitherium* or *Heterotherium*. As in all that we can deduce from a study of the portions of jaws submitted to our examination, I see nothing which indicates an ambiguous or heterogeneous nature,—and as the names proposed by these naturalists express doubts which in my opinion no longer have any foundation, I think it would be advisable now to apply a more significant appellation. I do not think that sufficient time has elapsed for the ill consequences to arise which generally follow changes of names in Natural History, because those which I propose to replace by others have not yet been adopted by systematic writers, and consequently have not yet received the sanction of naturalists in general. The name of *Thylacotherium* appears to me a preferable one.

If we call to mind the figure of the fossil jaw published by Mr. Broderip, which is taken from a fragment that I have not examined, the new genus of fossil *Mammalia* will have the following characters, taken from the examination of the lower jaw only.

Eight incisor teeth, two canines, and ten molars, with five or six false anterior ones; the hinder teeth presenting a summit consisting of five tubercles, three internal and two external, the latter succeeded by a small "talon."

The two species referable to this genus, are—

Thylacotherium Prevostii, (*Didelphis Prevostii*, Cuvier), having its horizontal *ramus* some what straightened; its depth about the fourth part of its length. And—

Thylacotherium Bucklandii, (*Didelphis Bucklandii*, Broderip), having its horizontal *ramus* narrower and more curved.

Such are the zoological characters at present known of this genus of fossil *Mammalia*.

Art. II.—*Notice of Undescribed Zoophytes from the Yorkshire Chalk.* By John Edward Lee, Esq.

Professor Phillips, in his "Illustrations of the Geology of the Yorkshire Coast," has observed, that "the interesting remains of *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 enclosed in flint, allow their organization to be studied with the greatest advantage."

This locality however, does not seem to have attracted the attention it deserves: the chalk cliffs from Sewerby to the Danes' Dyke on the south of Flamborough Head abound in *Zoophytes*, and a diligent collector will not be long in obtaining an extensive suite of specimens; the chalk is of such a nature as to admit of being easily worked, so that the fossils may be cleared without much difficulty, and their characters properly exposed. The labour however has only commenced: the varieties in form, and the gradations from one to another, are almost endless, and the difficulty in determining species is so great, that it almost operates as a bar to the study of these remains; still as every additional fact respecting them must be of some value, where so little comparatively is known, I shall endeavour to give a description of several species which appear to me to be new; and should it afterwards prove that I have been mistaken, they can then be referred to their proper situations.—Two of the species described seem to be *Siphoniæ*; four, or perhaps five, may for the present be considered as sponges, and one seems to be a *Udotea*.

It is a curious fact, that though the locality from which these fossils were obtained, is extremely rich in *Zoophytes*, yet the rest of the Yorkshire chalk is comparatively barren: this is particularly the case with the southern part of the range; I have sought almost in vain, for any specimens worthy of preservation, in the numerous chalk pits from Market Weighton to Hessle.

The kind most abundant near Bridlington is the *Spongia radiciformis* of Phillips; numbers of this species lie in all directions in the cliff below Sewerby, both parallel with, and across the direction of the strata: many specimens appear to have been a good deal worn *before* they were imbedded, while others, particularly of the cup-shaped form, are perfect, even to the finest fibres of the root. In some cases these latter have disappeared, but are yet shown very beautifully by the hollows in the chalk they once filled, being coloured with ochreous matter.

I have never yet observed the root of any sponge attached to any of the other fossil bodies which are found in the chalk; this fact appears singular, since the fine fibres of the root are in many cases perfectly preserved: about two years ago however, I obtained a specimen of a variety of *Spongia radiciformis*, (or perhaps a new species), in which the short thick fibres of the root appear attached to the head of another individual of the same species.

The variety in outward form has been already referred to; the internal structure also exhibits very great irregularity of character: for instance, it has been generally believed that the root-shaped sponges had a central cylindrical cavity, extending downwards to the stem: the annexed diagram (*fig.* 1.)

1

shows however that this character is not constant: it is a magnified representation of the section of one of these fossil bodies. The specimen, when obtained, was broken in two or three places; in the lower part of the stem there was a simple circular perforation, but about an inch higher this cavity had assumed a quadrangular appearance, and other circular canals were visible on each side, two of which were of much larger size than the others. At first sight, it appeared to connect the *Siphoniæ* with the *Choanites* of Mantell, and being very anxious to obtain further specimens, I examined with great care the neighbourhood of the spot where this fossil was procured: from that day to this however, I have never been able to find another instance of such a conformation, and at length I have come to the conclusion, that these characters must be considered as merely accidental.

The young *Spongiæ* are very abundant along the whole face of the cliff: a great variety of globular specimens may be obtained, from the size of a small pea to that of a common nut; the form then becomes rather conical, and there are often appearances of a process of attachment.—As they increase in size the specific characters gradually develope themselves; but the young specimens as well as the old, are subject to great variety in character.

Some of the cup-shaped sponges attain a large size; I have one which measures 12 inches in diameter.

Many specimens in my possession exhibit characters which apparently indicate new species, besides those about to be described. I have however thought it best only to give an account of such as are sufficiently perfect to afford a distinct idea of the character.

SIPHONIA.

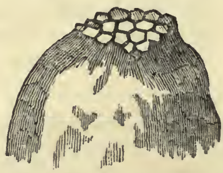
1. *Siph. clava.*—Club-shaped; gradually increasing in size till very near the crown: the larger canals, after spreading widely in the substance of the body, are crowded together at the top, presenting a pentagonal, or hexagonal appearance. *Fig.* 2.

The shape of this species is very regular, as will be seen from the annexed figure, (*fig.* 2.); the original is seven inches in length: the stem is pierced by a single canal, for about an inch and a half from the bottom: about an inch higher, four or five principal canals, and several smaller ones shew themselves; the subjoined sketch, (*fig.* 3.) drawn of the natural size, will give some idea of the appearance: still higher, the canals increase in number, and are considerably spread in the body of the fossil.

2

3

4



At the crown there seems to be a still greater number, and they are so crowded, as almost to represent a honeycomb; figure 4, which is drawn of the natural size from a specimen a little ground down at the top, will give some idea of this arrangement.

In specimens which have been rolled on the beach, and which are consequently without the external covering, the whole surface appears studded with minute pores; these are the orifices of small radiating tubes, which communicate with the larger canals.

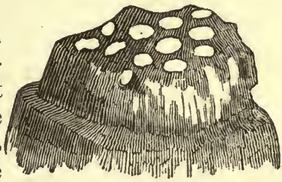
This species does not appear to be very rare.

2. *Siph. anguilla.*—Elongated, cylindrical, nearly of an equal size throughout; length equal to eight or more times the breadth; larger canals not crowded at the summit. *Fig.* 5.

5

Fig. 5. which is reduced from a specimen thirteen inches in length, will shew the general form of this species: the bottom is pierced by a single canal, which about an inch and a half higher, appears divided into eight or ten: this number is not materially encreased at the top, where the canals are scattered over the surface, and not crowded together as in the last species: the annexed figure, (*fig.* 6.) which is of the natural size, shows the appearance of the summit: it will be seen, that the highest part is of a less size than the rest of the fossil, and forms a sort of crown. The specimen figured is considerably compressed, so that in the sketch it appears broader in proportion to its length than it would have done had it been of its natural form.

6

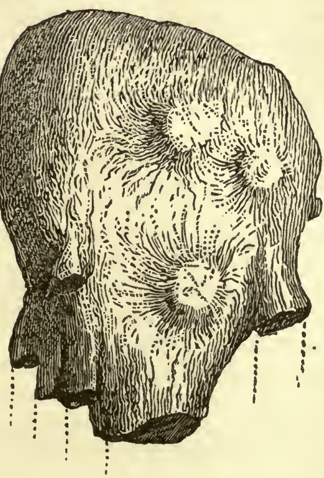


This species is rare: besides the specimen from which the above description was taken, I have only met with two or three fragments.

SPONGIA.

1. *Sp. catablastes.*—Inversely conical, with a considerable depression at the crown: from ten to fifteen arms projecting downwards from the lower part of the body. *Fig.* 7.

7



Of this beautiful fossil, (*fig.* 7.), only one specimen has hitherto been discovered: but as the characters are very well marked, it will not, I hope, be thought premature, to consider it a new species. Nothing can be said respecting the length of the stem, as it had unfortunately been lost when the specimen was taken from the face of the cliff: the whole body is covered with irregular depressions, which on the superior surface, and in the neighburhood of the side arms, take a flexuous appearance: neither the stem, nor the side arms appear to have had any central perforation. The original is nearly six inches in length.

2. *Sp. fastigiata.*—The lower part funnel-shaped, inflated; the upper part a cone, rising from a slight depression. *Fig.* 8.

8

This fossil is not by any means common; I have only seen two specimens, of which the most perfect is represented in the annexed sketch. (*fig.* 8.) The inferior part is surrounded by depressed undulated lines, some of which take a diagonal direction: the terminating cone is small, and not by any means proportionate to the inflated appearance of the lower part: the central cavity appears to be very small indeed.

The figure is about one half the natural size.

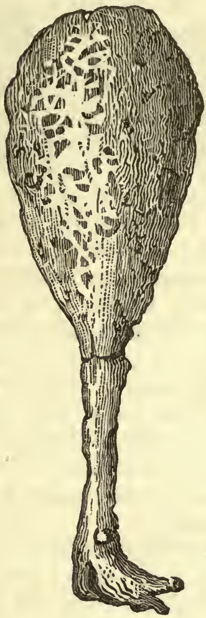
3. *Sp. sepiaformis.*—Irregularly funnel-shaped: marked externally with a few scattered elevated orifices; from eight to ten arms, rising upwards from the superior edge: one or more additional branches arising from the same root. *Fig.* 9.

9

This beautiful species appears to be extremely rare: besides the specimen represented by the figure, (*fig.* 9.) I have only met with two or three fragments, which still were sufficient to convince me that the above characters were not accidental: the length of the fossil from the root to the extremity of what remains of the longest arm, is about eight inches: there is an appearance of one small side arm, thrown off downwards, but most probably this is not a constant character: the root does not appear to have been very fibrous.

4. *Sp. ampulla.*—Bladder-shaped, covered with irregular depressions; stem equal to the body in length; fibres of the root short and thick; central cavity cylindrical, half the depth of the body. *Fig.* 10.

10



This species is not so rare as the preceding, but is seldom met with in such complete preservation as the specimen figured, (*fig.* 10.); the greater number of those which have been found, are compressed and distorted. Two or three weathered specimens in my possession show very clearly that the central cavity is in the shape of a short, thick cylinder, suddenly terminating about the middle of the body: the length of the specimen is about nine inches and a half.

5. *Sp. spinosa.*—Globular, unattached, covered partly with oval notched plates, overlying each other, partly rough, covered with irregular depressions: armed with from eighteen to twenty spines: internal structure fibrous, radiating from a point in the circumference. Spines varying much in size, hollow, covered with an appearance of pointed scales overlying one another. *Fig.* 11.

This most singular fossil has I believe, only been found in two localities; one of which is the cliff about a hundred yards west of the Danes' Dyke, and the other a quarry north of Marton, probably where the same bed appears on the surface. It is rare; I only know of five specimens, of which one was found by my friend Mr. W. H. Dykes, and is now in the Museum of the Hull Literary and Philosophical Society. I have indeed heard of a fossil in the collection of Mr. Bowerbank, which from the account given to me by Mr. Charlesworth, may probably be the same species, but I have never been fortunate enough to obtain a sight of it.

The general appearance, when most perfect, is that of a small *Cidaris*, with the spines attached: when imperfect, it would probably be taken for one of the small globular sponges, so common in the chalk near Bridlington, which may perhaps account for its not havin g been before noticed.

11

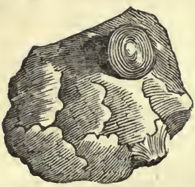
12

13

The annexed (*fig.* 11.) will give some idea of its general form. The specimen drawn (*fig.* 12.) is one which was found on the scar, and having been water-worn and weathered, shows the internal structure; the figure, which is a little magnified, displays the fibrous structure rather more plainly than is seen by the naked eye, but when a lens is applied, the radiating structure becomes very apparent. The structure of the spines is very singular; at the base, they seem composed of an aggregation of little spiculæ, which afterwards are so arranged as to give the appearance of a series of furrowed, pointed scales. *Fig.* 13. represents the lower part of one of the spines very higly magnified.

The covering of the body is of a peculiar character; in some places it appears similar to that of many other sponges, marked with indefinite depressions; in others, there are very decided oval notched or jagged plates, most of which overlie one another; this arrangement is generally seen most distinctly in the neighbourhood of the spines. *Fig.* 14 represents a portion of the covering very highly magnified. From the singularity of this appearance, the animal might almost be supposed to belong to a very different class from that of the sponges, and the associated genera; so at least it appeared to me, till, being anxious to see more of the internal structure, I had the specimen cut through, just below the plates figured in the last diagram: an irregular fibrous structure then became visible, similar to that shewn in (*fig.* 12.) with the exception of the radiated appearance: this difference however may be accounted for by its being a cross section. Under these circumstances, as the spongy structure appears to be constant, while the plated appearance is not so, I have placed it amongst the sponges till it shall have been examined, and its place assigned by some more experienced naturalist.

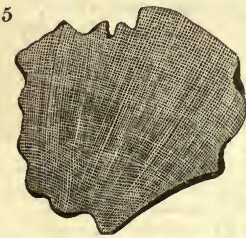
14



UDOTEA.

1. *Ud. cancellata.*—Form simple, not lobed, marked with numerous parallel lines, which are crossed by others equally strong, as well as by several concentric undulations.

15



The imperfect specimen figured is the only one which I have seen, so that its characters cannot be very correctly defined.

The annexed sketch (*fig.* 15.) will give a general idea of its appearance, though it does not mark the undulations so well as could be wished; it is drawn of the natural size.

It was found in the same locality as the other specimens.

Hull, Nov. 15*th*, 1838.

ART. III.—*Observations on the Lamellicorns of Olivier.* By THE REV. F. W. HOPE, F.R.S., F.L.S., F.Z.S., &c.

GENUS.	SPECIES.	COUNTRY.	ARRANGEMENT OF AUTHORS
MELOLONTHA.	1 *fullo.*	England.	*Melolontha*, Fabricius.
	2 *alba.*	Siberia.	*Lepidiota*, Kirby.
	3 *Commersonii*	Madagascar.	————
	4 *serrata.*	C. of Good Hope	*Holotrichia*, Kirby.
	5 *vulgaris.*	England.	*Melolontha*, Fabricius.
	6 *villosa.*	Germany.	*Anoxia*, Laporte.
	7 *occidentalis.*	South of France.	————
	8 *candida.*	East Indies.	*Lepidiota*, Kirby.
	9 *alopex.*	C. of Good Hope	*Cephalotrichia*, Kirby.
	10 *solstitialis.*	France.	*Rhisotrogus*, Latreille.
	11 *æstiva.*	Paris.	————
	12 *pini*	Provence.	*Microdonta*, Kirby.
	13 *fusca.*	Italy.	*Rhisotrogus*, Latreille.
	14 *oblonga.*	Paris.	*Anomala*, Megerle.
	15 *cornuta*	Calabria.	*Pachypus*, Latreille.
	16 *glauca*	Brazils.	*Pelidnota*, MacLeay.
	17 *lanigera*	North America.	*Areoda*, Leach.
	18 *punctata*	Virginia.	*Pelidnota*, MacLeay.
	19 *lutea*	North America.	————?
	20 *elongata*	Pennsylvania.	*Genus novum*
	21 *fervida*	North America.	*Holotrichia*, Kirby.
	22 *reflexa*	Senegal.	————
	23 *plebeia*	Senegal.	*Anomala*, Megerle.
	24 *pallida*	C. of Good Hope	————
	25 *unicolor*	Senegal.	————
	26 *ruficollis*	Coromandel.	*Anomala ?*
	27 *rustica*	Guadaloupe.	Unknown.
	28 *atriplicis*	Barbary.	*Hoplopus*, Laporte.
	29 *signata*	Jamaica.	*Cyclocephala*, Latreille

GENUS.	SPECIES.	COUNTRY.	ARRANGEMENT OF AUTHORS.
MELOLONTHA.	30 *immaculata*	Guadaloupe	*Cyclocephala*, Latreille.
	31 *viridis*	China	*Euchlora*, MacLeay.
	32 *Leii*	East Indies	*Mimela*, Kirby.
	33 *bicolor*	Java	*Euchlora*, MacLeay.
	34 *suturalis*	New Holland	*Stethaspis*, Hope.
	35 *dubia*	Cayenne	*Chalepus*, MacLeay.
	36 *angulata*	Brazils?	*Bolax*, Fischer?
	37 *bimaculata*	China	*Adoretus*, Escholtz.
	38 *dorcyi*	St. Domingo	*Rutela*, Latreille.
	39 *vitis*	England	*Anomala*, Megerle.
	40 *Frischii*	Holland	
	41 *femoralis*	East Indies	*Adoretus*, Escholtz.
	42 *cærulea*	C. Good Hope	?*Popillia*, Leach.
	43 *cærulocephala*	East Indies?	——— ? ———
	44 *bipunctata*	C. Good Hope	——— ———
	45 *maura*	Barbary	*Glaphyrus*, Latreille.
	46 *glacialis*	Terre de Feu	*Macrosoma*, Hope.
	47 *testacea*	Ditto	——— ———
	48 *striata*	Ditto	——— ———
	49 *globator*	C. Good Hope	*Genus novum.*
	50 *rauca*	Coromandel	*Apogonia*, Kirby.
	51 *erythrocephala*	East Indies?	——— ———
	52 *melanocephala*	Cayenne	*Cyclocephala*, Laporte.
	53 *obscura*	Equin. Africa	*Adoretus*, Escholtz.
	54 *rufa*	C. Good Hope	*Genus novum.*
	55 *brunnea*	England	*Serica*, MacLeay.
	56 *ferruginea*	East Indies	*Apogonia*, Kirby.
	57 *pubescens*	Coromandel	
	58 *errans*	North America	*Anomala*, Megerle.
	59 *innuba*	South America	
	60 *nitidula*	Cayenne	*Bolax*? Fischer.
	61 *picea*	C. Good Hope	*Trochala*, Laporte.
	62 *festiva*	New Zealand	*Calonota*, Hope.
	63 *læta*	Ditto	——— ———
	64 *aulica*	Equin. Africa	*Genus novum.*
	65 *splendida*	C. Good Hope	*Serica*, MacLeay.
	66 *lineata*	Sierra Leone	*Trochala*, Laporte.
	67 *gibba*	C. Good Hope	
	68 *versicolor*	Sierra Leone	
	69 *mutabilis*	Tranquebar	*Serica*, MacLeay.
	70 *variabilis*	North America	——— ———
	71 *ruricola*	England	
	72 *humeralis*	Paris	
	73 *Zebra*	C. Good Hope	*Stripsipher*, G. P.
	74 *vittatus*	East Indies	*Glaphyrus*, Latreille.
	75 { *vulpes, mas*	Siberia	*Amphicoma*, Latreille.
	76 { *hirta, fœm.*	Caucasus	
	77 *crinita*	C. Good Hope	*Anisonyx*, Latreille.
	78 *cinerea*	Ditto	
	79 *ursus*	Ditto	
	80 *lynx*	Ditto	
	81 *proboscidea*	East Indies	*Anisoplia*?
	82 *limbata*	C. Good Hope	*Agenius*, Serville.
	83 *praticola*	Siberia	*Hoplia*, Illiger.
	84 *agricola*	Germany	*Anisoplia*, Megerle.

GENUS.	SPECIES.	COUNTRY.	ARRANGEMENT OF AUTHORS.
MELOLONTHA.	85 *horticola*	England	*Anisoplia*, Megerle.
	86 *fruticola*	Germany	
	87 *arvicola*	Siberia	
	88 *regia*	Algiers	*Hoplia*, Illiger.
	89 *farinosa*	France	——— ——
	90 *squamosa*	Paris	
	91 *argentea*	England	
	92 *rupicola*	C. Good Hope	*Lepisia*, Serville.
	93 *sibirica*	Siberia	*Hoplia*, Illiger.
	94 *pulverulenta*	England	——— ——
	95 *floralis*	Provence	——— ——
	96 *marginata*	Guadaloupe	*Hoplia* ?
	97 *subspinosa*	Jamaica	*Macrodactylus*, Latreille
	98 *atomaria*	C. Good Hope	*Genus novum.*
	99 *crassipes*	Ditto	*Pachynema*, Serville.
	100 *spinipes*	Ditto	*Monochelus*, Illiger.
	101 *podagrica*	Ditto ?	——— ———
	102 *dentipes*	Ditto	*Dichelus*, Serville.
	103 *gonagra*	Ditto	——— ———
	104 *arthritica*	Ditto	*Monochelus*, Illiger.
	105 *abbreviata*	Ditto	*Lepitrix*, Serville.
	106 *longipes*	Ditto	*Dichelus*, Serville.
	107 *capicola*	Ditto	*Lepitrix*, Serville.
	108 *monticola*	New Holland	*Liparetra*, Kirby.
	109 *semistriata*	Surinam	*Cyclocephala* ?
	110 *varians*	C. Good Hope	*Anomala* ?
	111 *castanea*	Surinam	*Cyclocephala.*
	112 *hæmorrhoida-lis*	East Indies ?	*Mimela* ?
	113 *undata*	Surinam	*Rutela* ?
	114 *picipes*	Bengal ?	*Mimela* ?
	115 *æquinoctialis*	Hungary	*Rhisotrogus*, Latreille.
	116 *ignea*	South America	*Bolax* ? Fischer.
	117 *pagana*	Geneva	*Rhisotrogus*, Latreille.
	118 4-*punctata*	Spain	*Rhisotrogus* ? Latreille.
	119 *tibialis*	C. Good Hope	*Lepitrix* ?
	120 *alpina*	Geneva	*Rhisotrogus*, Latreille.
	121 12-*punctata*	Siberia	*Hoplia*, Illiger.

Genus 5. *MELOLONTHA.*

Sp. 2. *alba.* This is evidently the same insect as *Scarabæus Hololeucus* of Pallas; as the latter name was previously used by that author it ought to be retained I consider it as belonging to Mr. Kirby's genus *Lepidiota.* Le Comte de Castelneau, however, ranges it with true *Melolontha.*

Sp. 3. *Commersonii.* This insect appears to be the same species which Fabricius has published under the name of

Mel. rorida, to which he has given Sumatra as the native country. *Lepidiota Commersonii* was originally brought from the Island of Madagascar, by the celebrated botanist Commerson. Possessing insects from both of the above localities, and particularly a specimen named by Fabricius as *Mel. rorida*, I should have doubted their being identical had I not carefully examined them. It may be remarked, that *Lepidiota*, as a genus, is common to Asia and Africa, as well as some of the islands adjacent to the two continents.

Sp. 4. *serrata*. Now an *Holotrichia* of Kirby. For the generic details refer to Hope's Coleopterist's Manual, page 99. The species seem from what is known at present, to be peculiar to Asia; they will no doubt eventually be found in tropical Africa.

Sp. 6. *villosa*. This species, according to M. Laporte, belongs to his genus *Anoxia*. Vid. Hist. Nat. des Anim. (Articul.,) par Laporte de Castelnau, page 132; where the details are published. The following species belong to it, viz.: *Mel. orientalis*, Ziegler; *Mel. occidentalis*, Jab; and *matutinalis* and *africana* of Laporte.

Sp. 9. *alopex*. Now a *Cephalotrichia* of Kirby. It is probable that *Mel. brunnipennis* of Castelneau belongs to this genus. The *Platyonix* of Dr. Reich (since changed to the name of *Sibaris*, by Laporte,) seems closely allied to *Cephalotrichia*, differing chiefly in the form of the *clypeus*. The family name of *Sparmannia* has been suggested by the above writer to be given to these *Melolonthidæ*.

Sp. 10. *solstitialis*. Latreille gave this species as the type of his genus *Rhisotrogus*; the term *Amphimallon*, which included under it all the species having nine joints to the *antennæ*, he afterwards re-united to *Rhisotrogus*. Laporte however, still retains *Amphimallon*, and singularly enough considers *solstitialis* one of the species; while he gives *Mel. albus*, Jab., and *æstivus*, Olivier, as examples of *Rhisotrogus*. Such changing of types creates great confusion, and never should be attempted. The Latreillian name ought to be adopted, as originally used.

Sp. 12. *pini*. Now a *Microdonta* of Kirby; Vid. details in Hope's Coleopterist's Manual, part 1., p. 105. Various European species belong to it.

Sp. 14. *oblonga*. In the Manual I was induced, on reference to Illiger's Magazine, to consider the Fabrician insect named *oblonga*, as an *Anomala*. Olivier's *oblonga* appears to be more allied to *Rhisotrogus*. The reference to Schrank's Enum. Insect. Austrice, No. 27, and to Scopoli's Entom. Carniol, No. 19, lead to that conclusion

Sp. 15. *cornuta.* Latreille makes this insect the type of his genus *Pacyphus; Geotrupes excavatus*, Jab., is the same insect. The Baron Dejean, in his catalogue, gives it the name of *Calodera*, I retain however, the Latreillian term, being averse to changing names without there is an absolute necessity for so doing.

Sp. 16. *glauca.* This is now a *Pelidnota*, and is the *Scarabæus æruginosus* of the " Systema" of Linnæus. The latter specific name should therefore be used instead of the former.

Sp. 19. *lutea.* This insect is probably a *Pelidnota.* No locality is mentioned by Olivier.

Sp. 20. *elongata.* Evidently the type of a new genus; apparently this would be a *Philochlænea* of De Jean. As that genus is not, I believe, yet published, I do not adopt the name, but leave it for a future describer.

Sp. 23. *plebeia.* This insect according to the French cabinets is an *Anomala*, and I think most probably is the same species as *Anom. scutellaris* of De Jean.

Sp. 27. *rustica.* It is impossible to say to what genus this species is allied from the figure. I am inclined to doubt the locality of Guadaloupe.

Sp. 31. *viridis.* Now an *Euchlora* of MacLeay: the species are more numerous than in the allied genus *Mimela.* Olivier gives the Cape of Good Hope as its locality; it is an East Indian species.

Sp. 32. *Leii.* A *Mimela* of Kirby. For an account of the species see my monograph in the first volume of the 'Entomological Transactions,' p. 116. No locality is given by Olivier: all the known species are peculiar to the East Indies.

Sp. 33. *bicolor.* Olivier gives this insect as from the Cape, which is erroneous, as all the true *Euchloræ* belong to Java and the East Indian continent.

Sp. 34. *suturalis.* This insect I make the type of the genus *Stethaspis;* it is probably the *Xylonichus* of the French cabinets.

Sp. 35. *dubia.* Now a *Chalepus* of MacLeay: the same insect is named *geminatus* by Fabricius.

Sp. 36. *angulata.* No locality is given for this species by Olivier. It is evidently a *Bolax* of Comte Fischer de Waldeim, (vide 'Moscow Transactions' *in loco*), and most likely therefore inhabits Brazil.

Sp. 37. *bimaculata.* This insect was sent to me by Dr. Escholtz. The name of *Trigonostoma* has been given to it by the Baron Dejean; as that term is only found in the catalogues, without any published characters, I abandon it and adopt Escholtz' manuscript name of *Adoretus*, as the characters are detailed by M. Laporte in the 'Suite de Buffon (Articulés), vol. ii. p. 142.

Sp. 41. *femoralis*. An *Adoretus* of Escholtz, and the type of the genus, (according to a manuscript letter which I received from the author previous to his death), is *Melolontha compressa* of Weber. The species allied to it are chiefly from tropical Africa, Asia, and the Polynesian Isles. It has been reported in England and France that Dr. Escholtz died of cholera; this is erroneous, as he died of a bilious fever.

Sp. 42. *cærulea*. I consider this insect as a *Popillia;* it occurs in the East Indies, and not in Africa.

Sp. 43. *cæruleocephala*. Now a *Popillia*. In form it approaches the African more than the Asiatic species, its locality is probably the Cape of Good Hope. The reader is referred to Mr. Newman's monograph on this genus.[1]

Sp. 44. *bipunctata*. The type of the genus *Popillia*, Leach. No locality is mentioned by Olivier; it is from the Cape.

Sp. 45. *maura*. This insect is the same as *Melolontha cardui*, Fab., and is the type of Latreille's genus *Glaphyrus*.

Sp. 49. *globator*. This insect appears to afford sufficient characters for constituting a sub-genus: it is probably a *Schizonycha* of Dejean; as, however, the Baron has not published its generic details, I cannot adopt it. The form is not confined to Africa or Asia, it occurs alike in the old and new world.

Sp. 51. *rauca*. An *Apogonia* of Kirby. M. Laporte mentions two species from Africa, namely, *Ap. africana* and *pusilla*, from Senegal.

Sp. 54. *rufa*. I have not seen this insect in any collection but the Banksian: from the description and general appearance it cannot be ranged with any modern genus.

Sp. 58. *errans*. No locality is mentioned by Olivier: I have received it from M. Leconte, of the United States.

Sp. 59. *innuba*. This insect I have received from Rio Janeiro: its country is not mentioned in Olivier.

Sp. 60. *nitidula*. Entomologists must be careful not to confound *Mel. nitidula*, Fabr., (which is probably an *Anisoplia*), with *Mel. nitidula* of Olivier. The latter insect is probably a *Bolax* of Fischer.

Sp. 64. *aulica*. Olivier has properly changed the annexed

[1] The Monograph is unpublished; a synopsis of the new species is given in the 'Mag. Nat. Hist.' vol. ii. n. s. p. 336.—*Ed.*

name in his work to *aulica*, which Fabricius in his 'Systema Eleut.' had converted into *aulicola*.

Sp. 67. *gibba*. Now a *Trochala* of Laporte. Vide three new species of this genus described in the 'Suite de Buffon, Hist. Nat. (Articulés), par Laporte de Castelneau, p. 149, vol. ii.

Sp. 68. *versicolor*. In my 'Manual' I have given this species as a *Serica*, ML.; it may however belong to the genus *Trochalas*, Laporte.

Sp. 69. *variabilis*. The localities of North America and Germany are given to this insect: probably more than one species is included under the name.

Sp. 73. *Zebra*. This insect is the type of *Strepsipher*, G. P. No locality is mentioned by Fabricius; Olivier mentions South America as its country, which is erroneous: I have frequently received it from the Cape of Good Hope. *Cetonia vittata*, Fabr., is the *Mel. Zebra* of Olivier.

Sp. 74. *vittata*. Now a *Glaphyrus* of Latreille. I have lately received it from Persia.

Sp. 75 & 76. These insects are the different sexes of the same species; the former is the male and the latter the female of *Amphicoma vulpes*, Fabr.

Sp. 77. *crinita*. According to Olivier Fabricius cites (Pallas 'Ins. Siber.' *tab. a, fig.* 17), *Scarabæus bombyliformis*, as *Mel. crinita;* the former author thinks that the insect described by Pallas is distinct.

Sp. 81. *proboscidea*. Olivier states that this species occurs in Asia and Africa; I am disposed to think it peculiar to the East Indies.

Sp. 82. *limbata*. No locality is mentioned in Olivier, it is undoubtedly from the Cape, and the type of the genus *Agenius* of Serville.

Sp. 83. *praticola*. Olivier's figure would lead one to believe that *praticola* was an *Anisoplia*, according to Illiger it is an *Hoplia*.

Sp. 88. *regia*. This species was named *regia* by Fabricius; the Linnæan name *aulica* should be adopted, as previously used by that author. It occurs in Spain and Barbary, from whence I have received it.

Sp. 96. *marginata*. I am totally unacquainted with this insect. I give it as an *Hoplia*; without a doubt its locality, according to Badier, is Guadaloupe.

Sp. 98. *atomaria*. M. le Baron DeJean in his catalogue, gives the generic name of *Gymnoloma* to this insect. As I am not aware of the characters being published I purposely refrain from adopting it. Any future entomologist who chooses to publish the details, is entitled to name it. Manuscript names published in catalogues such as Dahl's, Megerle's, and DeJean's, &c. &c. &c., cannot stand.

Sp. 99. *crassipes.* In my Manual I considered this insect as a *Monochelus* of Illiger. It appears to be a *Pachynema* of Serville, according to M. Laporte.

Sp. 101. *Podagricus.* I am inclined to consider this insect as a Cape species, although the locality given by Olivier and Fabricius is that of Coromandel.

Sp. 103. *gonagra.* In the same Manual I gave the term *Monochelus* to the above species, with a query, and as I suspected, it turns out to be a *Dichelus* of Serville.

Sp. 106. *longipes.* Probably a *Dichelus;* the locality is the Cape of Good Hope.

Sp. 108. *monticola.* All the species of this genus are peculiar to the Continent of Australia.

Sp. 110. *varians.* I know not under what modern genus I can place this species; it has never fallen under my inspection. Can it be a gigantic *Anomala?*

Sp. 112. *hæmorrhoidalis.* No locality is given by Olivier. From the figure I am inclined to consider it a *Mimela,* and consequently as inhabiting the East Indies.

Sp. 114. *picipes.* I have added the name of *Mimela* with a doubt; the country is not mentioned.

Sp. 116. *ignea.* Probably a *Bolax* of Dr. Fischer.

Sp. 121. 12-*punctata.* This species is evidently the same as *Sc. aureolus* of Pallas, and is now considered to be an *Hoplia.*

(To be continued).

ART. IV.—*Description of two new species of Beetles, belonging to the Family* Cetoniidæ *of MacLeay.* By Mr. ADAM WHITE.

THE two species now to be described belong to a family which comprises about 600 species, and is peculiarly tropical, not more than seven species having been registered as British by the most latitudinarian entomologist. By Linnæus and old authors they were included in the genus *Scarabæus,* and even after the division of that overloaded group into several genera, some of the *Cetoniidæ* were placed along with *Melolontha.* Latreille, MacLeay, Kirby, St. Fargeau, Serville, Gory and Percheron, have by their labours, rendered the study of them a work of comparative ease.

The genus *Trichius* of Fabricius, distinguished at once from *Cetonia* of the same author by many characters, among others by the *mentum* not covering the *maxilla,* and by the *epimeron* (Audouin,) (*pèice axillaire* Latr.) not being prominent between the *thorax* and *elytra*, contains several remarkable forms ;[1] one of the most singular of these is a very flat African genus first characterized by Mr. MacLeay in the appendix to his celebrated 'Horæ Entomologicæ,' part I. p. 151, and there named *Platygenia*. The only species known at the time of the establishment of the genus (*Pl. zairica*,) seems to be the insect described shortly before at great length by Afzelius, in the appendix to the third part of Schönherr's 'Synonymia Insectorum,' p. 38, (*Trichius barbatus*,) an insect which Mr. MacLeay himself, in his memoir on the *Cetoniidæ* of Africa, says certainly belongs to the sub-genus.

M. M. Gory and Percheron, in their monograph of the family *Cetoniidæ*, have figured an insect, which, from the emargination of the *clypeus*, and the want of the tufts of hair on the inside of the intermediate and posterior pair of legs, may possibly be the female of the *Platygenia barbata*, though it is impossible, from the rarity of specimens in collections, to determine this point by the mere inspection of a figure. The figure in Guerin's 'Iconographie,' (pl. 26, fig. 6,) seems to be copied from that given in M.M. Gory and Percheron's beautiful work. Mr. Samouelle found two specimens of a new species in a collection brought from the Gambia ; he has named it after the distinguished author of the genus, whose works on the *Annulosa* have done so much to promote and facilitate the study of his favourite science. Both of these specimens are in the collection of the British Museum, and seem to be females, both wanting the strong spine at the base of the claws.

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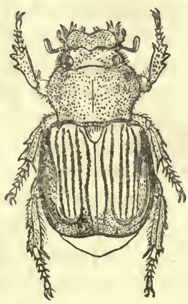

Platygenia MacLeaii, Samouelle.

Platygenia MacLeaii, Samouelle MSS., (*Fig.* 16).

P. picea, elytris subferrugineis, suturâ subelevatâ, tibiis sublævibus, anticis externè distinctè tridentatis. Long. lin. 13, lat. max. elytr. lin. 7.—*Hab*. Gambia. Mus. Brit.

[1] Most of them in the *larva* state are found in rotten wood, upon which

Head pitchy brown ; *clypeus* in front emarginate, much and coarsely punctured, the spots decreasing in number in front of and between the eyes ; the *vertex* quite smooth, side of *clypeus* at base (*canthus*) extended like an arch over the middle of the eye, and fringed with ferruginous hairs.

Thorax pitchy brown, lateral margin not ciliated ; the sides are coarsely and much punctured, the dorsal part is very delicately and sparingly punctured.

Scutellum distinct, rounded at tip, and at base impressed transversely close to the slightly produced posterior edge of thorax, the impressed part in front punctured.

Elytra subferruginous, throughout wider than *thorax* ; widest in the middle, towards the *suture* slightly raised ; each *elytron* with eight impressed longitudinal lines somewhat arranged in pairs, none of them reaching either the anterior or posterior edge ; the three inner at base not impressed, formed of an interrupted line of dots ; the sides of the lines are punctured, as are the lateral margins of *elytra* and the tips, especially at the end of suture, which part is also clothed with short ferruginous hairs ; segment between the second and third pair of legs without hairs in the middle. Apical segments of abdomen beneath with a few short hairs on the sides.

Legs and under side pitchy brown ; *femora* compressed and punctured. *Tibiæ*, anterior dilated at tip and furnished externally with three distinct teeth, the intermediate the strongest ; at the tip internally there is a strong tooth ; the surface above is punctured, some of the dots being arranged in lines.

Tarsi and *tibiæ* of intermediate and posterior pair of legs with spinous short hairs, the posterior *tibia* behind the middle with a tuft of flattened spine-like hairs arranged transversely and inserted on a projecting part.

Lamarck in 1801, in his ' Systême des Animaux sans Vertébres,' first separated certain species of the Fabrician genus *Cetonia*, characterized by having short *antennæ*, terminating in a trilamellar knob—no upper lip[1]—membranaceous mandibles—and a straight head, with a projecting forked or bifid *clypeus* (Syst. p. 209). He named this division *Goliathus*, from the gigantic size of the typical species, first figured and described by Drury, (Illustr. I. pl. xxxi.) in 1770, and in the

they feed ; in the perfect state they generally subsist on the sap of trees, at the roots of which several species are found. (Gory & Percheron, 'Monog.' p. 21 &c. MacLeay, ' Illustr. Annul. S. Africa,' p. 16. Stephens, ' Brit. Entom. Mandib.' iii. p. 229).

[1] " Point de levre superieure." In the ' Hist. Nat. des Anim. sans Vert. i v. p. 580, he altered this erroneous character to " *Labrum occultatum.*"

following year named by Linnæus, *Scarabæus Goliatus.* (Mantissa Altera p. 530). Lamarck included in his genus six species, all of which had previously been described. These are, *Gol. Africanus,*[1] *Cacicus,*[2] *Polyphemus,*[3] *bifrons,*[4] *micans,*[5] and *marginalis.*[6]

Weber, about the same time as Lamarck, after his description of the *Cetonia Ynca,* remarks (Obs. Entomol. p. 67,) "Fortè *Ynca, Goliata, Cacicus, Polyphemus,* &c., novum constituunt genus;" and Fabricius immediately after expressed the same opinion. (Syst. El. II. p. 136.)

Many other species have been added to this fine group of beetles by subsequent authors, and the *Cetonia quadrimaculata* of Oliv., (tab. viii. fig. 73, p. 30,) and *Scarabæus torquatus* of Drury, (Ill. pl. 44, fig. 1.,) have been since ascertained to be females of species of the genus. The male of the last mentioned has been lately brought from Sierra Leone by Mr. Strachan, and an excellent figure and description have been given of it by Mr. Waterhouse, in the last number of this Magazine. The male of the *Gol. quadrimaculatus* is in the possession of Mr. MacLeay.

I shall now confine myself to that section of *Goliathus* which Mr. MacLeay has called *Smithii,* in his lately published elaborate memoir.[7] It is characterized by the generally metallic colour of the species composing it, which have "the *elytra* wider at the base, the body very depressed, the *thorax* nearly truncated behind, or at least only slightly emarginate to receive the *scutellum.* The males have almost always the anterior *tibiæ* denticulated on the inside." (MacLeay.)

In one division the males have the anterior *tibiæ* externally

[1] Afterwards changed to *Gol. giganteus* in the 'Hist. Nat. des Anim. sans Vert.' iv. p. 580. Fabricius, Olivier, and Latreille, as well as Lamarck, regarded the insect figured by Drury in 1782, ('Illust.' iii. pl. xl.) and named in his index *Scarabæus Goliatus,* as a mere variety.—Subsequent authors are of opinion that it is distinct; and Mr. Westwood has named it *Goliathus Drurii* in his new edition of Drury's 'Illustrations.'

[2] *Scarabæus Cacicus ingens,* Voet, 'Coleopt.' ord. 1, gen. 1, p. 34, No. 151, *tab.* 22, *fig.* 151,—originally regarded as a native of the New World, and named accordingly, but since ascertained to be African.

[3] *Scarabæus Polyphemus,* Fabr. 'Mantissa,' i. 7, 53. *Cetonia Polyphemus,* Oliv. *Mecynorhina Polyphemus,* Hope, 'Col. Man.' p. 119.

[4] *Cetonia bifrons,* Oliv. 'Coleopt.' 6, pl. 6, *fig.* 117, p. 82. *Inca bifrons,* Lep. & Serv. 'Ency. Meth.' x. p. 381.

[5] *Scarabæus micans,* Drury, 'Illustr.' ii. pl. xxxii. *fig.* 3. *Dicronorhina micans,* Hope, 'Col. Man.'

[6] *Cetonia bifida,* Oliv. p. 43, pl. ii. *fig.* 9. *Schizorhina,* Kirby, G. & P.

[7] On the *Cetoniidæ* of S. Africa, in 'Illustr. of the *Annulosa* of S. Africa,' forming No. 3 of Dr. Smith's African Zoology.

tridentate. In the other the anterior *tibiæ* have no teeth externally. To this division the Rev. F. Hope has applied the name *Dicronorhina,* (Coleopt. Man. p. 119,) giving as the type, the *Scarabæus micans* of Drury, *Goliathus micans* of Lamarck. He regards the " *Cetonia quadrimaculata,* Oliv. which is evidently the same as *Gol. Daphnis* Buquet, and also *Gol. Grallii* of the same author," as belonging to the genus. Mr. MacLeay, who has the male of the *Cetonia quadrimaculata* in his collection, regards it as quite distinct from the *Daphnis.* He has lately described a new species, discovered near the Tropic of Capricorn, by Dr. Smith, after whom he names it, (Illustr. Annul. S. Africa, p. 34.

The species about to be described comes near the *Goliathus Grallii* of Buquet, (Ann. de la Soc. Ent. de France, v. p. 201, pl. 5. B. fig. 3,) from which however it is evidently quite distinct. The shape of the *mentum,* the nearly equilateral *scutellum,* the depressed much produced *clypeus,* and the want of a brush of hairs on the last joint of *tarsus,* with other characters, at once indicate that it belongs to a section distinct from the *Goliathus* (*Dicronorhina*) *micans,* and for which I would suggest the name of *Eudicella.*[1] The *Gol.* (*Eu.*) *Grallii,* Buquet, *Gol.* (*Eu.*) *Smithii,* MacL., *Gol.* (*Eu.*) *quadrimaculatus,* seem to me to belong to the same group.

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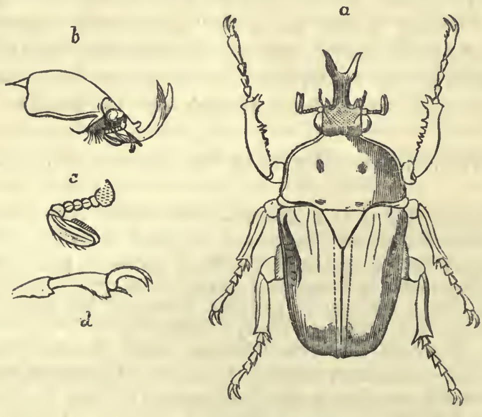

Goliathus (Eudicella) Morgani.

(*b*) *Thorax* and head viewed from the side. (*c*) *Antenna* magnified. (*d*) Part of *tarsus* of anterior right leg.

I know only the male of the following species, which may be characterized as follows :—

[1] Eυ well, δικελλα a fork.

Goliathus (*Eudicella*) *Morgani.*

G. (*Eudicella*). Nitidè viridis, thorace subæneo, pedibus æneis. Mas clypei cornu medio valdè elongato, depresso porrecto-elevato, paulo recurvo, piceo-rufo, supra (basi apiceque exceptis) lutescente. *Hab.* Sierra Leone. Rev. D. F. Morgan. Mus. Brit.

Head green, coarsely punctured; *clypeus* very much produced; porrecto-elevated and slightly recurved, flattened and deeply forked at the tip, the prongs nearly straight and furnished on the posterior side at the tip with two blunt, slight tubercular elevations; on one of the prongs in the specimen described there is a more distinct internal tooth. The basal part of pedicel ferruginous brown, the fork above pale yellowish brown, beneath reddish brown, the tips with the small teeth, black; base of *clypeus* with two excavations, the sides of which are produced in front into a somewhat acute brown tooth, directed forwards and upwards.

Antennæ dark brown, situated close in front of the eye, basal joint sub-globular, largest, distinctly dotted, third, fourth and fifth with irregular, rather deeply impressed dots on the basal parts; inner joint of knob, hairy on the outside.

Trophi brown, the apical lobe of *maxilla* with ferruginous hairs. *Mentum* bright green, dotted, at base apparently rounded and rather deeply excavated, in front notched, densely hairy, having the sides towards the front sinuated.

Thorax above and below of a bright shining green with coppery reflections, broad behind, in front narrowed and distinctly sinuated for reception of head; the front and sides distinctly margined; posteriorly at insertion of *scutellum* there is a slight somewhat sinuated lobe, with a short transverse impressed line in front of the angles. The surface above is most delicately punctured, the puncturing most distinct in front, the raised lateral edges being free from dots. *Scutellum* almost equilateral, bright green.

Elytra of the same shining green as *thorax*, but with little if any metallic reflection; the shoulders have a few irregular ferruginous marks; the surface most delicately punctured, and having about twelve longitudinal lines of impressed dots, the line on each side of suture being the most distinct; the sutural part of *elytra* at base depressed, the sides of suture towards the middle raised, and at the tip poduced beyond the plane of the *elytra*, lateral margin of *elytra* raised; brown with ferruginous hairs.

Body beneath green with coppery reflections, the margins of the segments, as well as an abbreviated line on the produced basal segment of abdomen, ferruginous. Apical segment green.

Legs green, and in some parts curiously lineated with red. *Tibiæ* internally, as well as the terminating spines and all the joints of *tarsi* pitchy brown; *femora* of anterior pair densely clothed in front with ferruginous hairs, before insertion with *tibia* ferruginous ; anterior *tibiæ* with from eight to ten teeth on the inner side, the two terminal the largest. The *tibiæ* with regard to dentation not symmetrical. In all the *tarsi* there is a rather strong spine between the claws, but no brush of hairs on the terminal joint.

The Rev. D. F. Morgan has made two valuable collections of Insects during his residence at Sierra Leone, both of which he has most liberally presented to the British Museum.—The above described species is named after him.

Art. V.—*Upon the claims of the* Ardea alba—*Great Egret, or White Hearn, to be considered a British bird.* By Arthur Strickland, Esq.

Doubts have by late authors been thrown upon the propriety of continuing this species in our catalogue of additional visitors to this country. Mr. Jenyns, in his valuable work on the British *Vertebrata*, has stated, "there is no well authenticated instance of its having been met with in this country of late years, or any British specimen in existence." Mr. Gould in his beautifully illustrated work on European birds, just completed, has reiterated these sentiments. I am happy however, to be able most satisfactorily to refute these statements, and to remove all doubts as to the propriety of retaining this fine species in our list of British Birds, as an occasional visitor ; indeed upon much better authority than many we do not hesitate to retain as such.

Twelve or thirteen years ago, (but the exact date of which I cannot now satisfactorily determine) a beautiful specimen of this bird appeared at and in the neighbourhood of Hornseamere, in the East Riding of York. It had remained about there some weeks, and several attempts had been made to procure it by different members of the family of the proprietor of that fine piece of water, when it was accidentally seen by a friend of mine one morning, in his way to meet the hounds, who took some more successful mode of procuring it, and had it sent to him a few days afterwards in beautiful condition. It was well preserved by Mr. Dunn, who still lives at Hull, and remained some years in the possession of the gentleman above alluded to, when it was kindly added to my collection, where it is at this time in perfect preservation.

This bird being killed in winter, is without the scapular plumes, and in that state which was formerly called the great white heron. But much more recently another specimen, in all the beauty of summer plumage, has been killed, not many miles from the place that produced the above mentioned specimen. Three years ago this bird was seen by a labourer, in the fields of James Hall, Esq., of Scorbro,[1] near Beverley, in the immediate neighbourhood of what used formerly be a decoy, but which modern draining or cultivation has rendered useless. The person who saw it procured a gun and killed it while sitting upon the top of a gate. This specimen has been beautifully preserved by Mr. Read of Doncaster, and is now in the possession of Mr. Hall, who duly appreciates its value.

We have thus two instances of this bird being recently killed in this country, all the circumstances of which may still be satisfactorily traced, and both of which specimens are in perfect preservation at this time. But these are not the only facts that can be deduced for warranting our continuing this bird in our catalogue. In the beautiful collection of British birds belonging to Mr. Folgambe, of Asberton, there is a specimen of this bird, with a label attached to the case, stating it was killed in the neighbourhood of that place;—as the country not far from Asberton is very likely to attract such a bird, and as there can be no doubt that that label was placed there by the late proprietor and former of that collection, whose accuracy cannot be disputed, there is no reason to doubt but that this is another well authenticated instance of its having been killed in this country, and in which the specimen itself is still in existence.

Another example has been mentioned to me, but which I am sorry to say I cannot enumerate amongst the well authenticated instances; indeed so little reliance is to be placed in these matters upon the statements of those who do not accurately know the facts, or do not carefully discriminate species, that I should not have mentioned it were it not in the hopes of drawing the attention of some one who may have an opportunity of investigating the account and removing our doubt upon the subject. The statement is, that a bird of this species was a few years ago seen, and after much trouble procured, in the south east part of Lincolnshire; a country I may observe, very productive of the wading and water birds—this specimen was stated to have been preserved and pre-

[1] Not *Scarborough*, which is forty miles from this place.

sented to one of the collections in that county, but in which town I could not learn.

As my only object at present is to rescue this interesting bird from being unjustly excluded from our catalogue of visitors to this country, I will not enlarge upon other matters connected with it, but only observe that an attentive examination of the specimens above referred to, will, I have no doubt convince any one of the propriety of separating this European species from the *Ardea garetta*, the great Egrett or large white heron of America, a bird which has in many instances been placed in our collection to represent this bird; but which is, I have no doubt a distinct species.

Burlington Quay, Dec. 10th 1838.

Art. VI.—*On the Synonymy of the* Perlites, *together with brief Characters of the old, and of a few new Species.* By Edward Newman, Esq., F.L.S.

Class—*NEUROPTERA.* Natural Order—*PERLITES.*

Family *PERLIDÆ.*

The family *Perlidæ* I now use in a restricted sense, including only those genera which are furnished with caudal *setæ*: Leach and Stephens incorporate with them the ecaudate *Nemouræ.*

Economy.—*Larva* and *pupa* active, carnivorous, aquatic: *imago* winged, reposes by day in the crevices of the bark of trees, &c., flies by night.

Geographical distribution.—Europe, Asia, Africa, North America, New Holland, Van Dieman's Land.

Authorities.—Linneus, Fabricius, Fourcroy, Latreille, Geoffroy, Panzer, Pictet, Curtis, Stephens, Westwood, Newman.

Genera.—*Eusthenia, Pteronarcys, Perla, Isogenus, Chloroperla, Leptoperla.*

Genus I.—*Eusthenia*, Westwood.

I find this genus proposed in the English translation of Cuvier's 'Règne Animal' by Griffith and others: the following quotation is all that appears on the subject.—" Mr. Westwood has established this genus on account of the jaw being horny, and very much dentated." As I trust Mr. Westwood will give us a more detailed description on some future occasion, I shall at present merely employ the name. Neither of the species has ever been described under any other generic appellation.

Sp. 1. *Eust. Thalia.* Subnigra; alæ opacæ, fuscæ, maculâ subrotundâ ponè medium albidâ; pedes nigri, femora basi testacea, tibiæ propè basin testaceo annulatæ. (Corp. long. .5 unc. ant. .5, set. caud. .05, alar. dilat. 1.425 unc.)

The apical portion of the forewings is completely reticulated, and the costal cell interrupted by very numerous transverse nervures, the hind wings possess similar characters; the wings of the female are abbreviated occasionally (but not invariably) in the same manner as those of the male in the British species of the restricted genus *Perla;* the *antennæ* have a large basal joint, and are somewhat longer than the body; the caudal *setæ* are extremely short, scarcely equalling in length the diameter of the abdomen; they are curved, of uniform thickness, and are composed of few joints: in colour this insect is nearly black, the forewings are opaque and dark brown, with a nearly round white spot situated rather beyond the centre; the hind wings are brown without the spot; a series of testaceous spots extends along the costal margin of all the wings, and round the extreme tips; the legs are nearly black, the basal portion of the *femora*, and a ring round each of the *tibiæ* being bright testaceous.

Inhabits Van Dieman's Land. There are four of this species in the cabinet of the Rev. F. W. Hope, to whom I am indebted for the loan of specimens. The extreme difference between this and the cognate species, as regards the caudal *setæ,* would have induced me to raise it to the rank of a genus, had not Mr. Westwood, on examination, considered it to belong to his genus *Eusthenia.*

Sp. 2. *Eust. spectabilis.* (Corp. long. 1 unc. alar. dilat. 2 unc.)
„ „ Westwood; Translation of Cuvier's 'Règne Animal' by Griffith and others. Part Insects, vol. ii. p. 348, *tab.* lxxii. *fig.* 4.

Body, including the *antennæ* and caudal *setæ* of a very dark brown, nearly black; the upper wings are opaque and brown, with an elongate red spot near the costal margin, and rather nearer the base than the apex of the wing, beyond and below this is a large blotch of dirty white; the hind wings are red at the base and black externally.

Inhabits Van Dieman's Land. In the cabinets of the Entomological Club (donor J. O. Westwood), Rev. F. W. Hope and Mr. Westwood. The very ample and reticulated wings of this beautiful insect, together with its straight caudal *setæ,* and general habit, lead us to the giants of this group composing the genus *Pteronarcys.* It is on this account that I have placed the described typical species subsequently to the new and aberrant one.

Genus II.—*Pteronarcys*, Newman.

The genus is founded on the reticulation of the wings, which is nearly as complicated as in the genus *Libellula*. It was first characterised in the 'Entomological Magazine,' where a detailed description is given. Neither of the species has ever been described under any other generic appellation.

Sp. 1. *Pter. regalis*. (Corp. long. 1 unc. alar. dilat. 3.35 unc.)
„ „ Newman; 'Entomological Magazine,' vol. v. p. 176.

The body is dark brown; the head, *pro- meso-* and *meta-thorax* are marked by a longitudinal yellow line common to them all; each segment of the abdomen has its posterior margin yellow; the wings are hyaline, but have throughout a dingy tinge of brown, which tinge is darker along the subcostal nervure of the forewings, and terminates in a still darker spot beyond the middle. The legs are brown, the knees concolorous.

Inhabits Canada. A single specimen is in the cabinet of the British Museum; a second, purchased at the sale of Mr. Lee's insects, in that of the Entomological Club.

Sp. 2. *Pter. biloba*. (Corp. long. .9 unc. alar dilat. 2.75 unc).
„ „ Newman; 'Entomological Magazine,' vol. v. p. 176.

The body is dark brown, the head has no yellow markings, the *prothorax* has various impressed lines, and also a faint yellow spot on the anterior and posterior margins; these are connected by a still fainter line; the *mesothorax* is shining and without markings, the *metathorax* is also shining, and has a longitudinal yellow line. The abdomen is brown, the eleventh segment beneath being furnished with two flat obtuse processes, which are parallel with the abdomen, and point towards its extremity. The forewings have three very conspicuous subcostal brown spots, and the hind wings one. The legs are brown and the knees concolorous.

Inhabits North America. A single specimen (donor R. Foster) is in the cabinet of the Entomological Club.

Sp. 3. *Pter. Proteus*. (Corp. long. .85 unc. alar. dilat. 2.75 unc,)
„ „ Newman; 'Entomological Magazine,' vol. v. p. 177.

The body is dark brown, the head, *prothorax* and *metathorax* having an interrupted longitudinal yellow line. The abdomen is brown, without the appendages noticed in the last species. The wings are deeply and distinctly variegated with brown. The legs are brown and the knees yellow.

Inhabits North America. Three specimens (donors E. Doubleday and R. Foster) are in the cabinet of the Entomological Club.

GENUS III.—*PERLA*, Geoffroy.

Phryganea, Linneus; *Semblis*, Fabricius, &c.

The wings are abbreviated in the male, in the female they are fully developed; the longitudinal nervures towards the tips of the wings are uninterrupted (or nearly so) by transverse nervures.

* *Species aberrans.*

Sp. 1. *Perla abnormis.* (Corp. long. .9 unc. alar. dilat. 2.5 unc.)
„ „ Newman, 'Entomological Magazine,' vol. v. p. 177.

Testaceous brown, with scarcely any shade of different colour, the eyes and *ocelli* alone being obviously darker. Wings tinged with brown, the upper portion of the tips of both fore and hind wings have various transverse nervures, forming a decided although small portion of the wing completely reticulated.

Inhabits North America. Several specimens of this insect are in the cabinet of the British Museum, also in that of the Rev. F. W. Hope; and one, much injured and discoloured, owing to which circumstance it was originally characterised as "fuscous," in that of the Entomological Club, (donor R. Foster.) The aberrant species is here again placed before the normal ones, because it serves to connect the latter with the species of *Pteronarcys*.

** *Species normales.*

Sp. 2. *Perla Lycorias.* Caput prothorace manifestè latius, testaceum; oculis ocellisque fuscis: prothorax testaceus lineâ longitudinali nigrâ, alarum apices haud reticulati. (Corp. long. .8 unc. alar. dilat. 1.8 unc.)

Head considerably broader than the *prothorax*, and scarcely at all immersed therein, testaceous, with the eyes and *ocelli* fuscous, and in some specimens the *ocelli* are enclosed in a somewhat quadrate fuscous spot.—The *prothorax* is testaceous with a black longitudinal line. The *meso-* and *metathorax* are shining and pale brown, scarcely testaceous. The abdomen is brown. The nervures of the wings are testaceous, the tips of the wings have only the longitudinal nervures. The legs are testaceous.

Inhabits Canada. In the cabinets of the British Museum and the Rev. F. W. Hope.

Sp. 3. *Perla Xanthenes.* (Corp. long. .75 unc. alar. dilat. 1.75 unc.)
„ „ Newman, 'Entomological Magazine,' vol. v. p. 178.

Pale yellow, the nervures of the wings, the *antennæ*, and legs of the same colour: the eyes and *ocelli* alone are black. The *prothorax* is quadrate but much narrower posteriorly.

Inhabits———. Two specimens in the cabinet of the British Museum.

Sp. 4. *Perla bicaudata.* (Corp. long. .7 unc. alarum dilat. 2 unc. *fem.*)
„ *flavipes*, Fourcroy; 'Entomologia Parisiensis,' p. 349.
„ *a pattes jaunes*, Geoffroy; 'Histoire abrégé des Insectes, vol. ii. p. 231.
„ *flavipes*, Latreille; 'Hist. Nat. Crust. &c.' vol. xiii. p. 49.
„ *bipunctata*, Pictet; 'Annales des Sciences Naturelles,' vol. xxviii. p. 55, *tab.* v. *fig.* 12—14.
„ *marginata*, Stephens; 'Illustrations of British Entomology' Mand. vol. vi. p. 135.
Phryganea bicaudata, Linneus; 'Fauna Suec.,' p. 379, No. 1489.
„ „ „ 'Syst. Naturæ,' vol. i. 908, No. 1
„ *maxima*, Scopoli; 'Entomologia Carniolica,' p. 269.

Head fulvous, with two brown spots including the *ocelli*, and often prolonged to the base of the *antennæ*, which are nearly black, with the basal joint generally yellow: in front of these spots is a third, somewhat triangular, and situated nearer to the *clypeus*. The *prothorax* is fulvous, with the margins and a median longitudinal line dark brown or nearly black, and on each side of this median line is a black spot in the living insect, but this frequently nearly disappears after death, and in some specimens becomes quite obliterated, and the entire disk of the *prothorax* appears brown. The *meso-* and *metathorax* are bordered with yellow: the legs are yellow, with the joints fuscous: the wings are less transparent than in the following species, and the abdomen is of a more dusky hue.

Inhabits Europe and England. In the cabinet of the Entomological Club. That Fabricius and all subsequent authors have entirely mistaken the *Phryganea bicaudata* of Linneus will be perfectly evident to any entomologist who will take the trouble to examine the Linnean specimen now in possession of the Linnean Society. As to the real distinctness of the following species from the present, I am unable to decide. I had considerable doubts on the matter, against which M. Pictet's detailed characters of the species in their *larva* and *imago* states, have so far prevailed as to induce me to keep them separate for the present.

Sp. 5. *Perla marginata.* (Corp. long. .7 unc. alar. dilat. 2 unc.)
„ „ Panzer; 'Fauna.' lxxi. *fig.* 3.
„ „ Pictet; 'Annales des Sciences Naturelles,' vol. xxviii. p. 53, *tab.* 5, *ff.* 1—11.
Semblis marginata, Fabricius; 'Entomologia Systematica,' vol. ii. p. 73, No. 7.
„ „ } Rœmer; 'Genera,' *tab.* xxiv. *fig.* 8.
Phryganea bicaudata, }
„ *maxima*, Scopoli; 'Entom. Carniol.' p. 269.

The head is yellow, margined with brown. The *ocelli* are black, with a triangular space between them brown; the *antennæ* are entirely black, the *prothorax* is brown, with a median longitudinal furrow and various irregular yellow markings, which usually disappear on the death of the insect: the *mesothorax* is brown, with a yellow margin; the *metathorax* is entirely brown: the legs are brown, the *tibiæ* rather paler: the wings are hyaline, slightly tinged with yellow; the abdomen is yellowish, with dusky sides.

Inhabits Europe and England. In the cabinet of the Entomological Club.

Sp. 6. *Perla cephalotes.* (Corp. long. .65 unc. alar. dilat. 1.75 unc. fem)
„ „ Curtis; 'British Entomology,' pl. 190.
„ „ Pictet; 'Annales des Sciences Naturelles,' vol. xxviii. p. 56, *tab.* vi. *ff.* 1—3.
„ „ Stephens; 'Illustrations of British Entomology' Mand., vol. vi. p. 136.

Head variegated with black, brown, and yellow; *prothorax* brown, very rugose, traversed longitudinally by a furrowed yellow line. *Meso-* and *metathorax* nearly black, each with a brown or paler spot posteriorly. Abdomen yellow throughout in the female, at the extremity only in the male.

Inhabits Europe and England. In nearly all collections of British insects. I see that M. Pictet complains of an incorrectness in Mr. Curtis's figure, as regards the neuration of the wings in this species. In this I think he is wrong, the nervures being so exceedingly variable as often to differ in the opposite wings of the same insect. I could wish the continental figures were always as accurate as those in 'British Entomology.'

Sp. 4. *Perla Cymodoce.* Nigricans, vittâ communi longitudinali flavâ capitis prothoracisque. (Corp. long..65 unc. alar. dilat. 1.75 unc. fem.)
„ *bicaudata?* Fourcroy; 'Entomologia Parisiensis,' p. 349.
„ *bicaudata*, Stephens; 'Illustrations of British Entomology,' Mand. vol. vi. p. 136.
Semblis bicaudata, Fabricius; 'Ent. Syst.' vol. ii. p. 73, No. 8.

Nearly black, the head and *prothorax* marked by a longitudinal yellow line, the *prothorax* is rugose, and has a median longitudinal furrow in which occurs the yellow line: the wings are dusky; the abdomen beneath yellowish.

Inhabits Europe and England. In nearly all cabinets of British insects; always labelled as the *Perla bicaudata.*

(To be continued.)

REVIEWS.

ART. I.—*Illustrations of the Zoology of South Africa.* By ANDREW SMITH, M.D. No. 3, *Annulosa;* by W. S. MACLEAY, Esq., M.A., F.L.S. London: 1838. 4to., 75 pp. 4 col. plates.

As the contents of the present and preceding numbers of the 'Magazine of Natural History' place before our readers some valuable additions to our knowledge of the *Cetoniidæ*, it appears to us a desirable opportunity for noticing the work at the head of this article, or rather that portion of it in which attention is so prominently directed to this group of insects. The plan of this part is not in accordance with that of the two which have preceded it, and to which we shall on a future occasion advert. The *Annulosa* have been placed in the hands of Mr. MacLeay, who has here given us, not a series of isolated descriptions, but illustrations of particular groups worked out upon the quinarian principle.

Acquainted with Mr. MacLeay's great opportunities for investigation whilst at the Havannah, naturalists were anxious to learn whether his views, as developed in the 'Horæ Entomologicæ,' remained unchanged, or whether the recent attempts which have been made to uphold a trinarian, quaternian, or septenary system, had materially altered them. That Dr. Smith's work should have been chosen for the solution of these enquiries, we cannot but regret, as it gives to the work the appearance of a want of unity in the plan; and we fear that there are many readers who would have preferred descriptions and figures of a greater number of species, rather than the endless and unsatisfactory observations intended to support the favorite views of the author.

The number contains three memoirs, which we will proceed shortly to notice. The first is entitled "On the *Cetoniæ* of South Africa," but it is rather a memoir on the quinary distribution of the *Cetoniidæ*, with descriptions of the new South African species, twenty-one in number. It would lead us too far to analyse the introductory remarks; but it is worthy of notice that Mr. MacLeay deems the following as the uniform gradational series in the Animal Kingdom; 1, Sub-kingdom; 2, Class; 3, Order; 4, Tribe; 5, Stirps; 6, Family: 7, Genus; 8, Sub-genus; 9, Section; 10, Sub-section; 11, Species: each of these groups except the last, being divisible into five minor groups, and forming a circle. But Mr. MacLeay himself, in the outset, shows the inconvenience of supporting such a series, by introducing another division without a name, between the stirps and family; namely,—"5, Stirps, *Petaloce-*

ra, *Thalerophaga*, 6, Family, *Cetoniidæ*." Again, the mode in which the genera, sub-genera, sections, and sub-sections are treated, appears to us sufficient to prove the necessity for the adoption of some other plan than that now proposed by Mr. MacLeay. For instance, after characterising the family, and asserting that it contains more than 600 species,—having previously remarked that with the exception perhaps of Central Africa, the world contains of *Cetoniidæ* few species unknown, at least in comparison with those which are known,—we are favored with an account of the five genera, and of the sub-genera, sections, and sub-sections known to the writer. As there are five sub-genera in each genus, and so on, the family will, according to Mr. MacLeay's views, naturally comprise 25 subgenera, "125 sections, and 625 subsections." (p. 51): but although the group is so well marked, the insects of such large and conspicuous size, and the number so great as to lead to the idea that the greater part are known;—Mr. MacLeay has only been able to make out 47 sub-sections out of the 625, exclusive of the sections which are not cut up into sub-sections; and even of the sections, of which there ought to be 125, he has only filled up 40, exclusive of those sub-genera which are not cut up into sections.

A plan is here also adopted which appears to us to set the rules of zoological nomenclature entirely at defiance. All generic names are made to terminate in *inus;* and thus we have *Trichinus*, *Cetoninus*, &c., instead of *Trichius*, *Cetonia*, &c. This may or may not be an improvement, according to the views of different readers; but when we find the name of Fabricius tacked to *Trichinus*, or that of Kirby to *Gymnetinus*, we cannot but object to the innovation. The five genera into which Mr. MacLeay divides the family are *Trichinus*, *Cetoninus*, *Gymnetinus*, *Macrominus*, and *Cryptodinus*.—But it is evident, on a very slight examination of an extensive series of these insects, that these five groups are not of equal rank; for instance, *Cetoninus* and *Macrominus* have characters much weaker than those of *Trichinus* or *Cryptodinus*. Again, whilst we doubt the propriety of regarding *Cryptodus* as belonging to the family, we are astonished to find it sunk into a sub-genus, and regarded as only of equal rank with each of the four subgenera of *Cremastocheilus*. *Platygenia* in like manner is of far higher rank than *Osmoderma*, although regarded only as a sub-genus of *Trichinus;* whilst the giant *Goliathi* are sunk into a sub-genus of *Cetonia*.

We may be told that by considering them in the light in which they are exhibited to us by Mr. MacLeay, they clearly prove the circular and quinarian arrangement; but we maintain that nature is, in this work of Mr. MacLeay, repeatedly violated. Any one, for instance, unprejudiced by system, would at once see that *Platygenia* is of far higher rank than *Valgus*,—that in fact it is equal, in its characters, to the four united sub-genera *Osmoderma*, *Valgus*, *Trichius*, and *Campulipus*. Hence we consider that three additional genera at least ought to be added to the family as extended by Mr. MacLeay, namely, *Platygenia*, *Cryptodus*, and *Goliathus*.—With respect to the sections and sub-sections of the sub-genera we have a similar remark to make. If we take the lowest of these groups, we find for instance, two well-marked groups, *Trigonophora* and *Jumnos*, regarded as sub-sections. Now the character of these two sub-sections of sections of sub-genera, as they are termed by Mr. MacLeay, have been given by Mr. Hope, in his recently-published 'Coleopterists' Manual,' and are as strong even as those of the sub-genera themselves separated by Mr. MacLeay from the genus *Macrominus*. It is not difficult to prove that an equality of rank is not maintained in the sub-genera, sections, and sub-sections throughout. In the genus *Cetoninus* the sub-sections of the sections of the sub-genus *Cetonia* are of very varied character; for instance, the sub-sections of the section *Typicæ* are so closely allied that they are only distinguished by colour, *C. aurata* and *fastuosa* being types of two of these sub-sections, between which the relation is as close as possible. In the *Trichioideæ* we have the sub-sections characterised from their geographical range, and thus the two equally allied species *C. capensis* and *stictica* are placed in different sub-sections. The sub-sections however of the Cremastocheilideous and Polybapheous sections of the sub-genus *Cetonia* are characterised by structural peculiarities, they must therefore be evidently of higher rank than those distinguished merely by colour.

Mr. MacLeay will perhaps assert that he is correct in his views, because *Cetonia* being the most complete in the number of its species, he is in that sub-genus best able to seize the plan of the natural system; but this will apply equally in condemnation of the application of his principles in other groups, and even in working out this very sub-genus: thus if the species composing "*CETONINUS*; CETONIA, *Typica*," be so close that no better character than colour can be found to separate them into a required number of sub-sections, we ought to consider that the same proximity would also exist in every other group, if we knew all its species as fully as those of the *Typicæ* are known; and hence, for want of a knowledge of all the species existing in nature, groups having good structural characters equivalent to sub-genera, have been sunk to the level of sub-sections of sections of sub-genera. We are disposed to agree with Mr. MacLeay in advocating uniformity in the rank of the gradational series of nature; but we contend that Mr. MacLeay has acted in violation of his own principles in every page of his work. As to the disadvantages resulting from giving names resembling those of genera to so many groups of sectional character, we have only to cast our eyes over the work to be convinced of the difficulty of following the author. There is no general synopsis given of the sections and sub-sections, (which we have been compelled to construct, in order to gain a clearer notion of the author's meaning), and as we have the specific name used indiscriminately in conjunction with its generic, sub-generic, sectional, or sub-sectional name, the confusion of ideas thereby originating is completely unavoidable and most perplexing. Thus the *Agenius Horsfieldii* (p. 14) is called *Trichinus Horsfieldii* in the plate, and (*Trichinus*) *Campulipus Horsfieldii* in the text: and throughout the figures we have either the generic or sub-generic name alone used. And thus in speaking of the *Jumnos Ruckeri* we may call it *Cetoninus Ruckeri*, *Coryphe Ruckeri*, *Rhomborhina Ruckeri*, or *Jumnos Ruckeri*, its legitimate name being *Cetoninus Coryphe Rhomborhina Jumnos Ruckeri*. Surely this kind of nomenclature cannot be adopted.

Of the species we have but little space to remark further that Mr. MacLeay is not sufficiently acquainted with what has already been done. This will be evident when we state that four at least out of the six species figured as novelties have been previously described. *Trichius Horsfieldii* is *Agenia flavipennis*, Gory; *Cetonia leonina* is scarcely a variety of *Cet. compressa*, Goldfuss; *Ischnostoma pica* is *Cet. albomarginata*, Herbst: *Macrominus spinitarsis* is *Cet. variabilis*, Gory; and *Ischnostoma spatulipes* is probably the male of *Cet. pimeloides*, Hope: the specimen of the last-named insect, which we have under examination, thus labelled by M. Gory himself, (as indeed are the majority of the *Cetoniæ* above mentioned, which have enabled us to give these corrections), having one of the posterior *calcariæ* spatulate, but with the *clypeus* truncate.

We have given a greater extent to our notice of this memoir, not only because it occupies more than two-thirds of the part before us, but also because it will render it unnecessary to enter into any farther notice of the principles adopted by Mr. MacLeay in the other parts of his work.

The second memoir is "On the Brachyurous Decapod *Crustacea* brought from the Cape by Dr. Smith," and contains descriptions of twenty-three new species. Instead however of giving us a sketch of the primary distribution of the *Crustacea*, we have the debateable question of the metamorphoses of these animals introduced, apparently for the purpose of telling us that Mr. J. V. Thompson has merited well of science for his researches, "which is more than can be said of any of those persons who, by crude inferences, but never by direct observation, ventured to attack him." Can Mr. MacLeay be ignorant that Rathke has most elaborately traced the developement of the embryo cray-fish ?—That Westwood has dissected the *ova* of the land crab of the West Indies ?—And that Rathke has recently asserted that "as to the Decapods, so far as I have examined their developement, I must deny the assertion of Thompson : and of them I can say nothing less than that at the end of their existence in the egg they have exactly the same aspect, and are as fully developed, as the full grown individuals."—(Annals Nat. Hist. 1837). If these be not direct observations,—or if they merit the term of "crude inferences," we would ask what kind of observations Mr. MacLeay would require ?

Mr. MacLeay divides the Decapods into five tribes,—*Tetragonostoma* and *Trigonostoma* (forming the *Brachyura*), and *Anomura*, M.E., *Sarobranchia*, and *Caridea*, Latr., (forming the *Macroura*. Each of the tribes *Tetragonostoma* and *Trigonostoma* is divided into five *stirpes*, which are placed opposite to each other from analogy ; but nothing appears more arbitrary than the adoption of their analogous characters, for instance, *Pinnotheres* and *Dromia*, or *Cancer* and *Corystes*, are as unlike as can well be conceived, and yet they are opposed to each other. As to the genera and other subordinate divisions, the author constantly expresses his inability to decide upon them, from not being acquainted with a sufficient number of species.

The third memoir is "On a new species of *Cerapterus*," but it contains a monograph of the genus, so far as Mr. MacLeay was acquainted with the species ; and also observations on the family (*Paussidæ*) to which it belongs. To these Mr. Westwood has published a reply in the last number of the 'Entomological Magazine,' in which he has described a fifth species, not contained in Mr. MacLeay's monograph.

We cannot conclude without alluding to the beautiful execution of the four plates with which this part is embellished from the pencil of Mr. C. Curtis, although they are destitute of those structural details of the parts of the mouth, which

Mr. MacLeay has shown to be so necessary:—nor without expressing our regret that the author should have thought it necessary to speak in such harsh terms of so many of his fellow-labourers.

SCIENTIFIC INTELLIGENCE.

The determination of the zoological relations of the fossil jaws from the Stonesfield strata, and also those of the animals whose footmarks have been left in rocks of still higher antiquity, are two subjects now before the scientific world. As regards the first of these, our readers are already in possession of much interesting matter that has been advanced by two distinguished continental naturalists, who entertain very opposite opinions. With respect to the sandstone impressions, this subject is so nearly related to that of the "supposed fossil didelphs," that we are induced (knowing the report to be a correct one) to quote the following article from the columns of the 'Liverpool Mercury,' of the 24th of August, 1838. It contains the substance of a lecture delivered by Prof. Grant, at the Liverpool Mechanics' Institution; and the portions we extract refer to the numerous footmarks lately noticed in Stourton stone-quarries.

In the oldest fossiliferous beds of transition rocks the organic remains are chiefly of invertebrated animals, with obscure traces of fishes belonging to forms altogether extinct; and although in the secondary mountain limestone, immediately below the coal, diversified forms of fishes abound, no trace of reptiles or of warm-blooded animals has yet been perceived in rocks of that antiquity. In the new red sandstone before us, however, the densest parts,—the teeth, and distinct impressions of the feet of reptiles, begin to make their appearance, and most colossal forms of the animals of this class abound through all the lias formations, extending almost from this sandstone rock to the oolites. The numerous large footmarks on this block of sandstone are most quadruped-like in their forms, but as no fragment or trace belonging to that elevated class of animals has ever been observed in formations below the oolites, which oolites approach to the newest of the secondary rocks, it behoves us not only to compare these impressions cautiously with the feet of different classes of vertebrated animals, but also to suspend our judgment, if they are not capable of affording satisfactory evidence regarding the nature of the animal which has left them. In attempting to draw determinate conclusions from imperfect relics of this kind, it is to be remembered that Scheuchzer described, as the remains of our species, as a *homo diluvii testis*, what is now acknowledged by every one to be the skeleton of a salamander, and that Spallanzani described as the relics of antediluvian giants, what were afterwards found to be bones of extinct elephants. An imperfect relic from the new red sandstone of Burdiehouse, lately pronounced by an English anatomist to be the tusk of a wolf, has been subsequently ascertained to be the tooth of a sauroid fish, common in that formation. Although no remnant of our race was ever found but in alluvial deposits, impressions of this kind found in the sandstones of America have been confidently referred to the human species: and impressions identical in every respect with those now before you, and which were found in the new red sandstone of Germany, have been pronounced, by a distinguished naturalist of that country, to belong to an animal of the class *Mammalia*, and of the order *Marsupialia*. The free condition of the supposed thumb both on the large hind feet and on the small anterior extremities in the specimen before you, as in those of Germany, might as well entitle this animal to a place among the *Quadrumana*, next to man, but the geologists are more attached to the heterogeneous order of marsupial quadrupeds, from a belief that certain bones found in the oolites of Stonesfield, have been determined to belong to *Mammalia* of this order. Impressions of the feet of tortoises were observed several years since in quarries of this new red sandstone in Dumfriesshire, and in other localities, and they abound in this sandstone from the Stourton quarry, along with numerous impressions of the webbed feet of *Emydes*, of jointed reeds, and of the slender feet and claws of lacertine reptiles. But, as might be expected, these footmarks of tortoises were at first referred to *Mammalia*, to dogs or similar quadrupeds walking up an inclined plane of yielding sand, which had subsequently consolidated, to form the dense rocks of the quarry.

The rock at Stourton from which these specimens have been obtained, is extremely soft, loose, and everywhere percolated by water, so that but little of it is capable of being used as a building material. It dips about fifteen degrees to the east, like the present acclivity of Stourton hill, and it appears to have done so when the foot-marks were impressed and the reeds grew on its surface. It forms the surface rock of all this part of England on the shores of the Mersey, and appears to have been very little disturbed in its primitive horizontal position by voltaic agency, so that its rapidly decomposing surface forms the loose sandy soil around this city, and we have to wade for a mile through deep sand, in ascending Stourton hill to the quarry. But the same new red sandstone acquires very different properties where it has been subjected to pressure from superincumbent strata, and to greater heat from volcanic action; as around Edinburgh, where it has been consolidated by the volcanic agency, which has thrown up Arthur's seat, Salisbury Crag, the Calton-hill, Castle-hill, Inchkeith, and other masses of trap rocks,—and where this sandstone forms the beautiful material of which that city is built. In Stourton quarry there are two distinct strata of these footmarks, about two feet vertically separated from each other, and the workmen believe that there is a third stratum of the same impressions a very little lower in the rock; but I have been able to examine only the two upper strata of these remarkable impressions. This specimen, and the others in Liverpool, were obtained from the upper stratum of markings, which occurs at a vertical depth of 37 ft. from the actual surface of the rock. The lower stratum of footmarks is 39 feet from the surface of the rock, and the sandstone in this quarry has been worked in some places to a depth of nearly 100 ft. and has been pierced for a well to a further extent of 40 ft. without reaching the lower limit of this bed of new red sandstone. The continuity of this bed of sandstone is only interrupted by occasional very thin conformable layers of soft clay, which vary from one line to two inches in thickness. The prints of the feet have always been first made on the upper surface of these thin layers of clay, which have but imperfectly communicated them to the surface of the rock below, but have given most perfect casts of these impressions to the under surface of the superincumbent rock. The specimen before you, therefore, and all the others which have been obtained, do not represent the prints left by the animal on the soft substance on which it once trod, but are perfect casts of these prints taken by the under surface of the rock immediately above. The same is the case with the foot impressions met with in Scotland, Germany, America, and everywhere else, indeed, the impressions could not have been preserved but by the intervention of this clay, which, by interrupting the continuity of the sand-deposits, has prevented these prints from becoming obliterated. There are also innumerable small isolated pieces of soft clay spread through the texture of the sandstone, and the superincumbent soft clay is much used in this neighbourhood in brick-making for building.—A large portion of the present floor of Stourton quarry exhibits the inferior stratum of foot impressions, at the depth of 39 ft. from the surface of the rock; but as the clay which received the prints adheres tenaciously to the under surface of the superincumbent rock, which has been there removed, the exposed prints seen at present on the floor of the quarry, are far from being so distinct as in the block before you. The workmen have traced these large footmarks in a continuous single line, produced by the walking of one animal, for 20 or 30 feet over the surface of the rock, and they occur everywhere at this level in the quarry. Sometimes the impressions are crowded together in great numbers in a small space, as in the specimen before you, where there are about twenty marks of the large hind foot alone in a surface of about 5 ft. by 4 ft.; in other places the rock is marked only by the pacing of a single animal across the surface. Towards the upper part of this block you observe four large footmarks passing in a curved direction to the right side, and below them three similar large footmarks directed to the left side; but both above and below these two lines, nearer the margins of the block, you perceive numerous other large footmarks of the same kind.—These large impressions of the hind feet, which are about 9 inches long, 4 inches broad, and pentadactylous, are always accompanied, as in the German specimen preserved in the British Museum and figured in Dr. Buckland's late Treatise, by small anterior feet, about 4 inches in length and breadth, also pentadactylous, and with an opposable or free toe, like the hind feet. From the point of the right or left foot to the point of the same foot in advance, I have commonly measured a clear pace of about 3 ft. 8 inches, but the feet of the opposite side of the body are here interposed, and nearly in the same straight line. The similar feet of this animal must therefore have moved alternately, as in saurian and chelonian reptiles, and not in pairs, like those of kangaroos, rodents, and other leaping quadrupeds, which have this great disparity between the anterior and posterior members. The impressions indicate a free toe or thumb both on the anterior and hinder feet of this animal, and the creature thus apparently endowed with prehensile members has been called *Chirotherium*, or handed beast; but this quadrumanous character is not seen in the order of marsupial quadrupeds, to which Kaup supposed the unknown animal to belong.

Associated with these anomalous markings of the *Chirotherium*, are numerous short club feet, with large broad claws of tortoises; some feet with the toes and claws more elongated and webbed, of *Emydes*, or wading *Chelonia*; many with the long free toes and slender claws of lizards; some approaching in form and gait to ornithichnites, but without the hind toe, and with the anterior toes approximated and collapsed; and some resembling the long tapering feet of frogs, advancing by alternate motions of their hinder webbed feet alone;—but all agreeing with the impressions of the reeds and branches of trees, in indicating a great river or estuary opening remotely into the sea, and that the *Chirotherium* itself may have been also semi-aquatic, like the crocodiles and *Emydes* of existing shores.

In the crocodilian reptiles, of which numerous gigantic remains abound in the lias deposits, nearly as ancient as this rock; the *hands* are proportionately very short and broad, and pentadactylous, as in this *Chirotherium*, and the outer finger projects, short and free, as the supposed inner finger or thumb in the animal before you. In these reptiles, also, it is the outer, and not the inner toe, of the proportionately large hind *feet*, which is short and rudimentary; and there may have been great diversities in the extent or freedom of this outer rudimentary hind toe in the various *Teleosauri*, *Steneosauri*, and other semi-aquatic forms of reptiles which have long become cxtinct like the *Ichthyosauri* and *Plesiosauri* which swarmed at the same period in the ocean. If we suppose the free projecting toes of the *Chirotherium* to have been inner toes or prehensile thumbs, this animal must have crossed the line of gravity of its body with its feet, at every pace, in bringing them to the ground, as may easily be perceived by carrying the eye along the line of footmarks.—Although this supposition agrees with the developement, if muscular and not osseous, at the base of the thumb, it forces us to believe that this animal crossed the right foot to the left side of the line of gravity of the body, by the entire breadth of that foot, before it reposed it upon the ground, and that the left foot, to the same extent, crossed over to the right side before it rested to support the trunk. But, if the supposed thumbs, which here curve backwards in a manner extraordinary for such members, be only forms of the short outer toes of the large hind feet of crocodiles, gavials, and alligators, the feet no longer cross the median line of the body, but assume the positions seen in the walking of most other reptiles. Although I have not been able to find any shells, bones, or other organic relics in these rocks, nor have heard of any having been observed by others, the ordinary ripples seen on the sands of the seashore, and on the banks of lakes, are everywhere common and distinct in the sandstone of this quarry. In the upper stratum of the footmarks there is a remarkable pitted appearance over the surface of the impressed clay, as if produced by drops of rain, or by the unequal shrinking of the clay in drying, and this often produces a warty appearance in the casts of the footmarks. In some of the specimens preserved I perceive smooth, rounded, broad markings, with transverse slight corrugations, as if the animal, between the efforts of progression, had rested its belly on the ground, a constant character with reptiles, but not with mammals.—The long, recurved, angular claw seen distinctly on the supposed posterior thumb, as on the other hind toes of the *Chirotherium*, is crocodilian, and not mammiferous; it is obvious on the rudimentary outer toe of alligators, but was never seen on the opposable hind thumb of an opossum. In the footmarks you perceive that the heel of the hind foot has pressed heavily on the ground, and raised much of the sand around it, as in the heavy-bodied and feeble-footed reptiles, and that it was not able to raise itself on tip-toe, and sink its claws into the ground, like the more active and vigorous unguiculated quadrupeds. The terminal tapering of the hind toes of this animal into the large, broad, conical claws, is crocodilian in its character, and most unlike the sudden setting-on of these parts on the rounded toes of quadrupeds; so that, although these relics, of vast antiquity in the history of our globe, are full of scientific interest, and may long exercise the acumen of naturalists, they do not appear to me to have yet satisfactorily established the existence of hot-blooded mammiferous quadrupeds at the remote period assigned to the deposition of this new red sandstone. They show that notwithstanding the extremely perishable character of all organic deposits committed to those porous siliceous beds, percolated incessantly by water, they are capable of preserving, for an indefinite period, impressions thus mechanically made upon their surface, and of transmitting entire, to the remotest posterity, the most delicate footmarks of animals, every other trace of whose existence has long been effaced from our globe.

Among the promised forthcoming Works on Natural History or general science, we may mention 'A History of the Fishes of Madeira,' by the Rev. R. T. Lowe; in which the author will have the able assistance of Miss M. Young, in delineating the species. The admirable sketches made by this lady which illustrate Mr. Lowe's already published ichthyological memoirs in the 'Transactions of the Zoological Society,' lead us eagerly to anticipate the appearance of this more extensive undertaking.

Mr. Edward Newman announces an illustrated 'History of British Ferns': and the editor of the 'Arcana of Science' a scientific annual, entitled 'The Year-Book of Facts.'

THE MAGAZINE

OF

NATURAL HISTORY.

FEBRUARY, 1839.

ART I.—*New Doubts relating to the supposed* Didelphis *of Stonesfield.*[1] By M. DE BLAINVILLE.

[M. De Blainville introduces the present memoir with some general observations explanatory of the reasons which have led him to enter so fully into details, in laying before the Academy his opinions upon the subject under discussion].

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IT was under the influence of these sentiments that I had the honour of reading before the Academy on the 20th of August last, some doubts and observations relating to the supposed fossil *Didelphis* found at Stonesfield; in which observations my object was rather to draw the attention of English naturalists to a matter of such great importance in palæontology, and to show how questions of this nature ought to be treated, than really to solve the problem, deprived as I was of the necessary elements for so doing. After having indeed set forth and compared the data that I was able to advance as premises in the question, and which data necessarily became the special subject of the discussion, I arrived at the conclusion that the fossil jaws from the oolitic schist of Stonesfield had certainly not belonged to an animal of the marsupial subclass, nor even to the family of the *Insectivora* of the placental subclass; and that hence it became probable that it was not even a mammal, but rather an oviparous animal of the family of the saurians, in the class *Reptilia.* But before giving a definite character to these conclusions, I was very careful to mention to you that I had not examined any one

[1] 'Nouveaux Doutes sur le prétendu Didelphe de Stonesfield; (Comptes Rendus,' October 6th, 1838, p. 727)

of the original fragments upon which I raised these doubts, having only seen the figures and descriptions of them which had been published by M. Constant Prevost, Mr. Broderip, and Dr. Buckland. I therefore concluded my memoir by invoking the aid of those skilful observers who had the fossil remains in their possession, or at their disposal, to assist in the farther examination of the question.

The result of my appeal has not, I am happy to say, been long delayed. Professor Buckland, who has two of these fragments under his care in the Ashmolean Museum, at Oxford, being about to visit Paris, Dr. Roberton, at the suggestion of M. Laurillard, happily thought of requesting him to bring them with him, which he did; but unfortunately for me, and perhaps for the question, the day on which Dr. Roberton wished me to pass an evening at his house with Dr. Buckland, I had set out for the country, and thus lost the opportunity of clearing up my doubts, and of correcting any errors I might have committed. Nevertheless this courteous and liberal attention of Professor Buckland has not been without advantageous results, since, during my absence, four persons, —M. Agassiz, M. Valenciennes, and two of our fellow-members, M. E. Geoffroy and M. Dumeril, have made known to the Academy their observations on the same subject; and thus the inquiry is seriously taken up.

The first of these observations in point of date is due to M. Agassiz, who, in a letter addressed to the Academy on the 3rd of September, and inserted in the 'Comptes Rendus,' (p. 537, 2nd. sem., 1838), claims priority in the view which I had adduced, by saying that since the year 1835 he had offered an opinion concerning the supposed *Didelphis* from Stonesfield, perfectly in accordance with mine. Although I certainly had no knowledge of the fact, it would have been very unskilful of me not to have supported my opinion by those of observers like Prof. Grant, M. Agassiz, and M. Meyer; I therefore did so, and I thought I should secure myself against all reproach on this subject, by quoting M. Agassiz as having at first entertained the same views as myself, but as having afterwards apparently abandoned them. As to the rest, I am far from refusing myself the credit, which I may claim as a matter of justice, of having added some fresh details upon this subject.

M. Agassiz appears to have mentioned these fossils for the first time in 1835, in a very short note inserted in the German Journal of MM. Leonhard and Bronn, p. 186; and, according to M. Valenciennes, the object of this note is to establish, in a definite manner, the opinion that the Stonesfield animals are undoubtedly mammals, but that their affinity with the marsupials does not appear to him so evident; that the teeth are more like those of the *Insectivora*, and that they also bear some resemblance to those of the seals. From this then it appears that the claim of M. Agassiz can relate only to the erroneously supposed relation of these fossil remains to the opossums, and to a certain resemblance of the posterior molars to those of many species of seal. I therefore very willingly repeat what I said in my first "Doubts," and which I learned from M. de Roissy, that M. Agassiz had told him that he had printed in a note added to the German translation of Prof. Buckland's work on Geology and Mineralogy, that the fossil bones of Stonesfield did not belong to a mammiferous animal. To this M. de Roissy added that he knew from another source, and not from M. Agassiz, as I erroneously remarked in my first "doutes," that Dr. Grant, the Professor of Comparative Anatomy at the London University, had advanced the same opinion in his course of Lectures this year, at the same time assigning his reasons for it.

But as I have been able myself to consult the first article quoted above, in M. Leonhard's Journal, and the second in the German translation of Dr. Buckland's work, of which, however, a part only has recently arrived in Paris;—I think it requisite for me to give my own literal translation of it, in order that I may be able to notice some inaccuracies which have escaped M. Valenciennes.

In the first place let us consider the first note.

"As to the enigmatical species of *Didelphis* from Stonesfield," says M. Agassiz, "I now know that it is not a fish.—I have seen all the specimens which are in the English collections,—five lower half jaws belonging to two species,—but nowhere any trace of *vertebræ*, or of bones of the extremities. The trenchant crown of the largest molars, laterally compressed, always has two small notches on each side, and consequently five pointed tubercles. The smaller ones have but three; they are certainly those of mammals; but that they may be compared with the teeth of the marsupials, is not the case. The dental system indeed has also much resemblance to that of the *Insectivora*, and each separate tooth resembles even the greater part of those of the seals, near which group the animal to which these jaws belonged should form a distinct genus. In fact the aspect of these fossil fragments is so peculiar, that it draws our attention towards aquatic animals rather than away from them."—'(Neue Jahrbuch Mineral. und Geolog. von Leonhard und Bronn, 1835; tom. iii., p. 185; in a letter written from Neufchatel, Switzerland, June 20th, 1835.)

M. de Blainville also quotes the second note of M. Agassiz, which, though longer, adds scarcely anything to the contents of the first; except that M. Agassiz very justly remarks that M. Cuvier, in speaking of these fossils, never positively affirmed that they ought to rank in the genus *Didelphis;* and he [M. Agassiz] proposes to designate the genus by the name of *Amphigonus.*

From these two passages we may infer, that prior to his having actually seen these fossils, M. Agassiz had supposed that they might belong to a fish; an opinion which he has abandoned to refer them decidedly to the class *Mammalia.*

Thus, as M. Valenciennes properly observes, it would be unjust in M. Agassiz to lay claim to the opposite opinion; although in fact neither of these articles has for its object the establishing, in a direct manner, that these remains from Stonesfield are those of mammals; as M. Valenciennes nevertheless observes. We may, on the contrary, find there the assertion, though destitute of proofs, that the dental system of the supposed *Didelphis* of Stonesfield is too far removed from that of the marsupials to allow of our placing it in that sub-class; and that if, regarded in its totality, it bears a certain resemblance to what we find in the *Insectivora,* the posterior teeth in particular may also be compared to those of certain seals. He thus leans towards the opinion that it is rather an aquatic than a terrestrial animal, considering it as approaching to the seals. We there also find that M. Agassiz was of opinion that these fossils ought to form a distinct genus; but that he did not propose for this genus the name *Amphigonus* until his second note; of this, indeed I, was ignorant, as M. Valenciennes very correctly observes, nor could I possibly have known it, since this note, if it were printed at the time my memoir was read, was certainly not published.

Finally, I ought to notice a very just observation of M. Agassiz, which is, that M. G. Cuvier, in speaking of these fossils, always retained a doubtful form of expression, or at least very slightly affirmative, and such as would follow from a very rapid and consequently slight examination.

But of the four communications made to the Academy relating to the supposed *Didelphis* from Stonesfield, that of M. Valenciennes must necessarily occupy the first place, as being the longest. In fact, Dr. Buckland, who from the first intrusted these fossils to M. Laurillard, that is to say, not only the specimen upon which rests the *Did. Prevostii* of M. Cuvier, but also another, in some respects more complete, and of which no one had previously spoken;—at the particular request of M. Valenciennes, very obligingly allowed him to make them the subject of his observations, and even to take from them impressions in sulphur, very carefully executed, and the casts in plaster were thus procured which are to enrich the paleontological collection of our Museum.

M. Valenciennes has also received, through M. Laurillard, a drawing very carefully executed, which appears to me to be that originally sent to M. G. Cuvier by Mr. Phillips, and which was taken from a third half-jaw in the possession of Mr. Sikes.

So that instead of the two specimens of this curious fossil being, as I imagined, the only ones existing in England, geologists now possess four, including that in Mr. Broderip's collection, and even five, according to the first note of M. Agassiz, without reckoning the fragment in "l'Ecole des Mines" which we mentioned in our first "doutes," and which is generally referred to the saurians.

From an actual examination of the two portions of jaw brought over by Professor Buckland, merely the casts of which have been exhibited to the Academy;—and from the drawing of that in the collection of Mr. Sikes;—M. Valenciennes returns to M. Cuvier's opinion, that it is a marsupial mammal; he however thinks, like every one before him, that it must form a distinct genus, to which he assigns another new name; "mais qu'il choisit assez signicatif pour qu'à lui seul, il formule nettement sa maniére de voir."

It is also on this side of the question that M. E. Geoffroy de Saint-Hilaire, and M. Dumeril have ranged themselves; the one without explaining the reasons of his conviction, the other basing his upon the presence of a condyle, and the unity of the jaw.

Without doubt persons who are little versed in the study of organic structures, and who place too implicit a reliance on perhaps rather a presumptuous assertion, that by the aid of a single bone, or of a simple facette of a bone, the skeleton of an animal can be reconstructed, and consequently its class, order, family, genus, and even species determined, may very probably think it strange that four or five half-jaws, more or less furnished with teeth, should be insufficient to indicate promptly and with certainty to what class the animal to which they belonged should be referred; but their astonishment would cease if they would in the first place observe that in the present case these jaws are perhaps not one of them entire; that they are not to be fully examined either by ourselves or by the parties to whom they belong, on account of their attachment to the matrix enclosing them, and its extreme hardness; but above all because the assertion above quoted, although it has almost passed into a common phrase, and is to a certain degree correct when we apply it to known animals, or to such as differ but little from them, becomes strained, and even quite fallacious, when the forms in question are more or less isolated, whether recent or fossil; this will be placed beyond doubt in the continuation of my great paleontological work.

M. De Blainville then passes on to the detailed description of three portions of jaw, which form fresh elements in the solution of the question.

With respect to the first, the basis of the *Did. Prevostii*, of which he has been able to form a much more correct idea from the cast, and one very different to that derived from very inaccurate sketches, especially that given by M. Prevost,—he alludes chiefly to there being no trace of a condyle, but rather a sort of articular *fossa*, something like that in fishes; he insists upon the presence of a lower marginal ridge, (*sillon*), and he observes that the teeth, which are far from displaying that regularity of disposition indicated by the figures which have been mentioned, have the summit of their roots adherent to, and continuous with, the substance of the jaw.

Respecting the second portion of jaw which is now for the first time introduced in the discussion, and which, while it is more perfect with regard to the bone, is much less so as respects the dental system,—M. de Blainville thinks, in opposition to what was said of it by M. Valenciennes, who looked upon it as the inner side, that it is also a *ramus* of the right side, with its external aspect visible; and in proof of his opinion he points out the general curve of the horizontal portion longitudinally, and its declension towards the dental line; the existence of a "*fosse massétérienne*," and of an angular process, which is evidently convex on the free side and bent back on the adherent one; and finally, the existence of the same ridge (*sillon*) observed in the preceding piece. He does not admit the orifice of the dental canal noticed by M. Valenciennes as a small circular foramen, situated at the point of junction of the *fosse massétérienne* with the horizontal branch; M. de Blainville supposing that this appearance, which is so evident in the drawing, is owing to some defect in the colouring, since there exists no trace of it in the sulphur impression, nor upon the plaster cast. Neither does he admit the *symphysis* described by M. Valenciennes, any more than an articular condyle, nor even a coronoid process, clearly as it appears terminated in the figured fragment, because nothing similar shows itself in the sulphur impression.

Finally, with respect to the third piece, consisting of a design carefully executed, which he has merely seen for a moment in the hands of M. Valenciennes, who unfortunately did not consider himself at liberty to lend it to him,—M. de Blainville thinks that the palmated, five-lobed form of the posterior molars would alone be sufficient to negative all approach to the didelphs, and even to the *Mammalia*.

Insomuch that M. de Blainville reviewing the reasons upon which M. Valenciennes bases his opinion, namely,—the existence of a condyle, the presence of which upon either of the impressions cited M. de Blainville positively denies,—the form of the teeth, which certainly have no relation in number, disposition, or shape, to those of the *Didelphis murina*, any more than to those of any other known mammal, although they support themselves upon what M. Agassiz has said of the teeth having five points, disposed as in the *Insectivora*, which is not the case, as we have seen in the note given literally above; the aspect of the ascending *ramus*, which, in both specimens is mutilated, and has only left its impression, indicating a kind of very slender plate, slightly convex externally, and concave within;—the *symphysis*, which exists only in appearance;—the opening of the dental canal, of which also he denies the existence, since the jaw is seen on the outer side, and which had neither the form nor the position of that of the *Didelphis*, nor even of other *Mammalia*;—the prolongation of the angular process, which has nothing in its shape to remind us of that of the didelphs, and which rather brings to our recollection that of certain fishes;—and finally, the compound structure of the jaw, which might very well be no longer distinctly visible in a fragment so long ago fossilized, and yet have existed; and of which, it appears to him there are left some traces in the lower marginal ridge still visible in the two specimens, and in the projection where it commences.

M. de Blainville then finds himself compelled to pause, at least until fresh evidence be produced; in the conviction that the portions of fossil jaws found at Stonesfield, certainly do not belong to a marsupial,—and probably not to a placental mammal, either insectivorous or amphibious; and that consequently it is more likely that the animal may have been oviparous.

As to the doubt which he has just formed by analogy with what is known of the *Basilosaurus*, a large fossil reptile of America, the teeth of which display the peculiarity of possessing a double root,—that this might be an animal of the saurian order,—M. de Blainville says that if M. Agassiz, who has studied fossil fish much more even than himself, had not decidedly given his opinion against all approach to fishes, he would have been rather led to suppose that it might be an animal of that class.

We see from this, adds M. de Blainville, that I ought to persist in retaining the name *Amphitherium* which I proposed, if only because it has the priority over that of *Amphigonus* given by M. Agassiz; and that so much the more, because even if it should be beyond a doubt that these jaws are those of a mammiferous animal, I see nothing in them, any more than in their dental system, which could lead to their being necessarily those of an opossum; for, from the dental system, and especially from the molar teeth, to form conclusions respecting the rest of the organization, and above all as to its marsupial nature, is, as I propose to show in a report which I am about to make immediately to the Academy, to go far beyond what the method of analogy will allow.

As to the rest, it appears that every one has not regarded the question as so completely solved as our fellow-members have supposed it to be; since, according to what is reported to me by a zoologist and anatomist, whom, for my own part, I very much regret I do not see among the number of competitors for the vacant place in our section, Dr. Buckland has himself offered the problem and the fragments on which it rests, to the investigation of the German naturalists assembled in congress at Fribourg, in Brisgau, in the month of September last, which was his intention in bringing them to Paris.

We may therefore hope that the German zoologists who have seen and studied these enigmatical fossils, co-operating with those who possess or have access to them in England, and the matter being discussed by arguments based upon evident and incontestible facts, it may attain to a demonstration, of what nature is of but little consequence, provided it be satisfactory enough to be admitted, if not generally, at least by all those who, in scientific questions, are so fortunate as to have leisure and the ability to judge without prejudice, but with a knowledge of the cause.

In conclusion I ought also to announce to the Academy, that the scientific conductor of the English Journal called the 'Athenæum,' has already laid before his readers the point under discussion, having no doubt but that there will soon be discovered, in the Stonesfield quarries, some fragment that will be sufficiently demonstrative; and in the mean time he himself proposes, to avoid he says being accused of partiality towards either of the three already proposed,—the name *Botheratiotherium* for the supposed *Didelphis* of the oolite; so that science is already embarrassed with four or five denominations for an animal, of which our knowledge is most imperfect; since, by one party it is referred to the *Mammalia*, by another to the insectivorous monodelphs, or the *Amphibia;* and by a third to the didelphs allied to opossums, or to a genus representing the seals, in the sub-class of *Marsupialia;* whilst others make a saurian, or even a fish of it; which, it may be remarked *en passant*, appears much more in accordance with the age and the geological character of the formation which contains the fossils in question, as well as with the organized bodies with which they are associated.

ART. II.—*A Catalogue of the Fossils found in the Cornbrash Limestone of Scarborough: with Figures and Descriptions of some of the undescribed Species.* By WILLIAM BEAN, Esq.

THE cornbrash limestone on the Scarborough coast is a "thin and unimportant rock," which cannot be applied to any useful purpose: it has certainly been sometimes injudiciously used to repair our highways, a practice we hope will be discontinued, as much better road-stone may be more easily obtained. But that this "thin and unimportant rock" is not deficient in interest to the enquiring geologist, the following catalogue of its organic remains will amply testify. Commencing at Gristhorpe Cliffs, and, with some interruptions, terminating at Ewe-nab, (a wider range than Mr. Phillips has assigned it), we meet with little to reward our labours; the stone is of a bluish grey colour, and rises in shapeless masses, full of shells laid in every direction, and strongly cemented together, so that it is almost impossible to obtain a perfect specimen. A blue shale covers this rock, and may be met with four or five times within the above-named limits. It contains several fossils rarely found in the bed below, particularly *Sanguinolaria parvula*, *Cardium latum*, *Isocardia triangularis*, *Belemnites tornatilis*, *Astacus rostratus* and *As. Birdii;* the two last are in nodules which occur in the greatest abundance. Proceeding onwards we again meet with the cornbrash on the north side of the Castle Hill, and it finally disappears before reaching Peaseholm Beck. To the left of the bathing-place the same blue shale occurs as at Mill Bay, containing the same fossils; but our favourite locality is opposite Harland's cottage, where most of the fossils recorded in the following pages have been obtained: the stone is here of a reddish colour, not so coarse-grained, contains fewer organic remains, but in a better state of preservation. The minerals met with in this stratum are iron pyrites, lenticular calcareous spar, and common iron glance.

When the 'Illustrations of the Geology of Yorkshire' was published, the cabinets in this place contained only thirty-seven species of cornbrash fossils; our collection now amounts to one hundred and thirty-four, all procured by our own exertions. To this we attach some importance, after having witnessed with regret the extent to which fossil-making has been carried in this neighbourhood: and (we say it "more in sorrow than in anger") such impositions have not always been confined to ignorant and mercenary dealers. We cannot close this article without returning our kindest thanks to Miss Travis for the correct and elegant drawings which illustrate this paper.

ABBREVIATIONS.

S.—Sowerby's 'Mineral Conchology.' P.—Phillips's 'Geology of the Yorkshire Coast.' B.—Bean.

REMAINS OF PLANTS.

Dicotyledonous wood, very much compressed.

ZOOPHYTA.

SPONGIA *floriceps*, P.
——— *papillosa*, B.
CELLARIA *Smithii*, P.
FLUSTRA imperfect.
MILLEPORA *straminea*, P.
CARYOPHYLLIA
ASTRÆA *Dunnii*, B. Found by John Dunn, Esq. A unique and interesting specimen.
TUBIPORA
———? *acervalis*, B. Common in the Bath oolite.
——— *incrustans*, B. (New Sp.)
Crust very thin, spreading, smooth, and almost covered with short cylindrical tubes.

This beautiful fossil is found adhering to oysters, &c., and is very rare.

RADIARIA.

CIDARIS *vagans*, P.
CLYPEUS *clunicularis*, P.
——— *orbicularis*, P.
GALERITES *depressus*, P.

CRUSTACEA.

ASTACUS *rostratus*, P.
——— *Birdii*, B.

One if not both of the above species must be removed from this genus. We have perfect specimens from the inferior oolite, which will be described should the fossils of that formation come under our consideration.

ANNULATA.

SERPULA *intestinalis*, P.
———— *squamosa*, P.
———— *clava*, B.

CONCHIFERA.

Order I.—*Dimyaria.*

PHOLADOMYA *Murchisoni*, P.
———— *ovalis*, S.
———— *acuticostata*, S.
———— *obsoleta*, P.
———— *simplex*, P.
———— *nana*, P.
MYA *modica*, B.
—— *literata*, P.
—— *depressa*, S.
—— *calceiformis*, P.
AMPHIDESMA *decurtatum*, P.
———— *securiforme*, P.
———— *decussatum*, B. (New Sp.)

Shell oval-oblong, equivalve, unequilateral, gaping, and a little rounded at each extremity, covered with numerous lines of growth, and the anterior end finely striated longitudinally. Length 2 in., breadth $3\frac{1}{4}$ in.

This rare shell is evidently of the same family as the above; probably none of them belong to the genus *Amphidesma*.

AMPHIDESMA *recurvum*, P.
CORBULA *depressa*, P.
SANGUINOLARIA *undulata*, S.
———— *parvula*, B. (New Sp. *fig.* 18).

18

Shell transversely oblong, compressed, smooth, and marked with a few lines of growth. Anterior end a little rounded, and the posterior with a rounded truncation. Beaks nearest the anterior extremity. Length $\frac{1}{4}$ in., breadth, $\frac{1}{2}$ in.

A rare shell, which has not yet been found in any of our other strata.

PSAMMOBIA *lævigata*, P.
TELLINA
———— *proletaria*, B. Very rare.
CORBIS *ovalis*, P.
—— *lucida*, B.
LUCINA *crassa*, S.
—— *despecta*, P.
ASTARTE *minima*, P.
———— *lurida*, S.
———— *extensa*, P.
———— *politula*, B.
———— *rotundata*, B.
PULLASTRA *peregrina*, B. *Unio peregrinus*, P.
———— large species, imperfect.
TRIGONIA *costata*, S.
———— *elongata*, S.
———— *clavellata*, S.

CARDIUM *lobatum*, P.
——— *cognatum*, P.
——— *latum*, B.
——— *citrinoïdeum*, P.
——— *globosum*, B. (New Sp. *fig.* 19).
Shell globular, equivalve, equilateral, smooth, shining, and covered with numerous very fine concentric *striæ*. The length and breadth are equal.
Occurs in other strata, but rare in all.

19

——— *striatulum*, P.
CARDITA *similis*, S.
ISOCARDIA *tumida*, P.
——— *minima*, S.
——— *angulata*, P.
——— *nitida*, P.
——— *triangularis*, B. (New sp. *fig.* 20).

20

We possess perfect specimens of the five species of *Isocardia* enumerated above, and consider them all distinct. The two last, in shape and size, are very much alike, but *Iso. triangularis* may at once be distinguished by its stronger concentric lines and longitudinal *striæ*.

CUCULLÆA *cancellata*, P.
——— *proxima*, B.
——— *triangularis*, P.
——— *abrupta*, B.
ARCA *æmula*, P
NUCULA *Lachryma*, S.
——— *variabilis*, S.
MODIOLA *cuneata*, P.
——— *imbricata*, S.
——— *bipartita*, P.
MYTILUS *sublævis*, S.
PINNA *lanceolata*, S.
——— *cuneata*, P.

Order II.—*Monomyaria*.

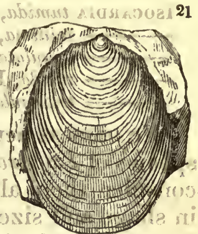
AVICULA *Braamburiensis*, P.
——— *inæquivalvis*, S.
INOCERAMUS. Fragments of a very large and thick species.
GERVILLIA *aviculoïdes*, S.
PLAGIOSTOMA *rigidulum*, P.
——— *interstinctum*, P.
LIMA *rudis*, P.
——— *gibbosa*, S.
PECTEN *elimatus*, B.
——— *cancellatus*, P.
——— *arcuatus*, S.
——— *inæquicostatus*, P.
——— *demissus*, P.
——— *fibrosus*, S.
——— *lens*, S.
——— *vagans*, S.

EXOGYRA *mima*, B. *Chama mima*, P.
GRYPHÆA *bullata*, P.
OSTREA *Marshii*, S.
——— *spatiosa*, B.
——— *Meadii*, S.
——— *granulata*, B.

In Dr. Murray's cabinet. Our specimen of this beautiful oyster is from the Bath oolite.

OSTREA. A small, thick, oval species.
ANOMIA *inæqualis*, B. *Ostrea inæqualis*, P.
——— *duriuscula*, B. *Ostrea duriuscula*, P.
——— *semistriata*, B. (New sp. *fig.* 21).

21



Shell oval, convex, thick, with numerous longitudinal, undulated *striæ*, only visible towards the margin. Beak pointed, but not terminal.—Length, 1 in. breadth, ¾ in.

In looking over a great number of specimens of the fossils which we have placed in this genus, only one of what may be the lower valve has been met with. It is perforated, and has the appearance of the under valve of an *Anomia*, but it is very thin and fragile, and may possibly have been broken by accident.

Order III.—*Brachiopoda*.

TEREBRATULA *socialis*, P.
——— *digona*, S.
——— var. S.
——— *ornithocephalus*, S.
——— *subrotunda*, S.
——— *ovoides*, P.

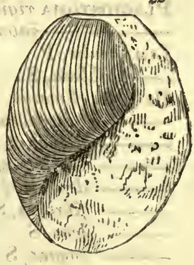
This is not the *Ter. ovoides* of Sowerby, but a common shell in the shale that covers the cornbrash on the north shore. Good specimens are rarely met with, but the beak of the larger valve is always very perfect, prominent, and incurved, which gives the shell a fanciful resemblance to a bird's head.

MOLLUSCA.

Order I.—*Gasteropoda*.

BULLA *undulata*, B. (New sp. *fig.* 22).

22



Shell oval, approaching to globular, longitudinally wrinkled or undulated. Aperture large, comprising nearly the whole shell, but much wider at the lower than the upper part. Apex umbilicated. Length, 1½ in. breadth, 1 in.

Mr. G. B. Sowerby in his 'Genera of Recent and Fossil Shells,' says,—"Fossil species are only to be distinguished in the tertiary beds and in the green sand." For once we must differ from him, at the same time acknowledging the correctness of his general assertions. Fossil *Bullæ* are certainly rare; the specimen figured being the only one that has occurred in this neighbourhood. The *Bulla elongata* figured by Professor Phillips in his 'Illustrations of the Geology of Yorkshire,' cannot belong to this genus, as all our specimens (though imperfect) have one fold on the pillar.

VERMETUS *nodus*, B. *Vermicularia nodus*, P.
——————reverse var. B.
DENTALIUM *glabellum*, B.
CIRRUS *funiculatus*, B. *Turbo funiculatus*, P,
ROTELLA *expansa*, S.
PLEUROTOMARIA *granulata*, S.
TROCHUS *monilitectus*, P.
LITTORINA *ornata*, S.
——————*punctura*, B. (New sp. *fig.* 23).

23

Shell turbinated, finely striated longitudinally and transversely, which, under a high magnifier, gives it a very beautiful appearance. Whorls six, rounded and well divided, the body whorl occupying one half the length of the shell. Aperture elliptical. Pillar lip thick and a little flattened: outer lip very thin. Length nearly ¾ in. breadth ½ in.

The only specimen procured from the cornbrash, but in the inferior oolite at Peak Hill it is not uncommon; the specimens found there are larger, coarser, and the spire is not so much produced.

PHASIANELLA *Heddingtonensis*, S.
——————*vittata*, B. *Melania vittata*, P.
TURRITELLA *longiuscula*, B. *Tur. cingenda*, P.
—————— *gemmata*, B.
TEREBRA *granulata*, P.
ROSTELLARIA *bispinosa*, P.

Order IV.—*Cephalopoda.*

BELEMNITES *tornatilis*, P.
NAUTILUS imperfect.
AMMONITES *Hervii*, S.
—————— *terebratus*, P.

This ammonite grows to a large size, in which state it is compressed, smooth, and destitute of its former ornaments.

REMAINS OF FISHES.

Part of a fish of the genus *Lepidotus*.

REMAINS OF REPTILES.

Vertebræ and bones of saurian animals.

Scarborough, Dec. 12, 1838.

ART. III.—*Notices of Irish Entozoa.* By JAMES L. DRUMMOND, M.D., Professor of Anatomy in the Royal Belfast Institution, President of the Belfast Natural History Society.

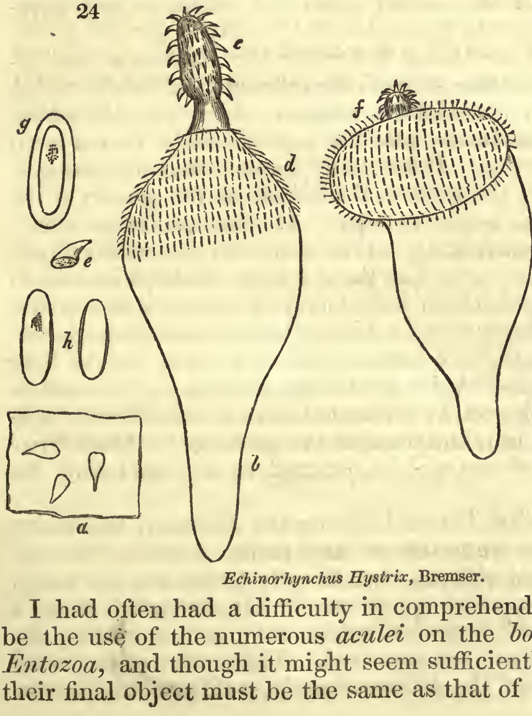
(*Continued from page* 662 *vol.* ii. n. s.)

ECHINORHYNCHUS Hystrix; Bremser.

"*Ech.* Proboscidis cylindricæ parte anticâ angustatâ, collo brevi, corpore antrorsum crassissimo aculeato, apice caudali tenui subnudo." Rud. 'Syn.' p. 75.

On Friday, the 9th of November last, I received from my friend Dr. Hopkirk, (now attached as naturalist to the Irish ordnance survey), the bodies of two goosanders, (*Mergus Merganser*), which had been recently shot. In one of these there were nearly a hundred specimens of *Echinorhynchus Hystrix* adhering to the intestine, from about two inches above its lower extremity to the distance of a foot and a half higher up. They were very white, and to the naked eye not larger than the head of an ordinary pin; but after maceration in water, they enlarged in every direction, so as to present the appearance shown at *a, fig.* 24.

24



(*a*) appearance of *Echinorhynchus Hystrix* when distended and adhering to the mucous coat. (*b*) a detached specimen, magnified. (*c*) the proboscis, with its large *uncinuli*. (*d*) minute *aculei* on anterior part of the body. (*e*) form of the animal when un-distended, resembling the *Patella Hungarica*. (*f*) magnified view of a specimen when distention has commenced. (*g*) a mature *ovum*. (*h*) two immature *ova*.

Echinorhynchus Hystrix, Bremser.

I had often had a difficulty in comprehending what could be the use of the numerous *aculei* on the *bodies* of various *Entozoa*, and though it might seem sufficiently obvious that their final object must be the same as that of the *uncinuli* of the *proboscis*, yet the difficulty remained of knowing how they could come into action; and on looking at *b*, *fig.* 24, which is a magnified view of the present species, it is not easy to conceive how the *proboscis* (*c*) could be assisted by the *aculei* at *d*. And were the *natural* state of the animal such as is represented here, and in delineations of this and various allied species in helminthological works, these *aculei* would be little better than useless; but the figures alluded to show the animals not in their natural state, but distended to six times their original bulk, or more, by the absorption of water, and rendered rigid, and almost ready to burst, instead of being shrivelled and flaccid. In accordance with this observation I found that on examining the present species, when immediately removed from the intestine, it bore in form a close resemblance to a *Patella Hungarica* in miniature; there was a small, conical, raised extremity, but the broad end was expanded like a circular disc, with the *proboscis* projecting from its centre, as represented at *e*, *fig.* 24. The first sketch which I made of this species, was that shown at *f*, *fig.* 24, after the absorption of water had commenced; while *b*, *fig.* 24, shows the animal when the distention was completed.

Now it must be obvious that while the *Entozoon* can apply the *aculei* to the side of the intestine, or to the tough mucus lining it, considerable adhesive force must be added to that of the *proboscis*, and the animal's hold be rendered thereby more secure. It would appear too that the younger, and consequently the weaker, the animal is, the greater is the surface which the *aculei* occupy. All the specimens which I obtained were evidently adult, and only the anterior part was armed with them, but those which Rudolphi received from Bremser, and which were found in the intestines of the cormorant (*Pelecanus Carbo*, Linn.), would seem from the following sentence to have been of different ages, and to bear out this opinion.—"Apice posteriore excepto corpus aculeis exiguis reflexis horret, in specimine minimo ad ultimum apicem protractis; in reliquis major pars nuda est."—'Ent. Syn.' p. 332. This subject will be recurred to in considering the next species.

Contrary to what is usual among the *Entozoa*, the males in my specimens are nearly as large as the females; the caudal vescicle is not oblique, but directly terminates the body. On cutting into several specimens in the distended state, a fluid crowded with granules rushed out; and on cutting the females thousands of *ova* appeared. These were of the usual form of the *ova* of the *Echinorhynchi*,—elliptic and linear.

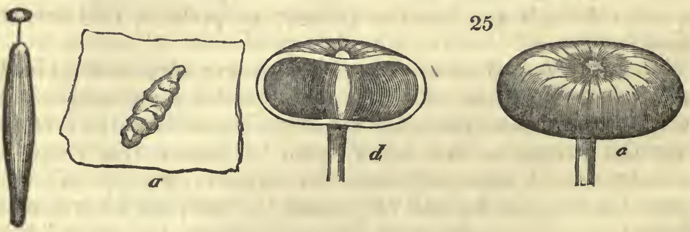
Those which were immature exhibited only one envelope, but in such as were more advanced, a second was very conspicuous, a considerable space intervening between the two, especially at one end. A granular mass occupying some part of the central axis was always visible in the mature, and sometimes in the immature *ova*. The round or oval masses were likewise numerous, but exhibited no appearance of contained *ovula*. With regard to these bodies I will take this opportunity of remarking, that though at page 523 of the last volume I spoke strongly against the supposition of the spicular *ova* having any intimate connection with them, as no such union, after very numerous observations, had ever presented itself to me, yet I am now persuaded that they are masses of *ovula* in a rudimentary state. On the 6th of October last while examining some specimens of *Echinorhynchus versicolor* from a duck, I saw in one individual so distinctly that the round bodies consisted of young *ova*, that I marked down the following words in my diary.—"I saw, without any manner of doubt, that most of the rounded masses were composed of immature *ova*, their outline being so clearly visible that there could be no mistake." Among the spicular free *ova*, too, were many minute specimens which exactly resembled those in the orbicular masses. In several other individuals which I examined from the same duck, and in others afterwards from the sheldrake, I found no similar appearance; but in the instance mentioned, the ovular composition of the masses was so indisputably evident, that in my own mind there was left no farther room for doubt.

To return to our more immediate subject,—my friend Dr. Bellingham of Dublin, who has paid more attention to the *Entozoa* than any other person in this country, having kindly offered to co-operate with me in illustrating our native species, I gladly avail myself of his friendly assistance in describing the present. In a letter dated December 9th, 1838, he observes,—"I have obtained the *Echinorhynchus Hystrix* from the large and small intestines of the crested cormorant, from the small intestines of *Mergus serrator*, and what I take to be it from the *rectum* of the common cormorant, and of the red-necked grebe (*Podiceps ruficollis* ?). The following are the observations which I find I had made on this species. May 8th, 1838.—In large and small intestines of crested cormorant found many specimens of *Echinorhynchus Hystrix*. In most instances they were firmly adherent to the mucous membrane. The greater number and the largest existed in the *rectum* and close to its short *cœca;* in the small intestines they were fewer and of less size. Their colour is white, the largest are three lines in length, and a line in breadth across the thickest part of the body. The *proboscis* is conical, armed with very numerous recurved hooks, rounded anteriorly; the neck in some is retracted, when fully protruded it is about the length of the head, smaller where it joins the head, and increasing in diameter posteriorly; it is unarmed. The body is thick and somewhat globular anteriorly, gradually diminishing in diameter as it approaches the posterior extremity. It is armed, especially anteriorly, with innumerable minute recurved hooks, which are much smaller than those on the head; some specimens are armed from one end of the body to the other, others are unarmed near the posterior end. The body in the female is rounded posteriorly, and has a very small yellowish spot at its extremity. The male is not so long as the female, but as wide anteriorly. Two vessels appear through the *parietes* of the neck, running into the body, where they are lost."

This species is beautifully figured in Bremser's seventh plate, *fig.* 22—23, but the *proboscis* is there represented more conical than I have seen it. It has, so far as my information extends, been hitherto found only in the following birds:—by Bremser in the *Pelecanus Carbo;* by Dr. Bellingham in the same? and in *Carbo cristatus, Mergus serrator;* and *Podiceps ruficollis?* and by myself in the *Mergus Merganser.*

Echinorhynchus *filicollis*, Rud.

"Proboscidis (semper latentis) receptaculo magno sphærico, collo filiformi, corpore oblongo utrinque obtusissimo."—Rud. 'Syn.' p. 71.



Echinorhynchus filicollis, Rudolphi.

(*a*) *Echinorhynchus filicollis* in its natural or corrugated state, adhering to the coat of the intestine. (*b*) a specimen distended with water, and separated from its connections. (*c*) head magnified. (*d*) head with part of it removed by a vertical section, shewing the thick central pillar surmounted by the *umbo*.

Rudolphi mentions this species as having been observed in the wild duck, the tufted duck (*Fuligula cristata*), the summer duck (*Anas sponsa*), the eider duck (*Anas mollissima*), and the bald coot (*Fulica atra*). Dr. Bellingham has found it in the wild duck and the tufted duck; from which latter species I have obtained it, and also from the golden eye (*Anas clangula* Lin).

On the 25th of November last my friend Dr. Hopkirk sent me two specimens of *Anas clangula*, in one of which I found three *Entozoa* so closely resembling the figures of *Echinorhynchus sphærocephalus* in Bremser's plate, ('Icones Helminthum,' *tab*. vii. *ff*. 14—19), that I sent Dr. Bellingham a specimen under that denomination. He informed me shortly afterwards that it was what he had been in the habit of considering as *Ech. filicollis*, and on comparing it with the description of that species, I accordingly found it to be so, but for reasons which I shall presently state I cannot help thinking that *Ech. filicollis* and *Ech. sphærocephalus* are identically the same.

On the 14th of the present month in examining a tufted duck sent by my friend Wm. Thompson, Esq., I found upwards of thirty specimens of the same *Entozoon*. When seen lying in the intestine it resembles a portion of a thick *Tænia*, so much is it corrugated transversely. It is found however to be very firmly fixed to the intestine, and on farther examination it is ascertained that while the body of the animal is in the intestinal cavity, the head is on the outer or peritoneal surface, while the slender neck connecting the one with the other passes through the intestinal walls. The outer surface of the intestine hence presents the appearance of being studded with a number of tubercles, as when the *Ech. versicolor* is present, but with this difference, that many of the tubercles are not in immediate contact with the surface, but are appended each to a slender projecting pedicle, one or two lines in length.

Rudolphi describes this species as being from half an inch to an inch and a half in length; my largest specimen, which is from the *Anas clangula*, measures about fourteen lines. He states that in the examination of above thirty specimens, he never saw the *proboscis* exserted, ('Ent. Hist.' i. p. 283); and again in the 'Synopsis,' p. 327, he observes,—"*Echinorhynchus filicollis*, quemadmodum præcedens (*Ech. porrigens*) nunquam proboscidem exsertam affert, sed in bullam sive receptaculum et ita quidem retractam sistet, ut nulla encheiresi evolvi possit." I believe that the proper explanation of this is, that there is no *proboscis* to exsert; and for these reasons. On examining at least a dozen specimens in the microscope, I found first, that the head and projecting part of the neck (or pedicle) are surrounded by a thin layer of *peritonæum*, which can be readily torn away; under this is a much thicker and stronger envelope, which with a little trouble can also be removed or torn, so that it may be everted, in doing which it is seen to be every where in close contact with, though not adhering to, the ball or head; there is no perforation whatever, either through it or the peritoneal covering, nor is there any vacant space into which the *proboscis* could be protruded. A *proboscis* therefore could not pass into the abdominal cavity of the bird, nor is there any space for receiving it in the coats which envelope the head.

But farther, when the extraneous coats are removed and the head itself comes fairly into view, there is not on the latter the slightest appearance of any aperture, nothing like the entrance into an investing sheath in which the instrument could be retracted, and the centre of the disc, instead of being depressed, is prominent and rounded. Rudolphi describes the disc, or top of the head, as apiculate, "seu puncto eminente insignem;" but this term does not fairly express its nature, the central projection not being a minute or sharp point, but blunt, convex, and surrounded by a broad fosse; the proper term, as applied to the head would be *umbonated*, and to the central projection, that of *umbo*.

The circumstances mentioned are sufficient, I believe, to show that the only *proboscis*, if so it can be called, is the head itself.

The neck of this species is very slender, being no thicker than an ordinary sewing thread, but it is extremely tough, and difficult to break, so that by care and patience the intestine may be cleared away from it; and in doing this I have succeeded better by tearing away the intestine piecemeal, with a pair of forceps in each hand, than by using cutting instruments. Rudolphi observes,—"Tuberculo extus aperto sphæra invenitur, quæ cum collo facile a corpore discedit, intestino vero prius aperto, et eodem circa vermis collum cautè dissecto, vermis illæsus extrahitur. Tum vero intestinum circa collum tenue contractum conspiciendo, qui bulla canalem tenuissimum transgredi potuerit mireris."—'Ent.' i. p. 284. The first part of this passage does not correspond with my own experience, for I have always found that the neck and body adhered most tenaciously to each other; and with regard to the last clause, that our wonder should be excited by the passing of so large a body as the head of the *Entozoon* through so small a canal as that which contains the neck, my opinion is that it never makes any such passage. I have no idea that the head of the animal is first contained in the intestinal cavity, or that it is attached to the *parietes* of the latter, and afterwards works its way through to the peritoneal surface; I am strongly inclined to believe that the animal's progress is in a contrary direction,—that in its first stage of being, the head is formed in the peritoneal coat, and that from it the neck penetrates the other tunics, and that afterwards the body is developed.

In support of this opinion I may at present mention, that besides the tubercles on the outside of the intestine of the tufted duck, to which were appended the bodies of perfect *Entozoa*, hanging free in the intestinal cavity, there were many other similar tumors having no such appendages, and on examining these I found the head of *Ech. filicollis*, with its enveloping coats, its central *umbo*, and the *striæ* running from it, similar in all respects to the head of the fully developed animal, but the neck was a pedicle of about two, or at most three, lines in length, terminated by a blunt, conical point, but not entering into any coat of the intestine, the peritoneal excepted, in which it was involved. It may be objected that these were the heads of perfect *Entozoa*, whose bodies had previously dropped off, and this idea occurred to me in their examination, but I could perceive no circumstance in any way favouring such a supposition. I am ready to admit, however, that much more observation will be required to settle this point as an absolute matter of truth, but in the mean time I am much inclined to suppose that various intestinal *Entozoa* have their embryotic period of existence in the *peritonæum*, and are afterwards developed into their final state by prolongation through the other intestinal coats into their common cavity. This I suspect to be the case with the *Bothriocephalus* so common in the cod, the head of which is always lodged in a curved irregular tumor, on the outside of one of the pyloric appendages, while the body hangs free in the *duodenum*.[1]

The *Ech. filicollis* absorbs water, but by no means so rapidly as any others of the same genus which I have examined, and in several of the specimens which I obtained from the tufted duck, the process was defective both at the anterior and posterior ends, while it was nearly perfect in the middle, so that the centre was swelled and the extremities narrow, exactly as the *Ech. sphærocephalus* is described by Rudolphi,

[1] On enquiring from Dr. Bellingham whether he had ever detected the head of this species, he thus writes,—"I have seldom examined a cod that I have not found the *Bothriocephalus* you mention; that it is a *Bothriocephalus* appears, I think, from the situation of the ovaries. I have never been able to unravel the head, so as to examine it, although I have drawn it out to a fine point, but could see neither depression nor *oscula*." Dr. B. farther states that he is sure it is a new species, and suggests for it the very appropriate specific title of *cryptocephalus*.

and figured by Bremser. The only point of difference indeed which exists between my specimens of *Ech. filicollis* and *Ech. sphærocephælus* is their being unarmed, though even this may not perhaps be an insuperable obstacle to their identity. Bremser first observed that several species which are fully armed in their young state, lose a great part of their spines on becoming adult. Rudolphi at first rejected that idea, but at length, and from the examination of this very *Ech. sphærocephalus*, embraced it as an undoubted fact.—"Ita nunc factum est, ut Echinorhynchos juniores cum senioribus, armatos illos sensim in denudatos transientes."—'Syn.' p. 672. I may remark too that while in Bremser's seventh plate, figure 15 represents the *Ech. sphærocephalus* with the head and anterior part of the body thickly armed, figure 17 with the head also thickly armed, but with only a few *aculei* on the anterior of the body, figure 19 is totally destitute of armature on any part of it whatever; a pretty strong presumption that in this species at least, the presence or the want of armature is not of primary importance as a distinctive mark.

The specimens of *Ech. sphærocephalus* examined by Bremser and Rudolphi were sent by Natterer from Brazil, and were found in the intestines of the sea pie (*Hæmatopus ostralegus*),[1] and in those of some species of gull: they were of various sizes, and very numerous. Rudolphi says of those from the *Hæmatopus*,—"Plurima specimina duas cum dimidia, unum septem, alterum novem lineas attingunt,"—'Syn.' p. 670; but no mention whatever is made of their neck penetrating the intestine, whence it may be concluded that they were found free in the cavity; and as we know that various *Ascarides* &c. are sometimes found in the alimentary canal, and at other times in the *peritonæum*, there can be nothing absurd in the conjecture that this species may also occupy one or other of these localities. Supposing then *Ech. filicollis* and *Ech. sphærocephalus* to be in reality the same, it is easy to conceive that when the head is in the *peritonæum* it will be unarmed, for there armature would be useless; but on the contrary if attached simply to the mucous coat, then the same necessity for armature would exist as in other *Echinorhynchi* similarly placed; it is therefore not improbable that since, according to the circumstances of the growth of the animal, the *aculei* are shed or retained; so according to situation they may be formed or not. These ideas are however only conjectural.

[1] Mr. Thompson suggests that this probably was the *Hæmatopus palliatus* of Temminck, the *Hæm. ostralegus* not being found, according to that author, in South America.

The head found in the tumors before mentioned, and when the neck or pedicle did not pierce the intestine, was as large as in the fully-developed specimens; but supposing the young animal to be attached to the mucous coat, it must be obvious that a small proboscis-like head would answer better, as giving a more penetrating and surer hold than an expanded bulb. Now Rudolphi describes the head of the smaller specimens of *Ech. sphærocephalus* as if it were really a *proboscis*, and makes no mention of a head at all. "*Minorum:* Proboscis globosa vel sub-globosa (anticâ parte tum minus convexa), echinorum mediocrium seriebus plurimis densè armata."—'Syn.' p. 670. Of the larger specimens he says,—"*Magnorum:* Proboscis nulla, sed *bulla* terminalis magna, rotunda, parum armata."—'Syn.' p. 471. Now if *Ech. filicollis* and *Ech. sphærocephalus be* the same, the *peritonæum* and not the mucous coat is the more natural situation of the head, which I would infer from this, that *Ech. filicollis* is by no means unfrequent, whereas *Ech. sphærocephalus* is only known I believe through the medium of the specimens from Brazil. When therefore the developement of the animal commences in the intestinal cavity, although the head may be so constitutioned as to adapt itself to that locality, yet the more natural developement into a ball will occasionally master the tendency to accommodation; and hence we find that at least in one of the small specimens examined by Rudolphi the head did not assume a proboscideal form. "Unicum tantum specimen acque parvum proboscidis loco *bullam magnam* seriebus longitudinalibus armatam obtulit."—'Syn.' p. 671.

The head of *Ech. filicollis* is not truly globular, but is of the form of an oblate spheroid; and when the side of it is removed by a vertical section, a white strong pillar is seen, standing in its centre, and continued into the *umbo*, while a considerable interspace (containing a fluid?) lies between it and the outer walls. It thus bears a considerable resemblance to the vertical section of the capsule of some mosses, especially of *Splachnum*. In the central pillar I could find no trace of a *proboscis*. The lateral bandelettes of Cloquet are very conspicuous on opening the body of the animal; they are two round, firm cords, about four lines long, and having their extremities free, while their base is firmly attached to, or rather continuous with, the root of the neck.

Belfast, Dec. 30*th*, 1838.

Art. IV.—*A few Observations on some of the Natural Objects in the neighbourhood of Cheadle, Staffordshire.* By James Carter, Esq.

As it is only by the accurate recording of facts and observations made by individuals on the objects of the districts in which they reside, that a general knowledge of the natural history of any country can be acquired, I am induced to publish the following scattered notes, made during the years 1836,-37, and part of 1838, in the intervals of time left unoccupied by the discharge of professional duties, and by so doing add another mite to the information on local natural history, at present "rudis indigestaque moles," but from which, at some future period, general laws of great interest may be deduced.

The country in the vicinity of Cheadle is highly picturesque, being very hilly, and intersected in various directions by narrow valleys, the sides of which are frequently very abrupt and rocky, whereby the scenery is rendered romantic. The general features of the country are in fact intermediate between those of the southern and of the northern counties.

The Flora also, as might be expected from the situation of the county, consists of a mixture of the plants common in the south with those characteristic of the north of England.—Thus, *Clematis Vitalba* entirely disappears, and *Acer campestre* is by no means common or abundant: and on the other hand we meet with *Empetrum nigrum*, *Parnassia palustris*, *Saxifraga hypnoides*, *Vaccinium Vitis Idea*, and other northern plants. The difference however consists rather in the degree of abundance of the same plants, than in the occurrence of different species; for instance, *Vaccinium Myrtillus*, which occurs sparingly in the south, grows in the greatest profusion in many of our fir plantations and commons, even to the exclusion of almost every other plant, with the exception of *Calluna* and *Erica*.

Many of the tracts of common in this part of the country are still very extensive, although within the last few years a vast quantity has been enclosed and planted with firs. Grouse are found in tolerable abundance on some of the large heaths in the possession of the Earl of Shrewsbury, and also on those belonging to the Duke of Devonshire near Buxton, Derbyshire. Besides the plants usually met with on the heaths in the neighbourhood of London, *Eleocharis cæspitosa*, *Juncus squarrosus*, and *Digitalis purpurea* are extremely common and abundant, as are also *Jasione montana* and *Empetrum nigrum*. *Plantago Coronopus* and *Genista anglica* occur sparingly: in the moist spots *Eriophorum angustifolium*, *polystachion?* (I cannot affect to be able satisfactorily to distinguish the latter species from *angustifolium*) and *vaginatum*, *Oxycoccus palustris* and *Viola palustris* are found. *Vaccinium Vitis Idea* is tolerably abundant, and *Vac. Myrtillus* extremely so, as already mentioned; the fruit of the bilberry when ripe is gathered by the poor, and carried to the neighbouring markets; mixed with currants, or even by themselves, they form a very palatable tart. The wood-pigeon also feeds upon them, and on account of the peculiar flavour which its flesh then acquires, this bird is considered excellent eating during the bilberry season.

The principal plants which occur in boggy situations are *Hydrocotyle*, *Viola palustris*, *Drosera rotundifolia* and *longifolia*, *Menyanthes trifoliata*, *Narthecium ossifragum*, and, in elevated positions, as about Cotton and Whiston, *Parnassia palustris* in abundance, but, as Mr. Luxford remarks in the November number of this Magazine, always confined to limited spots.

There is a ridge of limestone hills,—the Wever Hills,—on which some rather uncommon plants are met with; among them may be enumerated *Draba muralis*, *Spiræa filipendula*, *Lathræa squamaria* (near the lime-kiln), *Arabis hirsuta*, *Trifolium striatum*, *Primula elatior*, *Spergula nodosa*, *Arenaria tenuifolia*, *Carduus nutans*, *Asplenium Ruta-muraria* and *Asp. Trichomanes*, and the common limestone plants *Helianthemum vulgare*, *Poterium Sanguisorba*, *Saxifraga tridactylites*, &c. Several species of land shells also occur abundantly; as *Helix crystallina*, *pulchella*, *rupestris*, (in the crevices of the rocks); *Pupa umbilicata*, *Clausilia rugosa*, and a variety something similar to *Cl. dubia*. In a pasture on the same range of hills, near the Three Lows toll-gate, *Gentiana campestris* grows plentifully, in company with *Platanthera viridis*, which latter plant is rather common in gravelly pastures. On the right hand side of the road leading from the toll-gate above spoken of, to the village of Oakamoor, is a lovely romantic ravine, which will well repay the naturalist for his researches. The sides are rugged and steep, but wooded, and on them are found *Pyrola minor*, *Luzula sylvatica*, *pilosa*, and *congesta*, *Polypodium Dryopteris*, *Hieracium sylvaticum* and *umbellatum*: I was also highly delighted to discover, by the side of a stream which runs along the bosom of the valley, *Valeriana Pyrenaica*, growing in tolerable abundance; it occurred for a considerable distance up the stream, but was out of flower, (August 5th). I have not been able to find any recorded English habitat for this plant; it is, I am aware, considered as one of our certainly-not-indigenous plants, but no one who sees it in the locality here given, will hesitate to pronounce it decidedly wild, or at least perfectly naturalized. The vegetation generally in this spot was particularly luxuriant; *Asplenium Filix-fœmina* was especially fine, and the leaves of the *Arctium Lappa* were so large that I stood erect under them during a shower of rain. *Myrrhis odorata* occurred in the same spot, but rather sparingly: where also I took *Helix fusca* and *Scarburgensis;* of the latter I found only four specimens, which were among dead beech-leaves.

Another very picturesque valley called Demon's Dale, or Dimsdale, extending from Alton Towers, the seat of the Earl of Shrewsbury, in the direction towards Cheadle, affords *Viola palustris*, *Chrysosplenium oppositifolium* and *alternifolium* in great profusion; also *Adoxa moschatellina*, which indeed is much more abundant in many places in this neighbourhood than I ever observed it elsewhere; it abounds on every moist, bushy bank. *Angelica sylvestris*, *Lycopodium inundatum*, *Polypodium Dryopteris*, *Pol. calcareum* (one specimen), *Gnaphalium rectum*, *Empetrum nigrum*, *Pyrola minor* (by the side of the private coach-road), and *Orobanche elatior* occur in the same locality, as does *Circæa lutetiana*, but of so dwarf a stature, although growing in a damp situation, and with leaves so decidedly heart-shaped, as to be easily mistaken for, if indeed it be not, *Cir. alpina*. In the woods which cover the sides of this valley I found several colonies of *Helix nitens*, of a very large size, occupying rounded excavations under stones, which in three instances also contained a rather uncommon beetle (*Cychrus rostratus*). *Pupa edentula* is very common, adhering to the back of the barren fronds of *Blechnum boreale;* and on the luxuriant herbage which grows on the moist spots by the side of the rivulet traversing the valley, *Helix fusca* is found sparingly.

In the summer of 1837 I took many specimens of *Hylobius straminea*; indeed this beetle was abundantly met with in many localities in the latter part of the summer of last year. This insect afforded a singular instance of tenacity of life: I plunged two specimens into a phial filled with spirits of wine, at the bottom of which they lay apparently dead for three days; on the evening of the third day I transfixed them with a pin, and stuck them on a setting-board; the next day, to my surprise, I found them alive, and as active as when I first took them.

In the barren pastures *Gentiana Amarella* grows plentifully; and in several localities, as about Wootton, Cheadle Common, and Dilhorn, that elegant little fern *Botrychium*

Lunaria occurs in profusion; in a pasture near Wootton I saw hundreds of plants in the space of a few yards: I also had the pleasure of collecting it in Cheadle Park,—the very spot where it had been found many years since by Sir Joseph Banks, who was then Lord of the Manor of some large estates in this neighbourhood. In the same pasture wherethis fern occurred so abundantly, I took two specimens of *Ludius cupreus.*

Needwood Forest has been given as a habitat for that rare plant, *Euphorbia Characias;* I fear however it is now extinct there: many botanical friends who have searched the spot have not been able to discover it, and the Rev. T. Gisborne, who has lived in that neighbourhood nearly fifty years, and has made botany a particular study, states in a letter, with a copy of which I have been favoured, that he has been equally unsuccessful. *Eu. amygdaloides* grows there abundantly.

Among the peculiarities of our Flora I may mention that the place of *Papaver Rhœas* is supplied by *Pa. dubium;* so exclusively so indeed, that out of a large number of red poppies which I caused to be gathered from several localities, I could not discover a single specimen of the former species.—Another plant which is common in the south, but with which I never met in Staffordshire, is *Malva rotundifolia; Malva sylvestris* is much less common than *M. moschata.* A white-flowered variety of *Calluna vulgaris* grows sparingly on Cheadle Common; I am informed it is abundant about Buxton, Derbyshire.

The following is a list of some of the plants occurring about Cheadle which have not already been incidentally mentioned. Those marked with an asterisk are on the authority of various botanical friends.

Ranunculus *hederaceus*
——— *auricomus*
——— *arvensis*
——— *flammula*
Corydalis *claviculata*
Fumaria *capreolata*, Dimsdale
Nasturtium *terrestre*
Cardamine *amara*, Dimsdale
*——— *impatiens*, Dovedale
*Hutchinsia *petræa*, Dovedale
Hesperis *matronalis*
Viola *canina*
——— *odorata*
———(not *hirta*)
——— *flavicornis*, near Draycott
*Silene *nutans*, Dovedale
Arenaria *rubra*
——— *trinervis*
Geranium *pratense*, Cotton
Geranium *pusillum*
——— *lucidum*, Alton
Rhamnus *catharticus*, Dovedale
Genista *anglica*
——— *tinctoria*
Vicia *Cracca*
——— *angustifolia*
Orobus *niger*
Geum *rivale*, Cresswell
Potentilla *anserina*
——— *Comarum*
Alchemilla *vulgaris*
——— *arvensis*
Sanguisorba *officinalis*, near the Delph House
Epilobium *angustifolium*, on a rabbit-warren, Cotton
Sedum *acre*
——— *Telephium*

RIBES *alpinum*, Needwood Forest
SAXIFRAGA *hypnoides*, Dovedale &c
VIBURNUM *Opulus*
ASPERULA *odorata*
VALERIANELLA *olitoria*
——— *dentata*
PRENANTHES *muralis*
HIERACIUM *sabaudum*
——— *umbellatum*
EUPATORIUM *cannabinum*
TUSSILAGO *Petasites*
ACHILLEA *Ptarmica*
TANACETUM *vulgare*
CAMPANULA *latifolia*
——— *rotundifolia*, *fl. albo*
*POLEMONIUM *cæruleum*, Wetton
LITHOSPERMUM *officinale*
LYCOPSIS *arvensis*
ATROPA *Belladonna*, Alton Castle
VERONICA *scutellata*
——— *officinalis*
——— *montana*
MENTHA *acutifolia*, side of the river, Oakamoor
ORIGANUM *vulgare*
GALEOPSIS *Tetrahit*
——— *versicolor*, Draycott
STACHYS *annua*
——— *ambigua*, Alton
*ANAGALLIS *tenella*, Chartley
POLYGONUM *Bistorta*
——— *hydropiper*
.... *Fagopyrum*
ORCHIS *mascula*
——— *latifolia*
*——— *conopsea*
PLATANTHERA *bifolia*
LISTERA *ovata*
EPIPACTIS *latifolia*
PARIS *quadrifolia*, copse by the side of the Leek road
HYACINTHUS *non scriptus*, *fl. alb*
ALLIUM *ursinum*, Oakamoor &c.
TRIGLOCHIN *palustre*
SAGITTARIA *sagittifolia*
SPARGANIUM *simplex*
——— *ramosum*
ANDROMEDA *polifolia*, Chartley
CAREX *stellulata*
——— *curta*
——— *ovalis*
——— *muricata*
——— *vulpina*
——— *pendula*
——— *strigosa*
——— *sylvatica*
——— *flava*
——— *binervis*
——— *pilulifera*
——— *paludosa*
——— *riparia*
——— *hirta*
LYCOPODIUM *clavatum*, Cheadle Common
OPHIOGLOSSUM *vulgatum*
ASPIDIUM *aculeatum*
——— *lobatum*
——— *Oreopteris*
——— *spinulosum*
——— *dilatatum*
CYSTOPTERIS *fragilis*
OSMUNDA *regalis*, Chartley

ART. V.—*Analytic Descriptions of the Groups of Birds composing the Order Strepitores.* By EDWARD BLYTH, Esq.

No. IV.—*Zygodactyli Levirostres*, or the Toucan family (*Rhamphastidæ*), and the Touraco and Coly family (*Musophagidæ*).

THE second principal division of the *Strepitores*, or the *Zygodactyli*, comprises every member of the class, save only the parrots (*Scansores*) and jacamars already described, which has the *outer* toe reversed, in consequence of which the middle or longest toe becomes the external front one; differing in this respect from the yoke-footed *Heterodactyli*, or the trogons (*Accurvirostres*), wherein the first and second toes are opposed to the third and fourth, and the longest (or representative of the middle toe in the generality of birds) is accordingly inward. It also includes certain genera (as the touracos and puff-birds) which have the first and fourth toes disposed laterally, and one (that of the colies) generally described to have all four toes directed forwards. By stating that the tarse is always scutellated in front, we succeed in excluding the parrots from the definition; and the syndactyle jacamars, by mentioning that the forward toes are separate from the first joint. I am aware of no further generalization that can be advanced, apart from other *Strepitores;* unless it be that the young appear, without exception, to shed their entire nestling plumage during the first autumn or winter.

The *Zygodactyli* primarily subdivide into two very distinct groups, which I have termed *Picoides* and *Cuculoides*.

The *Picoides* are distinguished by having the muscular coat of the stomach more developed, and by the absence of *cœca* to the intestine: the *sternum* is always doubly emarginated at its posterior border, and the coracoid bones are of unusual length. All of them produce purely white eggs; and the young (I have reason to suspect) are in every instance hatched naked. The clothing feathers possess an accessory plumelet, more or less developed.

In the *Cuculoides*, the stomach is comparatively lax; and there are large pedicillate dilated *cœca*, resembling those of the owls, as in all other *Strepitores* that have any: the *sternum* is sometimes only singly emarginated, and the coracoid bones are stout, and never elongated. Many of them lay coloured or spotted eggs; and probably all (like our native cuckoo) are hatched covered with down. The clothing feathers exhibit not the slightest trace of a supplementary plume. It may be added that the brain is remarkably diminutive, which is not the case in the *Picoides*.

The former of these divisions is especially remarkable for the variations which it presents in the structure of the tongue, which is barbed like a feather in the toucans, vermiform and protrusile, with generally some small retroflected lateral spines near the tip, in the woodpeckers, and of the ordinary shape in the barbets. The great majority of its species display bright colours. They fall under two principal and very distinct minor groups, which I have designated *Levirostres* and *Cuneirostres*. The latter contains the only scandent members of the *Zygodactyli*, although the entire group (with the addition even of the jacamars and trogons) is still denominated "*grimpeurs*" by the French. We must now confine our attention to the *Levirostres*.

Under this appellation I have brought together the two very distinct families of *Rhamphastidæ* (comprising the toucans and aricaris), and *Musophagidæ* (consisting of the plantain-eaters, touracos, and colies); the former restricted in its distribution to South America; the latter peculiar to the eastern hemisphere, and with the exception of two or three species of coly, to Africa. The name, if not quite all that may be wished, is nevertheless the least objectionable that has yet occurred to me: it is appropriate enough to all except the colies. There is considerable similarity in the conformation of the skeleton in these two families, the principal difference consisting in the very small size of the *sternum* throughout the *Musophagidæ*, and in the imperfection of the clavicles, or lateral halves of the *furcula*, in the true toucans, though not in the closely allied genus of aricaris (*Pteroglossus*), to judge from l'Herminier's representation of the sternal apparatus of *Pt. aricari*, wherein the *furcula* is made to resemble that of a touraco: in both, there are no false ribs attached to the anterior anchylosed *vertebræ* of the *pelvis*,[1] a very peculiar character. The beak is inflated and permeated by osseous fibres in the plantain-eaters (*Musophaga*), and to a less extent in the touracos (*Corythaix*) and nape-crests (*Chizæris*); with proportionally thin *parietes*, as in the toucans (*Rhamphastos*), where the inflation and consequent attenuation of its substance attain their ultimatum. The tongue, which in the toucan family is barbed throughout its length with lateral appendages like a feather, is in the touracos similarly fringed, but towards the tip only, to a variable extent. The digestive organs chiefly differ in the presence of a small gall-bladder in the *Musophagidæ*, which is wanting in the *Rhamphastidæ*. Lastly, of their external characters, it may be remarked that both have only ten tail-feathers, that their wings are much rounded, and more or less of their body plumage loosely webbed. They subsist principally (and some of them it would appear wholly) on fruits; and, excepting the colies, are remarkable for the airy lightness of their movements.

The distinctions between the *Rhamphastidæ* and *Musophagidæ*, however, are considerably more obvious than their points of similitude, being principally external. The modification of the foot is very different, and in the former group, to which I shall now restrict myself, typically zygodactyle. From the singularity of their appearance, occasioned by the

[1] At least, I can perceive no traces of such having been broken off, in the skeletons to which I have access.

disproportionate size of the bill, as compared with that of others of the feathered race, the *Rhamphastidæ* have excited a more than usual degree of interest; in consequence of which we are now in possession of much satisfactory information respecting their internal structure and economy. Some interesting details on their anatomy, by Prof. Owen, are appended to Mr. Gould's admirably illustrated monograph of the family; and the observations of several naturalists on their wild habits, together with those of Mr. Broderip, Mr. Vigors, and others, made upon individuals which have lived in captivity in Europe, leave little to be desired in order to complete our knowledge of their economy and general history.

On inspecting a fine perfect skeleton of a species of toucan (the only one which I have seen) in the Museum of Comparative Anatomy at Guy's Hospital,[1] I found the entire structure to be less frail than descriptions had led me to anticipate; its conformation, however, evidently betokening a bird of feeble flight: the *sternum* was proportionally much larger than in the *Musophagidæ*, and similarly emarginated at its posterior edge; its crest low, though the pectoral muscles would seem to have been large and full, and LeVaillant expressly describes the toucans to have heavy and fleshy bodies, as is analogously the case with the diminutive todies. The separate clavicles were $1\frac{3}{8}$ inch in length, and taper at their extremities. These birds have a wide gullet, a moderately muscular stomach (which extends into the abdominal portion of the cavity of the body), no gall-bladder, the intestine short, not exceeding the length of the body, and devoid of cœcal appendages, as already noticed: they have been observed to regurgitate partially digested food, and after submitting it to a rude kind of mastication, again to swallow it: Petiver remarks the same of the syndactyle hornbills.

Exteriorly, their enormous bill has the first claim to our attention; the magnitude of which, in some instances, is indeed astonishing: this organ, however, is excessively and surprisingly light; its horny sheath being (save towards the tip) extremely thin, especially that of the upper mandible, but elastic, and though yielding in a slight degree to moderate pressure, presenting a considerable amount of resistance if the force be increased for the purpose of crushing the beak: its interior structure resembles what has been already described in the analogous instance of the hornbills. Its form is length-

[1] I take this opportunity to express my obligations to Mr. Gardiner, of the above-named institution, for the ready access which he has ever afforded me to the valuable collection of skeletons there deposited.

ened, and a little decurved, the downward bend increasing in both mandibles towards the tip: and its surface is extensively traversed by ramifications of the fifth pair of nerves, which render it unusually sensitive, in beautiful adaptation to the purposes for which it is employed. In connection with this sensitiveness, it may be remarked that these birds are careful to preserve their beak from cold, and at night are enabled to bury completely its immense bulk within their body-plumage: they are also frequently observed to scratch it gently with the foot, as if this produced an agreeable sensation. Its structure is extremely delicate in the young; and these, accordingly, must subsist on very delicate and soft food: and it is scarcely necessary to add that it does not attain its ultimate magnitude for a series of years; becoming finely coloured as it approaches to maturity. The edges of both mandibles are distinctly denticulated.

The tongue, as already noticed, is a very curious instrument, elongated and slender, and barbed not unlike a feather; its sheath giving off from the lateral margins a series of stiff bristle-like appendages, directed forwards, which structure is continued to the apex: the peculiar or accessory function of this sort of tongue appearing to be that of touch; it acting as a kind of *antenna*, whereby to test the softness and ripeness of fruit, and the fitness of other substances for food. That the toucans also possess, however, the sense of taste in very considerable perfection, will appear from a fact to be stated in the course of this summary: but the developement of nervous tissue and *papillæ* over the beak has been erroneously deemed an extension of the olfactory surface.

These birds have the legs of mean length, and covered, as are also the toes, with large *scutellæ*: their feet are adapted for hopping from bough to bough. The wings are short and rounded; and tail of moderate length, and but slightly cuneated, in the genus *Rhamphastos*; longer, and much graduated, in the others: it is mostly held erected. The cheeks are bare; the skin of them being generally blue, and sometimes red, or even green: *irides* most commonly pale blue: and the clothing plumage is of rather open texture (as in the motmots), having the webs of the feathers disunited, and often glistening on those parts that are brightly coloured:[1] the accessory plume is flocculent and of considerable length, in some,

[1] One species, known as the curl-crested aricari, is remarkable for a curious modification of the feathers of its crown, which have the webs soldered so as to be undistinguishable, appearing like curled and brilliantly shining *laminæ* of black sealing-wax. The intent remains to be explained.

but reduced to a mere tuft in others. They are birds of gorgeous colouring, and peculiar in the disposition of their tints: the true toucans being chiefly black, with large masses of crimson, white, or yellow (or very rarely faint blue), on the breast or below, and especially beneath the tail, where it is rendered conspicuous by the habitual elevation of the latter; there is often, also, a band of bright colouring across the rump, and generally a gorget of one or more different hues contrasting with and bounding the mass of colouring on the forepart of the breast: the aricaris differ in having the upper parts chiefly green, of various degrees of brightness, and are in general rather more variegated: in these the sexes also differ, the female being chestnut-rufous where the male is black; whereas the male and female toucan present only a trivial disparity of size: the groovebills (*Aulacorhynchus*, Gould), which constitute a sub-genus of aricaris, have the ground colour vivid green. In all the young possess the gorgeous livery of the adult, and are at first sight chiefly distinguishable by their smaller beaks. Azara remarks, that he has often observed that these, when brought up tame, underwent a moult when about two or three months old: at which time there can be little doubt, from analogy, that the primaries are shed. Levaillant and others have considered the relation which the aricaris bear to the toucans, to be similar to that which the magpies and jays hold to the crows and ravens.

These birds breed in the hollows of decayed trees, producing (in every known instance) two delicately white eggs, of a nearly spherical form: the young recurve their tails upon the back while in the nest. They are of a social disposition, small flocks of ten or a dozen being commonly seen together; different species of them mingling in society. They are shy of approach, more particularly the larger toucans which generally perch on the higher branches of lofty trees, where they skip from bough to bough with the most lightsome agility; or sit, with invariably the beak turned towards the wind. They fly rapidly, but evidently with much exertion, and with difficulty against the wind; at a mean height, and always in a straight line; flapping their wings at intervals, and with some noise; and carrying the beak elevated above the level of the body, with the tail overlying the back. On the ground they are rarely seen, where they advance by oblique hops, and rather awkwardly. They are very fond of washing. Individuals are often noticed perched upon high trees, watching the moment at which other birds leave their nests, on which they instantly pounce to feed on the eggs or young, sometimes even contesting a prize with the monkeys. The ex press use of their singularly formed bill is deemed to be for insertion into the deep pensile nests which abound in their indigenous locality; the sensitiveness of this organ having reference to the same object, by enabling them to feel the contents. Azara relates that they devour a prodigious number of young birds, upon which, and on eggs, they subsist principally during the season; and he states that, after rain, they will descend and demolish the mud-built domed nests of the ant-catchers, which are so firm as to withstand the weather for years: he adds that they have been known to rob those of the caracaras (*Polyborus*). For the rest of the year, continues the same Spanish naturalist, the toucans maintain a rigid and protracted lent, feeding only on fruit and other vegetable produce: though it is not to be supposed but that they likewise prey on caterpillars, and any other small animal food that may fall in their way. Linnæus even applied the term *piscivorus* to one of the species: but I am unaware that the information on which this rested has ever been confirmed.

Of toucans that have been brought up tame, it has always been remarked that a decided preference is evinced for animal over vegetable diet; and so eagerly, even gloatingly, do they pounce upon a small bird or quadruped whenever such prey is offered to them, as to remove all doubt that they have a natural carnivorous propensity, which, notwithstanding the foregoing direct testimony of Azara, and of others equally worthy of credit, has been denied by some who have studied them in their native abode. The sight of such prey immediately rouses them into a state of violent excitement: and a captive individual being presented, by Mr. Broderip, with a small bird, it snatched it with its bill, and killed it instantly by the violence of the squeeze, which was so powerful as to cause the bowels to protrude. As soon as it was dead, the toucan hopped with it, still in its bill, to another perch, and then placing it between one foot and the perch, began to strip off the feathers. When it had plucked away most of them, it broke the bones of the wings and legs (still holding it in the same position) with its bill, taking the limbs therein, and giving at the same time a strong lateral wrench: continuing this work with great dexterity, till it had almost reduced the body to a shapeless mass. It then first ate all the soft parts, leaving the larger bones to the last, which seemed to give it more trouble, particularly the beak and legs. From the deportment of the animal, the flavour of its prey seemed to impart the most keen sense of enjoyment, such as was never manifested when it fed on fruit or vegetables; and it even appeared to protract its feast considerably, by continually applying the tongue to each morsel, before throwing it up and catching it in the throat, as these birds are necessitated to do whatever they feed on, their singularly formed tongue being inadequate to assist in deglutition. It may be that the smaller species are somewhat less carnivorous; and the *Pteroglossus aricari*, which abounds in Guiana, is stated by Levaillant to make great havoc in the plantations of bananas, guavas, and even of coffee: bnt the truth is that they are all very general feeders, more so than any other *Zygodactyli*.

The *Rhamphastidæ* are much more hardy in the climate of England than would be expected; are tame and fearless; and display a tolerable share of sagacity: becoming soon attached to persons they know. They are lively and active in the extreme, and surprisingly light and elegant in all their movements, so much so that in the living bird the beak has not the least appearance of being disproportionate: erecting the tail, which, Mr. Vigors remarks, is jerked up as though it moved by a spring, the conformation permitting of which is described by Mr. Owen in the 'Appendix' before referred to. They have only a harsh and grating cry. Those individuals which have been tamed have heen noticed to catch, with the utmost facility, grapes and other fruit thrown to them; to seize which they open the bill sideways or horizontally.—Towards evening, after taking their last meal, they retire to roost, and sit listlessly for an hour or two with the plumage puffed and tail lying close upon the back, as if dozing; at which time they will suffer themselves to be gently handled: at length, they turn the head backward, and so completely bury their enormous beak between the scapulary and interscapulary feathers, that frequently, not a portion of it remains visible; the plumage of the breast descending and covering the flanks; so that the bird presents the appearance of a round ball of feathers, every naked part being as effectually covered as in birds of less extraordinary proportions. The foregoing detailed account is derived from various authentic sources, of which Azara's description, and the observations of Messrs. Broderip, Bennet, and Vigors, in the 'Zoological Journal,' and 'Gardens and Menageries of the Zoological Society Displayed,' are the principal. I have endeavoured to bring into one focus the substance of all that I know has been written respecting the habits of this singular group of birds, that future observers may corroborate or refute according to their experience.

Perhaps it may be as well just to mention that the rainfowl (*Scythrops*), an Australian genus, is included among the

Rhamphastidæ by Mr. Swainson, solely on account of the magnitude of its bill; the actual structure of which, however, together with every detail of conformation, even to that of an individual feather, also the style of colouring, the progressive changes of plumage, and indeed everything that can be supposed to indicate real affinity, combining to show the impropriety of such arrangement, and alike intimating the close and immediate relationship of that genus for the restricted cuckoos, with which it even forms a particular subdivision of the family *Cuculidæ*, peculiar to the eastern hemisphere.

(*To be continued*).

ART. VI.—*On the Synonymy of the* Perlites, *together with brief Characters of the old, and of a few new Species.* By EDWARD NEWMAN, Esq., F.L.S.

(*Concluded from Page* 37).

GENUS IV.—*ISOGENUS*, Newman.

The genus was separated from *Perla* on account of its having the wings equally developed in both sexes. The habit is also more slender, the wings more ample. They have usually fifteen nervures, reaching the margin of the fore-wing between the subcostal nervure and the base.

Sp. 1. *Isog. Ligea.* Fusca: facies testacea; abdomen testaceum, lateribus saturatioribus; alæ vix hyalinæ, croceo-brunneo tinctæ. (Corp. long. .55 unc. alar. dilat. 1.5 unc.)

The face is testaceous, the other parts of the head, and the entire *pro-meso-* and *meta-thorax* are dark brown and glabrous; the abdomen is dorsally testaceous, laterally dusky brown: the wings are scarcely hyaline, and are tinted throughout with a clear, rich brown, resembling the colour of burnt sienna.

The country of this species is unknown. A single specimen is in the cabinet of the Rev. F. W. Hope.

Sp. 2. *Isog. nubecula.* (Corp. long. .6 unc. alar. dilat. 1.5 unc.)
" " Newman; 'Entom. Magazine,' vol. i. p. 415.
" " Stephens, 'Illustrations of British Entomology,' Mand. vol. vi. p. 137, *tab.* xxxi. *fig.* 2.

The text refers to *tab.* xxxi. *fig.* 4, which represents *Leuctra geniculata*, Steph., subsequently also erroneously referred to *fig.* 3, which represents *Nemoura variegata*, Steph.—The figure of *Isog. nubecula* is without the brown spot on the forewing, which serves most readily and obviously to distinguish this species from those which follow.

Perla bicaudata, Pictet; 'Annales des Sciences Naturelles,' vol. xxviii. p. 58, *tab.* vi. *ff.* 6—7; but I believe not of either of the authors as quoted by M. Pictet.

I make the assertion that my *Isogenus nubecula* and M. Pictet's *Perla bicaudata* are identical, on that author's own authority; who, not having examined the Linnæan specimen, expressed his opinion when in England, that the insect in question was the *Phryganea bicaudata* of Linnæus, which I think I have shown above to be perfectly distinct.

Body dark brown; head and *prothorax* with a longitudinal ochreous line. Forewings hyaline, with a small oval spot of a dark brown colour on the costal margin, situated about two thirds of the distance from the base to the tip, hind wings beautifully hyaline, iridescent.

Common in Herefordshire, Worcestershire, and Nottinghamshire. In most cabinets of British insects.

Sp. 3. *Isog. frontalis.* (Corp. long. .775 unc. alar. dilat. 1.425 unc.
„ „ Newman; 'Entom. Magazine,' vol. v. p. 178.
Perla bicaudata, Kirby; 'Fauna Boreali-Americana,' part Insects, p. 252.

Brown, having the anterior part of the head between the *antennæ* yellow, at the back of the head is a second yellow marking, and the *prothorax* has a yellow longitudinal line; the wings are hyaline; the forewings have a very slight brown costal spot in the same situation as the preceding species.

Inhabits North America. Several specimens (donor R. Foster) are in the cabinet of the Entomological Club.

Sp. 4. *Isog. microcephala.* (Corp. long. .8 unc. alar. dilat. 1.5 unc.)
Perla microcephala, Pictet; 'Annales des Sciences Naturelles,' vol. xxviii. p. 59, *tab.* vi. *ff.* 4, 5.

Black: head spotted with yellow and narrower than the *prothorax*, which is very short, wider posteriorly, and marked with a yellow longitudinal line; the *femora* are brown, the *tarsi* yellow spotted with black: the wings are hyaline, with light clouds of a brown tint.

Inhabits France, Switzerland, &c. There are several specimens in the cabinet of the British Museum.

Sp. 5. *Isog. infuscatus.* (Corp. long. .55 unc. alar. dilat. 1.6 unc).
„ „ Newman, 'Entom. Mag.' vol. v. p. 499.

The head is entirely brown and wider than the *prothorax*, in which, however, it is deeply immersed: the *prothorax* is much wider anteriorly than posteriorly; it is dark brown, with the exception of a very slender, pale, anterior margin: the disks of the *pro-* and *mesothorax* are brown, their lateral margins inclining to yellow: the wings are entirely opaque and nearly black, with the exception of the *costa*, which in all the wings is yellow.

Inhabits the East Indies. A single specimen is in the cabinet of the Rev. F. W. Hope.

Sp. 6. *Isog. Drymo.* Caput testaceum, clypeo maculâque quadratâ posticâ fuscis; prothorax fuscus maculis duabus magnis lætè testaceis signatus; cætera fusca, femoribus basi pallidioribus. (Corp. long. .4 unc. alar. dilat. 1.3 unc.)

The head is testaceous, the clypeus dark brown, and on the crown of the head adjoining the *prothorax* is a quadrate brown mark, from each of the anterior angles of which a brown line passes to the root of the *antenna:* the *prothorax* is dark brown, and adorned with two bright testaceous spots, which are separated only by a very narrow, median, longitudinal, brown line, the anterior portion of the *prothorax* is testaceous; the other parts of the body are dark brown; the legs are of the same colour, with the basal portion of *femora* paler: the wings are slightly suffused with brown, all the nervures of the fore wings and the apical ones of the hind wings are dark brown.

Inhabits Georgia. There are two specimens in the cabinet of the British Museum.

Sp. 7. *Isog. Clio.* Caput fuscum, lateribus circa oculos flavidis; prothorax fuscus, lineâ medianâ longitudinali flavidâ; abdomen testaceum; antennæ, meso- et metathorax pedesque fusco. (Corp. long. .25 unc. alar. dilat. 1.1 unc.)

Head dark brown with lateral yellow marks surrounding the eyes, *prothorax* dark brown, with a median longitudinal yellow line: *abdomen* rufo-testaceous: *antennæ*, *meso-* and *metathorax*, legs and caudal *setæ* brown; the fore wings and the costal portion of the hind wings are tinged with brown, and have darker nervures.

Inhabits Georgia. There are two specimens in the cabinet of the British Museum.

Genus V.—*Chloroperla*, Newman.

In this genus the habit is still more slender, the wings still more ample: the wing-nervures are much reduced in number

**Species aberrantes.*

These have usually eleven nervures reaching the margin of the forewing below the subcostal nervure.

Sp. 1. *Chlo. Spio.* Testacea ferè unicolor: ocelli duo fusco-nigri, oculi magni, nigri; caput prothorace latiùs: pedes incrassati: alæ subobscuræ iridescentes. (Corp. long. .35 unc. alar. dilat. 1.1 unc.)

Colour a uniform and obscure but pale testaceous: the *ocelli* are two only and of a dark brown colour; the eyes are black and very large, making the head considerably broader than the *prothorax :* the *prothorax* is somewhat quadrate, but broader than long, and broader anteriorly than posteriorly; its disk is wrinkled longitudinally: the wings are rather obscure, and obviously iridescent; the legs are very stout, more so than is usual in this genus; the *tibiæ* are attenuated at both extremities, more particularly the apical; the *tarsi* are extremely small.

Inhabits Sierra Leone. A single specimen is in the cabinet of the British Museum.

Sp. 2. *Chlo. grammatica*. (Corp. long. .295 unc. alar. dilat. .95 unc.)
" *fuscipennis*, Stephens, 'Illustrations of British Entomology,' Mand. vol. vi. p. 138.
" *lateralis*,
" *media*,
" *venosus*,
" *rufescens*,
Stephens, *loc. cit. varietates.*
Perla virescens, Pictet, 'Annales des Sciences Naturelles,' vol. xxviii, p. 60, *tab.* vi. *ff.* 8—10.
Phryganea grammatica, Scopoli, 'Entomologia Carniolica,' p. 269. 1763.

The colour of this insect is a pale yellowish green, which pervades also the wings; head yellowish, with the eyes and *ocelli* black, the crown of the head is often marked with brown; the *antennæ* are yellowish, inclining to brown towards the tips; the *prothorax* is of the same colour, rather dusky towards the sides, the *meso-* and *metathorax* are dusky, as also is the upper side of the *abdomen:* the nervures of the fore wings are more or less brown.

This insect is common on the continent of Europe and in England. It is extremely variable, and Mr. Stephens has, from this circumstance, been induced to divide the species as above. In nearly all cabinets of British Insects.

Sp. 3. *Chlo. transmarina*. (Corp. long. .3 unc. alar. dilat. 1 unc.)
" " Newman, 'Entomological Magazine,' vol. v. p. 499.

Head fuscous, *thorax* with a yellow longitudinal line, head yellow, with two long fuscous spots which extend to the margin of the *prothorax:* wings hyaline, shining, tinged with yellow at the base; nervures of the forewings and those of the apex of the hind wings brown.

Inhabits North America. Several specimens (donors E. Doubleday and R. Foster) are in the cabinet of the Entomological Club.

Sp. 4. *Chlo. Clymene*. Caput flavum, oculis ocellisque nigris; alæ fusco leviter tinctæ, nervuris omnibus fuscis. (Corp. long. .3 unc. alar. dilat. 1.05 unc.)

Head bright yellow, with black eyes and *ocelli; antennæ* brown throughout: *prothorax* broader than long, pale testaceo-fuscous, with a still paler but ill-defined longitudinal dorsal line; the *meso-* and *metathorax* and *abdomen* are dusky testaceous, and the legs are of the same colour, the basal portion of the *femora* being rather paler: the wings are suffused with a delicate tint of brown, and all the nervures are dark brown.

Inhabits Georgia. There is a single specimen in the British Museum.

Sp. 5. *Chlo. Ephyre*. Caput flavum, maculâ verticali fuscâ, oculis nigris; setæ caudales virescentes fusco annulatæ. (Corp. long. .45 unc. alar. dilat. 1 unc.)

Head yellow, with a brown spot on the crown, and black eyes; the body and legs are of a pale sickly green cast, with many variously-disposed markings of a faint brown hue; the nervures of the fore wings are brown, in the hind wings the marginal nervure alone is of this colour: the caudal *setæ* are pale green, with brown rings; the joints of the *setæ* in this species are unusually long.

Inhabits Georgia. There is a single specimen in the cabinet of the British Museum. In the abdomen of this specimen I observed, through the transparent cuticle, a large *Filaria;* it is coiled up in several rings, and occupies a very considerable portion of the cavity.

** *Species normales.*

These have usually nine nervures reaching the margin of the forewing between the subcostal nervure and the base.

Sp. 6. *Chlo. flava.* (Corp. long. .37 unc. alar. dilat. .7 unc.)
„ „ Stephens, 'Illustrations of Brit. Entomology,' Mand. vol. vi. p. 139.
opteryx
Perla flava, Fourcroy, 'Entomologia Parisiensis,' p. 349.
punctata.
Phryganea tripunctata? Scopoli, 'Entomologia Carniolica,' p. 269.
Semblis viridis, Fabricius, 'Entom. Syst.' vol. ii. p. 74.
„ *lutea*, Latreille, 'Hist. Nat. Crust. &c.' vol. xiii. p. 49.

Yellow green, the tips of the *antennæ*, the eyes, and *ocelli* black, the *prothorax* is almost circular, with reflexed margins and longitudinal wrinkles, the margins are also very distinctly brown: the *abdomen* is yellowish, with a dorsal fuscous line.

Common in Europe and England. There are specimens in nearly all collections of British insects.

Sp. 7. *Chlo. apicalis.* (Corp. long. .3 unc. alar. dilat. .6 unc.)
„ „ Newman, 'Ent. Mag.' vol. iii. p. 501, April, 1836.
„ *pallida*, Stephens, 'Illustrations,' Mand. vol. vi. p. 139,—August, 1836.

Entirely of a delicate yellow green, with the eyes and tips of the *antennæ* black: the *prothorax* nearly quadrate and perfectly concolorous, *tarsi* dusky.

Inhabits Europe and England. Specimens in nearly all collections of British Insects.

Sp. 8. *Chlo. Cydippe.* Pallidè lutea, alis venustè virescentibus, nervuris concoloribus; antennæ fuscæ, basi imò tantum luteæ. (Corp. long. .15 unc. alar. dilat. .5 unc.)

Pale yellow, the wings beautifully tinged with green, the nervures being exactly concolorous, and not observable without some difficulty; the *antennæ* are brown, the extreme base alone being yellow.

This insect nearly approaches *Chlo. apicalis,* which appears identical with *Chlo. pallida* of Stephens, a species not uncommon in Great Britain, France, and Switzerland; but the *antennæ* are differently coloured, and several other slight discrepancies are observable on a minute comparison.

Inhabits Georgia. There are two specimens in the British Museum.

Sp. 9. *Chlo. bifrons.* (Corp. long. .3 unc. alar. dilat. .65 unc.) Capnia nigra.
„ „ Newman, 'Entom. Mag.' vol. v. p. 401.

Entirely of a dark shining brown, wings tinged with brown, the nervures being rather darker: the *antennæ* and caudal *setæ* are of about the same length, which is nearly equal to that of the body.

Inhabits Scotland; taken by Mr. Walker at New Lanark. In the cabinets of the Entomological Club and Mr. Stephens.

Sp. 10. *Chlo. nigra.* (Corp. long. .37 unc. alar. dilat. .75 unc.)
Perla nigra, Pictet, 'Annales des Sciences Naturelles,' vol. xxviii. p. 61. *tab.* vi. *fig.* 11, 13.

Entirely of a shining black colour: it is extremely slender, the legs and *antennæ* being remarkably slight; the wings are opaque at the base and hyaline at the tip.

Inhabits Switzerland, where it takes short and rapid flights among the stones on the banks of rivers: it is very difficult to capture this delicate insect without spoiling it. In the cabinet of M. Pictet of Geneva.

Sp. 11. *Chlo. Opis.* Nigra, nitida, concolor; prothoracis latera convexa alæ obscuræ fusco tinctæ, nervuris saturatioribus. (Corp. long. .2 unc. alar. dilat. .5 unc.)

Entirely black, shining: the *prothorax* is rather wider than the head, and its sides are very convex, the *antennæ* are about as long as the body, the caudal *setæ* longer, and have the joints remarkably long and distinct: the wings are tinged with brown and the nervures are darker; the *femora* are black, the *tibiæ* and *tarsi* brown.

This little insect inhabits Newfoundland. The only two specimens I have seen are in Mr. Westwood's cabinet, and have been kindly lent to me for description.

Genus VI.—*Leptoperla*, Newman.

Proalarum nervuræ apicales paralleles 6, nervuris transversis numerosis intersectæ: antennæ setæque caudales elongatæ; pedes elongati.

Sp. 1. *Leptoperla Beroë.* Fusca; alæ opacæ, fuscæ, versus apicem maculis albidis notatæ; pro- et mesopedes fusci, tibiis medio testaceis: metafemora testacea, apice fusca. (Corp. long. .3 unc. ant. .475 unc. set. caud. .475 unc. alar. dilat. .9 unc.)

This is a slender and very elegant insect; it differs generically from *Isogenus* and *Perla* in the neuration of the fore wings, the exterior portion of which is occupied by six strong parallel longitudinal nervures; of these the fourth is furcate at the extremity, and the fifth unites with the fourth just before its furcation; these longitudinal nervures are intersected by several very delicate transverse nervures: the *antennæ* and caudal *setæ* are extremely slender, and much longer than the body of the insect; the terminal segment of the *abdomen* below is furnished with two leaf-like processes, which curve upwards, passing between the caudal *setæ* and terminating in acute points: the legs are very long and slender: the insect is of a dark brown colour, the wings being opaque, dark brown, and the exterior portion of the fore wings regularly spotted with dirty white; the hind wings are immaculate; the *pro-* and *mesofemora* having a bright testaceous ring; the *metafemora* are testaceous, with the apex only dark brown, the *tibiæ* are rather paler, and the *tarsi* nearly black.

Inhabits Van Dieman's Land. There is a single specimen in the cabinet of the Rev. F. W. Hope.

ART. VII.—*Observations on the* Rodentia, *with a view to point out the groups, as indicated by the structure of the* Crania, *in this order of Mammals.* By G. R. WATERHOUSE, Esq., Curator to the Zoological Society.

THE various published classifications of the *Rodentia* appear to be chiefly founded upon the external structure of the species composing this order, combined with their dentition. The habits of animals of the same group, however, are often very variable, and their external characters and certain portions of their skeletons, are of necessity equally so. "The skeletons of *Rodentia*," says Cuvier,[1] "are so variable, owing to the diversity of the movements of the species of different genera, and to the presence or absence of clavicles, that it is difficult to find any characters in common, unless it be in the bones of the skull." These considerations have led me to search in the skull for characters by which to define the larger groups and to determine the affinities of the genera, and the object of the present communication is to point out such as appear most important, and in fact to state the results arising from the examination of an extensive series of *crania*, with the view of so arranging the various species of rodents, that by the position of any particular individual the most important points in its structure shall be indicated, and the relative value of the characters expressed by the nature of the divisions and sub-divisions.

It may be asked upon what principles I estimate the value of characters? and as this is a very important point, a few words on this subject appear necessary. I may answer that I value a character by its constancy; and consider that character of most importance which extends through the greatest number of species, provided these species evince affinities one with another by the gradual modifications of other characters of less importance,—that is to say, more subject to variation.

[1] 'Ossements Fossiles.'

There are, however, certain points in which the greater portion of the species agree,—these, which may be called the typical characters of the group, in my opinion should not be selected, with the departures from such typical characters, for the establishment of *primary* divisions. The skulls of rodents, for instance, generally possess a large glenoid cavity, longitudinal in its direction; but in the genus *Lepus* this cavity is remarkably small and narrow:—thus rodents in general might be arranged in one family, and the genus *Lepus* in another.

Or if we take the perfect or imperfect state of the clavicles as our guide, the present order would also be divided into two families or sections. Rodents are typically claviculated animals, those with imperfect clavicles being exceptions in this respect to that structure which is most commonly found in the species. The claviculated or unclaviculated groups cannot, I think, be of equal value.

My principles will be more fully illustrated by the mode in which I have proceeded in the investigation of the affinities of the animals under consideration.

After a careful comparison of part with part throughout the whole series of rodent skulls which I have had an opportunity of examining, it appeared to me that the zygomatic arch and ant-orbital *foramen* afforded the most constant characters. In the *Sciuridæ*, *Muridæ*, and *Arvicolidæ* for instance, we find the zygomatic process of the maxillary bone to consist of a large thin plate of bone, which is oblique in its position, and has the lower edge emarginated so as to throw the anterior portion of the zygomatic arch above the plane of the palate: here the anterior outlet of the sub-orbital *foramen* is much contracted. On the other hand in the *Hystrices*, the genera *Echimys*, *Myopotamus*, *Dasyprocta*, and in the *Chinchillidæ* and *Caviidæ*, the ant-orbital *foramen* is very large, enclosed by two meeting branches from the maxillary bone, the lower branch being thrown out from the level of the palate.

In the hares and rabbits (*Lepus*), taking the same character, we find quite a new type of form, indeed these animals appear to be in many respects isolated. In the very imperfect state of the palate, however, and in some other characters which will be hereafter mentioned, there appears to be an approach in the *Chinchillidæ* and *Caviidæ*.

Thus we have nearly all the principal genera of rodents thrown into three great sections, which may be easily distinguished; and upon arranging the various species of the genera or families above mentioned *in* these sections, we find many other points indicative of the mutual affinity of those placed in the same section.

Two genera, however, form exceptions, not possessing the combination of characters above noticed; I allude to *Dipus* and *Helamys*. The whole of the skulls were therefore re-examined, with a hope that the discovery of some other characters might enable me to determine the situation of these genera. I then perceived that the lower jaw afforded points of distinction of great importance, by means of which the affinities of one of the two genera just mentioned (*Dipus*), can, I think, be satisfactorily determined.

In order the more clearly to describe the lower jaw, I shall view each *ramus* as divided into four portions, which may be called the *alveolar portion*, the *condyloid*, the *coronoid*, and the descending *ramus*.—A ridge of bone on the inner side of the *ramus*, extending from the alveolar portion to the condyle,forms the upper or anterior boundary of what I term the descending *ramus*.

In the first section, which I shall call *Murina*, the descending *ramus* of the jaw consists of a broad plate, concave on the inner side, and flat or convex on the outer. It approaches more or less to a quadrate form, the upper posterior angle is directed outwards, and the lower posterior angle, which is often rounded, is directed inwards. The lower boundary of this plate consists of a thickened ridge or branch, which springs from the under side of the alveolar portion of the jaw, and is directed backwards and downwards. The posterior part of the descending ramus is usually in the same perpendicular line as that of the condyle, and very seldom extends beyond that line.

The coronoid process terminates usually high above the level of the molars. The condyloid portion is long and directed obliquely upwards and backwards. The *rami* of the jaws converge to a point at the *symphysis*, which is usually of but small extent, and forms an angle of about 45° with the horizontal *ramus*.

The lower jaw of a squirrel may be regarded as the type of the form just described. I shall have occasion to notice the departures from this type when I define the families.

The principal genera contained in this section are *Sciurus*, *Arctomys*, *Myoxus*, *Dipus*, *Mus*, *Arvicola*, *Geomys*, and *Castor*.

Section II.—*Hystricina*. In this section the descending ramus of the jaw is formed by a triangular flattened plate, the lower boundary of which consists of a thickened ridge or branch, (the under surface of which is almost always flat) which springs from the *outer* side of the alveolar portion, and the apex of which is produced and forms an acute angle, which almost invariably terminates beyond the *condyle.* The *rami* of the jaw somewhat suddenly diverge behind their junction at the *symphysis menti*, which is of considerable extent. The horizontal *ramus* is separated from the alveolar portion beneath, by a groove, which is more or less distinct. The *coronoid* process is usually small or but slightly elevated above the level of the molars, and situated more forward than in section I., and the *condyloid* is *comparatively* short.

The principal genera, are *Bathyergus*, *Poephagomys*, *Octodon*, *Abrocoma*, *Myopotamus*, *Capromys*, *Echimys*, *Aulacodus*, *Hystrix*, *Dasyprocta*, *Chinchilla*, *Cavia and Hydrochærus.*

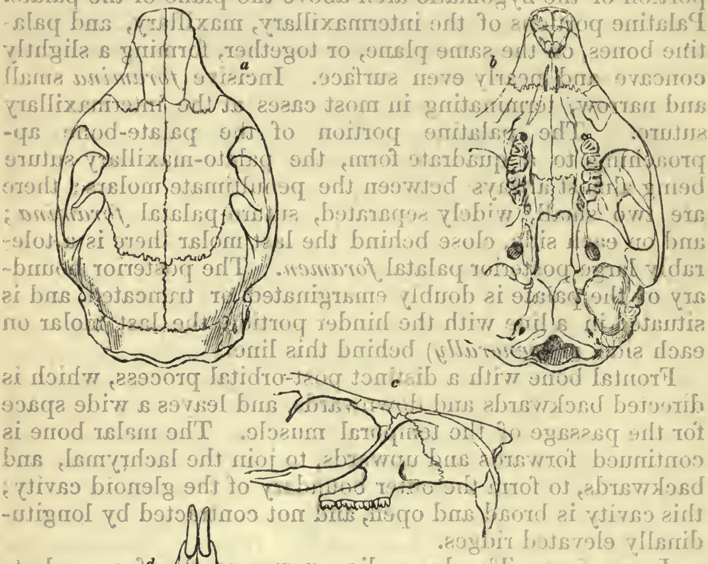
The greater portion of the genera here mentioned possess all the characters combined which have just been pointed out. Some, however, will not agree with the description in all respects, but it is a curious fact that in these instances the remainder of the distinguishing characters are more than usually evident. In *Bathyergus* for instance, the posterior portion of the descending *ramus* is rounded, and not *acute* ; but here, this portion of the jaw is thrown out from the *alveoli* of the great inferior incisors in an extraordinary degree, and there is a *very distinct* broad channel on the under side of the jaw separating the two portions in question—a character never found in the species of the first section. The coronoid process is also very small. Again, in the cavies (*Cavia*) the lower boundary of the descending ramus is *not* thrown out from the outer side of the alveolar portion ; the angle of the jaw however, is greatly produced, the *condyloid* process is short and the *coronoid* is very small. It is not, therefore, by any *one* particular character that I would pretend to define the sections, but by the *combination of characters.*

Section III.—*Leporina.* The hares (*Lepus*) are remarkable for the flatness of the *rami* of the lower jaw, and their great size compared with the teeth, the almost horizontal direction of the *symphysis menti,* the great height of the condyloid portion—along the outer side of which there is an elevated ridge which represents the coronoid. The condyloid process is also more upright than in other rodents. The descending *ramus* is very large and flat, and has the lower margin rounded or angular, as in the genus *Lagomys,* at least in some of the species.

Section I.—*Murina.*

Family I.—Sciuridæ.

Dentition.—Incisors laterally compressed. Molares $\frac{5\ 5}{4\ 4}$, rarely $\frac{4\ 4}{4\ 4}$, equal in size or nearly so, excepting the anterior molar of the upper jaw (where there are are $\frac{5\ 5}{5\ 5}$), which is smaller than the rest. The series of molars on the opposite side of each jaw are widely separated, and parallel.



Skull of *Sciurus vulgaris*.

(*a*), upper side. (*b*), under side (*c*), side view, showing the position of the ant-orbital *foramen*, &c. (*d*), lower jaw, viewed from beneath. (*e*), one of the *rami* of the lower jaw, inner side.

Skull.—*Ant-orbital foramen* very small, situated near the plane of the palate, and about midway between the line of the front molar and the intermaxillary suture. This *foramen* has its anterior outlet bounded externally by a bony protuberance, which is produced downwards into an angle more or less distinctly marked. *Zygomatic process* of the *maxillary bone* consisting of a broad thin plate, which is concave in front, oblique in its position, (the lower part being the farthest removed from the nasal portion of the skull), and occupies the whole space between the plane of the palate, and that of the upper surface of the skull. The lower boundary of this plate is emarginated, and forms an arch which throws the anterior portion of the zygomatic arch above the plane of the palate. Palatine portions of the intermaxillary, maxillary, and palatine bones, on the same plane, or together, forming a slightly concave and nearly even surface. Incisive *foramina* small and narrow, terminating in most cases at the intermaxillary suture. The palatine portion of the palate-bone approaching to a quadrate form, the palato-maxillary suture being almost always between the penultimate molars: there are two small, widely separated, suturo-palatal *foramina*; and on each side, close behind the last molar there is a tolerably large posterior palatal *foramen*. The posterior boundary of the palate is doubly emarginated or truncated, and is situated in a line with the hinder portion, the last molar on each side, or (*generally*) behind this line.

Frontal bone with a distinct post-orbital process, which is directed backwards and downwards, and leaves a wide space for the passage of the temporal muscle. The malar bone is continued forwards and upwards, to join the lachrymal, and backwards, to form the outer boundary of the glenoid cavity; this cavity is broad and open, and not contracted by longitudinally elevated ridges.

Lower jaw.—The descending *ramus* nearly of a quadrate form, its upper posterior angle acute and directed outwards from the line of the condyle, and the lower posterior angle rounded and directed inwards. The lines formed by the lower margins of the descending *ramus* on each side, are nearly parallel. The horizontal *rami* meet in front and join by a *symphysis* of limited extent.

The most striking feature in the skulls of the present family, and one which distinguishes them from all other rodents with which I am acquainted, is the distinct *post-orbital* process. This process however, although always distinct, varies considerably in size. It is most developed in the larger species of the genus *Pteromys.* In some of the marmots it is also very large. In the genus *Sciurus* it varies considerably, but neither in this genus nor in any other of the present family, have I ever found it wanting. It is least developed in the palm squirrel, (*Sciurus palmarum*). In some of the *Spermophili* (if not all) it is very small, and it is also small in the genus *Geosciurus* of Dr. And. Smith, (which I have no doubt is the same as the genus *Xerus* of Hemp and Ehr.) The palate is proportionally larger in the *Sciuridæ* than any other Rodents. It almost always extends considerably beyond the last molars. In *Sc. Prevostii* however, the palate terminates *in* the line of the hinder portion of the last molar, and in *Sc. maximus* and *Sc. Leschenaultii* it terminates rather within this line. The position, combined with the small size of the ant-orbital *foramen*, will also serve to distinguish the *Sciuridæ*. The genus *Castor*, in the character of the ant-orbital *foramen*, makes the nearest approach to the present family; here however, this opening is not so low down.

The general form of the skull in the true *Sciuridæ* is short and rounded, the cranial portion is very large, and the nasal portion short. In the genus *Arctomys* the nasal portion is proportionately larger, and the cranial smaller. Here the interorbital portion of the skull is considerably contracted, as we also find the same part in the larger species of *Pteromys*, these however have the short nasal bones, as in the genus *Sciurus*. In *Sc. palmarum*, and in the genera *Spermophilus* and *Geosciurus* (*Sci. erythropus*[1]), the skull is considerably elongated and somewhat ovate, the nasal bones are longer than in the true squirrels. The animal last named offers many peculiarities in the form of the *cranium*, it is not however my intention to enter into detail at present; I will merely notice one, viz., the horizontally compressed form of that portion of the zygomatic arch which forms the lower boundary of the orbit: a character in which it differs from all the other *Sciuri* examined by me, but to which I find an approach in the skull of a species of *Spermophilus*, (*Sp. Franklinii*).

The genera and subgenera contained in this family the skulls of which I have examined, are—*Pteromys*, *Sciuropterus*, *Sciurus*, *Macroxus*, *Tamia*, *Geosciurus*, *Spermophilus*, and *Arctomys*.

(*To be continued.*)

[1] I am indebted to Dr. Richardson for the loan of the skull of this species, and also of the *crania* of several other rodents, which have been of great service to me.

SHORT COMMUNICATIONS

Note on Amphicoma vulpina, Hentz.—When in East Florida I received a letter from Count Castelneau, in which, amongst other matters relating to Entomology, he informed me that what he considered the most interesting coleopterous insect he had taken in West Florida was an *Amphicoma*, or rather an insect of a new genus very closely allied to *Amphicoma*. This, he added, was peculiarly interesting, as this group of the lamellicorns was heretofore supposed to be confined to the Old World, and in a great measure to the shores of the Mediterranean.

When at Cambridge (Mass.) last October, I for the first time saw the insect to which I believe the above remark refers; and there learned from Dr. Harris a few particulars with regard to its history, which, from their being upon the interesting subject of Insect Geography, are of some importance.

This insect is the *Amphicoma vulpina* of Hentz, but I am not quite sure that his name is more than a manuscript one. Perhaps it ought to form a new genus, and be considered as the American representative of *Amphicoma* but I have not yet had leisure to examine the only specimen I brought home with me. Be this as it may, the fact of an insect of this genus, or of one so nearly allied to it, being found in North America, is interesting and important; and not less so is the fact that its range over that vast continent is extremely wide, extending from the hills of New Hampshire to the Upper Mississipi, and across the Rocky Mountains as far as the shores of the Pacific, from all which places Dr. Harris knows of specimens: to these we must add West Florida, as its southern limit, and thus we find that it ranges throughout the whole territory of the United States, from east to west, and from north to south.

A specimen of this insect, which I owe to the kindness of Dr. T. W. Harris, is now in the cabinet of the Entomological Club. It was taken by Dr. Gould of Boston, on the flowers of the American elder, in New Hampshire, I believe in the month of July.

At present we know but little of the geographical distribution of insects; our entomological authors being very careless about defining their exact localities. I have been particularly struck with this carelessness in regard to the insects of the United States. Some European entomologists who have written on the insects of that country, appear to think it quite needless trouble to indicate whether their species are from the snow-clad mountains of the eastern states, the flowery prairies of Illinois, or the orange-groves of East Florida.—Whether this fault has *originated* on this side of the water or on the other, I know not. It may be that the American entomologists themselves, in their remittances of insects to Europe, have neglected to specify their exact localities; or it may be that we are too apt to forget the vast extent of the various republics known as the United States of America.—Be this as it may, that such carelessness should exist cannot be too much lamented.—*Edward Doubleday.—Sudbury,* 21*st Jany.* 1839.

On the Fossil Remains of Cetacea.—The philosophical journals both of England and Scotland record instances of the discovery of cetaceous remains in positions to which it is physically impossible the present seas can have reached; and yet the condition of such remains, and their isolated entombment, added to the fact of their occurrence exclusively in the most superficial strata, have led to a doubt of their fossil character. On the banks of the Forth the bones of an animal 72 feet long were once discovered, imbedded in clay more than 20 feet above the reach of the highest tide of that river. A solitary *vertebra* was described by Sir George Mackenzie in the 'Edinb. Phil. Trans.' vol. x., p. 105, as obtained from Strathpepper in Rosshire, at an altitude of 12 feet above the present level of the sea. Several bones of a whale were subsequently discovered at Dumore Rock, Stirlingshire, in brick earth, nearly 40 feet above the present level of the sea. Still in all these instances no remains of extinct animals were present with them, nor were there any extinct marine *Testacea* attached to the bones: so that their fossil character rests upon the inference to be drawn from the condition of the beds in which they were deposited, and from the relative position of their respective mausoleums. The latter, be it observed, are generally on more or less elevated ground, adjacent either to the sea or to tidal rivers. The stratum in which they repose is either without exception what is termed marine *diluvium*, or the clay beds subordinate to it. It is true moreover that living *Cetacea* are occasional visitants to the neighbourhood in which the supposed fossil remains are discovered. We must therefore await additional evidence before we can with confidence assign to these remains any degree in the chronological scale higher than that of the recent period of geologists.

To the before-mentioned instances I may add that in the course of the summer of 1837, I obtained twelve *vertebræ* of a whale, some caudal others dorsal, from the yellow marle or brick earth of Herne Bay, in Kent. The spot from whence they were taken is not more than 10 feet from the high water mark, and certainly not more than 10 feet above the occasional reach of the sea on that coast. They were the bones of a young animal, since their *epihpyses* were still unconnected with their bodies, and the bony structure not fully developed. Their specific gravity was little above that of water, and their texture frail, although embedded in tenacious clay. No other animal remains were discoverable in the clay. It is only necessary to remark that the remains in question singularly correspond with their predecessors in position and character, and add their corroborative testimony, by way of accumulation, to whatever view may be taken of cetacean *reliquiæ.* I send this statement under the impression that your Magazine is ever open to the details of facts in Natural History, be the evidence to be drawn from these facts what it may.—*Wm. Richardson.*

Note on the Argonaut.—I have talked with Della Chiaja very much about the argonaut; he states that he has traced the animal from the *ovum* to the formation of the shell, and he has published plates of the progress of its developement, which are beautifully executed. I think we may place full confidence in his observations; he is animated with the greatest zeal for science,—almost unsupported, and certainly unremunerated.

I am sorry I have not yet been able to get an argonaut; I have requested the fishermen to bring the first they catch to me. They come off this coast only in summer, and are then more in the Gulf of Genoa, and off Baia and Puzzuoli, rather than in our Bay.—*J. C. Cox.—Naples, Dec.* 28, 1838.

Ornithological Notes.—Seeing from time to time lists of birds shot in different counties, it has occurred to me that if such lists were procured from all parts of the kingdom, it would be as useful an index to collectors of British birds as could be formed. These lists might be much abridged by leaving out such species as are common to all parts of the country; they would greatly aid the British ornithologist, for innumerable are the difficulties which he has to encounter, and after all his exertions but very few are the birds he can procure with his own gun. He will have to contend with the unprincipled conduct and exorbitant demands of those who call themselves "naturalists." For alas for the rare birds of Britain! whenever a harmless and interesting stranger makes its appearance, some ruthless eye is immediately upon it, and it is generally murdered in mere wantonness: for I believe but few of the rarities taken are preserved; they are just handed about for a day or two, to gratify the stare of stupid wonder, or else nailed against a barn, as a trophy of cruelty.

But few of these rarities have come under my own observation. A fine male honey-buzzard (*Pernis apivorus*) was shot here last June; it was exceedingly tame. The goshawk (*Astur palumbarius*) has been taken here, and the kite (*Milvus ictinus*), though formerly plentiful, has now, through the ruthlessness of the gamekeepers, almost disappeared. The scops owl (*Scops Aldrovandi*) was taken some years ago, and I have no doubt would have continued with us, but for the same cause, for the aforesaid gentry never trouble themselves to inquire whether such visitors may not do as much or more good than harm, it is enough for them to know that they are not game, and of course must be exterminated.

Amongst other birds which I have known taken is the ash-coloured shrike (*Lanius excubitor*). That very interesting little bird the pied fly-catcher (*Muscicapa luctuosa*); the chatterer (*Bombycivora garrula*), the finest case I ever saw of which were purchased of a boy who was feeding his ferrets with them, for one penny each; in fact most of these things are destroyed to no purpose, as soon as seen. The grey-headed wagtail (*Motacilla neglecta*) was once obtained from a boy. Next comes the poor little crossbill (*Loxia curvirostra*), of which we have lately had numbers, and which, by a cessation of hostilities, might be induced to take up its abode and increase among us; but no sooner is it heard, (and its note being a peculiar one is the herald of its own destruction), than it is driven from plantation to plantation, and, like the dove from the ark, can find no rest for the sole of its foot.

The little busy barred woodpecker meets with no encouragement here, and is obliged to seek a habitation elsewhere. The stock dove (*Columba Ænas*) has become scarce of late; and the large bustard (*Otis tarda*) is all but exterminated. A fine female was sold in Cambridge market last February for £2. 2s.; it was shot between Cambridge and Lynn. A male was killed near this place seven or eight years ago, and hawked about for half-a-crown. The little bustard (*Otis tetrax*) was taken last year in this county. The little sandpiper (*Tringa pusilla*), the little auk (*Mergulus melanoleucos*), and the fulmar (*Procellaria glacialis*), have also, singularly enough, been taken here; as well as the fork-tailed petrel (*Thalassidroma Bullockii*). Some of the above are preserved in the Museum of this town, but I am sorry to say not the whole of them.

But I have not yet stated the chief difficulties the naturalist has to contend with; these are the jealousies and envyings which seem to pervade the breasts of men of all classes in the different branches of science. This to me is unaccountable. When all are animated by a common object, mutual assistance ought to be cheerfully rendered, especially when all are working for the public good. Creation is full of beauties for the naturalist to admire. In the lively and interesting feathered race, the well-adapted and graceful figures of quadrupeds, the infinitely diversified forms of the insect tribes, and in the beauty and variety of the surrounding vegetation,—there is nothing to excite envy, but everything to induce an opposite frame of mind. Everything was intended for our enjoyment and instruction; everything is beautiful and happy; and

"All save the *spirit* of man is divine:"

and but for that spirit the earth would be a paradise.—*Joseph Clarke.*—*Saffron Walden*, *Nov.* 24*th*, 1838.

LITERARY INTELLIGENCE.

Mr. James F. Stephens, author of the Illustrations of British Insects, is preparing for publication a series of Manuals descriptive of all the species of British Insects. The first volume, containing the whole of the British Beetles, is nearly ready.

THE MAGAZINE

OF

NATURAL HISTORY.

MARCH, 1839.

Art. I.—*Observations on the Poulp of the Argonaut.* By Madame Jeannette Power.[1]

Having for many years past devoted to natural science, and to enriching my cabinet with marine objects, the few hours to be spared from domestic cares, for in fact few are the moments that one of my sex and condition can enjoy in study,—the poulp of the argonaut specially fixed my attention, from so much having been said on the subject by naturalists. I have since been enabled to follow up a series of observations upon this cephalopod, which other naturalists could not perhaps have done, for want of those opportunities and means with which I have been fully supplied. I therefore deemed it incumbent upon me to make careful inquiries on the most disputed points which regard the physiological condition of the animal, and consequently devoted myself for some years to an uninterrupted course of observations; and after repeated experiments, I have at last been able to obtain data which lead to very important results: first, by assuring myself that this mollusc is the constructor of the shell which it inhabits; secondly, by clearing up doubts with regard to the first developement of its eggs; and, finally, by making known many new facts respecting its habits. I will therefore present to you, Gentlemen, after a short sketch of the state of zoological knowledge as regarded the *Argonauta Argo* when I commenced my experiments, an account of the method followed by me in my researches, and the physiological inferences deduced from them.

[1] "Osservazione fisiche sopra il polpo dell' Argonauta Argo, della Socia Correspondente Madame Jeannette Power." Read at the Meeting of 26th November, 1836. From the xii. vol. of the Academy, Catania.

It has been a subject of much controversy amongst naturalists, whether the poulp of the argonaut really secretes the shell in which it is commonly found, or, like the *Paguri*, forces itself in after the proper inhabitant has been either driven out, devoured, or become naturally extinct. Indeed, whilst Lamarck, Montfort, Ranzani, &c. supported the former opinion, Blainville and others maintained as certain the latter; and this learned malacologist went so far as to assert that the animal of the argonaut was *totally unknown*,—("Animal tout-à-fait inconnu."—'Manuel de Malacologie,' p. 494").—Prior to these the enlightened Abbé Olivi had stated, although he had not had the opportunity of seeing a living argonaut, that he was inclined to believe that a cephalopod might easily form a calcareous shell like that of the argonaut, if another cephalopod, according to the observations of Martini, was the constructor of the heavy and chambered shell of the nautilus.

The reasons which induced the opposers of this opinion to think the shell not the work of the poulp, were that its body had not a spiral conformation, and that it did not adhere to the shell, which bore no resemblance to the neighbouring parts of the inclosed animal, being regularly furrowed at the sides, and possessing a spiral convolution something like an ammonite, while nothing analogous was observed in the animal, whose folds, when it withdrew into the shell, presented the appearance of anything but regular furrows. To these objections I will now reply, because I am glad to show at this time how Signor Poli, attentively scrutinizing the eggs of the argonaut, assures us that he saw the young shell attached to the mollusc, and concludes that there is no longer room to doubt that the shell in which we see the argonaut is generated in the egg with the mollusc, and not merely inhabited by it afterwards, as many believe. With all this, the observations of Poli do not appear to have entirely removed the doubts of the celebrated Baron Cuvier, who, not being willing to declare the opinion of Blainville erroneous, qualified it as *exceedingly problematical*.

Such was the state of things with respect to the argonaut, when it occurred to me that the absence of experiments alone was the cause of such conflicting opinions, and that all must be brought to light if attentive examinations were instituted on so important a subject.

Determined on this undertaking, I well considered the aim of my observations, which was to assure myself of the fact that the constructor of the argonaut shell was the cephalopod which inhabited it. In this case to become acquainted with the structure of this mollusc should be the first of my endeavours; to examine the relation of the mollusc with its shell the second; and the third to accompany it in its developement from the egg through its entire growth. But how to prosecute so difficult a series of observations? The Port of Messina, daily frequented by me in search of marine objects, offered opportunities and means which perhaps no other situation could present. For this object I thought of cages, which were constructed under my direction; they were eight palms long and four broad, with a convenient interval (three or four lines) between the bars, which allowed the water to enter freely when placed in the sea, whilst the escape of the animal was prevented. I placed the cages in a shallow bottom in the sea near our citadel, in a spot where I could examine them without disturbance. I inclosed in them a number of living argonauts, which I took care to supply every two or three days with both naked and testaceous molluscs for food. Fortified with invincible patience, I never once thought of desisting from the undertaking, although many and many times my experiments met with no fortunate result.—It was only after several months that I succeeded in clearing up my doubts, and in seeing my researches crowned with success.

With regard to the structure of the mollusc of the argonaut, as no one is ignorant of what authors have said on the subject, it will not be out of place to recount what I have observed as singular, or not described by others, doubting that some essential particulars in the history of this animal may have escaped many naturalists.

The cephalopod of the argonaut is furnished with eight arms, having on each two rows of suckers; the first two arms are more robust than the others, and should be so, because they serve as masts to support the sails, which, spread out, act before the wind as such. At the base they have, on the inferior sides, the double row of suckers like the other six; but from the inferior row, at about an inch from the base in adults, a rather furrowed membrane begins to develope itself, which extends as far as the tip of the arm, and holding it bent, it can no longer follow the office of a *rowing arm*, but as every one knows, it is employed by the animal as a sail. But here I am glad to observe that these sails (for so we will call them) attached to the *sailing arms* are so large, that when turned backwards and pressed against the shell they can entirely cover and protect it. Thus, as far as I can conclude, the true office of these sails is exactly that of keeping themselves applied to the shell at all times, in reserve for the moment when the animal, coming to the surface of the water, removes them, and spreading, raises them in the office of sails. In fact, the series of suckers of the sail-arms, when the membrane of the sails is wrapped about the shell, are placed exactly over the keel of it, in such a manner that each sucker corresponds to each point in which the ribs of the argonaut terminate until they reach the two margins of the spiral.

Observation leads me to compare the sails of the argonaut with the two wings of the mantle of the *Cypræa*, not only from the manner in which they cover the shell, but because I have reason to believe that the formation itself of the shell results from a transudation by the membrane of the sails, the corrugations of which, in secreting the calcareous matter, may be the cause of the ribbed form of the shell. These may also serve as a means of retention of the animal in its shell during the movements of the mollusc, which, without all these furrows, might easily slip about from one side to the other.

This consideration may weigh in obviating the difficulties of those who cannot imagine how a shell containing a cephalopod should present no resemblance with the folds of the animal compressed within it. For if they would consider it the result of a calcareous deposition of the membrane of the sails, they would find not only the series of little points corresponding to the suckers, which adapt themselves to the keel of the spiral, but an explanation of the disposition of the ribs, and of the smooth and paper-like condition of all the shell. They have not all seen, I can frankly assert, how the argonaut appears when it has placed its sails over the shell; drawing alone can shew it, and I have here annexed a figure which is a very good resemblance.

The sail when spread out presents a silvery surface, speckled with concentric circles of spots with a black spot in the middle, and surrounded with a beautiful gold colour; and this and the vicinity of the suckers along the keel and the spiral assume so vivid a purple colour that it approaches that of the *Ianthina*.

The mouth, the head, the bag, and the *branchiæ*, have not presented me with any particularity but what has been already well described by naturalists, and which is common to the *Sepia* and *Calamaries*, in these parts little differing from my argonaut. However, as regards the funnel with which these cephalopods are furnished, I believe I have two new observations to offer. One is, that it holds the office of a pump or proboscis, rather than that of a funnel; and that the animal employs it, when swimming with its arms on the surface of the water, as a helm, elongating it in front of the widest part of the shell, at the same time that the spiral serves as a prow.

Reflecting on the delicacy and fragility of the shell here treated of, it seems strange to see them so rarely broken, and wishing to trace the cause, I set about touching one whilst its poulp was within; and taking it dexterously between my fingers to learn what degree of flexibility it would admit, I discovered that it was extremely pliant, so much so as to be able to bring in contact the two extremities of the great curve without breaking it; and indeed, shells so fragile ought to possess this flexibility, in order that they should not continually be liable to be broken to pieces by the restless and uninterrupted movements of their poulps, as well as the shocks which they would be likely to suffer in the depths during a stormy sea. In this case it would prove very unfortunate for them, not being capable of forming an entire new shell, as will be observed afterwards.

Having ascertained the flexibility of the above mentioned shell, while the living animal was within it, I tried to assure myself whether such would be the case without it, and after having been exposed to the air for some time, I immersed some empty ones in fresh water, and at the end of three days found them as pliant and flexible as the first.

As regards the connection between the animal and the shell in which it is housed, I have not found any ligament or muscle which connects them; while the sac is simply held by the turning of the end of the spiral, from which it may be easily separated; and it appears that the tight adhesion of the sac against the internal surface of the ribs of the shell is sufficient to hold it attached. Moreover the external super-position of the sail-arms keeps the shell firmly upon the poulp.

Passing on now to what it has been my fortune to observe with regard to the habits of this mollusc, I shall remark that in a state of natural liberty in the environs of Messina, and even in the port, the argonaut is to be found almost all the year, although in larger or smaller quantity. But I should say their true season to be during autumn, or September, October, and November. It may be because the sea at that time brings them with the current of the Faro; or because that season is more favourable to them on account of certain marine matters on which they feed; or finally because it may be the time of their fecundation. They are therefere seen most abundantly in the muddiest parts of the port, and exactly where the anchored boats are thickest among them.

On observing any person, if they are on the surface of the water, they fold the sail-arms over the shell, and the rowing ones inside of it, and sink to the bottom.

If they are under water, by means of the tube, where terminate the excretory ducts of the ink-vessel, they throw the ink forth, like the rest of the cephalopods, in order to make the water turbid, and thus escape from the enemy by gaining time to hide in the mud. When still further pursued, whilst in the cage, they would make use of another stratagem, after having employed the first; this was to spirt a quantity of water by means of the tube, then tired, they would shrink into the shell, and withdrawing the sails, which are always folded over it, would spread them and cover it entirely, making it appear at first silvery, as I have before said, but an instant after along the suckers, over all the keel and spiral, a purple colour would spread, and the concentric circles of spots would appear spread over the two surfaces.

During calm weather, and in quiet water, if not feeling themselves observed, they make a parade of their many beauties, rowing with full sails tinged with beautiful colours, and resting the extremities of the sail-arms on the two sides of the shell, or embracing the shell with them. It is then that their different movements and habits may be observed; but I was obliged to act with the greatest caution in order to enjoy this spectacle, for the creatures are extremely suspicious, and no sooner find themselves observed, than they let themselves fall to the bottom of the cage, and do not rise again for many hours; neither could I, like others, have become so assured of their habits in open sea, without the precautions taken by me, and from accidental observations.

Sometimes when pressed by hunger, they would come almost to the surface of the water, and when I offered them food would snatch it out of my hands, exhibiting great voracity.

Although I have studied to learn whether these animals are of separate and distinct sex, I have not been able to make out more than that all those examined by me, and these were more than a hundred, were furnished with eggs. I have thence concluded that they were hermaphrodites. But hereafter I intend to make other careful anatomical researches on this subject, which at present I have not the opportunity to do.

(*To be continued.*)

Art. II.—*On some Snow Crystals observed on the 14th of January, 1838.* By William Thompson, Esq., (V.P.), and Robert Patterson, Esq., Members of the Natural History Society of Belfast.

At Belfast, on the 14th of January, 1838, about half an hour after noon, we remarked among some ordinary snow-flakes which, since the morning, had been falling very sparingly, some of the beautiful lamellar crystals which present so great a diversity of figure. We immediately hastened out of town, that we might have an opportunity of observing them undisturbed, and for about an hour enjoyed this high gratification. They then ceased to fall, the day became fine, and no return of the phenomenon took place.

With respect to the means of observation, we were very differently circumstanced from Dr. Nettis, who states that he was "prepared, in the year 1740, to make the most minute observations, and the most exact drawings in his power, of the most perfect figures of snow."—('Phil. Trans.' 1755, p. 645): and mentions the kind of microscope, and double convex glasses employed for this purpose. We were furnished only with the ordinary pocket lenses, and consequently were unable to attain that minute accuracy which is so desirable. However, we most carefully sketched the crystals, either as they fell, or lay undisturbed on pieces of wood or metal exposed to the weather; and thus secured representations of a considerable number.

On the following day we had the pleasure of comparing and identifying nearly all our figures with those of Hooke,[1] Nettis, and Scoresby,[2] but at the same time discovered that some which we had seen, had not been described or delineated by these authors. Nineteen distinct forms at least were distinguished; and when the limited period of our observations is considered, in connection with the simple lenses employed, we feel satisfied that under more favourable circumstances, the number of figures might easily have been doubled.

It was the opinion of Scoresby that the configuration of the crystals "may be referred to the temperature of the air," and in his table some (which we recognised) are mentioned as having been observed at a temperature of 10°, and others at a temperature of 27.26°. From the circumstance of several distinct figures having been detected by us falling simultaneously, it is obvious that a great diversity of form may be co-existent with the same degree of temperature, and of course

[1] 'Micrographia.' [2] 'Arctic Regions.'

that a great range of temperature is not essential for the production of this diversity. Among the configurations we observed as identical with those of Scoresby, were two forms (*figs.* 59 and 69) which had only once fallen under his observation. Dr. Nettis mentions that in one day and night "he observed fifteen, twenty, or more particles of snow differently formed;" and by the observations of eight days, viz., the 11th, 12th, 13th, 21st and 23rd of January, and the 6th, 23rd, and 24th of February, he was enabled to figure the ninety-one crystals published in connection with his memoir. The shower of crystals which we had the gratification of witnessing, would seem in comparison to have been peculiarly rich in *diversity* of figures.[1]

The *size* of our crystals may next be noticed. Scoresby

[1] The following notice of their previous occurrence to me in England presents a remarkable difference in this respect: since it was published I have not seen any record of these lamellar crystals having been observed in the British Islands. "On the 22nd of March, 1833, when travelling outside a stage coach from London to Shrewsbury, and near to Daventry, the day being up to this time mild and calm, (the weather for some weeks previously had been excessively cold, with prevalent easterly and north-easterly winds), snow, of the loose fleecy kind common to the climate, began to fall, but mingled with it there appeared beautifnlly delicate lamellar crystals, of uniform transparency, having a spherical nucleus, from which sprang six and twelve radii, most exquisitely formed, all the rays on each species being equal, and not in a single instance deviating from the regularity of geometrical proportion, as has on some occasions been observed. By far the greater number of these were of the former species, having six points radiating from a centre." The figures 20 and 94 in the plates of snow crystals in Scoresby's 'Arctic Regions' represent both these crystals, the lines exhibited as extending from the centre of the latter not having been however visible to the naked eye."—Lond. & Ed. Phil. Mag. vol. v. p. 318.

On this occasion two forms only of these crystals were observed, and it is considered by Scoresby that Nos. 93 and 94, each having twelve spines, appear to be accidental varieties, and are produced probably by the correct application of two similar crystals upon each other. If this opinion be correct, one normal kind only occurred, and merely the two forms having come under notice may seem to favour this idea; as may also the fact of the six being much more numerous than the twelve pointed ones. Opposed to this view however is the circumstance, that the twelve points on all I saw were placed at equal distances, as they are figured by Scoresby, who does not state that he ever observed any irregularity in them: but if formed by the application of two six-sided crystals, why should not the points have occasionally appeared at irregular as well as regular distances? Of the two forms seen in England, No. 20, or the six-sided, only appeared on this occasion. Both days were alike calm; the wind on the former was north, with a point of east: on the latter south-east.

Mr. Patterson was the first to observe the crystals at Belfast, and immediately hastened to inform me of the circumstance, when I joined him, and from our united observations the above article has been drawn up.—Wm. Thompson.

mentions that the largest crystal represented was $\frac{1}{3}$ of an inch in diameter, the smallest $\frac{1}{35}$."[1] Dr. Nettis remarks,—"the natural size of most of the shining quadrangular particles, and of the little stars of snow, as well the simple as the less compound ones, does not exceed the twentieth part of an inch."[2] It is possible that there might have been very minute figures, which, from our manner of observation, may have escaped our notice; but those which we did observe, and were able to identify, generally exceeded very considerably the sizes recorded by the above authors. To *fig.* 39 of Nettis (No. 6? of Scoresby) he has attached a mark denoting the natural size. This is less than a line in diameter, and is consequently only one-third the size of some similar in form which came under our observation. Some of ours very considerably exceed the extreme size mentioned by Nettis, and equal the largest described by Scoresby; and their average diameter was such that the unassisted eye could discriminate the various figures as they lay on a dark ground, and could even detect some of the varieties floating through the air, their descent being slow in consequence of the calmness of the day. After falling they remained undissolved, retaining, from the freezing state of the atmosphere, their undiminished sharpness and perfection of figure, and continuing obvious to the most unpractised eye which should chance to fall upon the wood or metal on which they were conspicuously exhibited. Judging from their abundance in such situations, they constituted fully one-third of what had fallen.

It is worthy of remark that all the varieties figured by Hooke in his 'Micrographia,' published in 1665, or by Dr. Nettis of Middleburgh, in 1740, and the whole of those observed by us, belong exclusively to the "lamellar," or first of the genera into which they are divided by Scoresby. All, with the exception of Nos. 5 and 19, were "perfect figures," and we may also add "many instances occur of mutilated and irregular specimens; some wanting two or three radii, and others having radii of different sizes and shapes." We observed also that an excess instead of a deficiency of some of the parts occasionally interfered with the geometric accuracy of the figures; a circumstance which did not escape the minute accuracy of Dr. Nettis, who gives two representations (Nos. 57 and 84) of "anomalous figures of snow," of which, he adds, "there is an infinite variety."

In the observations made by Mr. Hooke and in those by Dr. Nettis, on lamellar crystals, no information is conveyed

[1] 'Arctic Regions,' vol. i. p. 431. [2] 'Phil. Trans.' part i. 1755, p. 674.

respecting the state of the atmosphere at the time any peculiar configuration was distinguished. Mr. Scoresby on the contrary has referred almost every figure to a table, exhibiting the most obvious atmospheric phenomena at the time each crystal was observed. The portion of this table which relates to the varieties noticed by us, is here extracted for the convenience of reference in our remarks on the several forms hereafter recorded.

DATE.	FIG.	THERM.	BAR.	WINDS.		REMARKS.	SIZE.
				DIRECTION.	FORCE.		
1809 Apr. 15	1	21	29.92	N.N.E.	Fresh gale	Snow very profuse	$\frac{1}{10}$ to
May 2	6	10	29.84	N.N.E.	do.	Delicate crystals floating in the air	$\frac{1}{20}$
....	10	..	— —	——	——		
Apr. 17	..	19	29.84	——	——	A considerable quantity of snow	
May 1	15	12	29.65	N.E.	Strong breeze	Occasional crystals deposited	$\frac{1}{10}$
——	20	—	— —	——	——	No observations recorded	
——	22	—	— —	——	——	Do.	$\frac{1}{20}$
1816 Apr. 29	24	23	29.95	N.N.W.	Mod. breeze	Small showers of fine crystals	$\frac{1}{10}$
1809 May 2	38	10	29.84	N.N.E.	Fresh gale	Delicate crystals floating in the air	$\frac{1}{15}$
Apr. 15	41	21	29.80	N.N.E.	——	Snow very profuse	$\frac{1}{15}$
1817 May 6	59, 69	27.26	29.80	S.E.	Fresh breeze	Various and beautiful figures vastly profuse	$\frac{1}{8}$
1810 Apr. 21	95	20	29.67	N.E.	Strong gale	Snow in considerable quantity	$\frac{1}{15}$

State of the atmosphere as observed at the Belfast Museum, Jan. 14th, 1838.

9 A.M. Therm. 31.50. Bar. 29.95. Wind E.S.E. calm. } Sky generally
3 P.M. —— 32.95. ——29.86. —— S.E. „ } overcast.

No. 1. This is identical with No. 1 of Scoresby. In speaking of it he remarks,—"It is the most general form met with. It varies in size from the smallest speck to $\frac{1}{3}$ of an inch diameter. It seems in greatest profusion when the temperature approaches the freezing point." This figure with its various modifications, forming No. 1 to 8 in our list, was by far the most abundant. Its size varied from 2 to 4 lines in diameter. Its radii, with their attendant ramifications, recal immediately to the mind the appearance of some vegetable productions. This idea occurred nearly two centuries ago to Hooke; who remarks, "there is a vegetable which does exceedingly imitate these branches, and that is Fearn, where the main stem may be observed to shoot out branches, and the stems of each of these lateral branches, to send forth collateral," &c.

No. 2. In this the lines diverging from each ray *increase* in length as they approach the extremity, so that those from the adjacent radii come nearly into contact. It does not appear among the numerous figures of Nettis or Scoresby.

No. 3. In this on the contrary the lines gradually *decrease* as they approach the extremity, and the figure precisely resembles one given in Hooke's Micrographia (the largest in the second line), except that the six radii presented a more pointed appearance.

No. 4. Here the lines diverging from the radii were extremely irregular in length. It is not figured by the authors above referred to.

No. 5. This had the peculiarity of possessing eight radii, the alternate ones little more than half the length of the others; all finely feathered; the diverging lines decreasing as they approach the extremity, as in figure 3. One only of this configuration was observed. It is not figured in the works before us.

Nos. 6, 7, 8. These are identical with the representations given by Nettis, numbered 62, 78, 79.

No. 9. Identical with No. 56 of Nettis, but less abundant than the preceding.

No. 10. The *spiculæ* of this form (No. 6 of Scoresby, 39 ? of Nettis) were very few in number and about 2½ lines diameter.

No. 11. No. 10 of Scoresby is nearly but not precisely the form which we observed. In ours the radii, instead of maintaining a uniform thickness throughout their entire length, gradually expand as they approach the terminating trefoil, and merge into the curves of that figure. They were few in number. Diameter 1½ line. This was twice noticed by Scoresby: the thermometer in the first instance being 19°, in the latter 10°.

No. 12. Identical with figure 15 of Scoresby. Few in number. Diameter 2 lines.

No. 13. No. 20 of Scoresby. One only observed by us. Diameter 1½ line

No. 14. Vide figures 22 and 29 of Scoresby. Neither of these conveys an accurate idea of the form indicated by our No. 14. It had the margin and points opaque, the disk filmy and transparent, as in fig. 59, but the points resembled those delineated in figure 22. Diameter about 1½ line.

No. 15. Here, as in the preceding, it is necessary to combine two of Scoresby's figures, to convey a correct idea of the *spicula* we mean to represent. In this instance the radii were feathered as in figure 24, but terminated as in figure 15. One only was observed. Diameter 2 lines.

No. 16. This accords with figure 38 of Scoresby, and occurred to him at a temperature as low as 10°. We observed but one specimen of this form; it was somewhat opaque. Diameter 2 lines.

No. 17. A few *spiculæ* presented themselves differing from No. 41 of Scoresby in having three instead of two leaflets. Diameter about 2 lines

No. 18. Fig. 69 of Scoresby. One of this form and opacity was remarked. Diameter about 2½ lines.

No. 19. Two of Scoresby's figure 95 were found united, forming by their union an irregular figure.

The weather for some days previous had been frosty, and the barometer gradually falling from about noon on the 12th inst. On the morning succeeding these observations there was snow, followed by showers of sleet, and at noon a heavy rain set in, which continued without intermission the remainder of the day.

Since the preceding observations were made we have found that snow crystals are not unfrequent in Ireland, although we are not aware of any published record of their occurrence.— The facts which have led to this conclusion may be briefly stated.

After the crystals had been observed by us, we mentioned the matter to some friends, who, a few days afterwards, informed us that several had fallen about four miles from Belfast, on a lake then frozen over. On being shown Scoresby's figures, they identified several of them, and pointed out two pyramidal forms as particularly abundant. None of this configuration were noticed by us.

Robert Ball Esq., of Dublin, informs us that he has occasionally observed them at Youghal and Dublin.

On the 13th of February, 1838, Mr. Patterson travelled by coach from Dublin to Belfast. Snow had been falling heavily all the morning, but had ceased before his arrival at Jonesborough. While stopping to change horses he found on the low stone wall which separates the road from the adjoining fields, a number of snow crystals such as he had formerly seen. A few hundred yards farther on, the ground was perfectly free from snow, and continued so to Belfast. This partial fall was the precursor of the great snow storm which commenced on the 23rd of February, and for some days rendered many roads impassable.

In the morning of March 23rd, at 8 o'clock, Mr. Patterson noticed at Belfast, among many small compact particles of snow scattered over the street, several hexagonal crystals, the same as before, and from one to three lines in diameter. On the little pools of water and ditches by the way-side towards the Botanic Garden, the crystals appeared to great advantage on the dark surface of the frozen water.

The ensuing morning at 9 o'clock a very small number of snow crystals were falling. Immediately afterwards they became more loose and irregular, and in five minutes more began to descend as a gentle rain. The sun then broke out, and an instantaneous change of temperature was apparent.

Belfast, March 1838.

[The appearance of this article so many months subsequently to the date of its reception, has arisen from the circumstance of the original manuscript having been lost in passing through the twopenny post, and we were therefore reluctantly obliged to give the authors the trouble of drawing out a second copy.—Ed.]

ART. III.—*Monograph of the Genus* Sciurus, *with Descriptions of new Species and their Varieties, as existing in North America.*— By J. BACHMAN, D.D., President of the Literary and Philosophical Society, Charlestown, South Carolina, &c. &c.[1]

THIS genus includes many species, of which one or more exist in the various portions of the globe, with the exception perhaps of New Holland. Several of these are extensively diffused, and, from the operation of climate and other causes, are subject to deviate into many varieties. This circumstance has given infinite perplexity to European naturalists, in designating the species existing in the warmer portions of the eastern continent. Even the common squirrel of Europe (*Sciurus vulgaris*) varies so much in colour in high latitudes, that a doubt has for a long time existed whether these varieties ought not to be regarded as true species.

In designating the species of American squirrels, and in separating varieties from true species, a still greater difficulty presents itself. Some of these are scattered over a vast territory,—presenting peculiarities of colour in various localities. The same species often differs considerably in size, varying also in summer and winter pilage. The skulls and teeth of most of the species present a striking similarity, nor do they differ very widely in habit. Much confusion has also crept into the accounts of different authors who have written on our American squirrels; great uncertainty exists respecting the species alluded to, and all our monographs are acknowledgedly very imperfect. In attempting to throw additional light on this genus, I am far from supposing that I have noticed all the true species that may exist in our extensive and in many portions unexplored country; nor can I say with positive certainty that I have in every case been able to draw the line of separation between varieties and true species.— This difficult and perplexing task, however, has not been undertaken without due caution and careful examination. Several hundred specimens, procured from various portions of North America have been compared. Specimens of all the species, with the exception of the great tailed squirrel (*Sci. macrourus*, Say), are in my possession. The latter also I had an opportunity of examining in the Philadelphia Museum.—

[1] Communicated by the author. Specimens of nearly all the squirrels noticed in the present Monograph were exhibited by Dr. Bachman at the Zoological Society's Meeting, Aug. 14th, 1838; and in the Society's Proceedings under that date a full abstract of the characters &c. of the species is given.—*Ed.*

The species existing in Louisiana and in the territories bordering on Texas, require a more careful examination, and the vast and varied regions between the Rocky Mountains and the Pacific, and especially those portions bordering on the Mexican possessions, will no doubt present species not yet enumerated.

Order *RODENTIA.*

Genus *Sciurus*, Linn., Erxleb., Cuv., Geoffr., Illiger.

Eng. *Squirrel.* Gr. *Σκιουρος.* Fr. *Ecureuil.* Germ. *Eichorn.*

Dental formula.—Incis. $\frac{2}{2}$. Can. $\frac{00}{00}$. Grind. $\frac{44}{44}$ or $\frac{55}{44}$.—20 or 22.

Squirrels are distinguished by large inferior incisors much compressed; by long tails generally longer than the body, furnished with hairs arranged on the sides so as to resemble a feather. The tail, when the animal is in a state of rest, is usually turned over the back and head, and partially conceals the body. All true squirrels are destitute of cheek-pouches. They have on the fore feet four toes, with a short rudimental thumb, protected by a blunt nail. On the palm are five tubercles, three of which are situated at the roots of the toes, and two larger ones behind. The third toe from the inner side is longer than the second, which distinguishes the squirrels from the marmots and spermophiles. In the hind foot there are five toes, with four naked callous eminences on the sole at their roots. They have four large grinders on a side in each jaw; these are variously tuberculated. In young animals there is a small additional grinder above in front, which, in many of the species, very soon drops out, but in the majority of our American squirrels this fifth grinder is either permanent, or remains for more than a year. The *mammæ* are eight in number, two of which are situated on the chest, and six on the sides of the belly. They produce from four to six young.

The squirrel is admirably adapted to a residence on trees, for which nature has designed it. Its fingers are long, slender, and deeply cleft, and its nails very acute and greatly compressed. It is enabled to leap from limb to limb, and from tree to tree, clinging to the smallest twigs, and seldom missing its hold. When this happens to be the case, it preserves its instinctive habit of grasping in its descent at the first object which may present itself; or if about to fall to the earth it spreads itself out in the manner of the flying squirrel, and thereby presenting a greater resistance to the air, is enabled to reach the ground without injury, and recovers itself so instantaneously that it often escapes the vigilance of the dog that watches its descent and stands ready to seize upon it at the moment of its fall. It immediately ascends a neighbouring tree, emitting very frequently a querulous bark, which is either a note of fear or of triumph. Although the squirrel moves with considerable rapidity on the ground, yet it rather runs than leaps; on trees however its activity and agility are surprising, and it is thus enabled often to escape from its enemies, concealing itself eventually either among the thick foliage,—in its nest,—or in the hollow of a tree.

The squirrel usually carries its food to the mouth by the fore paws. Nuts and seeds of all kinds are secured between the rudimental thumbs and the inner portions of the palms.—When disturbed in this situation, it either drops the nut and makes a rapid retreat, or seizes it with the incisors and carries it to its hole or nest.

All our species of this genus, as far as we have been able to become acquainted with their habits, build their nests either in the fork of a tree, or on some secure portion of its branches. The nest is spherical in shape, and is composed of sticks, leaves, the bark of trees, and various kinds of mosses and lichens. In the vicinity of these nests, however, they have a still more secure retreat in some hollow tree, where they retire in cold or in very wet weather, and where their young are generally produced.

Several species of squirrel collect more or less food during the abundant season of autumn, to serve as a winter store.—This hoard is composed of various kinds of walnuts (*Juglans*), hickories (*Carya*), chesnuts, chinquepins, acorns, corn, &c., which may be found in their vicinity. The species however that inhabit the southern portions of the United States, where the ground is seldom covered with snow, and where they can always derive a precarious support from the seeds, insects, and worms which are scratched up among the leaves &c., are less provident in this respect; and of all our species the chickaree, or Hudson's Bay squirrel (*Sci. Hudsonius*), is by far the most industrious, and lays up the greatest quantity of food.

In the spring the squirrels shed their hair, which is replaced by a thinner and less furry coat; during summer the tails are narrower and less feathery than in autumn, when they either receive an entire new coat, or a very great accession of fur; at this season also the outer surfaces of the ears are more thickly and prominently clothed with fur than in the spring and summer.

Squirrels are notorious depredators on the Indian corn fields of the planter, consuming great quantities of grain, and, by tearing off the husks, exposing an immense number of ears to the mouldering influence of the dews and rain.

The usual note emitted by this genus is a kind of tremulous querulous bark, not very unlike the quacking voice of a duck. Although all our larger squirrels have shades of difference in their notes, which will enable the practised ear to designate the species even before they are seen, yet this difference cannot easily be described by words. Their bark seems to be the repetition of a syllable five or six times,—quack-quack-quack-quack-qua,—commencing low, and gradually raising its voice, and ending with a drawl on the last letter in the syllable. The notes however of the smaller Hudson's Bay squirrel, and its kindred species existing on the Rocky Mountains, differ considerably from those of the larger squirrels; they are sharper, more rapidly uttered, and of longer continuance; seeming intermediate between the bark of the larger squirrels and the chipping calls of the ground squirrels (*Tamias*). The bark of the squirrel may be heard occasionally in the forest during all hours of the day, but is more common in the morning and afternoon. Any sudden noise, or the distant report of a gun, is almost certain, during favorable weather, to be succeeded by the barking of the squirrel. This is either a note of playfulness or of love. During such times it seats itself for a few moments on the limb of a tree, —elevates its tail over its back towards the head, and bending the point backwards continues to jerk its body and elevate and depress the tail at the repetition of each successive note. Like the mocking bird and the nightingale, however, the squirrel no sooner begins to sing, (for to his own ear at least his voice must be musical), than he also commences skipping and dancing. He leaps playfully from limb to limb, sometimes pursuing his rival or his mate for a few moments, and then reiterating with renewed vigour his querulous and monotonous notes.

One of the most common habits of the squirrel, with which a mysterious instinct has favoured it to conceal itself from the prying eyes of its enemies, is that of circling around the tree on the opposite side, so as completely to evade the sight; hence it is almost essential to the sportsman's success, that he should be accompanied by a second person, who, in walking slowly round the tree on which the squirrel has been seen, causes him to move to the side where the gunner is silently stationed. When the squirrel has been seated on a limb at the approach of man, and fancies himself undiscovered, he immediately depresses his tail, and extending it along the limb behind him, presses his body so closely to the branch, that he frequently evades the most practised eye, and is thus enabled to escape.

Notwithstanding the agility of the squirrel, man is not his only nor even his most formidable enemy. The owl makes a frequent meal of those species which continue to seek their food late in the evening and early in the morning. Several kinds of hawk, especially the red-tailed (*Falco borealis*), and the red-shouldered (*Fal. lineatus*), pounce upon them by day. The black snake, rattlesnake, and other species, have the means of entrapping them; and the ermine, the fox, and the wild cat are incessantly exerting their sagacity in lessening their numbers.

1. Fox Squirrel. *Sciurus capistratus.*

Sciurus capistratus; Bosc, 'Ann. du Mus.' vol. i. p. 281.
——— *vulpinus?* Linn. Ed. Gmel., 1788.
——— *niger;* Catesby.
Black Squirrel; Bartram's Travels in North America.
Sciurus capistratus; Desm. 'Mammalogie,' p. 332.
——— *variegatus;* Desm. 'Mammalogie,' p. 333.
——— *capistratus;* Cuv. 'Regne Animal,' vol. i. p. 193.
Fox Squirrel; Lawson's Carolina, p. 124.
Sciurus capistratus; Harlan.
——— *vulpinus;* Godman.

Essent. Char.—Size large; tail longer than the body; hair coarse, ears and nose white: subject to great varieties in colour.

This is the largest and most interesting species of this genus found in the United States; and although it is subject to great varieties of colour, which has occasioned no little confusion in the creation of several nominal species, yet it possesses several striking and uniform markings by which the species, through all its varieties, may be distinguished at a glance from any other.

Dental formula.—Incis. $\frac{2}{2}$. Can. $\frac{0-0}{0-0}$. Grind. $\frac{4-4}{4-4}$.—20.

Although I have given to this species but four grinders on each side in the upper jaw, and which peculiarity applies to nearly all the specimens that may be examined, yet in a very young animal obtained on the 5th of April in South Carolina, and which had apparently left the nest but a day or two, I observed a very minute, round, deciduous, anterior grinder on each side. These teeth however must be shed at a very early period, as in two other specimens obtained on the 20th of the same month, they were entirely wanting. The teeth of all our squirrels present so great a similarity that it will be found impossible to designate the species from these alone, without referring to other peculiarities which the eye of the practical naturalist may detect. In young animals of this species, the tuberculous crowns on the molars are prominent and acute; these sharp points however are soon worn off, and the tubercles in the adult are round and blunt. The first molar in the upper jaw is the smallest, and is triangular in shape; the second and third are a little larger and square; and the posterior one, which is about the size of the third, is rounded on its posterior surface. The upper incisors, which are of a deep orange colour anteriorly, are strong and compressed, deep at their roots, flat on their sides; in some specimens there is a groove anteriorly, running longitudinally through the middle, presenting the appearance of a double tooth,—in others this groove is wanting. In the lower jaw the anterior grinder is the smallest,—the rest increase in size to the last, which is the largest.

Form.—Nose obtuse; forehead slightly arched; whiskers black, a little longer than the head; ears rounded, covered with short hairs on both surfaces; there is scarcely any projection of the fur beyond the outer surface, as is the case in nearly all the other species; the hair is very coarse, appearing in some specimens geniculate; tail broad and distichous; legs and feet stout, and the whole body has more the appearance of strength than of agility.

Colour.—In the grey variety of this species, which is, as far as I have observed, the most common, the nose, extending to within four or five lines of the eyes, the ears, feet, and belly, are white; forehead and cheeks brownish black; the hairs on the back are dark plumbeous near the roots; then a broad line of cinereous; then black, and broadly tipped with white, with an occasional black hair interspersed, especially on the neck and fore-shoulder, giving the animal a light grey appearance; the hairs in the tail are, for three fourths of their length, white from the roots, then a ring of black, with the tips white. This is the variety given by Bosc and other authors as *Sciurus capistratus.*

Second variety; the *black* fox squirrel. Nose and ears white, a few light-coloured hairs on the feet, the rest of the body and tail black; there are occasionally a few white hairs in the tail. This is the original black squirrel of Catesby and Bartram, (*Sci. niger*).

Third variety. Nose, mouth, under jaw and ears, white; head, thighs, and belly, black; back and tail dark grey.—This is the variety alluded to by Desmarest, 'Ency. Méthod.' —Mammalogie, 333.

There is also a *fourth variety*, which is very common in Alabama, and also occasionally seen in the upper districts of South Carolina, and has on several occasions been sent to me as a distinct species. The ears and nose, as in all the other varieties, are white. This indeed is a permanent mark, running through all the varieties, by which this species may be easily distinguished. Head and neck black; back a rusty blackish brown; neck, thighs, and belly bright rust colour; tail annulated with black and red. This is the variety erroneously considered by the author of the notes on McMurtrie's translation of Cuvier (see vol. i. Appendix, p. 433) as the *Sciurus rufiventer*.

The three first varieties noted above are common in the lower and middle districts of South Carolina; and although they are known to breed together, yet it is very rare to find any specimens indicating an intermediate variety. Where the parents are both black, the young are invariably of the same colour; the same may be said of the other varieties: where on the other hand there is one parent of each colour, an almost equal proportion of the young are of the colour of the male the other of the female. On three occasions I had opportunities of examining the young produced by progenitors of different colours. The first nest contained four,—two black and two grey; the second, one black and two grey; and the third, three black and two grey. The colour of the young did not, in a majority of instances, correspond with that of the parent of the same sex; although the male parent was black, the young males were frequently grey, and *vice versâ*.

Dimensions of the fox squirrel.—

	IN.	LIN.
Length of head and body	14	5
Ditto of tail, (*vertebræ*)	12	4
Ditto of tail to the tip	15	2
Ditto of palm and middle fore claw	1	9
Ditto of sole and middle hind claw	2	11
Ditto of fur on the back	„	8
Height of ear posteriorly	„	7

Geographical distribution.—This species is said to exist sparingly in New Jersey: I have not observed it farther north than Virginia, nor could I find it in the mountainous districts of that state. In the pine forests of North Carolina it becomes more common. In the middle and maritime districts of South Carolina it is almost daily met with, although it cannot be said to be an abundant species anywhere. I have also seen it in Georgia, and have received specimens from Middle Florida and Alabama.

Habits.—Although there is a general similarity of habit in all the species of *Sciurus*, yet the present has some peculiarities which I have never noticed in any other. The fox squirrel, instead of preferring the rich low lands, thickly clothed with timber, as is the case with the Carolina grey squirrel, is seldom seen in such situations, but prefers elevated pine ridges, where the trees are not crowded near each other, and where there is an occasional oak or hickory interspersed. It is also frequently found in the vicinity of rich valleys, to which it resorts for the nuts, acorns, and chinquepins (*Castanea pumila*) which such soils produce. In some aged and partially decayed oak, this squirrel finds a safe retreat for itself and mate. A hollow tree of this kind is sufficient for its purpose; if nature has prepared a hole for it, it occupies it; if otherwise, it finds no difficulty in gnawing a hole,—sometimes several,—for its accommodation. The tree itself is however, in all cases, hollow, and it only gnaws through the outer shell in order to find a residence, which requires but little labour and skill to render it secure and comfortable. At other times it takes possession of the deserted hole of the ivory-billed woodpecker (*Picus principalis*).—The summer duck too is frequently a competitor for the same residence; contests for possession occasionally take place between these three species, and I have generally observed, that the tenant that has already deposited its eggs or young in such situations is seldom ejected. The male and female summer duck unite in chasing and beating with their wings any squirrel that may approach their nests, nor are they idle with their bills and tongues, but continue biting, hissing, and flapping their wings until the intruded is expelled. On the other hand, when the squirrel has its young in the hole of a tree, and is intruded on either by a woodpecker or a summer duck, it immediately rushes to its hole, and after having entered, remains at the mouth of it, occasionally protruding its head, and with a low and angry bark keeps possession until the intruder, weary of the contest, leaves it unmolested.—Thus, nature imparts to each species additional spirit and vigour in defence of its young; whilst at the same time the intruder on the possession of others, as if conscious of the injustice of his acts, evinces a spirit of pusillanimity and cowardice.

In the vicinity of this permanent residence of the fox squirrel, several nests, composed of sticks, leaves, and mosses, are usually seen on the pine trees. These are seldom placed on the summits, but in the fork of a tree, and more frequently where several branches unite to afford a sure resting-place to these nests. This may be called their summer home, for it seems to be occupied only in fine weather, and is deserted during wintry and stormy seasons.

The breeding season is in December and January, when the male chases the female for hours together on the same tree, running up one side and descending on the other, following her from one branch to the other, making at the same time a low guttural noise that can scarcely be compared with the barking notes which they utter on other occasions. The young are produced from the beginning of March, and sometimes earlier, to April. The nests containing them which I have had an opportunity of examining, were always in hollow trees. They receive the nourishment of the mother for four or five weeks, when they are left to shift for themselves, but continue to reside in the vicinity of, and even to occupy, the same nests with their parents, till autumn. It has been asserted by several planters in Carolina, that this species has two broods during the season; as far however as my personal observations have enabled me to judge, I have been led to believe that they have no other product than that of early spring.

The food of this species is various; besides acorns and the different kinds of nuts, its principal subsistence for many weeks in autumn is on the fruit extracted from the cones of the pine, especially that of our long-leaved pitch pine (*Pinus palustris*). Whilst the green corn is yet in its milky state, the fox squirrel makes long journeys to visit the fields, and for the sake of convenience frequently builds a temporary summer-house in the vicinity, in order to share with the little Carolina squirrel and the crow a portion of the delicacies and treasures of the husbandman; where he is also exposed to the risks incurred by the thief and plunderer; for these fields are usually guarded by a gunner, and in this way thousands of squirrels are destroyed during the green corn season. It is doubtful whether the fox squirrel lays up any winter stores. There appears to be no food in any of his nests, nor does he, like the red squirrel (*Sciurus Hudsonius*), resort to any hoards which, in the season of abundance, were buried in the earth or concealed under logs and leaves. During this season he leaves his retreat but seldom, and then only for a short time, and in fine weather in the middle of the day. He has evidently the power, like the marmot and racoon, of being sustained for a considerable length of time, without much suffering, in the absence of food. When this animal makes his appearance in the winter, he is seen searching among the leaves where the wild turkey has been busy at work, and gleaning the refuse acorns which have escaped his search; at such times also this species does not reject worms and insects which he may detect beneath the bark of fallen or decayed trees. Towards spring he feeds on the buds of the hickory, oak, and various other trees, as well as on several kinds of roots, especially of the wild potato. As the spring advances farther, he is a constant visitor to the black mulberry tree (*Morus rubra*), where he finds a supply for several weeks.—From this time till winter the fruits of the field and forests enable him to revel in abundance.

Most other species of this genus when alarmed in the woods immediately betake themselves to the first convenient tree that presents itself,—not so with the fox squirrel. When he is aware of being discovered whilst on the ground, he pushes directly for a hollow tree, which is often a quarter of a mile distant, and it requires a good dog, a man on horseback, or a very swift runner, to induce him to alter his course, or compel him to ascend any other tree. When he is silently seated on a tree, and imagines himself unperceived by the person approaching him, he suddenly spreads himself flatly on the limb, and gently moving to the opposite side, often by this stratagem escapes detection. When however he is on a small tree, and is made aware of being observed, he utters a few querulous, barking notes, and immediately leaps to the ground and hastens to a more secure retreat. If overtaken by a dog he defends himself with great spirit, and is often an overmatch for the small terriers which are used for the purpose of treeing him. He is very tenacious of life, and an ordinary shot gun, although it may wound him repeatedly, will seldom bring him down from the tops of the high pines to which he retreats when pursued, and in such situations the rifle is the only certain enemy he has to dread.

This squirrel is seldom seen out of its retreat early in the mornings and evenings, as is the habit of the other species. He seems to be a late riser, and usually makes his first appearance at 10 or 11 o'clock, and retires to his domicile long before evening. He does not appear to indulge so frequently in the barking propensities of the genus as the other and smaller species. This note when heard is not very loud but hoarse and guttural. He is easily domesticated, and is occasionally seen in cages, but is less active and sprightly than the smaller species.

As an article of food the fox squirrel is apparently equally good with any other species, although I have observed that the little Carolina squirrel is usually preferred, as being more tender and delicate. Where however squirrels are very abundant, men soon become surfeited with this kind of food, and in Carolina, even among the poorer class, it is not generally preferred.

This species, like all the rest of the squirrels, is infested during the summer months with a troublesome *larva*, which, fastening itself on the neck or shoulders, must be very annoying, as those most affected in this manner are usually poor, and their fur appears thin and disordered. It is however less exposed to destruction from birds of prey and wild beasts than the other species. It leaves its retreat so late in the mornings and retires so early in the afternoons, that it is wholly exempt from the depredations of owls, so destructive to the Carolina squirrel. I have seen it bid defiance to the attacks of the red-shouldered hawk (*Falco lineatus*), the only abundant species in the south, and it frequents those high grounds and open woods where the fox and wild cat seldom resort, during the middle of the day, so that man is almost the only enemy it has to dread.

(*To be continued.*)

Art. IV—*On the Anatomy of the Lamellibranchiate Conchiferous Animals.* By Robert Garner, Esq. F.L.S.

(*Continued from* Vol. ii. n. s. page 583).

With respect to the chemical composition of the shells of Bivalves little has been done. Hatchett[1] found them to consist of carbonate of lime, and animal matter. In the oyster shell Vauquelin[2] noticed animal matter, carbonate and phosphate of lime, carbonate of magnesia, and oxide of iron. The earthy matter has commonly more or less of crystalline structure, and the membranes which support it, have, when freed by a weak acid from the earthy matter and viewed with a lens, a regular reticulated appearance.[3] The earthy matter is deposited in these membranes, which are themselves merely indurated mucous transudations. The colorations of the shells are various. Chemists have not ascertained the nature

[1] Home, Lectures. [2] Malacologie. [3] Poli.

of this colouring matter. From its easy destructability it has been supposed not to be of a mineral nature.[1] The coloured markings on the external surface of the valves are of various forms ; they are dependant upon the disposition of the veins of the mantle ; they are often interrupted from the cessation of the secretion at certain periods. The internal stains sometimes seen, and which pervade the whole thickness of the shells, are produced by the contact of an excreting venous organ,[2] destined to throw off the redundant colouring and earthy matter, &c., and from its secretion the foot and extremities of the tubes also are often brilliantly stained. Light has an effect on this coloration ; when one valve is fixed, or is constantly buried in the sand, the other, being most exposed, is most coloured ; and such species as live immured in the interior of rocks, wood, &c., are commonly destitute of colour.

The articulation of the valves, one with the other, presents an infinite variety. The elastic substance, or *cartilage*[3] is so placed, as to be compressed when the valves are closed by the muscles ; and, regaining its original state when the muscular force ceases, to open the shell. In addition to the cartilage, a *ligament* frequently adds to the security of the hinge. These two may be conjoined or not. The cartilage is often divided. In *Perna* it is perfectly so, the portions being situated in parallel grooves. In *Arca*, &c., the portions are conjoined at the point of the beak and diverge from it. The former appears to be the divided elongated cartilage seen in the generality of the *Dimyaria ;* the latter the divided vertical cartilage, common in the *Monomyaria*. The cartilage is composed of layers like the shell, being secreted, when internal, in a corresponding sac of the mantle, or, when external, by a glandular prominence of it from a set of minute glands. The former is the case in the *Pecten*, *Spondylus*, &c., the latter in the *Anadonta*, *Bucardium*, &c. In the former case the layers are deposited from below ; in the latter from behind. There is no case in which the cartilage is before the beaks, unless, as in the *Arca*, it is divided and divergent. In all cases, the cartilage must have its commencement apparent at the very beaks of the valves, unless eroded, as it is in *Ostrea*, *Gryphæa*, &c. This disunion of the cartilage may take place more from one valve than the other, as is seen in some species of the last named genus, causing the great length of

[1] Iodine and bromine have been found in these shells. Is either of them concerned in the coloration?

[2] Not of the liver, as supposed by Blainville.

[3] Gray has shown the distinction between the cartilage and the ligament, 'Zoolog. Journal,' vol. 1.

the beak in the lower valve. The situation of the ligament is various; in the *Pecten* it unites the ears of the valves; in the *Arca* it is stretched over the wide space between the beaks; it unites the edges of the valves anterior to the beaks, or is spread over the *lunule* in many other *Dimyaria*. When as in the *Bucardium*, &c., the cartilage is external, and convex and prominent above, its compression does not happen from the pressure of the valves, as is the case with the species with internal cartilages, but from the bending of it upon itself. The elastic substance of the cartilage of this conformation differs from that of the *Pecten*, &c., by its containing a portion of carbonate of lime in its composition.

The hinge is likewise commonly furnished with teeth, often, as in the *Trigonia*, of most regular conformation; developed for the purpose of preventing the sliding of the valves upon each other; fitting between their fellows of the opposite side with great harmony. The teeth are wanting or weak when there is great strength of muscle or cartilage; when the irregularity of the edges of the valves prevents sliding motion; when the shell is small, flat and polished, and hence little exposed to violence; or when the hinge and cartilage are long. They are, however, very numerous in the long hinge of the *Arcacea*, compensating for the weakness of the cartilage.

From the superior and posterior situation of the cartilage in many bivalves, the anterior and inferior part of the shell opens widest when the ligament acts, and from this part the foot commonly protrudes. When the foot protrudes inferiorly, the cartilage is in the middle of the dorsal edge.

In those genera which have gaping shells and long fleshy syphons, the cartilage is internal and situated on a projecting process of one of the valves; by such a disposition the shell is not readily quite closed nor much opened. The shell is only allowed to be opened widely when the lobes of the mantle unite to a small extent; as is done by the internal cartilage of many of the *Monomyaria*.

When the foot is of a compressed form, from the position of the ligament and cartilage, one on each side the beaks, much motion is not provided for. When, as in the *Arca*, the foot is thick, we see in the linear hinge and in the remoteness of the beaks, a provision for the considerable opening of the valves by that organ, and in some species the valves themselves are gaping inferiorly for its exsertion. Besides the teeth, the *Osteodesma* has a loose calcareous piece at the hinge, before the internal ligament. In the *Pholades* there is no cartilage;[1] but a process of the mantle overlaps the beaks of the valves, and secretes a calcareous plate upon them. This reflected portion of the mantle covers the anterior muscle, which here goes from beak to beak; in the calcareous plates in the *P. dactylus*, without the insertion of the muscle, is an external row of large and an internal one of small cavities, into which are inserted corresponding fimbriations of the reflected portion of the mantle. This fleshy process is protected and covered by several thin calcareous plates, imbedded between it and the cuticle: there are four of these in the *P. dactylus*, but one in the *P. candidus*, *P. conoides*, &c. There are likewise two spoon-like processes in the interior of the valves, below the beaks; secreted in two reflections of the mantle, and giving attachment to a few of the fibres of the foot. The *Teredo* has the valves joined by muscular fibres alone, as has the *Myastropha*. The teeth are of infinite diversity, in shape and position, and merit a more minute examination than they have hitherto had.[2]

MUSCULAR SYSTEM.

Many of these animals are immoveably fixed to the spots on which they are found. The oyster, for instance, in the young state, secretes the calcareous matter of the left valve on rocks, &c., and only ceases to do so when a firm attachment is formed. Other species are attached by a set of horny filaments called the *byssus*. This is formed from the secretion of a bilobed gland, situated within the base of the foot. This gland, of which the existence is erroneously denied by Blainville, is of a brown granular appearance; it may readily be found in the *Mytilus* or *Modiola*, lying upon the nervous ganglion of the foot. Its duct opens into the bottom of the groove situated on the posterior surface of that organ. Its fluid secretion is moulded in this groove, and the thread, which rapidly hardens, is fastened at one end to the tendinous base of the foot, and at the other, by an expanded extremity, to the rocks to which the animal adheres. On rocky shores we see how firmly and immoveably the common muscles are bound by these threads. The *Modiola discors* fixes itself to the cartilaginous tunics of *Phallusia* and other *Tunicata*, and becomes buried in them, the anal extremity only projecting. Some species of *Pecten* are fixed by the spinous processes of their valves, some by a byssus, while

[1] In the *P. candidus*, however, the author finds one, between the two small spinous processes.

[2] See a paper on the hinge of *Bivalves* by Wood, 'Linn. Trans.' vol. 6.

others, as the *P. maximus*, have the convex valve commonly buried in the sand. These free species of *Pecten* swim and leap by striking the water with their valves, closed by the action of the voluminous adductor muscle. It is evident in opening an oyster how powerful this muscle is ; in the *Pecten* it is much more so. The principal organ of locomotion, however, in these animals is the foot. The *Monomyaria* have it little developed, some, as the oyster, having no trace of it; and in them it seems of little use as an organ of locomotion. When present in them it is of a cylindrical figure, expanded at the extremity as in *Lima*, *Pecten*, &c. In the *Spondylus*, from its terminal disk a filament depends, at the extremity of which is a small oval body. In these genera a long slender muscle arises from the upper part of the left valve, and is inserted into this organ, bending it when in action, up to the mouth. The byssus, according to Cuvier, is present in the *Perna* and *Malleus;* in one species of *Lima* the author does not find it, though Blainville and Cuvier also, correctly says it is present in another. It exists also in the *Avicula*, *Pinna*, *Lithodomus*, *Byssomya*, &c. The foot, which moulds it, receives several pairs of muscles, originating from the valves, at different points, and inserted into its base. In the *Pecten* and the other *Monomyaria*, there is but one adductor muscle. In *Avicula*, *Pinna*, *Mytilus*, &c., another is added at the anterior part of the shell; in them, however, yet small. In *Lithodomus* the anterior one is become equal to the other; in some species of *Solen* it is much the larger of the two. These muscles pass directly from one valve to the other, and are the antagonists to the force of the elastic cartilage. The foot, in the *Dimyaria*, varies in its form, and is occasionally very large. It has circular, longitudinal and oblique fibres, and is attached to the valves by two or more pairs of muscles as mentioned above. In *Arca* it has a horny substance at its lower part, analogous to the byssus of other genera. In *Nucula* it is tentacular at its lower circumference. In the *Unio* it is large, oval, and slightly compressed laterally, with anterior and posterior retractile muscles; and there is an orifice at its posterior extremity, by which the animal can distend it with water; as is the case in a greater degree in others, as the *Solen*. In the *Cyclas* it is elongated, compressed and blunt; in the *Cardium* round, and bent at a right angle in the centre, and pointed at the extremity. In the *Mactra* it is very long, large and lanceolate. It is broadly lanceolate in *Tellina*, *Psammobia*, &c.; larger and falciform in *Donax*. It is securiform and rather expanded below in *Pectunculus;* of the same outline, but sharp inferiorly, in the orbicular species of *Venus*. In *Mya, Thracia, Corbula, Pandora*, &c., the muscular part is very small, projecting through a small opening of the mantle. It is something like the human foot in *Chama*; very long and attenuated in *Loripes*.[1] It is club-shaped in *Solen*; in *Pholas*, small, short and rounded. The extremity of a cartilaginous body, to be described hereafter, is contained within this organ; and seems to add to its elasticity and resilience. By the action of this foot these animals can bore with great facility in the sand, where some are found at considerable depth; they can, likewise, accomplish a quick progression, by using it as a hook, or pushing themselves forwards by its means; they also swim on the surface of the water, by expanding it into a concave dish; and climb perpendicular surfaces, by fixing its extremity like a sucker.[2] Some species have the power of secreting air into two sacs of the mantle, attached to the excretory organs, by which their specific gravity is diminished, and they readily change their situation at the ebb and flow of the tides. The edge of the mantle is muscular; in some genera it is strongly adhesive to the shell; in others loose, and capable of being considerably retracted by means of distinct bundles of muscular fibres, attached to the valves at some distance from their edge, as is the case in *Pecten, Pinna*, &c. In *Lima, Pecten, Spondylus*, &c., its margin is furnished with long tentacles; and in the two latter we see, at regular distances on this margin, small *ocelli*, looking in the fresh animal like so many emeralds, from their green colour and great brilliancy. Each of these *ocelli* possesses a cornea, lens, choroid, and nerve: they are without doubt organs of vision.[3] There is, likewise, in these animals, a muscular flap at the edge of the mantle, apparently for the purpose of preventing the escape of the water. When the syphons are developed, a strong muscle takes its origin from the impression seen in many shells at the posterior part of the internal surface, and is inserted into them. The external fibres of these tubes are circular, the internal longitudinal; they are very contractile. In the *Anomia* we find the ordinary muscle of the *Monomyaria*; also another which originates chiefly from the convex valve, and is inserted into the *operculum*. This latter likewise receives a bundle of fibres from the articulating process

[1] Poli.

[2] Bosc says the *Venus* genus comes to the surface, using one valve as a boat and the other as a sail. Kirby, 'Bridgewater Treatise.'

[3] See Poli.

of the flat valve, and sends others to the foot and mantle.[1]

NERVOUS SYSTEM.

In more than twenty genera, examined for the purpose, the nervous system has presented few differences; and these differences arise from the greater or less developement of certain parts, and the greater or less distance at which the organs are from each other. Mangili's[2] description of the nerves of the *Anadonta* is the only correct account of this system in these animals. Poli mistook the nerves for lacteals, as their sheaths are readily injected when the nervous pulp is softened by incipient putrescence. Cuvier was not aware of the existence of the pedal ganglion. Blainville considers the labial ganglia to be infra-œsophageal, and does not find the filament connecting the labial and pedal ganglia. When a foot is present there are three ganglia, or pairs of ganglia; when absent, but two. These ganglia are of an orange colour externally, and white within. Two ganglia are situated at the mouth, more or less removed from each other, but always connected by a supra-œsophageal nerve; they are sometimes on a level with or before the mouth, sometimes behind it. They give off on each side filaments to the anterior muscle, tentacles, lips, and anterior part of the mantle. Each ganglion likewise gives off a twig, going to the posterior ganglia, which are situated between the *branchiæ*, on the posterior muscle. These are united into one, when the *branchiæ* are united medianly, as in *Mactra*, *Mya*, *Solen*, &c.; but at a distance from each other when the *branchiæ* are remote;[3] but when so, are always connected by a transverse nerve as in *Modiola*, *Avicula*, *Lithodomus*, *Arca*, &c. These ganglia give nerves to the *branchiæ*, syphons, viscera, posterior muscle, mantle, &c. The anterior ganglia also give off two twigs, which enter the foot and unite into a double ganglion, from which that organ is supplied with nerves. The posterior and pedal ganglia are totally unconnected with each other. The mouth then is surrounded by a wide ring, of which the part posterior to the situation of the anterior ganglia upon it is double.

(*To be continued.*)

[1] See Reaumur, 'Du mouvement de quelques coquillages.' Mem. Acad. Sciences, par 1710. Des differentes manières dont plusieurs animaux s'attachent, id. 171.

[2] Archives fur Physiol. b. 9.

[3] In *Venus*, where the ganglia are united, the *branchiæ*, though divided medianly are not remote.

Art. V.—*Observations on the History and Classification of the Marsupial Quadrupeds of New Holland.* By W. Ogilby, Esq. M.A., &c. &c.

[The following "Observations" form the introduction to a paper on the "General History and Description of Marsupial Animals," which was read at different meetings of the Linnean Society, between the 6th of December 1831, and the 3rd of April, 1832. Its design was to describe the *species* of Australian quadrupeds, at that period very imperfectly known in this country, and of which the Linnean Society possessed the only collection at all approaching to completeness, even in generic forms: but the imperfect materials at my disposal for the illustration of the genus *Macropus*, first induced me to postpone the completion of my memoir till I should have an opportunity of examining the Continental Museums; and when this did happen, the advances which British zoologists had made in the knowledge of Marsupial species, rendered my original design in a great measure useless. Great accessions had been made in the interim, both to the British Museum and to that of the Zoological Society, especially to the latter, at the different meetings of which I had repeated opportunities of directing the attention of the Fellows to the generic characters of these animals, and of describing many new species.

During the progress of my inquiries, I had, besides, occasion to alter my opinion as to the integrity of the group *Marsupialia* as a natural order of mammals. One of the principal objects of my original paper was to reform the very arbitrary classification, or division into minor groups, which the French naturalists had introduced into this department of mammalogy; and though I am no longer disposed to view the principal group itself in the same light as formerly, I still think the publication of my labours at that period may be of advantage to science, not only as a record of the state of our knowledge upon this subject at the period in question, but likewise because a simple and natural classification, admitting of ready application to practical purposes, is likely to be of great use to colonial enquirers. Indeed I have the satisfaction to think that this object has been in some measure accomplished already, though to a limited extent, by means of manuscript copies of the classification in question, and lists of species, with which I furnished various gentlemen about to visit the different Australian colonies; among others Mr. Allan Cunningham, to whom I am happy to have this opportunity of acknowledging my obligations for very copious details relating to the habits and economy of these animals; Mr. George Bennett, (through the medium of our mutual friend Prof. Owen); Mr. Gould, &c.]

Long ere British enterprise had planted the arts and cultivation of civilized life upon its solitary shores, at a period when its very existence was inferred only from the conjectures of theoretical geographers, or the scarcely less vague reports of mariners, whom accident or misfortune drove out of their usual course, the continent of New Holland, the *Terra Australis Incognita* of the sixteenth and seventeenth centuries, divided the attention of Europe and the interest of the curious with the recently discovered Western Hemisphere, the land at once of fiction and obscurity, of boundless wealth and still more boundless cupidity. Even at the present day, when its coasts have been partially surveyed and its productions explored, the primitive interest which attended the discovery of this new world remains, in a great measure, unabated; and the statesman and the philosopher equally look towards the shores of Australia, as the theatre upon which nature is expected to develope the most wonderful principles both of moral and physical science. The rapid progress and growing importance of the colonies which have been planted in that country,—the repeatedly baffled attempts to explore its internal geography,—the savage and degraded condition of its primitive inhabitants,—and finally, the strange and anomalous forms of its natural productions,—are well calculated to arrest the attention and excite the surprise of the most oppositely-constituted minds; to gratify the philanthropist by the contemplation of the greatest and rarest of moral phenomena, —the most degraded vice and misery converted into honest and contented prosperity,—and that too, upon a scale never dreamt of by former ages,—and to excite the awe and reverence of the philosopher whilst he admires, in new forms and unknown beings, the inexhaustible variety of nature's works, and recognizes the infinite wisdom and omnipotence of the Great Creator.

To gratify a small portion of this very rational curiosity,—to trace the history and describe the forms of the most interesting, though, at the same time, the most limited, class of the productions of this strange land,—to investigate the relations, and establish the zoological characters of Australian Marsupials,[1] —is the object of the present essay; and if, in this attempt, I have been in some cases less successful than I could have wished,—as well from the imperfect opportunities which I have enjoyed, of examining these animals in the living state, as from the brief and often confused notices of colonial writers,—I venture to hope that my labours may at least have the merit of directing the attention of colonial observers to this interesting subject, and of thus forming the basis of more valuable researches.

[1] I have substituted this form of the plural, throughout my paper, instead of the more usual Latin terminations, *Mammalia*, and *Marsupialia*, as more congenial to the spirit of our language. The word *Mammal*, from *mamma*, a breast or udder, like *Animal*, from *anima*, mind or spirit, was formed by Linnæus to denote those animals which are furnished with mammary glands. As we have no term of similar import in the English language, I venture to propose the adoption of this, with its plural, *mammals*, as of equally classical formation, and more agreeable to the genius of our vernacular tongue, than the French word *mammifcres*.

In considering the mammals of New Holland generally, the first circumstance that particularly attracts our attention is that, with a very few exceptions, they all appear to belong to the same natural group, and to possess organs, and execute functions, different from those of the Old World. This is a most important as well as a curious fact, and one from which we may deduce some valuable conclusions, with respect to the origin and distribution of animals. If we were told, for example, that a continent had been discovered, insulated from all other parts of the habitable globe, and differing in its geographical features and natural productions, from all that experience had made familiar to us in the Old World;—if we were told that its plants were peculiar, and its animals of an anomalous race; that,—excepting the dog, which follows his master, man, wherever he establishes his dominion,—it had not a single species, and scarcely even a genus, of mammals, in common with other countries; that it nourished no quadruped with which we were already acquainted, and that its own were absolutely confined within the circle of its shores; —finally, if we were told that the mammals which it did possess, were formed upon a distinct and peculiar model, and endowed with organs and modifications different from those of known quadrupeds,—what would be our natural reflection? Should we not be inclined to ascribe the formation of such an insulated continent to a distinct plan, perhaps to a different period, of creation? Or rather, should we not consider its animal productions as affording evidence of a separate and peculiar design in their formation? One conclusion, at least, forces itself upon our belief with irresistible certainty; viz., that, at whatever period these animals were first called into existence, they must, necessarily, have been created upon the insulated continent which they now inhabit: nor do I think it at all inconsistent with the idea which we entertain of the Great First Cause of all things, or derogatory either to his glory or power, to suppose that their existence may be the result of a subsequent act of creation;—nay, that new species like new individuals, may be daily springing into being, to supply the place of those which daily perish, and of which the remains are so abundantly strewed beneath the surface of the earth.

Whatever degree of probability may attach to these speculations, it is a fact no less certain than curious, that the continent of Australia, as far, at least, as regards the mammals hitherto discovered upon its shores, is precisely placed in the circumstances here described. With the exception of the American opossums, and a few species of phalangers, scattered over that long chain of islands which forms an almost uninterrupted communication between the northern shores of Australia and the continent of India, these animals possess no organic type among the quadrupeds of the Old World; and those, on the other hand, have but few representatives within the boundaries of New Holland and its dependencies. What inferences, then, are we to deduce from these singular facts? Do this vast continent, and the strange and anomalous productions which it nourishes, really owe their existence to the operation of peculiar causes? Are they the result of a subsequent act of creation? Or, are we to regard them merely as modifications of the same general plan? Is their existence, abstractedly considered, independent of the climate and soil which they inhabit? Or must we ascribe their peculiar and anomalous organization to the influence of local circumstances? These are inquiries which we have no means of answering satisfactorily. The little which we know of its Geology, however, warrants us in concluding that Australia, like other parts of our globe, has had its changes and revolutions; the osseous caves and breccia of Wellington Valley, lately described by Mr. Clift, contain fragments of the bones of mammiferous animals in as great perfection and abundance as those of Germany, Yorkshire, and Gibraltar.—These remains, sufficiently important in other respects, acquaint us with the singular and interesting fact, that, even at that early period, before the operation of those causes which swept them off from the surface of the earth, the mammals of Australia were, generally speaking, of the marsupial order, a tribe, of which, I believe, only a single undoubted species has been hitherto discovered among the fossil remains of the Old World.

Another remarkable circumstance, connected with this singular tribe of animals, is the very limited number of species which have been hitherto discovered, considering the vast extent of the continent over which they are dispersed, and the consequent variety of soil and climate to which they are exposed. At the present moment indeed there are not more than thirty distinct species of Australian marsupials enumerated as authentic, in the most correct and extensive catalogues of Zoology. To these nearly half that number of new species will be added, and described for the first time, in the present paper; but, even with this addition, our knowledge of Australian mammals will still remain extremely limited and imperfect. Nor are the genera of these animals, as far at least as we are at present acquainted with them, comparatively more numerous than the species: on the contrary, all the marsupials hitherto discovered upon the continent of Australia and its neighbouring isles, present only eleven really distinct and well defined types of organic structure, or, technically speaking, genera; being on an average not quite one to every three known species.

This extreme paucity both in the number and variety of its mammal productions, supposing it to be really the case, becomes the more surprising when we consider that the continent of Australia alone, without reckoning the large islands of New Guinea, New Zealand, and Van Dieman's Land, and the numerous smaller groups, its natural dependencies, embraces an extent of nearly thirty degrees of latitude by forty degrees of longitude, and ranges throughout an almost infinite variety of climate, from the parched and barren sands which border the Gulf of Carpentaria, to the humid soil of Tasmania. But a little farther consideration will convince us that we are, in all probability, only commencing our acquaintance with the animal productions of this extensive country. In fact, when we consider the circumstances of the colonies which have been already planted upon its shores, hitherto struggling for bare existence, and attentive only to establish and secure themselves against the miseries of famine and the hostility of the natives; when we consider, moreover, the comparatively limited extent of country which has been properly explored, and the extreme difficulty of penetrating far into the interior; but, above all, when we consider the natural apathy of the settlers towards all subjects which do not immediately concern their own situation and prospects, and that ignorance of zoological information which disqualifies common observers for distinguishing specific differences, or describing, with accuracy, what they examine but slightly; finally, when we reflect that we are altogether ignorant of the Zoology of the northern and western coasts, and that new species are daily added, even from the limited extent of our principal settlement, we have every reason to conclude that the zoological treasures of Australia yet remain to be explored, and that the few discoveries already effected only indicate the value of the harvest which still remains to be reaped. The lately established settlement at the Swan River has already opened an easy and favourable path to the investigation of the western shores; and as the communication between the coast and the interior becomes more frequent, in the eastern colonies, greater facilities will be afforded of obtaining the productions of the remoter districts. The unexampled prosperity of these flourishing colonies also, and the spirit of inquiry which already begins to animate their inhabitants, will materially contribute to extend our knowledge of the natural productions of Australia; the habits and economy of the singular animals which surround them, can only be studied in their native climate; nor do I despair of shortly seeing new genera and species added, by colonial science and enterprise, to those already known; and that too in numbers exceeding our most sanguine expectations.

But if the number of genera and species be comparatively limited among the quadrupeds of New Holland, the number of individuals of the same species appears to be still more so. This is a well-ascertained fact, and arises from the operation of causes which are easily explained and understood; some depending upon the nature and circumstances of the country, others arising from physical causes connected with the animals themselves. Among the former are to be considered the swampy nature of many parts of the interior, and the sudden and destructive floods to which the most fertile districts are so frequently exposed; in addition to which vast numbers annually perish by the hands of the inland or bush natives, who are chiefly supported by the produce of the chase; as well as by their wanton and thoughtless practice of periodically firing the long grass, which burns with the most astonishing rapidity, and destroys the nocturnal animals in their retreats, before they have time to escape from its ravages.—But a still more potent and influential cause of the scarcity of mammals in New Holland, arises from their physical constitution. They seldom produce more than two young ones at a birth, and that, in all probability, not oftener than once or twice in the course of the year, since their growth is comparatively slow, and the progressive developement of their organs unusually tardy among the inferior animals. All these causes tend powerfully to check the multiplication and diffusion of Australian quadrupeds; and when we add the reflection that many individuals must necessarily perish before arriving at maturity, or employing their productive powers in the increase of the species, we must cease to be surprised that their numbers are so limited, under circumstances which, at first sight, seem so favourable to their multiplication.

The anatomy of the marsupials has been diligently examined and amply discussed by M. Geoffroy St. Hilaire, Sir Everard Home, and other able zootomists; and the late valuable discoveries of Mr. Morgan have thrown considerable light upon the most interesting, though, hitherto, the most obscure part of their economy. The conjectures of this gentleman, however, still require to be confirmed by actual observation, for as yet, we have no certain knowledge either of the manner in which the young animal is deposited in the abdominal pouch, how it becomes attached to the nipple, or of the nature and circumstances of its subsequent developement. It is not my intention to enter at any length into anatomical details, but the following observations are rendered absolutely necessary, as well to preserve the uniformity of my plan, as to put the reader in possession of the principal circumstances regarding the organic structure of these animals, upon which their classification depends.

The most singular and important of these phenomena is the premature production of the young, which are brought forth in a scarcely organized form, containing, as it were, the mere germ of the future animal, before its senses are fully organized or its members developed, and deposited in the abdominal pouch with which nature has provided the female parent for its reception. In this recess, and in all probability, without the exercise of any act of volition on its own part, the *fœtus* is attached to the nipple of its mother by means of a scarcely formed aperture, which collapses closely round it, and represents the position, as it already executes the functions of the future mouth. Here it continues to cling and imbibe nourishment, like a plant engrafted on a strange stem, till the gradual developement of its members, and the more complete organization of its parts, allow it to drop off from the nipple and become an independent being. At this instant, it is precisely on a par, in point of organic developement, with the young of ordinary quadrupeds when first brought forth; that is to say, though a separate being and possessed of independent volition, it is, nevertheless incapable of providing for its own wants, but depends, for education aud nourishment, upon the care and assiduity of its parent. Accordingly, it continues, for a considerable time, to occupy the abdominal pouch of its mother, and to be supported by her milk; occasionally coming out as it acquires size and strength; and it is only when its increasing growth renders that retreat too small for its reception, that it finally abandons it.

The next circumstance to be noted in the organization of marsupial quadrupeds, and the last which I consider it necessary to mention for the elucidation of my present purpose, is closely connected with the phenomenon of premature fœtal production, and may be considered, in some degree, as a necessary consequence of that singular economy. It consists in the existence of two supernumerary bones, articulated with the *pubis*, and serving to support the abdominal pouch, and to give attachment to the muscles by which it is expanded and contracted. These bones exist even in the males, which have no abdominal pouches; and as they are altogether peculiar to the present order, and, at the same time, common to all the species which it contains, they form the best and surest characteristic by which to distinguish it from other groups of equal value.

(To be continued).

ART. VI.—*Remarks on the Botany of Selborne.* By MR. WILLIAM PAMPLIN, jun., A.L.S.

HAVING visited Selborne several different times in the course of my botanical researches in the county of Hants, I am enabled to give the accompanying short and confessedly imperfect sketch of the Botany of that truly delightful spot,—a spot not less dear to the admirers of its amiable natural historian and topographer, the Rev. Gilbert White,—than to the lovers of rural retirement, or the cultivators of either branch of natural knowledge, with whom this romantic district will always be esteemed as truly classic ground.

In preparing this rough draft of the Flora Selbornensis, two separate objects have been aimed at:—First I have enumerated such of the plants as are recorded by Mr. White as growing there in his time; so far as, from my own actual observation, I have succeeded in verifying their present existence in the localities which he has pointed out: and secondly, I have given a catalogue of a few other plants of rather rare occurrence, or otherwise interesting, which I have met with at various times in the immediately surrounding neighbourhood.

A list of so many of Mr. White's plants mentioned in letter lxxxiii, as have come under my observation at different times between 1829 and 1836.

CHRYSOSPLENIUM *oppositifolium.* Abundantly in the moist rocky lanes, particularly in the very deep lane near Norton farm, where it grows luxuriantly.

DAPHNE *Laureola.*

——— *Mezereum.* I did not perceive it in the spot mentioned by Mr. White; it however grows, to all appearance perfectly wild, and not sparingly, in the beech woods between West Meon and Bramdean. I am indebted for this locality to Mrs. W. Moody, of West Meon, who showed me specimens collected there.

DIPSACUS *pilosus.* In sufficient plenty in 1836.

DROSERA *rotundifolia.* } And in bogs on the Common between Oakhanger and Kingsley.
——— *longifolia.* }

EPIPACTIS (*Serapias* in White) *latifolia.*

HELLEBORUS *viridis.* I was unable to find this plant, although I diligently sought it in Mr. White's recorded station, May, 1836.

HYPERICUM *Androsæmum.*
LATHRÆA *squamaria* I saw not.
LISTERA (*Ophrys* in White) *Nidus-avis.* In sufficient plenty.
MONOTROPA *Hypopitys.* It also occurs in many other parts of this county, in woods of beech or fir.
PARIS *quadrifolia.* I gathered some remarkably strong specimens of it here in May, 1836.
SAMBUCUS *Ebulus.*
VACCINIUM *Myrtillus.*
———— *Oxycoccus* is said to grow also in the bogs of Hind Head Heath, near where the *Osmunda regalis* grows.

A catalogue of the rarer species of indigenous plants which have been observed growing near Selborne.

ADOXA *moschatellina*, plentifully
ARABIS *hirsuta*
ASPIDIUM, many species, including
———— *lobatum*
———— *aculeatum*
———— *spinulosum* and its varieties
BLECHNUM *boreale*
CAMPANULA *patula*, on the dry gravelly banks of a lane near Bramshot, plentifully, 1829; and I have specimens gathered there in 1835, by Miss Frances Pamplin.
CHENOPODIUM *Bonus Henricus*, about the Priory, plentifully
EPILOBIUM *angustifolium*
ERIOPHORUM, two species grow together in the bogs at Oakhanger
HESPERIS *inodora*, in the hedge of the orchard field adjoining Mr. White's garden, whence it may possibly have originally escaped. I have however, in the present year (1836), seen it in three distant spots in this county, apparently wild
HYPERICUM *elodes*, bogs on the various Commons, plentifully
LATHYRUS *latifolius*, Long Lithe, Selborne, 1837; Mr. Al. Irvine
LITHOSPERMUM *officinale*
LITTORELLA *lacustris*, Woolmer pond is in a manner paved with it; also Frensham ponds
LYCOPODIUM *inundatum*, bogs near Oakhanger
MELAMPYRUM *cristatum.* I am induced to notice here this beautiful and rare plant, although strictly it would not come within the present limits. I found it in August 1828, most abundantly in the large woods between East Meon and Clanfield, a few miles S.W. by W. of Petersfield
MENTHA *rotundifolia*
MŒNCHIA *erecta*
NARTHECIUM *ossifragum*
RADIOLA *millegrana*
RANUNCULUS *parviflorus*, on the stony banks in and near the village
RIBES *grossularia*, hedge-banks; also at Prior's Dean, near Selborne
———— *rubrum*, near the Priory, towards Oakhanger
SPERGULA *nodosa*
TAXUS *baccata.* There are two remarkably fine and large old trees in this neighbourhood; the one in Selborne and the other in Prior's Dean Church-yards; the stem of the latter measures nearly 30 feet in circumference, and that of the former scarcely less. Both equal in appearance, if they do not surpass, the famous venerable tree at Aldworth, in Berkshire.
TEESDALIA *nudicaulis*, most abundant all over the sandy district.
TURRITIS *glabra*, bank near Froxfield, sparingly
VIOLA *flavicornis*, not unfrequent

The district is rich in Ferns, Willows, &c., the former indeed flourish in the deep shady lanes in wonderful variety and unusual beauty.

ART. VII.—*List of the Entomological Writings of Thomas Say.* By EDWARD DOUBLEDAY, ESQ.

Since my return from the United States, several of my friends have suggested to me that the publication of a list of the entomological writings of Thos. Say, especially if that list indicated the works in which they can be found, would render a service to Entomology, and be in part the means of doing justice, or causing it to be done, to the merits of that indefatigable naturalist, whose labours are far less known than they ought to be, partly from the vast variety of publications through which his papers were given to the public, and partly from the little attention which has been paid in England to the labours of our transatlantic brethren.

We are, it is true, accustomed to look on Say as, *par excellence, the* American entomologist; but how few form an adequate idea of that ardent zeal, that untiring energy, that perseverence under the most depressing circumstances, that indefatigable industry in collecting, that laborious accuracy in describing with clearness and precision, and above all, of that high moral worth, that kindness of heart and gentleness of disposition, which make him an object of veneration to all who knew him, and cause his memory to be cherished with fondness by all who had once the happiness of calling him their friend!

Thomas Say is no more. Science mourns yet over the noblest of her votaries in the Western World. Long has he been robbed of much of the merit due to him, by some, through ignorance, by others, wilfully. There are those, shame be upon them! there are those to whom he sent specimens, labelled with his own hand, with names given them by himself, to whom he pointed out when and where he had described those species,—there are those who yet have wantonly disregarded his names, and, taking advantage of the difficulty of procuring his writings, described these very specimens under others, for the sake of a claim to an apparent priority in naming them, false though that claim were. Let us, in England, for the future, strive to do him justice. From English naturalists he has experienced no *wilful* injury; by *neglect* however he has suffered.

By the kindness of Dr. Harris of Cambridge, Mass., I am enabled to publish a more complete list of Say's entomological writings than has yet appeared. They are as follows.—

1. Description of several new species of North American Insects. Journal of the Academy of Nat. Sciences of Philadelphia; vol. i. pp. 19—23. Published in June, 1817.

   This paper contains 5 *Cicindelæ*, 1 *Nemognatha*, 1 *Zonitis* and 1 *Diopsis.*

2. Some account of the Insect known by the name of the Hessian Fly, and of a parasitic insect that feeds on it. Journ. Acad. Nat. Sci. vol. i. pp. 45—48, and 63—64. Published July and August, 1817.

3. Monograph of the North American Insects of the genus *Cicindela.*—American Philosophical Transactions, New Series, vol. i. pp. 401—426. Published in 1818.

4. Descriptions of the *Thysanouræ* of the United States. Journ. Acad. Nat. Sci. vol. ii. pp. 11—14. Published in 1821.

5. On a South American species of *Œstrus* which infests the human body· Jour. Acad. Nat. Sci. vol. ii. pp. 353—360. Published Decemb. 1822

6. Descriptions of Insects of the Families *Carabici* and *Hydrocanthaci* inhabiting North America. Am. Phil. Trans. New Ser. vol. ii. p. 1—109. Published in 1823.

7. Descriptions of some new species of Hymenopterous Insects, collected during the expedition to the Rocky Mountains, under the command of Major Long, in 1819-20. Western Quarterly Reporter, Vol. ii. No. 1 for Jany. Feby. & March, 1823, pp. 71—82; 8vo. Cincinnati, Ohio.

8. Descriptions of Insects belonging to the Order *Neuroptera*, Linn. and Latreille, collected by the Expedition under the command of Major Long. West. Quart. Reporter, Vol. ii., No. 2, for April, May, & June, 1823, pp. 160—165.

9. Descriptions of Dipterous Insects of the United States. Jour. Acad Nat. Sci. vol. iii. pp. 9—54, and 73—104. Published in 1823.

10. Descriptions of Coleopterous Insects collected in the Expedition to the Rocky Mountains; (356 species). Jour. Acad. Nat. Sci. vol. iii. pp. 139—216, 238—282, 298—331, 403—462; and vol. iv. p. 83—99. Published in 1823-4.

11. Account of the Insect (*Ægeria exitiosa*) so injurious to the Peach-tree Journ. Acad. Nat. Sci. vol. iii. pp. 216—217. Published 1823.

12. Keating's Narrative of an Expedition to the Source of St. Peter's River, &c. 8vo. Philadelphia, 1824.

    The Appendix contains descriptions by Say of 47 Coleopterous, 1 Orthopterous, 7 Hemipterous, 11 Neuropterous, 74 Hymenopterous and 39 Dipterous Insects.

13. American Entomology, 3 vols. Published 1817—1828.

14. Descriptions of New American species of the genera *Buprestis*, *Trachys* and *Elater*. Annals of the Lyceum of New York, vol. i. pp. 249—268. Published February and June, 1825.

15. Descriptions of new Hemipterous (and Orthopterous) Insects collected in the Expedition to the Rocky Mountains. Jour. Acad. Nat. Sci. vol. iv. p. 307—345. Published March and April, 1825.

16. Descriptions of new species of *Hister* and *Hololepta* inhabiting the United States. Journ. Acad. Nat. Sci. vol. v. p. 32—47. Published June and July, 1825.

17. Descriptions of new species of Coleopterous Insects inhabiting the

United States. Jour. Acad Nat. Sci. vol. v. pp. 160—204, 237—284, 293—304. Published Dec. 1825, Nov. and Dec. 1826.

18. Note on LeConte's Coleopterous Insects of North America.

19. Descriptions of new species of *Hymenoptera* of the United States.

These two papers were published in a periodical which expired at the third number, entitled 'Contributions to the Maclurean Lyceum of Philadelphia,' the former in July, 1827, and the latter in Jan. 1828.

20. Descriptions of North American Dipterous Insects. Journ. Acad. Nat. Sci. vol. vi. part 1. p. 149—178, and vol. vi. part 2, p. 183—188.—Published in 1829-30.

21. Correspondence relative to the Insect that destroys the Cotton Plant. From the New Harmony Disseminator, 1830.

22. Descriptions of new North American Insects, and Observations on some already described.

This paper contains only *Coleoptera*, and ends with part of the *Elateridæ*. It was printed at New Harmony, at different intervals between March 17th, 1830, and August 1st, 1834, forming an 8vo. volume of 81 pages. Part of this paper was reprinted in the fourth vol. of the new series of the Transactions of the Philosophical Society of Philadelphia, in 1834. The remainder of the part already published at New Harmony, and a continuation from Say's MSS. will appear in the next volume of their Transactions. It ends with *Eucnemis* and *Throscus*.

23. Descriptions of new species of *Curculionites* of North America, with Observations on some of the species already known. 8vo. pp. 30.—New Harmony, Indiana, 1831.

24. Descriptions of new species of Heteropterous *Hemiptera* of North America. 8vo. pp. 39. New Harmony, Dec. 1831.

25. New species of North American Insects found by Joseph Barabino, chiefly in Louisiana. 8vo. pp. 16. New Harmony, Jany. 1832.

26. Descriptions of new North American Hemipterous Insects, belonging to the first family of the section *Homoptera* of Latreille. Jour. Acad. Nat. Sci. vol. vi. pp. 235—244, and 291—314. Published 1830-1.

27. Descriptions of new North American Coleopterous Insects, with Observations on some already described. Boston Journal of Natural History, Vol. i. No. 2, for May, 1835.

28. Descriptions of new species of North American *Hymenoptera*, and Observations on some already described. Boston Journal of Nat. Hist. Vol. i. No. 3, May 1836, and No. 4, May, 1837.

29. Descriptions of new North American Neuropterous Insects, (*Libellulidæ*, *Ephemerides*, and *Megaloptera*), and Observations on others already described.

This paper was not published when I was at Cambridge, Mass., in October, but Dr. Harris informed me that it would appear in the forthcoming volume of the Journal of the Academy of Natural Sciences of Philadelphia. A few manuscript descriptions are still in Dr. Harris's hands.

Epping, Feb. 18*th*, 1839.

Art. VIII.—*Remarks on the Red-Legged Partridge* (Perdix rubra, Briss.) By W. Bernard Clarke, M.D.

Thinking some remarks upon the red-legged partridge, which is now rapidly spreading over our island, may prove interesting to some of your many readers, I venture to send them for insertion in your 'Magazine of Natural History.'

Red-legged Partridge.

Perdix rubra;	Brisson.
———— *barbarica;*	———
——— *rufa major;*	Gesner, & Jonston.
———— *alba;*	Brisson.
——— *græca;*	———— Ray.
Tetrao rufus;	Gmelin.
Red Partridge;	Albin.
Greek or Great red Partridge;	Willughby.
Greek Partridge, and Guernsey Partridge;	Latham.
Red-legged Partridge;	Ray, Willughby, & [Albin.
———— *from Barbary;*	Edwards.
Barbary Partridge;	Shaw's Travels.
Bartavelle;	Buffon.

This partridge is called the "red-legged bird" by sportsmen, to distinguish it from the common species, which is designated the "grey bird."

The red-legged partridge is found in France and the southern parts of Europe, in Italy, Greece, and the islands of Jersey and Guernsey; it is also said to frequent the woody mountains of Asia and Africa. It is generally about half as large again as the common species, from which it is at once distinguished by the variety of the plumage. The colour of the crown of the head and back is a reddish brown; throat of a pure white, bordered by a dense black band, which passes upwards as far as the eyes; breast of a bluish ash colour, the upper part of which is beautifully mottled with black; abdominal surface of a reddish tint: the feathers on the sides of the body, which overlap the wings when closed, are marked with bluish-ash, white, black, and chestnut, so disposed as to present a series of somewhat crescent-like spots, giving to the whole a very elegant appearance: the bill and *tarsi* are red, the latter, in the adult male, are furnished with a strong tubercle on the inner surface.

This species was introduced into England about the year 1790, by the Marquis of Hertford and Lord Rendlesham, each of whom had eggs procured on the continent, carefully brought to England, and placed under domestic fowls; the former at Sudbourn (near Orford, in Suffolk), one of his shooting residences; the latter on his estates at Rendlesham, a few miles distant from Sudbourn: from the above-mentioned places the birds have been gradually extending themselves over the adjacent counties, and in the ratio of their increase the grey partridge appears to have diminished, and from the pugnaceous character of the former species, it threatens ultimate destruction to the latter; for wherever it establishes itself, the grey bird is driven from the inclosures.

For several years after its first introduction it was much prized and sought after by sportsmen, as it was a larger bird for the table, although very far inferior in richness of flavour to the common grey partridge; and it is still preferred by some from its flesh being whiter and more delicate. Being also a bolder bird in habits, more alert, and rising at a greater distance than the common species, it was consequently more difficult to secure, and was thought to reflect more sportsman-like credit upon him who possessed the skill required to bring down the object of his pursuit. At length its habits became better known, and it was then found that one great difficulty attending the shooting this species of game arose from the peculiar habit which it possessed of running to a distance after alighting from its flight; on which account the dogs, coming upon the scent, were baffled, being induced to draw upon their game, and even then the birds would not rise except at a very considerable distance, generally far out of gun-range. As it is the habit of the bird to run to a distance upon being disturbed, very little sport can be expected in the pursuit, unless the weather is extremely wet, when they appear less inclined to run; they rise at a less distance, and the sportsman consequently secures a greater number of shots. But the most effectual means of securing them, and one which is resorted to by many sportsmen, who are anxious to exterminate the breed, finding they are destroying their sport and rapidly reducing the numbers of grey birds, is to attack them during severe weather, in the snow, when the birds resort to the hedge-rows for shelter, whence they may be dislodged, and thus made to present easy shots for the sportsman. Instances have been known of these birds alighting in the midst of a field deeply covered with snow, into the depths of which they sunk, and were afterwards taken out alive by hand. In the shooting season, when they have been disturbed, I have observed them to rise from one field, fly, and alight in the midst of the next, run over the remainder of that field, take wing, fly over the adjacent hedge, and alight in the field beyond: this they will repeatedly do, effectually baffling the party who had marked them down in the first field, and supposing them secure, had followed them up to get shots upon their next rising. These birds run with great rapidity, with the head and neck erect: thus being able to observe their pursuers at a distance, they can the more effectually escape the threatening danger. They frequent corn-fields, preferring the upper land, amid the security and shelter of which they breed: during harvest, when the fields are occupied by the reapers, they retire to the adjacent fallow fields, or the neighbouring copses; and in the evening, when all is still, return to the corn-fields and feed on the ears of corn in the sheaves, both late in the evening and early in the morning. After the corn is cut they frequent the same fields, then in stubble, night and morning, where they regale themselves upon the grain which has fallen from the sheaves during harvest. In the middle of the day they retire to the fields of turnips, by the leaves of which they are sheltered from the heat of the sun, or to the lowland meadows, where they delight in the humidity of such situations. They also occasionally bask in the sun, in the middle of the day, by the side of some sandy bank, where, like many of the feathered tribes, with outstretched leg and fluttering wing, they shake the dry warm sand into their feathers, occasionally preying upon the numerous insects which they find around them; in such situations they often assemble their young broods, which sport around the parent birds, essaying to capture their insect prey. In the winter, when the stubble fields are ploughed up, they retire to the upland meadows, or to the hedge-rows or copses, where they are sheltered from much of the inclemency of the season. The female lays from fifteen to twenty eggs, of a light stone colour, freckled with very minute reddish brown spots, and varied, here and there, with spots of a larger size, and of a rather darker colour. The nest is constructed of dried grass and leaves, upon the ground, in some warm and sheltered part of a field of growing corn, grass, or clover, where the parent bird sits with much assiduity until the young are hatched, which, like those of the grey partridge, are capable of running as soon as they are fairly excluded from the shell.

Since the introduction of these birds into England, they have spread throughout Suffolk, into Norfolk, Essex, and Cambridgeshire; it appears they are now making their appearance in Lincolnshire, and probably will soon extend themselves over the adjacent counties.

Ipswich, Feb. 13th, 1839.

SHORT COMMUNICATIONS.

Fall of Meteorolites at the Cape.[1]—Knowing your intimacy with Mr. Charlesworth, the Editor of the 'Magazine of Natural History,' it has occurred to me that some account of an extraordinary phenomenon that took place on my return from the interior, may not prove wholly uninteresting to him. On the morning of the 13th October, about 9 o'clock, a fall of stones (of which a specimen is herewith sent) occurred in the Bokkeveld, about fifteen miles from Tulbagh, attended with the most awful noise, louder and more appalling than the strongest artillery, causing the air to vibrate for upwards of eighty miles in every direction. Indeed it was felt from the Cape Flats to the edge of the Great Karroo, and again from Clan William to the River Zonderend, near Swellendam.—The noise was awful; and by those in the immediate neighbourhood of the spot where the stones fell, is described as something similar to the discharge of artillery,—by those at a greater distance as rocks rolling from a mountain; which was the sensation at Worcester, some forty miles from the chief site of the phenomenon. Many felt a curious sensation, especially about the knees, as if they had been electrified. At the time of the occurrence I was on the very skirts of its influence, on the edge of the Karroo, in company with the Hon. Mr. Justice Menzies. At the moment of the explosion I witnessed a volume of the electric fluid forcing its way from the west in the form of a Congreve rocket; it exploded almost immediately over my head, into apparent globules of fire, or transparent glass. Throughout the region of the phenomenon the air was highly charged with the electric fluid, especially the night prior to the fall of the stones. The mountains around Worcester and the Bokkeveld being in one continued blaze of lightening, and some of the inhabitants described the fire as rising from the earth. The stones (the quantity I have not been able to ascertain, but supposed several cwts.) fell in the presence of a farmer, who had with him a Hottentot, who stood so near the shower as to become perfectly insensible for some time, either from the electricity or from the effects of fright. The stones fell in three spots, but all within a square of forty or fifty yards. Some fell on hard ground when they were smashed into small particles; others in soft

[1] In a letter addressed to Robert Thompson, Esq., of the Admiralty, by George Thompson, Esq., author of the well known "Travels in South Africa."—ED.

ground, where they were dug out. Prior to the real cause of the phenomenon being known, it was taken for an earthquake.

Mr. MacLear our Astronomer Royal, considers the accompanying specimen as an exceedingly fine one, as it shows distinctly the action of fire upon it, and will help to bear out the opinion that such stones are formed in the air, and that we are not indebted to some of the planets for them, as has been imagined.—*George Thompson.—Cape Town, Nov.* 28*th*, 1838.

[In a succeeding number we may probably be able to furnish some additional information respecting the meteorolite which was transmitted with the above notice. We understand from Prof. Faraday, that one of the same shower has been received by Sir John Herschell —Ed.]

Singular Procession of Caterpillars.—[1] My engagements have been too close to admit of even a day's entomologizing, but when returning from business excursions to the port I have taken my forceps with me and caught everything that came in my way, the results I shall send you by the Goshawk if possible; most of the insects I find under bark which here peels off annually. One day last week I chased a moth for full ten minutes, and when I at last secured it, I found it to be *Deispeia pulchella*, or so nearly allied to that species that I can detect no difference, but you must judge when you receive the specimen. *Cynthia cardui* is abundant, also a *Polyommatus*, very like one of ours but not identical. The moths I have seen are in no respect un-English, and in beetles I have seen no forms that are new to me. I have obtained one very fine *Ichneumon* out of a split pine-tree. *Hymenoptera* are now tolerably abundant.

On the 3rd of May I saw a procession of caterpillars. They were evidently *Bombyces*, and in form somewhat resembling *Arctia caia*, very hairy but the hairs white; the body dark brown but marked with paler lines. These caterpillars were crossing the road in single file, each so close to its predecessor as to convey the idea that they were united together, moving like a living cord in a continuous undulating line. At about fifty from the end of the line I ejected one from his station—the caterpillar immediately before him suddenly stood still, then the next, and then the next, and so on to the leader; the same result took place to the other extremity. After a pause of a few moments the first after the break in the line attempted to recover the communication; this was a work of time and difficulty, but the moment it was accom-

[1] Extract from a letter addressed to Edw. Newman, Esq. by A. H. Davis Esq., F.L.S.

plished by his touching the one before him, this one communicated the fact to the next in advance, and so on till the information reached the leader, when the whole line was again put in motion. On counting the number of caterpillars I found it te be 154, and the length of the line 27 feet. I next took the one which I had abstracted from the line, and which remained coiled up, across the line; he immediately unrolled himself, and made every attempt to get admitted into the procession, after many endeavours he succeeded and crawled in, the one below falling into the rear of the interloper. I subsequently took out two caterpillars about fifty from the head of the procession; by my watch I found the intelligence was conveyed to the leader in thirty seconds, each caterpillar stopping at the signal of the one in his rear; the same effect was observable behind the break, each stopping at a signal from the one in advance; the leader of the second division then attempted to recover the lost connection; that they are unprovided with the senses of sight and smell appeared evident, since the leader turned right and left and often in a wrong direction when within half an inch of the one immediately before him: when he at last touched the object of his search, the fact was communicated again by signal, and in thirty seconds the whole line was in rapid march, leaving the two unfortunates behind, who remained perfectly quiet without making any attempt to unroll themselves. I learn from a medical gentleman here that these caterpillars feed on the *Eucalyptus*, and that when they have completely stripped a tree of its leaves they congregate on the trunk and proceed in the order here described to another tree. The caterpillars I saw must be nearly full grown, measuring about 2¼ inches each in length.

I have seen the empty shells of *chrysalides* four inches long; the moths from them must be as large as *Erebus Strix*. We have some very beautiful flowers. *Orchideæ* have been very numerous. *Mimosæ* and *Epacridæ* are just now fading. In the plains there are *Ranunculi* in full bloom, and an extremely beautiful double *Centaurea*. There are tree mallows by the river six or eight feet high. I shall send a few lizards, a fine snake sixty-one inches long, and a few scorpions.—*A. H. Davis.—Adelaide, South Australia, 6th September*, 1838.

Description of a new species of Lamia.—

Lamia Lucia. Lanuginosa, brunnea, capite obscuriori, prothoracis maculæ tres lætè flavi; elytra lætè flava, marginibus scutellari et costati brunneis; cætera brunnea. (Corp. long. 1.5 unc. lat. .35 unc.)

Clothed with a thick coating of short hairs. The *antennæ* are rather shorter than the body, and, together with the head, are of a deep brown colour approaching to black. The *prothorax* is slightly broader than the head, and has a short and very obscure spine situated near the middle of each side; the sides are moreover a little wrinkled; it is of a rich velvetty brown colour, with three large yellow spots on the upper side; one of these is situated centrally, is broad anteriorly and narrow posteriorly but does not quite reach either of the margins; the other spots are situated one on each side, are of an oblong shape, rather wider posteriorly. The *scutellum* and the parts of the *elytra* immediately adjoining it, are brown. The *elytra* are yellow, the lateral margins being bordered by a somewhat flexuose brown line, which ceases before the apex. The underside and legs are brown.

Inhabits Congo.

This magnificent insect I believe to be unique in the British Museum; it was brought to this country by Tuckey's expedition.—*Edw. Newman.—Deptford, Feb. 22nd*, 1839.

Botanical Society of London.—The number of Members amounts to 100, of which 42 are resident, 34 corresponding, and 24 foreign,—47 having been elected since the last Anniversary: and the Council are happy to state that they have received no notice of secession of Members.

The number of Specimens of British Plants received, amounts to 18,592, including 1050 species, from which the Society's collection has been considerably enriched; especially through the kindness of Mr. Baxter, who has presented a valuable collection of British *Salices*, comprising 44 species, from specimens presented by Mr. Borrer to the Oxford Botanic Garden. The Society has also received nearly the whole of the British *Carices;* and solicit the attention of members in completing the genera *Rosa* and *Rubus*, and the *Cryptogamia*.

The number of foreign plants received is 10,000 specimens. The Council have much gratification in stating that they have made arrangements with the Botanical Society of Edinburgh, who have promised them every assistance, and have contributed largely to the Society's British and foreign herbaria, and to the library. A mutual exchange of specimens will annually take place between the two Societies, which cannot fail to be advantageous to the members of both.

The Council have caused to be published a sheet containing the whole of 'DeCandolle's Natural Orders and Genera,' and the 'Linnæan Classes and Orders.' It is intended to answer the purpose of arranging British collections.—*Extract from the Second Annual Report, read 29th November*, 1838.

THE MAGAZINE

OF

NATURAL HISTORY.

APRIL, 1839.

Art. I.—*Observations on the Poulp of the Argonaut.* By Madame Jeannette Power.

(Concluded from Page 106).

Coming now to the most essential point of my researches, that is, to verify, by unequivocal proofs, that the poulp constructs the shell of the argonaut, I can assert that my design was at first to repeat the experiments of the celebrated Poli on the eggs of this cephalopod, in which he discovered the embrio of the shell. But I must confess that here I was unsuccessful; and indeed I obtained very different results from my investigations.

I repeated the experiments of the illustrious Neapolitan physician, in company with my learned friend Dr. Anastasio Cocco, of Messina, (famous for his ichthyological works), and other persons, but nothing more was found than a group of eggs in each individual, similar to millet seed, perfectly white and transparent, attached by filaments of a brilliant gluten to a common stem of the same substance. Three days after the first observation, on visiting an argonaut, the little poulps were found in it, already developed, but without shell, and resembling worms; and having at the inferior extremity a spot of a brown colour, with some smaller ones disposed laterally. These, when looked at in the microscope, were concluded to be the *viscera* of the animal. This was their form at the age of three days; then they gradually began to show prominences of a bud-like appearance, with two series of obscure points, which are the rudiments of the arms and suckers. The arms began to be distinguishable as such some days after the sailing ones, and on the sixth day they had already formed the first *lamina* of the shell, exceedingly soft to the least pressure of the finger.

The eggs are attached to the interior of the spire, and when excluded by the above-named animals, remain between the roof of the spire and the mantle of the mother. From these observations the result is that the newly-born poulp has no shell, and, it may be concluded, has none in the egg. The observations of Poli therefore do not correspond with the experiments made by me on purpose; and if not speaking of so celebrated a man, I should venture to say that the internal membrane of the egg was mistaken by him for the supposed rudiment of the shell.

I much wished to discover whether the little poulp could by itself, without extraneous aid, begin to work the structure of its shell, or whether the parent took part in the original formation, the proper organs for secreting calcareous matter in the former not being as yet developed. With this view I took divers argonauts at the time of their fecundation, and cautiously cut off the spire. In the direction of its axis I found, in one, a little poulp rolled up, and near the apex.—Observing it attentively I perceived that between it and the bottom of the spire of the parent shell there was a thin membrane, disposed in the same form as the curve of the spire, and fitted to the rolled-up little poulp, as if the gluten in which the whole mollusc was embedded, pressed between it and the end of the spire, became consolidated into a fine membrane in the same form as the spire, and embraced the new little poulp.

The 10th of September 1835, wishing to continue my experiments, I inclosed in the cage some argonauts at the time of their fecundation, taking care to examine them every fourth day, and with the usual precautions in handling them, for they are very irritable, and suffer so much from being disturbed that they soon die after it. I therefore took them up in a basin, by immersing it in the water underneath, which I thus brought up together with them, and posted myself so that I might observe all their movements without their seeing me.

On the 14th I found in one of the shells a little poulp fourteen lines in length. Searched others, and in some found little poulps, in others none.

On the 18th of the same month, visiting them as usual, found two parent poulps dead. In the one in which I had first seen the little poulp I found it had already passed into the spire.

On the 24th returned to examine the same shell, and there found the little mollusc already covered by its thin shell, which was $3\frac{1}{2}$ lines long. The mollusc was completely formed, and its shell had the form of the spire in which it had been framed.

All the experiments made by me on this head have always had the same results; from which I have deduced that the mollusc when born, is naked and incomplete at the time of exclusion from the egg; that it becomes progressively developed in the end of the spire of the parent argonaut; and that after a given time it goes on forming its shell.

As far as I have been able to make out, not more than two or three eggs develope themselves at the same time; and when the young have grown to the length of 9 lines, they successively inclose themselves in the spiral of the parent shell, where the other seven arms are thrown out in the manner of buds. The young poulp takes three days to arrive at the length of 9 lines; and four in the spiral to develope itself.—The parent retains it three days more under her, and then throws it forth from the shell.

I attempted to produce the developement of the eggs as far as the production of the young poulp, without the aid of the mother, by suspending them in a fine linen bag in a phial of sea water, taking care to change it three times a day; but this attempt did not succeed, having no other result than the swelling of the eggs, and this alone from their beginning to putrify.

I have concluded from this that the glutinous material in which they are enveloped in the spire of the parent conduces to their developement; and this material being evidently a secretion of the parent, it may be said that without her aid the eggs could not be developed, and the young shell could not have its foundation laid in the end of the spire.

In spite of all these successful experiments in favour of the shell being the property of the poulp of the argonaut, I wished to assure myself of it in a manner never yet attempted by others. "If the argonaut" I said "be the constructor of its shell, it should be able to repair the damage in case of fracture." Although Signor Ranzani had said, "It is not to be believed that these poulps of the argonaut should be so ill provided with means wherewith to preserve their existence, that if the first habitation be broken or lost, they cannot construct another." Still I thought from his manner of expressing himself, it was very evident that he had never made experiments to this end. Moreover, I, who have experimented on a hundred of these molluscs, have found that having lost their shell they are not capable of forming another, but die. Certain, now, that the experiment I intended to make was new, I broke in several places the shells of twenty-six individuals, and to my great satisfaction found after thirteen days the fractures healed in all those which survived, which were not more than three. The newly secreted portion is stouter than the shell itself, but it is not so white, and also looks a little rough and disturbed, neither does it present the usual risings, and instead of ribs, it has some longitudinal furrows.

Being desirous of observing in what manner the poulp operated in repairing the broken shell, I took one the day after the first experiment, and found that the aperture was covered by a thin glutinous *lamina*, which, somewhat in the way of a cobweb, unites the two margins of the broken shell. The next day the *lamina* became thickened to a certain degree, and more opaque, till at the end of ten or twelve days the new piece had become quite calcareous. Whilst in the act of mending the fractures in the shell, I am quite sure the argonaut applied the sails to the shell, and wrinkled them upon it, and by this movement I considered the glutinous secretion, which finally became calcareous substance, to be verified.

As yet I have shewn the argonaut to be the constructor of its shell, because it can repair it, is like other *Testacea*, which are not more expert than the argonaut in hiding the appearance of the patch mended: but a circumstance in my mollusc has appeared new to me, and I do not know that it has ever been observed in other *Testacea*. This is, that whenever the poulp can find pieces of other argonaut shells in the place where it is going to mend its own, by means of its sail arm it takes the piece of broken shell which it believes capable of filling up the space fractured, and holds it there till it has excreted the material necessary to attach it firmly, thus sparing itself the trouble of filling up a large aperture by its own secretion.

After such a series of experiments it seems to me to be sufficiently proved that the poulp of the argonaut is the fabricator of the shell in which it lives, and out of which it cannot long exist.

In presenting to you, gentlemen, a succinct account of the results of my experiments, I have claimed no more than to merit your indulgence, and shall feel pleased if I have obtained it, if only for my good intentions.

The illustrious members Prof. Carmelo Maravigna, Prof. Anastasio Cocco, and Prof. Carlo Gemmellaro, encouraged me to prosecute my researches so far, and having been honoured by this illustrious society with the title of Corresponding Member, I am encouraged still farther to make my researches prove useful. My principal aim, which was to prove that the argonaut, like other *Testacea,* had the power of forming its own shell, has been fully attained by successful experiments, the results of which I have not failed to send to you, whether proved by the broken shells mended by the molluscs themselves; or by means of the shells and animals preserved in spirits; or by the eggs and young poulps in different stages of developement; or finally by means of coloured drawings: and you are now in possession of all that I am able to explain.

I have sent you other notices respecting the physiology and history of this mollusc, having thought them worthy of your study and attention; and if they meet the approbation of men like you, illustrious in science, I intend to institute many other researches, not only upon the argonaut, but on other molluscs, upon which I have already commenced some experiments to prove whether any of the parts of the animal are capable of being reproduced, and which I shall have the honour before long to submit to your attention.

ADDITIONAL REMARKS.[1]

Madame Power commences her account of this new series of observations on the argonaut, by stating that they were made on her return to Sicily after a visit to London, where, having exhibited her collection of argonauts to Mr. Gray and Mr. Charlesworth, she was made acquainted with the true nature of the little parasite[2] which she had previously mistaken for the young of the argonaut itself. Madame Power then proceeds to say,—"The *vermicule* believed by me to be a poulp might have misled others better versed than myself in Malacology; for it had two rows of suckers along its body, and resembled one of the arms of the poulp: it is not, therefore, to be wondered at that I mistook it for a poulp, because many animals at their birth present one form, and another when fully developed; and besides, from the extreme irritability and delicacy of the poulp, it is not so easy for the naturalist to examine it. Having, in fact, seen these

[1] "Nuove Osservazione sulle uovo del Polpo dell' *Argonauta Argo.* Di Madame Jeannette Power, Socia Corresp. dell' Acad. Giœnia, &c."

[2] The specimens alluded to by Madame Power, preserved in spirits, were by that lady placed in the hands of the Editor of this Journal, and first examined by Prof. Owen, who, in the supposed young poulps, immediately recognised the parasitic genus *Hectocolytus* of Cuvier.—*Ed.*

animalcules, of a few lines in length, in the shell of a living argonaut,—then, on the following day, finding them considerably increased in size,—two or three days after not finding any in the shell,—again, upon re-examining the parent shell five or six days afterwards, and finding therein a very young poulp with its little shell, both perfectly formed;—and having several times repeated these observations on other argonauts, and always finding the *vermiculi* before observing the little poulp,—I was led to the conclusion that the vermicule became transformed into a poulp. Having, moreover, shown these *vermiculi* to some *savans*, who affirmed them to be what I conjectured, viz., young poulps, I became the more persuaded of it, and no longer took care to observe the *ova* themselves. This year, however, I have made the following observations on the progressive developement of the poulp of the argonaut. The egg is at first white and transparent, and no structure can be discerned in it. Fifteen days after the egg presented some spots of a beautiful red colour, without anything more. In ten days more the perfect poulp could be discerned through the epidermis of the egg. Then the poulp began to break through this involucrum, and appeared to the naked eye of an elliptical form, with the eyes and mouth; a very transparent membrane is also observed, which forms the mantle. Towards the mouth some small and almost imperceptible filaments are to be observed, which I suppose to be the rudiments of the *branchiæ*. The poulps are now naked, but in twelve days from this time, on visiting them again, some were found which had already formed their shell, and the parent retained them and nourished them with her gelatinous secretion, as I have already described in my Memoir inserted in the 12th vol. of the 'Transactions of the Gioenian Academy.'"

ART. II.—*Monograph of the Genus* Sciurus, *with Descriptions of New Species and their Varieties.* By J. BACHMAN, D.D., President of the Literary and Philosophical Society, Charlestown, South Carolina, &c.

(Continued from Page 123*).*

2. TEXIAN SQUIRREL. *Sciurus Texianus*, (n. s.)

In the Museum at Paris I observed a species of squirrel of which I can find no description. It was said to have been received from Mexico. In the Museums of Berlin and Zurich I also found what I conceive to be the same species; and in the British Museum there is a specimen obtained at Texas by Douglass, agreeing with the others in almost every particular. I find also among my notes a description of a specimen received by a friend from the south-western parts of Louisiana, which, on a comparison with memoranda taken of the other specimens, I do not find to differ in any important particular. It is probable therefore that this species has a pretty extensive range, from the south-western portions of Louisiana, through Texas, into Mexico. Of its habits I possess no information.

The Texian squirrel is about the size of the fox squirrel. On the upper surface there is a mixture of black and yellow, and on the under parts deep yellow. The under sides of the limbs, and also the parts of the body contiguous, are whitish at the base. Fore legs externally, and the feet, rich yellow. Ears on both surfaces yellow, with interspersed white hairs. Nose and lips brownish white. Hairs of tail rich rusty yellow at base, with a broad black space near the extremity, and finally tipt with yellow.

DIMENSIONS.

	IN.	LIN.
Length of body	13	6
Ditto of tail to end of hair	15	0
Ditto of *tarsus*	3	0
Height of ears to end of fur	,,	6½

The Texian squirrel bears some resemblance to the *Sciurus capistratus;* the latter species however in all the varieties I have examined, has uniformly the white ears and nose. I am moreover not aware that the *Sci. capistratus* exists in the south-western parts of America, where it seems to be replaced by the present species.

3. Golden-bellied Squirrel. *Sciurus sub-auratus,* (n s.)

Essent. Char.—Size intermediate between the Northern Grey and the Little Carolina Squirrel; tail longer than the body; colour above grey, with a wash of yellow, beneath deep golden yellow.

Dental formula.—Incis. $\frac{2}{2}$. Can. $\frac{0\text{-}0}{0\text{-}0}$. Mol. $\frac{4\text{-}4}{4\text{-}4}$.—20.

In the two specimens now before me, and which are very similar in size and markings, there is no appearance of the small anterior upper molar found in several other species of this genus. I conclude therefore that it either does not exist at all, or drops out at a very early period; and have accordingly set down this species as having only 20 teeth.—The upper incisors, which are of a deep orange-brown colour, are of moderate size; the lower incisors a little paler than those above; head of moderate size; whiskers longer than the head; ears short and pointed, clothed with hair on both surfaces. The body seems more formed for sprightliness and agility than that of the small Carolina squirrel, and in this respect comes nearest to the northern grey squirrel: the tail is long, and nearly as broad as that of the last-named species.

Colour.—The whole upper surface grey, with a distinct yellow wash. The hairs which give this outward appearance are greyish slate colour at their base, then very broadly annulated with yellow, then black, and near the apex annulated with yellow-white. The sides of the face and neck, the whole of the inner side of the limbs, feet, and the under parts of a deep golden yellow; on the cheeks and sides of the neck, however, the hairs are obscurely annulated with black and whitish; the ears are well clothed on both surfaces with tolerably long hair, of the same deep golden hue as the sides of the face; hairs of the feet mostly blackish at the root, and some are obscurely tipt with black; hairs of the tail black at the root, and the remaining portion of a bright rusty yellow, each hair, three times in its length, annulated with black; the under surface of the tail is chiefly bright rusty yellow; whiskers longer than the head, black.

DIMENSIONS.

	IN.	LIN.
Length of head and body	10	6
Ditto of tail, (*vertebræ*)	9	2
Ditto including fur	12	0
Ditto of palm to end of middle fore claw	1	7
Ditto of heel to point of middle nail	2	7
Ditto of fur on the back	„	7
Height of ear posteriorly	„	5
Breadth of tail with hair extended	8	6

Weight 1¼ ℔.

The two specimens from which the above description was taken were procured in the markets of New Orleans, by J. J. Audubon, Esq. I possess no information with regard to their habits.

4. Great-tailed Squirrel. *Sciurus magnicaudatus.*

Sciurus macrourus; Say, Long's Expedition, vol. i. p. 115.
——— *magnicaudatus;* Harlan's Fauna, p. 170.
——— *macrourus;* Godman's Nat. Hist. vol. ii. p. 134.

Essent. Char.—Intermediate in size between the *Sciurus cinereus* and *Sci. leucotis;* body above, a mixed grey and black; ears long; tail very broad.

In a number of Museums both in England and on the continent, I have observed squirrels labelled with the above name, but which must be referred to the varieties of other species. The only genuine specimen that has come under my notice is the one now existing in the Philadelphia Museum, and which was, I believe, brought by Say, the original discoverer. Having at present no access to my notes with a description of this species made two years ago, I am obliged to copy the original description of Say, which I found, on comparison, to be very accurate. I regret, however, that I am unable to annex an interesting account of the habits of this species, which was communicated to me by Mr. Peale.

"The body above, and on each side, is of a mixed grey and black; the fur is plumbeous, black at base, then pale cinnamon colour, then black, and finally cinereous, with a long black tip; the ears, $\frac{3}{4}$ of an inch long, are behind of a bright ferruginous colour, extending to the base of the fur, which, in the winter dress, is prominent beyond the edge; on the inside of the ear the fur is of a dull ferruginous hue, slightly tipped with black; the sides of the head and orbits of the eyes are pale ferruginous: beneath the ears and eyes the cheeks are dusky; the whiskers are composed of about five series of rather flattened hairs, the inferior ones are more distinct; the mouth is margined with black; the teeth are of a reddish yellow colour; the under part of the head and neck, and the upper part of the feet, are ferruginous; the belly is paler, the fur being plumbeous at base; the tail is of a bright ferruginous colour below, and this colour extends to the base of the fur with a sub-marginal black line; on its upper part it is ferruginous and black; the fur within is of a pale cinnamon colour, with the base and three bands black; the tip is ferruginous; the palms of the fore feet are black, and the rudimental thumb, which is very short, is covered by a broad flat nail.

"The fur of the back in the summer dress is from $\frac{3}{5}$ to $\frac{7}{10}$ of an inch long; but in the winter dress the longest hairs of the middle of the back are from 1 inch to $1\frac{3}{4}$ in length; this difference in the length of the hairs, combined with a greater portion of fat, gives to the animal a thicker and shorter appearance, but the colour continues the same; and it is only in the latter season that the ears are fringed, which is the necessary consequence of the elongation of the hair. This species was not an unfrequent article of food at our frugal yet social meals at Engineer cantonment, and we could always immediately distinguish the bones from those of other animals by their remarkably red colour. The tail is even more voluminous than that of the *Sciurus cinereus*, (cat squirrel)."

DIMENSIONS.

	IN.	LIN.
Length of head and body	11	1
Ditto of tail to the end of hair	11	3
Height of ear, fur included	,,	9

5. Californian Squirrel. *Sciurus aureogaster.*

Sciurus aureogaster ; F. Cuv. and Geoff. Mamm.
Ecureuil de la Calafornie ; Id.

General hue above deep grey grizzled with yellow; under parts and inner side of limbs deep rusty red; chin, throat and cheeks pale grey; limbs externally and feet coloured as the body above; hairs on the toes chiefly dirty white; tail large and very bushy; hairs of the tail black, twice annulated with dirty yellow, and broadly tipped with white, the white very conspicuous where the hairs are in their natural position; ears thickly clothed, chiefly with blackish hairs, the hinder basal part externally with long white hairs, extending slightly on the neck; all the hairs of the body are grey at the base, those of the upper parts annulated first with yellow, then black, and then white; whiskers black, the hairs very long and bristly; the under incisors almost as deep an orange colour as the upper.

Habitat Mexico and California.

DIMENSIONS.

	IN.	LIN.
Length from nose to root of tail	12	0
Ditto of tail to end of hair	10	6
Ditto of heel to end of claws	2	5½
Ditto from nose to ear	2	1½
Height of ear posteriorly	,,	7½

A second specimen, the locality of which was not given, differed from the above in having a much richer colouring. The belly was of a very bright rust colour; hairs on the tail black at the roots, then broadly annulated with rusty yellow, then a considerable space occupied by black, the apical portion white; but when viewed from beneath, a bright rust colour, like that of the belly, was very conspicuous, occupying the basal half of the hair: the upper parts of the body were grizzled with black and white, and many of the hairs were annulated with rust colour; over the haunches and rump the hairs are annulated with rusty yellow and black; the hairs of the feet are chiefly black.

The original specimen on which this species was founded is in the Museum at Paris, and Mr. Waterhouse supplied me with the following description from his own manuscript notes.

"General colour, grizzled black and white; throat, chest, belly, inner side of legs, nearly the whole of the fore legs and the fore part of the hind legs rusty red; tail very broad; the hairs black, red at the base and white at the apex; lips white; feet black, with a few white hairs intermixed; fore part of head also black, with a few intermixed white hairs; chin blackish in front, shading into grey.

DIMENSIONS.

	IN.	LIN.
Nose to root of tail	11	6
Tail to end of hair	11	0
Tarsus	2	$4\frac{1}{3}$

In the Museum of the Zoological Society are three specimens, one of which is from Mexico, and the others are, unfortunately, not named. If they should prove the same, they exhibit considerable variations in colour. In one specimen the chin and throat are grey; the animal appears to be changing its colour, over the haunches there is a considerable admixture of rusty red colour; the general hue of the back was deep grey; the hairs at base plumbeous, the apical portion annulated with first black, then rust colour, then black, varying in some hairs.

6. Cat Squirrel. *Sciurus cinereus.*

Sciurus cinereus; Linn., Gmel.
Cat Squirrel; B. Penn. 'Arct. Zool.' i. 137.

Essent. Char.—A little smaller than the Fox Squirrel, larger than the Northern Grey Squirrel; body stout; legs rather short; nose and ears not white; tail longer than the body.

This species has been sometimes confounded with the fox squirrel, and at other times with the northern grey squirrel; it is, however, in size intermediate between the two, and has some distinctive marks by which it may be known from either. The northern grey squirrel has, as far as I have been able to ascertain from an examination of many specimens, permanently five grinders in each upper jaw, and the present species has but four. Whether, at a very early age, the cat squirrel may not, like the young fox squirrel, have a small deciduous tooth, I have had no means of ascertaining; all the specimens before me having been obtained in autumn or winter, and being adults, present the dental formula as given above. The fox squirrel is permanently marked with white ears and nose, which is not the case with the cat squirrel: the former is a southern species,—the latter is found in the middle and northern states.

Description.—The head is less elongated than that of the fox squirrel, the nose more obtuse; incisors rather narrower, shorter, and less prominent; molars, with the exception of their being a little smaller, bear a strong resemblance to, and are similarly arranged to those of the former species. The neck is short; legs short and stout; nails narrower at base than those of the fox squirrel, shorter and less arched; the tail also is shorter and less distichous; the body, although shorter is thicker, and the whole animal has a heavy, clumsy appearance. The fur is not so soft as that of the northern grey squirrel, but finer than that of the fox squirrel.

This species, as well as the last, is subject to great varieties of colour. I have observed in Peale's Museum specimens of every shade of colour, from light grey to nearly black. I have also seen two in cages which were nearly white, but without the red eyes which form a characteristic mark in the albino. There appears however to be this difference between the varieties of the present species and those of the fox squirrel;—the latter are permanent varieties; scarcely any specimens being found in intermediate colours: in the present there is every shade of colour, scarcely two being found precisely alike.

The most common variety however is the grey cat squirrel, which I shall describe from a specimen now before me.

Teeth orange; nails dark brown near the base, lighter at the extremities; on the cheeks there is a slight tinge of yellowish brown, extending to the neck at the insertion of the head; the inner surface of the ears of the same colour, the outer surface of the fur on the ear, which extends a little beyond the outer edge, and is of a soft woolly appearance, is light cinereous edged with rusty brown; whiskers black and white, the former colour predominating. Under the throat, the inner surface of the legs and thighs, and the whole under surface, white; on the back the fur is dark cinereous near the roots, then light ash, then a line of black and tipt with white, giving it on the outer surface an iron-grey appearance. The tail, which does not present the flat distichous appearance of the majority of the other species, but is more rounded and narrower, is composed of hairs which, separately examined, are of a soiled white tint near the roots, then a narrow marking of black, then white, then a broad line of black, and finally broadly edged with white.

Another specimen is dark grey on the back and head, and a mixture of black and cinereous on the feet, thighs, and under surface. Whiskers nearly all white. The markings on the tail are similar to those on the other specimen.

DIMENSIONS.

	IN.	LIN.
Length of head and body	11	3
Ditto of tail, (*vertebræ*)	9	6
Ditto to the tips	12	6
Height of ear posteriorly	,,	6
Palm and middle fore claw	1	6
Heel and middle hind claw	2	9
Length of fur on the back	,,	7

Geographical Distribution.—This has been to me a rare species. It is said to be common in the oak and hickory woods of Pennsylvania, and I have occasionally met with it near Easton and York; I also observed one in the hands of a gunner near Fredericksburgh, Virginia. In the northern part of New York it is exceedingly rare, as I only saw two pair during fifteen years of close observation. In the lower part of that state, however, it appears to be more common, as I recently received several specimens procured in the county of Orange.

This squirrel has many habits in common with other species, residing in the hollows of trees, and building in summer its nest of leaves in some convenient crutch, and subsisting on the same variety of food. It is, however, the most inactive of all our known species: it mounts a tree, not with the lightness and agility of the northern grey squirrel, but with the slowness and apparent reluctance of the little striped squirrel (*Tamias Lysteri*). After ascending it does not mount to the top, as is the case with other species, but clings to the body of the the tree, on the side opposite to you, or tries to conceal itself behind the first convenient limb. I have never observed it leaping from branch to branch. When it is induced in search of food to proceed to the extremity of a limb, it moves cautiously and heavily, and returns the same way. On the ground it runs clumsily, and makes slower progress than the grey squirrel. It is usually fat, especially in autumn, and the flesh is said to be preferable to that of any of our other species.

The cat squirrel does not appear to be migratory in its habits. The same pair, if undisturbed, may be found taking up their residence in a particular vicinity for a number of years in succession; and the sexes seem mated for life.

(To be continued).

Art. III. *Notice of a species of* Rotalia *found attached to specimens of* Vermetus Bognoriensis. By Nathaniel Wetherell, Esq., M.R.C.S., F.G.S., &c.

When I first observed some specimens of *Rotalia* upon the whorls of the *Vermetus Bognoriensis*, I imagined that these minute fossil bodies had been casually lodged in some of the small furrows upon its external surface; further observations and additional specimens, however, convinced me to the contrary, and I perceived, on a careful microscopic examination, that not only were the *Rotalia* attached to the *Vermetus*, but that in several instances they were absolutely imbedded in the substance of the shell itself.

27

a

b

On my first discovery of these remains, I briefly alluded to the circumstance in a paper read before the Camden Literary and Scientific Institution, (April 26th, 1836), subsequently published in the 'London and Edinburgh Philosophical Magazine.'[1] I have since considered that it would be an interesting record to have them engraved, exhibiting the fossils of the natural size, together with magnified figures, as annexed.

[1] "Observations on some of the Fossils of the London Clay, and in particular those Organic Remains which have been recently discovered in the Tunnel of the London and Birmingham Rail-road. By Nath. Thos. Wetherell, Esq., F.G.S., M.R.C.S., &c." The London and Edinburgh Philosophical Magazine and Journal of Science, Vol. ix., Dec. 1836, No. 56.

Fig. 27, *a*, which is exceedingly minute, is accompanied with three magnified views; and *fig.* 27, *b*, with the same.

I was induced to have both specimens represented, as there are some slight differences between them, which, unless depending upon particular periods of growth, may be considered sufficient to constitute them different species or varieties.

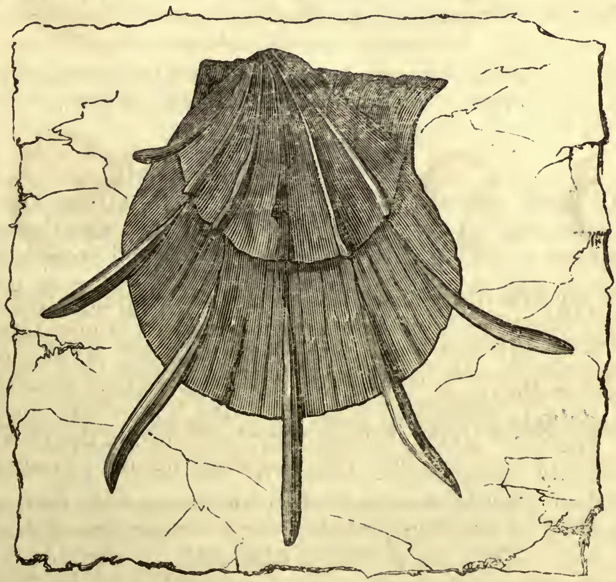
The locality whence I obtained my specimens is the tunnel of the London and Birmingham rail-road, near Chalk farm. Although I have examined several hundreds from this place, I have only found about eight or nine with the *Rotalia* attached. I have had in my possession at different times some thousand specimens of *Vermetus Bognoriensis*, from Highgate, Bognor, and Sheppey, but I have never before noticed any minute shell or coral attached to them.

It was at first my intention to have given a specific name; the present fossil however appears so closely to resemble a species found at Grignon, that I have thought it better not to do so.

Highgate, March 12th, 1839.

ART. IV.—*Description of a new fossil* Avicula, *from the Lias Shale of Somersetshire.* By SAMUEL STUTCHBURY, Esq., Curator to the Bristol Philosophical Institution, &c.

28



Avicula longicostata, Stutchb.

Avicula longicostata.

Shell inequilateral, with six raised *costæ* radiating from the *umbo*, each rib extending far beyond the margin of the valve; minutely striated between the ribs.

This very elegant fossil is remarkable from the great extension of the ribs which radiate from the *umbo*, in several instances extending more than an inch beyond the margin of the valve. In the five specimens which have come under my observation, there appears to have been a determinate stoppage of growth, which is evidenced by a raised line crossing the disc of the shell and spinous terminations of the first-formed ribs.

The internal characters determine the genus to which it belongs, while the external characters alone would have left me in doubt to which of the following genera it most probably belonged; viz. *Avicula*, *Pecten*, or *Plagiostoma*. The number of ribs (*six*) appears to be a constant character, at least judging from the specimens which have already come to hand.

For this beautiful fossil we are indebted to the excavations made through the lias shales along the line of the great western railway, at Saltford, between Bristol and Bath. *Avicula Cygnipes*, figured in Phillips's 'Geology of Yorkshire' resembles it, but the two are sufficiently distinct to justify their separation.

Bristol, January 16*th*, 1839.

ART. V.—*On the Anatomy of the Lamellibranchiate Conchiferous Animals.* By ROBERT GARNER, Esq., F.L.S.,

(*Continued from Page* 129).

DIGESTIVE SYSTEM.

All these animals derive their nourishment from the animalcules and other nutrient particles drawn in with the water, by means of the currents excited by the ciliated *branchiæ* and tentacles. The particles are collected at the anterior part of the cavity of the mantle, and are conveyed into the *œsophagus* by means of tentacles and lips, strongly ciliated internally for that purpose. In some species, as the *Pecten*, the foot seems a prehensile organ of the food, and the curious foot of the *Spondylus* is perhaps of some use in this way. The tentacles are precisely similar to the *branchiæ* in structure, being commonly membranous, striated by the vessels, and ciliated; and their vascular system is often continuous with that of the *branchiæ*, so that they probably serve the purpose of respiration also. They are generally triangular in shape. In the *Nucula*, the external one is large and spiral; in the *Corbula* they are long and volute. They are large in the *Tellina* and similar genera; small in *Modiola, Mya, Psammobia,* &c. When lips are developed the tentacles are small. These are of a fringed appearance in *Pecten, Spondylus,* &c., more foliated in *Chama.*[1] The mouth is small in *Venus,* &c., larger in several of the *Monomyaria.* The *œsophagus,* generally very short, is however occasionally pretty long, as in the *Pholas.* Home describes salivary glands in the *Teredo,* but these I have not been able to find; and Poli, bodies which he supposes to be such in the *Pinna.* The stomach is always in the centre of the liver, and the bile ducts enter it by one or more orifices. Into the stomach projects the extremity of a lengthened cartilage, the "*crystalline style*" of Poli. The other extremity has been described as going to the foot, and adding to the elasticity of that organ. This body is of various shapes, and has at its superior extremity a cartilaginous membrane, the "*tricuspid body*" of Poli. This lies at the inferior surface of the stomach, and its extremities enter the bile ducts. The crystalline style is wanting when the foot is small; the membrane is always present. The former is evidently analogous to the tongue of the *Patella* and other cephalous *Mollusca;* it is secreted from behind and comes forward into the stomach; the membrane at its extremity is analogous to the membrane always found in a similar situation at the end of the tongue in other *Mollusca.* The apparatus of mastication in the *Gasteropoda* is then in the *Lamellibranchiata* partly subservient to digestion, but has also another use assigned to it—the giving elasticity to the foot, or, in the *Anomia,* where its extremity is seen in the mantle, the preserving in its situation the free extremity of the left lobe of the latter part.

These organs have been supposed by Poli to regulate the flow of bile; which appears probable. By Carus[2] they are imagined to be concerned in the function of generation, which supposition is not warranted by the facts; but, on the contrary, there are grounds on which we may infer that it is unlikely. The *duodenum* or first part of the intestine is wider than the remainder and is by some called a second stomach. It sometimes originates from the true stomach distinct from the style, as in *Mactra, Pholas,*[3] some species of *Solen,* &c. Sometimes the style lies in a groove of the *duodenum,* which

[1] Poli. [2] Lehrbuch, v. 2.
[3] The digestive system of the *Teredo* only differs from that of the *Pholas* in its greater length.

leaves its extremity, as in some *Tellinæ*, &c., or diverges from its side at a greater or less distance from the end, as in *Cardium*, *Solen vagina*, &c. The *parietes* of the *duodenum* are glandular. The remainder of the canal has many veins originating from it, which perhaps act the part also of lacteals. The extremity of the *duodenum* is always near the pedal pore and perhaps the *vitellus* of the embryo so enters. The intestine varies much in length. As shewn by Poli, those species which are fixed have it shortest. In *Anomia* it is not an inch long, and makes no turn; it has a rounded projecting process in its whole length. A similar projection is seen in other genera. The convolutions of the intestine interwoven with the liver and ovaries, are generally contained in great part in the foot. In the *Monomyaria*, in the *Mytilus*, *Pinna*, &c., it makes only two or three turns, the last often surrounding the stomach. In the fresh water species it is longer by a turn or two; longer still in *Pholas*, *Mya*, *Venerupis*, *Tellina*, &c.; but longest of all in *Cardium*, *Donax*, *Venus*, *Mactra*, and some other genera, where it is sometimes ten or twelve times the length of the animal. The intestine, having made its convolutions, is directed towards the heart, through the ventricle of which it commonly passes, and ends on the posterior muscle by an opening, which, in some species, has a divided margin. This *anus* is situated between the lobes of the mantle, and opens into the superior of the two tubes, when they exist. In the oyster the ventricle is not perforated by the intestine, the heart being in a different situation. In the *Anomia* the heart lies upon it. When there are two ventricles, as in *Arca*, *Lima*, and certain *Pectunculi*, the intestine passes between them. In the *Unio* it has been described that the intestine makes its escape from the cavity of the heart to re-enter it again; such a description is not taken from the normal disposition of the animal. The curious circumstance of the perforation of the ventricle by the intestinal tube appears to be a result merely of the disposition of the parts.

The liver, in all the *Lamellibranchiata*, surrounds the cavity of the stomach, into which its secretion of greenish bile is poured by one or more ducts. It has no *vena porta* going to it, but its arteries, and hepatic veins are large. Its situation is at the anterior and superior part of the animal, and it is composed of a multitude of oval granules, differing in size in different species, opening into the termination of the *ramuscules* of the duct.

CIRCULATING SYSTEM.

This system is not so simple as it is described by Cuvier, Poli, &c. Bojanus[1] in the *Anadonta* first described its correct anatomy. By means of mercurial injections it may be readily made out in the common scallop or *Pecten maximus* The venous blood from the liver, ovaries and intestine, does not go to the *branchiæ* immediately, but a portion of it enters, on each side, a *sinus* or system of veins situated upon the adductor muscle, the remainder is poured into a large vessel, which is distributed to a dark coloured excretory organ, situated at the base of the *branchiæ* on each side. These organs have other veins which open either into the *sinus* or into the branchial arteries. The *sinus* receives likewise the veins of the muscle, and also in part the blood of the mantle. It opens into the branchial arteries by two valvular openings. The blood from the *viscera* must in great part pass through the tissue of the excretory organs to enter the branchial artery, and the tissue itself appears to be entirely formed by these veins. Bojanus from this considers these bodies as the organs of respiration. The auricles, besides the branchial veins, receive the extremities of the large veins of the mantle, small hepatic branches, and other veins from the neighbouring parts. Poli has figured this circumstance in the *Arca, Spondylus, &c.* The branchial artery then has its principal origin from the large veins or venous *sinus,* situated upon the adductor muscle; it then receives veins from the organs above mentioned, also others from the root of the *branchiæ* and from the mantle: it then at regular distances gives branches to the processes of the *branchiæ*, which run into the corresponding *ramuscules* of the branchial vein. The branchial vein, formed by these *ramuscules,* lies nearer to the processes of the two vessels, and is crossed by the divisions of the artery; it is joined by the extremity of the great vein of the mantle, and by small veins from the liver, &c., as described above, and forms the auricle. No valve exists between the veins and auricles. The latter have projecting processes upon them, secreting perhaps the fluid of the *pericardium.* They are connected by a transverse vein, receiving some small vessels from the *pericardium,* &c. A valve formed by two semilunar membranes exists at the entry of each auricle into the ventricle. The *pericardium,* always situated in the

[1] A translation of his paper may be found, 'Journ. de Physique,' t. 89, with observations upon it by M. Blainville.

back of the animal, except in the oyster, contains a thickish, transparent fluid. The ventricle is muscular, and is pierced by the *rectum*, which, in some species, though not in the animal whose circulation is now described, likewise traverses more or less of the *aortæ*. The ventricle gives off an anterior and a posterior *aorta*, and a valve exists at the commencement of each. The former runs over the liver, giving hepatic arteries, and surrounding the mouth with a ring, furnishes the labial, ovarian, intestinal, pedal, and other arteries. The latter goes backwards, and furnishes, principally, the muscle and mantle with arteries. The coats of the veins are thin, but they are readily injected; those of the arteries thicker, but these vessels are not easily filled with mercury. Blood taken from the auricles is almost colourless,[1] separates on standing into a liquid and solid part, and, microscopically examined, its globules, which are about a thousandth part of an inch in diameter, show some appearance of movement, even out of the vessels. This fact appears to have been observed by Mayer.[2] The heart is slow in its pulsations; they are generally from twenty to thirty in the minute.

In the *Unio* and *Anadonta* the *sinus*, corresponding to that of the *Pecten*, lies under the *pericardium*, receiving anteriorly large veins from the mantle, *viscera*, &c., and posteriorly other vessels from the posterior part of the body. Part of its blood goes to the branchial artery on each side, a few twigs enter the auricles and the remainder goes to the excretory organs. The vein of the mantle, at one extremity, is connected with the excretory organ. This organ on each side has a few small veins entering the auricles, but the mass of its blood enters the branchial artery. The branches of this vessel are found on the outer side of the inner branchial *lamina*, and on the inner side of the external one. The corresponding venous *ramuscules* enter three veins, one lying between the two internal *branchiæ*, which sends its blood to the two others, situated at the superior margin of the external *laminæ*. These last form the auricles. There is nothing remarkable in the distribution of the arteries.

Poli found two ventricles in the *Arca;* there are two likewise in some other genera, the shells of which have their beaks remote. There are never more than two real auricles; but dilatations at the commencement of the *aortæ* have been so called. In the *Cardium echinatum*, where there are two posterior *aortæ*, each at its commencement is considerably di-

[1] It is rather red in *Teredo*, according to Home.
[2] Mayer, Supplem. zur Lehre vom Kreiselaufe, 1827.

lated, and the cavities thus formed have strong muscular columns on their internal *parietes*.

The communication between the auricles, effected by a transverse vein in the *Pecten*, *Spondylus*, *&c.*, is more complete in the oyster, where they are united into one, but there are still two auriculo-ventricular openings.

The veins, then, do not all enter the branchial artery, some joining the branchial vein, where it forms the auricles. In the *Pecten* we see the visceral blood circulating through the excreting organs, which return it to the branchial arteries. The veins between the excreting organs and the sinus, may be the channels by which the former receive blood from, or remit it to the latter. The first supposition is perhaps the correct one, and in this case, this part of the circulation in the *Anadonta*, &c., only differs by the visceral blood entering the *sinus* before it circulates through the excreting organs; and by more of the blood of the *sinus* going to them. This distribution is something like a portal system. There is a free passage from the veins of the mantle into the auricles and *sinus* in the *Pecten*, and into the *sinus* and tissue of the excretory organs in the *Anadonta*, &c.[1]

RESPIRATORY SYSTEM.

As is known to zootomists, the *branchiæ* of the *Lamellibranchiata* are ciliated for the purpose of exciting currents in the water. In the *Monomyaria* and *Arcaceæ* there are no orifices or siphons to the mantle for the inlet and exit of the water &c. In the *Pecten*, *Spondylus*, and *Lima* the *branchiæ* of each side are situated on a triangular membrane, at a distance from those of the other. The two *branchiæ* of the same side are not distinct from each other, and their processes are disunited, and do not form a continuous membrane as is generally the case, but are kept in contact with each other by lateral processes. In the oyster the *branchiæ* have not only their processes conjoined into a membrane, but the several *laminæ* are united at their bases. In the *Arca*, *Pectunculus*, &c., the *branchiæ* of each side are separate from those of the other; as they are in *Modiola*, *Mytilus*, *Lithodomus*, and other genera; but in these latter, the water enters by the posterior fringed extremity of the mantle, and makes its exit by the separate orifice situated higher up. There is a valve be-

[1] Treviranus considers the blood from the branchial veins to pass through the excretory organs before it enters the auricles. Vanderhoeven was aware that the venous blood circulated through them, in opposition to the erroneous opinion of the former, according to Prof. Grant. Vid. Lancet.

low this orifice, and another above, to regulate the currents in the proper direction. The orifice is lengthened into a tube in the *Lithodomus;* and in the *Pinna* the anal valve has taken a lengthened ligulate form. The *Uniones* only differ from this in having the *branchiæ* united, and the water appears to make its exit by insinuating itself between them and the foot, and so through the orifice. In the *Cardium* we see two distinct openings behind; the water enters by the lower one, distends the mantle, and this orifice being then closed by the valve, it gets between the foot and the *branchiæ*, and is discharged through the superior orifice. In this animal the posterior extremity of the *branchiæ* is united to the *septum* between the orifices, so that the two respiratory cavities only communicate by the side of the foot. In the *Cyclas* both the short tubes open internally below the *branchiæ*, and there is no passage required between the latter and the foot. The water in this and similar cases has only access to the spaces left internally between the *laminæ* of the *branchiæ* (oviducts of Home) from behind: it is over these spaces that the secretory organs and oviducts commonly open. We find this last disposition, only with the siphons more developed, in *Donax*, *Tellina*, *Psammobia*, and many others. There is in these commonly a valve between the internal orifices; but the water is frequently ejected from both tubes. In the *Mactra*, *Cytherea*, *Venus*, and *Venerupis*, the tubes are more muscular than in the *Tellinidæ*, &c., and they are more or less united; the *branchiæ* are in these often medianly separated. In the *Solen*, *Hyatella*, *Mya*, *Pholas*, *Teredo*, &c., a different disposition takes place. Here the *branchiæ* are prolonged into the inferior siphon, and as they are not separated from the base of the foot within, nor from the mantle without, the water drawn in through the inferior orifice must make its exit by the same, or by the anterior opening. But water is likewise drawn in by the other, and so gets access to the interior inter-laminar spaces of the *branchiæ;* and by this superior siphon the *ova*, *fæces*, and secretions are discharged.[1] Here the *branchiæ* are often very long, and the siphons very muscular. We sometimes find small supplementary *branchiæ*, as in the *Psammobia*, *Pholas*, &c., or the external pair may be shortened in front, as in *Mya*, *Venerupis*, and many other genera. In the *Pandora* the only appearance of the external

[1] We see this also in the *Tunicata*. By one orifice water enters the respiratory sac, by the other it is drawn into the external meshes of the *branchiæ*. The water drawn in by each opening must make its exit by the same. Those writers who say the contrary must be incorrect, unless the water pass through the stomach and intestine.

laminæ consists of two very narrow strips at the base of the others; this is the case also, according to Blainville, in the *Osteodesma*, allied to the former. Though it is not by the action of the orifices or siphons, or by the relaxation of the shell-muscles, and the opening of the valves, that the water is drawn into the mantle, yet these accompany the occurrence; and though the water commonly escapes in a continuous stream from the action of the *cilia*, a sudden ejection of it frequently takes place, accompanied by a closing of the valves and a contraction of the siphons. These latter parts have frequently at their extremities circles of ciliated fringed processes.

(To be continued.)

ART. VI.—*Observations on the Lamellicorns of Olivier.* By THE REV. F. W. HOPE, F.R.S., F.L.S., F.Z.S., &c.

(Continued from Page 24.)

GENUS.	SPECIES.	COUNTRY.	ARRANGEMENT OF AUTHORS.
CETONIA.	1 *Goliathus*	Sierra Leone	*Goliathus*, Lamarck
	2 *Cacicus*	Guinea	————
	3 *Polyphemus*	Africa	*Mecynorhina*, Hope
	4 *micans*	Senegal	*Dicronorhina*, Hope
	5 *Chinensis*	China	*Agestrata*, Escholtz
	6 *nigrita*	Ceylon	————
	7 *aurata*	England	*Cetonia*, Fabricius
	8 *corticina*	Senegal	————
	9 *bimaculata*	C. Good Hope	*Coryphe*, Gory
	10 *guttata*	Sierra Leone	————
	11 *aulica*	C. Good Hope	*Cetonia*, Fabricius
	12 *fascicularis*	Ditto	————
	13 *marmorea*	Tobago	*Gymnetis*, MacLeay
	14 *nitida*	North America	————
	15 *lanius*	Carolina	————
	16 *carnifex*	C. Good Hope	*Diplognatha*, Gory.
	17 *fuliginea*	Senegal	*Oplostomus*, MacLeay
	18 *pubescens*	C. Good Hope	*Cetonia*, Fabricius
	19 *hepatica*	St. Domingo	*Chasmodia*, MacLeay
	20 *tristis*	Florida	*Gymnetis*, MacLeay
	21 *lobata*	South America	————
	22 *irrorata*	Ditto	*Cetonia*, Fabricius
	23 *elongata*	Cayenne	*Cyclidius*, MacLeay
	24 *sinuata*	C. Good Hope	*Cetonia*, Fabricius
	25 *Gagates*	Ditto	*Diplognatha*, Gory
	26 *marginatus*	Senegal	*Cetonia*, Fabricius
	27 *morio*	South of France	————
	28 *Capensis*	C. Good Hope	————
	29 *signata*	Ditto	————
	30 *elegans*	Coromandel	*Coryphe*, Gory

GENUS.	SPECIES.	COUNTRY.	ARRANGEMENT OF AUTHORS.
CETONIA.	31 *4-maculata*	Guinea	*Dicronorhina*, Hope
	32 *Africana*	Sierra Leone	*Chlorocala*, Kirby
	33 *Iris*	Surinam	————
	34 *suturalis*	Senegal	*Schuppelii*, MacLeay
	35 *fulgida*	Pennsylvania	*Cetonia*, Fabricius
	36 *5-lineata*	East Indies	*Macronota*, Hoffmans.
	37 *Philippensis*	China	*Cetonia*, Fabricius
	38 *herbacea*	North America	*Macraspis?* MacLeay
	39 *sulcata*	Madagascar	*Cetonia*, Fabricius
	40 *maculata*	Coromandel	————
	41 *olivacea*	Sierra Leone	————
	42 *interrupta*	C. Good Hope	————
	43 *bifida*	East Indies	*Schizorhina*, Kirby
	44 *crucifera*	Bombay	*Diplognatha*, Fabricius
	45 *impressa*	East Indies	*Macronota*, Hoffmans.
	46 *inda*	North America	*Cetonia*, Fabricius
	47 *cyanea*	Java	*Schizorhina*, Kirby
	48 *acuminata*	C. Good Hope	*Cetonia*, Fabricius
	49 *aurichalcea*	Surat	————
	50 *lurida*	Brazils	————
	51 *stolata*	Sierra Leone	————
	52 *lugubris*	C. Good Hope	————
	53 *histrio*	Egypt	*Polybaphes*, Kirby
	54 *versicolor*	East Indies	————
	55 *cœrulea*	Ditto	*Gymnetis*, MacLeay
	56 *variegata*	Tranquebar	*Cetonia*, Fabricius
	57 *bipunctata*	Senegal	*Agenius*, Gory
	58 *areata*	Virginia	*Cetonia*, Fabricius
	59 *sanguinolenta*	Senegal	*Polybaphes*, Kirby
	60 *æquinoctialis*	Ditto	————
	61 *argentea*	Mauritius	*Cetonia*, Fabricius
	62 *irregularis*	Mexico	————
	63 *hirta*	Europe	————
	64 *stictica*	France	————
	65 *punctulata*	Senegal	————
	66 *hæmorrhoidalis*	C. Good Hope	————
	67 *nitidula*	Ditto	————
	68 *Hottentotta*	Ditto	*Genuchus*, Kirby
	69 *cruenta*	Ditto	————
	70 *pulverulenta*	Brazils	*Incas, fœm.*, Serville
	71 *eremita*	Europe	*Osmoderma*, Serville
	72 *nobilis*	England	*Gnorimus*, Serville
	73 *variabilis*	Germany	*Gnorimus*, Serville
	74 *fasciata*	England	*Trichius*, Fabricius
	75 *bidens*	North America	————
	76 *viridula*	Ditto	————
	77 *lunulata*	Ditto	————
	78 *pigra*	Carolina	————
	79 *delta*	Virginia	*Archimedius*, Kirby
	80 *hemiptera*	England	*Valgus*, Scriba
	81 *lineata*	C. Good Hope	*Lepitrix*, Serville
	82 *nigripes*	Ditto	————
	83 *crassipes*	Ditto	*Pachycnema*, Serville
	84 *canaliculata*	Ditto	*Valgus*, Scriba
	85 *ignita*	Surinam	*Chrysophora ?* Dejean?

GENUS.	SPECIES.	COUNTRY.	ARRANGEMENT OF AUTHORS.
Cetonia.	86 *glabrata*	East Indies?	*Rutela*, Latreille
	87 *bicolor*	South America	———————
	88 *emerita*	Ditto	*Chrysophora ?*
	89 *clavata*	Ditto	*Macraspis*, Macleay
	90 *convexa*	St. Domingo	———————
	91 *smaragdula*	South America	———————
	92 4-*vittata*	Brazils	———————
	93 *tetradactyla*	Jamaica	———————
	94 *lucida*	Guadaloupe	———————
	95 *splendida*	Cayenne	———————
	96 *chrysis*	Surinam	———————
	97 *brunnipes*	South America	*Chasmodia*, MacLeay
	98 *lineola*	Cayenne	*Rutela*, Latreille
	99 *Surinama*	Surinam	———————
	100 *striata*	Guadaloupe	———————
	101 4-*punctata*	East Indies	*Popillia*, Leach
	102 *lateralis*	South America	*Macraspis*, MacLeay
	103 *pustulata*	Guadaloupe	*Cnemida*, Kirby
	104 *bifrons*	South America	*Incas*, Serville
	105 *Bajula*	Ditto	*Gymnetis*, MacLeay
	106 *holosericea*	Surinam	———————
	107 *strigosa*	South America	———————
	108 *undata*	Cayenne	———————
	109 *picta*	Surinam	———————
	110 *maculosa*	South America	———————
	111 *liturata*	Brazils	———————
	112 *cincta*	South America	*Rhomborhina*, Hope
	113 *marginella*	Sierra Leone	*Cetonia*, Fabricius
	114 *tricolor*	East Indies	*Polybaphes*, Kirby
	115 *tridentata*	Senegal	*Cetonia*, Fabricius
	116 *Hebræa*	Equin. Africa	*Diplognatha*, Gory
	117 *velutina*	Caffraria	*Polybaphes*, Kirby
	118 *hispida*	C. Good Hope	*Cetonia*, Fabricius
	119 *ciliata*	South America?	*Rutela ?*
	120 *tigrina*	C. Good Hope	*Cetonia*, Fabricius
Hexodon.	1 *reticulatum*	Madagascar	*Hexodon*, Fabricius
	2 *unicolor*	Ditto.	———————

Genus 6. *Cetonia.*

Sp. 1. *Goliathus.* Now the type of the genus *Goliathus:* it is named *Drurii* by Mr. Westwood. For the genera belonging to this important group the reader is referred to the 'Illustrations of the *Annulosa* of South Africa,' lately published by Mr. W. S. MacLeay, and to my observations in the 'Coleopterist's Manual.'

Sp. 2. *Cacicus.* Now a *Goliathus* of Lamarck. Olivier, with his usual inaccuracy with regard to country, makes this species an inhabitant of South America; it comes from the Old World,—from Guinea.

Sp. 4. *micans*. Now a *Dicronorhina* of Hope. Mr. Strachan has brought to England with him a new species of this genus from the vicinity of Sierra Leone. It most probably will appear in an early number of the 'Entomological Transactions' of London.[1]

Sp. 6. *nigrita*. Olivier states his belief that this insect is only a variety of *Macronota Chinensis;* Col. Whithill obtained it from the Concan, and from an examination of the specimen in the British Museum I consider it as a distinct species.

Sp. 7. *corticina*. This is still a *Cetonia*, and is the *Cet. purpurascens* of Fabricius.

Sp. 9. *bimaculata*. This insect is not a *Gnathocera*, but a *Coryphe* of Gory; the specific name of *flavomaculata* Fab., should take precedence of *bimaculata*.

Sp. 10. *guttata*. Olivier describes this species as inhabiting South America. I have received it from Sierra Leone.

Sp. 11. *aulica*. Still a *Cetonia*. It appears, however, to afford ample characters for a sub-genus.

Sp. 13. *marmorea*. This is now a *Gymnetis*, MacLeay. Mr. Kirby has suggested the adoption of another genus, named by him *Marmorina*, to which this species with several others ought to be attached.

Sp. 16. *carnifex*. Olivier's locality for this species is South America; it inhabits the Cape of Good Hope, and belongs to the genus *Diplognatha*.

Sp. 17. *fuliginea*. This is now an *Oplostomus* of MacLeay. For the details consult his 'Illustrations of the Zoology of South Africa,' lately published. Olivier gives no locality; I have received it from the banks of the Gambia, and Mr. MacLeay from the Cape.

Sp. 23. *elongata*. Now a *Cyclidius* of MacLeay, of which this species is the type. *Cetonia axillaris*, Dupont, belongs to the same genus. Olivier does not mention the country from which he received it: Mr. MacLeay and Mons. Gory give it as a South American insect.

Sp. 31. *quadrimaculata*. A *Dicronorhina*, Mihi. The original specimen from which Fabricius and Olivier described the above insect is now in my possession, and I consider it as the female of *Goliathus Daphnis* of Buquet; Mr. MacLeay however, regards it as distinct.

[1] The insect alluded to at *Cetonia* 4, appears to be one of the *Goliatidæ*, and is the male of *Cet. torquata*, Fab.; in its characters it seems mediate between *Mecynorhina* and *Dicronorhina*.

Sp. 33. *Iris.* This species is not mentioned in Percheron's and Gory's *Cetoniidæ;* according to Mr. Kirby it belongs to his genus *Chlorocala*, and is the typical species.

Sp. 35. *fulgida.* No locality is stated by Olivier; it is well known however to be a North American insect.

Sp. 36. *quinquelineata.* Two species have been described with the above name, both of them I believe are from the East Indies.

Sp. 38. *herbacea.* This insect is not noticed in Percheron's and Gory's Monograph; it is apparently allied to *Macraspis*

Sp. 44. *crucifera.* Now a *Diplognatha.* This insect was called by Fabricius, *Cet. atromaculata*, and is properly preferred by Gory to the former name. I have repeatedly received it from Poona and Bombay.

Sp. 46. *Inda.* The locality of the East Indies is given by Olivier; it appears peculiar to North America.

Sp. 47. *cyanea.* According to Gory this is a *Schizorhina*; the *clypeus* is bifid certainly, but it deviates however from the type of the genus, and should be separated from *Schizorhina*, as well as other Asiatic species. Its true locality is Java.

Sp. 49. *aurichalcea.* This as well as other species recorded by Olivier, are omitted in the 'Monographie des Cetòines.'

Sp. 51. *stolata.* Olivier mentions New Holland and Senegal as the localities of the above insect; with respect to the former he is in error, it may however occur in Senegal, as I have received it from Sierra Leone.

Sp. 55. *cærulea.* Fabricius originally named this insect *quadrimaculata:* there are several oriental species closely allied to it. They ought to be formed into a sub-genus allied to *Gymnetis.* The Asiatic *Gymnetidæ* require further sub-division.

Sp. 62. *irregularis.* Olivier does not mention the locality of this species; it is evidently a Mexican insect.

Sp. 63. *hirta.* This insect was originally called *Scarabæus hirtellus* by Linnæus; the *Sc. squalidus* of the same author, is only a spotless variety of the above.

Sp. 70. *pulverulenta.* As Olivier does not state the country from which this insect was received he was probably unacquainted with it. The Brazils abound with them.

Sp. 76. *viridula.* Olivier gives a wrong locality to this insect, viz. the East Indies; it occurs only in Northern America.

Sp. 79. *Delta.* Now an *Archimedius* of Kirby, one of the *Trichiidæ.* For an account of the natural groups into which this genus may be resolved, the reader should consult the third volume of the 'Zoological Journal,' p. 136, where there is an excellent paper by my friend Mr. Kirby.

Sp. 85. *ignita.* This is most likely a *Chrysophora;* if not it is a *Pelidnota* of MacLeay.

Sp. 86. *glabrata.* Olivier gives his opinion that this is an East Indian insect; I believe it to belong to South America and to be one of the *Rutelidæ.*

Sp. 88. *emerita.* Most likely a true *Chrysophora.*

Sp. 91. *smaragdula.* Now a *Macraspis* of MacLeay. Mr. Westwood in the new edition of Drury considers this insect as a *Chasmodia.* As no mention in the description is made respecting a divided *clypeus*, a peculiarity of *Chasmodia*, I consider it a *Macraspis.*

Sp. 92. *quadrivittata.* The name of *fucata*, Fab., should be used instead of the above. The *Scarabæus cinctus* of Drury, is the same insect.

Sp. 97. *brunnipes.* Now a *Chasmodia* of MacLeay. It is probable that *Chasm. castanea* De Jean, is only an immature variety of this species. Olivier gives no locality; it abounds in the Brazils.

Sp. 98. *lineola.* Now a *Rutela.* This insect is subject to vary considerably, several of the varieties are considered as species. *Sc. Hesperus* of Drury is one of them.

Sp. 101. *quadripunctata.* Certainly a *Popillia* of Leach.

Sp. 107. *strigosa.* This species is apparently unknown to M.M. Percheron and Gory, as it is omitted in their monograph; so also is the following species of Olivier, named *Undata.*

Sp. 109. *picta.* This is a true *Gymnetis.* A specimen is in my collection, others I have seen which vary much in the yellow markings.

Sp. 110. *maculosa.* The name of *Gracula* used by Fabricius should take the place of *maculosa*, on the ground of priority.

Sp. 111. *liturata.* Now a *Gymnetis.* As Olivier has omitted it, I give the Brazils as its true locality.

Sp. 112. *cincta.* This is now a *Rhomborhina* of my 'Manual.' *Cet. Tænia* of Palisot Beauvois, is the same insect.

Sp. 113. *marginella.* A *Cetonia* of authors. Three species in the European Cabinets are confounded together under the above name; they certainly cannot be considered as mere varieties, their form and proportions being very different.

Sp. 117. *velutina.* Now a *Polybaphes* of Kirby. The name of *velutina* must be changed: the following are the synonyms of the species.

Cetonia { *discoidea* Fab., 'Syst. Elect.' 2, 158, 116
velutina Oliv., tab. 14, fig. 121
flammea Vigors, 'Zool. Jour., vol. 2, p. 237, tab. 9. }

Sp. 119. *ciliata*. Most likely a *Rutela*; if so, its country will be South America.

In concluding these remarks on the species of Lamellicorns mentioned by Olivier, two observations will occur to most entomologists. The first is Olivier's want of a better acquaintance with the Fabrician species; this is remarkable. It certainly should not have occurred respecting the species described from our English cabinets, as Fabricius and Olivier described from the self-same specimens; every species was labelled by Fabricius, and there ought not, therefore, to have occurred so many glaring instances of decided neglect. The second great error of Olivier was an indifference about stating the countries from which the insects were received. This blame attaches equally to Linnæus, Fabricius, and other writers of the same period, and was the fault of the age in which they lived: geographical distribution is of mere modern growth, it is however of very great importance, and will eventually be found the best clue to conduct us out of the labyrinths of doubt and error, and without it we never can satisfactorily arrange the families, genera, or even the species of *Insecta*.

Olivier's work, as a whole, is one of the best which has appeared in France or Europe; although many of the figures are bad, many again are tolerably faithful portraits of the species. A wretchedly miserable work, with Olivier's figures was published at Nuremberg about 1800, under the title of 'Abbeldungen zuk. Illigeri, Uebersetzung, von Olivier's Entomologie.' The plates are so bad that it is rarely admitted by entomologists into their libraries. Faulty indeed as the above works may be, they are yet better than none. It is remarkable, that with the exception of Drury's 'Illustrations of Exotic Entomology,' the English authors have scarcely ever published a general work of any magnitude, with plates. As far as our British Fauna goes however, we greatly surpass the continental writers, as no where in Europe will be found more valuable Faunas than those of Messrs. Stephens and Curtis. A publication on the same scale as that of Olivier's would do much to advance the science of Entomology, and is at the present moment a great desideratum. There are in England several magnificent collections, able artists, and unrivalled comparative anatomists, but where is patronage to stimulate to exertion? How little is science encouraged, —how weakly is it supported!

Art. VII.—*On the structural differences observable in the* Crania *of the four British Species of the Genus* Cygnus. By W. G. Pelerin, Esq.

It may be considered by many that structural variation in the *crania* of birds is of little importance; but I am inclined to think, from an attentive study of the comparative anatomy of the class for some years, that it may frequently tend, if not absolutely to decide species, at least materially to strengthen the characters. Many species that were long considered different, as the purre, dunlin, &c., had the *crania* been minutely examined, would have proved identical, and *vice versâ*, as in the present instances, where the birds are so nearly allied in point of colour &c. as to have been for years confounded, it appears to me worthy of attentive consideration.

As some doubts have been lately promulgated on the continent with regard to the swan characterised by Mr. Yarrell being specifically different from *Cygnus olor*, a description and comparison of the *cranium* of each may be interesting to naturalists, and tend to prove satisfactorily that they are distinct.

The measurement of an adult *cranium* of each bird is as follows.

Length from the tip of the bill to the base of the occipital bone :—

Cyg. immutabilis, $6\frac{3}{8}$ in. *Cyg. olor*, $6\frac{7}{8}$ in.

Height from the bottom of the lower mandible when closed to the top of the protuberance at the base of the bill :—

Cyg. immutabilis, $1\frac{5}{8}$ in. *Cyg. olor*, 2 in.

Height from the base of the under jaw to the vertex of the head, just behind the orbit of the eye :—

Cyg. immutabilis, $2\frac{1}{8}$ in. *Cyg. olor*. $2\frac{1}{4}$ in.

In *Cyg. immutabilis* the bill is rather more flattened, particularly in the middle between the *dertrum* and the nostrils; the protuberance at the base of the upper mandible is less developed, and the top of the skull, instead of being nearly on a level from thence to the summit of the parietal bones, as in *Cyg. olor*, rises gradually to that point, and does not indicate any sign of the small foramen observable at that part in the latter species: but the greatest difference is perceptible on comparing the occipital bones; the upper portion of this bone in *Cyg. immutabilis* (A) protrudes considerably more, and there are two oval *foramina* (B), one on each side just above the *foramen magnum,* which are not present in any specimens of *Cyg. olor* that I have examined; the portion forming the boundary of the external orifice of the ear (C) is much more prominent, and the condyle forms a more acute angle with the basilar portion of the occipital bone.

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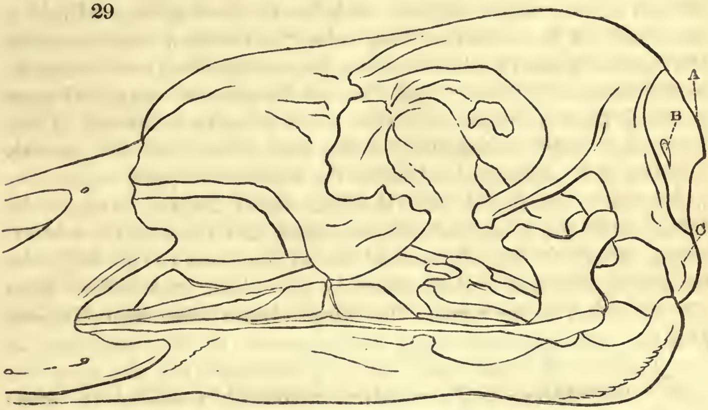

Skull of *Cygnus immutabilis.*

A, upper portion of occipital bone. B, oval *foramina.* C, external orifice of ear.

One of the chief distinctions of *Cyg. olor* appears to be the small *foramen* on the top of the *cranium,* which I have invariably found in this, but never in a single instance in the three other species: the two *foramina* in the occipital bone do not appear so constant, as, although I have always detected them in *Cyg. Bewickii* and never in *Cyg. olor*, they are occasionally observable in *Cyg. ferus,* but wanting in the greater number, and even in some, though perceptible, nearly obliterated.

The small size of the head of *Cyg. Bewickii,* being usually about one third less than that of *Cyg. ferus,* and the comparative shortness and breadth of the bill, render it unnecessary to describe it more minutely, as it would be at once detected by any observer at all conversant with the subject.

The specimen of *Cyg. immutabilis* from which the accompanying drawing and description are taken, was procured in the London market, and has been some years in my collection; and from a frequent comparison with many *crania* of *Cyg. olor,* from which it uniformly differed in the above particulars, I considered it as the head of a nearly-allied but distinct species, although as I never subsequently met with either the bird or *cranium*, I could not identify it with any recognised or previously described, till Mr. Yarrell having mentioned to me that he had determined a new swan, confounded with, but in reality perfectly separable from *Cygnus olor*, I had no doubt that mine was the same species, and on showing it to him, after a careful investigation, he had no hesitation in confirming my views with regard to their identity.

Since writing the above I have dissected the lately characterised goose, which affords additional proof of the utility of the study of the *cranium*, and also furnishes a corroboration that those authors who have *not* separated the geese from the bernacles are correct; this species forming a beautiful connecting link between the two: the plumage, colour of the beak, and legs, assimilate to the true geese, but the greater portion of its anatomy is that of the bernacles, particularly the head, as, were it not that it is one third larger, it might be taken, without attentive consideration, for that of *Anser Bernicla*, which it exactly resembles in the form of the bill, the height of the skull, and, wherein it particularly differs from all the other true geese, the large size of the super-orbital glands, and corresponding enlargement of the processes of the lachrymal bones and the depressions over the eyes for their attachment and insertion, although not near so much developed as in *Anser brenta*, in which these glands not only meet, but lap considerably over each other, and occupy a depression formed between the orbits for their reception.

65, *Great Russel St.*,
Bloomsbury Square.

[The new goose referred to above was described by Mr. Bartlett at the meeting of the Zoological Society, January 8th, 1839, under the name of *Anser phœnicopus*, or pink-footed goose. It bears a close resemblance to the bean goose *Anser segetum*, for which it is probable that it has often been mistaken; but it may readily be distinguished from that species by the legs and feet, which, in a living or recently-killed specimen, are of a reddish flesh colour or pink, while the legs and feet of the bean goose are of a yellowish orange; the bird is smaller, the bill shorter, and the plumage more inclined to grey than in the bean goose. Mr. Bartlett stated that he had examined twenty specimens of the new species, in all of which the above distinguishing characters were present.—*Ed.*]

ART. VIII.—*On the Artificial Arrangement of some of the more extensive Natural Orders of British Plants.* By FREDERICK JOHN BIRD, Esq.

(*Continued from Vol.* 2, *n. s., page* 609.)

LEGUMINOSÆ.

(*FABACEÆ*, Lindl.)

In the analysis of the genera of this order made by Dr. Lindley, the distinctions upon which the principal divisions (*Loteæ* and *Vicieæ*) are founded consist in the cotyledons rising above, or remaining beneath the ground during germination. To determine, however, which of these two conditions obtains, is frequently rendered very difficult from the rarity of specimens, or from their not being met with during the earlier stages of development; I have therefore been induced to construct the following table, without reference to the abovementioned divisional characters adopted by Dr. Lindley.

The British genera of *Leguminosæ* are contained within the Linnæan division *Diadelphia Decandria.*

Stamens monadelphous..................𝔄
Stamens diadelphous.....................𝔅

𝔄.

A.	Calyx 2-lipped	B.
	Calyx equal	C.
B.	Calyx with the upper lip entire	*Cytisus.*
	Calyx with the upper lip divided	D.
C.	Calyx inflated, 5-toothed, tubular	*Anthyllis.*
	Calyx close, 5-cleft, campanulate	*Ononis.*
D.	Calyx, upper lip with 3, lower lip with 2 teeth	*Ulex.*
	Calyx, upper lip 2-parted, lower lip 3-toothed	*Genista.*

𝔅.

A.	Leaves with tendrils	B.
	Leaves without tendrils	F.
B.	Calyx with 5 foliaceous segments	*Pisum.*
	Calyx 5-toothed	D.
C.	Style curved, flat, villous in front	*Lathyrus.*
	Style not curved, or at right angles with the ovary	E.
D.	Style villous at the upper side, fruit many-seeded	*Vicia.*
	Style smooth, fruit 2- or 4-seeded	*Ervum.*
E.	Leaves ternate	F.
	Leaves pinnate or absent	K.

F.	Flowers in loose racemes	*Melilotus.*
	Flowers in heads or dense spikes	G.
G.	Stipules ovate, leafy, pod apterous	*Lotus.*
	Stipules pointed, often awned	H.
H.	Legumes falcate or spiral	*Medicago.*
	Legumes straight	I.
I.	Legumes few-seeded	*Trifolium.*
	Legumes many-seeded	*Trigonella.*
K.	Leaves pinnate with an odd leaflet	L.
	Leaves abruptly pinnate or terminating in a *seta*	*Orobus.*
L.	Legumes 2-celled	M.
	Legumes many-celled	N.
M.	Carina obtuse	*Astragalus.*
	Carina ending in an exserted point	*Oxytropis.*
N.	Flowers yellow	*Hippocrepis.*
	Flowers red, white, or rose-coloured	O.
O.	Stem prostrate, pod with several joints and seeds	*Ornithopus.*
	Stem erect, pod with 1 joint and 1 seed	*Onobrychis.*

UMBELLIFERÆ.

(*APIACEÆ*, Lindl.)

The sub-divisions of this arrangement of the umbelliferous genera are those originally formed by DeCandolle, and which are also adopted in Lindley's 'Synopsis;' but the characters on which the "tribes" of the latter author are founded, namely, the primary and secondary ridges of the fruit, have not been employed, as from their minuteness in many cases, it frequently becomes difficult to determine the relative situations which they occupy.

The plants of this very natural assemblage are comprehended in the Linnæan group *Pentandria Digynia.*

Sub-divisions.

Fruit with the face flat	†
Fruit with the face rolled inwards at the edges, forming a longitudinal furrow	††
Fruit with the face curved inwards from base to apex	†††

†	Umbels simple, fascicled, or capitate, terminal	𝕬
	Umbels compound, terminal or lateral	𝕭

𝕬.

A.	Fruit smooth; laterally compressed	*Hydrocotyle.*
	Fruit rough with scales or prickles; roundish	B.
B.	Flowers in dense heads upon a scaly receptacle	*Eryngium.*
	Flowers in close umbels; fruit with hooked prickles	*Sanicula.*

B.

A.	Fruit compressed laterally	B.
	Fruit either rounded, or compressed dorsally	N.
B.	Calyx leafy, 5-toothed	*Cicuta.*
	Calyx obsolete or nearly so	C.
C.	Plants diœcious	*Trinia.*
	Plants hermaphrodite	D.
D.	Leaves simple, undivided	*Bupleurum.*
	Leaves compound, pinnate or divided	E.
E.	Fruit crowned with the persistent styles	F.
	Fruit not crowned with the styles	H.
F.	Styles straight	*Conopodium.*
	Styles reflexed	G.
G.	Umbels without any involucre	*Pimpinella.*
	Partial involucre present	*Sium.*
H.	Fruit apparently single	I.
	Fruit apparently double	M.
I.	Rays of the umbel not exceeding 4 or 5	*Sison.*
	Rays of the umbel numerous	K.
K.	Petals ovate, entire	*Helosciadium.*
	Petals inversely cordate, emarginate	L.
L.	Channels with single *vittæ;* leaflets linear	*Carum.*
	Channels without *vittæ;* leaflets ovate	*Ægopodium.*
M.	Involucra absent	*Apium.*
	Involucra present	*Petroselinum.*
N.	Fruit taper, or but slightly compressed	O.
	Fruit much compressed at the back	X.
O.	Ridges of the fruit prickly	*Daucus.*
	Ridges of the fruit not prickly	P.
P.	Fruit crowned with the persistent styles	Q.
	Fruit not crowned with the styles	R.
Q.	Styles straight	*Œnanthe.*
	Styles reflexed	*Seseli.*
R.	Involucra both absent	*Fœniculum.*
	Partial involucre present	S.
S.	Partial involucre 3-leaved, pendulous	*Æthusa.*
	Partial involucre many-leaved	T.
T.	Seeds unattached in the dried pericarp; lvs. fleshy.	*Crithmum.*
	Seeds attached in the pericarp; leaves not fleshy	U.
U.	Petals acute at both ends; leaflets finely divided	*Meum.*
	Petals obovate, emarginate	W.
W.	Leaflets nearly rhomboid, serrated; flowers white	*Ligusticum.*
	Leaflets linear, not serrated; flowers yellowish	*Silaus.*
X.	Fruit flattened, with a thick knotted margin	CC.
	Fruit flattened, winged, wings not knotted	Y.
Y.	Fruit with a double wing on each side	BB.
	Fruit dilated into a single wing on each side	Z.
Z.	Ridges of fruit equi-distant, channels with 1-3 *vittæ.*	*Peucedanum.*
	Two lateral ridges remote, channels with single *vittæ.*	AA.

AA.	*Vittæ* filiform, involucella absent or few-leaved......	*Pastinaca.*
	Vittæ clavate, involucella many-leaved	*Heracleum.*
BB.	Calyx 5-toothed, seeds with many *vittæ*...............	*Archangelica.*
	Calyx obsolete, channels with single *vittæ*............	*Angelica.*
CC.	Channels with single filiform *vittæ*.....................	*Tordylium.*
	Channels each with 3 *vittæ*	*Condylocarpus*

† †

A.	Fruit armed with prickles..................................	B.
	Fruit smooth, or nearly so................................	D.
B.	Fruit beaked..	*Anthriscus.*
	Fruit not beaked	C.
C.	Fr. with about 4 rows of prickles; rays of umbel 3..	*Caucalis.*
	Fr. covered with prickles; rays of umb. exceeding 4.	*Torilis.*
D.	Umbels without involucra..................................	*Smyrnium.*
	Umbels with at least a partial involucre...............	E.
E.	Fruit laterally compressed, linear	F.
	Fruit laterally compressed, ovate.........................	I.
F.	Fruit beaked..	*Scandix.*
	Fruit beakless..	H.
H.	Fruit with blunt ridges; pericarp solid	*Chærophyllum*
	Fruit with acute ridges; pericarp hollow..............	*Myrrhis.*
I.	Partial involucre 3-lvd. halved; ridges of fr. crenate.	*Conium.*
	Partial involucre many-lvd. ridges fine or depressed.	K.
K.	Flowers monœcious	*Echinophora.*
	Flowers hermaphrodite.....................................	*Physospermum*

† † †

Fruit globose, partial involucre halved .... *Coriandrum.*

The last-named genus is here enumerated as indigenous to this country, although it is still a matter of doubt whether it ought to be ranked as such; but the numerous and wild localities in which it has been found, together with its frequent abundance, tend considerably to strengthen the opinion of its being so.

(To be continued.)

Art. IX.—*Observations on the* Rodentia, *with a view to point out the groups as indicated by the structure of the* Crania, *in this Order of Mammals.* By G. R. Waterhouse, Esq., Curator to the Zoological Society, Vice-Pres. of the Entomological Society.

(Continued from page 96).

Family II.—Myoxidæ.

Dentition.—Incisors laterally compressed. Molares $\frac{4\,4}{4\,4}$, unequal in size, rooted; the series on each side of each jaw widely separated and parallel.

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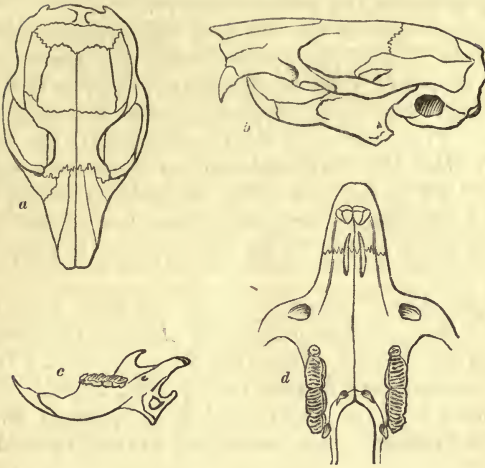

(*a*) Skull of *Graphiurus Capensis*, seen from above. (*b*) the same, seen laterally. (*c*) ramus of lower jaw of *Myoxus avellanarius*, (inner side. (*d*) skull of the same seen from beneath.

Skull.—Without any post-orbital process to the temporal bone; zygomatic process of maxillary bone consisting of a broad thin plate, the base of which occupies the whole space between the plane of the palate and that of the upper surface of the skull: this plate perforated by a tolerably large ant-orbital *foramen*. Palatine portions of intermaxillary, maxillary, and palate bones (in *Myoxus avellanarius*[1]) on the same plane. Incisive *foramina* long and narrow, situated partially in the intermaxillary and partially in the maxillary bones; palatine process of the maxillary terminating opposite the penultimate molar, and followed by a narrow palatine process of the palate bone. In the palato-maxillary suture are two large *foramina*, and there are two large posterior palatal *foramina*, one on each side, near the inner margin of the last molar. Glenoid cavity somewhat contracted.

Lower jaw with the descending *ramus* forming a quadrate process, which is sometimes perforated. The lower posterior angle of this process is incurved, and either angular or rounded and the upper posterior angle is acute and twisted outwards.

The drawings of the skulls of *Myoxus glis*, and *Graphiurus Capensis*, which illustrate M. F. Cuvier's paper in the 'Nouvelles Annales du Mus.' vol. i., together with some skulls

[1] I have not had an opportunity of examining the palate in the skulls of any other species of this family.

of *Myoxus avellanarius*, now before me, enable me to give the above characters of the present family.

The general form of the skull of the *Myoxidæ* is intermediate between that of the *Sciuridæ* and the *Muridæ*; the inter-orbital portion is more contracted than in the *Sciuridæ*, and the nasal bones are proportionately narrower and more elongated. The species of the present family are readily distinguished from the *Sciuridæ* by the want of a post-orbital process and the larger size of the ant-orbital *foramen*, which, instead of being placed far forward and low down, is situated in the thin plate which forms the zygomatic process of the maxillary bone.

The larger size of the ant-orbital *foramen* and the imperfect state of the palatine process of the palate-bone, lead us to the Jerboas (*Dipus*), where the form of the jaw bears a remarkable resemblance to that of *Myoxus*, as will be seen.

The genera *Myoxus* and *Graphiurus* contain all the species I am acquainted with belonging to the *Myoxidæ*.

Family III.—Gerboidæ.

Dentition.—Incisors laterally compressed. Molars $\frac{4\cdot4}{3\cdot3}$ or $\frac{3\cdot3}{3\cdot3}$, rooted and unequal in size; the series on each side of each jaw parallel and widely separated.

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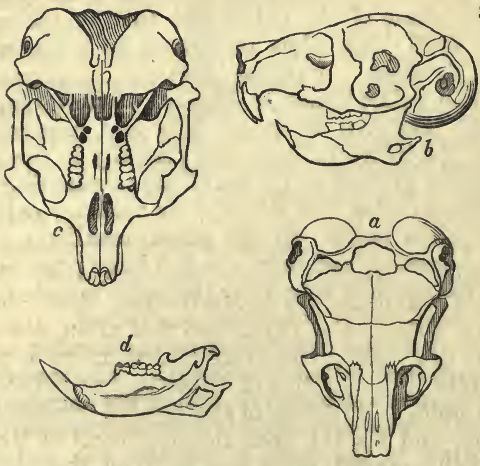


(*a*) Skull of *Dipus hirtipes*, seen from above. (*b*) the same seen laterally. (*c*) skull of *Dipus Ægyptius*, seen from beneath (*d*) ramus of lower jaw of ditto, inner side.

Skull.—Palatine portions of the intermaxillary, maxillary, and palatine bones on the same plane, or nearly so. Incisive *foramina* rather large, long and narrow, situated partly in the intermaxillaries and partly in the maxillary bones.—Orbits large, extending far back, and leaving but a narrow passage for the temporal muscle. *Ant-orbital foramen* very large. The arch which incloses the ant-orbital *foramen*, and separates this from the orbit, is formed by two bones, the superior maxillary bone and the malar, the latter running parallel with the former, and articulating with the lachrymal bone. The maxillary bone may be described as throwing out two processes, one superior and one inferior, which unite to form an arch. The superior process is thrown out from the plane of the upper surface of the skull, and the inferior is directed outwards from the plane of the palate, and is bifurcate, one portion being carried upwards to join the superior process and form the arch, and the other portion, directed backwards beneath the malar bone, assists in the formation of the *zygoma*. Zygomatic arches slender and curved downwards, so that their lower boundary is below the level of the palate, the hinder portion of the *zygoma* is horizontally compressed. The glenoid cavity somewhat contracted and oblique in its position, being directed forwards and inwards from the root of the zygomatic process of the temporal bone, and extending upon the sphenoid. Palatine process of palate bone continuing the plane of the palate beyond the line of the last molars. The inter-parietal bone is large and nearly of a semicircular form.

Lower jaw with the coronoid process rather small, the condyloid curved inwards: the descending *ramus* (or posterior coronoid process, according to Carus) is somewhat quadrate and perforated, angular in *Dipus*, and has the lower and posterior portion somewhat rounded in *Alactaga*. The *symphysis menti* is of but small extent.

My materials for drawing up the characters of the present group are very limited: skulls of *Dipus Ægyptius*, and two or three figures, are all I have at my command. M. F. Cuvier (in his 'Mémoire sur les Gerboises,' &c.[1]) has figured the skull of a species of *Dipus* and that of an *Alactaga*, and in both the descending *ramus* of the lower jaw is perforated.

The skulls of the species of *Dipus* are remarkable for the somewhat oblique direction of the glenoid cavity of the temporal bone, and for the great developement of the auditory *bullæ*, which encroach upon and contract the occipital portion of the *cranium*. A narrow band of the squamous portion of the temporal bone is extended backwards over the

[1] See 'Transactions of the Zoological Society,' Vol. ii. pl. 24.

auditory *bulla*, and joins a similar band which forms part of the supra-occipital bone. In the genus *Alactaga* the auditory *bullæ* are comparatively small, and the peculiar bands just described do not appear to exist.

In the form of the lower jaw the genus *Dipus* very closely resembles *Myoxus*, especially *My. avellanarius;* in both the descending *ramus* is perforated, and in *Myoxus* as in *Dipus* the glenoid cavity of the temporal bone is oblique, though in a less marked degree. On the other hand we find a considerable resemblance, in the palate and its *foramina*, between the animals of the present family and those of the genus *Gerbillus*.

The genera *Dipus*, *Alactaga*, and *Meriones* belong to the present family; I must observe however that the *Dipus Canadensis*, (which constitutes the genus *Meriones*, according to most of the *later writers*), presents a form of skull which, in many respects, is intermediate between the jerboas and the dormice (*Myoxidæ*). Comparing the lower jaw of *Dipus Ægyptius* with that of *Myoxus avellanarius*, we perceive that the coronoid process is proportionately larger in the latter; in this respect the *Meriones Canadensis* agrees with the dormouse; it also approaches more nearly to the last-mentioned animal in the comparatively small extent of the palatine portion of the palate bone. In the size of the ant-orbital *foramen*, the *Mer. Canadensis* is intermediate between the two animals with which we are comparing it. This *foramen* being larger than in *Myoxus*, and smaller than in *Dipus*. In *Mer. Canadensis*, as in the jerboas, the portion of the zygomatic process of the *maxilla* which forms the lower boundary of the ant-orbital passage is thrown out from the plane of the palate. The incisive *foramina* are larger in *Mer. Canadensis* than in *Myoxus avellanarius*, thus agreeing with *Dipus*.

(To be continued.)

Art. X.—*Observations on the application of Heliographic or Photogenic Drawing to Botanical Purposes; with an account of an economic mode of preparing the Paper: in a Letter to the Editor of the 'Magazine of Natural History.'* By Golding Bird, M.D., F.L.S., &c.

Sir,

The mode of fixing the images of the camera obscura, and copying engravings, by means of the chemical action of light on paper prepared with a solution of chloride of silver, has attracted so much notice, and produced so much popular excitement, that a few observations on this interesting process will not perhaps be considered out of place in your Magazine. I venture to occupy your pages with the less reluctance, because I feel that the application of this heliographic or photogenic art will be of immense service to the botanist, by enabling him to procure beautiful outline drawings of many plants, with a degree of accuracy which, otherwise, he could not hope to obtain.

That light will act on chloride of silver is by no means a novel discovery, and paper prepared with it was long ago used by Ritter and Wollaston, in testing the chemical action of the rays of the solar spectrum; still, in this country it was not, I believe, applied to any purpose likely to be of use to the naturalist and traveller, until brought into notice by the researches of Mr. Talbot. It is not a little amusing to observe how many pretenders to the discovery have started up since the announcement of Mr. Talbot's discovery, and that of M. Daguerre in France. The latter gentleman has, through M. Arago, at a late meeting of the French Institute, announced his mode of preparing a sensitive paper, far exceeding that of Mr. Talbot in delicacy, but otherwise possessing the same property of indicating intensity of light by depth of colour, and consequently differing from that marvellous preparation which he is said to possess, and which represents shadows by depth of colour, precisely as in nature.

M. Daguerre prepares his heliographic paper by immersing a sheet of thin paper in hydrochloric ether, which has been kept sufficiently long to be acid; the paper is then carefully and completely dried, as this is stated to be essential to its proper preparation. The paper is next dipped into a solution of nitrate of silver, (the degree of concentration of which is not mentioned), and dried without artificial heat in a room from which every ray of light is carefully excluded. By this process it acquires a very remarkable facility in being blackened on a very slight exposure to light, even when the latter is by no means intense, indeed by the diffused daylight of early evening in the month of February. This prepared paper rapidly loses its extreme sensitiveness to light, and finally becomes not more readily acted upon by the solar beams than paper dipped in nitrate of silver only. M. Daguerre renders his drawings permanent by dipping them in water, so as to dissolve all the undecomposed salt of silver.

This process is very inconvenient, for many reasons, among which are the difficulty of procuring, as well as the expense of, hydrochloric ether: on this account I prefer Mr. Talbot's process, although it is to be regretted that this gentleman has not stated more explicitly the proportions in which he uses the ingredients employed in the preparation of his sensitive paper. I have performed a set of experiments on this subject, and can recommend the following proportions as the most effective and economical. 200 grains of common salt are to be dissolved in a pint of water, and sheets of thin blue wove post paper saturated with the solution, which, for this purpose, should be poured into a dish, and, the paper being immersed, the application of the solution to every part should be ensured by the use of a sponge. The paper is then to be removed, drained of its superfluous moisture, and nearly dried by pressure between folds of linen or bibulous paper.

240 grains of fused nitrate of silver are then to be dissolved in 12 fluid ounces of water, and this solution is to be applied by means of a sponge to one side of each sheet of the previously prepared paper, which side should be marked with a pencil, so that when the paper is fit for use the prepared side may be distinguished. The sheets of paper are then to be hung upon lines in a dark room to dry, and when nearly free from moisture, their *marked* sides are to be once more sponged over with the solution of silver, and finally dried; they are then to be cut into pieces of convenient size, and preserved from light, or even too much exposure to air, by being wrapped up in several folds of brown paper, and kept in a portfolio.

The proportions above recommended are sufficient for the preparation of a quire of the kind of paper alluded to; if more of the salt of silver were used, the paper would indeed become darker by the action of light, but its expense would be proportionally increased: and when prepared in the manner directed, it assumes, by less than a minute's exposure to the rays of the sun, a rich mulberry brown tint, of sufficient intensity to define an outline very beautifully, which indeed is all that is required.

To use this paper, the specimen of which a drawing is required, is removed from the herbarium, placed on a piece of the paper, and kept *in situ* by a pane of common glass pressed by weights: a piece of plate glass, however, is preferable, as it is sufficiently heavy to press the plant close to the paper. The whole is then placed in the sunshine, and in less than a minute all the uncovered parts of the paper will assume a rich brown tint. The paper should then be removed from the direct influence of the sun, and placed in a book until the drawing be rendered permanent: the specimen, quite uninjured by the process, may then be replaced in the herbarium, and the drawing of another be taken, and so on. So rapidly is this process executed, that twenty-five or thirty drawings may be obtained in an hour, providing we are favoured with a direct sun-beam; if, however, we have only the diffused day-light, five or ten minutes, and sometimes even more, are required to produce a drawing with well-defined outlines.

If drawings of recent plants be required, specimens of proper size should be cut, and if not too rigid, placed on a piece of the paper, and kept in a proper position by means of a pane of glass, as in the case of dried specimens; but if the plant be rigid, the specimens should be placed for twenty-four hours between folds of blotting-paper, under a heavy weight, before placing them on the sensitive paper.

Having obtained as many drawings as are required, the next thing is to fix them, so that their otherwise evanescent character may not deprive them of their value. For this purpose place them in a dish, and pour cold water over them; allow them to soak for ten minutes, and then transfer them to, or sponge them over with, a solution, made by dissolving an ounce of common salt in half a pint of water, to which half a fluid ounce of the tincture of the sesqui-chloride of iron has been added. The drawings thus prepared may be dried by pressure between folds of linen, and exposure to the air; and may then be examined without danger. On looking at them every one must be struck with the extreme accuracy with which every scale, nay, every projecting hair, is preserved on the paper; the character and habit of the plant is most beautifully delineated, and if the leaves be not too opake, the venation is most exquisitely represented; (this is particularly the case with the more delicate ferns, as *Polypodium Dryopteris*). Among those classes of plants which appear to be more fitted than others for representation by this process, may be ranked the ferns, grasses, and umbelliferous plants; the photogenic drawings of the former, are indeed of exquisite beauty.

The fact of the object being white on a brown ground does not affect the utility of this mode of making botanic drawings; indeed, I almost fancy that their character is better preserved by this contrast of tint, than by a coloured outline on a white ground. Every one will be fully aware of the value of this process to the botanist, in obtaining drawings of rare plants preserved in the herbaria of others, and which he would otherwise have probably no means of obtaining.

If the drawing of a tree or large shrub be required, a box, blackened inside, having a hole at one end about 1¼ inch in diameter, must be provided; in this hole should be placed a lens of 5 or 6 inches focus; if one of longer focus be used, the dispersion of light becomes too great to ensure an accurate representation. When the tree or shrub is well illuminated by the solar beams, the lens should be presented towards it, at a distance varying of course with the height of the object. A piece of card-board should then be placed in the box, a little beyond the true focus of the lens, and the former moved until a well-defined bright image of the tree &c. is formed on the card, of course in an inverted direction. The box is then to be placed on any convenient support in this position, and a piece of the prepared paper fixed on the card, the lid of the box is then to be closed, and the whole left for half an hour, at the end of which time a beautifully accurate outline of the object will be found on the paper, which is then to be rendered permanent in the usual manner. It is obvious that this plan is unavailable on a windy day, on account of the branches of the tree &c. being continually moving, so that it is of far less use to the botanist than the above described process for obtaining drawings of small specimens.

Various other applications of this paper will suggest themselves to the minds of naturalists, but having far exceeded my intended limits, I conclude by subscribing myself,

Yours very faithfully,
GOLDING BIRD, M.D.

22, *Wilmington Square*,
March 25*th*, 1839.

THE

MAGAZINE OF NATURAL HISTORY.

APRIL, 1839.

THE Memoir of Madame Power upon the Paper Nautilus and the cephalopodous animal as yet its only known occupant, originally published in the Proceedings of the Academy of Catania, is concluded in our present number: and to those who feel at all curious upon the subject, the history of this lady's researches will furnish matter of extreme interest. To us it appears that the observations of Madame Power, in connection with evidence subsequently drawn from materials in her possession, all but demonstrate the relation between the poulp and the argonaut-shell, to be one of *necessity* and not of *convenienee*. At all events, this long-disputed question will henceforward hold a position very different to that which it has for a long period occupied; for it will hardly now be asserted that the arguments for and against the parasitic hypothesis are equally balanced. We admit that in some particulars Madame Power's descriptive details are open to objection, as being sometimes evidently inaccurate; but this, to a great extent, may be explained as a consequence resulting from her want of physiological knowledge, and partly from a very natural wish on her part not to appear ignorant of things which she supposed *every body knew*. Fortunately it happens that some of the more important facts bearing upon the question at issue, although originating in the researches of this lady, do not rest upon her individual testimony as the sole authority for their existence. M. Sander Rang has fully confirmed all that she has stated of the manner in which the poulp applies its palmated or sail-arms to the keel and sides of the shell; and Professor Owen, at a recent meeting of the Zoological Society, communicated the result of his own observations upon the materials placed at his disposal by Madame Power. In a series of *ova* exhibiting various stages of developement, he found in those most advanced the contained embryo having the distinction of body and head established; the pigment of the eyes, the ink in the ink-bladder, the pigmental spots on the skin were distinctly apparent; the siphon, the beak, and the arms were also discriminated by a low microscopic power; but no trace of the shell. Now Madame Power has uniformly asserted that the young poulp is excluded *naked* from the egg, although fully cognisant of Poli's belief that he had detected the embryo-shell within the *ovum;* and the result of Prof. Owen's examination is therefore strong presumptive evidence in favor of her statement. With respect to the supposed exception among the testaceous *Mollusca* which the young of the poulp would form, (granting the condition of its naked exclusion from the egg), and the consequent inference which might be drawn in favor of the parasitic theory, Mr. Owen observed that the mode of the development of the *ova* of *Mollusca* has not been investigated even to the amount of one per cent., so that the data are far too imperfect for arriving at even a general law respecting the existence of the shell within the *ovum*, and much less one so precise as almost to prohibit the possibility of a cephalopod that is born naked secreting a shell some days afterwards. The collection of argonauts with the respective animals brought by Madame Power on her present visit to this country, consists of twenty specimens in all stages of growth. In every case Mr. Owen found that the position of the cephalopod with respect to the shell corresponded to that in the pearly nautilus; in the young specimens the body of the cephalopod was exactly adapted to the whole cavity of the shell, but was withdrawn from the apex in those of a larger size, and the deserted place filled with the mucous secretion or *ova* of the animal. The argonaut-shells which had been perforated or fractured by Madame Power, and subsequently repaired whilst in her possession, went very far towards convincing us that the two kinds of repairing material which we have described on a former occasion[1] are deposited by one and the same mollusc, being merely different stages of a continued secretive process. Perhaps, however, the most convincing argument put forward by Mr. Owen, is this. The young cephalopod grows rapidly, and a uniform correspondence is found between its size and that of the shell which it inhabits; consequently, upon the parasitic hypothesis, the young *Ocythoë* must be engaged in waging continual warfare with the hypothetical true constructors of the argonaut shell, and the number of these hypothetical true constructors must infinitely exceed the number of the hypothetical parasitic occupiers; now from the abundance in which Madame Power has procured cephalopods and shells, the hypothetical true constructors ought to swarm in the port of Messina, and yet this great desideratum in the science of Malacology has not only evaded her observation, but the observation of all other collectors who have explored the coasts of the Mediterranean.

The entire summary of Mr. Murchison's researches upon the group of ancient fossiliferous rocks, to which he has applied the term "Silurian System," has appeared in two quarto volumes, accompanied by a splendid suite of maps and illustrations. Altogether we think this work must be regarded as the most important memoir, of a purely geological character, that has ever appeared in this, or perhaps any other country. Nothing but the high reputation with which Mr. Murchison's name must always be associated wherever Geology is known as a science, in connection with the "Silurian System," can in any way recompense him for the labour it must have cost in its production. We make this casual allusion to the appearance of the work, reserving for another occasion a more extended notice of its contents.

The Report by Mr. De la Beche on the Geology of Devon, and critical notices of many other geological works acknowledged on our wrapper, and with which our library table is almost covered, are, from the pressure of original articles, postponed for the present.

A work has been published within the last few days, entitled 'Proceedings of the Botanical Society of London, from July, 1836, to November, 1838.' We imagine that the majority of metropolitan botanists would feel somewhat indignant if the condition of botanical science in the capital of Britain were to be, in any way, tested by the contents of this vo-

[1] 'Mag. Nat. Hist.' n. s. vol. i. page 528.

lume. The anxiety of the Council to see their own names, or the name of the Society, in print, has overreached their discretion, or they certainly would have avoided a public record of their proceedings, so long as the reading of articles from foreign journals, in lieu of *original* papers, occupied the business of their monthly meetings. Belonging to the Society in question, we feel at liberty thus to express our sentiments, because we think the volume, taken as a whole, is not creditable to the Society, and calculated rather to keep it in the rear, instead of contributing to place it on a level with other bodies of a kindred nature. The plant allied to *Nymphæa*, and transmitted to this country from Guana by Schomburgh, is figured and described under the name *Victoria Regina*, Schomburgh, though in the 'Magazine of Zoology and Botany,' vol ii. page 440, it is published as *Victoria Regina*, Gray. The Society, it appears, has adopted this plant as its emblem, the Queen having, in accordance with the wish of its discoverer, granted permission for the use of her name to designate the genus. Should Her Most Gracious Majesty Queen Victoria have the curiosity to look at the description of this *Royal plant*, what must be her astonishment, if the *elements* of Botany and the *rudiments* of Latin have formed a part of Her Majesty's education, to find that under the sanction of the Botanical Society of London, or at any rate that of the Council, this said Royal plant, *Victoria Regina*, is characterised as having "*foliis orbiculatis, supra reticulato areolatis utrinque glabro; nervis venisque subtus prominentis aculeatis.*"

Messrs. Doubleday and Foster have been welcomed on their return from America, with a dinner by their entomological friends, principally intended as a public acknowledgment for the time and expense devoted by these two gentlemen to the advancement of science, and the liberal manner in which they intend to dispose of the rich collection formed during their travels.[1] On this occasion the uniform cordiality and kindness they had experienced among American naturalists, was spoken of in the warmest terms of grateful recollection.

It will be seen by a notice on the second page of the wrapper, that with the May number of this Magazine a supplementary part, containing plates will be issued. The introduction of Memoirs illustrated by plates constitutes a new feature in the publication of this journal, and one to which we respectfully invite the attention and support of our subscribers. We have long considered the limiting the illustrations to wood-cuts a

[1] It is understood that the collection will be distributed among the public cabinets of the metropolis.

drawback to the Magazine, not only from its excluding certain papers which would otherwise gain insertion, but by its preventing the work from taking that rank in scientific literature to which the number and character of its contributors fairly entitle it. We have thought it better to publish the plates in a separate form, rather than to make an alteration in the price of the Magazine, intending the purchase of the supplement, (after the issue of the *first* number), to be quite optional with the subscribers. It is proposed to publish about three of these supplementary parts in the course of a twelvemonth, and not in any way to reduce the number of woodcuts in the body of the Magazine.

SHORT COMMUNICATIONS.

Limnoria terebrans in Plymouth Harbour.—In my paper on the *Teredo* and *Limnoria* (vol. ii. n. s. page 206) I stated that I had submitted Kyanized wood to the test of the action of the *Limnoria;* accordingly on the 12th of January, 1838, I placed the following pieces of wood on the piles of the Pitch-House Jetty, in Plymouth Dock-Yard, at low water; a piece of American deal, 4 inches by $10\frac{3}{4}$ thick; also a piece of similar dimensions, which had been soaked for two months in a saturated solution of arsenic; and two others which had been prepared with Kyan's solution, by W. Evans, Esq., the agent of the patentee in this town. On the 12th of the following August, the pieces having all been under water for seven months, were taken up by some of the dock-yard men in presence of Mr. Churchward and myself, and they are now in my possession. It was found that the protected pieces had all been acted on, though not to quite so great an extent as the plain piece of deal; but the specimens were dotted with *Balani* and *Flustræ,* and all contained *living Limnoriæ,* and it was evident that, though retarded, the destruction of the wood would, in a few months more, have been equally as certain as where none of the above preparations had been employed.

It appears to me highly improbable that any protection can be afforded in cases of this kind, from the employment of soluble substances; for in the instance of the solution of oxide of arsenic, or of the bi-chloride of mercury (corrosive sublimate), which Kyan's solution is known to be, it is evident that any additional quantity of fluid coming in contact with it, will dilute it, or re-dissolve any of the salt which might have been deposited in the pores of the wood, by drying; the continual washing of the sea will effectually clear the surface of the wood of any deleterious matter; and although the foremost depredators may perish in making a lodgement in the interior, yet myriads are ready to supply their places, and to maintain the ground already gained, while the continued action of the water will tend to assist them in their efforts: hence I am of opinion that we have not discovered in Kyan's solution a certain remedy against the destruction of wooden erections in any of the estuaries around our island.

Since the publication of my paper the Lords of the Admiralty have ordered the flooring of the south building-slip in this dock-yard to be removed, and replaced with stone.

I have just learned that two arches of the wooden bridge at Teignmouth have fallen down, in consequence of the piers having been destroyed by the *Teredo;* so that we have here found another locality for that animal.—*Edward Moore, M.D.—Plymouth, Sept. 20th*, 1838.

Ignes fatui.—The existence of this meteor, which I have endeavoured to confirm in your journal against the doubts of a correspondent, derives additional support from a statement communicated in Poggendorf's 'Annalen,' No. 6, 1838, p. 366, by Prof. Bessel, who made his observations in a perfectly calm and misty December night. The phenomenon consisted in numerous little flames, which originated over ground in many places covered with stagnant water, and disappeared, after having shone forth a short time. The colour of these flames was somewhat bluish, like that of the impure hydrogen generated from iron filings and dilute sulphuric acid.— The observation was made on one of the large moors in the Duchy of Bremen, at the distance of a few leagues from the observatory of Lilienthal. On the ground where the *ignes fatui* were seen, much peat had been dug out, and the surface is consequently uneven. There were hundreds of lights, each of which lasted about a quarter of a minute. They would often remain in the same place, but often also move horizontally; great numbers of them were commonly put into motion together. These movements were, no doubt, effected by currents of air, which were not perceived at the place where Prof. Bessel was. It will be perceived that in every essential particular the observation agrees with that communicated by me.—*W. Weissenborn.—Weimar, Jan. 20th*, 1839.

Curious capture of a White-headed Eagle.—In the menagery at the Pfaueninsel, near Potsdam, there is a white-headed eagle (*Falco albicilla*), which was caught in the following curious manner. It was seen to pounce upon a sturgeon in the river Havel, but the fish was too heavy to be lifted into the air by the bird, though not strong enough to draw the latter, which struggled with its wings, under the water.—Thus the fish rushed along on the surface, the two animals looking much like a boat with the sails spread, until both were secured by some people who went after them in a boat. —*Id.*

Capture of an Eagle at Swaffham.—About the end of December last a large eagle was observed on Beachamwell warren, about three miles from Swaffham, where it made great destruction among the rabbits. The warreners tried every scheme to entrap it, but without success; as it would not come down to a bait. On the 5th instant one of the keepers of John Motteux, Esq., saw it fly into a plantation adjoining the warren, and by sending a person to the farther side, it was frightened towards him, when he got a shot at it and killed it. It proved to be the white-tailed or cinereous eagle (*Falco albicilla*, Linn.), weighing 10¾ lbs., and measuring between the tips of the wings 7 ft. 5 inches; it was a male bird, but not in the adult plumage, the general colour being light brown, and the tail feathers not perfectly white. I have preserved it in my collection of British birds, and on skinning it found it a complete mass of fat.

There was a pair of the long-tailed duck (*Anas glacialis*, Linn.) killed in the beginning of February, in the neighbourhood of Lynn, but I was not fortunate enough to get them. Two pairs of the red-breasted merganser (*Mergus serrator*, Linn.) were shot about the same time.—*Henry Dugmore, Rector of Pensthorp.—Swaffham, March 12th*, 1839.

Early appearance of the common Bat.—I have, the last two years, observed an unusually early appearance of the common bat (*Vespertilio pipistrellus*). On the 6th of March, 1838, at 1 o'clock, P.M., it being a bright, warm, sunny day, I observed one of these animals flitting about in search of food, in a garden at Poole, in Dorsetshire; and although it frequently flew to a considerable distance, it returned again and again to the same locality, and I continued watching it for a considerable period. On the following day a similar circumstance occurred in another garden at Poole. This year I have observed a still earlier appearance of this little animal, viz., on the 23rd of February. I was riding on that day from Brading to Ryde, in the Isle of Wight, at about half-past 5, P.M. The weather was warm and serene, and the light of the moon was succeeding to that of the sun, which had lately set, when I observed a bat hovering about precisely as in a summer evening. Before arriving at Ryde I saw two more of these little creatures, but have not observed any since that date.—*T. Bell Salter.*—*Ryde, March 15th*, 1839.

Note on the Hirundinidæ.—On Wednesday, July the 25th, 1838, about a mile from Blackburn, I saw an immense multitude of swifts (*Cypselus Apus*); there were several hundreds of them: the locality was a print-work and a factory, turned by a water-wheel, a large lodge of water, and several streams, close by the river Darwen; this is always a favourite haunt of the whole of the swallow tribe, and they are generally met with there in great numbers, but so large an assemblage of swifts I never saw before, for of late years there have been very few of them. Could they, at that early period be preparing for their annual migration?

On Friday, October 19th, 1838, I saw three swallows hovering in the streets of Blackburn; they were busy hawking for flies, were strong on the wing, and apparently adult birds. —*John Skaife.*—*Blackburn, Oct. 21st*, 1838.

Improvements in the Microscope.—In the 'Magazine of Natural History' for June, 1838, page 345, was inserted a notice of improvements in the microscope, made by myself. I have now to inform you of an additional improvement for *equalizing the light*, and of a facility *in adjusting the focus*, which now scarcely leaves anything to be wished, in the use of this most invaluable instrument of research in its improved state.

To *equalize the light*, I have mounted upon the top of my graduating tube, *an exceedingly finely greyed plate of glass*, and by this means produce the effect, so very desirable, of a cloud. I thus entirely get rid of the unpleasant glare and glitter produced by the use of a candle or lamp. The *greying effect* was produced on the surface of the glass plate by the employment of emery, which was suspended in water half a minute, and was thus *levigated in a very high degree indeed.*

The *adjustment of the focus*, so highly necessary to accompany every change in the position of an object, I now effect as follows. I have before stated that Mr. Andrew Ross had effected the minute adjustment of the focus, by a fine screw with a milled head. Now, this milled head is placed upon the top of the stem of the microscope, and I had *only to bring the left hand into use*, instead of letting it lie idle as usual, and to employ it to turn the milled screw-head; and I thus at once constantly effected the minute adjustment of the focus with every change in the position of the object.

I hardly need expatiate upon this great advantage in the use of the microscope. The right hand is fully employed in effecting the crossing motions of the stage; and thus both hands are most usefully engaged: indeed, after fifty years of constant use of the microscope, I can truly say that it is only now that I am perfectly satisfied in the employment of that instrument.—*Thomas Gill.*—125, *Strand*, *March* 23*rd*, 1839.

Anomalous Insect found in Spongilla fluviatilis.—At the meeting of the Entomological Society held on the 3rd of December, 1838, Mr. Westwood read the description of a minute and anomalous species of insect recently discovered as the inhabitant of the *Spongilla fluviatilis*. These little insects are scarcely more than one eighth of an inch long, and of a pale green colour, with six moderately long legs, having, at first sight, much of the appearance of *Aphides*. They are, however, apterous, and of a very peculiar structure, so that not only is the family doubtful to which they belong, but even the order and class. The *antennæ* are about half the length of the body and very slender, and the mouth consists of four naked *setæ*, exceedingly delicate, porrected, and equalling the *antennæ* in length; they arise in pairs at a short distance apart, and are not inclosed in any sheath, like the *setæ* of *Hemiptera*. The body is clothed with numerous long hairs, and each of the abdominal segments is furnished at the sides with a pair of long, flattened, articulated filaments, somewhat like those of the *larva* of *Sialis lutaria*, which are evidently organs of respiration, and are kept in constant agitation in their watery abode. Mr. Westwood is doubtful whether, notwithstanding several of their characters, these insects ought not to be regarded as having arrived at their full growth, as they possess certain points of resemblance with the permanently apterous *Coccidæ* and *Aphidæ*, whilst there is no tribe or family of insects of which they can be regarded as the *larvæ*, (except perhaps the anomalous genus *Acentropus*, that has been regarded by Stephens as *Neuropterous*, Curtis as *Trichopterous*, and Westwood as *Lepidopterous*, and of which the *larva* is unknown).

Mr. Hogg, F.L.S., by whom these insects were discovered, during a series of minute investigations upon the *Spongilla*, has arrived at the conclusion that the motions of these insects, and the undulations which they produce in the water, have been mistaken by Laurenti and others for movements of the sponge itself, and which they have accordingly regarded as affording proofs of the animality of that substance.

THE MAGAZINE

OF

NATURAL HISTORY.

MAY, 1839.

ART. I.—*Extracts from the Proceedings of the Geological Society of London, relating to the supposed Mammiferous Remains of the Stonesfield Oolitic Strata.*[1]

"*Nov.* 21, 1838.—A paper was first read 'On the jaws of the *Thylacotherium Prevostii* (Valenciennes) from Stonesfield,' by Richard Owen, Esq., F.G.S., Hunterian Professor, Royal College of Surgeons.

"Doubts having been recently expressed by M. de Blainville, from inspection of casts, respecting the mammiferous nature of the fossil jaws found at Stonesfield, and assigned to the *Marsupialia* by Baron Cuvier, Mr. Owen brought the paper before the Society to meet the objections, and to give a detailed account of the fossils from a careful inspection of the originals.—In this communication, however, he confined his description chiefly to the jaws of one of the two genera which have been discovered at Stonesfield, and characterised by having eleven molars in each *ramus* of the lower jaw, reserving to a future occasion an account of the remains of the other genus.

"Mr. Owen commences by observing that the scientific world possesses ample experience of the truth and tact with which the illustrious Cuvier formed his judgments of the affinities of an extinct animal from the inspection of a fossil fragment; and that it is only when so distinguished a comparative anatomist as M. de Blainville questions the determinations, that it becomes the duty of those who possess the means, to investigate the nature of the doubts, and reassure the confidence of geologists in their great guide.

"When Cuvier first hastily examined at Oxford, in 1818, one of the jaws described in this paper, in the possession of Dr. Buckland, he decided that it was allied to the *Didelphys*, (me semblèrent de quelque didelphe[2]); and when doubts were raised by M. Constant Prevost, in 1824[3], relative to the age of the Stonesfield slate, Cuvier, from an examination of a drawing made for the express purpose, was confirmed in his former determination; but he added, that the jaw differs from that of all known carnivorous *Mammalia*, in having ten molars in a series in the lower jaw: "il [the drawing] me confirme dans l'idée que la première inspection m'en avoit donnée.—

[1] For other papers upon this subject by M.M. De Blainville and Valenciennes, see 'Mag. Nat. Hist.' vol. ii. n. s., p. 639, and vol. iii. pp. 1 & 49.

[2] 'Ossemens Foss.' tome iii. p. 349.

[3] 'Annales des Sciences Nat.' Avril, 1825; also the papers of Mr. Broderip and Dr. Fitton in the Zoological Journal, 1828, vol. iii. p. 409.

C'est celle d'un petit carnassier dont les mâchelières ressemblent beaucoup à celles des sarigues; mais il y a dix de ces dents en série, nombre que ne montre aucun carnassier connu." (Oss. Foss. 111. 349. note). It is to be regretted that the particular data, with the exception of the number of the teeth, on which Cuvier based his opinion, were not detailed; but he must have been well aware that the grounds of his belief would be obvious, on an inspection of the fossil, to every competent anatomist: it is also to be regretted that he did not assign to the fossil a generic name, and thereby have prevented much of the reasoning founded on the supposition that he considered it to have belonged to a true *Didelphys*.

"Mr. Owen then proceeded to describe the structure of the jaw; and he stated that having had in his possession two specimens of the *Thylacotherium Prevostii*, belonging to Dr. Buckland, he has no hesitation in declaring that their condition is such as to enable any anatomist, conversant with the established generalizations in comparative osteology, to pronounce therefrom not only the class, but the more restricted group of animals to which they have belonged. The specimens plainly reveal, first, a convex articular condyle; secondly, a well-defined impression of what was once a broad, thin, high, and slightly recurved, triangular, coronoid process, rising immediately anterior to the condyle, having its basis extended over the whole of the interspace between the condyle and the commencement of the molar series, and having a vertical diameter equal to that of the horizontal *ramus* of the jaw itself: this impression also exhibits traces of the ridge leading forwards from the condyle and the depression above it, which characterises the coronoid process of the zoophagous marsupials; thirdly, the angle of the jaw is continued to the same extent below the condyle as the coronoid process reaches above it, and its apex is continued backwards in the form of a process; fourthly, the parts above described form one continuous portion with the horizontal *ramus* of the jaw, neither the articular condyle nor the coronoid being distinct pieces, as in reptiles. These are the characters, Mr. Owen believes, on which Cuvier formed his opinion of the nature of the fossil; and they have arrested the attention of M. Valenciennes, in his endeavours to dissipate the doubts of M. de Blainville.[1]

"From the examination of a cast the latter, however, has been induced to infer that there is no trace of a convex condyle, but in place thereof an articular fissure, somewhat as in the jaws of fishes; that the teeth, instead of being imbedded in sockets, have their fangs confluent with or anchylosed to the substance of the jaws, and that the jaw itself presents evident traces of the composite structure.

"In answer to the first of these positions, Mr. Owen states that the portion of the true condyle which remains in both the specimens of *Thylacotherium* examined by Cuvier and M. Valenciennes, clearly shows that the condyle was convex, and not concave. It is situated a little above the level of the grinding surface of the teeth, and projects beyond the vertical line dropped from the extremity of the coronoid process, but not to the same extent as in the true *Didelphys*. In the specimen examined by M. Valenciennes, the condyle corresponds in position with that of the jaw of the *Dasyurus* rather than the *Didelphys;* it is convex, as in mammiferous animals, and not concave as in oviparous. The entire convex condyle exists in the specimen belonging to the other genus, *Phascolotherium*, now in the British Museum, but formerly in the cabinet of Mr. Broderip. Mr. Owen is of opinion that the entering angle or notch, either above or below

[1] 'Comptes Rendus,' 1838; Second Semestre, No. 11, Sept. 10, p. 527 *et seq*.

the true articular condyle, has been mistaken for "une sorte d'échancrure articulaire, un peu comme dans les poissons."

"The specimen of the half-jaw of the thylacothere examined by M. Valenciennes, like that which was transmitted to Cuvier, presents the inner surface to the observer, and exhibits both the orifice of the dental canal and the symphysis in a perfect state. The foramen in the fossil is situated relatively more forward than in the recent opossum and dasyure, or in the placental *Insectivora*, but has the same place as in the marsupial genus *Hypsiprymnus*. The symphysis is long and narrow, and is continued forward in the same line with the gently convex inferior margin of the jaw, which thus tapers gradually to a pointed anterior extremity, precisely as in the marsupial *Insectivora*. In the relative length of the symphysis, its form and position, the jaw of the *Thylacotherium* precisely corresponds with that of the *Didelphys*.

"In addition, however, to these proofs of the mammiferous nature of the Stonesfield remains, and in part of their having belonged to *Marsupialia*, Mr. Owen stated that the jaws exhibit a character hitherto unnoticed by the able anatomists who have written respecting them, but which, if co-existent with a convex condyle, would serve to prove the marsupial nature of a fossil, though all the teeth were wanting.

"In recent marsupials the angle of the jaw is elongated and bent inwards in the form of a process, varying in shape and development in different genera. In looking, therefore, directly upon the inferior margin of the marsupial jaw, we see, in place of the edge of a vertical plate of bone, a more or less flattened triangular surface or plate of bone extended between the external ridge and the internal process or inflected angle. In the opossum this process is triangular and trihedral, and directed inwards with the point slightly curved upwards and extended backwards, in which direction it is more produced in the small than in the large species of *Didelphys*.

"Now, if the process from the angle of the jaw in the Stonesfield fossil had been simply continued backwards, it would have resembled the jaw of an ordinary placental carnivorous or insectivorous mammal; but in both specimens of *Thylacotherium*, the half-jaws of which exhibit their inner or mesial surfaces, this process presents a fractured outline, evidently proving that when entire it must have been produced inwards or mesially, as in the opossum.

"Mr. Owen then described in great detail the structure of the teeth, and showed, in reply to M. de Blainville's second objection, that they are not confluent with the jaw, but are separated from it at their base by a layer of matter of a distinct colour from the teeth or the jaw, but evidently of the same nature as the matrix; and secondly, that the teeth cannot be considered as presenting an uniform, compressed, tricuspid structure, and being all of one kind, as M. de Blainville states, but must be divided into two series as regards their composition. Five, if not six, of the posterior teeth are quinque-cuspidate, and are *molares veri;* some of the *molares spurii* are tricuspid and some bicuspid, as in the opossums. An interesting result of this examination is the observation that the five cusps of the tuberculate molars are not arranged, as had been supposed, in the same line, but in two pairs placed transversely to the axis of the jaw, with the fifth cusp anterior, exactly as in the *Didelphys*, and totally different from the structure of the molars in any of the *Phocæ*, to which these very small *Mammalia* have been compared: and in reference to this comparison, Mr. Owen again calls attention to the value of the character of the process continued from the angle of the jaw, in the fossils, as strongly contradistinguishing them from the *Phocidæ*, in none of the species of which is the angle of the jaw so produced. The *Thylacotherium* differs from the genus *Didelphys* in the greater number of its molars, and from every ferine quadruped known at the time when Cuvier formed his opinion respecting the nature of the fossil. This difference in the number of the molar teeth, which Cuvier urged as evidence of the generic distinction of the Stonesfield mammiferous fossils, has since been regarded as one of the proofs of their saurian nature; but the exceptions by excess to the number seven, assigned by M. de Blainville to the molar teeth in each *ramus* of the lower jaw of the insectivorous *Mammalia*, are well established and have been long known. The insectivorous chrysochlore, in the order *Feræ*, has eight molars in each *ramus* of the lower jaw; the insectivorous armadillos have not fewer; and in one subgenus (*Priodon*) there are more than twenty molar teeth on each side of the lower jaw. The dental *formulæ* of the carnivorous *Cetacea*, again, demonstrate the fallacy of the argument against the mammiferous character of the *Thylacotherium* founded upon the number of its molar teeth. From the occurrence of the above exceptions in recent placental *Mammalia*, the example of a like excess in the number of molar teeth in the marsupial fossil ought rather to have led to the expectation of the discovery of a similar case among existing marsupials; and such an addition to our zoological catalogues has, in fact, been recently made. In the Australian quadruped described by Mr. Waterhouse under the name of *Myrmecobius*, an approximation towards the dentition of the *Thylacotherium* is exemplified, not only in the number of the molar teeth, which is nine on each side of the lower jaw in the *Myrmecobius*, but also in their relative size, structure, and disposition. Lastly, with respect to the dentition, Mr. Owen says it must be obvious to all who inspect the fossil, and compare it with the jaw of a small *Didelphys*, that contrary to the assertion of M. de Blainville, the teeth and their fangs are arranged with as much regularity in one as in the other, and that no argument of the saurian nature of the fossil can be founded on this part of its structure.

"With respect to M. de Blainville's assertion that the jaw is compound, Mr. Owen stated, that the indication of this structure near the lower margin of the jaw of the *Thylacotherium* is not a true suture, but a vascular groove, similar to that which characterises the lower jaw of *Didelphys*, opossum, and some of the large species of *Sorex*."

"*Dec.* 9, 1838.—A paper on the *Phascolotherium*, being the second part of the "Description of the remains of marsupial *Mammalia*, from the Stonesfield slate," by Richard Owen, Esq., F.G.S., was read.

"Mr. Owen first gave a brief summary of the characters of the *Thylacotherium*, described in the first part of the memoir, and which he conceives fully prove the mammiferous nature of that fossil. He stated that the remains of the split condyles in the specimen demonstrate their original convex form, which is diametrically opposite to that which characterises the same part in all reptiles and all *ovipara*;—that the size, figure and position of the coronoid process are such as were never yet witnessed in any except a zoophagous mammal endowed with a temporal muscle sufficiently developed to demand so extensive an attachment for working a powerful carnivorous jaw;—that the teeth, composed of dense ivory, with crowns covered with a thick coat of enamel, are everywhere distinct from the substance of the jaw, but have two fangs deeply embedded in it;—that these teeth, which belong to the molar series, are of two kinds; the hinder being bristled with five cusps, four of which are placed in pairs transversely across the crown of the teeth, and the anterior or false molars, having a different form, and only two or three cusps—characters never yet found united in the teeth of any other than a zoophagous mammiferous quadruped;—that the general form of the jaw corresponds with the preceding more essential indications of its mammiferous nature. Fully impressed with the value of these characters, as determining the class to which the fossils belonged, Mr. Owen stated that he had sought in the next place for secondary characters which might reveal the group of *Mammalia* to which the remains could be assigned, and he had found in the modification of the angle of the jaw, combined with the form, structure, and proportions of the teeth, sufficient evidence to induce him to believe that the *Thylacotherium* was a marsupial quadruped.

"Mr. Owen then recapitulated the objections against the mammiferous nature of the thylacotherian jaws, from their supposed imperfect state, and repeated his former assertion, that they are in a condition to allow of these characters being fully ascertained: he next reviewed, first, the differences of opinion with respect to the actual structure of the jaw; and secondly, to the interpretation of admitted appearances.

"1. As respects the structure.—It has been asserted that the jaws must belong to cold-blooded *Vertebrata*, because the articular surface is in the form of an entering angle; to which Mr. Owen replies that the articular surface is supported on a convex condyle, which is met with in no other class of *Vertebrata* except in the *Mammalia*. Again, it is asserted that the teeth are all of an uniform structure, as in certain reptiles; but, on reference to the fossils, Mr. Owen states it will be found that such is not the case, and that the actual difference in the structure of the teeth strongly supports the mammiferous theory of the fossils.

"2. With respect to the argument founded on an interpretation of structure which really exists, the author showed that the *Thylacotherium* having eleven molars on each side of the lower jaw, is no objection to its mammiferous nature, because among the placental *Carnivora*, the *Canis Megalotis* has constantly one more grinder on each side of the lower jaw than the usual number; because the *Chrysochlore* among the *Insectivora* has also eight instead of seven molars in each *ramus* of the lower jaw; and the *Myrmecobius*, among the *Marsupialia*, has nine molars on each side of the lower jaw; and because some of the insectivorous armadillos and zoophagous *Cetacea* offer still more numerous and reptile-like teeth, with all the true and essential characters of the mammiferous class. The objection to the false molars having two fangs Mr. Owen showed was futile, as the greater number of the spurious molars in every genus of the placental *Feræ* have two fangs, and the whole of them in the *Marsupialia*. If the ascending *ramus* in the Stonesfield jaws had been absent, and with it the evidence of their mammiferous nature afforded by the condyloid, coronoid and angular processes, Mr. Owen stated that he conceived the teeth alone would have given sufficient proof, especially in their double fangs, that the fossils do belong to the highest class of animals.

"In reply to the objections founded on the double fangs of the *Basilosaurus*, Mr. Owen said that the characters of that fossil not having been fully given, it is doubtful to what class the animal belonged; and, in answer to the opinion that certain sharks have double fangs, he explained that the widely bifurcate basis supporting the tooth of the shark, is no part of the actual tooth, but true bone and ossified parts of the jaw itself, to which the tooth is anchylosed at one part, and the ligaments of connexion attached at the other. The form, depth and position of the sockets of the teeth in the *Thylacotherium* are precisely similar to those in the small opossums. The colour of the fossils, Mr. Owen said, could be no objection to those acquainted with the diversity in this respect, which obtains in the fossil remains of *Mammalia*. Lastly, with respect to the *Thylacotherium*, the author stated that the only trace of compound structure is a mere vascular groove running along its lower margin, and that a similar structure is present in the corresponding part of the lower jaw of some species of opossum, of the wombat, of the *Balæna antarctica*, and of the *Myrmecobius*, though the groove does not reach so far forward in this animal; and that a similar groove is present near the lower margin, but on the outer side of the jaw, in the *Sorex Indicus*.

"*Description of the half jaw of the Phascolotherium.*—This fossil is a right *ramus* of the lower jaw, having its internal or mesial surface exposed. It once formed the chief ornament of the private collection of Mr. Broderip, by whom it has since been liberally presented to the British Museum. It was described by Mr. Broderip in the 'Zoological Journal,' and its distinction from the *Thylacotherium* clearly pointed out. The condyle of the jaw is entire, standing in bold relief, and presents the same form and degree of convexity as in the genera *Didelphys* and *Dasyurus*. In its being on a level with the molar teeth, it corresponds with the marsupial genera *Dasyurus* and *Thylacynus*, as well as with the placental *Zoophaga*. The general form and proportions of the coronoid process closely resemble those in zoophagous marsupials; but in the depth and form of the entering notch between the process and the condyle, it corresponds most closely with the *Thylacynus*. Judging from the fractured surface of the inwardly reflected angle, that part had an extended oblique base, similar to the inflected angle of the *Thylacynus*. In the *Phascolotherium*, the flattened inferior surface of the jaw, external to the fractured inflected angle, inclines outwards at an obtuse angle with the plane of the ascending *ramus*, and not at an acute angle, as in the *Thylacyne* and *Dasyurus*; but this difference is not one which approximates the fossil in question to any of the placental *Zoophaga*: on the contrary, it is in the marsupial genus *Phascolomys* where a precisely similar relation of the inferior flattened base to the elevated plate of the ascending *ramus* of the jaw is manifested. In the position of the dental foramen, the phascolothere, like the thylacothere, differs from all zoophagous marsupials and the placental *Feræ*; but in the *Hypsiprymnus* and *Phascolomys*, marsupial *Herbivora*, the orifice of the dental canal is situated, as in the Stonesfield fossils, very near the vertical line dropped from the last molar teeth. The form of the symphysis, in the *Phascolotherium*, cannot be truly determined; but Mr. Owen is of opinion that it resembles the symphysis of the *Didelphys* more than that of the *Dasyurus* or *Thylacynus*.

"Mr. Owen agrees with Mr. Broderip in assigning four incisors to each *ramus* of the lower jaw of the *Phascolotherium*, as in the *Didelphys*; but in their scattered arrangement they resemble the incisors of the *Myrmecobius*. In the relative extent of the alveolar ridge occupied by the grinders, and in the proportions of the grinders to each other, especially the small size of the hindermost molar, the *Phascolotherium* resembles the *Myrmecobius* more than it does the opossum, *Dasyurus*, or *Thylacynus*; but in the form of the crown, the molars of the fossil resemble the *Thylacynus* more closely than any other genus of marsupials. In the number of the grinders the *Phascolotherium* resembles the opossum and *Thylacynus*, having four true and three false in each maxillary *ramus*; but the *molares veri* of the fossil differ from those of the opossum and *Thylacotherium* in wanting a pointed tubercle on the inner side of the middle large tubercle, and in the same transverse line with it, the place being occupied by a ridge which extends along the inner side of the base of the crown of the true molars, and projects beyond the anterior and posterior smaller cusps, giving the quinquecuspid appearance to the crown of the tooth. This ridge, which, in *Phascolotherium*, represents the inner cusps of the true molars in *Didelphys* and *Thylacotherium*, is wanting in *Thylacynus*, in which the true molars are more simple than in *Phascolotherium*, though hardly less distinguishable from the false molars. In the second true molar of *Phascolotherium*, the internal ridge is also obsolete at the base of the middle cusp, and this tooth presents a close resemblance to the corresponding tooth in *Thylacynus*; but in the *Thylacynus* the two posterior molars increase in size, while in *Phascolothe-*

rium they progressively diminish, as in the *Myrmecobius*. As the outer sides of the grinders in the jaw of the *Phascolotherium* are imbedded in the matrix, we cannot be sure that there is not a smaller cuspidated ridge sloping down towards that side, as in the crowns of the teeth of the *Myrmecobius*. But, assuming that all the cusps of the teeth of the *Phascolotherium* are exhibited in the fossil, still the crowns of these teeth resemble those of the *Thylacynus* more than they do those of any placental *Insectivora* or *Phoca*, if even the form of the jaw permitted a comparison of it with that of any of the seal tribe. Connecting then the close resemblance which the molars of the *Phascolotherium* bear to those of the *Thylacynus* with the similarities of the ascending *ramus* of the jaw, Mr. Owen is of opinion that the Stonesfield fossil was nearly allied to *Thylacynus*, and that its position in the marsupial series is between *Thylacynus* and *Didelphys*. With respect to the supposed compound structure of the jaw of the *Phascolotherium*, Mr. Owen is of opinion that of the two linear impressions which have been mistaken for *harmoniæ* or toothless sutures, one, a faint, shallow, linear impression, continued from between the antepenultimate and penultimate molars obliquely downwards and backwards, to the foramen of the dental artery, is due to the pressure of a small artery, and that the author possesses the jaw of a *Didelphys Virginiana*, which exhibits a similar groove in the same place.—Moreover, this groove in the *Phascolotherium* does not occupy the same relative position as any of the contiguous margins of the opercular and dentary pieces of a reptile's jaw. The other impression in the jaw of the *Phascolotherium* is a deep groove, continued from the anterior extremity of the fractured base of the inflected angle, obliquely downwards to the broken surface of the anterior part of the jaw. Whether this line be due to a vascular impression, or an accidental fracture, is doubtful; but as the lower jaw of the wombat presents an impression in the precisely corresponding situation, and which is undoubtedly due to the presence of an artery, Mr. Owen conceives that this impression is also natural in the *Phascolotherium*, but equally unconnected with a compound structure of the jaw; for there is not any suture in the compound jaw of a reptile which occupies a corresponding situation.

"The most numerous, the most characteristic, and the best marked sutures in the compound jaws of a reptile, are those which define the limits of the coronoid, articular, angular, and surangular pieces, and which are chiefly conspicuous on the inner side of the posterior part of the jaw. Now the corresponding surface of the jaw of the *Phascolotherium* is entire, yet the smallest traces of sutures, or of any indication that the coronoid or articular processes were distinct pieces, cannot be detected; these processes are clearly and indisputably continuous, and confluent with the rest of the *ramus* of the jaw. So that where sutures ought to be visible, if the jaw of the *Phascolotherium* were composite, there are none; and the hypothetical sutures that are apparent, do not agree in position with any of the real sutures of an oviparous compound jaw.

"Lastly, with reference to the philosophy of pronouncing judgment on the saurian nature of the Stonesfield fossils, from the appearance of sutures, Mr. Owen offered one remark, the justness of which, he said, would be obvious alike to those who were, and to those who were not, conversant with comparative anatomy. The accumulative evidence of the true nature of the Stonesfield fossils, afforded by the shape of the condyle, coronoid process, angle of the jaw, different kinds of teeth, shape of their crowns, double fangs, implantation in sockets,—the appearance, he repeated, presented by these important particulars cannot be due to accident; while those which favour the evidence of the compound structure of the jaw, may arise from accidental circumstances."

"A paper was afterwards read, entitled 'Observations on the structure and relations of the presumed marsupial remains from the Stonesfield oolite,' by William Ogilby, Esq., F.G.S.

"These observations are intended by the author to embody only the most prominent characters of the fossils, and those essential points of structure in which they are necessarily related to the class of mammifers or of reptiles respectively. For the sake of putting the several points clearly and impartially, he arranged his observations under the two following heads:—

"1. The relations of agreement which subsist between the fossils in question and the corresponding bones of recent marsupials and *Insectivora.*

"2. The characters in which the fossils differ from those families. Mr. Ogilby confined his remarks to *Marsupialia* and *Insectivora*, because it is to those families only of mammifers that the fossils have been considered by anatomists to belong; and to the interior surface of the jaw, as the exterior is not exhibited in any of the fossil specimens.

"1. In the general outline of the jaws, more especially in that of the *Didelphys* (*Phascolotherium*) *Bucklandii*, the author states there is a very close resemblance to the jaw in recent *Insectivora* and insectivorous marsupials; but he observes that with respect to the uniform curvature along the inferior margin, Cuvier has adduced the same structure as distinctive of the monitors, iguanas, and other true saurian reptiles; so that whatever support these modifications of structure may give to the question respecting the marsupial nature of the Stonesfield fossils, as compared with other groups of mammals, they do not affect the previous question of their mammiferous nature, as compared with reptiles and fishes. The fossil jaws, Mr. Ogilby says, agree with those of mammals, and differ from those of all recent reptiles, in not being prolonged backward behind the articulating condyle; a character in conjunction with the former relation, which would be, in the author's opinion, well nigh incontrovertible, if it were absolutely exclusive: but the extinct saurians, the *Pterodactyles*, *Ichthyosauri*, and *Plesiosauri*, cotemporaries of the Stonesfield fossils, differ from their recent congeners in this respect, and agree with mammals. Mr. Ogilby is of opinion that the condyle is round both in *Did. Prevostii* and *Did. Bucklandii*, and is therefore a very strong point in favour of the mammiferous nature of the jaws. The angular process, he says, is distinct in one specimen of *Did. Prevostii*, and, though broken off in the other, has left a well-defined impression; but that it agrees in position with the *Insectivora*, and not the *Marsupialia*, being situated in the plane passing through the coronoid process and the *ramus* of the jaw. In the *Did. Bucklandii*, he conceives, the process is entirely wanting; but that there is a slight longitudinal ridge, partially broken, which might be mistaken for it, though placed at a considerable distance up the jaw, or nearly on a level with the condyle, and not at the inferior angular rim of the jaw. He is therefore of opinion that the *Did. Bucklandii* cannot be properly associated with either the marsupial or insectivorous mammals. The composition of the teeth, he conceives, cannot be advanced successfully against the mammiferous nature of the fossils, because animal matter preponderates over mineral in the teeth of the great majority of the insectivorous *Cheiroptera*, as well as in those of the *Myrmecobius*, and other small marsupials. In the jaw of the *Did. Prevostii* Mr. Ogilby cannot perceive any appearance of a dentary canal, the fangs of the teeth, in his opinion, almost reaching the inferior margin of the jaw, and being implanted completely in the bone; but in the *Did. Bucklandii* he has observed, towards the anterior extremity of the jaw, a hollow space filled with foreign matter, and very like a dentary canal. The double fangs of the teeth of *Did. Prevostii*, and probably of *Did. Bucklandii*, he says, are strong points of agreement between the fossils and mammifers in general;

but that double roots necessarily indicate, not the mammiferous nature of the animal, but the compound form of the crowns of the teeth.

"2. With respect to the most prominent characters by which the Stonesfield fossils are distinguished from recent mammals of the insectivorous and marsupial families, Mr. Ogilby mentioned, first, the position of the condyle, which is placed, in the fossil jaws, in a line rather below the level of the crowns of the teeth; and he stated that the condyle not being elevated above the line in the *Dasyurus Ursinus* and *Thylacynus Harrisii*, is not a valid argument, because those marsupials are carnivorous. The second point urged by the author against the opinion that the fossils belonged to insectivorous or marsupial mammifers, is in the nature and arrangement of the teeth. The number of the molars, he conceives, is a secondary consideration; but he is convinced that they cannot be separated in the fossil jaws into true and false, as in *Mammalia;* the great length of the fangs, equal to at least three times the depth of the crowns, he conceives, is a strong objection to the fossils being placed in that class, as it is a character altogether peculiar and unexampled among mammals; the form of the teeth also, he stated, cannot be justly compared to that of any known species of marsupial or insectivorous mammifer, being, in the author's opinion, simply tricuspid, and without any appearance of interior lobes. As to the canines and incisors, Mr. Ogilby said, that the tooth in *D. Bucklandii*, which has been called a canine, is not larger than some of the presumed incisors, and that all of them are so widely separated as to occupy full five-twelfths of the entire dental line, whilst in the *Dasyurus viverrinus*, and other species of insectivorous marsupials, they occupy one-fifth part of the same space. Their being arranged longitudinally in the same line with the molars, he conceives, is another objection, because, among all mammals, the incisors occupy the front of the jaw, and stand at right angles to the line of the molars. With respect to the supposed compound structure of the jaw, Mr. Ogilby offered no formal opinion, but contented himself with simply stating the appearances; he, nevertheless, objected to the grooves being considered the impression of blood vessels, though he admitted that the form of the jaws is altogether different from that of any known reptile or fish.

"From a due consideration of the whole of the evidence, Mr. Ogilby stated, in conclusion, that the fossils present so many important and distinctive characters in common with mammals on the one hand, and cold-blooded animals on the other, that he does not think naturalists are justified at present in pronouncing definitively to which class the fossils really belong."

"A paper was afterwards read, entitled, "Observations on the Teeth of the *Zeuglodon*, *Basilosaurus* of Dr. Harlan," by Richard Owen, Esq., F.G.S., Hunterian Professor in the Royal College of Surgeons, London.

"During the recent discussions respecting the Stonesfield fossil jaws, one of the strongest arguments adduced and reiterated by M. de Blainville and others in support of their saurian nature, was founded on the presumed existence in America of a fossil reptile possessing teeth with double fangs, and called by Dr. Harlan, the *Basilosaurus*. To the validity of this argument, Mr. Owen refused to assent, until the teeth of the American fossil had been subjected to a re-examination with an especial view to their alleged mode of implantation in the jaw; and until they had been submitted to the test of the microscopic investigation of their intimate structure with reference to the true affinities of the animal to which they belonged. The recent arrival of Dr. Harlan in England with the fossils, and the permission which he has liberally granted Mr. Owen of having the necessary sections made, have enabled him to determine the mammiferous nature of the fossil.

"Among the parts of the *Basilosaurus* brought to England by Dr. Harlan, are two portions of bone belonging to the upper jaw; the larger of them contains three teeth; the other, the sockets of two teeth. In the larger specimen, the crowns of the teeth are more or less perfect, and they are compressed and conical, but with an obtuse apex. The longitudinal diameter of the middle, and most perfect one, is three inches, the transverse diameter one inch two lines, and the height above the alveolar process two inches and a half. The crown is transversely contracted in the middle, giving its horizontal section an hour-glass form; and the opposite wide longitudinal grooves which produce this shape, becoming deeper as the crown approaches the socket, at length meet and divide the root of the tooth into two separate fangs. The two teeth in the fore part of the jaw are smaller than the hinder tooth, and the anterior one appears to be of a simpler structure.

"A worn-down tooth contained in another portion of jaw, Mr. Owen had sliced, and it presented the same hour-glass form, the crown being divided into two irregular, rounded lobes joined by a narrow isthmus or neck. The anterior lobe is placed obliquely, but the posterior parallel with the axis of the jaw. The isthmus increases in length as the tooth descends in the socket until the isthmus finally disappears, and the two portions of the tooth take on the character of separate fangs. It is evident that the pulp was originally simple, but that it soon divided into two parts, from which the growth of the ivory of the teeth proceeded as from two distinct centres, now separately surrounded by concentric *striæ* of growth, the exterior sending an acute-angled process into the isthmus. The *cavitas pulpi*, which is very small in the crown of the tooth, contracts as the crown descends, and is almost obliterated near the extremity, proving that the teeth were developed from a temporary pulp.

"The sockets in the anterior fragment of the upper jaw are indistinct and filled with hard calcareous matter, but a transverse horizontal section of the alveolar margin proves that these sockets are single, and that the teeth lodged therein had single fangs. In the anterior socket, there is an indication of the transverse median contraction, showing that this tooth resembled in form, to a certain degree, the posterior tooth. A plaster cast of a portion of the lower jaw afforded the only means of studying this part of the fossil. It contains four teeth, of which the two posterior are nearly contiguous, the next is at an interval of an inch and a half, and the most anterior of two inches from the preceding. The last tooth is more simple in form than those behind, and it has been described as a canine. This fragment of the lower jaw thus confirms the evidence afforded by the fragments of the upper jaw, that the teeth in the *Basilosaurus* were of two kinds, the anterior being smaller and simpler in form, and further from each other than those behind.

"Mr. Owen then proceeded to compare the *Basilosaurus* with those animals which have their teeth lodged in distinct sockets; as the *Sphyræna*, and its congeners among fishes, the plesiosauroid and crocodilean *Sauria*, and the class *Mammalia;* but as there is no instance of either fish or reptile having teeth implanted by two fangs in a double socket, he commences his comparison of the *Basilosaurus* with those *Mammalia* which most nearly resemble the fossil in other respects. Among the zoophagous *Cetacea* the teeth are always similar as to form and structure, and are invariably implanted in the socket by a broad and simple basis, and they never have two fangs. Among the herbivorous *Cetacea* however, the structure, form, number and mode of implantation of the teeth differ considerably. In the manatee, the molars have two long and separate fangs lodged in deep sockets, and the anterior teeth, when worn down, present a form of the crown similar to that of the *Basilosaurus*, but the opposite indentations are not so deep; and the entire grinding surface of the molars of the manatee differs considerably from those of the *Basilosaurus*, the anterior supporting two transverse conical ridges, and the posterior three. The dugong resembles more nearly the fossil in its molar teeth; the anterior ones being smaller and simpler than the posterior, and the complication of the latter being due to exactly the same kind of modification as in the *Basilosaurus*, viz. a transverse constriction of the crown. The posterior molar has its longitudinal diameter increased, and its transverse section approaches to the hour-glass figure, produced by opposite grooves. There is in this tooth also a tendency to the formation of a double fang, and the establishment of two centres of radiation for the calcigerous tubes of the ivory, but the double fang is probably never completed. The teeth in the dugong moreover are not scattered as in the *Basilosaurus*.

"Mr. Owen then briefly compared the teeth of the fossil with those of the Saurians, and stated that he had not found a single instance of agreement in the *Basilosaurus* with the known dental peculiarities of that class. From the *Mosasaurus* the teeth of the American fossil differ in being implanted freely in distinct sockets and not anchylosed to the substance of the jaw; from the *Ichthyosaurus* and all the lacertine *Sauria* in being implanted in distinct sockets, and not in a continuous groove; from the *Plesiosaurus* and crocodilian reptiles from the fangs not being simple and expanding as they descend, but double, diminishing in size as they sink in the socket, and becoming consolidated by the progressive deposition of dental substance from temporary pulp in progress of absorption. In the *Enaliosauria* aud the *Crocodilia*, moreover, there are invariably two or more germs of new teeth in different stages of formation close to or contained within the cavity of the base of the protruded teeth; but the *Basilosaurus* presents no trace of this characteristic saurian structure. From the external characters only of the teeth, Mr. Owen therefore infers, that the fossil was a mammifer of the cetaceous order, and intermediate to the herbivorous and piscivorous sections of that order, as it now stands in the Cuvierian system.

"In consequence however of the *Basilosaurus* having been regarded as affording an exceptional example among reptiles of teeth having two fangs, though contrary to all analogy, and as the other characters stated above, may be considered by the same anatomists to be only exceptions, Mr. Owen procured sections of the teeth for microscopic examination of their intimate structure and for comparing it with that of the teeth of other animals.

"In the *Sphyræna* and allied fossil fishes which are implanted in sockets, the teeth are characterised by a continuation of medullary canals, arranged in a beautifully reticulated manner, extending through the entire substance of the tooth, and affording innumerable centres of radiation to extremely fine calcigerous tubes.

"In the *Ichthyosaurus* and crocodile the pulp cavity is simple and central, as in *Mammalia*, and the calcigerous *tubuli* radiate from this centre to every part of the circumference of the tooth, to which they are generally at right angles. The crown of the tooth in these saurians is covered with enamel, while that part of the tooth which is in the *alveolus* is surrounded with a thick layer of cortical substance. In the dolphins which have simple conical teeth like the reptiles, the crown is also covered with enamel and the base with *cæmentum*. But in the cachalot and dugong, the whole of the teeth is covered with *cæmentum*. In the dugong this external layer presents the same characteristic radiated purkingian corpuscles or cells as in the *cæ*-

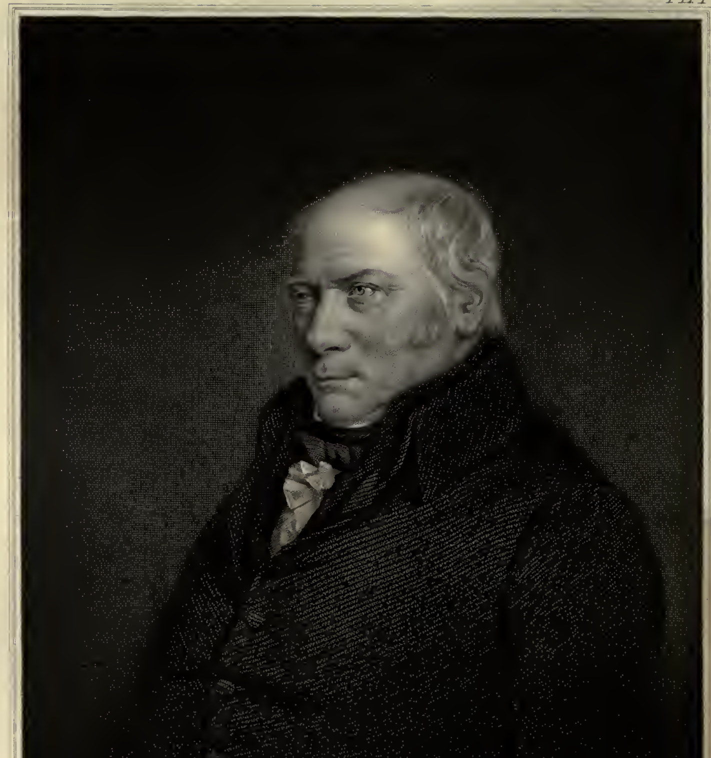
mentum of the human teeth, and those of other animals; but the *cæmentum* of the dugong differs from that of the pachyderms and ruminants in being traversed by numerous calcigerous tubes, the corpuscles or cells being scattered in the interstices of these tubes. Now the crowns of the teeth of the *Basilosaurus* evidently exhibit in many parts a thin investing layer of a substance distinct from the body or ivory of the tooth, and the microscopic examination of a thin layer of this substance proves it to possess the same characters as the *cæmentum* of the crown of the tooth of the dugong. The purkingian cells are, in some places, scattered irregularly, but in others are arranged in parallel rows. The tubes radiating from the cells are wider than usual at the commencement; but soon divide and sub-divide, forming rich reticulations in the interspaces, and communicating with the branches of the parallel larger tubes. These are placed, as in the dugong, perpendicular to the surface of the tooth, but they are less regularly arranged than the calcigerous tubes of the ivory, with which, however, they form numerous continuations. There is a greater proportion of *cæmentum* in the isthmus of the tooth than elsewhere; and the worn-down crown of the tooth must therefore have exhibited a complicated structure. The entire substance of the ivory of the teeth consists of fine calcigerous tubes radiating from the centres of the two lobes, without any intermixture of coarser medullary tubes which characterize the teeth of the *Iguanodon*; or the slightest trace of the reticulated canal, which distinguish the texture of the teeth of the *Sphyræna* and its congeners. The calcigerous tubes undulate regularly, and like those of the dugong, exhibit more plainly the primary dichotomous bifurcations, and the subordinate lateral branches given off at acute angles: they also communicate with numerous minute cells arranged in concentric lines.

"Thus, the microscopic characters of the texture of the teeth of the great *Basilosaurus* are strictly of a mammiferous nature; and Mr. Owen further showed that they differ from those of the fossil *Edentata*, which are also surrounded by *cæmentum*, in the absence of the coarse central ivory; and confirm the inference respecting the position of the fossil in the natural system drawn from the external aspect of the teeth.

"Mr. Owen then adduced further proofs of the mammiferous and cetaceous character of the *Basilosaurus* from the structure of the *vertebræ*, which proves that the epiphyseal *laminæ* were originally separated from the body of the *vertebræ*, but were afterwards united to it. In the bodies of the smaller *vertebræ* the epiphyses are wanting, and Mr. Owen agrees with Dr. Harlan in inferring from the common occurrence of this condition, that there were originally three separate points of ossification in the body of the *vertebræ;* a character never noticed in the *vertebræ* of saurians, but a most prominent one in those of the *Cetacea*. Another argument in favour of the mammiferous and cetaceous nature of the *Basilosaurus* is deduced from the great capacity of the canal for the spinal chord, which in the *Cetacea* is surrounded by an unusually thick plexiform stratum of both arteries and veins. The cetaceous character is further manifested in the short antero-posterior extent of the neurapophyses as compared with that of the body of the *vertebræ;* in their regular concave posterior margin, and the development of the articular apophyses only from their anterior part: also in the form and position of the transverse processes, which however present a greater vertical thickness than in the true *Cetacea*, and approach in this respect to the *vertebræ* of the dugong.

"With respect to the other bones of the *Basilosaurus*, Mr. Owen stated that the ribs in their excentric laminated structure are peculiar, and unlike those of any mammal or saurian. The hollow structure of the lower jaw of the *Basilosaurus*, which has been advanced as a proof of its saurian

PL. 1.



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Wm. Smith L.L.D.
aged 69.

nature, Mr. Owen showed occurs also in the lower jaw of the cachalot, and is therefore equally good for the cetaceous character of the fossil.

"In the compressed shaft of the *humerus*, and its proportion to the *vertebræ*, the *Basilosaurus* again approximates to the true *Cetacea*, as much as it recedes from the *Enaliosaurians;* but in the expansion of the distal extremity and the form of the articular surface, this humerus stands alone; and no one can contemplate the comparative feebleness of this, the principal bone of the anterior extremity, without agreeing with Dr. Harlan, that the tail must have been the main organ of locomotion.

"Mr. Owen, in compliance with the suggestion of Dr. Harlan, who, having compared with Mr. Owen the microscopic structure of the teeth of the *Basilosaurus* with those of the dugong and other animals, admits the correctness of the inferences of its mammiferous nature, proposes to substitute for the name of *Basilosaurus* that of *Zeuglodon*, suggested by the form of the posterior molars, which resemble two teeth tied or yoked together."

ART. II.—*Biographical Notice of William Smith, LL.D.* By JOHN PHILLIPS, Esq., F.R.S., Professor of Geology at King's College, London, &c. &c.[1]

WILLIAM SMITH was born on the 23rd of March, 1769, at Churchill, in Oxfordshire, amidst the oolitic formations from an investigation of which he was subsequently conducted to geological discoveries of great importance. He inherited a small patrimony, but his education and opportunities of acquiring knowledge were very imperfect, till, at the age of eighteen, he attached himself to the late Mr. Edward Webb, of Stow-on-the-Wold, to learn the business of land-surveying. Mr. Webb was a person of singular ability in his profession, endowed with an original and vigorous intellect, and a simple and friendly disposition. In these features the pupil resembled the master; and in all his after life he has entertained the most grateful recollections of this early friend.

Mr. Webb's practice as a surveyor was extensive, and Mr. Smith had opportunities of contrasting the lias and red marls of Worcestershire with the 'stonebrash' hills of Oxfordshire; and the distinctions thus brought under his notice as early as 1789, were the germ of that systematic analysis of English strata which he commenced in 1791.

In 1791 Mr. Smith was employed in surveying an estate at Nether Stowey, in Somersetshire; and from this time till 1799 he was continually occupied in the vicinity of Bath, as a land

[1] For the Portrait accompanying this Memoir, see Sup. Plate No. 1.

surveyor and civil engineer. In this latter profession, from 1793 till 1799, he was engaged in executing the Somerset coal-canal. On descending the Somersetshire coal-pits, every inquiring person would receive from the workmen the account of the regular sequence of the strata below the 'red ground' given by Mr. Strachey in the 'Philosophical Transactions' for 1721; but Mr. Smith, guided by previous observations toward a conclusion which perhaps was but dimly apparent to himself, immediately demanded if the "strata were regular above the red ground?" The answer was such as might be expected from persons of merely local experience; the workmen declared that "there was nothing regular above the red ground;" and Mr. Smith returned to the surface to correct this popular error. In the year 1791, he drew detailed sections of the coal-measures pierced at High Littleton and Timsbury, and represented the unconformity of the red marl and lias above.

Familiarized from childhood with some of the organic remains of the oolite, and acquainted with the lias and red marl below, Mr. Smith saw in Somersetshire these strata overlying the coal-measures, and having made detailed sections of the coal strata, and collected organic remains from these various deposits, he found himself in possession of new and wide generalizations, which it became the enjoyment and the labour of his life to unfold.

"In the course of the two following years, while continuing the duties of a surveyor and civil engineer, he became gradually acquainted with all the minute facts of stratification, in the country round Bath; and for the purpose of bringing to the test the inquiries suggested by his surveys in 1791, he made two transverse sections along the lines of two parallel valleys intersecting the oolitic group, (determining the actual elevation of these lines by levels referred to those of the Somerset coal-canal); and ascertained that the several beds, found in the high escarpments around Bath, were brought down by an eastern dip, in regular succession, to the level of his lines of section. During these two years Mr. Smith was in the constant habit of making collections of fossils, with strict indications of their localities; and in completing the details of his transverse sections, he found, where the beds themselves were obscure, that he could, by organic remains alone, determine the true order of succession. During this period he also extended his surveys through the Cotteswold hills, and became acquainted with the general facts of the range of the oolitic escarpment towards the north of England." (Sedgwick, in 'Address to the Geological Society,' 1831).

Early in 1794 he attended Parliament on behalf of the Somerset coal-canal company; and in his journey from Bath to London observed the successive escarpments of the oolitic formations and chalk hills. To this hour he relates with a peculiar delight, the history of a long journey to the north of England, with Mr. Palmer and Mr. Perkins, in August, 1794, undertaken for the purpose of collecting information on canals and collieries. Seated foremost in the chaise, he explored every point of broken ground on two lines between Bath and Newcastle-on-Tyne; and, instructed by previous knowledge, he interpreted rightly the contours of distant hills, and thus traced the strata of Bath to the coast of Whitby, and the chalk of the Wiltshire downs to the wolds of Lincolnshire and Yorkshire. Perhaps no more remarkable proof of the boldness and sagacity with which he followed out the principles he had established, can be given, than the fact that this *reconnoissance* of the north of England, corrected in detail by a multitude of minute considerations, regarding drainage, sites of population, and other circumstances almost unnoticed except by himself, enabled Mr. Smith, in the year 1800, to colour a small map, in which the geological structure of the North of England is rightly united to that of the south, and the range of the oolitic series in particular is represented, in some places very correctly, and in all with a considerable approach to accuracy.

At this period of his life Mr. Smith was utterly unacquainted with books treating of the natural history of the earth: he had no other teacher than that acquired 'habit of observation' which he has justly recommended to his followers. It is difficult in these days to conceive of such insulated and independent research, as that into which the young philosopher entered; rumours at least of the progress of science now circulate through the Cotteswold hills; and it would be impossible for the most reserved student to be wholly uninfluenced by them. That Mr. Smith was so uninfluenced is a fact attested by the very nomenclature which he created and established in Geology. The 'cornbrash,' the 'forest marble,' the 'lias,' &c., form a system of names almost barbarous to ears polite, but so firmly rooted in English Geology, as to constitute a most durable monument of the sagacity and originality of their author.

In 1795 Mr. Smith became a housekeeper, and immediately began to arrange his collection of fossils from the vicinity of Bath, in the order of the strata. His residence in the Cottage Crescent, near Bath, was favourable for this object; and before 1799 he had coloured geologically the large sheets of the Somersetshire survey, and a circular map of the vicinity of Bath. These are very accurate.

By maps and sections, and arranged collections of organic remains, Mr. Smith endeavoured to explain to many scientific persons those views regarding the regular succession and continuity of strata, and the definite distribution of animal and vegetable forms in the earth, which are now the common property of Geology. Among those who heard his explanations at this early period, may be mentioned Dr. James Anderson, of Edinburgh; Mr. Davis, of Longleat; the Rev. J. Townsend author of 'Travels in Spain;' and the Rev. B. Richardson of Farley.

The two last-named gentlemen were remarkably able to appreciate the truth and novelty of such views, both from their general attainments in Natural History, and their exact knowledge of the country to which Mr. Smith directed their attention. Both of them possessed large collections of organic remains, and both were astonished and incredulous when their new friend, taking up one fossil after another, stated instantly from what particular rock, and even bed of stone, or clay, the specimens were derived. Nor were they less surprised when, in the field, 'Strata Smith' (as he was termed) traced with ease and accuracy the ranges of the rocks, by following the courses of springs, and many other indications of a change of the sub-strata. Both entered with the zeal of novelty into the examination of a district which they had often traversed before; and Mr. Richardson's was the hand which, in 1799, wrote from Smith's dictation, the original 'Tabular View of the superposition of English strata,' which has since been presented to the Geological Society of London. Copies of this document were given by Mr. Richardson to Baron Rosencrantz, Dr. Muller of Christiania, and many others, in the year 1801; and Mr. W. Reynolds personally assured Mr. Smith, that within his own knowledge copies of it had been sent to the East and West Indies.

Dr. James Anderson earnestly intreated Mr. Smith to lay his discoveries before the public, and offered the assistance of his literary experience and connexions to aid him. Possibly the almost continual occupation in which he was now engaged, especially in the draining of land,—for which Geology had taught him new and certain methods,—may have prevented his complying with these friendly and judicious offers: the notion, however, once admitted, revived from time to time, and in 1801 a prospectus was printed, containing proposals for publishing by subscription, in 4to., a work to be entitled 'Accurate delineations and descriptions of the natural order of the various strata that are found in different parts of England and Wales; with practical observations thereon.' For this work a small and curious geological map was prepared, and it was to have been accompanied by a general section of the strata, showing their proportionate thickness. The prospectus is itself a little essay on the practical applications of Geology, and displays clearly the enlarged and precise mastery of his subject, which finally led to the completion (in 1815!) of the great 'Delineation of the strata of England and Wales.' This document is curious and scarce enough to deserve to be re-printed entire.

Mr. Smith's engagement as engineer to the Somerset coal-canal ceased in 1799, and he was from that time, for many years, almost continually travelling in various directions in the exercise of his profession. To this he appears not to have looked so much as a source of profit, as an occasion for seeing new districts, and completing his general survey of England and Wales. He was in the habit of attending the agricultural meetings called 'sheep-shearings,' at Woburn and Holkham, to exhibit his maps and sections for the information of the assembly. At one of these, in 1804, Sir Joseph Banks originated a public subscription, to aid in defraying the cost of publishing his 'Observations on the Strata of England and Wales.' In 1804 he fixed his nominal residence in London, (15, Buckingham St., Strand), re-arranged his collection there on a new and curious plan, and received many distinguished visitors. But his time was principally passed in Norfolk and Suffolk, where he accomplished a remarkable work,—stopping out the sea from a vast extent of marsh land. In 1806 the first of his publications appeared,—a 'Treatise on Irrigation,'—from the Norwich press. For one of the successful efforts at irrigation directed by Mr. Smith, the Society of Arts awarded their medal.

In 1808 the president and other members of the Geological Society visited Mr. Smith, and saw his collection of fossils. In 1811 appeared the first volume of the 'Geological Transactions,' in which Mr. Smith's discoveries regarding organic remains are noticed; in 1813 the Rev. W. Townsend published the first volume of his curious work,—'The character of Moses vindicated,'—containing much information communicated by Mr. Smith; and at length, in August, 1815, appeared the long-expected 'Delineation of the Strata of England and Wales,' on a new map engraved for the purpose by Messrs. Carey, of London.

An arrangement was made in 1815, by which the British Museum became possessed of Mr. Smith's whole collection of organic remains, for the sum of £500. and the task of arranging and describing this collection, led to the publication of two works in 4to., entitled 'Strata Identified by Organized Fossils,' (1815), and 'Stratigraphical System of Organized Fossils,' (1817), the latter designed as an index to the specimens deposited in the British Museum. In 1818 appeared, in the 'Edinburgh Review,' the most able, just, and discriminating survey of the progress of English Geology ever penned; and if Mr. Smith's friends regretted the late appearance of his great map, and the slow and difficult growth of his hard-earned fame, they had reason to be thankful that in the maturity of geological research, at a time when the progress of continental science could be rightly appreciated, the delicate task of estimating the value and originality of his labours was accomplished with the taste, truth, and independence which characterize the writings of Dr. Fitton.

Between the appearance of the great general map in 1815 and the year 1821, Mr. Smith published no less than twenty geological maps of English counties, often remarkable for their accuracy; and he has not desisted from the labour of preparing others, amidst difficulties and privations such as few men devoted to science have ever endured. In 1819 Mr. Smith resigned his residence in London, and had, in fact, scarcely any home but the rocks until 1823, which year he passed in Kirby Lonsdale. In 1824 he delivered a course of lectures on Geology to the members of the Yorkshire Philosophical Society, then recently established; these were repeated in the same year, in conjunction with his nephew, Mr. John Phillips, (now Professor of Geology in King's College, London), at Scarborough and Hull. A similar effort was made at Sheffield in 1825, and soon afterwards Mr. Smith accepted an engagement as agent to Sir J. Johnstone, Bart., of Hackness, near Scarborough, and withdrew for a while from the wandering life and endless labours he had imposed on himself.

In 1829 one who deeply felt the enthusiasm of active geological research, was led by curiosity, or a better motive, to visit the secluded valley of Hackness, and contemplate the imprisoned energies of an impassioned mind. He found a patient though disappointed man; an inflexible activity of intellect, forced into new and not infertile channels; a generous sympathy with the progress of science, shaded only by deep regret at his own compulsory exclusion from the active promotion of it. Nothing that could be effected by individual kindness was omitted by the worthy proprietor of Hackness, to encourage the veteran geologist, whose mind, singularly gifted with the power of living through the past, was often far away from the spot where his labours, and perhaps his life, were amusingly and usefully prolonged.

The time, however, came at length, when the young geologists of England drew from his retirement the unforgotten leader of their science. The Geological Society of London awarded the first medal placed at their disposal by the bequest of Wollaston, to Mr. William Smith, "in consideration of his being a great original discoverer in English Geology: and especially for his being the first, in this country, to discover and to teach the identification of strata, and to determine their succession by means of their imbedded fossils."

Professor Sedgwick then occupied the chair of the Geological Society, and added to the value of the distinction he was conferring on Mr. Smith, by a careful estimation and proof of his right to receive it, and by the acknowledgment which could come with better grace or greater force from no living geologist, of his undoubted claim to be recognised as the 'Father of English Geology.' "If," observes this eloquent advocate of truth, "in the pride of our present strength, we were disposed to forget our origin, our very speech would bewray us; for we use the language which he taught us in the infancy of our science. If we, by our united efforts, are chiselling the ornaments, and slowly raising up the pinnacles of one of the temples of nature, it was he who gave the plan, and laid the foundation, and erected a portion of the solid walls, by the unassisted labour of his hands."

In 1835 he received the degree of LL.D. in Trinity College, Dublin.

No man ever withstood more bravely than Mr. Smith, the pressure of pecuniary difficulties; they were, in fact, neither rashly nor recklessly incurred, but inevitably brought on by the unconquerable desire of personally tracing the strata of England and Wales. These difficulties were however often excessive; and after the public tribute to the 'Father of English Geology,' decreed by the Geological Society, it was impossible to avoid an anxious fear that in the winter of his age he would be destitute. An application was made to the crown, on the part of several eminent men of science, and persons of high station, in the country, who had known the practical value of Geology, for the grant of a suitable pension. An annuity of One Hundred Pounds was the result of this well-timed application; and from this limited income, at three score years and ten, the first English geologist draws his scanty support, with no prospect of producing for the public advantage any part of that mass of information on practical applications of Geology, which the experience of fifty years has accumulated,—information which, it may be safely asserted, no other man can give to the world.

ART. III.—*Monograph of the Genus* Sciurus, *with Descriptions of New Species and their Varieties.* By J. BACHMAN, D.D., President of the Literary and Philosophical Society, Charlestown, South Carolina, &c.

(Continued from Page 162*).*

7. NORTHERN GREY AND BLACK SQUIRREL. *Sciurus leucotis.*

Grey Squirrel; Pennant's Arctic Zool., vol. i., p. 135; Hist. Quad. No. 272.
Sci. Carolinensis; Godman, non Gmel.
Sciurus leucotis; Gapper, Zool. Journ. vol. v. p. 206, published about 1830.

ESSENT. CHAR.—Larger than the Carolina Grey Squirrel; tail much longer than the body; smaller than the Cat Squirrel; subject to many varieties in colour.

This sprightly and very common species, existing in the northern and middle states, has hitherto been united with the Carolina grey squirrel; the name having been first appropriated to the latter, and the present species being, as I shall endeavour, in this and the succeeding article, to prove, specifically distinct, I have proposed for it the above name.

This squirrel seems to have permanently twenty-two teeth; among a large number procured in different seasons of the year, and some of them, from the manner in which their teeth were worn, appearing to be old animals, all presented the small front molars in the upper jaw, except a single specimen, and even in this instance, these teeth may have accidentally dropped out. This permanency in teeth that have been usually regarded as deciduous, would seem to require an enlargement of the characters given to this genus; it will moreover be seen that the majority of our species are similar to this in their dental arrangements.

The incisors are strong and compressed, a little smaller than those of the cat squirrel, convex, and of a deep orange colour anteriorly; the upper ones have a sharp cutting edge, and are chisel-shaped; the lower are much longer and thinner. The anterior grinder, although round and small, is as long as the second; the remaining four grinders are considerably more excavated than those of the cat squirrel, presenting two transverse ridges of enamel. The lower grinders corresponding to those above, have also elevated crowns. The hair is a little softer than that of the cat squirrel, being coarsest on the forehead.

Form.—Nose rather obtuse; forehead arched; whiskers as long as the head; ears sharply rounded, concave; both sides of the ear covered with hair; that which clothes the outside being much the longest. In winter the fur projects upwards, about three lines beyond the margin.

Colour.—Although this species exists under many varieties there appear to be two very permanent ones, which I shall attempt to describe.

1. *Grey variety.*—The nose, cheek, around the eyes extending to the insertion of the neck, the upper surface of the fore, and hind feet, and a stripe along the sides, yellowish brown; the ears on their posterior surface are a soiled white, edged with brown; on the back from the shoulder there is an obscure stripe of brown, broadest at its commencement, and running down to a point at the insertion of the tail; in a few specimens this stripe is wanting. On the neck, sides, and hips the colour is light grey; the hairs separately are for one half their length dark cinereous, then light umber, then a narrow mark of black, and tipt with white; a considerable number of black hairs are interspersed, giving it above a grey colour; the hairs in the tail are light yellowish brown from the roots, with three stripes of black, the outer one being widest, and broadly tipt with white; the whole under surface is white.

There are other specimens in which the yellowish markings on the sides and feet are altogether wanting. Dr. Godman (vol. ii. p. 133) asserts that the golden colour on the hind feet is a very permanent mark. The specimens from Pennsylvania in my possession have generally this peculiarity, but many of those from New York and New England have grey feet, without the slightest mixture of yellow.

2. *Black variety.*—This variety I have, on several occasions, seen taken from the same nest with the grey squirrel. They breed and rear their young together, and the observations made with regard to the fox squirrel will also apply to these. This is of the size and form of the grey variety; it is a dark brownish black on the whole of the upper surface, a little lighter beneath. In summer its colour is less black than in winter. The hairs of the back and sides of the body and tail are obscurely annulated with yellow. There is here and there a white hair interspersed among the fur of the body, but no tuft of white as in *Sciurus niger*.

DIMENSIONS.

	IN.	LIN.
Length of head and body	11	9
Ditto of tail (*vertebræ*)	10	0
Ditto to the tip	13	0
Height of ear	„	7
Ditto to the end of fur	„	9
Palm to end of middle claw	1	10
Heel to end of middle nail	2	6
Length of fur on the back	„	7
Breadth of tail with hairs extended	4	2

Geographical Distribution.—The northern limits of this species is not determined; it however exists as far as Hudson's Bay, was formerly very common in the New England states, and in the less cultivated portions is still frequently met with. It is abundant in New York, and in the mountainous portions of Pennsylvania. I have observed it on the northern mountains of Virginia. It probably extends still farther south; in the lower parts of North and South Carolina however it is replaced by a smaller species. The black variety is more abundant in upper Canada, in the western part of New York, and in the states of Ohio and Indiana.—It does not exist in Georgia, Florida, or Alabama; and among the specimens sent from Louisiana, stated to be of all the species existing in that state, I discovered that this squirrel was not of the number.

Habits.—This appears to be the most active and sprightly species existing in our Atlantic states. It rises with the sun, and continues industriously engaged in search of food during four or five hours in the morning, scratching among leaves, running over fallen logs, ascending trees, and playfully coursing from limb to limb,—often making almost incredible leaps from the higher branches of one tree to another. In the middle of the day it retires for a few hours to its nest, resuming its active labours and amusements in the afternoon, and continuing without intermission till the setting of the sun. During the warm weather of spring and summer it prepares itself a summer house on a tree, but not often at its summit. In constructing this nest, it does not descend to the earth in search of materials, but finds them ready at hand on the tree where it intends to take up its temporary residence. It first breaks off dried sticks, if they can be procured, to make a superstructure; if however such materials are not within reach, it commences gnawing off the green branches of the size of a thumb, and lays them in the crutch of the tree, or of some large branch. It then proceeds to the extremities of the branches, and breaks off those portions that contain tufts of leaves, with which a compact nest is constructed, which, in the inner side, is sometimes lined with such mosses as are found on the bark of trees. In the preparation of this nest a pair is usually engaged, for an hour in the morning, during several successive days; and the noise they make in cutting the branches, and dragging them with their leaves to the nests, can be heard at a great distance. In winter they reside altogether in holes of trees, where their young, in most instances, are brought forth. Although a family to the number of five or six, probably the produce of a pair from the preceding season, may occupy the same nest during winter, yet they all pair off in spring, when each couple seems to occupy a separate nest, in order to engage in the duties of reproduction. The young, in number from four to six, are, in the northern states, brought forth in May; they are of quick growth, and sufficiently advanced in a few weeks to leave the nest: at such times they are seen clinging around the tree which contains their domicile, and as soon as alarmed they run to the hole, when one of them usually returns, and, protruding his head out of the hole, watches the movements of the intruder. In this stage of growth they are easily captured; their hole is stopped up, another opening is made beneath, and they are taken out by the hand protected by a glove. They soon become tolerably gentle, and are frequently kept in cages with a wheel attached, in which, as in the interior of a tread-mill, they amuse themselves in playing for hours together. Sometimes two are placed together, and they soon learn to accommodate themselves to the wheel, and move together with great regularity. However gentle they may become in confinement, no instance has come to my knowledge of their having produced young in a state of domestication; although in a suitable cage such a result would in all probability be produced. A tame squirrel is, however, a troublesome pet; it is always ready to use its teeth on the fingers of every intruder on its cage, and does not always spare even its feeder; and when permitted to have the freedom of the house, it soon incurs the displeasure of the prudent housewife by its habit of gnawing chairs, tables, and books.

During the breeding season the males, like those of deer and other species, engage in frequent contests, and often bite and wound each other severely. The story of their emasculating each other on these occasions has been so often repeated, that it has become a matter of history, and it would now be somewhat dangerous to set it down as a vulgar error. It might however be advanced, on the other hand, that the admission of such skill and refinement in cruelty would be ascribing to the squirrel a higher degree of physical and surgical knowledge than is possessed by any other quadruped.—From the observations I have been enabled to make, I have been led to believe that the error has originated from the fact that those parts in the male which in one season are greatly enlarged, are in the other equally diminished, and that in young males especially, they are drawn into the *pelvis* by the contraction of the muscle. As a proof of this, a friend, who was a strenuous believer in this spiteful propensity ascribed to the squirrel, was induced to test the inquiry by an examination of a suitable number of specimens. He obtained in a few weeks upwards of thirty males;—in none of these had this mutilation taken place. Two however out of this number were triumphantly brought forward as evidences of the truth of the doctrine; on examination it appeared that these were young animals, with the organs perfect, but concealed in the manner above stated.

It is generally believed that this species lays up a great hoard of food as a winter supply; it may however be reasonably doubted whether they are so provident in this respect. The trees in which they conceal themselves in winter are frequently cut down, and no supply of provisions is ever found in their nests. In following their tracks in the snow they cannot be traced to any hoards buried in the ground. I have moreover observed them during a warm day in winter coming from great distances into the open fields, in search of a few dry hickory nuts which were still left suspended on the trees; if provisions had been laid up nearer home, they would hardly have undertaken these long journeys, or exposed themselves to so much danger in procuring a precarious supply. In fact this species, in cold climates, seldom leaves its nest in winter, except in a warm sunny day; and in this state of inactivity and partial torpidity, it requires but little food.

This squirrel feeds upon the various nuts, seeds, and grain which are periodically sought for by all the species of this genus, but it seems to prefer the shell-bark (*Carya alba*) and the several species of hickory, to any other kind of food.—Even when the nuts are so green as to afford scarcely any nourishment, the northern grey squirrel is seen gnawing off the thick epidermis, which drops to the ground like rain, and then, with its lower incisors, makes a small linear opening in the thinnest part of the shell, immediately over the kernel.—When this part has been extracted it proceeds to another, till in an incredibly short space of time, the nut is cut longitudinally on its four sides, and the whole kernel secured, leaving the portions of the hard shell untouched. Were, however, this species to confine its depredations to the hickory, chesnut, beech, oak, and maple, it would be less obnoxious to the farmer; but unfortunately for the peace of both, it is fond of the green corn and young wheat, to which the rightful owner imagines himself to have a prior claim. A war of extermination consequently ensues, and various inducements are held out to tempt the gunner to destroy them. In Pennsylvania an ancient law existed, offering threepence a head for every squirrel destroyed, and in one year (1749) the enormous sum of £8000. was paid out of the treasury, in premiums for the destruction of these depredators. In several of the northern and western states the inhabitants, on an appointed day, are in the habit of turning out on what is called a squirrel-hunt. They arrange themselves under opposite leaders, each party being stimulated by the ambition of victory, and of fastening on the other the expense of a bountiful supper. The hunters range the forest in every direction, and the accounts given us of the number of squirrels brought together at the evening rendezvous, are almost incredible.

In addition to the usual enemies of this species in the northern states, such as the weasel, fox, lynx, &c., the red-tailed hawk seems to regard it as his natural and lawful prey. It is amusing to see the skill and dexterity exercised by both in the attack and defence. When the hawk is unaccompanied by his mate, he finds it no easy matter to secure the squirrel; unless the latter be unconsciously pounced upon whilst on the ground, he is enabled, by his dodgings and twistings round the limb of a tree, to evade the attacks of the hawk for hours, and frequently worries him into a reluctant retreat.—But the red-tail, like other robbers, has learnt by experience that he is most certain of his prey when hunting in couples. He is frequently accompanied by his mate, especially in the breeding season, and in this case the contest is soon decided. They course rapidly, in opposite directions, above and below the limb; the attention of the squirrel is thus divided and distracted, and before he is aware of it, the talons of the hawk are in his back, and with a shriek of triumph the latter bears him off, either to the aery of his young, or to some low limb of a tree, or to a sheltered situation on the ground, where, with a suspicious glance towards each other, and an occasional hissing and growling for the choice parts, the hawks devour their prey.

This species of squirrel has occasionally excited the wonder of the populace by its wandering habits, and its singular and long migrations. Like the lemming (*Lemmus Norvegicus*) of the eastern continent, it is stimulated, either from a scarcity of food, or from some other inexplicable instinct, to leave its native haunts, and seek for adventures or for food in some distant and, to him, unexplored portion of our land. The newspapers from the west contain frequent details of these migrations; they appear to have been more frequent in former years than at the present time. The farmers in the western wilds regard them with sensations which may be compared to the anxious apprehensions of the eastern nations at the flight of the devouring locust. At such periods, which usually occur in autumn, the squirrels congregate in different districts of the far north-west, and, in irregular troops, bend their way instinctively in an eastern direction. Mountains and cleared fields,—the head waters of lakes and broad rivers,—present no unconquerable impediments.—Onward they come, devouring on their way everything that is suited to a squirrel's taste,—laying waste the corn and wheat fields of the farmer; and as their numbers are thinned by the gun, the dog and the club, others are ready to fall in the rear and fill up the ranks, till they occasion infinite mischief and call forth no empty threats of revenge. It is often enquired how these little creatures that, on common occasions, have such an instinctive dread of water, are enabled to cross broad and rapid rivers, like the Ohio and Hudson for instance. It is usually asserted, and believed by many, that they carry to the shore a suitable piece of bark, and seizing the opportunity of a favourable breeze, seat themselves upon this substitute for a boat, hoist their broad tails as a sail, and float safely to the opposite shore. This, together with many other traits of intelligence ascribed to this species, I suspect to be apocryphal. That they do migrate at irregular, and occasionally at distant periods, is a fact sufficiently established; but in the only instance in which I had an opportunity of witnessing the migrations of the squirrel, it appeared to me that he was not only an unskilful sailor, but a clumsy swimmer. It was (as far as my recollection serves me of the period of early life) in the autumn of 1808 or 9; troops of squirrels suddenly and unexpectedly made their appearance in the neighbourhood, but among the grey ones were varieties not previously seen in those parts; some were broadly striped with yellow on the sides, and a few with a black stripe on each side, bordered with yellow or brown, resembling the stripes of the little chipping squirrel (*Tamias Lysteri*). They swam the Hudson in various places between Waterford and Saratoga; those which I observed crossing the river were swimming deep and awkwardly, their bodies and tails wholly submerged; several that had been drowned were carried downward by the stream, and those which were so fortunate as to reach the opposite bank were so wet and fatigued, that the boys stationed there with clubs found no difficulty in securing them alive or in killing them. Their migrations on that occasion did not, as far as I could learn, extend farther eastwardly than the mountains of Vermont; many remained in the county of Rensselaer, and it was remarked that for several years afterwards the squirrels were far more numerous than before. It is doubtful whether any ever return westwardly, but finding forests and food suited to their taste and habits, they take up their permanent residence in their newly-explored country; there they remain and propagate their species, until they are gradually thinned off by the effects of improvement, and the dexterity of the sportsmen around them.

(To be continued.)

Art. IV.—*Notices of Irish Entozoa.* By James L. Drummond, M.D., Professor of Anatomy in the Royal Belfast Institution, President of the Belfast Natural History Society.

(Continued from p. 71.)

Anthocephalus rudicornis, Drum.

When about to send a communication to the 'Magazine of Natural History,' relating to some more of the *Echinorhynchi*, a fish, which in this part of the world is of rare occurrence, appeared in the Belfast market; namely, a halibut, (*Hippoglossus vulgaris*), which weighed 120 lbs. My indefatigable friend, Wm. Thompson, Esq., secured the *viscera*, attached to which I found a great number of tumors containing *Entozoa;* and, as much of this field of Helminthology remains to be explored, while every fact pertaining to it is of importance, I have thought it better to put on record the few observations I could make on the present species, than forward the remarks I had to offer respecting others already well known.

In the alimentary tube there was not an *Entozoon* of any description, but ample amends were made for this by the luxuriant crop on its external surface. The stomach, liver, spleen, mesentery, and intestines were everywhere studded with almost innumerable white or cream-coloured tumors, from the size of a large pea down to that of a grain of clover seed; while, at the same time were seen, under the transparent peritoneal coat of these *viscera*, numerous *Nematoidea* coiled up in spires.

The smallest vesicular tumors were spherical, but the larger were all depressed or lenticular, with a round or elliptical outline (*Fig.* 32, *a*). On examining these tumors, I had first to remove the peritoneal covering, under which was a white, thickish coat, of so soft a consistence that it could not be torn off like a membrane, but yielded to the forceps.— When this coat was perforated, a white, curdy fluid could be pressed out in considerable quantity, and along with it the *Entozoon* itself, (or sometimes two from the same capsule), of very small size, the animal bearing no correspondence in its bulk to that of the entire tumor.

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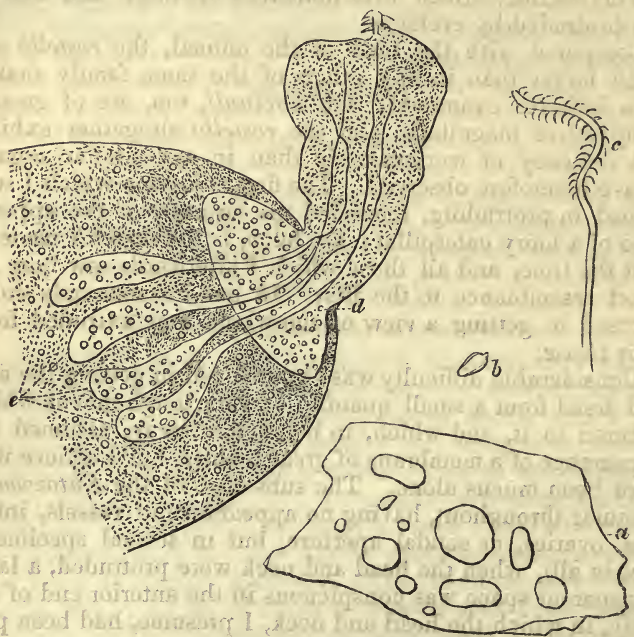

Anthocephalus rudicornis, Drum.

(*a*), portion of the intestine with the attached tumors containing the *Anthocephalus*. (*b*), the *Entozoon* as it appeared when first removed from a tumor. (*c*), a protruded *rostellum*. (*d e*) magnified view of the *Anthocephalus* when compressed, the head and neck protruding.

On getting the animal freed from its habitation, and washing off all extraneous matter, it appeared of an ovate form, and was very sluggish, though exhibiting signs of vitality by soon losing its regular outline, and contracting its margin so as to form various scallops and indentations; and after long watching it in the microscope no farther change could be observed.

I then tried the effect of compression: a specimen was laid on a slip of glass in a drop of water, and another slip placed over it. This had the effect of causing the head, which was previously invisible, to protrude; then the neck appeared, and it became evident that the animal was formed on the model of the *Anthocephali*. Four transparent sacs were seen in the anterior part of the body, (*Fig*. 32, *e*) and from these, four tubes ran up to the head, each evidently containing a *rostellum*. After watching in vain for the protrusion of the latter, I had recourse to stronger pressure, and in several instances succeeded in getting a *rostellum* to issue from its sheath, and show that it was constituted as in others of the same family, that it was crystalline, armed with numerous *uncinuli*, and that it was protruded by eversion.

Compared with the bulk of the animal, the *rostella* are much larger than in any others of the same family that I have hitherto examined; the *uncinuli*, too, are of greater comparative magnitude, and the *rostella* altogether exhibit less delicacy of workmanship than in any similar organs I have heretofore observed. The first *rostellum* which I succeeded in protruding, reminded me strongly of the appearance of a hairy caterpillar: *fig*. 32, *c*, is the sketch I made of it at the time, and all those which I afterwards saw bore an exact resemblance to the first. In one instance only did I succeed in getting a view of the whole four extruded from their *thecæ*.

Considerable difficulty was experienced in getting the animal freed from a small quantity of very tough mucus which adhered to it, and which, in being torn away, assumed the appearance of a membrane of great tenuity, but I believe it to have been mucus alone. The substance of the *Entozoon* is granular throughout, having no appearance of vessels, intestine, ovaries, or caudal aperture, but in several specimens, (not in all), when the head and neck were protruded, a large transparent space was conspicuous in the anterior end of the body, in which the head and neck, I presume, had been previously lodged.—(*Fig*. 32 *d*).

That this species has four *bothria* there can, I think, be little doubt; but as, from its sluggishness, the head could only be seen when compressed, their natural appearance could not, of course, be ascertained. In several instances, however, I observed the dilated portions of the head expanding and contracting (though very slowly) with an undulatory motion of their margins, like that of the *Bothriocephali*, *Scolex polymorphus*, &c.

These are all the observations I have been enabled to make on this species, which, I believe, has not been previously described, and I have referred it to the genus *Anthocephalus*, (as in a former paper I did that which I named *Anth. paradoxus*), not on account of its agreeing *exactly* with the character of that genus, for it has no caudal vescicle, but because it approaches more nearly to it than to any other. Much, I believe, must yet be known concerning the encysted *Entozoa*, before a proper arrangement and nomenclature can be applied to them; and in the mean time it is perhaps better to refer them to known genera, at the risk of some inaccuracy, than to fabricate new names, which, after a time would, in all probability, have to make way for others of still newer coinage. The specific title, *rudicornis*, I have applied on account of the coarse appearance of the *rostella* as compared with that of any others which I have hitherto observed.

The only other *Entozoon* which I observed in this large halibut was the *Filaria capsularia*, which, in great numbers, lay coiled up in the *peritonæum* of the stomach, liver, and intestines. But, however copious they might be in these localities, still the number was small when compared with that which I detected *between* the middle and inner coats of the stomach. The former, or muscular coat of this *viscus*, in the halibut, is connected with the inner or mucous coat, throughout a great part of its extent, by a thick, lax layer of cellular membrane; and on separating the one coat from the other, I found this layer to be, in many places, literally crammed with the *Filariæ*. They were in hundreds, each rolled up singly in a spiral form, but more frequently with several others under the same covering, forming so many distinct, round, flattened masses, lying as close to each other as stones in a pavement.

Belfast, March 5th, 1839.

(To be continued.)

Art. V.—*On a new Species of* Lamia *from the vicinity of the Swan River, New Holland.* By The Rev. F. W. Hope, F.R.S., F.L.S., &c., &c., &c.

I send for insertion in your 'Magazine of Natural History,' a description of a new species of *Lamia* from the vicinity of the Swan River, in Australia. My chief object in selecting *Lamia* is in consequence of the Baron De Jean, in his last Catalogue, omitting that term altogether, while he coins and publishes a new name to include under it insects which have years ago been ably described by the celebrated Fabricius. If entomologists of the present day are allowed to expunge, Plate. 2.

Lamia Boisduvalii

Chas. M. Curtis del.t Swaine sc.

ad libitum, the early Linnean and Fabrician names, and adopt others merely from caprice, there will be no end of confusion. Synonymy is always a perplexing study, and it is to prevent a serious evil gaining further ground, that I here protest against a system sadly too rife amongst naturalists, of changing well established names. The Baron De Jean, in his Catalogue of 1838, adopts the term *Batocera* instead of *Lamia* of Fabricius; why a new-fangled term is to be used instead of an old familiar name, remains to be explained. On the ground of priority I support the ancient names, and I feel convinced that there are many others who undoubtedly will advocate the same cause. Had *Lamia* been the only Fabrician term expunged by De Jean, I might have passed it over with a slight remark; but when I find *Buprestis*, *Stenochorus*, and *Haltica* entirely abandoned, and the genera of *Cerambyx*, *Elater*, *Cnodulon*, and *Tritoma* sunk into mere synonyms, and in their place the barbarous terms of *Hammaticherus*, *Ampedus*, and *Amarygmus* adopted, it is high time to speak out, and endeavour to put a stop to an evil which must embarrass science, and certainly greatly retard its progress.

In concluding my remarks, I quote a passage from the preface of the Baron De Jean's last Catalogue, (vide page 11), and for the future leave the question in other hands, hoping that those who wish well for science will oppose a system which, if acted on, can only lead to inextricable confusion. "Quoique je me sois toujours prononcé contre le principe exclusif de l'adoption du nom le plus anciennement publié, ce n'est pas cependant que je pense qu' un auteur ait le droit de changer les noms qui ont été etablis avant lui, ce n'est nullement cela que j'ai voulu dire. Je crois, au contraire, *qu'il faut conserver les anciens noms*, mais lorsqu'il y en a plusieurs, on a le droit de choisir, et il faut alors prendre le plus en usage, ou celui adopté dans l'ouvrage le plus marquant et le plus répandu, au lieu de s'attacher uniquement a la date de la publication." With respect to the above passage I have only to add "that the ancient names ought to be retained;" and acting on the suggestion of the Baron, I prefer the *ancient Lamia* to the *modern Batocera*, as it is a name in common usage, and occurs in one of the works of Fabricius, certainly "*le plus marquant et le plus répandu*," viz. the 'Systema Eleutheratorum.'

LAMIA *Boisduvalii*, Hope. (Sup. Plates No. 2.)

L. *Boisduvalii*. Long. lin. 25; lat. lin. 8.

Nigro-cinerea, thorace bispinoso elytris albidis maculis ornatis, humeris subspinosis, sutura ad apicem in spinam desinente.

Antennæ corpore longiores articulis pedibusque anticis scabris.

Caput postice annulo albido variegatum. *Thorax* utrinque spinosus rugisque transversis notatus. *Scutellum* albovillosum posticè rotundatum. *Elytra* nigro-cinerea basi scabra, seu melius tuberculis, parvis, nitidis, parum elevatis. Apex in medio spinosus. Disco maculis cretaceis variegato. Corpus infra nigro-cinereum, femoribus anticis tibiisque asperis. Plantis fuscis et spongiosis.

This magnificent insect was sent me by my friend Captain Roe, from the new settlement at Swan River, in Australia.—It is named in honour of M. Bois Duval, the author of the 'Voyage de Découverte de l' Astrolabe.' The above individual is justly considered one of the leading lepidopterists of Europe. I have mentioned that the Baron De Jean gives the name of *Batocera* to true *Lamia*; but six species are recorded in his last Catalogue, and all of them but one are designated as inhabiting the East Indies: the species alluded to is *Lamia Rubus*, Fabr., from the Island of Mauritius. The true *Rubus* of Fabricius, however, inhabits the East Indies, the *Rubus* from the Isle of France appears distinct, and is, I believe, as yet undescribed. *Lamia* according to my views is only found in Africa and Asia, and some of the adjacent isles; three species from the former continent have fallen under my notice, and about twenty from the latter, besides the species above described. The most magnificent of them all is *Lamia Roylii* from the Himalaya. According to Mr. W. W. Saunders, the perfect insect feeds on the blossoms of the pepal-tree (*Ficus religiosa*). In the interminable woods of Travancore, these insects abound; and from their excessive numbers and the effects they produce by perforating the trunks of large and gigantic trees, they act as useful pioneers, tending to clear the ground, and thin the exuberant vegetation which there abounds, Some of the native tribes of India in the vicinity of Travancore, and in the island of Ceylon, feed on the *larvæ* of *Lamiadæ*, as is the case in Africa with *Lamia gigas*, now denominated *Omacantha* by M. Serville. Col. Whithill has in his superb collection many of the *larvæ* of *Lamia* admirably preserved. It is a subject of regret among entomologists, that few collectors preserve insects in their earliest stages, in spirits; when we become better acquainted with them, and have it in our power to give the anatomical details of such gigantic forms as belong to the genera *Prionus* and *Lamia*, we may naturally expect that much light will be thrown on the sensorial organs of insects, which are at present very imperfectly understood.

March, 1839.

Pl.III.

1.2.3.4. Lima. — 5.6. Limatula.

J.D.C. Sowerby fecit

Art. VI.—*Descriptions of the Species of the Genus* Lima, *from the Coralline Crag, in the Cabinet of* Searles Valentine Wood, Esq., *late Curator to the Geological Society of London.*

13, *Bernard St., Russell Square,*
March 10*th*, 1839.

Sir,

During a residence of some years in the county of Suffolk, I devoted the greater part of my time to collecting the numerous fossils of the crag, and particularly those of the inferior beds described under the name of "coralline crag" in the 'Phil. Mag.' for August, 1835. The whole of my collection has been lately removed to the metropolis; and as a considerable number of the species which it contains are new to science, it is desirable that figures and descriptions of these should be published, as well as of those shells which have been described from inferior or imperfect specimens. I therefore forward to you the enclosed MSS., and accompanying series of the genus *Lima*, and if you think them of sufficient interest for publication, with illustrations, in the 'Magazine of Natural History,' I will, on a future occasion, continue the description of the new species contained in my cabinet.

Yours, &c.

S. V. Wood.

Editor of the Magazine of Natural History.

The genus *Lima*, Brug., is characterised as inequilateral and oblique, with an opening on one side, as the passage for a *byssus:* but there are some shells which, though they do not possess all these distinctions, retain other characters in common with the true *Limæ*, and cannot with propriety be entirely removed from the genus. The crag yields two species, perfectly equilateral, and apparently closed bivalves, so far deviating from the generic character that I have thought it necessary to institute for them a sub-genus, which I purpose to call *Limatula*. The *Plagiostoma* of Lluyd has been long established, and many different species delineated by Sowerby and other conchologists from the external character alone; and it is but recently that a specimen has been discovered (I understand now in the possession of Mr. J. D. C. Sowerby) which shows the hinge to be the same as that of *Lima*. Goldfuss unites *Plagiostoma* to *Lima*, and has included all the species of the former in the latter genus, with the exception of the *Plag. spinosa*, which he has altogether rejected. The only difference that I have been able to observe between *Plagiostoma* and *Lima* is the opening which appears on the anterior side of some of those which belong to the secondary formations, while those of more modern deposits have the large opening for the *byssus?* on the posterior side. I do not know whether I am right as to the universality of this character, but it is uniform in all the species that I have examined. Goldfuss has given figures of forty-six species, (from the lias to the tertiary inclusive), and Deshayes six more, from the Paris basin.

1. *Lima exilis*, Nobis. Suppl. Pl. No. 3, fig. 1.

Shell inequilateral, oblique, slightly convex, slender, gaping, costated, (*costæ* numerous, irregular, small, and distant), hinge-line oblique, ligamental area large, central pit rectangular, *umbones* distant, *lunula* smooth.—Length, $1\frac{1}{2}$ inch, breadth $1\frac{1}{2}$ inch, depth one valve $\frac{3}{10}$.

Localities: Coralline crag, Ramsholt.
Red crag, Walton, Essex.

The lines of growth are very distinct, and carried over the ribs, producing a slight imbrication, giving the whole exterior the characteristic roughness of the file: ribs sharp and elevated on the anterior slope, but growing indistinct towards the posterior side; beyond the slope it is free from *striæ*, the opening for the *byssus* is on the posterior side near the hinge, but it gapes also slightly on the other side near the front; the lines of the central pit diverge from the *umbo* at an angle of 90°, pit projecting inwards, a slight depression is visible internally, produced by the ribs, and it has one large, oval, muscular impression near the posterior side.

This is identical with a recent species in the possession of Mr. G. B. Sowerby, without name or locality.

2. *Lima oblonga*, Nobis. Pl. 3. fig. 2.

Shell oblong, inequilateral, oblique, depressed, gaping on both sides, costated, *costæ* slightly waved, projecting beyond the edge, ligamental area large, hinge-line oblique, *umbones* distant. Length 1 inch, breadth $\frac{6}{10}$, depth $\frac{2}{10}$.

Locality: Coralline crag, Ramsholt.

Shell depressed, gaping on both sides, the anterior opening large and somewhat triangular, with an internal margin, *striæ* numerous, becoming raised into *costæ* as they approach the anterior slope, beyond which it is smooth, lines of *striæ* slightly visible internally, and one large, lateral, sub-oval, muscular impression.

A recent species, *Lima tenera*, figured and described by Turton in the 'Zool. Journal,' vol. ii. p. 363, *tab.* 13, *f.* 2, much resembles this in general appearance, and may hereafter prove to be a variety of the same, but a specimen of it, the same valve and the same size as my fossil, kindly lent me by Mr. G. B. Sowerby for comparison, presented the following differences. Posterior opening, wider and shorter, consequently the slope not so great nor the opening so long as in the recent shell, which is also more oblique, rather deeper, and the ligamental area not so large as in the fossil, and the *striæ* are finer and more regular in the recent shell, nor does our shell deserve the name of *tenera* or *fragilis*, (the name given to it by Dr. Fleming), as it is thick and strong.

I presume it is rare in the crag, not having found the opposite valve.

3. *Lima fragilis*, Auct. Pl. 3, fig. 3.

Pecten fragilis; Montague, 'Test. Brit.' p. 63, Supplement.

Localities: Coralline crag, Sutton.
Red crag, Walton, Essex.

The copious description given by Col. Montague leaves nothing to be added. Our shell appears rather thicker and firmer, with a very slight difference in the *striæ*.

By no means rare at Sutton; rather more so in the red crag, owing probably to its fragility.

4. *Lima plicatula*, Nobis. Pl. 3, fig. 4.

Shell inequilateral, oblique, convex, ovato-orbicular, anterior truncated, costated, *costæ* 14-16, ligamental area small, oblique, *lunula* transversely crenulated. Length $\frac{2}{10}$ of an inch.

Locality: Coralline crag, Sutton.

A small shell and rare; my specimens not more than $\frac{2}{10}$ of an inch in length. The ribs are elevated, and as broad as the spaces between them, which are strongly imbricated; the ribs showing slight indentations; (*a*) is an enlarged figure with a portion more highly magnified. One ear on the posterior side is large and projecting while the other is scarcely visible; it differs from *Lima plicata* of Deshayes, inasmuch as it is smaller and more orbicular. The central ligamental area is very small and oblique, sloping towards the posterior side, which is not given in the figure.

Sub-genus *Limatula*.

1. *L. Limatula ovata*, Nobis. Pl. 3, fig. 5.

Shell equilateral, ovate, convex, equivalved, closed? bivalve; ligamental area large; *umbones* distant, costated, *costæ* 6-8, edge crenulated.—Length $\frac{3}{20}$ of an inch, breadth $\frac{2}{20}$, depth of single valve $\frac{1}{20}$.

Locality: Coralline crag, Sutton.

This shell is very abundant at the above locality. Although the coralline crag is generally considered to have been a deep water deposit, it must have been subject to some degree of agitation, as we find separated those bivalves whose attachment depends solely upon the ligament, and only under very favourable circumstances are their valves ever united. I have found some hundred single valves of this species, but never a double specimen.

The smaller figures are of the natural size, letter *a* is a magnified representation. There are about seven angular central ribs, beyond which are very faint traces of *striæ*, in well-preserved specimens the ribs are visible internally, giving about half-a-dozen rough crenulations in front. Ligamental area large, the lines of the central pit diverging from the *umbo* at an angle of about 80°, muscular impression sub-central and ovate. The shell figured by Brocchi, *tab.* 14 *f.* 14. is larger and longer. The young of the following species is much more cylindrical and not so largely costated.

2. *L. Limatula subauriculata*, Nobis. Pl. 3, fig. 6.

Pecten subauriculata; Montague, 'Test. Brit.' Supplement, p. 63, *t.* 29, *f.* 2.

Length $\frac{1}{2}$ an inch, breadth $\frac{1}{4}$ of an inch, depth $\frac{1}{5}$ of an inch.

Locality: Coralline crag, Sutton and Ramsholt.

(*a*) is a magnified portion.

This corresponds with Montague's description in every respect, but I have not seen the shell. The central *costæ* are angulated, dwindling into *striæ* on the sides, visible internally, crenulating the margin in front. The two opake *striæ* mentioned by Montague are not shown in the figure, but they are distinctly visible in two of my specimens. Montague's shell was only one quarter of an inch in length, breadth half its length.

Art. VII.—*Notice of the discovery of the Nests and Eggs of the common Crossbill, near Farnham, Surrey.* By H. L. Long, Esq. *With additional Remarks by* Mr. Yarrell.

It is now five or six years since I began to observe the crossbills; they were at first but few, and rarely seen, now they are in considerable numbers, and visible every day. If they migrate at all in the summer, some of them, the young birds perhaps, certainly remain behind, for some are to be seen here every month in the year.

They generally fly in flocks of from five to twenty, or upwards, hurrying along from plantation to plantation with an irregular flight, and a note expressive of alarm; when they are settled the note is changed into one of a lower tone, which continues in a sort of running colloquial *gazouillement*, while they feed on the cones of the larch, the spruce fir, or Scotch pine. The male bird has a gentle agreeable song, and I have this year frequently observed one singing, in fine weather, perched alone upon the summit of a fir.

The appearance of these birds, no longer occasional accidental passengers, but, it would seem, permanently domiciliated among us, is very remarkable. If the climate and latitude of England should suit their habits, why should they not always have been found in our island?

Perhaps the cause of their appearance is to be ascribed to the enormous extent of plantations of coniferous trees,—the growth almost entirely of the present century, and now inviting the crossbills by the abundance of fruit they offer. And indeed their appearance may be only a *re*-appearance; for, if ever in distant ages the Scotch and spruce firs were common in Britain, these birds might have inhabited our forests. Traces of the existence of these trees are too familiar in our peat-bogs to leave a doubt of their having been originally and indigenously most abundant; although the excellence of their timber, suitable to all purposes, in season at all times of the year, easily cut, and easily convertible,—led then perhaps to their reckless consumption and almost total extinction, as it is now leading, under more prudent management, to their re-establishment throughout the country. With the re-appearance of these coniferous trees occurs the appearance of the crossbills which feed upon them.

It seemed probable, after observing them here in every month of the year, and in increasing numbers annually, that they bred here; and, according to M. Neckar's observation, their nidification commences very early, almost in the winter. I therefore, early in February last, urged upon the attention of the labourers hereabouts, to keep a diligent watch in the plantations; and this day (April 13th) I have had the satisfaction of receiving a nest with four eggs, from the Holt forest in this neighbourhood. This is the third nest that has been met with in the Holt; the first was taken with two eggs; and then, on the 7th of April, one with four young birds, apparently above a fortnight old, which would date the commencement of the nest early in the month of March last.—These three nests were all found in the thick top of a young Scotch fir, of about thirteen or fourteen years' growth. The nest is of grass; the eggs are beautifully shaped, of an agreeable transparent white, and slightly speckled. In the young birds the crossing of the mandibles was scarcely discoverable, in accordance with the remarks in M. Necker's paper. Such a construction of the bill would indeed be useless, as long as the parent birds supplied the food. The contents of the crop of the young birds appear to consist, almost exclusively, of the *blanched* seeds of the larch.

I have thus the pleasure of sending,—

1. The top of a young Scotch fir, with the nest of a crossbill in it.
2. Two of the eggs.
3. A young bird, (preserved sufficiently to keep a short time), exhibiting the immature state of the beak.
4. The contents of the crop of the young bird.

M. Necker de Saussure, in his very agreeable "Mémoire sur les Oiseaux des environs de Genève,[1]" (a work upon a similar plan would be a pleasing addition to English Ornithology), has given some interesting details respecting the crossbill.

Hampton Lodge, near Farnham, Surrey;
April, 1839.

[Conceiving that the above notice would prove extremely interesting to Mr. Yarrell, we forwarded the MS. to him, along with the nest, eggs, and young crossbill: his acknowledgment of their receipt, which we are enabled to subjoin, gives additional value to Mr. Long's communication.—*Ed.*]

Ryder Street, 22nd *April*, 1839.

Dear Sir,

I am very much obliged by the opportunity you have afforded me of examining the nest, eggs, and young bird of our common crossbill; and if the following descriptions of them are worthy of being appended to the interesting communication forwarded by your correspondent, they are very much at your service.

The nest is rather small in proportion to the size of the bird, being only four inches and a half across the top, out-

[1] Lu à la Société de Physique et d' Histoire Naturelle de Genève, et extrait du second volume des Mémoires de cette Société. Reprinted in sm. 4to. by Paschaud, Paris and Geneva, 1823.

side measure, where it is widest, and the cavity but three inches in diameter. The outside is strengthened with a few slender twigs of fir, then a layer of coarse dry grass, lined with finer grass and a few long hairs. It is lodged close to the central stem of a Scotch fir, about thirty inches below its highest point, at the base of the shoots of the year 1837; here the nest is supported underneath by five or six ascending lateral branches of the fir, which so entirely conceal it, that it can scarcely have been perceptible from the ground, and the occasional visits of the parent birds probably betrayed their retreat.

The eggs measure seven eighths of an inch in length and breadth, the colour white, slightly tinged with pale skim-milk blue, and sparingly speckled with red, which is of a darker shade on one egg than on the other; the character of the egg like that of the greenfinch, but larger, with the smaller portion of red colour not confined to the larger end.

The young bird appears to be about three weeks old, and measures four inches and a half in length, the wing from the carpal joint to the end only two inches and a half long, the base of each primary being covered with its membranous sheath, or only as yet what is commonly termed pen-feathered. Both mandibles of the beak straight, the under mandible shutting within the upper; the plumage of the head, back, rump, and all the under surface of the body greyish white, tinged with yellow, and streaked longitudinally with dusky brown; the feathers of the wings and tail dark brown, edged and tipped with pale wood brown. Legs and toes flesh colour.

Yours very truly,
WM. YARRELL.

Editor of the 'Magazine of Natural History.'

ART. VIII.—*List of a few Rare or Interesting Plants noticed in the neighbourhood of Kirtlington, Oxfordshire.* By W. WILSON SAUNDERS, Esq., F.L.S., &c.

LOCAL lists of plants, however small, often prove interesting to the practical botanist, and with this idea I have drawn up the following, which pretends to nothing more than pointing out the localities of a few rare or interesting plants which I met with last summer in the neighbourhood of Kirtlington. The country about Kirtlington is gently undulating in its outline, and free from wood, except near the parks of Sir George Dashwood and — Annesley Esq. The river Cherwell bounds

Kirtlington parish to the west, accompanied by a belt of wet meadow land; and to the east, near the village of Weston, is a very interesting locality called "the Peat-pits," a boggy tract of very limited extent. Limestone is found at a few feet below the surface of the soil in all the elevated parts of the neighbourhood. Oldbury, which occurs several times as a locality, is a portion of Sir G. Dashwood's park at Kirtlington, adjoining the church-yard.

SALVIA *pratensis*, Linn. This rare plant occurs sparingly in the Green Lane as it is called, leading from Kirtlington to the western extremity of Lord Jersey's Park at Middleton. The plants grow close by the road side, in that part of the lane immediately under Lord Jersey's park, but at a distance from gardens or buildings. This lane is generally supposed to be the remains of an old Roman road, and the surface of the soil has probably been undisturbed for ages.

FEDIA *dentata*, Vahl. Grows abundantly in the corn fields near the locality for *Salvia pratensis*.

SCHŒNUS *nigricans*, Linn. Common in the boggy parts of the Peat-pits at Weston.

FESTUCA *Myurus*, Linn. This grass, so often confounded with *Fes. bromoides*, is common about the village of Kirtlington, where it reaches from 15 to 18 inches in height, in rich soils.

AVENA *pubescens*, Linn. In dry pastures and by road-sides to the south-west of the village.

BRACHYPODIUM *pinnatum*, Beauv. Abundant about some shallow stone-pits at the commencement of the Common through which the road passes from Middleton to Hayford, near Lord Jersey's park.

POTAMOGETON *pectinatus*, Linn. In the great pond in Kirtlington park.

MYOSOTIS *cæspitosa*, Schultz. An interesting variety, with the corolla of a pure white, occurs on the banks of the great pond in Kirtlington park. The colour of the flower of this variety remains constant under cultivation.

CAMPANULA *hybrida*, Linn. Common in the corn-fields to the west of the village of Kirtlington, especially near the Washford stone-pits.

RIBES *rubrum*, Linn. A few plants grow in the drier parts of the Peat-pits at Weston.

ŒNANTHE *peucedanifolia*, Poll. Common in the Peat-pits at Weston.—This is surely a good species; the want of the universal involucre, and the linear radical leaflets, leaving the difference of locality out of the question, distinguish it from *Œn. pimpinelloides*, Linn., and these differences I find constant, after examining a great many specimens from this locality as well as from others.

SILAUS *pratensis*, Besser. Abundant in Oldbury and the parts of the park adjoining.

SAMBUCUS *Ebulus*, Linn. In the copse at the boundary of Kirtlington park through which the foot-way passes from Kirtlington to Weston. Also by the gate at the entrance to the Peat-pits from Stonehouse farm.

PARNASSIA *palustris*, Linn. Occurs sparingly in the Peat-pits to the north of the little stream which runs through them.

BERBERIS *vulgaris*, Linn. A few bushes of this plant occur in the hedges at the lower part of Oldbury; and it abounds in the hedges of the lane leading from Stonehouse farm to the Peat-pits.

HYACINTHUS *non-scriptus*, Linn. A variety with delicate pink flowers grows in a copse by the side of the canal near the stone-pits at Enslow bridge.

RUMEX *Hydrolapathum*, Huds. Abundant by the side of the Cherwell.—I have gathered radical leaves of this plant in the above locality which were 3 feet 6 inches long and 8 inches broad,—the largest leaf produced by any of our native plants. A thin transverse slice of the leaf-stalk is a beautiful object under the microscope.

COLCHICUM *autumnale*, Linn. This plant abounds in a field to the south of the village of Kirtlington, called "Galway-close;" and also sparingly in Oldbury.

SILENE *noctiflora*, Linn. In the corn-fields to the right of the foot-way from Kirtlington to Bletchington. This I insert on the authority of Miss Mara Saunders, to whom I am indebted for some fine specimens from this locality, which were gathered last year.

SPIRÆA *Filipendula*, Linn. In the drier parts of Kirtlington park, near the great pond; and also in the Green lane, near the locality for *Salvia pratensis*.

GEUM *rivale*, Linn. In Oldbury, near the spring, and in a meadow near the Oxford canal, at the very south-west extremity of Kirtlington parish. In the former locality it occurs from 6 to 10 inches high, with one or two flowers on a stem; in the latter, which is much wetter, from 1 foot to 20 inches in height, with several flowers on a stem, and here and there a flower showing a tendency to become double.

THALICTRUM *flavum*, Linn. By the side of the Cherwell, and in the Peat-pits.

ADONIS *autumnalis*, Lin. Corn-fields between Kirtlington and Bletchington.

RANUNCULUS *aquatilis*, var. β, *pantothrix*, DC. In wet ditches between Kirtlington and Bletchington parks.

ACINOS *vulgaris*, Pers. In the corn-fields between Kirtlington park and the village of Weston.

PEDICULARIS *palustris*, Linn. Abundant in the Peat-pits.

LINARIA *minor*, Desf. In the same locality as *Acinos vulgaris*.

DRABA *verna*, Linn. This plant grows to an unusually large size, in the corn-fields near the Washford stone-pits, having flower-stems from 4 to 5 inches long, and many springing from the same root.

CARDAMINE *amara*, Linn. By the side of the Oxford canal, in the meadow at the south-west extremity of Kirtlington parish, mentioned as a locality for *Geum rivale*.

LATHYRUS *Aphaca*, Linn. Grows in some abundance in Clay Hill, a large field on the outskirts of Kirtlington village, on the road to Woodstock. A field-way runs down the northern side of this field, and the plant grows between the way and the hedge.

CNICUS *eriophorus*, Willd. In the lane leading from Stonehouse farm to the Peat-pits.

ANTHEMIS *arvensis*, Linn. By the sides of the road leading from Kirtlington to Bletchington.

ACHILLÆA *Ptarmica*, Lin. Grows to a very large size, and with a yellowish tinge in the flowers, in the meadows by the side of the Cherwell.

EPIPACTIS *palustris*, Sw. An interesting variety of this plant, with large flowers, and pale green stem, bracteas, and calyx, grows in the wet parts of the Peat-pits, and in appearance is very unlike the usual state of the plant.

ORCHIS *Morio*, Linn. Abounds in Oldbury and the parts of Kirtlington park adjoining.

CAREX *intermedia*, Gooden.? A plant which I take to be a variety of this species, with distant spikelets, occurs in some plenty on a boggy piece of ground, at the west end of the great pond, in Kirtlington park. It is, I believe, the *Carex uliginosa* of Suter, not Linnæus; but was made a variety of *Car. intermedia* by Hegetschweiler, in an edition of Suter's 'Flora Helvetica,' in 1822, with the following character:—"Spicis inferioribus distantibus." I have the same plant from meadows near Mortlake, Surrey; and Dr. Bromfield has kindly forwarded it to me from the Isle of Wight. In the Kirtlington locality I could not find *Carex intermedia* in its usual state.

——— *paniculata*, Linn. In the osier beds near the Cherwell below Enslow bridge. I insert this locality on the authority of Mr. James Saunders, who showed me a series of specimens he had gathered there.

——— *ampullacea*, Gooden. In the Peat-pits, common.

Myriophyllum *verticillatum*, Linn. In ditches in the meadows between the Oxford canal and the Cherwell, particularly near the swing bridge.

Salix *pentandra*, Linn. A tree, bearing sterile catkins, of this beautiful species of willow, hangs over the spring in Oldbury, and when in flower quite perfumes the air with the fragrance of its blossoms, which are also much resorted to by bees of various kinds.

Art. IX.—*Illustrated Zoological Notices.* By Edward Charlesworth, F.G.S., &c.

(Continued from Vol. i. n. s. p. 534.*)*

On the Fossil Remains of a Species of HYBODUS, from Lyme Regis.

Our acquaintance with the zoological history of the defensive fin-bones termed *Ichthyodorulites*, both as it respects their specific determination and the group of fishes to which they appertain, is principally due to the labours of Louis Agassiz: and a considerable portion of the work now in course of publication by this eminent naturalist,—the 'Recherches sur les Poissons Fossils,'—is devoted to the illustration and description of these interesting fossils. Ranging vertically from the deposits of the cretaceous period to those of the Silurian system, and horizontally throughout an area of probably unlimited extent, the *Ichthyodorulites*, owing to their bony texture and exterior of enamel, have been preserved during the long period of their entombment with singular fidelity: and when disinterred from their matrix, assisted by a knowledge of the teeth, with which these osseous rays were formerly associated, the ichthyologist may safely venture to infer their relation to existing types, though all other traces of the skeleton may have disappeared.

The genus *Hybodus* is spoken of by Agassiz as being perhaps the most important of the extinct genera of placoid or cartilaginous fishes, in which one or both dorsal fins were armed with these defensive weapons. A large number of species are already characterised in the 'Poissons Fossils,'

the greater portion of which appear to have existed during the deposition of the secondary rocks of this country. In 1822 Mr. De la Beche figured a spine and jaw of this genus in the 'Transactions of the Geological Society;' but fossil Ichthyology had at that time received little attention, and even up to a much more recent period, the *Ichthyodorulites* were erroneously imagined to belong to genera allied to *Balistes* or *Silurus*, although a comparative examination of the basal termination of these organs would have readily shown the incorrectness of the supposition. Agassiz, in his general observations upon the *Ichthyodorulites*, acknowledges the valuable assistance which he received from a manuscript paper by Dr. Buckland and Mr. De la Beche, containing the descriptions of twelve species; and he remarks that the authors of this paper had then arrived at a knowledge of the true affinities of the rays in question.

A few weeks since Mr. Edmund Higgins, of Cheltenham, a gentleman who has for some time been a very ardent collector of fossil remains, brought for my inspection the beautiful specimen which forms the subject of these observations, the joint discovery of himself and Miss Anning, in the lias of Lyme Regis. Appearing to be the most perfect jaw of the *Hybodus* I had yet seen, and to possess a feature altogether new to the genus, in the presence of a curved spine about the region of the head, I requested and readily received permission from its owner to draw up the present notice for the 'Magazine of Natural History.'

The specimen consists of two tabular masses, (see Supplementary Plates, No. 4, fig. 1 & 2), on which the teeth are arranged in a regular series. The larger fragment (of which, in the engraving, some portion is omitted) is of a quadrate shape, and from half an inch to three quarters in thickness. Its anterior border is raised, slightly curved outwards, and bristled with teeth, which are disposed along it in parallel rows six deep, the external row being placed upon the extreme edge. The remaining three borders have abruptly broken edges, and from the section of the interior thus displayed, the mass, with the exception of a part of the jaw forming the anterior border, appears to consist of folds of skin and portions of bone, probably of the head, compressed together; but the whole is so blended with the lias which has filled the interstices, as to render the separation or discrimination of the parts a matter of impossibility. On one surface, however, of the mass, the opposite to that represented in the plate, a considerable portion of the skin is preserved apparently uninjured, and it is seen thickly beset with beautifully enamelled conical studs, each of which is attached by a neck to a round and expanded base, (fig. 5, *b* & *c*). The surface of these dermal points is marked with very prominent *costæ*, and their substance appears to be exactly analogous to that of the teeth. The portion of the skin of *Acrodus*, an allied genus, figured in Dr. Buckland's Bridgewater Treatise, seems to present a closely analogous character.

Notwithstanding that the teeth in this specimen are very numerous, and for the most part implanted in the bone by their original attachments, I have been quite unable to form an idea respecting the character which the entire jaws would present, and the relations which they have borne to the surrounding parts. The fragments of jaws figured by Agassiz, throw no light upon this matter; and although in the 'Poissons Fossils' a great many species are characterised by the osseous spines, and the genus often alluded to in the remarks upon *Ichthyodorulites*, the complete history of its characters and probable affinities has as yet been postponed.[1]

I am not able to determine whether the two fragments figured belong to one and the same side of the mouth, or to the upper and lower jaws: there is nothing like a symphysis, nor at the termination of the rows do the teeth present any decided diminution in size or number, by which the position of the lateral ligamental articulations might be detected.— The series of teeth on the larger fragment consists of seven rows, six deep, disposed along the anterior border of the mass; at one extremity the continuity of the series being interrupted by the fractured lateral edge or border of the mass itself, the rows of teeth are continued nearly to the margin of the opposite lateral border, but here they make a sudden bend inwards and backwards, by which their continuity is preserved; the portion so recurved consists of five additional rows, and its termination about the centre of the mass is shown in the figure. Reasoning from the analogy of the jaws in the existing genera of sharks, and also from the apparently forcible displacement of the teeth at the immediate spot where the bend occurs, this sudden curve would appear to be the result of accident, rather than the natural disposition of the parts. The smaller fragment however exhibits a very similar and equally sudden alteration in the direction of the rows of teeth, and the same thing may be observed in the original jaw figured by M. de la Beche in the 'Geological Transactions.'

[1] I believe the 12th livraison of the 'Poissons Fossils' is very shortly expected, and it may possibly contain the history of the genus *Hybodus*.

A very strong and irregularly shaped bone arises from the centre of the mass, and, with its base apparently resting upon this bone, is placed the curved spine which constitutes the principal feature of interest in the present specimen.—From the position which this spine now occupies, it would appear to have been situated about the region of the head, bending abruptly forwards directly it emerged from the integuments. The apex of the spine is unfortunately broken off; but the portion left is about half an inch long, covered with a smooth glistening coat of enamel, and presenting a slight but well-defined upper edge. A few elevated and wavy *striæ* are irregularly distributed upon its surface. The spine arises from a strong, expanded, bony base, which is formed by three obtuse processes united in a common centre, one of them extending anteriorly in the median line, and the other two, which may be termed the lateral processes, at right angles to the anterior one. Some portions of the surfaces of these processes would appear to have given attachment to very strong muscles, (fig. 7 & 8).

At the first glance this hooked spine might be thought to be related to those which characterise so many species of the genus *Raia* of Linnæus, but its remarkable bony base, and the general aspect of the organ itself, would seem to indicate its connexion with more important functions than are possessed by a mere dermal prickle. In the absence of evidence to the contrary, I should feel disposed to regard it as a solitary spine, developed in the median line of the frontal region, and connected with or simply resting upon the bones of the *cranium*. In the *Chimera monstrosa*, to which *Hybodus* has some affinity, a horn or frontal process is also present. In this instance, however, it is only found in the male sex, and the process itself has none of the formidable character about it presented by the spine of *Hybodus;* having but a comparatively slight base, and though the apex is armed with a series of small prickles, the process itself is, I believe, externally fleshy, with an internal, slight, bony support. The apparent analogy, however, is worth a passing notice, because the teeth of *Chimera*, although an existing genus, have been found fossil in deposits which also contain the remains of *Hybodus*.

The teeth in the present specimen vary from half an inch to three quarters of an inch in length. They are slightly bowed, with the convexity outwards, and at the same time arched from above to below, so that the apices of the outermost lateral lobes, in many instances, are nearly on the same level with the base of the central process. The crown of the tooth slightly projects beyond the osseous root which connects it with the jaw, the line of separation being marked by a well-defined *sulcus*. The crown is composed of a central conical, blunt process, bounded on either side by four or five small lobes, which are more or less distinctly developed. A raised median line extends from the apex to the base of the central process, both on the inner and external aspects, giving off other lines, which diverge,[1] and spreading over the rest of the process, become suddenly thickened just before they reach its base. Upon the smaller processes or lobes of the teeth, the lines also exhibit a strong tendency to converge towards the large central one. The space between these raised lines is about double that occupied by the lines themselves. On the internal aspect of the teeth, the lines exhibit, in a greatly diminished degree, the tendency to converge towards the central process, (see fig. 4). In many of them indeed, over the internal surface, the lines are vertical in their direction. Below, and extending parallel to the groove which separates the crown from the osseous root, is a prominent ridge, (see fig. 3), but of this there is no corresponding indication on the *internal* aspect, (fig. 4).

The above description must be considered as applying to the apparently normal or typical character of the teeth, many modifications of which may arise from their position in a particular part of the jaw, or from accidental circumstances.

The teeth, as shown in the figure, appear to have been uniformly directed backwards and inwards, and the lowest row in the series lies quite flat, as in the recent genera *Galeus*, *Carcharias*, &c. A circumstance worth notice is that the lowest row in the series is shown, by fractured specimens, to be fully as capable of taking office as those occupying the front rank; now the corresponding teeth in many existing squaloid genera are mere hollow cases, which become gradually filled with osseous matter as they ascend in the series.

I have been led rather minutely to detail the characters presented by this fossil jaw, because so large a number of species are included in the genus, and also because I have not been able to refer it to any species hitherto described.—Agassiz has figured the teeth of three species of *Hybodus* from the lias of Lyme Regis and Bristol, namely, *Hyb. raricostatus*, *reticulatus*, and *medius*. The teeth of the present species differ from the first of these in the greater size of the central process, and the less distinct development of the lateral ones, and in presenting much more numerous and small-

[1] The divergence of these lines is best shown by the recumbent teeth about the middle of the anterior border of the larger fragment, (fig. 1).

er *striæ;* from *Hyb. reticulatus* they are at once distinguished by the bluntness of the dental processes, and the divergence of the *striæ* upon their surface: the teeth of *Hyb. medius* differ in the indistinctness of the division of their crowns into lobes, and in the regularity of the compressed cones which their forms exhibit.

By far the greater number of species of *Hybodus* enumerated in the 'Poissons Fossils' are merely known by the *Ichthyodorulites;* and Agassiz regrets that the rare occurrence of the teeth and spines under circumstances which establish their relation to the same individual, compels him to introduce a double nomenclature. It fortunately happens in the present instance, that in addition to the frontal spine, both dorsal were also discovered. One of these is represented in the plate of the natural size, (fig. 9). Its fellow differs in being about two inches longer, in presenting a much slighter decrease in the width of the grooved sides, and in having a smaller number of denticulations. The character of these parts is so well conveyed by Mr. Sowerby's engraving, that it is unnecessary for me to enter into any minute description.

In the future identification of this species, it should be borne in mind that the supposed frontal spine may be lost, while the jaws or other parts of the skeleton may be preserved; and on the other hand, this singular appendage may not improbably be common to several species of the genus. The circumstance of this fossil appearing to be generally unknown to collectors, even in a detached state, strengthens my assumption that the shark to which it belonged was not furnished with a series of these spines, and indeed perhaps indicates the rare occurrence of the particular species which it may serve to characterise. I hope the publication of this notice may draw the attention of those interested in fossil Zoology to the subject, but at present Mr. Lonsdale is the only person of those to whom the fossil in question has been shown, who had previously seen anything of the kind; and he tells me that a similar but detached fossil body, also from the lias, is preserved in the Bath Museum.

Being unable to identify the present species with any one that has been described, I have called it *Hybodus Delabecheii*, M. De la Beche having, I believe, been the first geologist who drew attention to the fossil remains of the genus.

REFERENCES TO PLATE NO. 4.

Figs. 1 & 2. Tabular masses upon the borders of which the teeth are disposed. The posterior and right lateral borders extend farther than represented in the engraving. The parts connecting the two fragments are missing.

Fig. 3 is a small tooth, showing the prominent transverse ridge which marks the roots on their outer side.

Fig. 4. The inner side of a larger tooth of the form which appears to characterise the species.

Fig. 5, *a*, apparently a portion of skin without studs; *c* and *b*, studs of the natural size. (From the under surface of the mass fig. 1).

Fig. 6, *b*, a stud magnified.

Figs. 7 & 8. Two views of the supposed frontal curved spine.

Fig. 9. One of the two *Ichthyodorulites*, or spines supporting the dorsal fins found with the jaws.

REVIEWS.

Art. I.—*Species Général des Coléoptères.* Tome 6ième. Paris, 1839. Par Ch. Aube.

The Baron Dejean, to whom we are indebted for the first five volumes of this work, comprising the *Cicindelidæ* and *Carabidæ* of his magnificent collection, having found it impossible, from his numerous political and military avocations, to continue it with regularity, has confided the descriptions of the water-beetles, composing the families *Dyticidæ* and *Gyrinidæ*, to Dr. Charles Aubé; and it is impossible to have placed the subject in better hands. Already well known by his monograph on the *Pselaphidæ* as a microscopical coleopterist, this gentleman has added greatly to his fame by this elaborate volume of upwards of 800 pages, in which nearly as many species of aquatic *Coleoptera* are carefully described. He has not, judiciously as we think, confined himself to the collection of Dejean, but being in correspondence with the chief European entomologists, he has been enabled to produce a volume, superior, in our opinion, not only as to the extent of its materials, but also in the style of its execution, to any of the previous volumes of the work. There are several new genera established; and amongst the species we find those described by Mr. Babington in the 'Transactions of the Entomological Society' adopted and referred to, but under names previously given to them by other writers.

Art. II.—*Zeitschrift für die Entomologie; Herausgegeben von* Ernst Friedrich Germar. Erster Band Erster Heft. 8vo. 196 pp. 2 plates. Leipzig, 1839.

Having just received from the author a copy of this work, we hasten to announce its appearance, being convinced that the re-appearance of the venerable Germar, the friend of Latreille and Leach, will be hailed with satisfaction by our readers.—In this, the first number of a work similar in character to his 'Magasin der Entomologie,' are contained memoirs of various groups of insects by the editor and others. They are as follows.—

1. A Memoir upon the *Scutelleridæ*, by M. Germar, in which a great number of species of this interesting group, together with several new genera, are described, and in which we find the works of Burmeister, Guérin, &c., and the synoptical catalogue of Mr. Hope, carefully cited.

2. A Monograph on the genus *Mantissa*, by Dr. Erichson, preceded by various considerations as to the place occupied by this anomalous genus, together with descriptions of twenty-four species. We may here take occasion to observe that the author has not consulted the last volume of the 'Encyclopédie Méthodique,' (wherein his *Mant. chalybea* has been previously described under the name of *Mant. semihyalina*), nor the 'Entomological Magazine,' in which a species has been described by Mr. Newman: neither is the author acquainted with any Australian species, of which, however, we are aware of the existence.

3. Memoir on the chemical composition of the fatty matter and oily secretion of lepidopterous insects, by Professor Döbner, of Augsburg.

4. Descriptions of three new genera of *Cicadidæ*, by Dr. Germar: 1st, *Clastoptera*, near *Penthimia*, seven American species: 2nd, *Xerophloea*, near *Gypona*, oue Brazilian species: 3rd, *Phylloscelis*, near *Eurybrachis*, two Pennsylvanian species.

ART. III.—*The Natural History of the Sperm Whale.* By THOMAS BEALE, late Surgeon to the 'Kent' and 'Sarah and Elizabeth' South-Seamen. London: Van Voorst, 1839.

THE author of this work is favourably known as the writer of a brief sketch of the natural history of the sperm whale which was published three or four years since; and the information which he then communicated to the public in the shape of a *pamphlet*, has been re-printed, and now comes before us in the more important character of a *volume*. Since the publication of his first edition it appears that Mr. Beale has examined the skeleton of a cachalot in the possession of Sir Clifford Constable, near Hull, and has thereby been enabled to draw up a detailed description of its osteology; and by freely availing himself of the labours of his predecessors in his account of the soft parts, he has thrown together a good summary of all that is known respecting the anatomical history of this gigantic mammal. His remarks upon the habits &c. of the cachalot, are clearly the result of careful and well-directed observation; and though here and there a few passages are penned a little in the '*book-making*' style, yet the volume, upon the whole, is a very creditable production, and in some respects a highly acceptable contribution to the science of Zoology. Mr. Beale is perfectly satisfied that he has never encountered more than one species of sperm whale, and *that* the *Physeter macrocephalus* of authors, which he tells us has yet "to assume the station to which it is entitled in the history of animated nature." It seems that Cuvier and a host of other distinguished savans who have taken upon themselves to write about the sperm whale, have made all sorts of misrepresentations in their attempts to describe this cetacean, and the absurdity of the greater part of their lucubrations is shown up by Mr. Beale in the most able and praiseworthy manner. Our author indeed plainly shows that in handling the subject he is no respector of persons; and Sir William Jardine, or even the great Linnæus, come in for a rap, if he thinks they have done ought to merit castigation.

Mr. Beale's observations agree in their essential points with those of Mr. F. Debell Bennett, published in the 'Proceedings of the Zoological Society' for 1837; and our author has therefore the merit of priority. On the subject of the ejection of a column of water from the spiracle, which has long been a matter in dispute, we have the following remarks.—

"Out of the thousands of sperm whales which I have seen during my wanderings in the south and north Pacific Oceans, I have never observed one of them to eject a column of water from the nostril. I have seen them at a distance, and I have been within a few yards of several hundreds of them, and I never saw water pass from the spout-hole. But the column of thick and dense vapour which is certainly ejected, is exceedingly likely to mislead the judgment of the casual observer in these matters; and this column does indeed appear very much like a jet of water, when seen at a distance of one or two miles on a clear day, because of the condensation of the vapour, which takes place the moment it escapes from the nostril, and its consequent opacity, which makes it appear of a white colour, and which is not observed when the whale is close to the spectator, and then it appears only like a jet of white steam; the only water in addition is the small quantity that may be lodged in the external fissure of the spout-hole, when the animal raises it above the surface to breathe, and which is blown up into the air with the spout, and may probably assist in condensing the vapour of which it is formed.

"It has, however, been stated by some naturalists that it is only at times that this whale projects water from the nostril, and that, they say, is at the

BOATS ATTACKING WHALES.

time of his feeding. How far such an observation can apply to the Greenland whale, which feeds near the surface, will be noticed in the conclusion of these remarks; but I can state here, that such an observation cannot hold good with regard to the sperm whale, for that creature feeds far below the surface, and, in so doing, the large male continues in the depths of the ocean from an hour to an hour and twenty minutes, without once showing himself above; so that, if he wishes to eject water from the mouth through the nostril, to avoid swallowing it, (if, indeed, he has any anatomical arrangement for so doing), it must be performed in the depths of his native element, into which he descends to feed, and therefore the operation is remote from observation."

Mr. Beale appears to be completely in his element when describing the chase and capture of this giant of the ocean.

"Let the reader suppose himself on the deck of a south-seaman, cruising in the North Pacific Ocean at its Japanese confine. He may be musing over some past event,—the ship may be sailing gently along over the smooth ocean, every thing around solemnly still, with the sun pouring its intense rays with dazzling brightness; suddenly the monotonous quietude is broken by an animated voice from the mast-head exclaiming "there she spouts." The captain starts on deck in an instant, and inquires "where away?" but perhaps the next moment every one aloft and on deck can perceive an enormous whale lying about a quarter of a mile from the ship, on the surface of the sea, having just come up to breathe,—his large "hump" projecting three feet out of the water, when at the end of every ten seconds the spout is seen rushing from the fore-part of his enormous head, followed by the cry of every one on board, who join heart and soul in the chorus of "there again!" keeping time with the duration of the spout. But while they have been looking, a few seconds have expired—they rush into the boats, which are directly lowered to receive them—and in two minutes from the time of first observing the whale, three or four boats are down, and are darting through the water with their utmost speed towards their intended victim, perhaps accompanied with a song from the headsman, who urges the quick and powerful plying of the oar with the common whaling chant, of—

"Away my boys, away my boys, 'tis time for us to go."

But *we* have not time to go with them, and must therefore refer our readers to the preceding spirited sketch, which forms one of the series in Mr. Beale's work; at the same time heartily recommending the volume to their perusal, as containing a great deal of entertaining matter, blended with really valuable scientific information.

THE

MAGAZINE OF NATURAL HISTORY.

MAY, 1839.

We have this month devoted a portion of the Magazine to the papers read before the Geological Society, on the zoological characters of the Stonesfield jaws; and having previously given translations of the Memoirs upon the same subject by MM. de Blainville and Valenciennes, our columns will be found to embody all the reasoning that has been advanced *for* and *against* the mammiferous nature of these fossil remains. The whole subject is one of which the investigation is attended with extraordinary interest, depending, however, not so much upon the abstract importance attached to the solution of the problem that has arisen from the "doutes" of M. de Blainville, as upon the ultimate considerations involved in the issue of the controversy. Are we mistaken in supposing that the comparative anatomist has obtained such an insight into those laws which regulate the development of organic structure,—such a knowledge of the limits assigned to deviation from uniformity in their operation,—that from a characteristic fragment of a skeleton he shall be able to restore the entire fabric, determine the element in which it was destined to exist, and the rank which it held in the scale of creation?

This inquiry, arising out of the present discussion, naturally forces itself upon our attention; and its vital relation to the science of Geology is so obviously apparent, that the mere allusion to its importance is all the notice that, in this view, the subject requires. In approaching the original question, it is hardly possible to shake off the impression conveyed by negative geological evidence, and to regard the matter as one in which the only legitimate data to guide our decision, must be sought for in the inductive reasoning of the comparative anatomist.

The frequency and abundance in which we find terrestrial mammals imbedded in *tertiary* rocks of marine origin, and the ample evidence which exists of *secondary* strata having often been deposited by the waters of bays, estuaries, or rivers, and under conditions which must have been favourable for the transportation of terrestrial productions, are facts which the geologist cannot easily exclude from recollection; and as the result of geological research in every country of the world where fossiliferous strata have been studied, the Stonesfield relics come before him, the one single exception—the solitary record during that period of the earth's history, of the existence of beings in the same elevated class in which man himself has been stationed.

We had a few casual remarks to offer on this subject, rather from a feeling that we ought not to pass by a topic in Paleontology that has excited such an unusual degree of attention, than. with the idea of testing the strength of the respective positions assumed during the course of the discussion; but perceiving that our observations would extend over a greater space than we can venture to afford, we must take another opportunity of reverting to the subject.

Some numbers of a work have, within the last few days, come under our notice, the publication of which we see with no small share of surprise, mingled wrth a feeling not far short of indignation.—The covers bear the following indication of their contents.—"Conchologie Mineralogique de la Grande Bretagne, par James Sowerby.—Traduction Française revue, corrigée, augmentée, par L. Agassiz." A French version of the text of Mr. Sowerby's 'Fossil Conchology,' with coloured imitations of the accompanying figures, and this published at one fourth the cost of the original work, is about the last thing we should have looked for from the hands of Louis Agassiz. The illustrations, for the most part, are but sorry imitations, though sufficiently characteristic to serve for the identification of the species, and thus check at least the foreign demand for a work, upon which so many years of toil have been expended. As a set-off against this undue appropriation of the labours of another,—this inroad upon the property of a fellow-labourer in the field of science, we are told that "l'utilité d'une édition Française du Mineral Conchology, mise à la portée de toutes les bourses, devant être incontestable aux yeux de tous ceux qui favorisent les progrès de la Géologie."

Now if some noble patroniser of science in this country, acting under a conviction that an English translation of the 'Poissons Fossils,' with a fac-simile of the numerous illustrations, would, if published at ten shillings each part, instead of thirty, be very acceptable to all those who are favourable to the progress of Geology, were, either by the aid of a government grant, or from his own private resources, to carry this idea into execution, the "*utilité*" of such an edition would, in this case, be equally incontestable, and probably no one would be better able to appreciate its value than Louis Agassiz himself. We believe the number of copies of Agassiz' work sold in this country exceeds one hundred, and were this demand supplanted by an English translation, we would not venture to predict how many more livraisons of the 'Poissons Fossils' would be forthcoming. Of this we feel satisfied, that the 'Fossil Conchology' would never have been undertaken, if its authors (the Messrs. Sowerby) had anticipated such a course as that pursued in the present instance by Agassiz, and if his first speculation succeed, we suppose he will follow it up with a regular system of piracy upon the literary productions of English naturalists.

Personal knowledge, and a feeling of respect for the proud position in the zoological world occupied by the author of the 'Poissons Fossils,' make us, on the present occasion, most reluctant censurers.— Agassiz has met with the most cordial support on all sides, and in various ways, from the cultivators of science in this country; and although it may appear harsh thus to express ourselves, we do not hesitate openly to declare our conviction, that in editing a transcript in the French language of the 'Mineral Conchology of Great Britain,' its author cannot be said to have really promoted the objects of science, still less to have added to his own reputation.

SHORT COMMUNICATIONS.

Breeding of the Woodcock in England.—On the 24th of March a woodcock was flushed in a wood near my house; and on examining the spot from whence it rose, a nest with four eggs in it was discovered. It was not disturbed for four or five days; when, finding it deserted, the eggs were taken and brought to me, and are now in a glass case. They had not been sat upon, as upon blowing them they were perfectly fresh.—*E. Eardly Wilmot.—Berkswell, April* 11*th*, 1839.

Iconographie des Insectes Coléoptères, par De Laporte Comte de Castelneau et H. Gory.—According to the prospectus, the above work was to consist of 20 livraisons; having just received the 27th and 28th, I beg leave to offer to your readers some observations on the publication. Livraison 27 contains twenty-three figures in five plates;—livraison 28 only *thirteen*. The anatomical details are not worthy of comparison with those published by M. Guerin, and there are also other faults requiring notice. A monograph, according to my views, should give the derivation of the new generic names adopted by the monographer; the authors have omitted to give them. Some are easy enough to guess at; others are very recondite and obscure, and require some explanation. Some again exhibit a sad want of taste and euphony. What is the signification of *Temina*, and the meaning of the absurd term of *Nascio?* *Acherusia*, *Asthræus*, *Bulis* and *Bubastes* require their derivatives to be mentioned. It is high time that this work should be brought to a close; if not, subscribers will probably withdraw their names, and not submit to receive a fasciculus in which only thirteen species are figured instead of at least thirty, as there ought to be. We recommend the attention of the authors to the latinity, as absolutely necessary. The typograpical errors are numerous, and ought to be corrected. It is to be hoped that the index will be more perfect than that of the *Cetoniadæ* published by M.M. Gory and Percheron. A word respecting the plates. The figures are engraved under the superintendence of Dumesnil, and certainly do him credit; the colours are too vivid, many of the species are more like peacocks than the insect originals; and the quantity of gum used to set off the colouring comes off, and damages the appearance of the plates. We have yet another fault to find; the Latin descriptions of the species are too concise, and the French descriptions which follow are little more than a mere copy of the former; the whole are so meagre and scanty that it is impossible to make out any species with certainty; the characteristic distinctions are generally omitted. So much for the Iconographie, a work which has only one recommendation, namely, Dusmesnil's engravings.—*F. W. Hope.*

New species of frog in yellow amber.—Baron Bülow-Rieth of Stettin, is in possession of a very curious specimen of a frog, imbedded in yellow amber, which appears to be the only known instance of an antediluvian amphibian being handed down to our time with its external characters. That this individual has not been imbedded in the amber by artificial means, appears evident from its differing specifically from all living frogs. Mr. Schmidt, of Stettin, considers it to belong to the true *Ranæ* of the moderns, and that it is nearly allied to *Rana temporaria*, Linn., which it resembles in the colour of the skin and markings on the legs, but essentially differs from that species in the thinness and delicacy of the toes, which taper almost to a point.—*W. Weissenborn.—Weimar*

THE MAGAZINE

OF

NATURAL HISTORY.

JUNE, 1839.

Art. I.—*Observations on the History and Classification of the Marsupial Quadrupeds of New Holland.* By W. Ogilby, Esq. M.A., &c. &c.

(*Continued from page* 137.)

With regard to the history and nomenclature of the marsupials, it must be recollected, that, at the period when Linnæus published the 12th edition of the 'Systema Naturæ,' Captain Cook had not yet commenced that brilliant career of discovery, which has since made us acquainted with the most remote parts of the habitable globe, and rendered his name as illustrious as that of Columbus himself. The Australian mammals were consequently unknown to the Swedish naturalist, and the few marsupial quadrupeds with which he was acquainted, admitted of an easy and natural classification, in accordance with the principles of the system which he adopted. They were accordingly formed into a single genus, named *Didelphis*, (from the nature of the abdominal pouch with which they were provided, executing, as it were, the functions of a second *uterus*), and characterised by having ten incisor teeth in the upper and eight in the lower jaw; a character the more appropriate from being altogether peculiar to these animals. This classification, applied as it was to the American opossums, with which alone Linnæus was acquainted, is altogether unobjectionable, and has been adopted, without alteration, by the most judicious of subsequent zoologists; but after the discoveries of Cook and other navigators in the Pacific, and above all, the settlement of the British colony on the eastern shores of New Holland, had opened to investigation the Zoology of these distant regions, the dasyures, kangaroos, and phalangers of the east were unadvisedly incorporated in the same genus with the opossums of the western world, from the single consideration of the abdominal pouch, and with an utter disregard of all other organic characters, however prominent or influential. Thus were the natural harmony of the genus, and the logical simplicity and precision of its definition, at once destroyed; nor was it till many years afterwards, that the confusion thus introduced, was finally corrected. Dr. Shaw, the first describer of most of the Australian marsupials, and the principal author of all this perplexity, has, at the same time, the merit of having first led the way towards its subsequent reform, by separating the kangaroos and flying phalangers from the true didelphes of Linnæus, and establishing them, in separate genera, under the denominations of *Macropus* and *Petaurus*, by which names they still continue to be designated. This division was proposed in the first volume of the 'Naturalist's Miscellany,' published in the year 1790, but attracted little notice till M. Geoffroy St. Hilaire effected a more complete arrangement of the marsupials in the 'Magasin Encyclopédique' for 1796. In that monograph, he restored the genus *Didelphis* to the original simplicity which Linnæus himself had contemplated at its formation, by separating from it all the Australian species which Gmelin and Shaw had incorporated with it; and, adopting the *Macropus* of Shaw, arranged the remaining species in two new genera, by the names of *Phalangista* and *Dasyurus*. The following abstract of this distribution, will exhibit more clearly the principles upon which it was founded.

1. *Didelphis*. Teeth $\frac{10}{8}$: $\frac{11}{11}$: $\frac{77}{77}$; tail naked and prehensile; toes $\frac{55}{55}$; hind feet with an opposable thumb.
2. *Dasyurus*. Teeth $\frac{8}{6}$: $\frac{11}{11}$: $\frac{77}{77}$; tail hairy and unprehensile; hind thumb short; other toes separate.
3. *Phalangista*. Teeth $\frac{6}{2}$: $\frac{22}{00}$: $\frac{66}{88}$; tail naked and prehensile; hind thumb turned backwards; index and middle hind toe united.
4. *Macropus*. Teeth $\frac{6}{2}$: $\frac{00}{00}$: $\frac{55}{55}$; tail very long, hairy and unprehensile; no hind thumb; index and middle toe, behind, very small and united.

It will be observed that, in this arrangement, M. Geoffroy suppresses the genus *Petaurus* formerly proposed by Shaw, incorporating the animals thus designated with the phalangers; though in so doing he has unwittingly stumbled upon the identical fault which his whole labour was designed to correct; introducing into his new genus the very confusion complained of in the original distribution of Shaw and Gmelin, and rendering his definition of the phalangers totally inapplicable to the majority of the species; for the petaurists differ from the phalangers as well by the unprehensile nature of the tail, as by the possession of lateral membranes. The only natural genus, therefore, which M. Geoffroy definitely formed at this period, was that which still continues to bear the name of *Dasyurus*, by which it was then distinguished; though he has undoubtedly the farther merit of having at least indicated the affinities of the phalangers, and the necessity of their generic separation.

Such was the state in which this department of Zoology continued till the return of Baudin's expedition in 1804; when, to use M. Geoffroy's own words, the rich materials collected by the accompanying naturalists, Peron and Lesueur, added to the marsupial animals already known on the continent, new systems of organic modifications, and types of new genera. From these data the French naturalist was enabled to establish the genera *Perameles* and *Phascolomys;* though it must be observed that the animals so denominated, as well as the dasyures and phalangers before mentioned, had been long previously described in the works of Shaw, Bewick, and other British zoologists. Monographs of these, and of some of the former genera, were afterwards published in successive volumes of the 'Annales du Museum d' Histoire Naturelle;' where their characters, according to M. Geoffroy's view of the subject, were finally settled, and their different species accurately described. From this period nothing farther was attempted in the Zoology of the marsupials, till the appearance of Illiger's 'Prodromus Systematis Mammalium et Avium,' in 1811. Three important separations were effected in this valuable work: the *Cheironectes* were distinguished from the *Didelphes*, the *Petaurists* from the *Phalangers*, and the *Hypsiprymni* from the *Kangaroos.* In adverting to this subject, M. Geoffroy criticises,[1] with considerable warmth and asperity of language, the presumption of Illiger in interfering with the divisions which he had formerly established; and casts an unmerited reflection on the memory of the German naturalist, as having been more conversant with the details of classical philology, than with the organic structure and affinities of the animal kingdom. Nevertheless, the labours of Illiger must be regarded, by every impartial judge, as the completion of the work which M. Geoffroy had himself commenced, and as presenting the first really natural and unexceptionable *generic* distribution of marsupial animals. As such it was adopted by Baron Cuvier, in the 'Règne Animal,' and its merits have since been tacitly acknowledged by all subsequent writers, not even excepting M. Geoffroy himself. M. De Blainville added, in 1814, the new genus *Phascolarctos*, and M. Temminck, on the appearance of his 'Monogra-

[1] Dict. des Sci. Nat., Art. 'Marsupiaux.'

phies de Mammalogie' in 1824, completed the natural distribution of marsupial quadrupeds, by separating the genera *Thylacinus* and *Phascogale* from the *Dasyuri*, with which M. Geoffroy had associated them.

As at present constituted, therefore, the marsupial animals, excluding the *Monotremata* of Geoffroy and Cuvier, are arranged in the following twelve natural genera, thus shortly characterised.[1]

1. *Didelphis*, Lin. Teeth $\frac{10}{8}:\frac{11}{11}:\frac{77}{77}$; tail naked and prehensile; hind feet with a clawless opposable thumb.
2. *Cheironectes*, Ill. Teeth $\frac{10}{8}:\frac{11}{11}:\frac{77}{77}$; tail naked and unprehensile? hind feet palmated and with unopposable thumbs?
3. *Phascogale*. Teeth $\frac{8}{6}:\frac{11}{11}:\frac{77}{77}$; the two middle incisors above much longer than the lateral; the molars armed with sharp tubercles; tail unprehensile; toes separate and slender; the hind thumb tuberculous and without a claw.
4. *Dasyurus*, Geoff. Teeth $\frac{8}{6}:\frac{11}{11}:\frac{66}{66}$; tail unprehensile; feet digitigrade, with separate prehensile toes, and a rudimentary tubercle in place of the posterior thumb, in some species.
5. *Thylacinus*, Temm. Teeth $\frac{8}{6}:\frac{11}{11}:\frac{77}{77}$; tail unprehensile; feet digitigrade, five toes on the fore and four on the hind.
6. *Perameles*, Geoff. Teeth $\frac{10}{6}$ or $\frac{10}{8}:\frac{11}{11}:\frac{77}{77}$ or $\frac{88}{66}$; two interior toes next the thumb of hind feet united.
7. *Phalangista*, Ill. Teeth $\frac{6}{2}:\frac{22}{00}:\frac{66}{88}$; tail prehensile; hind thumb opposable, and two next toes united.
8. *Petaurus*, Shaw. Teeth $\frac{6}{2}:\frac{00}{00}:\frac{88}{77}$; tail unprehensile; lateral membranes; feet like those of *Phalangista*.
9. *Hypsiprymnus*, Ill. Teeth $\frac{6}{2}:\frac{11}{00}:\frac{55}{55}$; hind feet much longer than fore, and with the two interior toes united.
10. *Macropus*, Shaw. Teeth $\frac{6}{2}:\frac{00}{00}:\frac{55}{55}$; feet as in *Hypsiprymnus*.
11. *Phascolarctos*, De Blainv. Teeth $\frac{6}{2}:\frac{11}{00}:\frac{55}{55}$; the toes before separated into two opposable groups, the two interior on one side, and the three exterior on the other; hind thumb opposable, and two next toes united.
12. *Phascolomys*, Geoff. Teeth $\frac{2}{2}:\frac{00}{00}:\frac{55}{55}$; hind thumb very short, and without a claw, next three toes united.

It will be observed that, from this enumeration of the genera of marsupials, which are here arranged and defined according to the prevailing ideas upon the subject, I have excluded the *Halmaturi* and some other proposed divisions of M. F. Cuvier, the *Isoödon* of M. Is. Geoffroy St. Hilaire, and the *Acrobata* of M. Desmarest, as not being founded upon organic modifications sufficiently influential to entitle them to the rank of generic groups. With these exceptions,

[1] Since the autumn of 1831, when this paper was written, two new genera of Marsupials have been added to those here enumerated; *Myrmecobius* by Mr. Waterhouse, and *Chœropus* by myself. The former is described in the Transactions, and the latter in the Proceedings, of the Zoological Society.—W. O. April, 1839.

however, I consider the *generic* distribution of marsupial animals as approaching more nearly to a perfect and natural division, than that of almost any other order of mammals, as at present constituted. Indeed I know of none against which fewer reasonable or valid objections can be urged, upon this head; but whilst I concede this just praise to the *generic* distribution of the marsupials, I am bound, at the same time, to acknowledge, that I know of no other order of which the *families*, or intermediate groups, are at once so arbitrary, so illogical, and so entirely inconsistent both with the structure and economy of the animals. Yet this higher step in generalization is a most important link in that chain of affinities which constitutes a good classification; since upon it depend not only the scientific character of the system, but even its practical value, so far as relates to the knowledge of the superior group, and the nature of its composition; and it becomes, therefore, a matter of some consequence, to point out the errors of the present division, and to endeavour, if possible, to substitute one less objectionable to logical criticism, and more conformable to the natural affinities of the animals.

Baron Cuvier, and after him M. Desmarest, divide the order *Marsupialia* into six families; to which, however, they have given no distinctive names; probably because the illustrious naturalist first named, considered the primary group, at the period of publishing the first edition of his 'Règne Animal,' only as a subordinate family of his order *Carnivora;* and it is well known that he was not in the bad habit, which has since become so prevalent among a very inferior class of imitators, of burdening the memory by assigning useless and high-sounding appellations to the mere subdivisions of families and genera. M. Desmarest, who scrupulously follows the footsteps of Baron Cuvier in every department of Mammalogy, has not departed from his guide in the present instance; nor does the second edition of the 'Règne Animal' make any change in this respect, though the primary group is there elevated to the rank of an order, and the subordinate divisions consequently assume the station of families; groups which it was M. Cuvier's invariable practice to distinguish by appropriate names. This, however, had been done some years previously by the late M. Latreille, who, in his 'Familles Naturelles,' published in the year 1825, had moreover introduced some modifications into the divisions of Baron Cuvier, which have but tended to make it still more confused and unnatural than it was before; and only show how imperfectly this eminent entomologist was acquainted with the habits and structure of marsupial quadrupeds. Such as they are, his alterations in both respects have been adopted by M. Lesson.

But to obtain a clear insight into the merits and defects of these arrangements, I shall set them forth in the order and with the definitions of their respective authors. That of M. Cuvier is as follows.—

MARSUPIALIA	I. DIVISION. Long canines and small incisors in both jaws; the back molars with pointed tubercles; and in general teeth having all the characters of insectivorous mammals......................	*Didelphis.* *Cheironectes.* *Thylacinus.* *Phascogale.* *Dasyurus.* *Perameles.*
	II. DIVISION. Six incisors above, and only two below; superior canines long and pointed; inferior small, sometimes entirely wanting; hind thumbs opposable and without claws; two following toes united; a large *cæcum*.	*Phalangista.* *Petaurus.*
	III. DIVISION. Incisors, upper canines, and two hind toes united as in 2*nd Division*, but without opposable thumbs or inferior canines.	*Hypsiprymnus*
	IV. DIVISION. Differs from the last only in having no canines whatever.......	*Macropus.*
	V. DIVISION. Two long incisors below; two long ones in the middle, and a few rather smaller on each side, above. ...	*Phascolarctos.*
	VI. DIVISION. Purely rodent teeth......	*Phascolomys.*

The arrangement of M. Latreille is but little different in reality, except that it does far more violence to the natural affinities of the animals than even that of M. Cuvier; but whilst it is thus inferior, in a philosophical point of view, it has certainly the merit of greater logical precision, being founded upon a simple and uniform principle, which the other is not: it is therefore greatly superior as an *artificial method.*

MARSUPIALIA.	I. ENTOMOPHAGA. Two canines and numerous small incisors in both jaws.		*Didelphis.*	
			Cheironectes	
			Dasyurus......	*Dasyurus* *Thylacinus* *Phascogale*
			Perameles	
	II. CARPOPHAGA. Six incisors above; no inferior canines	4 superior canines	*Phalangista* *Phascolarctos*	
		2 superior canines	*Hypsiprymnus*	
	III. PHYLLOPHAGA. No canines in either jaw.	6 incisors above	*Petaurus* *Macropus*	
		2 incisors above	*Phascolomys*	

If simplicity, comprehensiveness, and something at least approaching to equality of distribution, be the logical elements of a good system, and no system destitute of these qualities can be either true to nature or useful in its application to practical purposes, it is impossible to conceive an arrangement more deficient in these essential characters than that of M. Cuvier. It is in vain that we here search for any systematic or leading idea of classification: there is no *principle of method:* and the author's only rule appears to have been some arbitrary and undefined notions of relations, which he himself has not been able to clothe in language. Nor is this the only logical objection, however fatal to its pretences as a method. Not only is half the number of genera which belong to the order, comprised in the first division alone, but no fewer than four out of the six divisions of M. Cuvier contain only a single genus each, whilst there are no less than six families to twelve genera; circumstances which betray either an unpardonably faulty classification, or an extremely defective knowledge of the constituent members of the group. The latter excuse, however, is by no means admissible; the generic forms of the marsupials were perfectly well known to Baron Cuvier, who has defined and characterised them with his accustomed accuracy and elegance; and the real defects of his arrangement will be found to arise from a slavish adherence to the modifications of the dentition, and even to the least influential and important parts of it; viz. the mere number of the incisors, and the comparative size and number of the false molars and rudimentary canines; for it is often difficult among the marsupials to determine to which of these orders a particular tooth belongs. This is the only thing like a uniform principle that I can discover; but it is so awkwardly mixed up with other extraneous characters, as to deprive the arrangement of simplicity and precision. The first division, for instance, unites all the marsupials which have more than six incisors in the upper, and more than two in the lower jaw, without regard to any other quality, however prominent or influential. Hence we find the arborial didelphs, the aquatic yapocks, the digitigrade thylacines, the saltigrade perameles, the carnivorous dasyures, the insectivorous phascogales, and the frugivorous opossums, some with large *cæca*, some with small *cæca*, and some without any *cæca* whatever,[1] all jumbled together without distinction; and separated from genera to which they are most intimately related by the more influential details of their structure, habits and appetites, merely because they happen to agree in the very uninfluential character derived from the

[1] On the faith of Dr. Grant. April, 1839.

number of the incisors. The second and fifth divisions of M. Cuvier's arrangement differ only by the presence or absence of a small canine, frequently a mere rudiment, and totally devoid of any assignable influence; the same remark applies to the third and fourth divisions, the separation of which is really no more, as far as the natural and logical principles of classification are concerned, than a distinction without a difference; nor is there any valid reason for separating the opossums from the other *Pedimana*, or the *Perameles* from the kindred saltigrade genera.

The radical defect of this system, in a scientific or zoological point of view, and it is an error which systematists constantly fall into, arises from attaching an undue value to slight modifications of dentition, without attending to the more important modifications of other organs not less influential; and often without even regarding the relations which necessarily subsist between organic modifications and the habits and economy of animal life. It is less troublesome, and perhaps more gratifying to the vanity of our intellectual powers, to *infer* the habits and appetites of animals from their structure, than to undertake the painful and laborious drudgery of observing them ourselves, or searching for them among the voluminous writings of foreign travellers and historians; yet this latter process, however tedious and difficult, is the only mode of investigation which deserves the name, or accords with the principles of inductive philosophy, or by which Zoology can eventually pretend to a really scientific character: the other, or *a priori* process, is but the spurious and vainglorious philosophy of the schools, which, ever since the days of Bacon, has been banished from every department of science except Natural History. He entertains a very erroneous idea of the science, who fancies himself a zoologist, because perchance he may be acquainted with the outward forms of animals, and able to refer any given specimen to its proper genus and species; he is not less mistaken who conceives himself to be a philosopher, because he has studied their internal structure, and the modifications of their different organic systems; these, no doubt, are most important facts, but they are only facts; they are, in conjunction with the *observed* habits and economy of animals, the phenomena or raw material with which the scientific zoologist has to work; *and the relations which subsist between the observed phenomena of structure and economy*, is the only true and genuine philosophy of Zoology; which, like all philosophy, is the knowledge, not of simple facts, but of abstract relations. It is only when a distinct, palpable, and *necessary* relation subsists between structure and habit, that we are justified in deducing or inferring the one from the other. This is legitimate induction, but it has been pushed far beyond its legitimate limits in the hands of some anatomists and zoologists.

(To be continued.)

ART. II.—*On the Classifications of the* Amphibia. By JOHN HOGG, Esq., M.A., F.L.S., C.P.S., &c.[1]

IN my short paper "On the Snake-like *Proteus*," contained in the first volume of the new series of the 'Magazine of Natural History,' I assumed the *permanency* of the *gills*,—from a long acquaintance with that remarkable fact,—as the principle upon which the *Proteus* ought to be characterised, not only in conformity with its natural organization, but likewise in respect to its position in the animal kingdom, as so nearly approximating to some kinds of fishes.

Whilst examining Mr. Jenyns's excellent 'Manual of British Vertebrate Animals,' I found, at p. 299, that he arranged our native species in the class *Amphibia*, and in an order termed "*Caducibranchia*," from the *gills* being "deciduous;" it very naturally occurred to me to form for the *Proteus* another order, which I named *Manentibranchia*, signifying the *gills* remaining *permanent;* and this I decided on, without investigating under what orders or groups zoologists (with the exception of Linnæus and Cuvier) had distributed the genera of amphibious animals.

Having lately had an opportunity of paying some attention to this class of animals, I shall venture, after giving an outline of the different arrangements that have been adopted by several of the modern naturalists, to add one—partly indeed derived from that of Latreille—which I hope, notwithstanding our imperfect knowledge of the rarer American kinds, may not altogether be disregarded by those zoologists who are more conversant in the highly interesting subject of Amphibiology.

To begin with Linnæus. He arranged such of these animals (except the genus *Cæcilia*) as were then known, in his last (the 12th) edition of the 'Systema Naturæ,' 1766, under the first order, Reptiles, of the third class,—*Amphibia;* and which were all comprised in only *two* genera,—*Rana* and *Lacerta*.

Laurenti, about the same time (1768), publishing his 'Sy-

[1] Communicated by the Author. Read at the Linnean Society, Feb. 6, 1838.

nopsis Reptilium,'—a work which then contained more accurate and further information of these animals, than any other that had appeared, and is still accounted one of authority and reference,—divided his seven genera into two orders, viz., those reptiles which *leap* in their progressive motion, and those which *walk;* as follow.—

CLASSIS.—*REPTILIUM.*

Ordo I.—SALIENTIA. Genera.—*Pipa. Bufo. Rana. Hyla.*

Ordo II.—GRADIENTIA. Genera.—*Proteus. Triton. Salamandra.*

The Count de La Cépède, in the 'Hist. Nat. des Quad. Ovip.' tome i., which was given to science in 1788, naming them *Oviparous Quadrupeds,* classed his four genera just as simply, by taking for his characters the presence and absence of a *tail;* thus.—

CLASSIS I.—Quadrupedes ovipari *caudati.*

Gen. II. *Lacertus.* Div. 8. *Salamandra.*

CLASSIS II.—Quadrupedes ovipari *ecaudati.*

Genera.—*Rana. Hyla. Bufo.*

Duméril, (Zoologie Analytique, 1806), as Daudin had before done in his beautiful work,—'Hist. Nat. des Reptiles,' 1802,—followed Brongniart, (see his Essai dans le 'Bulletin de la Société Philomatique,' No. 36), who in 1799 first divided the class *Reptilia* into four orders, and in the last of which he placed these animals. Duméril distinguished them, after La Cépède, by the want and presence of a *tail,* and merely assigned them new Greek, instead of the old Latin, titles. His genera are the same as Laurenti's, with the addition of *Siren;* as are here seen.

CLASSE III.—REPTILES.

Ordre 4. BATRACIENS.

1re Famille. Anoures. *Sans queue.*

Genres.—Pipa. Crapaud. Grenouille. Rainette.

2de Famille. Urodèles. *Avec une queue.*

Genres.—Triton. Salamandre. Protée. Sirène.

The same system is adopted again, but with a new family, by Oppel in his 'Reptilien,' 1811; as follows.

CLASSIS III.—*REPTILIA.*

Ordo III. NUDA, (Klein). Ordo IV. BATRACII, (Brongniart).

1. Familia.—*Apoda.* Genus. *Cæcilia.*

2. Familia.—*Caudata*, (Duméril).

Genera.—*Triton. Salamandra. Proteus. Siren.*

3. Familia.—*Ecaudata*, (Duméril).

Genera.—*Hyla. Rana. Pipa. Bufo.*

Merrem published his 'Tentamen Systematis Amphibiorum' in the year 1820, wherein he gave a more extended arrangement; retaining Laurenti's two orders, taken from the *modes* of progression of the *feet*, he added Oppel's order,—"*Apoda*," without feet,—and two new tribes; in which latter he designated those animals that undergo a *transformation*, and those that do *not*. But it is worthy of remark, that he restricts the first tribe, *Mutabilia*, to *only Salamandra* and *Molge;* whereas he ought likewise to have included in *that* tribe *all* (equally undergoing metamorphoses in their young state) the genera of his second order, and to have placed his *Tribus* I.—*Mutabilia*, after "*Ordo* II.—*Salientia*," and before the "*Genera*," which would have rendered his classification more perfect. The original is this.—

AMPHIBIA.

Classis II.—*BATRACHIA.*

Ordo I.—Apoda. Genus.—*Cæcilia.*

Ordo II.—Salientia.

Genera.—*Calamita. Rana. Breviceps. Bombinator. Pipa. Bufo.*

Ordo III.—Gradientia.

Tribus 1. *Mutabilia;* i. e. *Metamorphosin subeunt.*

Genera.—*Salamandra. Molge.*

Tribus 2. *Amphipneusta. Metamorphosis nulla.*

Genera.—*Proteus. Siren.*

Latreille, five years afterwards, introduced to the world a still better system, (vide 'Familles Naturelles du Règne Animal,' 1825, p. 104), in which he judiciously founded his two natural orders upon the *branchiæ* being *deciduous* in some species, and *perennial* in others, though in two families he has followed Dumèril; thus.—

Seconde Classe.—AMPHIBIES. *Amphibia.*

Premier Ordre.—Caducibranches. *Caducibranchia.*

1re. Famille.—Anoures. *Anoura*, (Duméril).

Les Genres.—Pipa. Crapaud. Grenouille. Rainette.

2nd Famille.—Urodèles. *Urodela*, (Duméril).

Les Genres.—Salamandre. Triton. Axolotl.

Second Ordre.—PERENNIBRANCHES. *Perennibranchia.*

1re Famille.—Ichtyoïdes. *Ichthyoida.*

Les Genres.—Protée. Sirène.

It will be seen that Latreille places the *Axolotl* (*Siredon pisciformis*) amongst the caducibranchious *Amphibia*, but it had been previously discovered that its *branchiæ* are persistent; the details of which may be learnt from a paper by Sir Everard Home, published in the 'Philosophical Transactions' for the year 1824, p. 419. One of the accompanying plates accurately represents the external *gills* as still *remaining* on a female *Axolotl* when in the state of possessing fully developed *ovaria*, and just before the *ova* are shed;[1] thereby proving her to be a *perfect* animal. Consequently Latreille should have stationed the *Axolotl* next to the *Proteus* in his second order.

The Baron Cuvier, in both editions of the 'Règne Animal' (1817 and 1829), has merely followed Brongniart in considering the animals now under our notice, as forming a part of the third order, and the whole of the fourth order, of Reptiles, being his third class of *Vertebrata*.

Dr. Wagler, in his work entitled 'Natürliches System der Amphibien,' 1830, calls the class, (after Linnæus) *Amphibia*, in which he separates the different animals, under the names of *Testudines, Crocodili, Lacertæ, Serpentes, Angues,* making them his first five orders respectively; and then follow his

Ordo VI.—CÆCILIÆ.

Familia 1. *Hedræoglossæ.* Genus. *Cæcilia.*

Ordo VII.—RANÆ.

Familia 1. *Aglossæ.* Genus. *Asterodactylus, (Pipa).*

Familia 2. *Phaneroglossæ.*

Div. 1. *Cauda nulla.*

Genera.—*Dactylethra. Rana. Hyla. Ceratophrys. Breviceps. Bombinator. Bufo. Otilopha. Rhinella.*

Div. 2. *Cauda distincta.*

Genera.—*Salamandra. Triton.*

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[1] For a similar anatomical plate exhibiting the *ovaria* and *ova* of a female *Proteus anguinus*, together with its description, see 'Articolo sopra un Proteo femmina, con tavolo di Rusconi,' 1828. We must hope that some able American zootomist will ere long dissect a mature and oviferous female, of every one of the remaining *Diplopneumenous* species, and make the like illustrations, with accurate engravings, in order to determine, after this most satisfactory manner, the exact form and structure of each animal, in its perfect state.

Ordo VIII.—Ichthyodi.

Familia 1. *Hedræoglossi.*

Tribus 1. *Branchiis nullis.*

Genera.—*Menopoma. Amphiuma.*

Tribus 2. *Branchiis distinctis.*

Genera.—*Siredon. Proteus. Menobranchus. Siren.*

Some of the genera above given are not those of Wagler, but they are here introduced to avoid an unnecessary increase of synonymes. The families are characterised by the *tongue;* and the other characters are, the absence and presence of a *tail,* and of *gills.* The name of the last order is taken from Latreille.

In his 'Synopsis of the Species of the Class *Reptilia,*' appended to the 9th vol. of Cuvier's 'Animal Kingdom,' translated by E. Griffith, 1831, Mr. Gray has adopted Merrem's two tribes, under which he has arranged the following genera.

AMPHIBIA.

Section I. *Mutabilia.*—Undergoing a transformation. Gills deciduous, covered with a deciduous *operculum.*

Genera.—*Rana. Ceratophrys. Hyla. Bufo. Rhinella. Otilopha. Dactylethra. Bombinator. Breviceps. Pipa. Salamandrina. Salamandra. Molge.*

Section II. *Amphipneusta.*—Not undergoing transformation.

Genera.—*Proteus. Menobranchus. Siredon. Siren. Pseudobranchus. Menopoma. Amphiuma. Cæcilia.*

With regard to the next classification, Professor Bell observes,—"it appears to me that no one arrangement hitherto given sufficiently distinguishes the different forms; and I venture to propose the following modifications, as more consistent with the diversities of structure in the different groups."

Class.—*AMPHIBIA.*

Order 1. Amphipneusta. Genera.—*Proteus. Siredon. Menobranchus Siren. Pseudobranchus.*

Order 2. Anoura. Genera.—*Rana. Hyla. Ceratophrys. Bufo. Rhinella. Otilopha. Dactylethra. Bombinator. Breviceps.*

Order 3. Urodela. Genera.—*Salamandrina. Salamandra. Molge.*

Order 4. Abranchia. Genera.—*Menopoma. Amphiuma.*

Order 5. Apoda. Genus.—*Cæcilia.*

This arrangement comprehending, 1st, the manner of *breathing;* 2ndly, the *absence* of a *tail* in the adults; 3rdly, the *presence* of a long *tail;* 4thly, the *want* of *gills;* and

5thly, the *want* of *feet*;—as the *five* different characters whereby the *five* several orders are classed, strikes me as being too *varied*, and too much departing from simplicity and uniformity; which, in my opinion at least, are so essential in every classification, and in which indeed consist the real ability and clearness of the methods of arrangement, so manifest in the Linnean 'Systema Naturæ.'

Although I may thus differ from my friend Prof. Bell in his view of the above classification, yet I must be allowed to call the attention of my readers to his able essay on the *Amphibia*, in which are given instructive and perspicuous descriptions, not only of the anatomical, but also of the physiological structure and organization, of this class of animals.—The essay is illustrated with many good woodcuts, and is contained in Todd's 'Cyclopædia,' Part I, p. 90, &c., published in June, 1835.

The last arrangement which I have met with, is that introduced by Mr. Kirby, in his Bridgewater Treatise, (vol. ii. p. 415), as here shown.

REPTILES.

Sub-class I. SOFT-COATED. *(Reptilia Malacoderma).*

Order 1. AMPHIBIANS. Siren. Proteus. Axolotl, &c.

Order 2. BATRACHIANS. Amphiuma. Triton. Salamander. Toad. Frog. &c.

Next, if one person should be desirous of classifying the *Amphibia*, as the Count de La Cépède, M.M. Duméril, Oppel, and others have done, by making the *tail*, or the *absence* of one, the characters of the *adult* animals, for his *two* divisions or orders; the modern genera would then be distributed in this manner.—

Order I.—UROPHORA. *Tail* present.

Genera.—*Cæcilia. Salamandra. Salamandrina. Molge. Triton. Menopoma. Amphiuma. Siren. Parvibranchus.*[1] *Proteus. Menobranchus. Siredon.*

Order II.—ANURA. *Tail* wanting.

Genera.—*Rana. Ceratophrys. Hyla. Bufo. Rhinella. Otilopha. Dactylethra. Bombinator. Breviceps. Astrodactylus.*

Also, if another person should prefer to characterise these

[1] As the generic name *Pseudobranchus* is apt to convey an incorrect idea, concerning the use and function of the *small gills*, in the branchial classification herein subsequently given, I have thought it right to substitute that of *Parvibranchus* for it. See Cuvier's note (²) at p. 121, tome ii, of the 'Règne Animal,' edit. 1829.

animals by the *want* or *number*, of *feet*, when in their perfect or full-grown state, the annexed classification may be conveniently used.

Order I.—Apoda. *Without* feet.

Genus.—*Cæcilia.*

Order II.—Dipoda. With *two* feet.

Genera.—*Siren. Parvibranchus.*

Order III.—Tetrapoda. With *four* feet.

Genera.—*Rana. Ceratophrys. Hyla. Bufo. Rhinella. Otilopha. Dactylethra. Bombinator. Breviceps. Astrodactylus. Salamandra. Salamandrina. Molge. Triton. Menopoma. Amphiuma. Proteus. Menobranchus. Siredon.*

Again, if a third person should arrange all the *adult Amphibia* according to their external *forms*, or mere shapes, the genera may be thus placed in four groups, or, as I shall here call them, orders, for the sake of concinnity.

Order I.—Anguiformia. *Snake-like.*

Genera.—*Cæcilia. Amphiuma. Siren. Parvibranchus.*

Order II.—Raniformia. *Frog-like.*

Genera.—*Rana. Ceratophrys. Hyla. Bufo. Rhinella. Otilopha. Dactylethra. Bombinator. Breviceps. Astrodactylus.*

Order III.—Lacertiformia. *Lizard-like.*

Genera.—*Salamandra. Salamandrina. Molge. Triton. Menopoma. Proteus. Menobranchus.*

Order IV.—Pisciformia. *Fish-like.*

Genus.—*Siredon.*

Having before observed that I selected the *permanency* of the external *gills* for the character of an *Order*, in which to place the *Proteus;* I will now subjoin an arrangement, including both *that* order, which corresponds with the *second* order previously instituted by Latreille,[1] and also his *first* order. To these I have added *two* more orders; one, *Abran-*

[1] But it is interesting to learn from Prof. Owen's paper mentioned above, that the eminent John Hunter first suggested the idea of partly characterising these animals by their *branchiæ* or gills. Mr. Owen says (p. 214),—"the *Siren*, the *Amphiuma*, the Kaltewagoe or *Menopoma* of Harlan, in short, all the "*reptiles douteux*" of Cuvier that Mr. Hunter was acquainted with, he considered as a distinct *Class*, which he denominates "*Pneumobranchia*," in the manuscript which is quoted by Rusconi, in the work entitled 'Amours des Salamandres Aquatiques,' (p. 12, 1821), and which is now published in the 'Physiol. Cat. of the Hunterian Collection,' vol. ii. p. 145, 1834.

chia, denotes that the *gills* (so far at least as is yet known) are always *wanting:* and another, *Imperfectibranchia*, signifies that the *gills* are either by nature *imperfect*, or that we have only at present an *imperfect knowledge* of them. The latter, as will be supposed, I have introduced as a *provisional* order. This arrangement will be found also to combine all the characters given in the last *three* classifications. I have likewise considered it preferable to agree with that systematic writer, and several others of the present day, in making the *Amphibia* constitute an entire *Class* by themselves. Yet I ought to state, that one of the distinctions relied upon for that object by some zoologists,—respecting the heart of these animals having but *one auricle*, and one ventricle, (cor uniloculare *uniauritum*),—and in which Cuvier himself especially coincided; for, even in his last edition (1829) of the 'Règne Animal,' he remarks that the *single* auricle is common to,[1] and therefore characteristic of, the *Batrachian* order,—does *not* in reality exist, as Prof. Owen lately discovered in his very skilful dissections of the hearts of some of the *doubtful* species, and in particular of that of the *Siren lacertina*.[2] It appears then from the accounts mentioned in his paper, which is published in the 'Zoological Transactions,' (vol. i. p. 213, 1835), that the *heart* of the *Amphibia* has *one uniform exterior*, but is in the *interior* separated into *two* distinct *auricles*.[3] That distinguished comparative anatomist observes

[1] His words are,—" n' ont au cœur qu' *une seule oreillette*, et un seul ventricule."—'Règne Animal,' tome ii. p. 101.

[2] See the beautiful preparations of the *Siren*, numbered 912, 913, 914; and particularly 913, A, which shows the internal structure of the *two* auricles in the heart of that animal,—in the Museum of the Royal College of Surgeons, in London.

[3] Hunter instituted an elegant system of classing those animals which have a *heart* (*καρδία*) by its *cavities*, (*κοιλίαι*);—" for in some animals" (as he observes) " it has only one, others two, others three, and the most complete of all four cavities; and this difference of structure forms so many grand divisions of the animal kingdom, which I must be permitted to call by the names of *Monocoilia*, *Dicoilia*, *Tricoilia*, and *Tetracoilia*."—(See Phys. Cat. vol. ii. p. 147). In the third order, *Tricoilia*, he places all the *Amphibia*, Linn., from their having two auricles and one ventricular cavity; but his pneumobranchiate tribe he referred to the second order, *Dicoilia*, from their having only one externally visible auricle, and one ventricle.—The *Radiata* were named *Acardia*. Upon this system Mr. Owen justly remarks,—" like all classifications founded on the variations of a single organ, the *cardiac* arrangement is too artificial for general application.—"(Note in *loc. cit.*) The same objection cannot equally apply to the *branchial* classification here proposed, because the *absence* and *presence* of *gills* form distinct and *externally* apparent characteristics in these animals; whereas, on the contrary, the chambers of the heart, being *internal* organs, can only be examined by very careful dissections.

(*loc. cit.* p. 217),—"the presence of *two auricles* in the heart of the *reptiles douteux* now renders applicable to the whole class of reptiles the phrase "cor uniloculare *biauritum*," and forms an additional argument for retaining as an *order* of that class, the *Amphibia* of Latreille." Nevertheless, for several reasons, which are unnecessary to be here given in detail, but more especially on account of the remarkable *transformations* undergone by so many of these creatures, and of the *branchial apparatus* pertaining to almost all the rest, I do consider myself fully justified in keeping the *Amphibia* in a *class* altogether apart from the *Reptilia*. I will therefore limit the class "*Amphibia*" of Linnæus, to the *last* family of the ophidians, and to *all* the batrachians in the *fourth* order of the *third class*,—"Reptiles,"—according to the Cuvierian system. Hence, the present class, *Amphibia*, will occupy an intermediate station between the class *Reptilia* and the class *Pisces;* and in order to show better the connecting link in the great chain of this portion of the animal creation, whereby the several kinds of the former approximate to those of the latter, I place the genus *Cæcilia* the first, on account of its great resemblance to some of the *ophidians*, or serpents, with which indeed many naturalists, besides Cuvier, have classed it.—and I terminate the *amphibians* by the family *Proteidæ*,—which by their permanent and fully-developed gills so closely approach to fishes;—and among them, the genus *Siredon* I station quite the last, because *Sir. pisciformis*, the *Axolotl*, is in shape and structure most nearly allied to a fish.

Division I.—*VERTEBRATA*.

Class IV.—*AMPHIBIA*

Sub-class I.—*MONOPNEUMENA*. Respiring singly; *either* by lungs only, *or* by gills alone.

Order I.—Abranchia. Gills *wanting*.

Family 1. *Cæciliadæ*. Body lengthened, slender, snake-like. Tail extremely short. Legs none.

Genus.—*Cæcilia*.

Order II.—Caducibranchia. Gills *decaying*.

Family 1. *Ranidæ*. Adult body short, roundish, or oval, broad. Tail wanting. Legs four. Tongue long. *Tympanum* open.

Genera.—*Rana*. *Ceratophrys*. *Hyla*. *Bufo*. *Rhinella*. *Otilopha*.

Might not the *Fishes* also be clearly arranged in one uniform *branchial* classification, by the difference of form, structure, position &c. of their *gills?*

Family 2. *Dactylethridæ*. Adult body short, frog-like. Tail none. Legs four. Tongue distinct. *Tympanum* hid.

Genera.—*Dactylethra*. *Bombinator*. *Breviceps*.

Family 3. *Astrodactylidæ*. Adult body short, flat, frog-like, tailless. Legs four. Tongue wanting. *Tympanum* hid.

Genus.—*Astrodactylus*. (*Pipa*).

Family 4. *Salamandridæ*. Adult body long, lizard-like. Tail long.—Legs four.

Genera.—*Salamandra*. *Salamandrina*. *Molge*. *Triton*.

Sub-class II.—*DIPLOPNEUMENA*. Respiring doubly; *both* by lungs *and* gills.

Order III.—Imperfectibranchia. Gills *imperfect*.

Family 1. *Menopomatidæ*. Body long, lizard-like; or lengthened, snake-like; with a tail. Legs four. Gill-like organs internal.

Genera.—*Menopoma*. *Amphiuma*.

Order IV.—Manentibranchia. Gills *permanent*.

Family 1. *Sirenidæ*. Body lengthened, snake-like, having a tail. Legs two in front. Gills tufted, external.

Genera.—*Siren*. *Parvibranchus*.

Family 2. *Proteidæ*. Body long, lizard-like, or fish-like, with a tail. Legs four. Gills ramified, external.

Genera.—*Proteus*. *Menobranchus*. *Siredon*.

(*To be continued.*)

Art. III.—*Observations on the* Rodentia, *with a view to point out the groups as indicated by the structure of the* Crania, *in this Order of Mammals*. By G. R. Waterhouse, Esq., Curator to the Zoological Society, Vice-Pres. of the Entomological Society.

(*Continued from page* 188.)

Family IV.—Muridæ.

Dentition.—Incisors compressed laterally: molars $\frac{3\,3}{3\,3}$ (in one genus $\frac{2\,2}{2\,2}$), rooted; the anterior molar of each series the largest, and the posterior one the smallest. The series on each side of each jaw widely separated and parallel.

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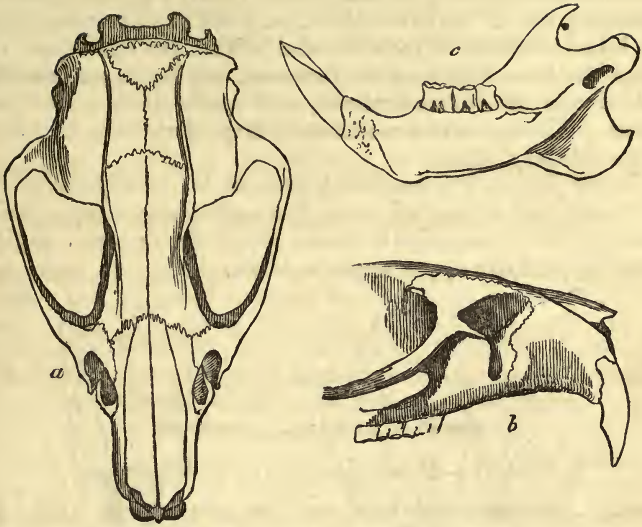

(*a*) upper view of the skull of *Mus giganteus*. (*b*) side view of the anterior portion of the skull. (*c*) one of the *rami* of the lower jaw, inner side.

Skull.—Zygomatic process of the *maxilla* broad, continued obliquely upwards and outwards from the plane of the palate, and divided into three parts, one of which is extended backwards to articulate with the malar bone, and complete the *zygoma;* the second is continued forwards in the form of a compressed and almost vertical plate, which serves to defend a vacuity connected with the nasal cavity. This vacuity is situated anterior to the orbit, and seems to hold the place of the lachrymal canal. The production forwards of the vertical plate converts the anterior outlet of the ant-orbital *foramen* into a narrow slit. Connected with this narrow slit, (through which the infra-orbital nerve passes), there is another opening of a larger size, and the outlet of which is directed upwards. Through this upper opening passes a portion of the maseter muscle. The third division of the zygomatic process of the *maxilla* is continued upwards and inwards, articulates with the ant-orbital process, and completes the anterior boundary of the orbit. The superior maxillary bone sends backwards a vertically compressed process almost immediately behind the intermaxillary suture. The zygomatic arch runs obliquely downwards and outwards from the ant-orbital process, and is recurved at the temporal portion. The glenoid cavity is of considerable extent in a longitudinal direction, and has a moderate transverse diameter. The palatine portions of the intermaxillary, maxillary, and palatine bones are all on the same plane, and the posterior margin of the latter is almost always situated behind the line of the posterior molars. The incisive *foramina* are large, and situated partially in the intermaxillary, and partly in the maxillary bones. There are two moderately large *foramina* in the palato-maxillary suture.

Lower jaw.—The coronoid process is usually large, and the condyloid elongated: the descending *ramus* approaches more or less to a quadrate form; the posterior lower angle is rounded, and the upper angle is acute.

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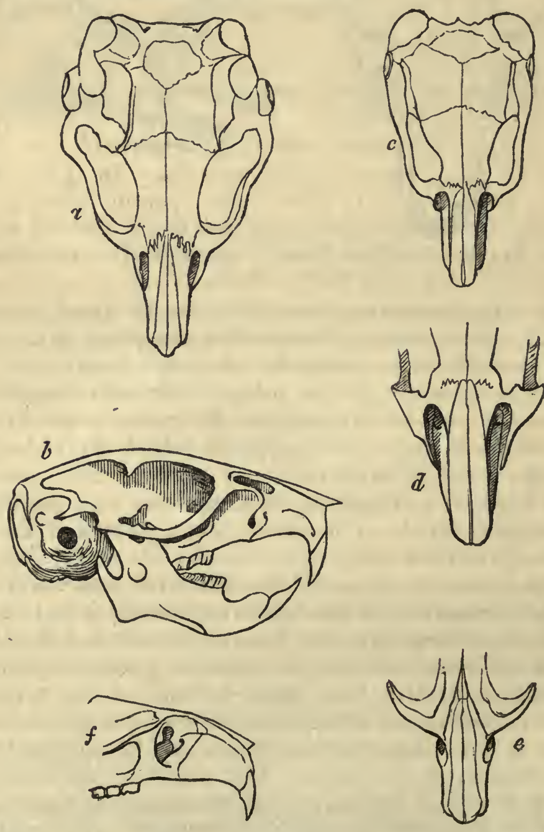

(*a* and *b*) *Psammomys obesus.* (*c*) *Gerbillus brevicaudatus.* (*d*) *Gerbillus Indicus* (*e*) anterior part of the skull of *Cricetus auratus.* (*f*) side view of the same.

In the form of the lower jaw the *Muridæ* do not differ essentially from the preceding families, the skull however is of a more elongated form, and the facial portion is proportionately larger as compared with that devoted to the protection of the brain. One of the most striking characters observable in the *crania* of the *Muridæ*, consists in the peculiar thin plate which is produced anteriorly from the zygomatic process of the *maxilla*. This thin plate (see *a*, fig. 34, and *d*, fig. 35) is usually of considerable extent, and is sometimes nearly vertical (as in *Gerbillus Indicus*, fig. 35, *d*), but is generally carried upwards and outwards from the palate, as in the common rat (*Mus decumanus*). This plate is proportionately most extended in the species of *Gerbillus* just mentioned, but in other species of the same genus it is very short; this is the case in *Gerb. brevicaudatus* (fig. 35, *c*). *Gerb. otarius*, *Gerb. pygargus*, &c.[1] In the hamster (*Cricetus vulgaris*) its outer surface is concave, and in *Neotoma Floridana* it is also concave, though in a less degree. *Cricetus auratus*[2] (fig. 35, *e* and *f*) is remarkable for the narrowness of this process of the *maxilla*. In this animal it does not project so as to protect the opening beneath, which leads into the nasal cavity, as in nearly all the other species of th e *Muridæ* which I have examined. In *Hydromys chrysogaster* there is a still narrower loop of bone inclosing the ant-orbital *foramen*, which is larger than usual, and there is a remarkable angular process projecting from the lower and anterior portion of this loop.

The two animals just mentioned (*Cricetus auratus* and *Hydromys chrysogaster*), and the *Rhizomys Sinensis* of Mr. Gray (which is the *Nyctocleptes Dekan* of M. Temminck), constitute the only species of the present family, the skulls of which I have examined, in which the thin plate arising from the *maxilla* above described is not produced anteriorly, as we find it in the rat.

Judging from the figure of the skull of *Nyctocleptes Dekan* given by Temminck in his 'Monographies,' I feel but little doubt that this animal belongs to the present family; it offers however some marked exceptions to the general characters of the *crania* of the *Muridæ:* the most remarkable of these is the want of the thin plate of the *maxilla* just mentioned, and the absence of the vertical slit through which (in the genus *Mus*)

[1] See M. F. Cuvier's 'Mémoire sur les Gerboises et les Gerbilles,' published in the 'Transactions of the Zool. Society,' vol. ii. pt. 2, pl. 25 & 26.

[2] A beautiful new species of hamster, from Aleppo, recently described by me, and to which I have applied the above specific name, on account of its rich yellow colouring; the under parts of the body, however, are nearly white. The length, measured in a straight line, is 6½ inches, the ears are about ½ an inch long, and the tail is about the same length.

the ant-orbital nerve passes. Here the ant-orbital *foramen* constitutes a tolerably large rounded opening, situated near the upper surface of the skull, and also near the anterior angle of the orbit. The broad spherical condyle also removes this genus from the typical rats. In *Mus Braziliensis*, however, we may perceive an approach to this spherical form of the condyle. The great size and strength of the incisors in *Nyctocleptes*, require a corresponding development of the temporal and maseter muscles; hence the great width of the temporal *fossæ*, and strength of the zygomatic arches, characters which exist in a minor degree in the common hamster.

The skulls of upwards of forty species of the family *Muridæ* have been examined by me, and among these were *crania* of the following genera. *Mus*, *Gerbillus*, *Psammomys*, *Reithrodon*, *Hydromys*, *Cricetus*, *Sigmodon*, *Neotoma*, *Hapalotis* and *Rhizomys*.

The skull of the *Mus giganteus* has been selected to exhibit the most common form observable in the present group, and the skulls of *Psammomys obesus* and *Gerbillus brevicaudatus* have been drawn to show the approach made by these species to those of the preceding family (the *Gerboidæ*). It is not only in the general form of the skull, with its narrow and elongated nasal bones, that this affinity is evinced, but what I consider more important, in the form of the descending *ramus* of the lower jaw. In several of the specimens from which M. F. Cuvier's figures of the *Gerbilli* (in the memoir before referred to) were taken, it appears that this portion of the lower jaw was imperfect, but where this was not the case, they are all represented as having the upper posterior angle of the descending *ramus* acute and elongated, as in the *Gerboidæ*.

The principal difference between the *Gerboidæ* and the *Gerbilli* consists in the size of the ant-orbital *foramen*, but in either group this varies considerably, hence in all probability the discovery of other species will render it necessary to merge the gerboas into the *Muridæ*. I have thought it desirable however, for the purpose of drawing attention to the various modifications observable in the *crania* of these animals, to separate these sections, and also to separate the *Myoxidæ* from the *Muridæ*, although in so doing I may give a name to groups which really are not distinct.

The genus *Psammomys* of M. Ruppell is evidently an offshoot (if I may so term it) of the *Gerbilli*. A skull figured by M. F. Cuvier,[1] as *Gerbillus*———? very closely resembles that of *Psammomys obesus*.

[1] See Transactions of the Zoological Society, vol. ii. pt. 2, pl. 26, fig. 1 & 2

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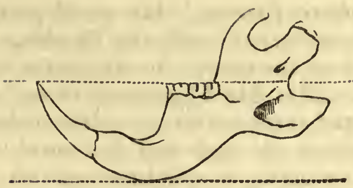

Lower jaw of the common Hamster.

I have also drawn one of the *rami* of the lower jaw of the common hamster, since it exhibits a modification of form which is important, especially to the investigator of fossil remains.[1] The peculiarity in this jaw consists in the *ramus* being so curved that the angle is considerably raised above the line of the symphysis, this line being drawn backwards from the *symphysis menti*, and parallel with the crowns of the molar teeth, as represented by the dotted lines in the woodcut. If similar dotted lines be introduced in the figure of the lower jaw of the *Mus giganteus*, it will be seen that in that animal the lower boundary of the descending *ramus* is in the same line as the lowest anterior portion of the jaw. In the *Arvicoli* (which appear to constitute a sub-family of the great group *Muridæ*) the angle of the jaw, as in *Cricetus*, is considerably raised, but excepting in these animals I am not acquainted with any rodents in which this is the case.

(To be continued).

Art. IV.—*Description of the Frontal Spine of a second species of* Hybodus; *from the Wealden Clay, Isle of Wight.* By William Ogilby, Esq., M.A., F.R.A.S., &c. &c.

The beautiful fragment of the jaws of *Hybodus Delabechei*, discovered by Mr. Higgins, and described in the last number of the 'Magazine of Natural History,' whilst it throws a new and valuable light upon the structure and characters of that remarkable genus of extinct fishes, has enabled me to ascertain the nature of a small fossil which had been for some time in my possession, but of which neither myself, nor the scientific friends to whom I showed it, could imagine the origin or relations. It consists of the tri-furcated base of a cranial spine, (fig. 37), or rather of the middle and one of the lateral processes, the corresponding process of the opposite side

[1] Fossil remains of a species of this group are figured n the 'Nouveaux Mémoires de la Société Impériale des Naturalistes de Moscou; see tome iii. tab. 20, fig. 6.

having been broken off, as well as a small portion of the spine itself; and comes very happily to illustrate some obscure points, which, from the manner in which the former specimen is imbedded in the lias, Mr. Charlesworth was obliged to leave doubtful. I found it myself in the wealden clay, at Sandown, Isle of Wight, between high and low water mark, partially exposed by the washing of the previous tide; and from the recently fractured surface, it was evident that the spine itself had been broken and washed off by the waves, only a short time before I found it.

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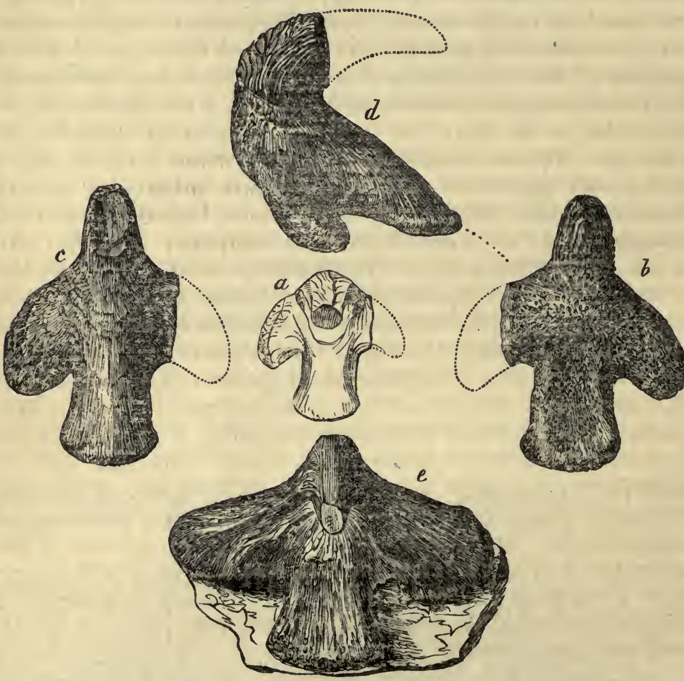

(*a*) represents the specimen of the natural size, as seen from above. (*b c* and *d*) are enlarged views, the first of the under surface, the second of the upper, and the third as seen sideways. (*e*) is a view of the superior surface of Mr. Charlesworth's specimen of *H. Delabechei* described in the last number of the Magazine, of the natural size, introduced for the sake of comparison.

The dimensions of this specimen are considerably smaller than those of the species figured and described by Mr. Charlesworth, its texture is more compact, and its general figure more symmetrical. The central process is comparatively longer, and more regularly formed. It is of a brownish horn colour, smooth and convex on the upper surface, but with a shallow longitudinal depression below, bordered on each side by a slightly elevated ridge, and surrounded in front by a partially raised margin, which has evidently given attachment to a powerful muscle for elevating and fixing the spine. The symmetrical form and general outline of this process, will be better understood from the accompanying figures, than from any description however detailed. Of the lateral processes, the right alone remains; this is shorter and less symmetrical than that just described, more gradually rounded on the outer margin, coarse and open in its texture, and irregularly convex on the under surface. Its general direction forms an angle of about 45° with the central process; and the whole fossil bears a not unapt resemblance to the foot of a minute *tapir* or *rhinoceros.* What may be called the heel, or junction of these three processes, is likewise irregularly convex, and forms a continuous curve, when viewed sideways, with the fragment of the spine itself. This, of which unfortunately a small portion alone remains, is of a very dense and compact structure internally, as may be seen by the newly-fractured surface, beautifully striated externally, and of large dimensions compared with the size of the whole fragment. This basal portion exhibits none of the enamel so apparent in the specimen described by Mr. Charlesworth; but it turns forward in the same direction, and appears to have pretty nearly the same general curvature.

However similar the specimen at present under consideration may be to that described in the last number of the Magazine, in its general form and characters, it is nevertheless very distinct in those minor traits which constitute specific differences; as might indeed be naturally expected from the geological position of the deposits in which they were respectively found. The bony base of the wealden species is not more than half the size of that from the lias, though the spine itself is equally large; the former, as already mentioned, is more symmetrical in form and closer in texture; and the lateral processes, instead of standing out at right angles to the central, have a more forward direction, whilst all the processes are longer and more slender. The following are some of the principal comparative dimensions of both.

	LIAS SPECIMEN.	WEALDEN DITTO.
Half distance between the tips of the lateral processes ...	.85 in.	.45 in.
Distance from the heel to the point of the middle process	1.2	.87
Breadth of the central part of the middle process	.55	.28
———— marginal rim surrounding front of ditto	.633	.34

As respects the *Hybodus Delabechei*, the two latter measurements must be received with caution, as the specimen has been a little injured in this part by the process of clearing away the surrounding lias; which may also account for its less symmetrical form, unpolished surface, and the absence of the marginal rim. The processes in both cases unquestionably gave attachment to powerful moving muscles; the central serving to direct the spine forwards, the lateral to either side, and all to fix and steady it. From the more expanded direction of the lateral processes, also, the spine of *Hybodus Delabechei* must have been capable of a greater extent of motion from side to side than that of the wealden species; and the nature of the instrument itself shows that it must have been a powerful weapon of offence. The specimen here described farther proves that, like the horn of the rhinoceros, it was connected with the bones of the skull, only by muscles; but, unlike, that instrument, it must have possessed great powers of motion. M. Agassiz, is said to have a manuscript note of the only species of *Hybodus* which has been hitherto discovered in the wealden formation. Whether the fragment here described may eventually prove to belong to that or a different species, time must determine; but it is interesting to know that the character of the frontal spine, first discovered by Mr. Charlesworth, is not confined to the *Hybodus Delabechei*, but common to the whole genus; or at least to the males, as in the allied genus *Chimæra*.

ART. V.—*Letter addressed to the Editor by* HENRY WOODS, Esq., F.L.S., &c., *respecting the supposed Frontal Spine of* Hybodus *in the Bath Museum.*

30, *Henrietta St., Bath,*
May 12*th*, 1839.

MY DEAR SIR,

A letter addressed by you to Mr. H. Jelly (who, I am sorry to state, has been for some time absent from Bath in consequence of ill health) having been handed over to me, I proceed to give you as good an answer as is in my power.

Before the receipt of your letter to Mr. Jelly, I had searched over the Museum of our Institution for the specimen mentioned by Mr. Lonsdale, and was fortunate enough to find it, or at least that which I consider to be it; and here you have the best drawing I can make, which I hope is precise enough for your purpose. It is of the natural size, and, from some peculiarities, may indicate another species of *Hybodus*: fig. 38, *a*, is a lateral, and *b* a dorsal view of it. The specimen measures $1\frac{1}{8}$ inch in length, and $\frac{7}{16}$ of an inch in breadth near the base, which is much mutilated. The apex is unfortunately broken off, but enough remains to show that, when perfect, it described a *reversed curve* at the end, as in fig. 38,

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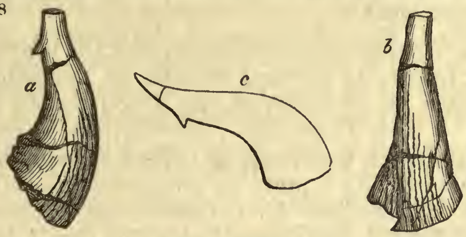

Spine of *Hybodus*.

c. Another peculiarity is the *barb*, or recurved hook, near the point—*a*, which, in your specimen, may have been broken off. Unfortunately, no part of the tri-lobed bony base is attached to this specimen, which has been broken into four pieces. Two of the three fractures occurred before it was found; and I think the curved form of the dorsal aspect is in a great measure owing to the edges of the fractured parts not being in exact juxta-position, the interstices being filled with clay.

Two peculiarities, in addition to those above enumerated, I consider to be worthy of notice. One is a raised and oblique lateral line, as seen in fig. 38, *a;* and the other, a number of nearly parallel *striæ* or *rugæ* on the *dorsum*, which so nearly resemble those upon the palatal or dental bones of the *Acrodus* ———, (vulgatè *Leeches* of the quarrymen), that I cannot help thinking this is rather a *palatal* than a *nasal* appendage, notwithstanding its extraordinary shape. Whether it may be identical with your specimen, or belong to some kindred species, or be altogether foreign to it, you must yourself judge; at any rate, it appears to me an object of interest, and you are perfectly welcome to make what use you please of this communication, which I can only regret is not more satisfactory both in figure and description.[1]

Yours very sincerely,
H. Woods.

Editor of the Magazine of Natural History.

[1] The specimen was found in the lias at Weston, a village two miles west of Bath; and was presented, about twelve or thirteen years ago, to the Museum of the Institution, by Jacob Wilkinson, Esq.

Art.VI.—*Catalogue of the Malacostracous Crustacea of South Devon.* By Edward Moore, M.D., F.LS., Secretary to the Plymouth Institution.[1]

It would appear almost superfluous, after the labours of Montagu and Leach, to attempt to take up the subject of the *Malacostraca* of Devonshire, as it constituted almost the chief field of their discoveries; nevertheless, in pursuance of my original object, to attempt to collect as many illustrations of the Fauna of this county as circumstances will allow, I shall make no apology for endeavouring, "haud passibus æquis," to follow in their steps: with this view I have sought from all sources within my reach, to ascertain what species have already been noticed, so as, by arranging them in the following catalogue, to lay the foundation of a more perfect acquaintance with some of the natural productions of our coast. The existence of a very excellent collection in the Museum of the Plymouth Institution, for which we are principally indebted to Mr. Charles Prideaux, of Hatch Arundel, near Kingsbridge, together with the advantages which I obtain by a correspondence with him and with Mr. J. Couch, of Polperro, will, I hope, render my catalogue not unacceptable to naturalists generally; and as I observe that Mr. Bell is shortly about to publish a work on British *Malacostraca*, I am unwilling that in the county of Montagu and Leach the subject should appear to be altogether neglected, possessing as it does such remarkable advantages for the pursuit. Yet, after all, it must be confessed that my paper will aim at no higher pretensions than that of a Catalogue, as in most instances it is almost impossible to obtain information beyond the mere fact of the occurrence of many species, which, living in deep water, all chance of obtaining any knowledge of their habits is precluded. In such cases, although I have been able to verify most of the observations of my predecessors, I have preferred letting the fact of existence stand in their names, merely referring to the works where their communications are to be found. There are, however, some species which I have been unable to identify as Devon specimens, from an inability to obtain access to works not procurable in this remote part of the scientific world; a deficiency, however, the less to be regretted, as it will most probably be supplied in Mr. Bell's expected work on British Crabs, a publi-

[1] We received the present catalogue from Dr. Moore in the month of September, 1838; but owing to the number of communications in hand, we have been unable to give it earlier insertion.—*Ed.*

cation which will be highly acceptable to all naturalists in this quarter.

In the following paper I have followed Cuvier's 'Règne Animal,' in which the *Crustacea* were arranged by Latreille.

The class *Crustacea* in the 'Règne Animal' has two sections, viz., *Malacostraca* and *Entomostraca*.

The *Malacostraca* are composed of five Orders, viz., *Decapoda*, *Stomapoda*, *Amphipoda*, *Lœmodipoda*, and *Isopoda*.

MALACOSTRACA with pediculated moveable eyes.

Order I.—*Crustacea Decapoda*. These have the head closely united to the *thorax*, both of which are inclosed in one entire shell or carapace, divided by lines into different regions, which indicate the places occupied by the principal interior organs; they have a vascular and nervous system; the lateral borders of the carapace fold down to protect the *branchiæ*, leaving an opening anteriorly for the passage of the water; the six jaw-feet are all of different forms, applied to the mouth, divided into two branches, the exterior of which is like a small *antenna;* the two anterior, and sometimes the four following feet are talon-shaped, the last articulation but one is dilated, compressed, and in the form of a hand.

Family 1. *Decapoda brachyura*, or short-tailed Decapods.

Genus *CANCER*.

Section 1. *Pinnipedes* or swimmers have the last feet with a flattened or fin-shaped articulation.

Polybius, sub-genus.

P. *Henslowii*. A fine specimen was obtained from the pilchard-nets at Bantham, in deep water, by Mr. C. Prideaux, and is now in the collection of the Plymouth Institution.

Portunus, sub-genus.

P. *puber*, Harbour or Mary Crab. Common on our coast; three specimens are in the Museum of the Plymouth Institution.

P. *mœnas*, (*Carcinus*, Leach), Common shore Crab. Abundant.

P. *corrugatus*. Dr. Leach says ('Linn. Trans.' vol. xi.) "habitat in Britanniâ rarissimè;" and afterwards states that the young was obtained in Plymouth Sound by Mr. C. Prideaux, who informs me that he procured it by the trawl net. My friend Mr. Couch, of Polperro, also states that he has obtained one specimen in his neighbourhood, so that it may be considered as belonging to our coast, although but rarely found from its habit of frequenting the deep sea.

P. *marmoreus*. Frequently obtained at Torcross by Montagu; Edinb. Encycl. vol. vii. p. 391. We have four good specimens in our Museum, presented by Mr. C. Prideaux.

P. *depurator*, the Flying Crab of fishermen. Not uncommon: we have two specimens, obtained by the trawl, from Mr. C. Prideaux.

P. *lividus*. One Plymouth specimen in our Museum, from Mr. C. Prideaux, by the trawl; others have been obtained by Montagu.

P. *emarginatus*. One specimen found at Torcross; (Leach, 'Lin. Tran.' vol. xi., and Edinb. Ency. vii., p. 390). Mr. Prideaux tells me it was also obtained in Plymouth by Gibbs.

P. *pusillus*. Two Devon specimens in our Museum from Mr. C. Prideaux.

PLATYONICHUS, sub-genus.

P. *variegatus*, (*Portumnus* of Leach, whose designation is changed by Cuvier, from being "trop rapprochée du mot *Portune*, déjà employée." It is said to be very common on our sandy shores; ('Linn. Trans.' xi. 314). Mr. Prideaux informs me it is found in Bigbury Bay.

Section 2. *Arcuata*, have the shell arched anteriorly, and all the feet pointed.

CANCER, sub-genus.

C. *pagurus*, Common Market Crab. Museum of the Plymouth Institution. Large quantities of these are caught in crab-baskets along our coast, from Plymouth to Torbay, the majority of which are picked up by the passing steam boats, and conveyed to Portsmouth and London for sale.

C. *poressa*, Oliv., (*Xantho florida*, Leach). Common in South Devon; we have several specimens.

PIRIMELA, sub-genus.

P. *denticulata*. Rare; we have three specimens, sent by Mr. Prideaux from Bantham. Mr. Couch finds them in Cornwall, though rarely.

ATELECYCHUS, sub-genus.

A. *septemdentatus*. Found frequently in Plymouth sound by Mr. Cranch, Edinb. Ency. vii. 430. A male and female are in our Museum, sent by Mr. Prideaux.

Section 3. *Quadrilatera*, having the carapace square or heart-shaped, with the front prolonged, inflected, and forming a sort of hood; tail of seven segments; eyes on thick pedicles.

PILUMNUS, sub-genus.

P. *hirtellus*. Obtained only in South Devon, Leach, Edinb. Ency. vii., 391. It is rare here, we have only three specimens from Mr. C. Prideaux, obtained at Bantham. Mr. Couch states that in Cornwall they are frequently found in crab-pots at from 4 to 6 fathoms water.

GONOPLAX, sub-genus.

G. *bispinosa*. Abundant in Salcombe Bay (Montagu), and in Plymouth Sound (Leach, 'Linn. Trans.' xi.) We have four specimens, and there are others in the possession of different collectors in the town.

PINNOTHERES, sub-genus.

P. *varians*. One Devon specimen is in our Museum, found by Mr. Prideaux in a *Cardium*. The *Pin. pisum* (*Mytilorum*, Latr.) appears to be the female, (see 'Dict. des Sciences Nat.' t. xxviii, 238), of which we have four specimens.

P. *veterum*. Of this we have one Devon specimen. Mr. Prideaux has found them in oysters as well as *Pinnæ;* the *Pin. pinnæ* appears to be the same, and was found at Salcombe, Devon, by Montagu and Cranch, Edinb. Ency. vii. 431.

P. *mytili*, (*Cranchii ?*). Kingsbridge, Devon; Edin. Ency., vii. 430.

P. *Modioli*, (*Montagui*). Edinb. Ency.
P. *Latreillii*. 'Dict. des Sciences Nat.' xxviii.

Section 4. *Orbiculata*, have the carapace rhomboidal or ovoid, always solid; eye-pedicles short; claws of unequal length in the males and females, longest in the former; third articulation of the exterior jaw-feet always an elongated triangle.

Corystes, sub-genus.
C. *cassivelaunus*, Pennant; (*personatus*, Herbst.) Found on our sandy shores, and sometimes thrown up during storms. We have two males and two females in our Museum.

Leucosia, (*Ebalia*, Leach), sub-genus.
L. *Pennantii*. We have three specimens, obtained by Mr. Prideaux at Salcombe.
L. *Cranchii*. Two specimens in our collection, obtained in Plymouth Sound by Mr. Prideaux.
L. *Bryerii*. One specimen, obtained with the trawl at Plymouth, by Mr. Prideaux.

Note.—Ad hoc genus pertinent species indigenæ *Cancer tuberosus*, Pennant, 'Brit. Zool.' iv., et *Can. tumefactus*, Mont., 'Lin. Trans.' ix. (Leach, 'Linn. Trans.' xi.)

Section 5. *Trigonia*, have the carapace triangular, pointed anteriorly, and generally irregular and rough; claws, especially of the males, always large and elongated, the last articulation of the exterior jaw-feet always nearly square, or hexagonal: segments of the tail seven or less: many of them are called "sea-spiders."

Parthenope, (*Eurynome*, Leach), sub-genus.
P. *aspera*. We have eight specimens of this crab, all young, sent by Mr. Prideaux from Bantham; who has also obtained them by the trawl in Plymouth Sound.

Pisa, sub-genus.
P. *Gibbsii*. First found in Devon by Montagu, 'Linn. Trans.' vol. xi. Five specimens in our Museum were obtained at Plymouth and Bantham by Mr. Prideaux; they have also been found by Mr. Couch at Polperro, Cornwall.
P. *Tetraodon*, (*Blastus*, Leach). One specimen sent by Mr. Prideaux, who informs me that it was also found by Dr. Leach at Teignmouth.

Maia, sub-genus.
M. *squinado*, Thornback or King Crab; Corwich Crab, (Cornwall); Spider Crab of the Plymouth fishermen. We have several specimens; it is common here, and is occasionally eaten, though its forbidding aspect prevents its general use. It is always destroyed when caught, as the fishermen imagine it deters the edible crab from entering the crab-pots.

Hyas, sub-genus.
H. *araneus*. Three specimens in our Museum from Plymouth Sound, obtained by the trawl.
H. *coarctatus*. Plymouth Sound and Salcombe; Leach, 'Linn. Trans.' xi., 239.

INACHUS, sub-genus.

I. *Dorsettensis*. Found in deep water at the mouths of rivers. We have three specimens from Salcombe; Mr. Prideaux.

I. *dorhynchus*. Discovered by Dr. Leach among some of the preceding species from Kingsbridge estuary. Mr. Couch says it is common in Cornwall.

I. *leptorhynchus*, (Leach, 'Mal. Brit.') We have two specimens from Mr. Prideaux, taken in Bigbury Bay.

ACHÆUS, sub-genus.

A. *Cranchii*, (Leach, 'Mal. Brit.' 22). Found, though rarely, in Devon and Cornwall.

STENORHYNCHUS, (*Macropodia*, Leach), sub-genus.

S. *tenuirostris*. Plymouth Sound. We have four Devon specimens; it is also common in Cornwall, according to Mr. Couch.

Family 2. *Decapoda macroura*, or long-tailed Decapods.

Genus *ASTACUS*.

Section 1. *Anomala*, have two or four hind feet, always smaller than those which precede them; the under part of the tail never displays more than four pairs of appendices or false feet, the lateral fins at the end of the tail do not form, with the last segment, a fan-shaped extremity.

PAGURUS, sub-genus.

P. *Streblonyx; (Cancer Bernhardus*, Linn.); Hermit or Soldier Crab.—Common on our coast. We have several small specimens corresponding to the description of *Pag. araneiformis*, but which Dr. Leach considers to be the young of the former. Mr. Prideaux tells me that he found two different species on this coast, one of which has been named after him by Dr. Leach.

P. *Prideauxianus*, Leach, 'Dict. des Sciences Nat.' tome xxviii.

Section 2. *Locustæ*, have only four pairs of false feet, the posterior extremity of the fin forming the tail is always more membranous than the rest; all the feet are nearly alike, and pointed at the end; the *thorax* is almost square, without any lance-shaped prolongation.

SCYLLARUS, sub-genus.

S. *tridentatus*. In the collection of Mr. Comyns, of Dawlish, Edin. En. vii. 397; but I am doubtful if it is a Devonshire specimen.

PALINURUS, sub-genus.

P. *quadricornis*, (Fab.); Thorny Lobster, or Sea Cray-Fish. This species is sold in our markets under the name of "Crawfish." It is very common: we have one specimen in the Museum.

Section 3. *Astacini*, are distinguished from the preceding by the form of the two anterior feet, which terminate by a didactylous hand; the extremity of the tail is fan-shaped; the *thorax* is narrow in front and the forehead more or less pointed.

GALATHÆA, sub-genus.

G. *spinigera*, or *strigosa*, (Leach); Plaited Lobster. Mr. C. Prideaux has furnished us with two specimens from the estuary of Salcombe. It is about 6 inches long.

G. *squamifera*. Discovered by Montagu in South Devon, where it is not uncommon. We have four specimens, they are about 5 inches long. It is common in Cornwall, (Couch).

G. *rugosa*, or *Bamfia*. Very rare: Mr. Prideaux has only seen three specimens, which were obtained by trawling in Plymouth Sound.

PORCELLANA, sub-genus.

P. *platycheles*. Found in Devon under stones, at low tides; Leach, Ed. Ency. vii. 398. We have four specimens. They are common also in Cornwall, says Mr. Couch.

P. *hexapus*, (*Pisidia*, Leach). Found on the roots of *fuci* after storms. We have one Devon specimen.

P. *Leachii*, Gray. I am not aware if this was found in Devonshire, although it is probable; it is common in Cornwall, (Couch).

MEGALOPA, sub-genus.

M. *Montagui*, (*Cancer rhomboidalis*, Mont.) Three lines long: found in Devonshire, Leach, 'Mal. Brit.'

M. *armata*, (Leach, 'Dict. des Sciences Nat.' tome xxviii). Found in Bigbury Bay, Prideaux.

GEBIA, sub-genus.

G. *stellata*, (*Cancer Astacus stellatus*, Mont.) Obtained from Salcombe estuary, in holes in the sand made by solens &c. It is very rare; we have one specimen from that locality.

G. *deltaüra*. Found in similar situations as the last by Cranch and J. Sowerby Jun. Leach, 'Linn. Trans.' vol. xi. 342.

CALLIANASSA, sub-genus.

C. *subterranea*, Found by Montagu in sand at Salcombe, "haud valdè infrequens," Leach, 'Linn. Trans.' xi. 343. We have two specimens from Mr. Prideaux.

AXIUS, sub-genus.

A. *stirhynchus*. Rare: specimens found at Sidmouth and Plymouth, Leach, 'Linn. Trans.' xi. 343. Mr. Couch has seen it in Cornwall, and thinks its rarity may only arise from its retired habits.

ASTACUS, sub-genus.

A. *marinus*, the Lobster. Common.

A. *fluviatilis*, (Lat.), the river Crawfish. I am doubtful if this be common in our rivers, as, on trying to procure specimens we are sure to have the *Palinurus* sent. We have, however, a good Devon specimen in our Museum, from Mr. Prideaux.

A. *Norvegicus*, (*Nephrops*, Leach). Rare: we have two excellent Devon specimens in our Museum.

Section 4. *Carides*, have the body arched and less solid than in the preceding; the front is always pointed, compressed, and toothed on its edges; *antennæ* always advanced, lateral ones very long, the exterior jaw-feet, being very long, resemble *antennæ*; one of the first pair of feet is often doubled on itself; the segments of the tail are dilated laterally; the exterior leaflet of the terminal fin always divided into two by a suture, the middle piece elongated and spinous above; the false feet, five pairs in number, are long and foliaceous.

PENÆUS, sub-genus.

P. *trisulcatus* (Leach, 'Mal. Brit.' 42) of our coast is a local variety of the

Pen. sulcatus of Olivier according to Cuvier, 'Règne Animal,' iv. 92.

CRANGON, sub-species.

C. *vulgaris*, Shrimp. Common on our coast.

C. *spinosus*, (*Pontophilus*, Leach, *Egeon loricatus*, Risso). Obtained in Plymouth Sound by Mr. C. Prideaux. Mr. Couch says it is 1½ inch long, with the carapace covered with spines in regular rows, and the *chelæ* singularly formed: he has only seen one specimen, which was taken from the stomach of a fish.

PROCESSA, sub-genus.

P. *canaliculata*, (*Nika*, Leach). Found at Torcross by Montagu.

HIPPOLYTE, sub-genus.

H. *varians*. Rocky shores of Devon, plentiful; Leach, 'Mal. Brit.'

H. *inermis*. "Habitat cum præcedente;" Leach, 'Lin. Trans.' xi. 347. Taken by dredging at Torcross; 'Linn. Trans.' ix.

H. *Prideauxiana*. Devon coast; Leach, 'Mal. Brit.'

H. *Moorii*, Plymouth. Named by Leach after a friend and cotemporary of his at Plymouth.

H. *Cranchii*. Found in the crab-pots here and in Cornwall.

PANDALUS, sub-genus.

P. *annulicornis*. Coast of Devon, common, particularly in summer, when they yield a greater supply than the true shrimp. Museum of the Plymouth Institution.

PALÆMON, sub-genus.

P. *serratus*, (*Pal. Squilla* of Latreille), Prawn. Devon coast; Leach, 'Linn. Trans.' xi. 343. They are not very common at Plymouth.—Museum of the Plymouth Institution.

P. *Squilla*. "Habitat cum præcedente in Danmoniâ australi vulgatè;" Leach, ubi supra.

P. *varians*. "Habitat in Danmoniâ;" Leach, 'Linn. Trans.' xi.

ATHANAS, sub-genus.

A. *nitescens*. Found in South Devon by Montagu; Leach, 'Edin. Enc.' vii. 401.

Section 5. *Schizopoda*, have the feet void of pincers, slender, and in form of lashes, exclusively adapted for swimming; the *ova* are placed between them, and not under the tail; eye-pedicles very short; the front is pointed or beaked, the shell is thin, and the tail ends in a fin, as usual.

MYSIS, sub-genus.

M. *spinulosus*, (*Prannus flexuosus* of Leach, 'Edin. Ency.' vii. 401; and *Cancer multipes*, Montagu, 'Linn. Trans.' ix.) Mr. Couch states that this has been named the "Opossum Shrimp," from carrying its *ova* and young under the *thorax*, but that he has reason to think it is the male only which does this, in a similar manner to the *Syngnathi*. It is common in Cornwall as well as here, and migrates regularly into fresh water.

M. (*Cancer scorpionides* of Montagu; *Diastylis* of Say. See 'Dict. des Sciences Nat.' tome xxviii. 337).

NEBALIA, sub-genus.

N. *Herbstii*. Placed here by some, this species has been removed by Cuvier into *Entomostraca*, Order *Branchiopoda*. It is common both in Devon and Cornwall.

Order II.—*Crustacea Stomapoda.* These have their *branchiæ* exposed and adherent to five pairs of appendices, situated under the *abdomen* (the tail); their shell is divided into two parts, the anterior of which carries the eyes and intermediate *antennæ,* or forms the head, without bearing the jaw-feet; these organs, as well as the four anterior feet often approximate the mouth in two converging lines; hence the name *Stomapoda.*

Family 1. *Unipeltata,* single-shelled Stomapods.

Genus *SQUILLA.*

Squilla, sub-genus.
S. *Desmarestii.* We have a good specimen in our Museum from Jersey. Mr. Couch has found it also at Polperro, which, being very near us, I have no doubt that future investigation will find it on our coast.

MALACOSTRACA with sessile, immoveable eyes.

Order III.—*Crustacea Amphipoda* are the only *Malacostraca* of this division, whose mandibles are provided with a *palpus,* or whose sub-caudal appendages resemble false or fin feet, by their *cilia,* &c.; in the following orders these parts are *laminæ* or scales; these *cilia* or hairs appear to constitute their *branchiæ;* many have vescicular pouches between their feet, the use of which is unknown; the *antennæ,* mostly four in number, are advanced, terminating in a point; body compressed and curved posteriorly; appendages of the tail resemble small articulated stylets; most of them swim and leap with facility, always on one side.

Genus *GAMMARUS.*

Section 1. Those with fourteen feet, all ending in a hook or point.

Division 1. *Uroptera.*

Hyperia, sub-genus.
H. (*Cancer Gammarus monoculoïdes,* Mont. 'Linn. Trans.' xi.)
Phrosine, sub-genus.
P. (*Can. Gam. Galba.* Mont. 'Linn. Trans.' xi.) Plymouth Museum.

Division 2. *Gammarinæ.*

Ione, sub-genus.
I. *thoracica,* (*Oniscus thoracicus,* Mont. 'Linn. Trans.' ix.) found on the *Callianassa subterranea,* 'Edinb. Enc.' vii. 406.
Orchestia, sub-genus.
O. *littorea,* (*Can. Gam. littoreus,* Mont. 'Linn. Trans.' ix.) Plymouth Museum.

TALITRUS, sub-genus.
T. *locusta*, (*Can. Gam. saltator*, Mont. Linn. Trans.' ix.), Sandhopper. The *Tal. littoralis* of 'Edin. Ency.' vii. 402. is the female; see 'Linn. Trans.' xi. 356. Plymouth Museum.

GAMMARUS, sub-genus.
G. *aquaticus*, (*pulex* of 'Edin. Ency.' vii. 402). In fresh water and rivulets, Leach, 'Linn. Trans.' xi. 359.
G. *marinus*. In the sea, South Devon; Leach, 'Linn. Trans.' xi.
G. *locusta*. In tide pools; Mont. 'Linn. Trans.' ix.
G. *obtusatus*, (Mont. 'Linn. Trans.' ix.)

MELITA, sub-genus.
M. *palmata*. Under stones on the shore at Plymouth; Leach, 'Ed. En. vii. 403.

MÆRA, sub-genus.
M. *grossimana*, (*Can. Gam. grossimanus*). In tide pools; Mont. 'Linn. Trans.' ix.

AMPITHOE, sub-genus.
A. *rubricata*. Rare; Mont. 'Linn. Trans.' ix.

PHERUSA, sub-genus.
P. *fucicola*. On *fuci*, South Devon; Leach, 'Linn. Trans.' xi.

DEXAMINE, sub-genus.
D. *spinosa*. At Torcross; Mont. and Leach, 'Linn. Trans.' xi.

LEUCOTHOE, sub-genus.
L. *articulosa*. Devon; Mont. 'Linn. Trans.' vii.

PODOCERUS, sub-genus.
P. *variegatus*. On *fuci* and corallines; Leach, 'Ed. Ency.' vii. 433.

JASSA, sub-genus.
J. *pulchella*. On *fuci*; Leach, 'Linn. Trans.' xi. 361.
J. (*Gam. falcatus*, Mont.); Leach, 'Linn. Trans.' xi.

Section 2. *Heteropa*, with fourteen feet, of which the four last only are adapted for swimming.

APSENDES, sub-genus.
A. *Talpa*, (*Can. Gam. Talpa*, Mont. 'Linn. Trans.' ix).

Section 3. *Decempedes*, those having ten feet.

ANCENS, sub-genus.
A. *maxillaris*, (*Gnathea*, Leach; *Can. maxillaris*, Mont. 'Linn. Tr.' vii.)

PRANZIA, sub-genus.
P. *cæruleata*, (*Oniscus*, Mont. 'Linn. Trans.' xi.

Order IV.—*Læmodipoda*, present no distinct *branchiæ* at the posterior extremity of the body, have scarcely any tail, the last two feet being inserted at this end; and they are the only *Malacostraca* in which the two anterior feet form a portion of the head; their body is linear, composed of eight or nine articulations; feet terminated by a strong hook. The females carry their *ova* under the second or third segments of the body, in a pouch formed of approximated scales.

Genus *CYAMUS.*

LEPTOMBRA, sub-genus.
L. (*Proto*, Leach; *Can. Gam. pedatus*, Mont. 'Linn. Trans.' xi.)
CAPRELLA, sub-genus.
C. *phasma*, Lamarck, (*Cancer phasma*, Mont. 'Linn. Trans.' vii.)
C. *penantis.* Devon; Leach, 'Edin. Encyc.' vii. 404.
C. *acanthifera.* Ditto.

Order V.—*Isopoda*, want *palpi* to their mandibles; feet always fourteen in number, unguiculated, and without vescicular appendages at the base; under part of tail furnished with leaflets or vescicular pouches, the two exterior usually covering the others; body generally flattened; the females carry their *ova* under the breast; the young are born with the form and parts proper to their species, and only change the skin while growing.

Genus *ONISCUS.*

Section 1. *Epicarides.*

BOPYRUS, sub-genus.
B. *crangorum*, (*Oniscus squillorum*, 'Mont. Linn. Trans.' ix.)

Section 2. *Cymothoades.*

ROCINELA, sub-genus.
R. *Danmoniensis.* Plymouth Sound; Leach, 'Dict. des Sci. Nat.' xii.
CONILERA, sub-genus.
C. *Montagui.* Salcombe estuary; Leach, ditto.
EURYDICE, sub-genus.
E. *pulchra.* Bantham, vulgatissimè; Leach.
LIMNORIA, sub-genus.
L. *terebrans.* I have shown this to be too common at Plymouth; see 'Mag. Nat. Hist.' vol. ii., New Series, p. 206.

Section 3. *Sphæromides.*

SPHÆROMA, sub-genus.
S. *serrata.* Devon; Leach, 'Linn. Trans.' xi. 368.
S. *Prideauxiana.* Leach, 'Dict. des Sci. Nat.' xii.
S. *rugicauda.* Wierhead on the Tamar; Leach, 'Ed. En.' vii. 405.
NÆSA, sub-genus.
N. *bidentata.* Leach, 'Ed. En.' vii. 405.
N. *hirsuta*, (*Campecopea*, Leach). Devon; Mont. 'Linn. Trans.' vii.
CYMODOCEA, sub-genus.
C. *truncata.* On *fuci*, rare; 'Ed. Ency.' vii. 433.
C. *emarginata.* Mount Edgecumbe; Leach, 'Dict. des Sci. Nat.' xii.
DYNAMENE, sub-genus.
D. *Montagui.* Leach, 'Dict. des Sci. Nat.' xii.
ANTHURA, sub-genus.
A. *gracilis*, (*Oniscus*, Mont. 'Linn. Trans.' ix.) Very rare.

Section 4. *Idoteides.*

IDOTEA, sub-genus.
  I. *entomon*, (*Oniscus marinus*, Penn.) Plentiful; 'Ed. Enc.' vii. 404.
STENOSOMA, sub-genus.
  S. *acuminatum*. "Semel obvium," Leach, 'Mem. Wern. Soc.' ii.

Section 5. *Asellotes.*

ASELLUS, sub-genus.
  A. *vulgaris*, (*Oniscus*, Linn.) Ditches and wells; 'Dict. Sci. Nat.' v.
ONISCODA, sub-genus.
  O. (*Janira*, Leach) *maculosa*. Devon coast, rare; 'Mem. Wern. Soc.' ii.
JÆRA, sub-genus.
  J. *albifrons*. Very common; Leach, 'Ed. En.' vii. 434.

Section 6. *Cloportides.*

LIGIA, sub-genus.
  L. *oceanica*, (et *scopulorum*). Rocks, Devon. Museum of the Plymouth Institution.
ONISCUS, sub-genus.
  O. *Asellus*, Wood-louse. Common.
PORCELLIO, sub-genus.
  P. *lævis*. Devon, rare; Leach, 'Edinb. Enc.' vii. 406.
ARMADILLO, sub-genus.
  A. *vulgaris*, (*Oniscus*, Linn.) Roots of trees and rocks; Leach, 'Edinb. Encycl.' vii. 406.

Plymouth, Aug. 28*th*, 1838.

ART. VII.—*On the Anatomy of the Lamellibranchiate Conchiferous Animals.* By ROBERT GARNER, Esq., F.L.S.

(*Continued from Page* 171).

EXCRETORY SYSTEM.

The veins of the mantle are large and numerous, and are, when shown by injection, curiously and regularly disposed. These veins probably furnish the calcareous matter, which exudes, and forms the shell. They often contain carbonate of lime, which, examined by the microscope, is seen to be in the form of minute *spicula*. At some periods the blood contains more of this matter than at others; thus in the fresh-water muscle anatomists have been puzzled to account for the appearance, at certain times, of a greyish matter diffused over the whole body, and entering into all the tissues. We know that the shell is more enlarged at some periods than at others, and this accumulation may precede the deposition, as a provision for its accomplishment; or it may be for the purpose of being thrown off by the excretory organs, as it is in the veins which surround them that the accumulation principally takes place. The grey matter is certainly composed of carbonate of lime.

The excretory organs throw off mucus and colouring matter, as well as carbonate of lime. The latter is often found within them in concretions of a crystalline appearance, and of an orange, pink, or purple colour. The situation of these organs has been described above. In all molluscous animals they are between the *branchiæ* and veins returning from the body. In the *Pecten*, a minute orifice leads directly on each side into them. The oviducts likewise enter them. Above each excretory sac leads into a single transverse cavity under the *pericardium*. In the *Unio* &c., an orifice, close to that of the oviduct, leads into a large cavity of the mantle, under the *pericardium*, into which the secreting organ opens by an internal orifice. Bojanus was not aware of this internal opening, or he probably would not have considered these organs to be lungs. The external orifice is seen to open at the anterior angle formed by the foot and the *branchiæ*. The oviduct is also distinct from the sac in *Modiola*, *Mytilus*, *Lithodomus*, &c., whilst in *Tellina*, *Cardium*, *Mactra*, *Pholas*, *Mya*, and most others, the *ova* are discharged into the secreting organs. Generally the secreting orifice is near the posterior muscle, and the oviduct more anterior. The former is often minute and difficult to find, and in the oyster it is absent altogether, and there is little trace of the excretory organs themselves: here we may conclude, from the great quantity of calcareous matter thrown off to the internal part of the valves, that the vessels have not become perfected into a gland, but, as is common in higher *Mollusca*, throw off from their extremities distributed to the mantle, the excretions, which, in a more perfect organization, are only got rid off by being secreted by a glandular organ, and thrown out by an excreting orifice. Swammerdam[1] considered these organs to be concerned in the formation of the shell, as did Poli, who terms them "the testaceous *viscera*." Blainville, in his remarks on the opinions of Bojanus regarding them, compares them to kidneys; and the author thinks he has said much to

[1] Biblia Naturæ.

confirm this opinion; and that what happens in the higher animals with regard to the liver, as to its circulation, takes place here in these organs.[1]

An intimate acquaintance with the anatomy of the *Radiata* and *Mollusca*, will show that where there is a shell secreted, some part of the venous system goes to form a spongy organ or pair of organs, which communicate with the exterior, and secrete a calcareous matter, when the system is not unloaded at the periods of the formation of the shell. Thus, in the *Stellerides*, below the calcareous disk, noticed on the dorsal surface, the veins of the *viscera* meet, and become conjoined with a brownish spongy substance, forming two organs which probably open without, through this disk or plate, and communicate on the other hand with certain canals in which the water circulates.[2] The *Tunicata*, having but a trace of calcareous parts, as has been described above, have only a rudiment of the secreting organs. In the *Gasteropoda*, a secreting organ always exists when there is a shell. It has two systems of veins,—branches sent from the visceral veins, the ramifications of which form its tissue,—and others which enter the auricle from it. In the *Patella* it opens by the oviduct and *rectum*, and is situated over the *viscera;* Blainville considers it to be the organ of respiration in these animals; it is here single. There are two in the *Chiton;* their orifices are between the branchial processes, not far from the openings of the oviducts. In *Eolida* and *Tritonia*, naked genera destitute of a shell, the author does not find them. In the *Doris* there is a sac, as is described by Cuvier, opening near the *anus*, which is probably the organ of secretion; and in some species of this animal, it may be seen that there is much calcareous matter in the dorsal tegument. In *Bullæa aperta* there is a small shell, and also, though unnoticed by Cuvier, two small glands, situated on each side the mouth, of a greenish colour; their situation is perhaps so, from the disposition of these organs to connect themselves with the generative outlets, which, in part, are situated in this animal

[1] Uric acid has been found in the excretory organ of the *Gasteropoda*, Jacobson, 'Journ. de Phys.' t. 91; and in those of the *Lamellibranchiata*, Treviranus, Zeitschrift, &c.

[2] From this disk extends likewise, by the side of the dark spongy substance, into the circular union of the canals, which run in the centre of the radiated rows of articulated pieces, a cylindrical calcareous part, itself articulated. The author considers this part to be analogous to the stem of the *Pentacrinus*, but become internal by the formation of the dorsal integument. The disk appears to be the base of the pedicle, fixed in *Pentacrinus*. The canals are analogous to those for which we see the perforations in the fossil remains.

by the mouth. In the *Helix*, *Buccinum*, and all the *Gasteropoda* in which the shell is developed, the excretory organ (the *mucous sac* of authors) is large, and its circulation is as described above. It opens in these by a canal near the *anus*, or directly by a wide opening into the respiratory sac. In the last case, which is general in the branchiated spiral *Gasteropoda*, it is not unreasonable to suppose that the animal, by means of it, can occasionally respire air, as well as water; which last is the ordinary medium of the aeration of its blood.

In the *Cephalopoda* two *papillæ* open on each side below the *rectum*, leading into two cavities communicating together, through which the veins of the animal traverse. These veins, particularly those from the *viscera*, are covered with glandular processes or appendages, which secrete matter, sometimes accumulating into considerable concretions, evidently formed of carbonate of lime. They also give out a mucous fluid. As has been shown by Cuvier, they communicate internally with the veins, and air blown into the latter escapes from their secreting pores into the cavity in which they are found. The hepatic vein separately enters the *cava* before its bifurcation, and does not join the other visceral veins; and Cuvier notices that the latter enter the *cava* in a direction opposite to the flow of blood, and the orifices of the visceral and hepatic veins being near, the blood of one might be directed into the other. Is this an intermediate state of circulation between that in which the intestinal, ovarian, &c. blood goes to the liver, and that in which the hepatic, intestinal and ovarian blood all goes to the excretory organ? The bile-ducts likewise pass through this cavity, and are also furnished with appendages, which probably secrete a similar matter to that formed by those of the veins.[1]

The excretory organs are more or less circumscribed. We see on their internal surface depressions, which might be mistaken for the open orifices of vessels, and in some species air blown into these openings gains access into canals extending in the manner of vessels into the contiguous parts of the body, and which, from their connection with the water without, are perhaps analogous to the hydroferous canals in the *Radiata*. No molluscous animal has been shown to possess absorbents; hence the necessity of the hard parts being external, and out of the circulation, as these animals have no means of

[1] Cuvier supposes these processes to be for the purpose of absorbing fluids from the cavities in which they are found. But these cavities are not shut sacs. Prof. Grant considers the processes on the ducts to be analogous to the pancreas.

providing for the gradual growth and change of an internal skeleton by the deposition and subtraction of its compound particles.

CILIA.

The *branchiæ*, tentacles, edges of the mantle, extremity of the foot, internal surface of the siphons, &c. are, in these animals, more or less covered with vibratile *cilia*, or *setæ*, for the purpose of producing currents in the water. In examining, under the microscope, the intestinal tube of the small British species of *Chiton*, taken from the living animal, the author observed a peculiar motion on the external surface of its posterior part. This arises from the passage of the intestine through the secreting organs, which lie between the *viscera* and the foot. The same has been observed on the intestine of the *Cephalopoda*,[1] which also passes through the secreting sac, and also on the appendages to the veins of those animals. The water appears to enter the secreting cavities from the existence of *cilia*. The existence of the curious appearance produced by the existence of the *cilia*, was noticed by Muller,[2] Heyde,[3] Diquemare,[4] Leuwenhoek,[5] Lister,[6] Baker,[7] &c. By some of these, from the imperfection of their instruments, the appearance was attributed to the circulation.—Raspail[8] has shown that many of the animalcules described by authors, are merely vibratile parts of higher animals; and many more instances of the same mistake might be given.—Dr. Sharpey[9] has shown that some of the higher *Vertebrata* are ciliated, as may be seen in the *branchiæ* of the tadpole. Swammerdam[1] and Carus[2] in the embryo of the *Paludina*, Stiebel[3] and Hugi[4] in that of the *Lymnæus*, Grant[5] in that of the *Buccinum*, and Leuwenhoek,[6] Home,[7] and Carus[8] in that of the *Unio*, have noticed a rotatory motion of the embryo in the *ovum*, evidently owing to the action of these *cilia*, though Carus does not attribute it to this cause, and Home

[1] Professor Grant notices "a remarkable peristaltic action" of the glands of the *Loligo*. Jam. Journal, 1826.

[2] Hist. Vermium, &c. [3] Anatomia Mytuli. [4] Ency. Meth. *Actinia*.

[5] Arcana Naturæ. [6] Exercit. Anatomie. [7] On the Microscope.

[8] Bull. Sciences Nat. 1827; Isis, 1829; and Ann. Sci. d'Observation, 1.

[9] Edin. Med. & Surg. Journ. 1830. In a paper read before the Linnean Society, in 1834, the author lays claim to a few observations previously made by Dr. Sharpey, and recorded in the paper here referred to, in the Med. & Surg. Journ., which the author had not seen.

[1] Bibel der Natur. [2] Von den Æusseren Lebensbedingungen, &c. 1824.

[3] Arch. der Physiol. vol. ii. [4] Isis, 1823. [5] Edin. Journ. 1828.

[6] Arcan. Natur. [7] Croonian Lecture. [8] Neue Untersuchungen, &c. 1832

considered the rotation caused by the vibratile *cilia* in the *ova* of the *Acephala* to be caused by a species of *Vibrio* getting into the interior of the embryo, and feeding upon it.—The latter has given figures of this supposed animalcule in its different stages of growth, and his representation is merely that of a branchial process. The author of these pages has noticed that the hydroferous vessels of the *Beroë*, and of other *Radiata*, are internally covered with *cilia*. He has not been able to find them at all in any crustaceous or cirrhopodous animal; nor in the water-breathing *larvæ* of insects. Dr. Sharpey observed them on the *branchiæ* of the *Patella* and *Chiton*, and on those of the *Annelides*. He was unable to see them in the *Tunicata;* but he might have done so by the aid of a more powerful lens, covering the meshes of the branchial cavity; they are remarkably small in these animals.—On the *branchiæ* of the *Cephalopoda* the author, though he has had every facility of investigation, has not found these organs, so general in water-breathing animals; if they exist there, they are particularly minute. They are present in the *Actiniæ* on the stomach and branchial cavity; and remarkable on the thread-like bodies dependant from the sides of the *Act. plumosa*. In the *Annelides* they are only partially found.—Their use being to excite currents in the water, they are, perhaps, only found when there is no muscular apparatus to answer that end. These *cilia* vary in size; sometimes, invisible with a lens of $\frac{1}{20}$ of an inch focus, they may, occasionally, be discerned with one of weak power, or even by the naked eye.

The piercing or excavation of rocks, wood, &c., by these animals, has been the subject of some dispute, as to the mode in which it is performed; and from the ravages committed by them on shipping, &c., is a matter of interest.[1] Some writers, as Montague,[2] Turton,[3] and Osler,[4] doubting the possibility of its being effected by the action of the extremities of the valves, moved by the muscles of the animal, have supposed the secretion of a solvent fluid. Were the existence of organs which might secrete it demonstrated, it is not probable that a fluid capable of dissolving so many different substances,—rocks of different compositions, wood, lava, madrepores, &c.,—could be formed; or, if so, act on the surrounding bodies without injuring the shell of the animal.—Others, as Reaumur,[5] Argenville,[9] &c. have believed that the

[1] Blondel, sur les Lithodomes, Mem. Acad. Sci. Par. t. i. Parsons, Phil. Trans. vol. xv. Rousset, sur les Tarets, 1733. Sellius, Hist. Tered. 1733

[2] Linn. Trans. [3] Conchological Dictionary. [4] Phil. Trans. 1826.

[5] Mem. Acad. Sciences, 1710. [6] Id. loc. 1712.

rocks are bored when soft; but this certainly, in many cases, cannot be the case.[1] They who believe the phenomenon to be accomplished by the action of the valves, differ as to the way in which they suppose them to act; some thinking it is by a filing, others by a rotatory motion. All animals which have the power of exciting currents in the water, appear to be able to excavate the most solid materials when they are exposed to the action of such currents; thus other animals, besides the *Lamellibranchiata*, have such a power. The *Patella*, for instance, when sticking to a rock of soft texture, forms a hole or pit, sometimes an inch in depth; and this it appears to do by the action of the streams of water, brought in by the circle of branchial processes, situated around the foot, a cast as it were of which may be seen on the floor of the cavity. This hole cannot be made by the shell, as it fits exactly in it, and is of a figure such as to allow of no rotation. The *Hipponyx*,[2] another similar gasteropode, forms cavities in the *Patella* and other shells to which it adheres. In the piercing bivalves we always find the apices of the valves in a particular direction, being constantly superior when the bore is inclined; and it is certain there can be no rotation, as the cavity, in many instances, does not admit of it. The crypts of the *Saxicava*, for instance, are not circular; hence M. de Bellevue and Osler in this instance, suppose them to be formed by the action of the phosphoric acid secreted by the animal, and they suppose that genus to inhabit only rocks composed of carbonate of lime. But it may be asked, in opposition, how the valves of the animal themselves are preserved untouched? Neither is it true, as the author of this has convinced himself, that the *Saxicava* is found only in chalky and limestone rocks. The valves are often rounded at their extremity, or so thin and fragile as to be ill adapted for mechanical action. When, as in the *Pholades*, the anterior extremities appear more suited for such an effect, they, on inspection, commonly present no appearance of having been worn by such an usage; on the contrary, their processes seem quite perfect, whilst the sides of the valves, from the sliding of the animal in its cell, are often nearly worn through. It appears then that the mechanical apparatus of the different boring animals of this class is insufficient to account for their power of excavation; and we must attribute it principally to the ac-

[1] The history of the temple of Serapis at Pozzuoli has been brought forward on this point, by many authors. There can be no doubt that it has been inundated by the sea, at which time its pillars were bored as they are now seen. See Lyell, Geology; and Stark, Brewster's Edin. Journ. vol. v

[2] Such specimens may be seen in the British Museum.

tion of the ciliated foot and tentacles causing a never-ceasing vortex at the inferior extremity of the cell. In some of these animals, too, the body is much produced, having the tube of its mantle garnished with its continuous *branchiæ*, the *cilia* of which must give great force to the rushing column of water. If any species make use of its valves as adjutory, it would be the *Teredo*, which attacks the hard planks of ships. On inspection, these certainly seem well adapted to act as fine rasps; and though it has been said by Turton that they do not correspond with the bore, they perhaps are so used, aided however by the action of the water: here however, particularly in the young animal, they are very fragile, and would break if used in a violent rotatory manner. It may be added that the author has found the *Pholas conoides* in timber, although its valves do not seem in the least adapted for such an action. According to Home,[1] Hatchett found sawdust in the stomach of the *Teredo*, but it is questionable whether this was anything more than the ordinary pulp therein contained.

Certain *Annelides* apparently possess this power of excavation. The rocks on our coast are pierced by a minute worm, probably of the genus *Diplotis* of Montague. Its mouth does not seem adapted for such an action, and many, like the one just named, have their *branchiæ*, mouth, and tentacular appendages ciliated; but it remains for future investigation to decide whether this circumstance gives them the power which they possess. It appears to be from the action of *Vorticellæ* and other vibratile animalcules, that the erosion noticed in so many shells at the beaks, particularly the fluviatile ones, takes place. At the beaks the *laminæ* are softer, and more distant from each other, so that they are more easily acted upon by destructive agents. We find the valves of the oyster, *Pecten*, *Lutraria*, &c. perforated by small circular apertures externally, leading into internal cavities. Dr. Buckland[2] showed this to depend upon the action of a zoophyte, which Professor Grant[3] has particularly examined, and named *Clionia celata*. Dr. Buckland considers the holes to be formed by little borers, which the polypes possess: these, however do not exist, and the author believes the phenomenon to be caused by the action of the *cilia* of the animal.[4]

All the *Lamellibranchiata* are inhabitants of the water, although some will live for months in a dry place, provided the

[1] Lectures on Comparative Anatomy.

[2] Rev. W. Coneybeare, on a remarkable class of organic impressions, Geol. Trans. 1814.

[3] Fleming, British Zoology.

[4] Many other animals, as some of the *Cirrhopoda*, *Radiata*, &c. excavate the rocks without any apparent mechanical means.

evaporation of the water within their valves is prevented.—The *Uniones* and *Anodontæ* will live a very long time in mud without the access of any other water than that contained in it.[1] It has been said that salt water bivalves will live in fresh water, and *vice versâ*. Freminviller[2] states, that the *Unio*, *Anodonta*, and *Cyclas*, are found in the Gulf of Livonia, together with the *Tellina*, *Venus*, &c. Nilson [3] says the same of some part of the Norwegian shore. From the following experiments the reader will perhaps conclude that in these places there is an influx of both salt and fresh water. To ascertain whether respiration could go on, the *habitat* being so changed, the author took a portion of the *branchiæ* of a *Mactra*, and placed it in fresh water for one minute; the *cilia*, strongly in action befere the experiment, stopped in their vibration, and could not be restored by immersion in sea water. Five grains of common salt were added to an ounce of fresh water, and a portion of the *branchiæ* placed in the solution, when the vibration ceased. In a solution of ten grains of common salt to an ounce of fresh water, the vibration was continued, as it was in a solution of twenty grains to the ounce. In a solution of thirty grains to the ounce, it went on for a time, but shortly stopped. After a portion of branchial membrane had been stopped in its action by momentary immersion in a strong brine, or in fresh water, it was restored by the second solution of ten grains to the ounce; but a *Mactra*, of which the *branchiæ* were exposed for a longer period to the action of fresh water, did not recover itself, though directly afterwards returned to its native element. Sea water, or a solution of two grains of common salt to an ounce of fresh water, immediately stopped vibration in the *Cyclas*, and other fresh-water-breathing *Mollusca*. A minute quantity of carbonate of soda added to fresh water, and a rather greater quantity dissolved in sea water, rendered them irrespirable. It would seem from this, that although perhaps some of these animals may bear a slight change as to the freshness or saltness of the water, (and perhaps those species inhabiting estuaries do so more than others), yet this capacity must be very limited. The *Cardia*, *Mactræ*, *Amphidesmæ*, &c., found in marshes on the coasts, become diseased and die when the water becomes concentrated by evaporation, or when it loses its saltness by mixture with fresh. The *Mytili* found in fresh water docks, are probably fresh-water species brought from

[1] Beudant, sur la possibilité de faire vivre des Mollusques fluv. dans les eaux salées. Stark, Brewst. Edinb. Jour., iv. Adanson, Acad. Sci. 1789.
[2] Jamieson's Edin. Journ. vol. iv. [3] Mollusca of Sweden.

foreign rivers, and which perhaps have survived their immersion in salt water during their voyage, by having kept their valves constantly closed; some species of *Mytilus* are known to inhabit fresh water. It appears certain, that in those rivers where the *Uniones*, *Anodontæ*, and *Cyclades* abound, they cease to be found where the water becomes salt.

Having shown the fatal effect which would be produced by the concentration of the sea water on the *branchiæ* of its bivalve inhabitants, it is worth enquiry how, in those animals which, on the retreat of the tides, are exposed to the desiccative action of the sun and air, this concentration is prevented. Those animals which have naked ciliated *branchiæ*, have the power of retracting them into sheaths, when they, like many species of *Doris*, frequent the bare rocks; or, if this power of withdrawing them does not exist, as in other species of *Doris*, the *Tritonia*, *Eolida*, &c., they take care to cover themselves with the wet *Algæ*, or to lurk in shady crevices. The *Patella*, in hot days, sticks firmly to the rocks, so as to prevent the escape of the confined moisture. The *Ascidiæ* frequent pools among the rocks, which are not drained at low water. The *Actiniæ*, *Lobulariæ*, &c., adhere to the dripping under-surface of the cliffs, or frequent shady places. The *Polypifera* either reside in deep water, or find a *habitat* where the sun does not reach them. Those *Lamellibranchiata* which, like the common muscle, are exposed on the bare rocks to the action of the sun and air, have the valves fitting to each other most exactly, preventing all evaporation.—When the valves are open at any part, the animal either inhabits deep water, as many species of *Pecten*, or, when left dry by the ebb of the tide, has the power of burrowing in the mud or sand. The *Gasteropoda* also hide themselves from the sun, although their *branchiæ* are not much exposed.—Walking along the sandy beach, we see numerous holes leading to the *branchiæ* of bivalve and other animals, which, by so boring, protect themselves from the effects of evaporation, and obtain a supply of water, loaded with nutrient matter.

The phenomenon called "animal phosphorescence" being, perhaps, peculiar to eiliated animals, the author has endeavoured to ascertain whether it may not be owing to the vibration of these *cilia*. In an *Annelide*, perhaps the *Nereis noctiluca* of authors, which presents this phenomenon very beautifully, covering, in great numbers, the nets of the fishermen when they are taken up from ihe sea, he found that the luminosity stopped when the action of the *cilia* ceased; that it was most vivid when they were most active; and that the tremulousness and unsteadiness, occasionally accompanying the phosphorescence, appeared to correspond with an interruption which sometimes took place in the vibration of the *cilia*. The author would infer from this that the two actions are concomitant, but he knows of no other proof that the one is the cause of the other.[1]

(To be continued.)

Art. VIII.—*Letter on the present state of the Hon. Company's* 'Botanical' *Garden at Calcutta.*

"Quousque tandem abutere patientiâ nostrâ?"

Sir,

Of the few scientific institutions in India, none is better and more generally known than the H. E. I. Company's botanical garden at Calcutta, the store-house in which the indefatigable industry of Dr. Roxburgh and Dr. Buchanan Hamilton accumulated the rich treasures of the Indian Flora, which, augmented by the present superintendent, were, a few years ago, through the liberality of the Hon. Court of Directors, distributed all over Europe. While this unequalled munificence has naturally attracted the interest of all botanists towards the noble establishment, still kept up with the same munificence in the East,—alas, few but actual visitors are aware of the rapid decline into which this garden has sunk!

While the home and local governments evince the greatest anxiety to promote science and spread the light of knowledge over India,—while, through their fostering care several scientific institutions have of late sprung up in India,—it remains an enigma how one of the oldest and most useful institutions should have been allowed to sink to its present state, which hardly justifies the application of the epithet "botanical" to the garden.

The latter assertion may probably appear incredible, as it indeed appeared to the writer, although repeated assertions to

[1] Borlase says, and the fishermen believe, that when this phosphorescence is vivid, it presages a storm. On the luminousness of the *Mollusca*, see Pliny, Hist. Nat.; Reaumur, Mem. Acad. Sci. Par. 1723; and Marsigli, Act. Bon. vol. ii., &c. The observations of Beccaria &c. seem to prove that the light is not owing to any chemical principle, and that it exists in exactly such circumstances as the *cilia* would continue to vibrate under.

When the *cilia* have their vibration stopped by any application, they are no longer visible. From this circumstance, Raspail concludes that their appearance is an occular deception, due to an emission or scintillation from the *branchiæ*.

the same effect, have of late years, through the public press, circulated all over India. Several visits to the garden, paid with a view to ascertain its true state, have tended to confirm the truth of the statements concerning the Hon. Company's 'botanical' establishment at Calcutta.

On entering the garden the eye is struck with all the grandeur of an Indian vegetation. As a pleasure-ground, laid out in tolerably good taste, and kept in exemplary order by some hundred and fifty workmen,[1]—a more beautiful spot could hardly be found. But now,—you stop before the nearest tree, and are desirous of ascertaining its name, its properties, its habitat,—you ask, of course, for a catalogue;—there exists *no catalogue*[2] of the Hon. Company's 'botanical' garden!!!

To some of the trees are tied little slips of bamboo, marked with Bengallee characters. If you happen to be a Bengallee scholar, you will wonder at what the writer intended to express, and after all you will be not a bit wiser than you would have been, had you never passed an examination in that language in Writers' Buildings. You send for one of the "serdár mállees" (native head gardeners), perhaps the only man upon the establishment who, with no small trouble, is able to decipher his own hand-writing, in which you, with no less trouble, may recognise—a Latin name—written and pronounced in Bengallee!!! The poor native has, at any rate, complied with your wish; if you like, you may go a step farther, —ask for the properties or the habitat of the tree;—whether the information thus gained is calculated to be of any use, is another consideration.

Suppose on your way to the gardens you have picked up a weed from the road-side; it is an old friend of yours, you have seen it a thousand times in the jungle, and you think you may now identify it in the 'botanical' garden. If you happen to see it there, you think perhaps you may, without a catalogue, ascertain its name by referring to the herbarium;—there *is no herbarium in the Company's 'botanical' garden.* If a man in India breaks a branch from a tree, and wants to know its name, he will be obliged to carry his specimen to Europe, and consult the herbarium of some museum or botanical garden; strange as this may appear, it is yet a melancholy truth.

To find out the plan upon which this garden is arranged, amounts next to an impossibility; it would at least appear so

[1] A by no means astonishing number, considering the vast area; only their hands might be employed in something better than keeping the weeds out of, and the gravel in, the walks.

[2] It is hardly necessary to observe that Dr. Roxburgh published a catalogue.

by finding a Nipalese pine surrounded by trees indigenous to Bengal, or some inhabitants of Malacca, so densely crowded, in such a 'sable throng,' as though it were the intention of the superintendent to try, on a large scale, with how little free access of air vegetation may be carried on. Such heaping together, such disregard to geographical distribution, may perhaps pass by way of experiment; whether the total absence of plots allotted to the Linnean arrangement or the natural families, in a 'botanical' garden, may pass under the same head, is another question: be this as it may, the botanical student will search in vain for either.

This establishment, forming a no small item in the Company's annual expenses, ought to prove of some little use to the public,—particularly now that Calcutta boasts a medical college for natives. How far the students can study Botany in a 'botanical' garden, without *catalogue*, *herbarium*, *artificial* or *natural arrangement*, is unnecessary to speculate upon; it would be a more desirable topic for speculation, to point out the most expedient manner in which this fallen, but still noble institution, might, instead of proving, as it of late has done, a *bar* to science,—be restored to its original purpose, which the liberality of its supporters and the public at large have a right to expect; viz., that of promoting science,—in short, that of being a *botanical* garden.

I remain, Sir,
Your obedient servant,
PHILALETES.[1]

May, 1839.

REVIEWS.

ART. I.—1. *The Coleopterist's Manual; containing the Lamellicorns of Linnæus and Fabricius.* By THE REV. F. W. HOPE, F.R.S., F.L.S., F.Z.S., &c. &c. 8vo. pp. 126. 4 pl. London: H. G. Bohn, 1837.

2. *The Coleopterist's Manual, part the second; containing the predaceous Land and Water Beetles of Linnæus and Fabricius.* By the same. 8vo: pp. 184, 4 col. pl. London: 1838.

THE appearance of these works, together with the numerous memoirs published in our various journals and transactions devoted to Natural History, fully prove the fact that scientific exotic Entomology, so long neglected by English entomologists, (if we except the venerated names of Kirby and Leach), is at length gaining a share of that attention which had been bestowed, almost exclusively, upon the insect produc-

[1] Communicated to the Magazine with an authentic signature.—*Ed.*

tions of our own island. It would carry us into too wide a field to speculate upon the advantages to be derived from such an extension of scientific research; but we cannot but observe, that now that the principles of natural classification attract so much of the attention of the student of Zoology, the absurdity of limiting our views to the productions of a given spot has become more and more evident. Hence it is that we find Mr. MacLeay himself remarking, that "if the natural system is ever discovered, it will assuredly be in the insect world, where, owing to the multitudes of species, the linkings of the great chain of nature will necessarily be most evident." Whilst, however, we admit this in respect to the natural relations existing among the insect tribes themselves, there are other, and certainly not less important, views of the subject to be obtained by the investigation of the species of particular districts. A knowledge of the geographical distribution of insects,—their internal and external anatomy,—and, above all, their relation with nature in general,—may be acquired or improved by the examination even of local collections, *properly* studied. Who, for instance, is not aware of the eminent service rendered to Botany by Mr. Robt. Brown's work on the Flora of New Holland? We make these remarks, being aware how many there are who either suppose that when they have amassed a large collection of animals, they have done all that is necessary for science; or who think, and even constantly assert in print, that the discovery of the natural system is, or ought to be, the *ne plus ultra*—the "*ultimus finis*" ('Annul. Javan. Pref.') of their observations.

We are glad to perceive, *en passant*, that the writer of the works now under notice has not confined his attention to the latter kind of investigations. This will appear evident from the following passage, written in answer to the objection that the lamellicorn beetles (genus *Scarabæus*, Linn.) ought not to be placed at the head of the beetle tribes.[1] "There are sufficient reasons why the lamellicorns should precede *Cicindela* or *Carabus*. It is not merely the simple structure of the stomach, it is not their vast bulk or strength (on which little stress can be laid), but it is in the important functions they perform, it is in relation to the economical purposes of the human race, that they ought to take precedence. They are of greater utility to man than nearly all other groups, in checking the over-luxuriance of tropical vegetation; in reducing to powder the mightiest monarchs of the forest; in purifying the air by burying all that is noxious and disgusting, and, at the same time they give fertility to the land, by carrying to the roots of vegetation the richest of manures. As to numbers, both of genera and species, they greatly surpass the *Cicindelidæ* or even the *Carabidæ*; and in the number of individuals of species, they appear amongst the most prolific of insects."—(Pt. ii. Pref. p. viii). Without adopting the author's opinion, that the lamellicorns are to be placed at the head of the insect tribes, we cannot but admit that these observations are founded

[1] This was their position in the writings of Linnæus and Fabricius, but the French authors placed the *Cicindelæ* and *Carabi* at the head of the *Coleoptera* from their more perfectly organized mouths.

upon an extended view of nature, although we are inclined to look at the subject in a still more general manner, and not to limit the question, as Mr. Hope appears inclined to do, to the advantages they impart to man.

It is time, however, that we should give the reader some account of these works. Instead of adopting the course pursued by so many of our modern entomologists, of describing the new species contained in his magnificent collection, Mr. Hope has thought that it would confer more service upon science, were he to review the species of beetles described by Linnæus and Fabricius, many of which, either from having been too concisely described, or from having some erroneous habitat given to them, have been either entirely overlooked, or greatly confused, by more recent writers. The attempt to rescue these species from oblivion, and to place them in their true genera and subgenera, is worthy of great praise. The possession by the Linnean Society of the Linnean cabinet, as well as of Sir Joseph Banks's collections, described and labelled by Fabricius, an extensive correspondence with the chief continental writers, and the possession of a very large collection, containing many authentic specimens, described by Fabricius, from the collections of Lee, Drury, Francellon and others, have certainly placed the author iu a very favourable situation for such an undertaking, which has been attempted in the following manner.

The first part commences with a table, containing a list of the Linnean *Scarabæi* and *Lucani,* the true locality of each species, and its modern genus or subgenus, each occupying a single line, as in the table of the lamellicorns of Olivier given by Mr. Hope in this Magazine for January last. This is succeeded by a series of observations on many of the species, where a change of habitat, genus, &c. is required.—Then follows a similar table of the lamellicorn beetles described by Fabricius, with similar observations upon the doubtful species. After this follow the descriptions of various new genera, the majority of which had been indicated and dissected by Mr. Kirby, whose collection and manuscripts, now in the possession of the Entomological Society, have been resorted to. An appendix is given, containing additional notes and a revision of the family *Goliathidæ.*

The second part commences with a table and similar observations upon the Linnean *Cicindelæ* and the Fabrician *Cicindelidæ;* then follow similar tables and observations on the Linnean and Fabrician *Carabi* (*Carabidæ* Leach), and the Linnean and Fabrician aquatic beetles; the part terminating with descriptions of some new genera and species.

As the various notes and observations are made in the order in which the species occur in the works of Linnæus and Fabricius, it necessarily happens that much irregularity exists in the arrangement of the great mass of information conveyed in these pages; for instance, amongst the "remarks and annotations on the Linnean *Cicindelidæ,*" we find a tabular sketch, and a long dissertation upon the Carabideous family *Elaphridæ,* some of the species of which were considered by Linnæus as *Cicindelæ.* Again, in the remarks upon the Fabrician "*Cicindeloidea,*" we have a tabular list of all the modern genera of that group, with observations upon each genus; then follow the remarks upon the

Fabrician species, including the descriptions, not only of new genera founded upon them, but also of completely new species.—We cannot but think that if these remarks and annotations had exhibited more method, they would have possessed much more utility; the notes upon the species might have been restricted in their extent, in the same manner as those given upon the species of Olivier in this Magazine. The tabular views given of the modern groups of genera, might have formed a distinct part of the work, arranged according to their relations; and the descriptions of all the new genera and species ought to have been confined to a separate appendix. These, it is true, are but points of editorial arrangement, and do not in the slightest degree militate against the value of the facts and observations themselves; but we must be allowed to enter our protest, as we perceive that Mr. MacLeay has also done, against the establishment of the mass of new families, terminating in *idæ,* into which the old Linnean genera are cut up by Mr. Hope and some recent French authors, as Messrs Laporte and Brullé, as well as by Mr. Kirby, in his American insects. The *Carabidæ* alone are formed into no less than forty of such families by Mr. Hope, without any table being given to show their classification or relations *inter se.* We must also object to the nomenclature of such groups. Thus whilst we have *Megacephalidæ, Manticoridæ, Cicindelidæ, Agridæ,* &c., formed from the feminine names *Megacephala,* &c., we find *Clæni*adæ, from the masculine *Clænius, Anthr*adæ, *Lebradæ* &c. from the feminine *Anthra* &c. We do but repeat the opinion already expressed by us in this work, that the uniform termination in *idæ,* first proposed by Mr. Kirby, ought to be retained for the groups equivalent with the genera of Linnæus, and the "familles naturelles" of Latreille. We would also suggest the advantage of the future parts, as well as the promised second edition, undergoing a more careful revision, as the present parts exhibit many proofs of great haste in their composition. For instance, in p. 13 (part ii) *Apteressa,* Hope, is called both a genus and a subgenus; the same thing occurs with *Apotomopterus,* (p. 48.) *Graphipterus* is called *Graphiptera* (p, 52); and numerous other *lapsus calami* might be pointed out.

ART. II.—*Hymenoptera Britannica; Oxyura.* Auctore A. H. HALIDAY.—Fascic. 1. pp. 16. London: H. Baillière. 1839.

THE present brochure contains the commencement of a Monograph of the British Oxyurous *Hymenoptera,* and includes the genus *Proctotrupes,* Latr., of which nineteen species are described with great care. We know no one so well qualified for such a task as Mr. Haliday, and look forward with interest to the appearance of the succeeding *fasciculi* of the work.

SHORT COMMUNICATIONS.

Breeding of the Crossbill in Gloucestershire.—On the 13th of this month (April) as I was passing by a plantation of larch and Scotch firs, the note of the crossbill attracted my attention, (having been from home all the winter I had supposed that these birds had left), and on looking up, I observed an old bird, that appeared much disturbed at my presence.—Presently another bird flew into the same tree, which, from its mottled plumage and difficult flight, I concluded was a young one. There was a nest at the spot from which this bird flew, and there appeared to be another bird in it. I left them for a short time, and, on returning, both the old birds were in the tree, and one of them was in the act of feeding the young bird, which fluttered its wings on being fed.

The next day I again visited the tree; the old birds fled on my approach, and not being able to see the young bird, I concluded that it had either been enticed away by the parents, or that it was in the nest. On climbing up to the nest, however, I found it deserted; it was placed in the fork of a Scotch fir, about 20 feet from the ground, and 4 feet from the extremity of the branch. The exterior of the nest was composed of dead larch and spruce twigs, within which it was formed of dead grass, and some tender dry stalks of plants, rendered warm and compact with wool; and the whole was lined with horse-hair.

The edge of the nest, on one side, was completely plastered over with the *fœces* of the young birds or bird, for I am inclined to think there was only one reared. I could not discover, either in the nest or on the ground, any remains of eggs. The nest had all the appearance of being just deserted: its diameter was 5½ inches, its depth 2 inches within, and measured 3 inches across the concavity. I have preserved it as a specimen.

We have had the crossbills in considerable numbers for the last two years; they feed solely on the seeds of the larch, as those of the spruce fir do not come to perfection here. These birds have been accused of attacking the apple-orchards in France; in 1837 that fruit was very abundant close to a plantation where they were constantly at work, and yet they never touched it.

P.S.—I have again witnessed the old bird feeding the young one.—*J. Brown.*—*Cotswold Hills; April*, 1839.

Breeding of the Crossbill in Surrey.—I have been informed since I wrote to you, that two nests with eggs had been met with by the labourers in the Holt forest, but that they did not observe them until the trees in which they were placed had been felled, so that the eggs were broken. This was in February last,—confirmatory of the very early nidification of this bird. I have been rather surprised at not finding a nest in the plantation here, although I have caused diligent search to be made, and the crossbills have been and still continue numerous. I am disposed to ascribe this to the number of squirrels we have, whilst there are very few in the Holt, and they are great devourers of eggs. I think of proclaiming war against them very soon.—*H. L. Long.*—*Hampton, near Farnham, Surrey; May 2nd,* 1839.

Carnivorous propensity of the Squirrel.—In the able Monograph on the genus *Sciurus* which has appeared in the two last numbers of your valuable periodical, the author has neglected to notice the fact, that the squirrel is occasionally a *carnivorous* animal. The same remark applies to all the works on Natural History which I have examined. That such however is the case, I have no hesitation in asserting, having observed the fact many times during the last three years. I believe I may add that the squirrel prefers animal food in a living state.

I first observed the fact in the spring of 1836; when, having occasion to clean out the cage of some young kingfishers which I had bred up, I left them on the table in a room in which three half-grown squirrels were allowed to play. On my return, I found one of the squirrels busily employed in plucking the feathers from the head of one of the birds. The following day a young cuckoo was placed in the same situation, when it was quickly attacked by a squirrel, which seized it under the wing, where it was safe from the blows aimed at it by the bird. In a few minutes the animal had eaten a great portion of the ribs of one side, so that the air inspired escaped from the wound; it had also eaten through the *femur* and muscles of the thigh. Shortly after the other squirrels joined the first, and partook of the remains of the unfortunate bird. I several times repeated this experiment, both with living and dead birds, and invariably found that the squirrels would forsake their vegetable food for the more agreeable animal diet.

I was then residing in the heart of Wiltshire, and on mentioning the fact to the shepherds, who, by the bye, are frequently very keen observers of the habits of wild animals, I found that it was by no means uncommon for the squirrels to be seen in the act of devouring young birds, particularly in the copses that intersect the bleak downs of Wiltshire. Indeed, one shepherd assured me, that one evening in autumn he observed a severe struggle between a wood-pigeon and a squirrel, among the branches of a tree, and that the latter proved victorious, and began devouring his victim. The fact appears strange, but I have no reason to doubt the veracity of my informant. I have bred upwards of a dozen squirrels, taken when a few days old, and in nearly every case have observed the fact above mentioned.—*Charles Coward.*—1, *Bridge Terrace, Southwark; April 4th*, 1839.

Distribution of the Marsupialia.—The following paragraph, extracted from a volume that probably has not come under the notice of many naturalists, is especially interesting as illustrative of Mr. Swainson's views of the distribution of marsupial animals. It contains, I believe, the first intimation that such a group is to be found among the feathered tribes. The author is a plain sailor, but evidently an observing man, and ignorant of the importance of the information he conveys to us.

King Penguin: "They lay but one egg, which they carry in a pouch under their bellies, very similar to that in which kangaroos carry their young. In this pouch it remains during the period of incubation, which is about seven weeks.—Their flesh is not good for food, but we used to make use of their eggs, of which we robbed them, and this they would permit us to do, without making the least resistance, being so tame that we could catch them with our hands, or knock them down with a stick, whenever we felt disposed. When robbed of their egg, they would lay again. They commence laying in November, and by depriving them of their eggs, they continue to lay till March."........"In the Crozet islands, between 46° and 47° S., between 46° and 50° E."

'Narrative of a Voyage to the South Seas, and Shipwreck and Residence for two years on an Uninhabited Island; by Charles Medgett Goodridge.' P. 45. Exeter: 1838.—*Jonathan Couch.*—*Polperro, April*, 1839.

THE MAGAZINE

OF

NATURAL HISTORY.

JULY, 1839.

Art. I.—*On the Relative Ages of the Tertiary Deposits commonly called "Crag," in the Counties of Norfolk and Suffolk.* By Charles Lyell, Esq., V.P.G.S.

In the course of last year I visited several parts of the counties of Norfolk and Suffolk, and examined the tertiary deposits there called "crag," principally with a view of satisfying myself respecting the following points:—First, the direct superposition of the red to the coralline crag, as first pointed out in 1835, by Mr. Charlesworth;[1] Secondly, whether the remains of *Mammalia* were really imbedded in regular and undisturbed marine strata in the Norwich crag, as affirmed by the writer above mentioned; Thirdly, whether the proportion of recent shells, as compared with the extinct, was decidedly larger in the Norwich crag, so as to indicate a posteriority in age relatively to the Suffolk crag.

Red Crag of Suffolk overlies Coralline.—First, in regard to the superposition of the red to the coralline crag, I found this fact exhibited in distinct sections at Ramsholt and Tattingstone, as indicated by Mr. Charlesworth, and in quarries near Sudburn, to which I was directed by Mr. Bunbury. In both the former localities,—Tattingstone and Ramsholt,—the red crag rests on the denuded surface of the older or coralline deposit.

At Sutton, near Woodbridge, in Suffolk, a large excavation has been made at the point of junction; and Mr. W. Colchester, a zealous collector of the fossils of these beds, had the kindness to cause an artificial section to be made, expressly to enable me to see more distinctly the manner of the junc-

[1] London and Edinburgh Phil. Mag. August, 1835, p. 81.

tion of the two deposits, which is sufficiently remarkable.—The older or coralline mass is chiefly composed of comminuted shells and zoophytes, the calcareous sand thus constituted being divided by thin horizontal layers or flags of impure limestone, which however are not continuous. It is evident that the calcareous sand had acquired a certain degree of consistency at the bottom of the sea, before the red crag was thrown down, for it is seen to have been perforated by numerous *Pholades,* the tortuous holes of which descend six or eight feet below the top of the coralline crag, and still contain the shells of the *Pholas,* while the remainder of the cylindrical hollow has been filled with differently-coloured sand derived from the superincumbent deposit. There is also another proof of the inferior mass having obtained a certain degree of consolidation before it was denuded. The loose upper crag at Sutton does not rest everywhere on a level foundation of subjacent coralline crag, but abuts abruptly against a vertical wall or cliff of the older formation, as shown in the annexed diagram (fig. 39). This buried cliff, eight or

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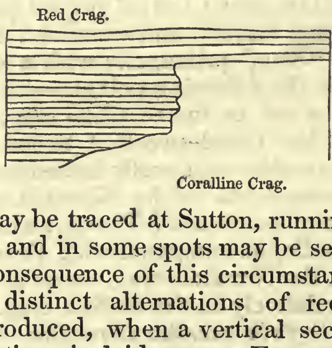

ten feet high, may be traced at Sutton, running in a direction N.E. and S.W., and in some spots may be seen slightly overhanging. In consequence of this circumstance, a deceptive appearance of distinct alternations of red and coralline crag is often produced, when a vertical section, parallel to the line of junction, is laid open. Even where the buried precipice of coralline crag has not been perpendicular, but merely having a very steep slope, an artificial cut at a high inclination may so intersect alternately the red and coralline crag, as to lead to the conclusion which I first entertained at Sutton, of a real intercalation of the two formations. Some of the apparent anomalies seen in like manner in the stratification of the red crag, may sometimes be ascribed to the deposition, on the steep sloping sides of submarine sand-banks, of new matter of a different colour and composition. When these are afterwards cut through in the steep slope of a sea-cliff, we occasionally see patches of the more modern bed adhering like plaster to the face of the older one.

At Tattingstone, in Suffolk, the inferior or coralline crag consists chiefly of greenish marl, with only a few stony beds. Here the number of corals is so small, and the shells for the most part are so comminuted, that the distinctness of the inferior mass from the red crag is far less striking than on the north of the river Deben. I caused a pit about seven feet deep to be sunk in the yard at Tattingstone Hall farm, piercing the lowest part there exposed of the coralline crag, through green marls, with intervening layers of flaggy limestone, two or three inches thick. At the bottom of this pit I found marl of the same character, containing a large *Nucula*, *Venus ovata*, and some other shells; when the workmen were stopped by the quantity of water which flowed in. One of the flaggy beds of limestone was almost of a brick red colour, and consisted chiefly of comminuted shells, like the green marl.

Although the upper crag at the point of junction is here (at Tattingstone) very like the lower formation, yet we can recognise it by the presence of *Fusus contrarius*, *Turritella terebra*, and other shells which are wholly wanting in the lower bed.

Fluvio-marine Crag of Southwold, &c.—Before offering any general remarks upon the fossils of the coralline and red crag, I shall pass on to the consideration of the crag of Norwich, or "mammaliferous crag" as it has been termed by Mr. Charlesworth, which is the principal object of this paper.—By examining this crag in the neighbourhood of Southwold and Norwich, I soon satisfied myself that instead of being of purely marine origin, like the deposits already alluded to, it is a fluvio-marine formation, containing everywhere an intermixture of land, fresh-water, and sea shells, with the bones of *Mammalia* and fish. I first examined this crag at Thorpe, near Aldborough, where it extends to the sea-coast. I did not observe its junction with the subjacent coralline crag, but was informed by Capt. Alexander that the latter crops out from beneath it upon the beach, where it is exposed for 200 yards at low water, being there called the "Thorpe rocks," which are broken up for building stone. Sizewell gap, several miles to the north, is the most northern point to which the the coralline crag has yet been traced. But it is at Southwold, about ten miles north of Thorpe, that the Norwich or fluvio-marine crag is most largely developed. It may there be studied both in a continuous line of sea-cliff, and in several large pits scattered through the interior. It is very variable in mineral composition, consisting of sand, shingle, loam, and laminated clay in regular strata, some of which bear marks of very tranquil deposition. A thickness of about forty feet is sometimes exposed in one section, as in the cliff at Easton Bavant, about three quarters of a mile N.E. of Southwold.—The marine shells are here spread through a thickness of ten and sometimes fifteen feet, chiefly in the lowest part of the deposit here laid open. Some of the bivalves, as the *Nucula Cobboldiæ*, *Tellina obliqua*, and *Mya arenaria*, have both valves united, and have not suffered by attrition, although associated, not only with land and freshwater shells, but with rolled fish-bones, and the bones and teeth of *Mammalia*, as of the elephant, rhinoceros, horse and deer. Capt. Alexander, whom I was so fortunate as to have as my guide, informed me that in one bed at the base of the cliff, which is most rich in marine shells, and which is only from four to six inches thick, he found the tooth of a horse, buried with sand, in the mouth of a large specimen of the *Fusus striatus*. I learnt from the same gentleman, that the bones of *Mammalia* are frequently met with in the same bed as those of fish, marine shells, and *Crustacea;* and in more than one instance I was enabled myself to verify this fact. He also showed me the tooth of a *Mastodon*, washed out of the cliffs between Dunwich and Sizewell, which may, without hesitation, be referred to the same formation.

In tracing the fluvio-marine deposit from the cliffs of Easton Bavant to the northward, in the direction of Kessingland, I found distinct layers of flinty shingle regularly interposed between the shelly beds, so that I have no hesitation in referring to the Norwich crag those strata of sand and shingle on this coast, which so much resemble the sandy portions of the plastic clay of the London and Hampshire basins.

I examined, with Capt. Alexander for my guide, several inland pits of Norwich crag near Southwold; and in one of these in the parish of Henham, on the property of Lord Stradbrooke, I picked up mammiferous bones and teeth, from an undisturbed bed containing marine, freshwater, and terrestrial shells. Among the freshwater shells I found a species of *Cyrena*, which appears to be one of the varieties of that variable species, *Cyr. trigonula*, found at Grays in Essex, and elsewhere. In each of the different localities of this neighbourhood, as in those of the red crag of Suffolk, some shells are found which are not met with at other spots; the whole assemblage, however, agrees very closely with that derived from the pits around Norwich, to the consideration of which I shall now pass.

Crag near Norwich.—The crag of the neighbourhood of Norwich is interposed, in patches of variable thickness, between the chalk, on which it rests, and a dense bed of gravel by which it is almost everywhere covered. It is only in some valleys, like that of the Yare, where denudation has extended down to the fundamental chalk, that the crag is partially exposed at the surface.

The various excavations made for chalk and sand at Bramerton and Whitlingham, on the right bank of the Yare, and at Thorpe and Postwick, on the left bank, places within four or five miles of Norwich, all agree in presenting beds of sand, loam, and gravel, in which we observe a mixture of marine, land, and freshwater shells, with ichthyolites and bones of *Mammalia*. It is clear that these beds have been accumulated by successive deposition at the bottom of the sea, near the mouth of a river. Mr. Woodward, in his account of the Norfolk crag, has described the drilled surface of the chalk at Postwick, showing that it had remained for some time exposed to the action of marine perforating animals, before the crag was thrown down: and similar facts were pointed out to me by the Rev. Thomas Clowes, of Yarmouth, respecting the chalk at Whitlingham. That gentleman presented me with a fragment of chalk, perforated to the depth of several inches by the *Pholas crispata*, the shell still remaining at the bottom of its cylindrical cavity, the upper part of which was filled with loose sand, which had fallen in from the incumbent crag. The chalk of this place when bored by the *Pholas*, was either exposed in the bed of the tertiary sea, or at least was not yet covered by a considerable thickness of sand and loam.

Among other observations which prove the gradual deposition of the tertiary strata themselves, I may mention that Capt. Alexander found the tusk of an elephant at Bramerton, to which there were many *Serpulæ* attached; a fact which also demonstrates, together with many others, that the bones of quadrupeds were really washed down into the sea of the Norwich crag, and were not introduced afterwards by diluvial action, as has been sometimes suspected.

Although many freshwater shells have, by dint of careful search, been detected in the Norwich beds, they are nevertheless rare in comparison with the marine *Testacea*, and the terrestrial species are still more rare. Mr. J. B. Wigham however informs me, that in one of the beds at Thorpe, near Norwich, there is a great predominance of freshwater shells, most of which cannot be preserved, as they fall to powder on being exposed to the air. In the pits of Thorpe last mentioned, the same gentleman found the tooth of a *Mastodon* in the bottom of the deposit, near the chalk, together with pectens and other marine shells. He also discovered, in 1838, at Postwick, together with the remains of fish, and marine shells, the left side of the upper jaw of a *Mastodon*, containing the second true molar, and in the socket the indication of another, namely, the first molar. This fragment was sufficiently perfect to enable Mr. Owen, to whom I submitted it, to refer it to *Mastodon longirostris*, a species also found at Eppelsheim. With these remains of a huge pachyderm were associated the teeth and jaw of a field-mouse, larger and with stronger teeth than the common species, (*Arvicola arvalis*, Cuv.). These fossils were accompanied also by the bones of birds, together with remains of several fish, such as the *Platax* and *Myliobates*. The horns of stags, together with bones and teeth of the horse, pig, elephant, and other quadrupeds, have also been detected at Postwick, Thorpe, Bramerton, and other localities of crag near Norwich. The association here, as in so many other places, both in Europe and America, of the remains of the *Mastodon* and horse, is remarked by Mr. Owen as a subject not without interest.

In addition to spots bordering the valley of the Yare, near Norwich, I visited several others, such as Belaugh and Wroxham, to the north of Norwich, and between that city and Horstead. In all these I found the same kind of crag interposed between the superficial gravel and the chalk; the shells consisting for the most part of *Fusus striatus*, *Turritella terebra*, *Cerithium punctatum*, *Pectunculus variabilis*, *Tellina obliqua*, *Tel. calcarea*, *Cardium edule*, and *Cyprina vulgaris*.

Proportion of recent shells in Norwich Crag.—The information which I was most desirous of obtaining respecting the Norwich crag generally, was the degree of the resemblance of its shells to those of the Suffolk crag on the one hand, and to those of the existing seas on the other. In accomplishing one part of this object, I have been particularly indebted to Mr. J. B. Wigham, of Norwich, whose labours alone have nearly doubled the number of shells which had been previously obtained from this formation, and who has most liberally placed his entire collection at my disposal. I have also to acknowledge the assistance of Mr. Fitch, of Norwich. I received moreover many shells of the Southwold strata through the kindness of Capt. Alexander, several of them belonging to species not yet discovered near Norwich.

But it would have been impossible for me to compare the Norwich shells, amounting to 111 in number, with those of the Suffolk crag, had I not obtained the kind assistance of Mr. Searles Wood, with opportunity of referring to his extensive collection. Nor would Mr. Wood and I have been able to institute a thorough comparison of these shells with recent species, if we had not been assisted by Mr.

George Sowerby. The number of shells of the Norfolk crag known in 1833, when Woodward published his list, amounted, according to that author, to 85 species; but so many of these consisted of mere varieties and monstrosities of a few of the commonest species, especially *Littorina*, *Fusus*, and *Purpura*, that we have found it necessary to reduce the 85 species, as named in that list, to about 58, and several even of this number must again be excluded from a genuine list of Norfolk crag shells, on the ground of their consisting of fragments, probably washed in from pre-existing beds of the red or Suffolk crag. The total number known in 1833 being thus brought down to less than 60, has been again nearly doubled by the additions recently made, especially by Mr. Wigham, 19 out of 111 consisting of land and freshwater shells.

It will naturally be thought that the total number is very small, whether as compared to the shells of the British seas, or to the Fauna of the Suffolk crag, especially when it is considered that the scantiness of this number is not owing to any want of industry on the part of collectors, nor to any paucity of individual shells. But I have already stated that the deposit has a fluvio-marine character, and it is well known that in brackish water, like the Baltic, or in any great estuary, the variety of species is far less considerable than in the salt sea, latitude, climate, and other conditions being the same. A similar scantiness in the list of species has been remarked in those tertiary formations which extend along the valley of the Rhine, from Basle to Mayence, and in which great numbers of land and freshwater shells are intermingled with marine species, the same strata including also the bones of *Mammalia*, and among others, at Eppelsheim, of the *Dinotherium* and *Mastodon longirostris*.

Of the 92 marine shells of the Norwich crag, Mr. Wood has recognized 73 as common to the red crag. This enormous proportion of species common to both (about 78 per cent.), struck me so forcibly when collecting at Southwold and Norwich, that I at first began to suspect, that by increasing our knowledge of the fossils of the Norwich beds we should eventually prove them and the red crag to be nearly, if not wholly of the same age. But the application of another test, namely, the per-centage of recent species, soon led to a very different result, for both in the marine and freshwater shells of the Norwich crag, we have found between 50 and 60 per cent. of recent species, and those almost exclusively northern, and nearly all British shells; whereas in the red crag, as I shall afterwards more fully explain, there are only 30 per cent., and in the coralline crag only 19 per cent., of recent species of true *Mollusca.*

That the crag of Norwich was newer than that of the red crag of Suffolk, had been already implied by Mr. Charlesworth when he suggested that shells of the former had probably been washed into the Norwich beds; and both he and Mr. Wood had recognized in the assemblage of Norfolk shells, a nearer approach to the existing British Fauna; but it is most satisfactory to have these conjectures borne out by a detailed examination of the Norfolk and Suffolk shells, a task, in the execution of which Mr. Wood and myself have had throughout the assistance of Mr. George Sowerby, without whose experience and knowledge of the living shells, we could not have arrived at such positive conclusions.

Only two species of freshwater shells have been hitherto found in the red crag of Suffolk, and these Mr. Wood collected at Sutton, namely, three individuals of *Auricula myosotis,* and a single specimen of *Planorbis marginatus,* belonging to that variety in which the keel is slightly prominent.— This same variety of *Planorbis,* as well as the *Auricula,* have both been discovered in the Norwich crag. Amongst the other freshwater species in this crag, I may mention *Cyrena trigonula,* which occurs both at Southwold, and at Crostwick near Norwich. The land shells consist of *Helix hispida* and *H. plebeium,* common British shells, and two perfect specimens of a *Helix* found by Capt. Alexander at Southwold, which bears a very near resemblance to the *Helix turonensis,* so common in the faluns of Touraine. Of the 92 marine shells all, with two or three exceptions, are either species found in the red crag, or now living, so that a very small number seem to have been peculiar to this period.

The most difficult point to determine in respect to the fossils of the Norwich crag, is the propriety of excluding certain species on the ground of their having been probably washed in from an older bed. The mere circumstance of shells being common to the red crag, and, at the same time, of extinct species, raises in itself no fair presumption against their belonging to the period of the Norwich beds. For some of the commonest shells, such as *Mya lata, Tellina obliqua, Astarte plana, Tellina pretenuis, Nucula Cobboldiæ, Auricula pyramidalis,* and some others, are extinct species, and found also in the red crag of Suffolk: yet no one can doubt that these lived in the sea of the Norwich crag, as they abound in it in a good state of preservation, although some of them are fragile shells, and the *Acephala* have occasionally both valves united. Nor have they in general the red ferruginous colour by which the fossils of the upper crag of Suffolk are tinged. I may however remark, that the fossils of the Norwich crag have also, in some places, acquired a yellow ochreous colour, so that the presence of this character does not at once stamp a shell as having been derived from the more ancient bed. When there is only evidence of a few fragments of a remarkable shell, such as *Hinnites Dubuissoni*, or when I have only met with one bouldered specimen, as of *Murex alveolatus*, and that stained red, I have rejected them as spurious without hesitation.—The greater number of specimens of the *Fusus contrarius* which are broken or bouldered, may also doubtless be referable to the same source. This last point however is one of minor importance, as a conchologist may satisfy himself, by referring to an extensive series, such as Mr. Wood possesses, that the *Fusus contrarius* is merely a sinistral variety of *Fus. striatus*, a fossil which properly belongs to the Norwich crag, and of which Capt. Alexander posseses a reversed specimen from Bramerton, of the ordinary striated variety with angular whorls. The individual last mentioned is quite perfect, and free from ferruginous stains.

No species of *Terebratula* was enumerated in Woodward's list of the Norfolk crag shells, although the species allied to, if not identical with, *Ter. psittacea*, is by no means rare. On the other hand, Woodward mentions *Ter. plicatilis* as being washed out from the chalk into the crag. Mr. Charlesworth also has spoken of various species of *Terebratula*, and other chalk fossils, as of frequent occurrence in the crag of Norfolk.[1] I collected many *Terebratulæ*, of the recent species before mentioned, without ever happening to meet with any derived from the chalk, the introduction of which therefore appears to me to have been a local accident.

It becomes a question of greater delicacy and difficulty when only one entire specimen, or a small number of broken specimens, of a well-known shell of the red or coralline crag have been met with. In this predicament the following ten species appear to stand at present.

1 Voluta *Lamberti*
Cassis *bicatenatus*
Murex *costellifer*
Buccinum *elongatum*
5 Cardium *edulinum*
Cardita *concentrica*
Pecten *plebeius*
Astarte *oblonga*
Lucina *obliqua*
10 Mactra *arcuata*

To exclude all these because of their extreme rarity, would, I think, be somewhat rash, because we have as yet only soli-

[1] Phil. Mag. No. 42. p. 468, Dec. 1835.

tary examples of some other species which are either quite peculiar to the Norwich beds, or are recent species never found in the red crag. Nevertheless, it is worthy of remark, that if we reduce the list of marine shells by ten, on the ground of doubts entertained respecting the authenticity of the species above enumerated, we then find nearly the same per-centage of recent species in the marine list as is obtained from that comprising the land and freshwater shells, namely, 60 per cent. In regard to the nineteen land and freshwater shells, there is no possibility of any individual having been washed in from the purely marine crag of Suffolk; so that when we have obtained a large number of these, they will yield the safest test of the analogy of the Fauna to that now existing.

Norwich Crag Older Pleiocene.—To whatever view we may at present incline respecting some of these doubtful shells, the Norwich crag will still be referable to some part of the older pleiocene period, according to the classification which I have adopted in the 'Principles of Geology,' while the red and coralline crag of Suffolk will each belong to different parts of the miocene epoch.

It would be foreign to the chief object of the present paper if I were to enter into any details respecting the fossil shells of the red and coralline crag, the examination of which could not have been accomplished without access to Mr. Wood's collection, where almost every species is illustrated by abundance of individuals. Assisted by Mr. George Sowerby and Mr. Wood, I have convinced myself that out of 345 species of coralline crag shells, 67 are identical with recent species, being about 19 per cent.; while out of 230 species from the red crag, 69 agree with living species, being in the proportion of about 30 per cent.

It is curious that a large proportion of the recent shells found in the coralline crag, are neither met with in the red crag nor in the Norwich formation. They disappear in the intermediate period, which may be attributed principally to the fragile nature of many of these shells, and in some cases to their having been peculiar to deep and tranquil water. If they should hereafter be detected in beds strictly contemporary with the red crag, it by no means follows that they would alter the proportion of 30 per cent., because with them we might expect to bring to light a great number of extinct species, some of which would probably agree with extinct species of the coralline crag, whilst others would be peculiar to the red crag.

Newer Pleiocene Deposits in Norfolk.—It also appears, from an examination in which Mr. Wood, Mr. Sowerby, and myself have been engaged, of the land and freshwater shells obtained from the superficial lacustrine or fluviatile deposits of certain parts of Norfolk, Suffolk, and the basin of the Thames, that the proportion of recent species in these formations is much greater than in the Norwich crag, exceeding 90 or 95 per cent., and which I therefore refer to the newer pleiocene or *pleistocene* period.[1] I allude, not only to certain deposits at Cromer and Mundesley in Norfolk, the shells of which have been collected by Mr. Fitch, of Norwich, but also to those of Stutton, Grays, Ilford, and other places near London; many of which have long been celebrated for the remains of extinct *Mammalia*.

The chronological order in which these various tertiary groups follow each other in an ascending series, namely, 1st, the coralline crag; 2ndly, the red crag; 3rdly, the mammaliferous or Norwich crag; and 4thly, the lacustrine strata, with mammalian remains;—has been correctly indicated by Mr. Charlesworth, in a paper communicated by him in 1836, to the British Association. In that paper he stated that the proportion of extinct to recent shells had not then been ascertained. It is now satisfactory to find that the palæontological test of age, as derived from the relative approach to the recent Fauna, is perfectly in accordance with the independent evidence drawn from superposition, and the included fragments of older beds. At the same time, the comparative proportion of recent species in the several formations affords us, I conceive, a considerable insight, not only into the order of sequence, but also into the relative distances of the times at which the deposits were formed.

Extension of the Norwich Crag into Yorkshire.—In a former number of this Magazine (vol. viii. o. s. p. 355), Mr. William Bean of Scarborough has described a deposit of sand and clay, containing marine shells, as occurring near Bridlington quay. It was exposed, he says, for a few yards only, on the north side of the harbour, at low water, near the pleasure-ground called the "Esplanade." He now informs me (May, 1839), "that the spot is inaccessible, as the ground has

[1] In the Appendix to the French translation of my 'Elements of Geology,' I have proposed, for the sake of brevity, to substitute the term *Pleiocene* for *Older Pleiocene*, and *Pleistocene* for *Newer Pleiocene*, from the Greek πλειστον, most, and καινος, recent. I have been induced to make this innovation, because in proportion as the progress of science calls for subdivisions of these periods, the longer terms have become more inconvenient. We have often for example, to speak of the *older* and *newer* portion both of the *older* and *newer* pleiocene epochs. To the pleiocene period I have referred those strata which contain between 40 and 70 per cent of recent species of shells; to the pleistocene those in which the per-centage exceeds 70.

been levelled, and a wall erected next the sea." I am indebted to the liberality of this gentleman for having, in immediate compliance with my request, forwarded to me a set of shells which he obtained from these beds, that they might be examined and compared with the collections of fossil and recent shells in London. They consist of about 35 species, after omitting certain specimens of *Balanus, Pecten, Cardium*, and *Astarte*, too imperfect to be determined. Of these 35 no less than 20 are identical with living species, being to the recent in the proportion of nearly 60 per cent., a per-centage coinciding remarkably with that previously obtained from the Norwich crag. No less than 26 moreover of the 35 are identical with species already obtained from the Norwich crag, which, when we consider that the latter has only yielded as yet about 100 marine shells, affords sufficient ground for referring the Yorkshire and Norwich deposits to one and the same period. Some species, moreover, such as the *Nucula Cobboldiæ*, so characteristic of the Norwich beds, were found very abundantly by Mr. Bean near Bridlington. Of the nine species not as yet known in the Norwich crag, five are recent, and the other four appear to differ from any previously known shells, whether fossil or recent. They belong to the genera *Astarte, Turritella, Natica*, and *Margarita*, and, like one or two extinct shells near Norwich, they may perhaps prove peculiar to the British pleiocene strata. I have received no information at present, either of mammalian remains or of land and freshwater shells, in this Yorkshire portion of the Norwich crag.

Contemporaneous Origin of the Suffolk Crag and the Faluns of Touraine.—There is one more subject only to which I shall allude before concluding. When M. Desnoyers first explored the faluns of Touraine and the crag of England, of which he published an account in 1825,[1] after visiting Aldborough, among other places, and inspecting the coralline crag of that neighbourhood, he ascribed a contemporaneous origin to the Suffolk crag and the French faluns. I was then unwilling to embrace this opinion, for various reasons. In the first place I imagined that the per-centage of recent species, in all parts of the English crag, was much larger than that of the Touraine beds; for the shells which I was enabled to submit to the examination of M. Deshayes in 1829, were chiefly derived either from the Norwich beds or the red crag, comparatively small progress having then been made in collecting the fossils of the coralline crag. Admitting that some

[1] Mém. de la Soc. d' Hist. Nat. tome ii. p. 238.

of the identifications then made by M. Deshayes of crag shells with recent species, were erroneous, it was still unavoidable that he should estimate the per-centage for 111 crag shells, gathered indiscriminately from the Norfolk and Suffolk crag, much higher than we now find to hold good in the case of the red or coralline crag taken separately. Secondly, I rejected the idea of the Touraine beds being contemporaneous with the crag, because I had ascertained that the fossils were almost entirely of distinct species, although the two regions are not 300 miles distant the one from the other. M. Deshayes also pronounced the testaceous Fauna of the crag to have a very northern aspect, and that of Touraine an almost tropical character: and yet the crag lies in the 52nd, while the faluns are in the 48th degree of latitude. I stated in the first edition of the 'Principles of Geology' (1830), that so great a discordance in the species of *Testacea* inhabiting two contiguous seas could not be paralleled in the present state of the globe, except where some rare combination of circumstances occurs, like that on the opposite sides of the Isthmus of Suez, where the Red Sea and the Mediterranean are separated by a tract of land, connected on the one side with Asia and on the other with the whole of Africa. There are not even 10 per cent of the species of Touraine fossil shells identical with shells of the crag, as Mr. Searles Wood has determined after examining for me a collection of about 240 shells which I obtained, in 1837, from M. Dujardin, the same collection from which the figures and descriptions were taken for M. Dujardin's paper on the faluns, in the Transactions of the Geological Society of France. Mr. George Sowerby has also assisted me in the careful examination of the whole of these Touraine shells, and we have come to the conclusion that the recent species are in the proportion of 26 per cent.

I am now therefore disposed to come round to the opinion of M. Desnoyers, that the red and coralline crag may correspond in age generally with the faluns of Touraine; for although the assemblage of fossils in the one has an extremely northern, and that of the other a southern and sub-tropical character, yet they seem to depart almost equally, though in opposite directions, from the type of the nearest existing marine Fauna. In the red crag we observe a large development of *Cyprina*, *Astarte*, and *Glycimeris*, and of those sections of *Fusus*, *Buccinum*, *Purpura*, and *Trochus* which are now common in the British or Arctic seas, together with the total absence of even the smallest cones and olives, as well as cowries, except those of diminutive size. In the coralline crag many of the same forms occur, with other genera which we should now only meet with in more equatorial latitudes, as *Lingula*, *Pholadomya*, *Pyrula*, nearly related to *Pyr. reticulata*, a large *Voluta*, &c. They are accompanied moreover by many stone corals of extinct genera, and one of these, the *Anthophyllum*, now occurs within the tropics.

Some explanation, perhaps, of the apparent anomaly of these associations may be sought in the analogy of the present state of parts of the southern hemisphere, which enjoy a mild and equable climate. In South America, for example, Mr. Darwin has shown that certain tropical species and genera will range to very high latitudes, provided their progress be not arrested by severe winter's cold. Thus he found on the east coast of South America, in latitude 39° S., three species of olive (one of large size), a *Voluta* and a *Terebra*, among the most abundant shells on the mud-banks of Bahia Blanca; and a large species of volute has been traced as far south as lat. 45°, or, according to some accounts, much farther.[1]—Such forms in the northern hemisphere would be characteristic of tropical seas. It is moreover said that in the southern hemisphere at present, the transition is very sudden from a latitude to which tropical forms extend, to one not far to the south, where there is extreme cold. But we have yet to learn how far such circumstances alone can give rise in the ocean to abrupt lines of demarcation between distinct geographical provinces of *Testacea*.

It appears to me impossible to account for the specific difference of the marine Faunas of Suffolk and Touraine, assuming them to be contemporaneous, without speculating on some other cause which co-operated perhaps with a state of climate like that above suggested, so as to prevent a free range of northern species towards the south, or of the southern species towards the north. Thus, for example, some geographical barrier, such as an isthmus, may formerly have existed between Dover and Calais. If Great Britain, thus joined to the European continent, stretched continuously far to the north, beyond the Shetland islands; while at the same time the Land's End, in Cornwall, was prolonged for some distance in a southerly direction, the two gulfs then placed on the opposite sides of the supposed isthmus might, in the course of time, become the habitations of very distinct assemblages of marine animals, the isthmus constituting the extreme boundary, on one side, of the range of certain tropical animals, and, on the other, of many arctic species.

[1] Journal of Travels in S. America, in Voy. of H. M. S. Beagle, p. 611.

The following list of fossil shells from the Norwich crag is the joint work of Mr. Searles Wood, F.G.S., Mr. G. Sowerby, F.L.S., and the author; the fact of certain species being common or not to the red and coralline crag of Suffolk, being given exclusively on the authority of Mr. Wood.

LIST OF FOSSIL SHELLS FROM THE NORWICH CRAG.

The fossil shells in this list have all been found in the immediate neighbourhood of Norwich, except where Southwold is mentioned as the locality. All the recent species, of which the habitations are not given, belong to the British seas.

Explanation of the Signs.—The * prefixed to a name implies that the species is now living; where a ? is added, the identification has been considered doubtful, either from the imperfect state of the specimens, or the want of a sufficient number of fossil or recent individuals to allow of a satisfactory comparison. In estimating the per-centage of living species, two of these doubtful cases have been counted as one, the authors anticipating that at least one half of the number will eventually be identified.

The mark ...... in either of the columns headed 'Red Crag' and 'Cor. Crag,' denotes that the species against which it is placed is also found in one or both older deposits. 'Min. Con.' Sowerby's Mineral Conchology.

MARINE SPECIES.

	Red Crag.	Cor. Crag.
1*PHOLAS *crispata*, Lamarck,	......	......
*SOLEN *siliqua*, Lamarck,	......	
MYA *lata*, Min. Con.	......	
—— *pullus*, including *M. subovata* of Woodw. list	......	
5*—— *arenaria*,	......	
*—— *truncata*, Mont.	......	......
*LUTRARIA *compressa*, Lam. (*Mactra Listeri* of Woodward),	......	
*?MACTRA *magna*, Woodward, (*Mactra stultorum ?*)...	......	
*——— *solida*, Mont. (*Mac. ovalis*, Min. Con.)......	......	
10 ——— *arcuata*, Min. Con.	......	......
*——— *subtruncata*, Mont. (*M. cuneata* of Woodw.)		
*AMPHIDESMA *Boysii*, Leach,	......	......
————— *n. s.* one valve only,	......	
*CORBULA *nucleus*, Lam. (*C. rotundata*, Min. Con.)	......	......
15*SAXICAVA *rugosa*, Lamarck,	......	......
*TELLINA *crassa*, Mont. (*Tel. obtusa*, Min. Con.) ...	......	......
——— *obliqua*, Min. Con.	......	......
*?——— *ovata*, Min. Con. same as *Tel. triangularis*, Wahl. (*Tel. calcarea* of some authors) of Norwegian seas,	......	
TELLINA *pretenuis*, Woodward,	......	
20*——— *solidula*, Montagu, found fossil at Crostwick, near Norwich.		
*?——— *fabula*, one valve of fossil from Southwold.		
LUCINA, *n. s.* allied to *divaricata*. Mr. Wood thinks that the ligament in this species was internal,	......	
*——— *radula*, (*L. antiquata*, Min. Con.)	......	......

	Red Crag.	Cor. Crag.
Lucina, *n. s.* allied to *Tellina rotundata*, Montagu,	......	......
25*Donax *trunculus*, Montagu.		
*?Astarte *plana*, Min. Con. (very near *Ast. borealis*).		
*——— *compressa*, Mont. (including *Ast. angulata* of Woodward's list),	......	
——— *n. s.* allied to *Ast. obliquata*, Min. Con...	......	......
——— *oblonga*, Min. Con.	......	......
30*Cyprina *islandica*,	......?	
Cytheræa, *n. s.* allied to *C. lineata*, Min. Con. ...	......	......
*Venus? *paphia*, Mont. including *Astarte ovalis* and *Ast. antiquata* of Woodward's list,	......	
Cardita, *n. s.* a small species,	......	......
——— *scalaris*, Min. Con.	......	......
35 Cardium *edulinum*, Min. Con.	......	......
*——— *edule*, (*Car. obliquum* of Woodward's list)	......	
*Pectunculus *pilosus*, Lam. (*variabilis*, Min. Con.)	......	......
Nucula, *n. s.* allied to *Nuc. margaritacea*,	......	
——— *Cobboldiæ*, Min. Con.	......	
40 ——— allied to *Nuc. oblonga*, Min. Con.	......	
*?Modiola *papuana*, Lam. (*M. vulgaris* of authors). One valve only from Postwick, near Norwich. Recent species inhabits Norwegian seas.		
*Mytilus *edulis*, (including *M. alæformis*, Min. Con. and *M. antiquorum* of Woodward's list),	......	
Pecten *plebeius*, same as *P. sulcatus* and *P. reconditus*, Min. Con.	......	......
*——— *obsoletus*, Min. Con.	......	......
45 ——— *princeps*, Min. Con.	......	......
*?Anomia *striata ?*	......	......
*?——— *ephippium ?*	......	......
*——— *undulata*,	......	......
*Terebratula *psittacea*, Lam. Recent species inhabits Newfoundland.		
50 Patella, *n. s.* allied to *P. virginea*, including *P. parvula*, Woodward,	......?	......?
*Calyptræa *Sinensis*, Mont. (*Infundibulum clypeum*, Woodward).		
*Bulla *obtusa*, Mont. (*Bulla minuta*, Woodward).		
*——— *cylindracea*, Mont.	......	......
——— allied to *B. millium*.		
55 Auricula *pyramidalis*, Min. Con.	......	
Ringicula *ventricosa*, Min. Con.	......	......
*?Natica *glaucinoides*, perhaps same as *Nat. glaucina*,	......	
——— *n. s.* resembling in shape *Paludina solida*, Say,	......	
——— *hemiclausa*, Min. Con.	......	
60 Velutina *similis*, (*Sigaretus similis*, Woodward).		
——— allied to *V. lævigata*.		
Tornatella, like *T. flammea* of E. Indian seas, but smaller; (*Actæon Noæ*, Min. Con.)	......	
*Scalaria *grœnlandica*, (*Sc. similis*, Min. Con.) Recent species inhabits Greenland,	......	
*——— *clathratulus*, (*Sca. minuta*, Min. Con.) ...	......	......
65*?Trochus *nitens*, (*T. tumidus ?*)	......	......
*?——— *similis*, (*T. zizyphinus ?*)	......	

	Red Crag.	Cor. Crag.
LACUNA, *n. s.* allied to *Turbo canalis*, Montagu.		
*TURBO? *ulvæ*, Mont. (*T. minutus*, Woodward).		
———? *semicostatus*, Woodward.		
70*LITTORINA *littorea*.	......	
*——— *squalida*,[1] (including *Turbo carinatus*, *bicarinatus*, *sulcatus*, *ventricosus*, *elongatus*, and *Delphinula carinata* of Woodward's list).		
——— *n. s.* allied to *Turbo crassior*, Montagu.		
*TURRITELLA *terebra*, Lamarck,	......	
*——— *incrassata*, Min. Con.	......	......
75 CERITHIUM *punctatum*, Woodward,	......	
——— *n. s.* allied to *C. reticulatum*.		
PLEUROTOMA *mitrula*, Min. Con.	......	......
*FUSUS *corneus*, Lamarck,	......	
——— *striatus*, Min. Con., including *F. contrarius*, Min. Con., and *Murex angulatus* and *Mur. compressus* of Woodward's list,	......	
80*——— *despectus?* (or variety of *Fusus striatus?*) ...	......	
*——— *turricula*, (*Murex punctuatus*, Woodward),	......	
CANCELLARIA *costellifer*, (*Murex costellifer*, Min. Con.),	......	
CASSIS *bicatenata*, Min. Con.	......	......
*?PURPURA *lapillus?* including *Murex crispus*, *elongatus*, *lapilliformis*, and *pullus* of Woodward's list,	......	
85*?——— *bulbiformis*, (query, variety of the preceding).		
BUCCINUM *rugosum*, Min. Con.	......	
——— *n. s.* allied to *B. macula*,	......	
——— *granulatum*, Min. Con.	......	......
*——— *undatum*	......	......?
90 ——— *elongatum*, Min. Con.	......	......?
TEREBRA, *n. s.* allied to *Helix elegantissima*, Mont.	......	......
VOLUTA *Lamberti*, Min. Con.	......	......

LAND AND FRESHWATER SPECIES.

*CYCLAS *amnica*.		
——— *n. s.* allied to *Cyclas amnica*.		
95*——— *cornea*.		
*? CYRENA *trigonula*, Wood (Loudon's Mag.) perhaps same as a recent undescribed species, common in Lower Egypt.		
HELIX allied to *H. Turonensis*.		
*——— *hispida*, Montagu.		
*——— *plebeium*, Drap.		
100*AURICULA *myosotis*, Drap. fossil from Southwold.	......	

[1] The name of *Littorina squalida* has been given to a recent species from northern seas, by Messrs. Broderip and Sowerby, in Zool. Journal. Perhaps when better known it may prove to be only a variety of *L. littorea*.

	Red Crag.	Cor.Crag.
*? PLANORBIS *corneus ?* Lam. only one specimen.		
*?——— *marginatus ?* Montagu; variety with keel slightly prominent and marginal.........	......	
*PLANORBIS *vortex*, Lamarck.		
*LIMNEA *palustris*, (*L. tenuis*, Woodward).		
105 ——— *n. s.* between *L. fossaria*, Mont. and *L. elongata*, Drap. Query, variety of *L. palustris.*		
*——— *peregra.*		
——— allied to *peregra.*		
——— *n. s.* from Southwold.		
*VALVATA *piscinalis*, Lamarck.		
110*?PALUDINA *unicolor ?* including *Pal. obsoleta*, *media*, and *rotundata*, of Woodward's list; recent species inhabits Bengal.		
*——— *impura*, Lamarck.		

In addition to the above, fragments of *Scalaria foliacea*, *Murex alveolatus*, *Hinnites Dubuissoni*, *Cardium Parkinsoni*, *Car. grœnlandicum*, *Astarte Danmoniensis ?* and other shells, probably washed out of the red crag. Also a young *Pileopsis*, and valve of a *Chiton*, called by Woodward *Chi. octovalvis;* also a valve of a *Cyclas* allied to *C. rivicola*.

The *Cirripeda* are not mentioned in the above list, as they have not yet been sufficiently examined; but at least two species of *Balanus* occur, besides some single valves of a large species allied to *B. Uddevallensis*, and common to the red crag, from which stratum they may have been washed out.

ART. II.—*Monograph of the Genus* Sciurus, *with Descriptions of New Species and their Varieties.* By J. BACHMAN, D.D., President of the Literary and Philosophical Society, Charlestown, South Carolina, &c.

(Continued from page 227.)

8. LITTLE CAROLINA GREY SQUIRREL. *Sciurus Carolinensis.*

Sciurus Carolinensis; Gmel.
Ecureuil gris de la Carolina; Bosc. vol. ii., p. 96, pl. 29.

ESSENT. CHAR.—Smaller than the Northern Grey Squirrel, tail narrower than in that species, the length of the body; colour above, rusty grey, white beneath, not subject to vary in colour. Dental formula; Incisors $\frac{2}{2}$; Canines, $\frac{00}{00}$; Molars, $\frac{55}{44}$;—22.

This species, which has been described for so many years, has been invariably considered by authors as identical with the northern grey squirrel. There are however so many marks of difference in size, colour, and habits, that any naturalist who has had an opportunity of comparing specimens, and of witnessing their difference in habit, will feel himself justified in regarding them as distinct species.

The head is shorter and the space between the ears proportionately broader, than those of the northern grey squirrel: the nose also is sharper. The small anterior molar in the upper jaw is permanent, and not deciduous, as I have invariably found it in all the specimens I ever examined. It is considerably larger than in the other species, and all my specimens, which give evidence of the animals having been more than a year old, instead of having the small, thread-like, single tooth, as in the northern species, have a distinct double tooth with a double crown; the other molars are not unlike those of the other species in form, but are shorter and smaller; the upper incisors are nearly a third shorter. The body is shorter, less elegant in shape, and has not the appearance of sprightliness and agility, for which the other species is so eminently distinguished. The ears, which are nearly triangular in shape, are so slightly clothed with hair internally, that they may be said to be nearly naked; externally they are sparsely clothed with short woolly hair, which, however, does not extend beyond the margins, as in the other species; the nails are shorter and less hooked; the tail is shorter, and does not present the broad distichous appearance of the other.

DIMENSIONS.

	IN.	LIN.
Length of head and body	9	6
Ditto of tail (*vertebræ*)	7	4
Ditto to point of hair	9	6
Height of ear	„	6
Palm to end of middle claw	1	3
Heel to end of middle nail	2	6
Length of fur on the back	„	5
Breadth of tail with hairs extended	3	0

Colour.—Teeth light orange colour; nails brown, lighter at the extremities; whiskers black; nose and cheeks, and around the eyes, a slight tinge of rufous grey. The fur on the back is, for three fourths of its length, dark plumbeous, then a slight marking of black, edged with brown in some hairs and black in others, giving it, on the whole upper surface, a uniform dark ochreous colour. In a few specimens there is an obscure line of lighter brown along the sides, where the ochreous colour prevails, and a tinge of the same colour on the upper surface of the fore legs, above the knees. The feet are light grey; the tail, for three fourths of its length from the root, is yellowish brown, then black edged with white; the throat, inner surface of the legs, and the belly, white.

This species is not subject to run into varieties, which is so striking a characteristic of the northern grey and black squirrel. The specimens received from North Carolina, Alabama, Florida, and Louisiana, scarcely present a shade of difference from those existing in South Carolina, and which I have described above.

Geographical Distribution.—This species is exceedingly abundant in South Carolina, especially in low swampy situations. A specimen was sent to me from Louisiana, where it is said not to be abundant. It is common in Alabama and Mississippi, is found everywhere in the low grounds of Georgia, and is the only species in the southern peninsula of East Florida. Its northern boundary I have been unable to determine with positive certainty. I have received it from North Carolina, and have an impression that I saw it in the southern portions of New Jersey, and that it is not uncommon in the neighbourhood of Philadelphia.

Habits.—This species differs as much in habit from the northern grey squirrel, as it does in form and colour. After an intimate acquaintance with the habits of the northern species, I was particularly struck with the peculiarities of this, on the first occasion afforded me of seeing it in the woods. Its bark has not the fulness of the other, and is much shriller and more querulous. Instead of mounting high on the tree when alarmed, as is the case with the northern species, this clings around the body, on the opposite side, at the distance of twelve or fourteen feet, often concealing itself beneath the Spanish moss (*Tillandsia usnoides*), which hangs trailing round the tree. When a person who has alarmed it, remains quiet for a few moments, it has the habit of the northern chickaree (*Sciurus Hudsonius*) of descending a few feet, and taking a seat on the first convenient limb, as if watching his motions. It is, however, capable of climbing to the extremity of the limbs, and leaping from tree to tree, but is less wild than the northern species, and is as easily approached as the chickaree. The person who is desirous of obtaining the Carolina squirrel, has only to take his seat for a few moments in any of the swamps of Carolina, and he will be surprised at the immense numbers that are running along the logs, and leaping among the surrounding trees. In this manner great numbers are killed, and their flesh is juicy and tender.

Although the Carolina grey squirrel is sometimes seen on high grounds, among the oak and hickory trees, yet its usual haunts are in low swampy places, and among the trees overhanging our streams and the borders of our rivers. In the cypress-swamps, covered in many places with several feet of water during the whole year, it takes up its constant residence, moving among the entwined branches above with great facility. Its hole, in such situations, is in the hollow of some cypress, and on the surrounding tupelos (*Nyssa aquatica*) many nests, composed principally of Spanish moss and leaves, are everywhere seen. In these nests they occasionally deposit their young. These are five or six in number,—brought forth in March; and it is generally stated that the female produces young twice in a season.

This species has one peculiarity which I have not observed in any other. It may be said to be, in some respects, nocturnal, or at least crepuscular, in its habits. In riding along the by-paths of our swamps, long after sun-set, we are often startled by the noise of this little squirrel. It scratches among the leaves, courses from tree to tree, and scatters over the earth the seeds of the maple &c., which are thrown off from the extremities of the branches above. I have noticed it by moon-light, as actively engaged as the flying squirrel. It is scarcely ever seen in the company of, or even found in the same neighbourhood with, the fox squirrel; not so much, probably, from their having any antipathy to each other, as from the very different localities suited to the habits of each species.

The habit of the Carolina grey squirrel in roving about late in the evening, causes it frequently to become the prey of the Virginian and barred owl, and especially the latter, which is very abundant in the swamps of Carolina. The owl glides with noiseless wing through the trees, and the startled squirrel is often seized without an effort to escape. The rattlesnake, black snake, and our southern chicken snake, are occasionally killed with this species in their bodies. They also frequently furnish the grey fox with a dainty meal; and the wild cat (*Felis rufa*) often captures them by stealth. On two or three occasions I have had opportunities of witnessing the dexterity of this prowling thief, in capturing the squirrel.—Concealing himself in the brush-wood, near some fallen log, in places frequented by this species, he remains immoveable for hours together, until the unsuspecting animal passes near his hiding-place, when he suddenly pounces upon it, and carries it to some neighbouring thicket, where, among the entangled vines of smilax and the wild rose-bush, he devours it at his leisure.

9. DUSKY SQUIRREL. *Sciurus nigrescens*, Bennett.

DIMENSIONS.	IN.	LIN.
Length from point of nose to root of tail	12	4
Ditto of tail to end of hair	15	4
Tarsus, claws included	2	7½
Nose to ear	2	2½
Height of ear posteriorly	„	8½

Colour.—Prevailing colour black, slightly grizzled on the body, crown of the head, and legs, with grey; sides of the neck, groins, upper parts of the thighs and rump, grizzled with pale yellow; cheeks, chin, throat, neck, breast, and the whole of the under surface, including the interior of the legs, dingy grey. Ears well clothed with hairs; hind part dingy grey, fore part the colour of the back; the hairs of the hinder parts of thighs black. Tail, hairs black at the roots, then grey, then a broad band of black, and broadly tipt with white. Feet black; the hairs of the toes grizzled with white points. Whiskers about the length of the head, black. Hairs on the back plumbeous black at the roots, for two thirds of their length, then grey, then black, and tipt with whitish grey. There are numerous strong black hairs interspersed over the body.

Described from the original specimen in the Museum of the Zoological Society; No. 429 in the catalogue.

10. COLLIE'S SQUIRREL. *Sciurus Colliæi*, Richardson.[1]

DIMENSIONS.	IN.	LIN.
Length from nose to root of tail	10	9
Ditto of tail to end of hair	9	6
Tarsus, including nail	2	5
Height of ear posteriorly	„	6
Nose to ear	2	0

Colour.—Above, grizzled black and buff yellow; sides of muzzle, under parts, and inner sides of limbs white. Tail moderate, the hairs greyish white, three times annulated with black. Hairs of the body, both above and beneath, grey at the root; that of the back with a lengthened black tip, and broadly annulated with buff yellow. The hairs of the head resemble those of the back, except on the fore part, where they are annulated with whitish. Top of the muzzle brown, cheeks greyish. Ears well clothed with hairs, which are internally of a yellowish colour, externally grizzled with black and yellow on the fore part, but posteriorly with long whitish hairs. Hairs of feet white, black at the root; the whiskers are as long as the head, composed of bristly black hairs.

Described from the original specimen, deposited by Dr. Richardson in the Museum of the Zoological Society.

[1] Appendix to Captain Beechey's Voyage.

11. The Black Squirrel. *Sciurus niger.*

Sciurus niger; Linn. non Catesby.
———————— Desm. Mammalogie, p. 334.
———————— Godman; Nat. Hist. vol. ii, p. 133.

A little larger than the Northern Grey Squirrel. Fur soft and glossy; ears, nose, and the whole body pure black, a few white tufts of hair interspersed. Dental formula; Incisors, $\frac{2}{2}$; Canines, $\frac{00}{00}$; Molars, $\frac{44}{44}$;—20.

Much confusion has existed with regard to this species.—The original *Sciurus niger* of Catesby is the black variety of the fox squirrel. It is difficult to decide, from the descriptions of Drs. Harlan and Godman, whether they described from specimens of the black variety of the northern grey squirrel, or of the species which I am about to describe. Indeed, there is so strong a similarity, that I have admitted it as a species with some doubt and hesitation. Dr. Richardson has, under the head of *Sciurus niger,* (see 'Fauna Boreali-Americana,' p. 191), described a specimen from Lake Superior, of what I conceive to be the black variety of the grey squirrel; but at the close of the same article (p. 192), he has described another specimen from Fort William, which answers to the description of the specimens now before me. There is great difficulty in finding suitable characters by which the majority of our species of squirrel can be designated; but in none is there greater than in the present. All our naturalists seem to insist that we have a *Sciurus niger,* although they have applied the name to the black varieties of several other species. As the name, however, is likely to continue on our books, and as the specimens before me, if they do not establish a true species, will show a very permanent variety, I shall describe them under the above name.

Dr. Godman states (Nat. Hist. vol. ii. p. 133), that the black squirrel has only twenty teeth;—the specimens before me have no greater number, with the exception of one, evidently a young animal, a few months old, which has an additional tooth on one side, so small that it appears like a white thread, the opposite and corresponding one having already been shed. If further examinations go to establish the fact, that this additional molar in the northern grey squirrel is persistent, and that of the present deciduous, there can be no doubt of their being distinct species. Its head appears to be a little shorter and more arched than that of the grey squirrel, although it is often found that these differences exist among different individuals of the same species. Incisors compressed, strong, and of a deep orange colour anteriorly. Ears elliptical, and slightly rounded at the tip, thickly clothed with fur on both surfaces, that on the outer surface in a winter specimen, extending three lines beyond the margin: there are, however, no distinct tufts. Whiskers a little longer than the head; tail long and distichous, thickly clothed with moderately coarse hair.

The fur is softer to the touch than that of the northern grey squirrel. The whole of the upper and lower surface, as well as the tail are bright glossy black; at the roots the hairs are a little lighter. The summer specimens do not differ materially in the colour of their fur from the winter ones, except that they are not so intensely black. In all the specimens I have had an opportunity of examining, there are small tufts of white hairs irregularly situated on the under surface, resembling those on the body of the mink. There are also a few scattered white hairs on the back and tail.

DIMENSIONS.

	IN.	LIN.
Length of head and body	13	0
Ditto of tail, (*vertebræ*)	9	1
Ditto, including fur	13	0
Palm to end of middle fore claw	1	7
Length of heel to the point of middle claw	2	7
Ditto of fur on the back	„	8
Breadth of tail with hair extended	5	0

Geographical Distribution.—The specimens from which this description has been taken were procured, through the kindness of friends, in the counties of Renssellaer and Queen's, New York. I have seen it on the borders of Lake Champlain, at Ogdensburgh, and on the eastern shores of Lake Erie; also near Niagara, on the Canada side. The individual described by Dr. Richardson, and which may be clearly referred to this species, was obtained by Capt. Bayfield at Fort William, on Lake Superior. Black squirrels exist through all our western wilds, and to the northward of the great lakes; but whether they are of this species, or the black variety of the grey squirrel, I have not had the means of deciding.

Habits.—An opportunity was afforded me many years since of noticing the habits of this species, in the northern parts of the state of New York. A seat under the shadow of a rock, and near a stream of water, was, for several successive summers, a favorite resort for retirement and reading. In the immediate vicinity were several large trees, in which were a number of holes, and from which, at almost every hour of the day, were seen issuing this species of black squirrel. There seemed to be a dozen of them; they were all of the same glossy black colour; and although the northern grey squirrel and its black variety were not rare in that neighbourhood, yet, during a period of five or six years I never witnessed any other than the present species in that locality; and recently, after the lapse of twenty years, a specimen, from which the above description was in part drawn up, was sent to me, which had been procured on that identical spot. They appeared to possess all the sprightliness of the northern grey squirrel;—appearing to prefer valleys and swamps to drier and more elevated situations: and I observed that one of their favourite trees, to which they retreated on hearing the slightest noise, was a large white pine (*Pinus Strobus*), in the immediate vicinity. I was surprised at sometimes seeing a red squirrel (*Sciurus Hudsonius*), which seemed also to have given a preference to this tree, pursuing the black squirrel, seeming to quarrel with and scold it vociferously, till the latter was obliged to make its retreat. When the squirrels approached the stream which ran within a few feet of my seat, they often stopped to drink, and instead of lapping the water like the dog and cat, they protruded their mouths a considerable distance into the stream, and drank greedily; they would afterwards sit upright, supported by the *tarsus*, and, with tail erect, busy themselves for a quarter of an hour in wiping their faces with their paws, the latter being also occasionally dipped in the water. Their barking and other habits did not seem to differ from those of the northern grey squirrel.

General Remarks.—I have admitted this as a true species, not so much in accordance with my own positive conviction, as partly in deference to the opinions of all our naturalists, and principally from the consideration that if it be no more than a variety, it has, by time and succession, been rendered a permanent race: and as the species differ so widely and uniformly in colour, we may perhaps be warranted in regarding them as distinct. The only certain mode of deciding whether this is a true species or merely a variety, would be to ascertain if the opposite sexes of these differently marked animals associate and breed together in a state of nature. Where the produce of two animals, however different in size and colour, are in the constant habit of propagating their species in a wild state, we are warranted in pronouncing them identical. Where, on the contrary, there is no such result, we are compelled to come to an opposite conclusion.

(To be continued.)

Art. III.—*Observations on the History and Classification of the Marsupial Quadrupeds of New Holland.* By W. Ogilby, Esq., M.A., &c. &c.

(*Continued from page* 265).

Tested by these indisputable principles, I have no hesitation in affirming that Cuvier's distribution of the marsupials into families is as unphilosophical, as I have already shown it to be illogical. It proceeds, in fact, upon mere modifications of dentition, often totally unimportant, and without the least regard to habit, unless such erroneous habits as are inferred from structure; which is entirely reversing the order of induction, and beginning to philosophise at the wrong end. The alterations introduced by M. Latreille are equally objectionable in a philosophical point of view, though a great improvement upon M. Cuvier's arrangement in logical simplicity and precision; they proceed upon the clear and definite principle of the existence and development of canine teeth in one or both jaws, or in neither; but as this is a purely arbitrary assumption, its results are consequently more confused, without being more natural, than those of M. Cuvier; and the names of *Entomophaga*, *Carpophaga*, and *Phyllophaga*, by which he has designated his principal groups, are purely imaginary, and have no juster application to the generality of the animals comprised under them, than they have to the *Cetacea* or the *Ruminantia*. The entire disregard of affinities which M. Latreille evinces in removing the kangaroo-rats (*Hypsiprymnus*) from the vicinity of the kangaroos, (*Macropus*), and the petaurists from the phalangers, with which even the method of Baron Cuvier left them in contiguity, is not the least glaring proof of the rashness of his attempts at improvement in this department of Zoology; whilst his association of the *Hypsiprymni* in the same family with the phalangers and koolas, and of the petaurists and wombats (*Phascolomys*) with the kangaroos, could only have arisen from a total disregard both of habits and structure, and an obstinate adherence to a preconceived arbitrary and artificial principle of classification. But it is unnecessary to pursue these criticisms farther: those who have studied the subject, will readily appreciate the defects of both these arrangements; and what I have already said will, I hope, be sufficient to guard the learner from trusting too implicitly to the reputation of the authors, and the weight of their authority.

To guide us to a more natural and philosophical arrangement, let us for a moment attend to the modifications which the two systems of organs, principally employed in governing the habits and economy of animals, undergo among the marsupials. I allude to the organs of mastication, which regulate the food, and accord with the internal structure of the alimentary canal; and to the organs of locomotion, upon which depend all the varied habits, and delicate and complicated actions of life. The former has been hitherto exclusively attended to by the makers of systems in Mammalogy; it is not too much to say, that the latter, and by far the more important of the two, has been entirely neglected. Nor have systematists confined themselves to the really influential modifications of their favourite organs; the golden maxim is constantly forgotten, that all modifications are not necessarily important, merely because they may happen to belong to an important organ; and the consequence is, that we have new methods and new arrangements continually proposed, which differ from their predecessors, not in any general or philosophical principle of classification, but only in some new combination of minor characters; which, leading to some slight difference in the distribution of the animals, is considered a proof of creative power of mind, and of a capacity for generalization. Indeed it may be safely affirmed, that it is the ordinary practice of inquirers in this branch, to commence the study of Zoology by forming a system of their own, by which they regulate their future studies, and of which they only discover the absurdity after having made some advance in the science; perhaps after having given it to the world as a great improvement upon their predecessors. They begin where they ought to finish; they commence at the wrong end; and attempt to form generalizations before they are acquainted with particulars: they may gratify their own vanity, but they render Zoology ridiculous as a science, by departing from that slow, modest, but sure path of induction, which proceeds patiently from the investigation of single facts, to compare and combine them into general propositious, and which is alone worthy of the name of Philosophy. There is no royal road to the acquirement of zoological knowledge more than of mathematical; and he who would pretend to be a philosophical zoologist, must not only be a diligent student of facts, but must take care to admit no principles of classification but such as are founded upon *organic characters of appreciable and admitted influence upon the habits and economy of animal life*. This is the grand and leading principle of scientific classification; and it is only owing to a total and culpable disregard of its authority, that the science of Zoology has been so long retarded in the development of its really philosophical principles, and so much overburdened by vague, arbitrary and fanciful generalizations.

These reflections are naturally suggested by an inquiry into the principles which determine the natural arrangement of marsupial quadrupeds; a group of mammals, in which, as I have endeavoured to show, the distribution into families is more arbitrary, and less consistent either with the organic structure of the animals, or with the habits and economy of their lives, than in any other group of equal value or extent. I proceed to point out the really influential modifications upon which these functions depend, and which alone should be taken into account in the zoological arrangement of these animals. And first with regard to their dental system.

Two principal forms of dentition prevail among the marsupials; which, from the genera in which they may be considered as characteristically presented, I shall take the liberty of calling the *didelphoid* and *macropoid* forms. The first is characterised by eight or ten incisors in the upper jaw, and six or eight in the lower; distinct, well-developed canines, of the normal form; and six, or more commonly seven, molars on either side, both above and below; of which two or three are false, and the remaining four real molars, provided with sharp tubercles, and adapted to an insectivorous regimen.—The incisors, which exceed in number those of all other mammals, are small, simple, upright and arranged regularly in a portion of a small ellipse, the two middle above being generally a little longer than the lateral, and partially separated from one another; the canines, as in all marsupial quadrupeds, are situated in immediate contact with the intermaxillary suture, and are, generally speaking, of tolerable size; but the tubercles on the posterior molars are by no means so sharp and pointed as in the true *Insectivora;* and, except among the smaller species, there is good reason to believe that insects form but a very small portion of the natural food of the animals. The *Opossums,* for instance, notoriously live upon wild fruits, and it is only when these fail in the woods, that they betake themselves to an animal diet; the *Thylacines* and *Dasyures* are purely carnivorous; and the testimony of all colonial authorities, as well historians and travellers, as officers and other gentlemen with whom I have conversed on the subject, agrees in representing the *Perameles,* or, as they are called by the settlers, *Bandicoots,* as equally destructive to their potato and corn crops, scratching up and devouring the tubers of the former, as well as all other kinds of bulbous roots, whether wild or cultivated; and greedily devouring the tender and milky grains of the young maize. That they occasionally, perhaps in some situations habitually, feed upon insects, I have no doubt, as I am well aware that all the smaller species, not only of marsupials, but likewise of quadrumanous and carnivorous mammals, do the same; but the united testimony of all competent observers who are acquainted with the animals in their native habitats, warrants us in concluding that the staple of their food is derived from the vegetable kingdom.

The genera which exhibit this form of dentition are *Didelphis*, *Cheironectes*, *Thylacinus*, *Phascogale*, *Dasyurus*, and *Perameles*.

The second form of dentition which is exhibited among the marsupials, consists of six incisors in the upper and only two in the lower jaw; minute canines, confined to the upper jaw or wanting altogether, and five or six permanent molars throughout, separated from the incisors or canines by a vacant space of considerable extent, which sometimes contains one or two minute deciduous teeth, commonly counted as false molars. The superior incisors are erect and contiguous; but the inferior are long, edged, and procumbent in so remarkable a degree, as to lie entirely in the plane of the inferior *ramus* of the lower jaw; the true molars are furnished with blunt tubercles, and indicate a frugivorous regimen; whilst the rudimentary false molars of the lower jaw are in some instances contiguous to the long procumbent incisors, and inclined in the same direction, so that they ought perhaps more properly to be regarded as belonging to this class of teeth; a view of the subject which tends considerably to break the abruptness of the transition, and to diminish the *hiatus* between the dentition of these animals and that of the *Opossums* and *Cheironectes*, to which they are so closely related by other influential parts of their structure.

Though this system of dentition betokens a pre-eminently frugivorous regimen, it is not to be supposed that the food of the animals possessing it is exclusively confined to the vegetable kingdom. On the contrary, those genera which approach most nearly to the former group in other parts of their structure, exhibit a marked predilection for animal food; nor is there any very striking difference, in this respect, between the appetites of the Australian phalangers and the American opossums. I have made numerous experiments upon the living animals, for the purpose of ascertaining this point, and invariably with the same result; proving that the regimen of the pedimanous marsupials is really omnivorous, and made up indifferently of animal and vegetable substances; a result which is confirmed by the testimony of all writers. Other marsupials possessing the macropoid form of dentition, such as the kangaroos and wombats, are, indeed, restricted to a purely vegetable diet; but their true molars are differently formed, and the second even departs from this type of dentition, by having only two incisors in the upper as well as in the under jaw.

This form of dentition is common to the genera *Phalangista*, *Petaurus*, *Phascolarctos*, *Macropus*, and *Hypsiprymnus*.

The next organs to be considered as influencing the habits and economy of the marsupials, are the extremities. I have already observed how wofully these organs have been neglected by the makers of systems; though it is difficult to conceive how scientific zoologists could possibly undervalue or overlook the instruments of the most important and striking actions of animal life. Not only do the great function of locomotion, and its thousand varieties and adaptations, whether to aquatic, arboreal, terrestrial, or aerial habits, depend solely and entirely upon the extremities; but the scarcely less important functions of prehension, manipulation,[1] burrowing, and even the sense of touch, the source of our most excellent ideas, and the index of intellectual power, reside in the same organs. The formation and modifications of the extremities, therefore, do not furnish those merely second-rate characters, which should justify the philosophical zoologist in postponing them to slight modifications of dentition, or neglecting them altogether. On the contrary, as every action and habit of animal life, except the mere appetite, depend upon these organs; as they are the most extensively influential, so their modifications should hold the most prominent place in every system, and will be invariably found to lead to the most natural and philosophical arrangements.

The marsupial quadrupeds, always excluding the *Monotremata*, which cannot be properly compared with other mammals, present four very distinct and primary influential modifications of the extremities.

1. The *Pedimanous form*, where the fingers are long, separate and prehensile, and the hind thumb opposable to the other toes. The animals consequently possess perfect powers of prehension and manipulation; they are entirely arboreal, feed indifferently upon vegetable and animal substances, though preferring the former, and all have a *cæcum* of moderate dimensions. This family, which I shall denominate *Cheirogrades*,[2] from their locomotion being performed by

[1] I use this term as synonymous with the common word, handling.

[2] In the paper as originally written, these families were called respectively *Scansores*, *Cursores*, *Saltatores*, and *Fossores*: I have now substituted the names in the text, as more pliant when used adjectively, as in speaking of saltigrade or digitigrade marsupials, &c. April, 1839.

means of *hands*, comprises the genera *Didelphis* and *Cheironectes*, with didelphoid teeth; and *Phalangista*, *Petaurus*, and *Phascolarctos*, with macropoid.

2. The *digitigrade form*, in which the functions of prehension and manipulation are very much impaired, or altogether absent. The hind feet are without opposable thumbs, which, however, are sometimes represented by a small, motionless tubercle; the animals tread only on the toes in walking, and their pace is confined to the surface of the earth.—All are characterised by the didelphoid system of dentition, a regimen principally confined to animal substances, [and an entire absence of *cæcum*].[1] This family, which, from the nature of their pace, I shall denominate *Digitigrades*,[2] comprehends the genera *Thylacinus*, *Dasyurus*, *Phascogale* and *Myrmecobius*.[3]

3. The *saltigrade form*, in which the posterior extremities so immeasurably exceed the anterior in length, as to preclude the ordinary mode of progression on all fours, and to compel the animals to proceed by a series of successive springs, sometimes from the long hind legs only, sometimes from the hind to the fore legs, as in the hares and rabbits. The toes of the fore feet are separate and prehensile, and the animals enjoy perfect powers of manipulation; but the conformation of the hind toes is altogether unique among mammals. The thumb is tuberculous, or altogether wanting; the two following toes are small, slender and inclosed in the same skin, being marked externally only by their double claw; the ring finger is the largest of all, of a size altogether disproportioned to the other toes, and armed with a powerful triangular claw; and the last, or outer finger is of intermediate size, and provided with a similar claw to that just described. The dentition comprehends examples of both the systems above characterised; the food of some genera is consequently mixed, though in all cases it is principally composed of vegetable substances, and a *cæcum*, sometimes of very large dimensions and complicated form, is invariably present. This family, which I shall call *Saltigrades*,[2] contains the genera *Macropus* and *Hypsiprymnus* with macropoid teeth, and *Perameles* and *Chæropus*[4] with didelphoid.

4. The *plantigrade form*, which is confined to the single genus *Phascolomys*. The toes here are short, rigid and unprehensile, well adapted for burrowing, and without any power of manipulation. The animal treads on the entire sole of the

[1] I have inserted this fact on the authority of Dr. Grant.

[3] and [4] These two genera have been discovered since the paper was written, and are now inserted for the first time.—W. O. April, 1839.

foot in walking, the pace is slow and confined to the surface of the earth, and the toes are so firmly united as to be altogether destitute of separate motion. The dentition, as far as regards the number of incisors, may be called rodent, though it is really very different from that of the true *Rodentia;* the food is exclusively vegetable, and the alimentary canal is characterised by the presence of a capacious and complicated *cæcum.* I distinguish this family by the name of *Plantigrades.*[2]

The following table exhibits these relations in a more condensed form; and will give a good idea of what I consider to be the most natural and philosophical arrangement of the marsupials. Except the kangaroos, they are all of nocturnal habits.

MARSUPIALIA Marsupiated Mammals	I. SALTIGRADA with saltigrade extremities	*Macropidæ* and macropoid teeth	*Macropus*, *Hypsiprymnus*
		Peramelidæ and didelphoid teeth	*Perameles*, *Chæropus*
	II. DIGITIGRADA with digitigrade extremities and didelphoid teeth		*Myrmecobius*, *Phascogale*, *Dasyurus*, *Thylacinus*
	III. CHEIROGRADA with pedimanous extremities	*Didelphidæ* and didelphoid teeth	*Didelphis*, *Cheironectes*
		Phalangistidæ and macropoid teeth	*Phalangista*, *Petaurus*, *Phascolarctos*
	IV. PLANTIGRADA with plantigrade extremities and rodent teeth		*Phascolomys*

Having thus traced the progressive history of the general distribution of marsupial quadrupeds, *inter se*, it remains for me to offer a few observations upon the rank which the main group itself ought to occupy among the natural families of the animal kingdom. M. De Blainville, in his view of the subject, seems almost disposed to regard the marsupials as forming a distinct class, parallel to and co-ordinate with the *Mammalia* themselves; and in this sentiment he has been, to a certain extent, followed by Baron Cuvier. Illiger, less happy in fixing their position in the graduated scale of existence, than in defining their generic differences, distributes them throughout three different orders; and Latreille, whilst he regards the marsupials generally as forming a distinct natural order, considers the *Monotremata* as a separate CLASS, intermediate, in rank and position, between birds and mammals. Finally, Baron Cuvier, in the second edition of the 'Règne Animal,' adopts the most judicious part of this arrangement, by separating the common marsupials from his extensive order *Carnassiers*, with which he had formerly associated them, to elevate them to the rank of a separate order: still, however, retaining the *Monotremata* as a family of the order *Edentata*. In this view he had been already preceded by Temminck, excepting that the eminent zoologist considers both the *Monotremata* and the ordinary marsupials as distinct orders, equivalent to other groups of the same rank and denomination.

This arrangement appears to me to be more consistent with the order which nature has herself established, than any other which has been yet proposed; unless that I am disposed, after the example of M. De Blainville, to unite the *Monotremata* with the other marsupials, rather than to continue them as a subordinate group among the *Edentata*. In fact, so long as the possession of mammary glands is considered as the distinctive and peculiar characteristic of the class of mammals, so long should the singular modification of these organs and of their functions, exhibited in the marsupials, entitle those animals to rank as a primary division, or order of mammals: but I can in no case consider them as an equal and coordinate group, or CLASS, since their distinctive characteristic is but a subordinate modification of the general type of organic structure, common to all mammiferous quadrupeds.

With regard to the *Monotremata*, also, though the question of their viviparous or oviparous production still remains undecided, I can, under no circumstances, regard them as a parallel and equivalent group to mammals, birds, and reptiles. Meckel distinctly asserts the existence of mammary glands in the female *Ornithorhynchus*;[1] and this circumstance alone, even though the *mammæ* exist merely in a rudimentary form, and without the accompaniment of the ordinary function, I esteem sufficient to determine the rank of the *Monotremata* as a subordinate group of mammals.[2] In fact the simple de-

[1] The observations of Meckel have been fully and most satisfactorily confirmed, since this passage was written, by the investigations of Mr. Owen; and it is now definitely established that these singular and anomalous animals, not only lay eggs and hatch them like birds, but likewise support their young, when excluded from the shell, by means of a thick milky fluid, which at that period exudes copiously from the glands observed by these able anatomists.

[2] For the following ingenious observations on this subject I am indebted to the kindness of Professor Agardh, now Bishop of Bergen: and it affords

finition of this class, as mammals, or animals provided with

---

me great satisfaction to find that my views regarding the value and position of the group, *Monotremata*, so entirely coincide with those of so distinguished a naturalist. They are contained in a letter dated Lund, in Sweden, Aug. 3rd, 1833; and are a translation from a work recently published by Professor Agardh, in the Swedish language, under the name of 'Allman Wext Biologi.'

"The marsupials," says the Professor, "are *Mammalia* which approach very nearly to birds; the *Monotremata* in particular almost coincide with them. Not only do the developed form of the hind legs, the deranged functions of the anterior extremities, the position of the body, and the destination of the tail to govern the pace, all indicate this affinity, but their internal structure is likewise very similar. They constitute a distinct group of *Mammalia*, combining carnivorous as well as herbivorous animals, in the same manner as birds contain predacious as well as frugivorous tribes. They have no distinct internal uterus, for it is only the connection of the two oviducts to which that name has hitherto been given; neither have they a peculiar vagina, for the organ which Daubenton and Geoffroy thus distinguish, when they assert that the marsupials have two *vaginæ*, belongs rather, according to the researches of Tyson, to the oviducts or Fallopian tubes: so that, except in the doubleness of the parts, the marsupials resemble birds in their organs of generation, as well as in other respects. The embryo also is brought forth, not as in other *Mammalia*, perfectly formed; but it is produced in the state of an egg, and in that form deposited in the *marsupium* or *uterus*. Now the egg or embryo of the *Mammalia* has the property of attaching itself to every part of the *uterus* at the point where the *placenta* is formed; and thus the embryo or egg of the marsupials fastens itself to the *mamma*, and there communicates with the *arteria epigastrica* in the same manner as in other *Mammalia* it communicates with the *arteria uterina*. It is fastened by a cord resembling the navel-string, (though it is unknown where this cord passes out from the embryo), which is often so long that the embryo hangs out of the bag, and which at the moment of real birth is separated by a rupture, as in the case of the *placenta* and ordinary *uterus*. This external *uterus*, however, does not invariably assume the form of a purse or bag; in some instances it consists of simple folds of the skin, and in the monotremes, even these disappear.

"The monotremes bear a very strong affinity to the ordinary marsupials. they likewise very closely resemble birds, not alone in the construction of the bill, *cranium*, clavicles, shoulder-bones, *sternum*, and undeveloped teats, but especially in their organs of generation. These animals have only one *ovarium* developed, as in birds, and both the *Echidna* and the *Ornithorhynchus* lay eggs and hatch them. Thus it is that the *uterus* of the *Mammalia* becomes modified in the marsupials, so as to be situated without the body, and finally vanishes altogether in the *Monotremata*.

"If we apply these considerations to ascertain the concatenation of the various groups of animals, in relation to their organs of generation, we find that it indicates one class, the *Mammalia*, which have an internal hatching organ, called the *uterus;* another class, the marsupials and monotremes, in which this hatching organ is placed without the body, vanishing totally in the latter group, the animals of which lay eggs and hatch them; and finally, a third class, birds, in which this property, which is irregular and limited in the monotremes, becomes fully normal."—Allman Wext Biologi af C. A. Agardh, p. 453.

mammary glands, altogether disregards the consideration of their viviparous production, and must, in strict logical acceptation, be taken to include all animals possessing these organs, even when the function, which they were originally designed to execute, no longer exists: for, in the progressive degradation of organic perfection, through successive groups, it is a necessary condition of existence itself, that the function should cease, either simultaneously with the organ, or before it is obliterated; and this latter phenomenon is so universally the case with regard to all other organs and functions, that it ought not to be accounted matter of surprise in the present instance.

The *Monotremata* must therefore be regarded as a subordinate group of mammals, but whether of primary or of secondary value, whether entitled to rank as an order or only as a family, is an inquiry which admits of more reasonable doubt. For my own part, as I consider the existence of the marsupial bones to be the simple and only unexceptionable character of the group, to which they are peculiar, I prefer considering the *Monotremata* as a subordinate group, or family, of this order, rather than elevating them to an independent and equal rank, or associating them with a different order. It is true indeed, that, strictly speaking, they come equally within the definition of M. Cuvier's *Edentata*, but if approximated to this order rather than to the other marsupials, the integrity and logical simplicity of the latter group is destroyed; for these, as already observed, depend, not upon the existence of the abdominal pouch, which is not common to all the species of animals included in the present order, but properly upon that of the marsupial bones.

ART. IV.—*Illustrated Zoological Notices.* By EDWARD CHARLESWORTH, F.G.S.

(*Continued from page* 248).

1. *On a Specimen of the Lower Jaw of the Mammoth.*
2. *On a Tooth of the Genus Otodus, Agassiz, from the London Clay.*
3. *On a Fossil Zoophyte from the Kentish Chalk, inclosing a Cidaris.*

THE fossil elephant's jaw represented in the accompanying

It appears from this extract that Professor Agardh, like M. De Blainville, is disposed to view the marsupials as forming a distinct class, intermediate between mammals and birds; I have already stated my reasons for dissenting from this opinion.

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Fossil Jaw of Mammoth.

figure (No. 40), was obtained by a Dover fisherman in 1837, whilst dredging off the Dogger Bank; and after having been offered for sale to the British Museum and other metropolitan institutions, was purchased by Mr. G. B. Sowerby, in whose possession it has since remained. It is decidedly the finest relic of the kind that I have seen; and the very faithful representation which I am enabled to publish of it, is due to the skill of Mr. G. B. Sowerby, jun., by whom the drawing on wood was executed.

The source from which this noble fossil was derived,—the bed of the German Ocean,—is that which has more or less enriched the various museums and private collections throughout the kingdom: indeed the profusion in which the disjointed skeletons of the larger *Pachydermata*, must lie strewn over the bed of the sea, along the south-eastern coast of England almost baffles conception. Mr. Samuel Woodward, in his Geology of Norfolk, supposes that upwards of two thousand elephants' grinders had been dredged up by the fishermen off one little village (Hasbro') on the Norfolk coast, in the space of thirteen years; and though he does not supply us with the data upon which he founded his calculation, his statement may readily be believed when one private collector in that neighbourhood,—the Rev. James Layton,—speaks of having had three hundred in his possession.[1]

It would be a matter of great interest to determine the extent of the sub-aqueous area over which these fossil remains are distributed; but conclusions upon this point must be in a great measure merely conjectural, as the necessary evidence can only be obtained where the soundings are sufficiently shallow to admit of dredging being carried forward. Until the finding of this jaw off the Dogger Bank, which is somewhere about midway between the English and Dutch coasts, the greatest distance from the shore where fossil remains had been met with was the Knole Sand. At this spot, which is about twenty miles from the coast, a tusk, weighing ninety-seven pounds, and measuring nearly ten feet in length, was discovered in 1829.

As in the case with the fossil volutes cast on shore near Harwich, the remains of extinct mammals drawn up in the nets of the oyster-dredgers, and which have perhaps reposed for thousands of centuries on the bed of the ocean, are in a much finer state of preservation than those which, in the present day, are so constantly being exhumed in our inland superficial deposits. The mammoth's teeth, instead of falling to pieces as they so frequently do when removed from the soil in which they are imbedded, in the former case will often bear slitting and polishing in the same manner as the teeth of the existing Asiatic elephant. A tusk, taken up off Scarborough about three years since, by some Yarmouth fishermen, was so slightly altered in character, that it was sawn up into as many portions as there were hands in the boat, each man claiming his share of the ivory for economical purposes.[2] In the present specimen, although the teeth are extremely perfect, their condition has more about it than usual of the ordinary character of fossil teeth; but the firm aspect, and the increased density and compact structure of the bony material of the jaw, would at once arrest the attention of an observer, familiarised only with such osseous remains as are procured under ordinary circumstances.

We cannot suppose this jaw to have been drifted far from the original site of its deposition, for although the condyloid apophyses are gone, if so ponderous a body had been acted upon by the operation of currents, a separation of the *rami* at the symphysis must have taken place. The detached grinders obtained in a similar way are seldom bouldered, and it is

[1] See Fairholme's Geology of Scripture. Mr. Layton has subsequently removed to Sandwich.

[2] The portion of this tusk which fell to one of the boat's crew is preserved in the collection of Mr. Robt. Fitch, at Norwich.

therefore probable that as the sea encroached upon the land, these remains, by the gradual falling away of the cliffs, became engulphed, and are now found at the spots where they were in the *first* instance deposited, although the level which they now occupy is necessarily somewhat lower.

Little or nothing has been added by subsequent writers to the description which the illustrious Cuvier has given us of the osteological peculiarities which serve to distinguish the fossil species of the genus *Elephas;* and paleontologists still follow him in referring elephantine remains, in whatever region they may be found, to one and the same species. A slighter amount of divergence in the horizontal *rami* of the lower jaw, accompanied with a change in the shape of the canal formed by the approximation of these parts, especially at its anterior termination;—grinding teeth wider in proportion to their length, and with more numerous and less festooned *laminæ;*—are points of distinction referred to by the above-named distinguished anatomist, when comparing the skeleton of the mammoth with that of the Asiatic elephant, the nearest allied of the two existing species. Mr. Sowerby's drawing admirably displays the form of the anterior termination of the canal in the present specimen. It is not nearly so wide as seen in the figures which illustrate Cuvier's observations, but at the same time it differs materially from that of the existing species, which, in the adult skeleton, has more the character of a deep cleft. A short distance from the symphysis the canal contracts to about two-thirds the diameter of its anterior termination, and a somewhat similar contraction is shown in one of the jaws figured in the 'Ossemens Fossiles.' The following dimensions may perhaps as well be recorded.

	FT.	IN.
Width between the ascending *rami* at the coronoid processes, ...	1	7
Width of each ascending *ramus*, measured midway between the angle of the jaw and the condyloid apophysis,......................	1	0
Width of canal at the anterior termination,............................	„	$3\frac{1}{4}$
Ditto ditto five inches from the symphysis, ...	„	$2\frac{1}{4}$
Circumference of the symphysis measured from before to behind, including the process of the *mentum* (one inch in length)	1	1

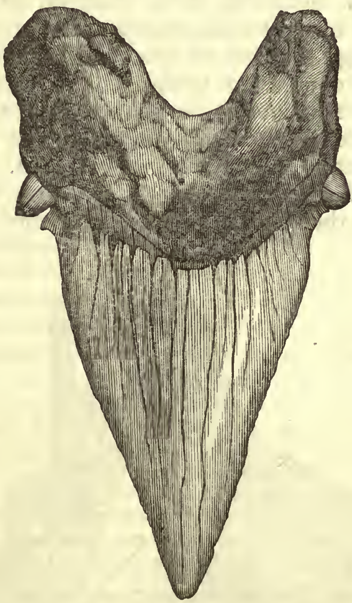
From the above dimensions it appears that the diameter of the anterior termination of the canal, as compared with the expansion of the ascending *rami*, is in the proportion of 1 to 6: in the two lower jaws figured in pl. 5 tome i. of the Ossemens Fossiles, this proportion is represented as 1 to 4.

I have remarked an extraordinary disproportion in the relative number of plates, when fossil elephants' teeth from North America are compared with teeth from the coast of

Norfolk; those of the former exceeding the latter in the proportion of at least 2 to 1: while I have noticed that the teeth found in the supposed hyæna's retreats, exhibit a proportion intermediate to these two. I fully anticipate that sooner or later it will be found that several species have been confounded under the name *Elephas primogenius*.

In the first volume of the new series of this Magazine, p. 226, I have noticed the occurrence of the teeth of a gigantic shark (*Carcharias megalodon*) in the red crag of Suffolk, and have given an engraving of a particularly fine specimen of that species in the cabinet of Mr. Colchester, of Ipswich.—The name *Otodus* has been lately applied by Agassiz[1] to the largest teeth in the family of sharks which occur in the London clay, and the tooth of this genus now figured (41) I believe to be unique as regards size and perfect state of preser-

41



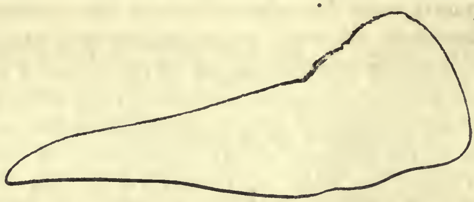
Tooth of the Fossil Genus *Otodus*.

vation. It was found in the cliffs at Walton, in Essex, by a servant of Lord Sidmouth, and Lady Sidmouth obligingly permitted me to remove it from her cabinet for the purpose of inserting the present notice. In size the tooth presents us with

[1] Figures are given in the last Livraison of the 'Poissons Fossiles,' but no descriptive letter-press.

an approximation to that of the crag *Carcharias,* but it differs widely in its relative proportions, and in the presence of lateral denticles.—Its robust form, and the great extent of surface by which it was implanted in the jaw, indicate its having been an organ of prodigious power. Its thickness is about equal to half its width, as seen by the section, fig. 42. That of *Carcha-*

42



rias megalodon is only in the proportion of 1 to 4. I am aware that the teeth in the existing species of *Carcharias* differ considerably in form, according to the position which they occupy in the jaw; but the above proportions will be found to hold good through a series of specimens, and may therefore be regarded as depending upon generic distinction. The edges of the teeth in *Otodus* are perfectly free from serrations, and the crag specimens of *Carcharias* appear so, but in the latter their absence depends upon attrition. Some of the squaloid teeth figured in Moreton's Synopsis of the cretaceceous fossils of the United States, probably belong to the present genus.

43

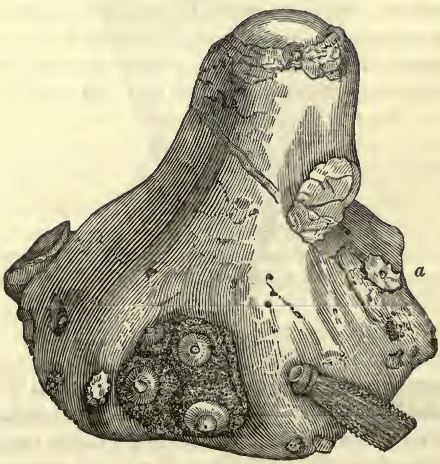


Figure 43 is a silicified zoophyte from the Kentish chalk, in which a *Cidaris* appears very snugly housed, with its spines in several places projecting through the substance of the organic body which surrounds it, as at (*a*). It would, I think, be a knotty point to determine, in this instance, which of the two has been the aggressor,—the *Ventriculite* or the *Cidaris*. The former cannot have been simply growing upon a dead shell, because the root of the zoophyte is at the small extremity, and the large spines of the *Echinus* are still in connection with the shell to which they belong. This curious fossil is in the cabinet of my friend Mr. Bowerbank.

ART. V.—*On Fossil Infusoria found in the County Down, Ireland.* By JAMES L. DRUMMOND, M.D., Professor of Anatomy in the Royal Belfast Institution, President of the Belfast Natural History Society.

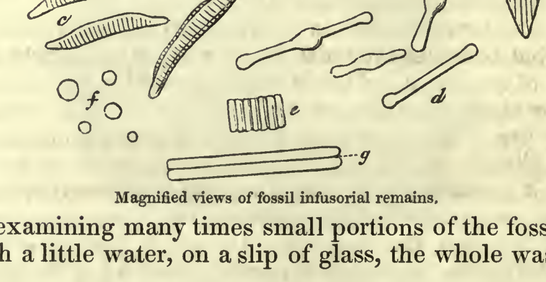
WHEN my friend William Thompson, Esq., was at Newcastle (at the base of the Mourne Mountains, County Down) last autumn, he received a specimen of a very light, white, earthy substance, which had been found some time previously in considerable quantity, in that neighbourhood; and a short time ago he requested me to investigate its nature, as he felt assured that it was the same kind of substance as Professor Bailey had found in a bog at West Point, in America, (as stated in Silliman's Journal for October, 1838), and which was composed of fossil infusorial remains. I undertook the investigation, and soon found that this anticipation was right; the whole mass consisting of the siliceous remains of organized microscopic beings, either animal or vegetable. I am not aware that fossil *Infusoria* have hitherto been detected in the British islands, but if not, their discovery is due to Mr. Thompson, as I have only followed up and ascertained, by microscopical investigation, that the views which he had previously entertained were correct.

The substance alluded to is, when dry, of the whiteness of chalk, but becomes brownish when wet; it is as light as carbonate of magnesia, which it much resembles, but is not acted on by nitric, muriatic, or sulphuric acids, and is indestructible by fire. The specimen I received was a compact mass, of the shape, and nearly the size, of an ordinary building-brick; it could easily be rubbed down into powder, and had a coarse and somewhat fibrous fracture; when a portion was rubbed between the finger and thumb, it had no grittiness, but felt like an impalpable powder, and when it was then blown into the air, it flew about almost like wood-ashes.

I had learned from my friend and assistant in my anatomical demonstrations, Mr. Shaw, that during the past summer, his uncle, Dr. Hunter, of Bryansford (near Newcastle), and himself, had been making chemical experiments on a singular substance which had lately been found in that neighbourhood; that they had proved it to be silex, but could ascertain nothing farther concerning it. On showing the specimen to Mr. Shaw, he at once knew it to be identical with the substance which they had been examining; I accordingly requested him to write to Bryansford, and obtain all the particulars he could concerning it, and the following is Dr. Hunter's answer.

"I should sooner have written, but I waited to procure accurate information respecting the deposit at Lough-Island Reavey.[1] It was found on lowering the water of the lake by the Bann Company, lying in considerable quantity under a covering of about a foot of boggy soil. It was in a semi-fluid state, of the consistence of thick mud, and could be lifted out with a shovel. It soon dried when laid out on the bank. There is also a stratum of an apparently similar substance found in a mountain valley to the south of Slieve Bernagh, in the midst of the Mourne range. It cuts out and shows itself on the face of a bank covered also with a stratum of peaty soil. There are also detached pieces of what I consider a similar matter occasionally found in the low parts of the alluvial soil of Corrogs, of these I shall endeavour to procure specimens, and if possible myself inspect the place where they are found, and send them to you as soon as possible."

44



Magnified views of fossil infusorial remains.

On examining many times small portions of the fossil mixed with a little water, on a slip of glass, the whole was found

[1] This Lough is a few miles from Bryansford.

to be composed of the bodies represented in fig. 44, of which the long, linear *spicula* (*a*) form at least four-fifths. The next most abundant are those marked (*b*), then (*c*); those marked (*d*) are still less numerous, and not always seen, though in some of my examinations the portion of fossil in the microscope consisted of them chiefly. Occasionally confervoid fragments (*e*) were seen, and frequently minute annular portions (*f*), while (*g*) is very rare. These are all the bodies which I have observed; there was no admixture whatever of unorganized matter, and no medium of cement whatever.

The spicular bodies (*a*) are joints of the *Diatoma elongatum*, ('Eng. Flora,' vol. v. pt. 1, page 406). This species grows in the utmost abundance in a small drain of clear water, in the grounds of the Royal Belfast Institution, and its joints in the microscope are seen to be precisely similar to the spicular bodies. When the loricated *Infusoria* are burned to ashes, the latter are found to be their siliceous coverings unchanged; and the same thing occurs in the *Diatoma*, as was discovered by De Brebisson and Professor Bailey.[1] On burning the *Diatoma elongatum* to a red heat, I found it, when cold, to be unchanged in form and appearance, its sharpness of outline being equally well defined as before. The *Navicula tripunctata* I found equally unaffected by heat, as also some other *Infusoria* with which I am little acquainted. Of the other bodies in the fossil I as yet know nothing more than their appearance; but I think an examination of the waters in the localities where the deposit is found, would bring them to light in a recent state.

The deposit which I have now described is evidently of the same description as that found by Professor Bailey in the New World, and analogous to what is found in several places of the Old; viz. the *Kieselguhr* of Franzenbad, and the deposit in peat-bog near the same place, the *Bergmehl* of Santa Fiora, &c., which are formed of fossil infusorial remains.[2]

Belfast, April 30*th*, 1839.

[1] See paper of the latter on fossil *Infusoria* discovered in peat-earth at West Point, in Silliman's Journal for October, 1838.

[2] See Edinburgh New Philosophical Journal, for January, 1837, p. 183.

AKT. VI.—*Letter from Prof. Agassiz on the subject of the French Edition of the 'Mineral Conchology of Great Britain.'*

Neuchatel, Mai 15, 1839.

MONSIEUR,

Je viens de lire dans votre journal (N. 29) une incrimination odieuse de la part que j'ai prise à la publication que fait dans ce moment M. Nicolet, d'une édition à bon marché de la 'Conchyliologie Minéralogique' de J. Sowerby.—Rien ne me parôitroit mieux mérité que les reproches qui m'y sont addressés, si les assertions et les insinuations que renferme cet article n'étoient d'un bout à l'autre perfides ou mensongères. Puisque vous avez accueilli cette accusation dans votre journal, j'attends de votre loyauté que vous y insérerez ma justification dans votre plus prochain No.

Malgré l' immense importance de l'ouvrage de Sowerby sur les fossiles d' Angleterre, cette publication n' a pu trouver qu' un petit nombre d' acquéreurs sur le continent. Aussi le connaissance que j'ai des établissements scientifiques des localités les plus importants d' Europe m'a telle donné *la certitude* qu'une édition Françoise ou Allemande de cet ouvrage, si elle pouvoit être publiée à meilleur marché que l' original, seroit un vèritable service rendu à la science, *sans nuire en aucun façon à l'édition originale*, qui s'est surtout écoulées en pays Anglois. N'y auroit-il pas dès lors mauvaise foi à représenter une pareille publication comme une piraterie systématique? comme si des traductions d'ouvrages scientifiques ne se feroient pas tous les jours au gré des auteurs, et à plus fort raison après leur mort! et comme si, en fesant ce que vous, auteur d'un journal scientifique, vous devez savoir être de bon droit, je devois causer la ruine des héritiers de Sowerby, en les privant du bénéfice d'une publication dont ils disposent depuis plus de quinze ans, et qui est terminée depuis dix, après avoir reçu deux volumes posthumes. Mais il y a plus, lorsque j'ai engagé un lithographe d'ici,—M. Nicolet,—à faire un Sowerby à bon marché, je lui ai fourni *gratuitement* la traduction du texte, enrichie *de nombreuses additions et corrections*. Il est donc absolument faux de dire que l'édition Françoise de Sowerby, dont il s'agit, n'est qu' une mauvaise contrefaçon des planches de l'ouvrage Anglois, accompagnée d'une simple translation du texte. Je n'aurois jamais prêté mon nom à une pareille machination. Je dois donc trouver bien étrange la conduite d'un éditeur d'un journal scientifique qui accueille sans examen de pareilles calomnies, et je déclare positivement mensongères les insinuations que j'aurois entrepris, ou fait entreprendre, cette publication dans le but d'en faire une affaire de lucre. Au contraire, il n'en a été tiré que 300 exemplaires, et j'ai mit à l'éditeur pour prix de ma participation, la condition que l'ouvrage ne seroit pas vendu au-dessus du prix nécessaire pour couvrir les fraix de publication. Je proteste en outre n'avoir eu aucune intention de nuire aux éditeurs de l'édition originale ; si j'en ai envoyé quelques exemplaires en Angleterre, c'est uniquement afin que mes amis scientifiques puissent prendre connaissance des nombreuses additions que j'ai faite à ma traduction. Tout ceci prouve, que dans cette circonstance, comme toujours, j'ai agi uniquement dans l'intérêt de la science. Un illustre géologue Anglois pourroit au besoin rapporter ce que je lui ai dit à ce sujet, avant de m'occuper de cette traduction.

Ceci m'amène à vous faire encore une observation. J'apprends que pour user de représailles envers moi, (comme si j'avois commis des hostilités), il se préparoit une souscription pour favoriser une contrefaçon de mes 'Poissons Fossiles,' accompagnée d'une traduction Anglaise du texte, qui puisse être publiée à 10s. la livraison, au lieu de 30s. Permettez-moi de vous dire ma façon de penser à ce sujet. Si le fait est vrai, j'envisagerois cet acte, *en tant que représaille*, comme tout ce que l'on pourroit imaginer de plus perfide et indigne de tout homme qui se respecte ; mais si la chose n'avoit lieu que dans un but d'utilité, je déclare aussi franchement que j'appelerois la réussite de tous mes vœux, espérant voir par là mon ouvrage passer entre les mains de quelques cents personnes qui n'auroient peut-être pas pû l'acquérir au prix de souscription. Depuis le nombre de mes souscripteurs m'est approximativement connu, je n'ai fait tirer qu'un petit nombre d'exemplaires en sus; mon édition sera donc épuisée avant q'une pareille contrefaçon puisse être terminée, et comme j'ai détruis les gravures de mes planches, dans aucun temps je ne serai curieux de refaire une édition d'un ouvrage qui n'a été pour moi qu'une source intarissable de désagrémens et de sacrifices, quelques jouissances intellectuelles qu'il m'ait procuré. Si donc l'idée d'une édition à bon marché de mes 'Poissons Fossiles' n'est pas une mauvaise plaisanterie, je désirerais sérieusement connoître les personnes qui veulent s'en charger; j'aurois, j'en suis certain, plusieurs bons conseils à leur donner, afin de contribuer à leur faire atteindre plus facilement leur but, qui doit être, je le pense du moins, de répandre un ouvrage envisagé comme utile, et non pas uniquement de me nuire. D'ailleurs, mon ouvrage sera complétement achevé dans un an, avec le 15me livraison que j'espère publier à

Pâques prochain; et je m'estimerais heureux de le voir traduit et reproduit sous quelle forme que ce soit.

Espérant que vous voudrez bien insérer le contenu de ma lettre au complet en le traduisant littéralement, j'ai l'honneur de vous prévenir que j'en expédie quelques copies à plusieurs de mes amis.

Veuillez agréer,
Monsieur,
L'assurance de ma considération distinguée,
L. AGASSIZ.

TRANSLATION.

Neuchatel, May 15, 1839.

SIR,

I have just read in the 29th number of your Journal an invidious crimination of the part which I have taken in the cheap edition of So. Min. Conchology, now in course of publication by M. Nicolet. Nothing would be more richly merited than the strictures which are there passed upon me, were it not that the assertions and insinuations which the article contains are altogether malicious and without foundation. As you have brought forward this accusation in your journal, I expect from your sense of honour that you will give publicity to my justification in your forthcoming number.

Notwithstanding the great importance of Mr. Sowerby's work on the Fossils of England, this publication has met with but few purchasers on the continent; and the knowledge which I possess of the most important European Scientific Institutions, has assured me that a French or German edition of the work, published at a lower price, would be rendering a real service to Science, without in any way proving injurious to the original edition, for which the principal demand is in England. Would it then not be unfair to represent such a publication as a systematic piracy; as though translations of scientific works were not being made every day with the consent of authors, and with still greater reason after their death; and as if in doing that, which you, as the conductor of a scientific journal, ought to know I am justified in, I am likely to injure the family of Mr. Sowerby in depriving them of the benefit of a publication of which they have had the disposal for more than fifteen years, and which has been completed ten years, after the addition of two posthumous volumes? But in addition to this, when I agreed with a lithographer, M. Nicolet, to bring out a cheap Sowerby, I gratuitously furnished him with a translation of the text, enriched with numerous additions and corrections. It is then altogether untrue to say that the edition in question is but a sorry imitation of the plates of the English work accompanied by a mere translation of the text. I should never have lent my name to such a machination. It appears to me therefore, very strange conduct in the Editor of a scientific journal to give, without examination, publicity to such calumnies; and I affirm that the insinuation of my having entered upon this undertaking with a view to pecuniary emolument, to be altogether unfounded. On the contrary, only 300 copies have been struck off, and I agreed with the Editor as the price of my participation in it, that the work should not be sold at a sum above that necessary to cover the expense of its publication. I protest also, that I had not the least intention of injuring the Editor of the original edition: if I have dispatched some copies to England it has been with the view of letting my scientific friends see the number of additions and corrections which I have incorporated in my translation. All this proves that in the present instance, as always, I have only acted from a regard to the interests of science. An illustrious English geologist can, if required, relate what I said to him on this subject before I occupied myself with the translation.

This leads me to make one other remark to you. I understand, that by way of reprisal, as though I had committed hostilities, there is in preparation a subscription to bring out a reprint of my Fossil Fishes, with an English translation of the text, at 10s. a livraison instead of 30s. Permit me to tell you my notions upon this subject. If the fact be true, and I am to regard this act in the light of a reprisal, I must deem it most perfidious and disreputable ; but if the thing be only undertaken as a matter of utility, I declare with the same frankness, that I shall be gratified, hoping thus to see my work pass into the hands of some hundreds of persons who would not perhaps be able to obtain it at the original subscription price. As I have now pretty well ascertained the amount of my subscribers, I have only had a few copies struck off beyond that number, and my edition will consequently be disposed of before a reprint can be completed; and as I have effaced the drawings from the stones, at no future time shall I be desirous of attempting another edition of a work which has all along been to me a source of vexation and sacrifice, whatever intellectual enjoyment it may have produced me. If, therefore, a cheap edition of my work be really seriously talked of, I should like to know the parties who are about to engage in it, as I should have some advice to give them to enable them more readily to attain the object which I, at least, think they should have in view ; viz., the diffusion of a work regarded as useful, and not merely an attempt to injure me. As my work will be completely finished in a year, with the 15th livraison, which I hope to publish next Easter, I shall esteem myself fortunate to see the work translated, in whatever shape it may appear.

Hoping that you will insert the contents of this letter entire and literally translated, I have the honour to inform you that I have sent copies to several of my friends.

LOUIS AGASSIZ.

THE

MAGAZINE OF NATURAL HISTORY.

JULY, 1839.

OUR remarks upon M. Nicolet's French edition of Sowerby's work on the fossil shells of this country, have drawn forth a reply from Prof. Agassiz, which should have received a place in our last month's number, had it not reached us too late for publication. We now insert his letter, with a translation of its contents, that every publicity in our power may be given to the vindication which he has put forward. Had the work under notice originated with none other name than those of the printer, publisher, and artist, greatly as we might have regretted, for the interests of science, the non-existence of international protecting enactments, the matter would have appeared to us one of comparatively trivial importance, and instead of advancing anything in the shape of reproach or remonstrance, we should have deemed it the wiser course to have been altogether silent.

The name, however, of Louis Agassiz, as the Editor and avowed projector of the reprint, and the plausible statement from a man of such high scientific reputation, that its cheapness, when compared with the price of the original work, must necessarily tend to further the progress of Geology, made us determine, without a moment's hesitation, on the course which we pursued. For though originating in such a quarter the scheme threatened to be tenfold more injurious in its operation, we felt that Agassiz was bound by so many ties to this country, that he would probably consider himself amenable to the expression of censure, if publicly directed against him in the columns of an English Journal. We are glad to find that on this head we have not been mistaken; and we may add too that our expectations have been completely realised, in not even the shadow of an argument being adduced to oppose the views which we put forward, as to the injurious prospective operation of the part acted by Agassiz. He repeats, it is true, the substance of the shallow sophism that we quoted from his preface; but how does he support the position which he would there maintain, the assumed "utilité" of the measure we condemn? Three hundred cheap Sowerbys, he tells us, will be disseminated over the continent, and pass into the hands of those who would not otherwise have possessed copies of this important work. But has Agassiz so little foresight, so small a share of penetration, that he looks to this *one* result as the sole and only consequence of the course which he is pursuing? Can he not perceive that the system which he has commenced, if followed up upon the strength of his example, must strike at the very existence of a class of works upon which the progress of Geology is essentially dependent;—works which convey to us delineations of new forms as they are brought to light in both the past and existing order of creation;—which tell their own tale without the aid of a translator, let the country be what it may to which science is indebted for their acquisition; but which, from the heavy cost of their production, and the limited class among which they circulate, require that kind of support which is not restricted by the boundaries of clime or country?

Agassiz has saved us the necessity of selecting an instance by way of illustration. Singularly enough, the same document which contains the attempt to justify his conduct, informs us that notwithstanding the unexampled support which, although a foreigner, he has in this country received, by the aid of public pecuniary grants, and that of most extensive private subscription, still that his 'Poissons Fossiles' has been to him "une source intarissable de désagrémens et de sacrifices." Surely then this, his own experience, might have suggested to Agassiz the importance of every possible encouragement being held out to the present author of the 'Mineral Conchology,' with a view to the continuation of that work, rather than that the continental demand should, for the future, be supplied by an edition so low in price, that competition on the part of Mr. Sowerby would be utterly impossible.

As it respects the minor points adverted to by Agassiz, we shall be very brief. That an English sale of the cheap edition was calculated upon, we feel satisfied, because a large number of prospectuses have been dispatched to this country, and great pains taken to circulate them; but whether at the instigation of Prof. Agassiz or his lithographer, we cannot say. The general principle of translating scientific works from one language into another is utterly foreign to the question, and cannot possibly be brought to bear upon those publications whose scientific value is vested in faithful representations of species, fac similes of which can be at any time produced at an enormous reduction of expense below that which they have originally cost the author.

That Agassiz is altogether in error on the subject of the relation in which the present Mr. James De Carle Sowerby stands in respect to the 'Mineral Conchology,' is clear from the following passage, which will be found in No. 105. "To the public the author feels deeply indebted, and cannot refrain from declaring his gratitude for the encouragement bestowed upon a work commenced by his lamented father, and in the continuation of which he himself has incurred so much responsibility."—Dated Camden Town, July. 1835.[1]

As to the numerous additions and corrections in the French edition upon which Agassiz seems to plume himself, we cannot give him a great deal of credit on this score, when his zeal for science has not induced him to procure from England such species as are now well known and readily obtained in a more perfect condition than some of the specimens figured in the early numbers of Mr. Sowerby's work. And upon the subject of an English edition of the 'Poissons Fossiles,' though, as far as we are aware, nothing of the kind is in contemplation, yet if its author really

[1] It is hardly necessary to observe that since the publication of the above number in 1835, English geologists have been anxiously hoping that Mr. J. de C. Sowerby would again proceed with the continuation of the 'Mineral Conchology.'

have acted with so little prudence as not to have reserved a supply to meet the demand that must arise when the work is rendered complete; and never intends, after the issue of his 15th livraison, to resume those labours in ancient Ichthyology which have shed so much light upon this department of science, and reflected so much lustre on himself; in that case most cordially should we adopt his avowed sentiments, and look upon a cheap English fac-simile of the 'Poissons Fossiles,' as a matter of the highest 'utilité.'

A paper from the pen of Mr. Lyell appears in our number for the present month, which embodies some results of the highest interest, as bearing upon the tertiary Geology of Norfolk and the adjoining counties.—The district treated of has long been celebrated for the number and beauty of its fossils; but until within a very recent period, no suspicion had been entertained that the fossiliferous beds called "crag" included deposits of distinct geological ages. It is now, however, satisfactorily shown by the application of the per-centage test to the very extensive series of crag *Testacea* in the cabinet of Mr. Searles Wood, that three marine deposits, of different and well-marked periods, overlie the chalk and London clay in this part of England. This result confirms the general views upon Tertiary Geology which Mr. Lyell has entertained in opposition to M. Deshayes, who asserts the existence in the tertiary group, of three definite proportions in the percentage of extinct species, and to one of which any member of the series may be referred.[1]

The misapprehension which has so long prevailed respecting the history of a formation that has so often been looked at with geological eyes, proves the absolute necessity for extreme caution in deciding upon the age of deposits that may be situated in less frequently explored localities.

From the recently published annual reports of the Geological and Zoological Societies, both these important scientific associations may be considered in a flourishing condition. The former has been steadily increasing in the amount of its members; and though the latter has probably attained its maximum number, and suffered a serious diminution of income from the unfavourable summers of the two past years, the receipts have still left a surplus over the expenditure. The Council of the

[1] "4. Constant proportions (3 per cent., 19 per cent., 52 per cent.) in the number of recent species, determine the age of the tertiary strata." Deshayes; translated in Mag. Nat. Hist. vol. i. n. s. p. 12.

Geological speak with regret of the resignation of their recently-appointed Curator, Mr. Searles Wood, whose health would not permit him to continue in office. Referring to the Society's collection of crag fossils, the Museum-Committee state that Mr. Wood "has added to it most li-"berally from his private cabinet, and has by this means augmented the "species of *Mollusca* and corals from about 100, of which they before "consisted, to no less than 400, besides inserting many specimens in a "more perfect state, of species of which the Society already possessed "some individuals. Duplicates, moreover, of many species common to "the upper and lower crag, have been introduced for the sake of compa-"rison; and the localities of all Mr. Wood's specimens, verified from his "own observations, have been carefully noted on the tablets. By these "important donations the number of drawers containing organic remains "of the crag, has been increased from 10 to 27."

The Zoological Society have recently been so unfortunate as to lose the chimpanzee and the male and female orangs, all of which were, a short time since, alive, and exhibited together in the Regent's Park.—The great object of interest now at the Gardens is the young giraffe, the birth of which took place about ten days since. No similar instance has ever previously occurred in Europe.

REVIEWS.

ART. I.—1. *Monographia Chalciditum.* By FRANCIS WALKER. London: Baillière. 1839. 8vo. pp. 330.

2. *Hymenoptera Britannica: Alysia.* Auctore A. H. HALIDAY. Fasciculus alter. London: Baillière. 1839. pp. 32.

THE cessation of the publication of the 'Entomological Magazine,' previous to the completion of the Monographs upon the *Chalcididæ* by Mr. Walker, and the *Ichneumones adsciti* by Mr. Haliday, has compelled these gentlemen to resort to separate publication for the termination of their memoirs.—Mr. Walker's work, therefore, instead of being a '*Monographia Chalciditum*,' is a monograph only of four of the genera of that family, with supplemental species of some of the other genera described either in the 'Entomological Magazine,' or the 'Annals of Natural History.' The present volume contains descriptions of 452 species, chiefly inhabitants of this country, and now for the first time described. It must therefore be considered an important addition to our Fauna.

Mr. Haliday's brochure comprises descriptions of about forty British species belonging to the Ichneumonideous genus *Alysia* and its subgenera,—sixty-one species of the same genus having been previously described in the 'Entomological Magazine.' It also comprises a very valuable Synopsis of the entire order *Hymenoptera*, upon which the author has bestowed so much attention, and in which we find the natural habits of the insects, as well as their structural peculiarities, considered as the ground-work of the classification here proposed.

It is impossible to compare these two works together without noticing the different mode in which they are written:—whilst the latter exhibits a lucid methodical arrangement in all its parts, the former is lamentably deficient therein. For instance, there is no generic character of *Aphelinus* and *Pteroptrix;* and almost every species is formed into a distinct section, apparently of equal rank, without any gradational series of groups. Thus, although the species may be well described *specifically*, their generic and subgeneric investigation will be attended with endless labour, unless the work be revised. As there are 84 species of *Cirrospilus* here described, it would have been well to have republished the 74 which have already, or are intended to appear in the 'Annals of Natural History,' and in which they are scattered through many numbers.

ART. II.—1. *Supplement to the 'History of British Fishes."* By WILLIAM YARRELL, F.L.S. London: Van Voorst. 1839.

2. *On the Growth of the Salmon in Fresh Water.* By the same Author. Van Voorst.

THE additions made to British Ichthyology in the short period that has elapsed since the publication of Mr. Yarrell's valuable 'History of British Fishes,' have now enabled the author to increase his work by the descriptions of nearly thirty species. Figures of all these are given in the present supplement, which, with their history, adds 72 pages of matter to the original publication. Of course, the supplement will find a place in the library of all those who possess a copy of the previous volumes, in the second edition of which latter we suppose the additional species will be incorporated. One of the fishes now recorded by Mr. Yarrell as an acquisition to the Fauna of the British seas, is also new to Ichthyology generally; it is a species of the genus *Osmerus*, captured near Rothsay, in the isle of Bute, and sent to the author by Mr. William Ewing, of Glasgow. It is described under the specific name *Hebridicus*.

The following is a list of the genera to which the additions contained in the Supplement are referable.—*Trigla*, 1; *Peristedion*, 1, (from Dr. Edward Moore; described Mag. Nat. Hist., vol. i. n. s.); *Gobius*, 3; *Crenilabrus*, 2; *Abramis*, 1; *Exocœtus*, 1; *Salmo*, 1; *Coregonus*, 2; *Motella*, 1; *Platessa*, 1; *Monochirus*, 1; *Echiodon* 1, (a new genus recently described by Mr. Thompson, in the Transactions of the Zoological Society), *Syngnathus*, 1; *Acipenser*, 1; *Echinorhinus*, 1; *Zygæna*, 1; *Raia*, 2, (one from vol. ii. of the Mag. Nat. Hist. n. s. described by Mr. Couch).

Besides the history of the new Fshes, the supplement contains some valuable additional matter relating to species which were figured in the previous volumes. The most important article of this description is one upon the growth of Salmon in fresh water. This has been separately published in the form of a large brochure, and is illustrated with six admirably coloured engravings on steel, exhibiting the character and natural size of the fish, and its exact appearance at various stages during the first two years. One novelty in the supplement with which we are highly gratified, is thus spoken of in the preface:—

"To render the pictorial part of this Supplement as useful as its size and character would admit, I have introduced, as vignettes, representations of the bones of the cranium of several well-known fishes, derived from the works of Cuvier, Rosenthall, and others: and should this part of the plan be approved as a worthy mode of occupying a portion of that space usually devoted to lighter subjects, it may, on some future occasion be so enlarged upon as to include an illustration of one cranium in almost all the principal genera. In the present instance, however, not to interfere with the ornamental appearance of these crania, as vignettes, by a repetition of letters or numbers in reference to each particular bone, I have confined the markings to the Perch only, as here introduced, premising, that a little useful perseverance will lead to a knowledge of the analogous bones in other crania."

We have only to add, that in the execution of the cuts, and the general style of getting up, this volume is on a par with any one in the series of Mr. Van Voorst's publications.

SHORT COMMUNICATIONS.

Descriptions of New Popilliæ, &c.—Mr. Solly having obligingly placed in my hands some specimens of the genus *Popillia*, which he has received from the East Indies, I hasten to transmit to you for publication descriptions of those species which appear to be new.

Popillia *varia*, Newman.

Antennæ nigræ; caput, prothorax, et scutellum, ænea, clypei margine antico, prothoracisque marginibus lateralibus luteis; elytra profundè puncto-striata, lutea, fasciis tribus, quarum anticâ interruptâ, mediâ flexuosâ, posticâ latâ apicali, nigris; podex nigro-æneus, lineâ longitudinali luteâ. (Corp. long. .5 unc. lat. .325 unc.)

Colour.—Antennæ black; *palpi* testaceous; head gold-green with a narrow anterior yellow margin to the *clypeus; prothorax* gold-green, with the lateral margins yellow; *scutellum* gold-green; *elytra* yellow, with the following black markings;—a marginal line surrounding each *elytron*, an anterior transverse band more or less interrupted or broken into spots, (in the specimen before me four distinct spots supply the place of the band), a median transverse flexuose band, and a broad apical band, in which, on each *elytron*, is a minute yellow spot; the *podex* is nigro-æneous, with a central longitudinal yellow line; the legs have a mutable metallic lustre, the *femora* being margined and tipped with yellow; the produced *mesosternum* is yellow, the *metasternum* has two somewhat triangular yellow spots; the underside of the *abdomen* has various yellow markings.

Inhabits Assam. There are several specimens in Mr. Solly's cabinet.

POPILLIA *gemma*, Newman.

Antennæ testaceæ; caput, prothorax, et scutellum caprea; elytra puncto-striata, testacea, regione suturali pallidiori; podex cupreus, pilis albis bisignatus; pedes testacei fulgore cupreo nitidi. (Corp. long. .425 unc. lat. .25 unc.)

Colour.—Antennæ testaceous; head, *prothorax*, and *scutellum* brilliant copper-coloured; *elytra* testaceous, with a tint of copper colour, the region of the *scutellum* being paler; the *podex* is brilliantly copper-coloured, and has two rather diffuse spots composed of white hairs; the legs are testaceous with a varying metallic lustre. *Sculpture.*—Head thickly punctured; *prothorax* punctured throughout, but posteriorly, near the *scutellum*, the punctures are less obvious; the *scutellum* is very sparingly punctured; the *elytra* are punctato-striate.

Inhabits Assam. In the cabinet of Mr. Solly.

GENUS.—*PARACRUSIS*, Newman.

E *Popilliâ* celeberrimi Leach mesosterno mutico nullo modo porrecto planè differt; elytra quoque convexiora, figura omninò globosior.

This genus, in the structure of its *antennæ*, *instrumenta cibaria*, &c., nearly agrees with *Popillia* of Leach; the formation of the legs is also nearly the same, the outer claw of the fore and middle feet being bifid at the apex: its habit, however, is very different, its figure almost globose, as in *Coccinella*, and the *elytra* very convex, but the most obvious structural difference is in the *sternum*, the *prosternum* is produced in a sharp ridge between the fore legs, and the *mesosternum* is depressed and indented, and entirely without the anteriorly porrected portion so very obvious in the *Popilliæ*.

PARACRUSIS *cyanipes*, Newman.

Rubra, oculis nigris, antennis testaceis, capitulo nigro; elytris rubris, glabris, obsoletè striato-punctis; tibiis tarsisque cyaneis. (Corp. long. .5 unc. lat. .375 .unc.)

Colour.—Red, shining, *antennæ* testaceous, with a black club; *palpi* and mandibles tipped with black; *elytra* red; *tibiæ* and *tarsi* of a bright metallic blue. *Sculpture.*—Head regularly but not very thickly or deeply punctured, a very distinct line (not observable in any of the *Popilliæ*), separates the *clypeus* from the vertex; *prothorax* regularly punctured and completely surrounded dorsally by a slender ridge; *scutellum* regularly but sparingly punctured, broader and shorter than in the species of *Popillia; elytra* with twelve series of punctures, the 1st parallel to the suture, and the interstice between this and the 2nd three times as wide as either of the other interstices, and irregularly punctured.

Inhabits Assam. In the cabinet of Mr. Solly.

Edward Newman, Deptford, June, 1839.

THE MAGAZINE

OF

NATURAL HISTORY.

AUGUST, 1839.

Art. I.—*On the Classifications of the* Amphibia. By John Hogg, Esq., M.A., F.L.S., C.P.S., &c.

(*Continued from page* 274.)

It will be here noticed that I have chosen the *modes* of respiration, and the *respiratory organs*, for the principal characters by which to divide the whole class into two leading sections, or *sub-classes*. The *absence*, the *decay*, and the *permanency* of gills, materially influencing the respiratory system, and so affording the most natural properties for the subdivision of the animals into their respective orders, present a classification, at once simple and uniform. And I cannot but consider, that these organs furnish the truest *characters* for more accurately distinguishing the several groups, not only in accordance with the most singular and curious phenomena, which have hitherto been found to arise from their physiological conformation, but also in direct explanation of their common name, '*Amphibia*,' and in farther elucidation of their supposed *amphibiousness*.

Some observations explanatory of the *sub-classes*, *orders*, and *families* adopted by me, may not now be deemed superfluous.

The *first* sub-class comprises the *monopneumenous* amphibians, or those animals in which the function of respiration is effected by means of a *single* breathing-apparatus ; that is to say, *either* altogether by *lungs* alone, *or* else *at first* by gills and *then* by lungs.

This *sub-class* includes the *first* and *second* orders. The *first* order gives the *abranchians*, viz., such animals as are never found to be furnished with gills at any time of their existence; wherefore they always breathe atmospheric air, and the consequent circulation of the blood is, of course, merely pulmonary. There is only one *family* in this order, —the *Cæciliadæ;* which naturally constitute a link intermediate between, and allied to, both the ophidians and the true amphibians: to the former they are similar in their external forms, in having neither legs nor gills, and from their second lung[1] being much smaller than the first; to the latter they approach in the smallness and shortness of their ribs, and in the formation of their hyoid bones, from the appearance of which one might be induced to suspect that some branchial apparatus once existed, and that a metamorphosis had actually taken place.

The *second* order embraces *all* those animals which (as yet are known to) undergo any metamorphosis: these are the frogs, the frog-like amphibians, and the family of salamanders. In their early forms, *larvæ* or tadpole stages, they breathe by *gills* in the water, just as fishes do; and after their transformations, or in their perfect state, they respire simply by the aid of *lungs* in the atmosphere. Hence, the term '*Caducibranchia*' sufficiently points out as well the phenomena exhibited by the changes in the forms of this natural group, as their most singular qualities,—of *first* respiring in water by *gills*, which, when they have performed their service to the immature creatures, become obliterated, or decay, together with their cartilaginous arcs and deciduous lids or *opercula;* —and of *afterwards* respiring in air by proper and fully-developed *lungs.*[2] And the circulation of the blood in the one case would be *branchial*,[3] but in the other only pulmonary.

[1] Cuvier observes, "leur deuxième poumon est aussi petit que dans les autres serpens."—'Règne Animal,' tome ii. p. 99.

[2] Les batraciens "ont tous deux poumons égaux, auxquels se joignent, dans le premier âge, des branchies qui ont quelque rapport avec celles des poissons, et que portent aux deux côtés du col des arceaux cartilagineux, qui tiennent à l' os hyoïde. La plupart perdent ces branchies et l' appareil qui les supporte, en arrivant à l' état parfait."—Cuvier; 'Règne An. tome ii. p. 101.

[3] The circulation through the external branchial tufts of the young tadpoles of the *common frog*, when only three or four days old, affords a very interesting object for the microscope. The globules of blood may be seen passing, in a distinct current, down one side of the transparent finger-like

In this order I have divided the animals into *four* families, characterized by the shape of their body when adult, their tailless form, the presence of a long tail, &c.

I must here observe, that although the *adult* caducibranchians may be well ascertained and correctly specified, we know little of the exact varieties of form assumed and changed by the *larvæ* of each species; to describe indeed the tadpoles of one or two species of any of the genera of that order, otherwise than the *supposed general* appearance of those of all the species, is clearly incorrect; for careful investigations have only been made on the tadpoles of the common frog, the edible frog, the toad, the aquatic salamander,[1] and probably a very few other species, but of the greater number of those of the more rare and foreign kinds, we are at present quite ignorant. So likewise we know nothing of the very first appearance of the immature animals,—I mean especially when first produced from the *ova*,—belonging to the latter, or *Amphibia Diplopneumena*, which are supposed never to transform; concerning them, I expect, Zoology will some day receive many curious facts.

The *second* sub-class, or *diplopneumenous* kinds of amphibians, are those which respire by the aid of a *double* breathing apparatus, namely, by lungs *and* by gills, or gill-like organs, both of which the animals *simultaneously* retain during the *whole* period of their life. So that consequently the circula-

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processes or lobes of the external *branchiæ*, turning round the tips or extremities, and ascending up the opposite side. The blood continues to circulate with great velocity, and in a regular and continued stream. This phenomenon struck me as one of the most beautiful I ever beheld.

[1] Those who wish to pay attention to this subject, and "mutatas dicere formas" of the different *larvæ*, I refer to the three following beautifully-illustrated monographs by Dr. Rusconi, as examples worthy of their imitation.—'Descrizione Anatomica degli organi della circolazione delle Larvæ delle Salamandre Acquatiche:' con tavola: 1817. 'Amoures des Salamandres Aquatiques, et developpement du têtard de ces Salamandres depuis l' œuf jusqu' à l'animal parfait.' 1821. 'Developpement de la Grenouille commune, depuis le moment de sa naissance jusqu' à son état parfait.'—1826. And see Humboldt and Bonpland's Voyage, vol. i. part 2 plate 13, for Cuvier's illustrations of the tadpoles of *Bufo fuscus* and *Salamandra aquatica*. Sir E. Home also published in the 'Phil. Trans.' for 1825, p. 81, a paper "On the changes the *ovum* of the Frog undergoes during the formation of the Tadpole," illustrated by accurate and beautiful plates from the pencil of Bauer; but he has neglected to give a representation of the singular mode in which the *external branchiæ* are often seen to disappear, about the sixth or seventh day from the birth. On one side the little creatures (in some specimens) exhibit at that age no appearance of external tufts; and on the other side, only the extremities of these tufts are visible, being nearly *drawn within* the cervical aperture.

tion may be named *branchipulmonary*, that is, *both* branchial *and* pulmonary; and therefore either the one or the other takes place as the respiration of the animals is aquatic or atmospheric. In this sub-class are comprised two orders.

The *third* order,—*Imperfectibranchia*,—is provisionally instituted in consequence of our present imperfect knowledge of the two American genera, *Menopoma* and *Amphiuma*, which alone constitute it.

These extraordinary creatures appear to have only *imperfect* gills, or rather *gill-like* organs, for they are not known to possess the *external* branchial tufts, which permanently belong to, and form the chief character of, the following order, though they are always furnished with the rest of the gill-like apparatus, viz., the branchial openings on the sides of the neck, the membranous lids or *opercula*, and cartilaginous arc formed from the hyoid bone. From a careful examination of these organs in the beautiful specimens of the anterior portions of the *Amphiuma means*[1] and the *Menopoma Alleghaniense*,[2] prepared by the celebrated John Hunter; and after attentively comparing them with the very similar parts in the *Proteus*[3] and *Siren*,[4] I think I have sufficient grounds, during our present confined knowledge at least, for maintaining that they, in all probability, do some service analogous to the true gills of the latter, and that they assist in, if they do not altogether perform, the function of respiration in the water. I was unable to perceive any particular difference in the structure of the branchial, pulmonary (except as to the origin of the pulmonary arteries), and circulatory organs, between the *Amphiuma* and the *Menopoma*, as exhibited in these specimens; wherefore the description of those organs in the one, will suffice for both the animals. Mr. Hunter, in his own account of the dissected specimen of the *Amphiuma means* just referred to, and which is lately published in the 'Physi-

[1] Numbered 915 in the Museum of the Royal College of Surgeons in London; described in the 'Phys. Cat.' vol. ii. p. 43; and figured in Rusconi's 'Amours des Salamandres,' pl. 5, fig. 7, where it is named by mistake "*Siren lacertina*." See Hunter's own description of it in Cat. vol. ii. p. 150, *note*.

[2] Numbered 916 and 917 in the same Museum; described in Cat. vol. ii. p. 45; also therein figured in plates 23 and 24. For Hunter's account from his MS., refer to the same Cat. pp. 149—154.

[3] Vide 'Monografia del Proteo,' da Configliachi e Rusconi; tab. 4, fig. 8: 1819.

[4] See preparation No. 914 in the Museum of the Royal College of Surgeons, and the plate illustrative of Prof. Owen's paper in vol. i. of the Zoological Transactions. Also plate 11, part 2, vol. i. Voyage de Humboldt et Bonpland.

ological Catalogue of the Hunterian Collection' (vol. ii. *note*, p. 151), calling the imperfect branchial organs *gills*, thus describes them.—" The gills are composed of three cartilages, which are placed in the same manner as gills in fish; but these cartilages have neither the pectinated part nor the mushroom partition, which those of fish have; their ends are articulated together, and the whole is joined to the extremity of the same bone as that of the tongue. From the *fauces* there is an opening outwards, between the two inferior cartilages of the gills, for the water to pass. In this opening, which is oblong, is placed a structure composed of two valves, which will obstruct the water passing in from without. The two cartilages which are above the opening, between which the two arteries pass, are lined on the inside by the membrane of the *fauces*, which is not very thin." Next, the *aorta*, or great artery, arising from the ventricle of the heart, swells at its upper part into a bulb-like bag (*bulbus arteriosus*), from the extremity of which there proceed eight smaller arteries, four diverging to the right side and four to the left; one of the lower arteries, on each side, passes downwards and enters upon the top of each lung, along which it ramifies, and forms the *pulmonary* artery.[1] The other arteries branching off from the arterial bulb on each side, proceed outwards to the *gills*, and becoming the *branchial* arteries, " there wind round and between the cartilages of those parts," both on the left and on the right side; thence, coming round towards the back, they unite into a single trunk on either side, which, running to the backbone, afterwards constitute (with other branches) the *aorta descendens*. This organization then proves the circulatiou of the blood to be *twofold*, and in fact *branchipulmonary*, or *pneumobranchial*, as it has been well named by Hunter, for there are two distinct arteries (*pulmonary*) leading to the two lungs, and as many separate *branchial* arteries wind around the gill-like organs, as there are such organs or gills in number.[2] This circulation is nearly identical with that of the animals in the next order of *Amphibia*, which have complete and persistent *branchiæ;* the only difference is, that in the latter the branchial arteries send off *branches*, which enter and ramify through the external gill-tufts attached to the ends of the hyoidean arcs, in order that the blood may be more subjected to the influence of the water. Now, I cannot imagine

[1] But the pulmonary artery in the *Menopoma* springs from the end of one of the branchial arteries.

[2] Cuvier says,—" tant que les branchies subsistent, l' aorte, en sortant du cœur, se partage en autant de rameaux, de chaque côté, qu'il y a de branchies." 'Règne Animal,' tome ii. p. 101.

that the *whole* function of the aquatic respiration in the manentibranchious amphibians is performed by the *external gills* alone, but I conceive it to be not improbable that a portion of it is aided, and in part effected, by the *internal branchial arcs* themselves. The American authors[1] assert that the *Amphiuma* and *Menopoma* have never been seen with any external gills, but that the rest of the branchial apparatus remains unchanged throughout life; unless then this apparatus be superfluous or useless, (which I cannot suppose at all likely), I think it more than probable that it performs the part of real gills to those aquatic animals; and that the blood, in circulating through the branchial arteries, which wind round and between those cartilages, becomes sufficiently aerated by being submitted to the influence of the water within the cervical apertures, and thus obtains the same effect or benefit, as if the respiration were carried on in the water by means of them and external tufts conjointly, as in the manentibranchians, or by the similar cartilages with their pectinated and membranous appendages, as in the fishes. If so, these two genera are correctly stationed in my *diplopneumenous* sub-class; and it is gratifying to learn that Mr. Hunter held the like opinion, for he has included them, with the *Siren*,[2] in his class which he termed *Pneumobranchia*. That philosophical zootomist, in his 'General Observations[3] on the *Pneumobranchiata*,' has admirably stated his view of their respiration in these two passages.—"This tribe of animals is widely different from all hitherto known. They are compounded of two grand divisions of the animal kingdom, yet not so as for all their parts to partake equally of both; for some parts incline more to the one of these divisions, other parts to the other, while a few are pretty distinctly made up of both, *so as to be truly double*, just as the parts of generation are in perfect hermaphrodites, and *these parts are the organs of respiration*, to which the circulation must of course correspond. They hold with respect to respiration, a middle rank between fish, which breathe water, and those immediately above them, which breathe air, viz., those called *Amphibia* (Linn.), and they are placed in this respect between the two,

[1] See Dr. Garden's letter to Linnæus in Smith's 'Correspondence,' vol. i. p. 599. Also Dr. Harlan's paper in the Journal of the Acad. Nat. Sci. of Philadelphia; vol. iii. p. 54. *cum tab.* 1823: and in Annals of the Lyceum of Nat. Hist. of New York, pp. 223, 270, vol. i. 1824.

[2] With the respiratory organs of the *Siren lacertina* he was long acquainted, for that animal became one of his first subjects of comparative anatomy. See his paper in the Phil. Trans. for the year 1766, p. 308.

[3] Now published in the Physiol. Cat. vol. ii. pp. 145 146.

filling up the scale."........"An animal to be truly amphibious, must have its *respiratory apparatus compounded* of the *pulmonary and branchial* organs, which is *the case with this tribe*, for these only can be said, when in the air, to be truly terrestrial, and when in the water truly aquatic."

Having before shown that the circulating organs are, in these two genera, *both* strictly pulmonary *and* branchial; and of these, the latter perhaps most prevail, for on either side of the *aorta*, *three* branchial arteries proceed to the gill-like parts, whilst only *one* artery descends upon each lung, and this organization is said to continue unaltered during the entire life of the animals; wherefore, it is almost naturally certain, that the *respiration* itself, like the corresponding circulation, is also *two-fold*,—*both* branchial or aquatic, *and* pulmonary or atmospheric. Again, by comparing these organs with those of the caducibranchians, or such animals as undergo a metamorphosis, for example, with those of the *water salamander*, we see that the branchial arteries proceed in the same course[1] in the young or tadpole, when its respiration is entirely aquatic; but when the lungs are fully developed, the pulmonary arteries are prepared for action, and when the gill apparatus is decayed, all the branchial arteries (except two) with their branches become obliterated, and the two remaining (formerly branchial) arteries unite into one at the back, and send off a branch directly to the lung;[2] and since the gills, the arcs, the apertures, and opercles, in the adult become quite evanescent, the two arteries (branchial) can no longer be of any service in aquatic respiration, for they are not exposed to, or in anywise influenced by, the water. The entire respiration is ever afterwards effected by the lungs alone in the atmosphere. But it has been already explained that the branchial arteries continue, in the *Amphiuma* and *Menopoma*, always to wind round and between the permanent arcs or gill-like organs, and to expose the blood contained within them to the water, either passing through the cervical openings, or therein retained by the closing of the persistent lids; thus do they differ in a most essential way from the final condition of the similar parts in the mature *salamander*,[3] and in

[1] This may be well seen on referring to the plates in Rusconi's 'Amours des Salamandres,' and to plate 13, part 2, vol. i. Voyage de Humboldt.

[2] Cuvier correctly writes,—" dans les espéces qui perdent leurs branchies, les rameaux qui s'y rendent s'oblitèrent, excepté deux, qui se réunissent en une artère dorsale, et qui donnent chacun une petite branche au poumon.—C'est une circulation de poisson métamorphosée en une circulation de reptile."—Règne Animal, tome ii. p. 102.

[3] Compare fig. 6, representing this adult animal anatomically displayed,

other amphibians which have changed their forms; consequently, from these comparisons I feel tolerably confident, that some use of those permanent organs, in the animals now under notice, may be derived by them in the function of respiration whilst in water; although satisfactory proofs of this supposition can only be established by future experiments, to be made for the express purpose of investigating that important question. The *third* order comprehends a single family, which I have named *Menopomatidæ*, by taking the appropriate title of the genus *Menopoma*[1] for its type.

The retention of external branchial tufts or ramified gills, with permanent hyoidean arcs, and mostly with lids or opercles, is distinctly intended by the word that denotes this last order,—*Manentibranchia*.

The two families I have distinguished principally by the *form* of the body and the *number* of the legs. The genera will exhibit (among other marks) the variations in the *number* of toes.

The comparative naturalist will here with pleasure consider, how the steps in the gradation of the different respiratory systems, among the higher classes of the animal kingdom, are nicely and beautifully varied; how inimitably and gradually they lead from the most complete to the inferior development; and how the transition from a perfect pulmonary respiration to a perfect branchial one, is gently, and not instantaneously, effected. For in the *Mammalia*, birds, and reptiles, there are lungs more or less perfect; in the *Amphibia* there exist, *first*, well-formed lungs without gills;—*secondly*, at first perfect gills and no lungs, afterwards lungs without gills;—*thirdly*, imperfect gills co-existing with lungs; —*fourthly*, perfect gills with less-developed lungs;—and *lastly*, in the fishes, most complete gills, but lungs entirely wanting.

If, however, it should be hereafter found, that the gill-like organs in the *Menopomatidæ* are in reality *gills*, or merely a

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in pl. 5 of Rusconi's 'Amours,' with the *Amphiuma means*, fig. 7 of the same plate: also examine the preparation of the Surinam toad, No. 917 A, in the Museum of the Royal College of Surgeons.

[1] Dr. Harlan bestowed that appellation on this genus, because the *opercula* are *persistent:* it is derived from μένω, *maneo*, and πῶμα, *operculum*. With regard to the name of the second genus, Dr. Wagler observes,—"der sippename *Amphiuma* wird wohl verändert werden müssen. Was soll *Amphiuma* heissen?" The generic name well deserves to be changed.—What does *Amphiuma* signify? I conclude that it is derived from ἀμφι, *circà*, and ὗμα for ὗσμα, *pluvia*;—circà pluviam, *i. e.* aquam habitans,—from its frequenting pools left by the rain and other waters.

peculiar *modification* of gills, by which the air from the water is imparted to the blood in the branchial arteries, I would then erase the provisional order *Imperfectibranchia*, and thus re-arrange the last sub-class:—

Sub-class II.—*DIPLOPNEUMENA*.

Order III.—Manentibranchia.

Tribe 1. *Internibranchia*. Gills plain, *internal*.

Family. *Menopomatidæ*.

Tribe 2. *Externibranchia*. Gills tufted or ramified, *external*.

Families. *Sirenidæ*. *Proteidæ*.

But, on the contrary, should future experiments prove that the branchial apparatus in the *Menopomatidæ* is decidedly *imperfect*, and that it has *no* share whatever in aquatic respiration, then it will become necessary to modify my classification after this manner:—

Class IV.—*AMPHIBIA*.

Sub-class I.—*MONOPNEUMENA*.

Order I.—Abranchia. Branchial apparatus *none*.

Family. *Cæciliadæ*.

Order II.—Caducibranchia. Branchial apparatus *decaying*.

Families. *Ranidæ*. *Dactylethridæ*. *Astrodactylidæ*. *Salamandridæ*.

Order III.—Imperfectibranchia. Branchial apparatus *imperfect*.

Family. *Menopomatidæ*.

Sub-class II.—*DIPLOPNEUMENA*.

Order IV.—Manentibranchia. Branchial apparatus *remaining*.

Families. *Sirenidæ*. *Proteidæ*.

And lastly, if the *Menopomatidæ* be hereafter ascertained to undergo a metamorphosis; and if the very young animals really possess the *external branchiæ*, but which are *very early* deciduous; which Cuvier thought likely, for he says,—"probablement qu'ils les perdent d' aussi bonne heure que notre salamandre terrestre;"[1]—and the branchial arcs, lids, and apertures remain permanent throughout life; I will, in such case, propose the following arrangement:—

Class IV.—*AMPHIBIA*.

Sub-class I.—*MONOPNEUMENA*.

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[1] Vide 'Règne Animal,' tome ii. p. 117, edit. 2.

Order I.—ABRANCHIA. Gills *wanting*.

Family. *Cœciliadæ*.

Order II.—CADUCIBRANCHIA. Gills *deciduous*.

Tribe 1. *Arcucadentia*. Branchial arcs *deciduous*.

Families. *Ranidæ*. *Dactylethridæ*. *Astrodactylidæ*. *Salamandridæ*.

Tribe 2. *Arcumanentia*. Branchial arcs *persistent*.

Family. *Menopomatidæ*.

Sub-class II.—*DIPLOPNEUMENA*.

Order III.—MANENTIBRANCHIA. Gills *permanent*.

Families. *Sirenidæ*. *Proteidæ*.

It was my desire to have given fuller definitions of the several sub-classes, orders, tribes, and families, and to have added characters of all the genera, which I have here thought right to adopt; but professional occupations at present entirely prevent the completion of that task.

With respect however to the word *Amphibia*, used to denominate this class of animals, its literal meaning signifies the being able to *live both* on land *and* in water,—that is to say,—the having at the same time *two* natures or faculties of *life ;* namely, the faculty of life in the *air*, and the faculty of life in the *water*. Now, the great vital principle, or original spring of *life*, is respiration ; hence, whatever animal has the faculty of respiring freely *both* in the atmosphere *and* in water, can alone be strictly called *Amphibious*. Moreover, lungs are—in the *higher* classes of animals—the only apparatus that can perform the function of the former ; and gills are the peculiar apparatus adapted to that of the latter. It is therefore evident, that all creatures not furnished with *both* lungs *and* gills, are naturally disabled from ever enjoying *real* amphibiousness, or the *twofold* faculty of life ; and so, none of the animals of this class, which belong to the *Monopneumena*, can receive the epithet of *amphibious* in its full and literal sense ; and of those belonging to the *Diplopneumena*, the *Amphiuma means*, the *Siren lacertina*, and the *Proteus anguinus*, as far as we have yet learned, are alone entitled to it. It is nevertheless more than very probable, that the greater number (if not all) of the *second* sub-class, will hereafter be proved to be *strictly* amphibious.

Amongst other interpretations of this word, and in its *restricted* but more common meaning, nearly the whole of the monopneumenous animals may be called *amphibious*,[1] for

[1] In this sense are to be understood the animals which Cuvier names "*les Amphibies*," consisting of the genera *Phoca* and *Trichechus*. In his System they form the third and last tribe of the *Carnivora*.

the greater part of them, although in their *adult* state terrestrial animals, are in the habit of resorting to lakes, ponds, and other fluviatile places, and are capable of remaining under the water[1] for a considerable length of time, without rising to the surface in order to inhale atmospheric air. In this sense, then, it is, that we must confine the signification of *amphibious,* as almost universally made use of; and certainly it is to be so translated in the following lines of the very ancient poet;—

> *Α'μφίβιον γὰρ ἔδωκε νομὴν Βατράχοισι Κρονίων,*
> *Σκιρτῆσαι κατα γῆν, καὶ ἐφ' ὕδασι σῶμα καλύψαι.*
>
> Homeri Batrach. v. 59.

> (For we, *amphibious*), "by gift from Jove,"
> (Do) "leap as well as swim, can range the land
> "For food, or diving, seek it in the deep."
>
> Cowper: Trans. v. 79.

Now, whether this power of remaining long submerged under water, without performing the function of respiration, arises from the cold blood in these animals, when first sufficiently aerated, being able to continue its slow circulation for a considerable time together; or, from the lungs having the capacity of retaining such a quantity of air, as to permit the circulation to go on uninterruptedly, for a long period; or, from the circulation being in some degree carried on independently of the lungs; because, in these amphibians, the blood is only in part passed through the lungs and so aerated, while the other part circulates again from the heart, through the rest of the body, independent of transmission through the pulmonary organs; or from the pulmonary vessels being so small as to allow the respiration to be suspended, without stopping the circulation of the blood; or from whatsoever organic cause[2] it may be considered to be effected, I will leave ana-

[1] Many of the monopneumenous *adult* amphibians are admirably adapted to an *aquatic* life, in having some of their organs protected against injury from the water, and in having others so formed as to be of material assistance to them, when diving in that element. Of the former are, the nostrils, (through which alone many sorts breathe), which are often furnished with small valves, to prevent both the entrance of water, and the escape of the air inhaled for respiration; the ears are usually covered by a membrane, and the eyes are defended by two, or even three, eyelids: of the latter, are, the crystalline lenses in the eyes of some kinds, which assume a more spherical shape, approaching to those in fishes, the toes of the hind feet are frequently webbed, and the tails, sometimes being compressed, greatly aid in swimming.

[2] I have not made any allusion to a *third* mode of *respiration*, with which some of these animals are endowed; *namely*, that of breathing water, or atmospheric air, by means of their *skin;* because, how far this *cutaneous* respiration is really possessed by, or of actual service to, the different groups of the *Amphibia*, is as yet unknown.

tomists to decide. But I must remark, that notwithstanding important zootomical examinations have been made upon the *Siren lacertina*, the *Proteus anguinus*, the *Siredon pisciformis*, the *Menopoma Alleghaniense*, and the *Amphiuma means;*[1] still, experiments directly in reference to the supposed faculty possessed by these, and other species, of respiring with ease both in the water and in the atmosphere, ought to be carefully instituted, on several living and healthy specimens, in various stages of their growth and age, in their natural countries or abodes; so that it may be ascertained with certainty how far each of them is to be esteemed *amphibious*, how necessary, or useful, the gills or branchial apparatus, and the lungs individually, may prove to those kinds that are furnished with both these organs; and how their respiration may be affected by the variations of temperature, and other atmospheric causes. At the same time, due attention being paid to any chemical changes that may take place in the water in which they may be kept. Of the discoveries likely to result from such investigations, we are now totally ignorant; but I feel perfectly assured that such observations would not fail to afford to science many new and interesting facts, in regard to the physiological relations of these, as yet, little known, and most extraordinary animals.

Temple, London;
February 5th, 1838.

ART. II.—*Monograph of the Genus* Sciurus, *with Descriptions of New Species and their Varieties.* By J. BACHMAN, D.D., President of the Literary and Philosophical Society, Charlestown, South Carolina, &c.

(*Continued from page* 337.)

12. LARGE LOUISIANA BLACK SQUIRREL. *Sciurus Audubonii.*

To the kindness of J. W. Audubon, Esq., I am indebted for a specimen of another species of squirrel, of which I have seen no description. His successful efforts in another department

[1] For the details of the organization of the first three animals, see Cuvier's 'Récherches Anatomiques sur les Reptiles Douteux,' (1807); published at p. 93, in part 2, vol. i. of 'Voyage de Humboldt et Bonpland; also MM. Configliachi et Rusconi's Monograph for the *Proteus;* and Professor Owen's and Mr. Hunter's papers already quoted, for the *Siren*, as well as the two last animals.

of Natural History and his having been the discoverer of the present species, fully entitle him to a much higher tribute than the above dedication.

CHARACTERS.—A little less than *Sciurus niger;* ears shorter; incisors broader: larger than the little brown squirrel. Tail the length of the body; fur very coarse, glossy and harsh to the touch; colour above black, beneath brownish. Dental formula: Incisors $\frac{2}{2}$; Canines $\frac{00}{00}$; Molars $\frac{44}{44}$;—20.

The specimen from which I describe contained the above number of teeth. If the small anterior molar in the upper jaw existed in the young, which I suspect to be the case in all our species, it is deciduous, and we are warranted in arranging this species among those which have permanently but twenty teeth. The head is narrower than that of *Sciurus niger.* In the upper jaw the anterior molar is triangular in shape, crowned with three blunt tubercles; the rest are quadrangular, with excavated crowns.

The body is thinner than that of the *Sciurus niger*, and the ears, which are triangular in shape, are much shorter; they are covered on both surfaces with short adpressed hairs, presenting none of the tuft-like appearances on the outer surface possessed by several of our other species. Whiskers longer than the head, extending to the shoulders. The fur on the back is the coarsest of all our species, with the exception of that of the fox squirrel (*Sciurus vulpinus*), black and very glossy.

Colour.—The incisors, as is the case with nearly all the species of this genus, are of a deep orange colour; whiskers black; the back, whole of the upper parts, limbs externally, and feet, are black, with a faint tinge of brown; many of the hairs are obscurely annulated with yellowish white.—The whole under surface, as well as the inner sides of the thighs and legs, brownish. Most of the hairs are greyish white at the base, and the remaining portion is annulated with black and yellow; in certain parts, however, the hairs are chiefly of a brown colour. The chin is black, with the extreme tip whitish; tip of the muzzle brownish. Tail black; when viewed from beneath, the hairs exhibit deep yellow annulations: most of the hairs are brownish towards the tip.

There are black varieties of *Sciurus leucotis*, having the hairs obscurely annulated; but the present species may be distinguished by its much shorter ears, which are well clothed with hair. The *tarsus* is shorter in proportion, and the coarseness of fur will prove a sufficient mark of distinction.

DIMENSIONS.

	IN.	L.
Length of head and body	11	6
Ditto of tail, (*vertebræ*)	8	9
Ditto including hair	11	6
Ditto of palm to end of the middle fore claw	1	6
Heel to point of longest nail	2	6
Height of ear posteriorly	„	3
Length of fur on the back	„	6

The specimen from which the above description was drawn up, was procured in the flesh, in the New Orleans market.—The species is said not to be scarce in Louisiana, but is not so frequently seen in the swamps as the little brown squirrel. It keeps more on high grounds, and has all the active restless and playful habits of the northern grey squirrel.

13. Sooty Squirrel. *Sciurus fuliginosus.*

I am indebted to J. W. Audubon, Esq. for a specimen of an interesting little squirrel, obtained at New Orleans, on the 24th March, 1837, which I find agreeing in most particulars with the specimen in the Philadelphia Museum, referred by American authors to *Sciurus rufiventer*.

Dr. Harlan's description does not apply very closely to the specimen in question, but seems to be, with slight variations, that of Desmarest's description of *Sciurus rufiventer*.

The following description is taken from the specimen procured by Audubon. It was that of an old female, containing several young; and I am enabled to state with certainty that it was an adult animal.

Characters.—A little larger than the Hudson's Bay Squirrel (*Sciurus Hudsonius*); tail flattish, and much shorter than the body; general colour black above, grizzled with brownish yellow; beneath brownish. Dental formula; Incisors, $\frac{2}{2}$; Canines, $\frac{0-0}{0-0}$; Molars, $\frac{5-5}{4-4}$;—22.

I have given to this species the character of 22 teeth, from the circumstance of my having found that number in the specimen from which I described; the animal could not have been less than a year old. The anterior molars in the upper jaw were small. The inner surface of the upper grinders is obtuse, and the two outer points on each tooth are elevated and sharper than those of most other species. In the lower jaw the molars regularly increase in size from the first, which is the smallest, to the fourth, which is the largest. Head short and broad; nose very obtuse; ears short and rounded, slightly clothed with hair, feet and claws rather short and strong; tail short and flattened, but not broad, resembling that of the *Sciurus Hudsonius.* The form of the body, like that of the little Carolina squirrel, is more indicative of strength than of agility.

Colour.—The hairs on the upper part of the body, the limbs externally, and feet, are black, obscurely grizzled with brownish yellow, On the under parts, with the exception of the chin and throat, which are greyish, the hairs are annulated with brownish orange and black, and a greyish white at the roots. The prevailing colour of the tail above, is black, the hairs being brown at the base, some of them obscurely annulated with brown, and at the apex pale brown. On the under side of the tail the hairs exhibit pale yellowish brown annulations.

DIMENSIONS.

	IN.	L.
Length of head and body	10	0
Tail, (*vertebræ*)	6	9
Ditto, including fur	8	6
Length of palm to point of middle fore claw	1	8
Ditto of heel to point of longest nail	2	1
Height of ear posteriorly	„	4
Length of fur on the back	„	7
Weight without intestines, $\frac{3}{4}$ ℔.		

I am under an impression that this little species is subject to some variation in colour; the present specimen, and that in the Philadelphia Museum having a shade of difference, the latter appearing a little lighter. In Louisiana it is so dark in colour, as to be called by the French inhabitants "la petite noir,"—the little black squirrel. It is an inhabitant of low swampy situations along the Mississippi, and is said to be abundant in its favourite localities.

As yet I am unacquainted with any species of squirrel fully agreeing with the description of *Sciurus rufiventer*.

14. Douglass's Squirrel. *Sciurus Douglassii*, Gray.

Oppoce-poce, Indian name.

Characters.—About one fourth larger than the Hudson's Bay Squirrel; tail shorter than the body; colour dark brown above, and bright buff beneath. Dental formula; Incisors, $\frac{2}{2}$; Canines, $\frac{0-0}{0-0}$; Molars, $\frac{4-4}{4-4}$;—20.

A number of specimens of the species described in this article, were obtained by Dr. J. K. Townsend, in his recent enterprising journey over the Rocky Mountains. All of them present the above dental formula, and if the species has, at any time, the small deciduous front tooth in the upper jaw, it must drop out at a very early period.

The incisors are a little smaller than those of *Sciurus Hudsonius*. In the upper jaw, the anterior molar, which is the smallest, has a single rounded eminence on the inner side; on the outer edge of the tooth there are two acute points, and one in front; the next two grinders, which are of equal size, have each a similar eminence on the inner side, with a pair of points externally; the posterior grinder, although larger, is not unlike the anterior one. In the lower jaw the bounding ridge of enamel in each tooth forms an anterior and posterior pair of points. The molars increase gradually in size from the first, which is the smallest, to the posterior one, which is the largest.

This species, in the form of its body, is not very unlike the *Sciurus Hudsonius;* its ears and tail, however, are much shorter in proportion, and in other respects, as well as in size, it differs widely.

Head considerably broader than that of *Sciurus Hudsonius;* nose less elongated and blunter; body long and slender; ears rather small, nearly rounded, slightly tufted posteriorly. As usual in this genus, the third inner toe is the longest, and not the second, as in the spermophiles.

Colour.—The whiskers, which are longer than the head, are black. The fur, which is soft and lustrous, is, on the back, from the roots to near the points, plumbeous, tipped with brownish grey, with a few lighter-coloured hairs interspersed, giving it a dark brown appearance; when closely examined, it has the appearance of being thickly sprinkled with miuute points of rust colour on a black ground. The tail, which is distichous but not broad, is for three fourths of its length the colour of the back; in the middle the fur is plumbeous at the roots, then irregular markings of brown and black, tipped with soiled white, giving it a hoary appearance; on the extremity of the tail the hairs are black from the roots, and tipped with light brown. The belly, the inner sides of the extremities, and the outer surfaces of the feet, together with the throat and mouth, and a line above and under the eye, are bright buff. The colours on the upper and under parts are separated by a line of black, commencing at the shoulders, and running along the flanks to the thighs. It is widest in the middle by about three lines, and tapers off to a point.—The hairs, which project beyond the outer margins of the ears and form a slight tuft, are dark brown, and in some specimens black.

DIMENSIONS.

	IN.	L.
Length from point of nose to the insertion of tail	8	4
Tail, (*vertebræ*)..	4	6
Ditto, including fur	6	4
Height of ear posteriorly................................	„	6
Palm to end of middle fore claw	1	4
Heel and middle hind claw	1	10

The specimens of the above squirrel exhibit scarcely any variations in colour; they were procured by Mr. Townsend on the Columbia river. He remarks in his notes,—"This is a very plentiful species, inhabits the pine trees in this neighbourhood, and, like our common Carolina, lays in a great quantity of food for consumption during the winter months. This food consists of the cones of the pine, with a few acorns. Late in autumn it may be seen very busy in the tops of the trees, throwing down its winter stock; after which, assisted by its mate, it gathers in and stows away its store, in readiness for its long incarceration."

15. THE CHICKAREE HUDSON'S BAY SQUIRREL. RED SQUIRREL. *Sciurus Hudsonius*, Pennant.

Common Squirrel; Foster, Phil. Trans. vol. lxii. p. 378, 1772.
Sciurus vulgaris, var. E.; Erxleben, Syst. an. 1777.
Hudson's Bay Squirrel; Pennant, Arctic Zool. vol. i. p. 116.
Common Squirrel; Hearne's Journey, p. 385.
Red Barking Squirrel; Schoolcraft's Journal, p. 273.
Red Squirrel; Warden's United States, vol. i. p. 330.
Ecureuil de la Baie d'Hudson; F. Cuvier, Hist. Nat. des Mam.
Sciurus Hudsonicus; Harlan: Godman.

CHARACTERS.—A third smaller than the Northern Grey Squirrel; tail shorter than the body; ears slightly tufted; colour reddish above, white beneath. Dental formula; Incisors, $\frac{2}{2}$; Canines, $\frac{0\,0}{0\,0}$; Molars, $\frac{4\,4}{4\,4}$;—20.

In the number and arrangement of the teeth there is a great resemblance between this species and the Townsend's squirrel. The present species also, being well known and having been frequently described, a short description in this place is merely added for convenient reference.

Forehead slightly arched; whiskers longer than the head, black; nose rather obtuse; ears somewhat concave, rounded, clothed with hair; that which covers the outer surface, during winter extends three or four lines beyond the margins; tail clothed with long hairs, but not bushy as in the larger species.

Colour.—This species varies a little in colour, but in general it will not be found to differ widely from the following description. The ears, upper surface of the fore and hind feet, and along the foreshoulders and hips, a faint stripe on the back, and the upper surface of the tail, bright chesnut; body above greyish brown, the hairs minutely speckled with reddish brown and black. The whole under surface white, with a narrow black line separating the colours of the upper surface from those beneath. The under surface of the tail is first rufous, then black, tipped with light brown.

DIMENSIONS.

	IN.	L.
Length of head and body	8	0
Ditto of tail, (*vertebræ*)	5	0
Ditto including fur	6	6
Palm and middle fore claw	1	2
From heel to point of hind claw	1	10

Geographical Distribution.—The limits of its northern range are not precisely determined, but all our travellers who have braved the snows of our polar regions, speak of its existence as far north as their travels extended. It has been observed in the 68th or 69th parallel of latitude; it also exists in Labrador, Newfoundland, and the Canadas. It is the most common species in New England and New York, and is not rare in Pennsylvania and New Jersey. It is still seen in diminished numbers in the mountains of Virginia, although in the low country of that state it is scarcely known. It is occasionally met with along the summits of the Alleghanies, in North Carolina and Tenessee, but is not, that I am aware of, found farther south.

Habits.—The habits of this little squirrel are, in several particulars, peculiar. Whilst the larger grey squirrels derive their sustenance from the buds and nuts of trees, growing in warm or temperate climates, and are constitutionally fitted, during winter, to subsist on a small quantity of food,—the chickaree, on the other hand, has the free circulation of its blood unimpeded, and exhibits the greatest sprightliness and activity amidst the snows and frosts of the polar regions. It consequently is obliged, during this inclement season, to consume as great a quantity of food as at any other. Nature has therefore instructed it to make provision in the season of abundance, for the long winter that is approaching; and the quantity of nuts and seeds sometimes laid up in store by this species is almost incredible. On one occasion I was present when a bushel and a half of shell-barks (*Carya alba*) and chestnuts were taken from a hollow tree occupied by a single pair of these industrious creatures. Generally the quantity is considerably less. It must however be remarked, that the chickaree has too much foresight to trust to a single hoard, often having several in different localities. Sometimes they are found under leaves, or beneath logs and brush-heaps, and at other times are contained in holes in the ground. These stores are sometimes only temporarily deposited in some convenient situation, to be removed at leisure. When, for instance, nuts are abundant in autumn, large quantities in the green state, covered by their thick envelope, are collected in a heap near the tree whence they have fallen; they are then covered up with leaves, until the pericarp, or thick outer covering, either falls off or opens, when the squirrel is able to carry off the nuts more conveniently. But Providence has placed much food of a different kind within its reach, during winter. The cones of many of our pines and firs in high northern latitudes are persistent during winter, and the chickaree can be supported by these, even should his other hoards fail.

This little squirrel seems also to accommodate itself to its situation in another respect. In Pennsylvania and New York, where the winters are comparatively mild, it is very commonly satisfied with a hollow tree as a winter's residence; but in Maine, Lower Canada, and farther north, it usually seeks for an additional protection from the cold, by forming deep burrows in the earth. Nothing is more common than to meet with five or six squirrel-holes in the ground, near the roots of some white pine or hemlock; and these retreats can be easily found by the vast heaps of scales from the cones of pines and firs which are, in process of time, accumulated.

This species, as well as the little ground squirrel, is very commonly found along fences near wheat-fields, and appears, in autumn, to confine itself more exclusively to wheat and buckwheat than any of our larger squirrels.

It is one of the noisiest of our species, and its querulous notes of *chick-chick-chick-a-ree—chick-a-ree* can be heard among the white pines and hemlocks, at nearly all hours of the day. It is easily approached, and rarely conceals itself from the presence of man. Its flesh is juicy and tender.

16. Columbia Pine Squirrel. *Sciurus Richardsonii.*

Small Brown Squirrel; Lewis and Clarke, vol. iii. p. 37.
Sciurus Hudsonius, var. β; Richardson, Fauna Boreali-Americana, p. 190.

CHARACTERS.—Smaller than *Sciurus Hudsonius;* tail shorter than the body; rusty grey above, whitish beneath; extremity of the tail black.

This small species was first noticed by Lewis and Clarke, who deposited a specimen in the Philadelphia Museum, where it still exists. I have compared it with the specimen brought by Mr. Townsend, and find them identical. Dr. Richardson, who appears not to have seen it, supposes it to be a mere variety of the *Sciurus Hudsonicus:* on the contrary, Dr. Townsend says in his notes,—"It is evidently a distinct species; its habits are very different from those of the *Sciurus Hudsonicus.* It frequents the pine trees in the high range of the Rocky Mountains, west of the great chain, feeding upon the seeds contained in the cones. These seeds are large and white, and contain a good deal of nutriment. The Indians eat a great quantity of them, and esteem them good. The note of this squirrel is a loud jarring chatter, very different from the noise of *Sci. Hudsonicus.* It is not at all shy, frequently coming down to the foot of the tree to reconnoitre the passenger, and scolding at him vociferously. It is, I think, a scarce species."

The difference between these two species can be detected at a glance, by comparing the specimens. The present species, in addition to its being a fourth smaller, and about the size of the *Tamias Lysteri,* has less of the reddish brown on the upper surface; and may always be distinguished from the other by the blackness of its tail at the extremity, as also by the colour of the incisors, which are nearly white, instead of the deep orange colour of those of *Sci. Hudsonius.*

Dental formula; Incisors, $\frac{2}{2}$; Canines, $\frac{00}{00}$; Molars, $\frac{44}{44}$;—20.

The upper incisors are small and of a light yellow colour, the lower are very thin and slender, and nearly white. The first or deciduous grinder, as in all the smaller species of pine squirrel that I have examined, is wanting; the remaining grinders, both in the upper and lower jaws, do not vary materially from those contained in Douglass's squirrel.

The body of this most diminutive of all the known species of genuine squirrel in North America, is short, and does not present that appearance of lightness and agility which distinguishes the *Sciurus Hudsonius.* Head large, less elongated, forehead more arched, and nose a little more blunt, than in that species; ears short; feet of moderate size; the third toe on the fore feet but slightly longer than the second; claws compressed, hooked, and acute; tail shorter than the body; the thumb-nail is broad, flat, and blunt.

Colour.—The fur on the back is dark plumbeous from the roots, tipped with rusty brown and black, giving it a rusty grey appearance. It is less rufous than the *Sciurus Hudsonius*, and lighter coloured than *Sci. Townsendii.* The feet, on their upper surface, are rufous; on the shoulders, forehead, ears, and along the thighs, there is a slight tinge of the same colour. The whiskers, which are a little longer than the head, are black. The whole of the under surface, as well as a line around the eyes, and a small patch above the nostrils, smoke grey. The tail, for about one half its length, presents on the upper surface, a dark rufous appearance, many of the hairs being nearly black, pointed with light rufous; at the extremity of the tail, for about an inch and three quarters in length, the hairs are black, a few of them slightly tipped with rufous. The hind feet, from the heel to the palms, are thickly clothed with short, adpressed, light-coloured hairs; the palms are naked. The sides are marked by a line of black, commencing at the shoulder, and terminating abruptly on the flanks; this line is about two inches in length and four lines wide.

DIMENSIONS.

	IN.	L.
Length of head and body	6	2
Tail (*vertebræ*)	3	6
Ditto including fur	5	0
Height of ear posteriorly	,,	3
Ditto including fur	,,	5
Palm and middle fore claw	1	3
Sole and middle hind claw	1	9

The specimen from which I have described is labelled,—"Rocky Mts. Aug. 12, 1834."

17. Downy Squirrel. *Sciurus lanuginosus.*

Characters.—Size of *Sciurus Hudsonicus;* ears short, well clothed with hair; tail shorter than the body; palms and inner surface of the toes thickly clothed with silky hairs; fur soft and downy; yellowish grey on the back, silver grey on the sides, white on the belly.

A singular and beautiful little quadruped, to which I have conceived the above name appropriate, was sent to me with the collection of Dr. Townsend. He states in his letter,—"Of this animal I have no farther knowledge than that it was killed on the north-west coast, near Sitka; where it is said to be common, and given to me by my friend W. F. Tolmie Esq. surgeon of the Hon. Hudson's Bay Company. I saw three other specimens from Paget's Sound, in the possession of Capt. Brotchie, and understood him to say that it was a burrowing animal." Sitka is, I believe, the principal settlement of the Russians on Norfolk Sound and Paget's Sound, a few degrees north of the Columbia river.

The head is broader than that of *Sciurus Hudsonicus*, and the forehead much arched; the ears, which are situaetd far back on the head, are short, oval, and thickly clothed with fur. They are not tufted, as in the *Sciurus Hudsonicus*, and *Sci. vulgaris* of Europe, but a quantity of longer fur, situated on the outer base of the ear, and rising two or three lines above the margins, gives the ears the appearance of being somewhat tufted. In the squirrels generally, the posterior margin of the ear doubles forward, to form a valve over the auditory opening, and the anterior one curves in form of a *helix;* in the present species, the margins are less folded than those of any other which I have examined. Whiskers longer than the head; feet and toes short; rudimental thumb armed with a broad flat nail; nails slender, compressed, arched and acute; the third on the fore feet is rather the longest, as in the squirrels. The tail bears some resemblance to that of the flying squirrel, and is thickly clothed with hair, which is a little coarser than that on the back. On the fore feet the palms are only partially covered with hair, but on the hinder feet the under surface, from the heel even to the extremity of the nails, is thickly clothed with short soft hairs.

The fur is softer and more downy than that of any other North American species, and the whole covering of the animal indicates it to be a native of a cold region.

Dental formula; Incisors $\frac{2}{2}$; Canines $\frac{00}{00}$; Molars $\frac{44}{44}$;—20.

The upper incisors are smaller and more compressed than those of *Sciurus Hudsonicus:* the lower ones are a little longer and sharper than the upper. The upper grinders, on their inner surface, have each an elevated ridge of enamel; on the outer crest or edge of the tooth, there are three sharp points instead of two obtuse elevations, as in the squirrels generally, and in this particular it approaches the spermophiles. In the lower jaw the grinders, which are quadrangular in shape, present each four sharp points.

Colour.—The teeth are of an orange colour; under teeth nearly as dark as the upper: whiskers pale brown; nails white. The fur on the back, from the roots to near the extremity, whitish grey, some hairs are annulated near the tips with deep yellow, slightly tipped with black; on the sides annulated with cream colour. Hind feet above grizzled with black and cream colour. There is a broad line of white around the eyes; a spot of white on the hind part of the head, a little in advance of the anterior portions on the ears; the nose is white, which colour extends along the forehead till above the eyes, where it is gradually blended with the colours on the back. The cheeks are white, a little greyish beneath the eyes. The whole of the under surface, including the feet and inner surface of the legs, pure white to the roots. In the tail the colours are irregularly blended, with markings of black, brownish yellow and white. In general it may be said that the tail, when examined without reference to rudimental hairs, is light ash at the roots of the hairs, then a broad but not well defined line of light rufous, then dark brown, and tipt with rufous and smoke grey.

DIMENSIONS.

	IN.	L.
Length of head and body	7	11
Tail (*vertebræ*)	4	8
Ditto including fur	6	0
Palm and middle fore claw	1	0
Sole and middle hind claw	1	9
Length of fur on the back	„	7
Length at the tip of the tail	1	10
Height of ear posteriorly, including fur	„	5

On the back and in the tail there are so many white hairs interspersed, and the white spot on the head being merely occasioned by a greater number of hairs nearly or wholly white, that there is great reason to believe that this species becomes much lighter, if not wholly white, during winter.

In the shape of the head and ears, and in the pointed projections of the teeth, this species approaches the marmots and spermophiles; but in the shape of its body,—its soft fur,—its curved and acute nails, constructed more for climbing than digging in the earth,—and in the third toe being longer than the second,—it must be placed among the squirrels.

In attempting a Monograph of the genus *Sciurus*, I have confined myself to descriptions of those species only, which are either found in the United States of America, and in the northern parts of that continent, or such as have been discovered along the range of the Rocky Mountains, as far west as the Pacific Ocean, extending to California. The squirrels of Mexico, of which there are several species, including *Sciurus hypopyrrhus* (Wagler), *Sci. albipes* and *Sci. socialis* (Wagner, Beiträge zur Kenntniss der warmblütigen wirbelthiere Amekas; Dr. J. A. Wagner, Munich), have therefore been omitted.

I have excluded several North American species, referred by authors to this genus,—such as *Sciurus Grammurus*, *Sci. lateralis*, *Sci. Clarkii*, &c.—they being more properly referred to *Spermophilus*; as also *Sci. quadrivittatus* and *Sci. Lysteri*, which belong to the genus *Tamias*.

Confining myself solely to species which I have personally examined and compared, I have omitted several which have been given by authors, and which may yet be detected.

The specimen of *Sciurus rufiventer* described by Geoffroy has disappeared from the Paris Museum, and the researches of naturalists in Louisiana have not been successful in procuring another specimen. It may prove to have been a young animal, or a variety of some species already known. *Sciurus Lewisii*, given by Griffith (Cuv. An. Kingd. vol. iii. p. 190), escaped my notice in the Philadelphia Museum. The descriptions I have seen of *Sci. ludovicianus*, Curtis, being very short and imperfect extracts from a work (Barton's Medical and Phys. Journal) which I have had no opportunity of consulting, prevented me from deciding on the species: it may possibly prove to be the *Sci. macrourus* of Say, or the species to which I have attached the name of *Sci. Texianus*; in the latter case his name will have the priority.

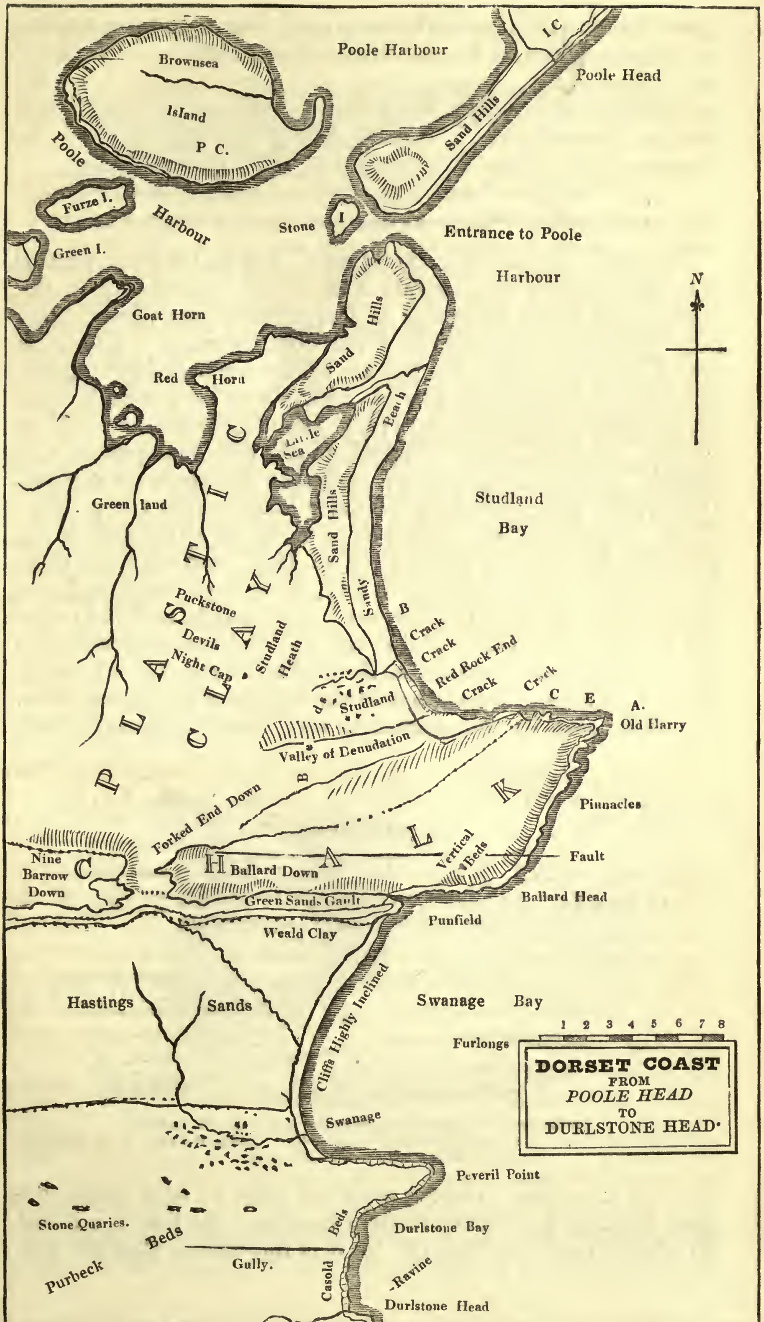
Art. III.—*Illustrations of the Geology of the South East of Dorsetshire.* By The Rev. W. B. Clarke, A.M., F.G.S.

No. III.—Studland.

The map which is appended to the present number represents geologically and geographically the coast line of the district, a portion of which is, in these illustrations, submitted to examination. It is taken from the Ordnance survey, with such observations added as appear necessary to make it useful in this investigation, and with the succession of the formations marked out by division lines, so as to serve generally for this and the preceding papers.

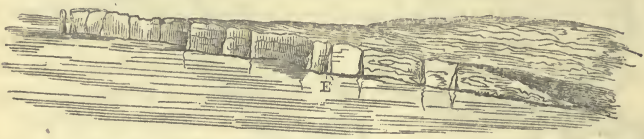
The portion now to be considered is that which is comprehended between the points A and B in the map, from the extremity of the chalk cliffs at Old Harry, to the commencement of the sand hills between Studland and Little Sea.

The extremity of these cliffs has already been figured, in the diagram No. 39, vol. i., p. 418; and the continuation of


Poole Harbour
Poole Head
Brownsea
Island
P C.
I C
Sand Hills
Poole
Furze I.
Harbour
Stone
I
Entrance to Poole
Harbour
Green I.
Goat Horn
N
Sand
Hills
Red
Horn
Beach
Little
Sea
Studland
Bay
Green
land
Sand Hills
Sandy
Puckstone
Devils
Night Cap
Studland
Heath
B
Crack
Crack
Red Rock End
Crack
Crack
C
E
A.
Old Harry
Studland
Valley of Denudation
B
Pinnacles
Forked End Down
Fault
Vertical
Beds
Nine
Barrow
Down
Ballard Down
Ballard Head
Green Sands Gault
Punfield
Weald Clay
Hastings
Sands
Swanage
Bay
Cliffs Highly Inclined
1 2 3 4 5 6 7 8
Furlongs
DORSET COAST
FROM
POOLE HEAD
TO
DURLSTONE HEAD.
Swanage
Peveril Point
Stone Quarries.
Beds
Durlstone Bay
Beds
Purbeck
Gully.
Casold
Ravine
Durlstone Head
PLASTIC CLAY
CHALK

them to their junction with the plastic clay at the point C on the map, is given in the following figure, (45).

45



Chalk Cliffs from Old Harry to the Plastic Clay. South side of Studland Bay.

The chalk is, as before mentioned, through a great part of the space, nearly horizontal; but it has a gentle dip to the north-west, which increases as it approaches the plastic clay, near which it has suffered local derangements. The cliffs are of a medium softness, but are easily separated into quadrangular or trapezoidal blocks, and, where horizontally bedded, are fissured by vertical cracks from top to bottom. They are also spotted, like the Suffolk chalk, with manganese, and contain much yellow matter, probably decomposed pyrites. It is by the instrumentality of these cracks, that the perpendicular buttresses before spoken of occur on either side of the promontory at Old Harry (vol. ii. p. 131); and thus the cliffs on the south side of Studland Bay, have been separated into divisions by the action of the sea. As there is nothing material between Old Harry Point and the division nearest to the plastic clay, I have introduced the profile from the point E of fig. 45, as a sufficient illustration of the whole of the phenomena. It will be seen by the examination of that diagram (fig. 46),

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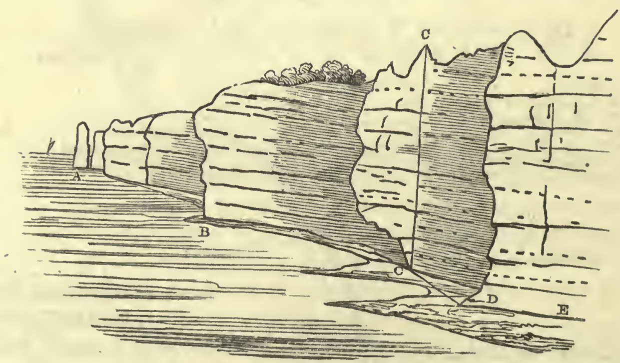

Profile view of Studland cliffs from the point E to Old Harry.
A, Old Harry Point. C c, vertical crack down the cliff. Distance from C to D, 49 paces.
Distance from D to E 28 paces.

that the measure of the decay of the cliffs is, to a certain degree, regulated by these vertical fissures: the line C c in fig. 46 shows this very clearly, for it is impossible that the protruding and bulging central part of the buttress can resist the elements long after the sea shall have a little further undermined the base. The changes, therefore, in the outline of these cliffs, cannot be exactly uniform, but must be produced by different measures of decay; and it also follows, that that decay must be of a more rapid character than if there were no assistance offered by these natural rents.

These vertical fissures are curious also in a more important geological sense. It is observed that they occur only where the chalk strata are horizontal, or nearly so; and that the fissures which traverse the *vertical beds* are at right angles, or nearly perpendicular, to the direction of the fault which occurs at Ballard Head, (vol. i. p. 467). Now this, upon the supposition I have advanced before, should be exactly the case; and, therefore, these *vertical rents* are nothing but joints, traversing the whole solid body of chalk, consequent upon the strain of elevation. There are two other evidences of this fact. At the approach of the chalk to the plastic clay, at the bottom of Studland Bay, represented at I and J in the diagram (fig. 47), which gives the plan of the cliffs from the

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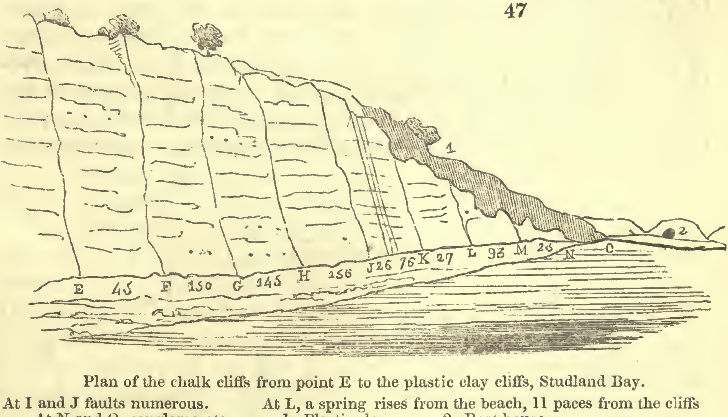

Plan of the chalk cliffs from point E to the plastic clay cliffs, Studland Bay.
At I and J faults numerous. At L, a spring rises from the beach, 11 paces from the cliffs
At N and O, conglomerate. 1, Plastic clay. 2, Boat-house.
The numbers represent the distance in paces.

point E in the map, and in figs. 45 and 46 looking westward, faults are very numerous; and in several cases there is the plainest proof that the masses have been ground against each other, as the surface of the chalk is sometimes ground smooth, and is shining, as if covered with *slickensides;* in other instances, the surface at the fault is covered with a thin coating of yellowish iron, which is striated by scratches exactly after the manner of the surfaces of faults in the older rocks. The flints in the vicinity of these faults are all fractured *in situ*, by cracks which have traversed them as well as the chalk; and the beds of chalk are compressed into extremely thin *laminæ*, the edges being turned up against the portions that yet retain their horizontality of position, as if, after the upheaving, they had again fallen back, which was also the case, as I endeavoured to show, in the Ballard Head fault. At I, in fig. 47, the situation of three faults is shown. The first is indicated by a vertical crack down the cliff, on each side of which the beds of flint are curved, first dipping to the fault, and then rising in a curvilinear course at a higher elevation, as shown in figure 48. A few paces to the eastward the thick blocks of chalk are succeeded by a mass of about two feet wide, consisting of *laminæ* from $\frac{1}{5}$ to $\frac{1}{2}$ an inch thick, gradually passing into larger blocks as before, but dipping 11° to N.W.: ten paces further a similar laminated mass, dipping to the S.E. occurs, so as to mark the eastern limit of the deranged mass. The beds are here all strongly marked by yellow seams, and the fault and strata divisions are coated with yellow matter,—the flints are also much displaced and shattered. But the most extraordinary appearance is, that the thinly laminated bed appears to mark an *internal* derangement in the cliff, for about six feet from the first fault, the face of the cliff is protected by a continuation of larger beds and blocks, through an opening in which the smaller *laminæ* are seen, and, on inspection, this face is separated from the portion behind by a line of fissure which slopes in a slanting di-

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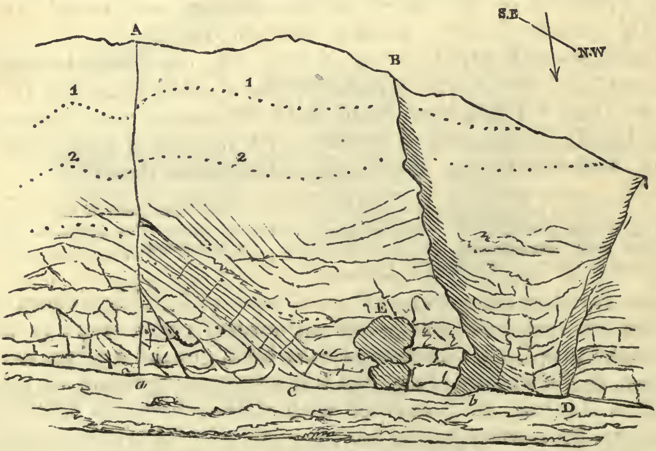

Faults in the chalk cliffs, Studland Bay.

A *a*, vertical fault. B *b*, line of fault. C, *b*, D, thin *laminæ* of chalk. E, opening in the face of the cliff, through which thin *laminæ* are seen. 1, 2, lines of flint. At C the flints are fractured and the chalk yellow,—the edge of the fault striated and rubbed.

rection into the interior of the promontory. This is shown in fig. 48.

There is a difficulty in comprehending the exact character of these derangements; but after considerable observation, I am inclined to think that these faults are occasioned by the action of a protruding mass of the lower chalk, pushed up in an arch-like form from below;—and that they betoken the localities of the up-heaving process: it seems impossible to account for the curvature, compression, and fractured state of the beds in the middle of a cliff, in any other way. Moreover, the vertical and diagonal joints which exist in the horizontal beds, are here made to correspond with the altered condition of those beds. The vertical joints become diagonal in the sloping beds, being still at right angles to the strata, and the diagonal joints appear to pass into lines of stratification, which is consonant to theory if we assume, as before explained, that the diagonal joints were the result of that force which produced the Ballard Head fault, and are parallels to it. And if this reasoning be correct, we see that the derangements exhibited on the Ballard Head side of the promontory are also traceable all through, and consequently, that the derangements in the plastic clay beds are attributable to the same causes. For the joints also that traverse the beds of the plastic clay at the Red Rock, soon to be mentioned, which dip at about 24° to the northward, are transverse to their direction; furnishing proof of the universality of the forces that have operated on the whole of the district, and which are clearly connected with elevation from below.

The lines at F, G, H, &c. to N, (fig. 47), represent the vertical rents, many of which occur in the short distance of 760 paces,[1] the whole length from E to the end of the chalk.—The beach all the way is strewn with masses of chalk and flints, and plastic clay sand-rock, fallen from the cliffs; but it is not wide, and there is no evidence whatever in this part, of any ancient elevated beach.

Towards the point N (fig. 47), the cliff of chalk becomes much lower, and is covered with a thick capping of plastic clay beds, consisting above of white and yellow sand, and below of a brown conglomerate with clay, abounding at the junction in springs, which have brought down vast masses, forming a sort of undercliff, and strewing the shore with fragments.

[1] The distance is calculated as one commonly walks along the shore of the sea,—not exactly in a right line; and the proportion of the paces is as 55 to 100 feet.

The conglomerate is composed of clay, fractured flints, green plastic clay, pebbles, and iron stone, the curvilinear direction of which is deserving of notice. It is seen in fig. 47 that the chalk, at its extremity, is worn into cavities, which are filled with conglomerate. The portions of chalk are yellow, curved, and fractured, and, corresponding to them, the lowest beds of plastic clay, which consists, in its upper member, of a black sand, and in its lower, of a hard iron stone containing hollows filled with crystals of iron,—is arched over the chalk and broken, evidently proving that the chalk has been pushed up so as to protrude through the super-incumbent deposits, which fill up the intervals between the domes of chalk, and dip vertically between them, as they ought to do in the supposition of a regular arch thus formed. The iron stone being the hardest, and the chalk being acted upon by destructive agents, in one instance the former remains a perfect arch, the chalk being removed. Now in these domes of chalk, that rock is fractured and split, together with its imbedded flints, as it is a little to the westward. In all these cases of derangement, it is remarkable that the chalk is of a yellowish hue, which Mr. Lyell conceives to be the result of the iron in the super-incumbent beds; but such can hardly be the case, when it is observed that these yellow lines are not external markings, but a portion of the solid matter itself. The chalk here is evidently composed of alternations of yellow and white layers, and in many cases most beautiful fragments may be found, in which the layers are concentric, the nucleus being a white nodule, and the yellow lines curving round, like the similar wood-like markings in the Red Rock of the plastic clay, (fig. 49). The strata are also distinguished by yellow partings, and often on the surface there are innumerable minute black spots, together with elegantly branching dendrites, the latter seeming to result from the pressure of the colouring liquid in the squeezing of the beds. This liquid seems to have been manganese in solution. What connection there may actually have been between the derangements in the beds and these metallic markings, is foreign to our subject; but the white beds of chalk are undisturbed, and the yellow fractured and curved: and the change of colour is a sufficient indication of the localities of disturbance. Another point to be remarked is, that

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Concentric curves of yellow chalk round a nucleus of white. Natural size. Studland Bay.

fossils are very rare in this chalk; here and there a *Belemnite* and a *Terebratula* signify their existence, but although the flints abound in large nodules, there are scarcely any shells.

The continuation of the chalk from this point is no longer traceable, save by the plants that occur along the shore and the recess at the junction of the two lines of cliff; but between the shore and the hill of Ballard Down, the conformation of the ground shows that the chalk extends under a thin superficial covering, from behind Studland to the edge of the ascent on the road to Swanage, where the steepness of the slope and the sudden and abrupt stages of ascent, and the broken character of the fragments of chalk and flint, the latter of which cover the summit, sufficiently point out the spot where the vertical chalk is to be found, though the surface is clothed with a thin vegetation of grass and furze bushes, affording a scanty herbage for sheep, and a bed for myriads of *Helices*.

Mr. Lyell ('On the Strata between Christchurch and Studland,' G. T. ii. s. s. p. 287) says that "the junction of the chalk and sands is buried under a mass of debris; but fragments of a breccia of flint, imbedded in a ferruginous cement, are observed immediately above the chalk." He also adduces Dr. Mantell as pointing out a similar breccia, containing green pebbles, at Seaforth; and also quotes them as occurring in the North of Hampshire and at Croydon.

Now this breccia or conglomerate consists of sandy loam and brown clay, with yellow clay, and greenish clay and sand, containing, not only flints from the chalk, but the *pebbles* themselves; and, as it appears to me, has resulted from the breaking up of the regularly-deposited *lowest plastic clay bed*, and the mixture of flints with it, from a portion of the cliffs higher than those in which the conglomerate occurs. That lowest bed is, I conceive, the *pebble bed* itself, which, in various parts of this county, as at Lulworth, Hinton Martell, and Booker's Hill, near Lytchett, occurs in great force immediately over the chalk. It may also be seen, not only at Croydon, but in a vast accumulation at Otterton Hill near Winchester, at Lewisham in Kent, and at Farnborough, where it lies upon the chalk; as it may be also seen at the chalk-pit near Shelley Church, and at Bramford, in the county of Suffolk. In all these localities I have noticed the occurrence of pebbles directly, or very nearly so, over the chalk, sometimes imbedded in green, and sometimes in other coloured sands and marls. These pebbles are also frequent in the surface drift of Dorsetshire, pointing out the former greater extent of their occurrence; and, singular enough, at the descent to the village of Etterbeek from the city of Brussells, and also at Tervureen, in the Forest of Soignies, I have found pebbles perfectly similar in every respect, in the former case occupying a position in the midst of the beds which are called 'calcaire grossier,' and are assumed to be the equivalent of the London clay.[1] I mention these localities, because I think that the origin of these pebble-beds, and their particular position in the supra-cretaceous deposits, have not received all the attention which they deserve. An observation upon the subject will not be out of place here.

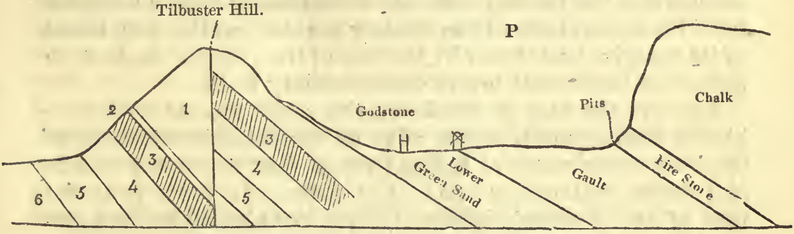
These pebbles invariably occur either in the lower beds of the plastic clay, or as imbedded in the pudding-stone of Hertford and Dorsetshire, or as in loose aggregations of superficial drift. In both the latter cases, their original position as pebbles was doubtless that of the former. Now it is the opinion of several eminent geologists, that the plastic clay beds have been derived in great measure from the destruction, at a very early period, of the lower green sand formation, which is the expressed idea of Professor Phillips, for instance.[2]—('Treatise on Geology,' pp. 165—169). And in considering the origin of these pebbles, I have been led to believe, that though they are called *flint* (Blackheath flint), they are not flint but *chert*, and derived from the *chert beds* of the green sand. Dr. Mitchell ('Mag. Nat. Hist.' vol. ii. p. 218) has very carefully described the true character of these "peculiar flints," as they occur in the neighbourhood of London, and I am sure, after that elaborate detail on the subject, no doubt can remain, that they are *not flint, but chert* pebbles. There is nothing extraordinary in admitting such an origin;—it cannot be the "countless multitudes" and "millions" of them which startle the mind;—for it is a fact, that nearly $\frac{99}{100}$ of all the drift gravel in that part of Dorsetshire of which I am treating, is composed of *chert*, which I have traced to the green sand of Devonshire: so that even in modern times, compared with the plastic clay era, the chert beds of the green sand have furnished the materials for innumerable beds of pebbles, of much greater extent than those composing the Blackheath and Croydon deposits. Analogous to the suppo-

[1] It is from this, and other causes, that I am not satisfied with the arrangement which assigns to the Brussells beds the geological cognomen of 'calcaire grossier.' Mr. Morris has, however, given reasons for us to believe, that the plastic clay and London clay are of the same formation, although of different divisions—(see Geol. Pro. vol. ii. p. 450),—an arrangement of some importance.

[2] Mr. Lyell, however, speaks of "shingle composed of perfectly rolled *chalk-flints*, with here and there small pebbles of quartz."—Geol. vol. iv. p. 212.

sition thus mentioned, is Dr. Mitchell's remark that "there is a spot beyond the boundaries" of his paper, "where such flints are exceedingly abundant, which is the hill immediately *above the fire-stone quarries*, a mile north from *Godstone Green*."—(p. 219) Now the *fire-stone* is the *lower green sand*, and at Godstone the pits occur in the side of the chalk escarpment of Tillingdown, having opposite to them, at little more than two miles distance to the south, the elevated ridge of Tilbuster Hill, which consists of *chert*, and the summit of which is nearly on a level with the chalk downs.

The subjoined section (P) is given to point out the pecu-



Section and faults at Tilbuster Hill, near Godstone, Surrey.

1, Sand and loam. 2, Grey sand. 3, Chalk. 4, Grey sand. 5, Sand and iron stone. 6, Weald clay.

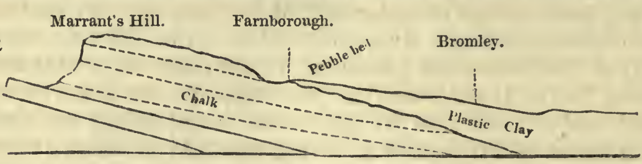
liar position of the chert beds,[1] which are, in some places, perfectly fragmentary, so near to the locality where the *pebbles* are found; and which I cannot help thinking supplied them. Should further examination lead to the conviction, that the *pebbles above* the fire-stone did come from Tilbuster, or the beds to which that hill belongs, there is no reason to deny, that the chert of Surrey was once perfectly sufficient in extent to have supplied all the beds of transported rolled fragments that form the accumulations at Croydon, Blackheath, &c.

Having suggested the above possible origin for the pebbles of the early tertiary epoch, it remains to say a word as to the method of their accumulation. This strikes me to have been occasioned by the very same causes that now produce shingle-banks and beaches on and near the shores of our present seas,—currents and agitations of the tidal waters, whether of the ocean or its estuaries. That this is probable is shown by the fact, that these pebbles are not universally scattered over the surface of the chalk, but only on such places (where found *in situ*) as at once justify the idea of an ancient littoral accu-

[1] A sketch of Tilbuster (Tilburstow or Tilvester) Hill is given by Dr. Fitton, G. T. iv. 138, and a description by Dr. Mantell, Geol. S.E. of Engl. p. 177.

mulation. Take the case of Farnborough for instance (fig. R).

R



The pebbles are there found over the chalk, just at its outcrop from under the tertiary beds that extend thence to London. And it will be found, in the generality of cases, that the accumulation has taken place, not at a distance from what must have been the shore of the tertiary sea, but on the very limits of its margin, as defined by the rise of the sloping chalk from under the horizontal layers of the tertiary beds.

Now, in the case of Studland, the conglomerate with pebbles is found exactly at the edge of the basin in the slope of the lofty chalk range of Ballard Down, just where the plastic clay series commences; so is it at Lulworth, for it is at the foot of the Purbeck downs that the pebbles make their appearance. But I am bound to admit, that two lines of these pebbles, regularly imbedded, occur in the sand at Booker's Hill, Lytchett, at a much higher level above the present sea, than that at Studland,—and the difference of elevation is probably 200 or 300 feet; of which a similar example is afforded at Hinton Martell, where the pebble-bed is found on the summit of a high chalk ridge, whilst the lower lands, also covering the chalk, have traces of these pebbles.

Here there seems a discrepancy, for if these pebbles mark an ancient littoral accumulation, the tertiary sea must have stood, in different places of the same geological area, at different elevations! But to explain this impossibility we have two solutions at hand. The plastic clay series in south-east Dorset, has experienced enormous dislocation and denudation; and it is not only probable, but proveable, that there have been depressions and elevations throughout this area.—Moreover, evidence will be advanced in the course of these illustrations, to show that during the deposition of the plastic clay beds, violent denuding and destructive agencies were at work, and that the first-deposited beds were in some cases, as at Wareham, and near the station-house, Studland, broken up to form the constituent portions of a later part of the deposit. So that the ancient shingle of the plastic clay may have been removed and re-accumulated upon other spots, which were then emerging from the general low level to a higher one, unnder the influence of those up-lifting agencies which we have reason to conclude accompanied the desolating torrents that have passed over, and excavated and broken up, the first deposited beds.

At Studland, where this conglomerate occurs, also is seen one of the most remarkable proofs of the occurrence of uplifting forces after the deposit of the plastic clay; and this we shall presently consider. But generally speaking, where the chalk and super-incumbent deposits have not been shattered and up-heaved, the pebbles in question occur at the outcrop of the chalk, on the slope of the tertiary basin, and extend only so far into the interior of the deposits now filling that basin, as is compatible with the belief that they represent what they once were, namely, a littoral shingle.

(To be continued).

REVIEWS.

Art. I.—1. *Narrative of an Expedition into Southern Africa, during the years* 1836 *and* 1837. By Captn. W. C. Harris, H. E. I. Company's Engineers, &c. Bombay: 1838. Re-published by Murray, London: 1839.

2. *An Expedition of Discovery into the Interior of Africa, under the auspices of Her Majesty's Government, and the Royal Geographical Society.*—By Capt. Sir James Edward Alexander, K.L.S., &c. 2 vols. 12mo. London: Colburn. 1839.

The steps which have led to a knowledge of the continent of Africa, viewed in its geographical relations, are so intimately associated with our insight into the Zoology of this intensely interesting portion of the globe, that contributions to Natural History seem almost of necessity to be part and parcel of the results consequent upon exploring expeditions to its interior. Bruce, Le Vaillant, Burchell, Rüpell, and Smith, are names too prominently enrolled on the pages that chronicle the progress of science, to render a syllable of comment on their labours necessary, or on the possession of that true spirit of philosophical enterprise, and unflinching zeal in the pursuit of knowledge, which led them to face the perils and difficulties that attend the traveller in his path through the African forests.

The announcement of the first work on our list,—the narrative of an expedition into Southern Africa by an officer in the Bombay Engineers, whose name is coupled with a brilliant addition to the antelope tribe, in the discovery of that magnificent species, the *Aigocerus niger*,[1]—led us to antici-

[1] Described and figured by Capt. Harris, in the last part of the Zoological Transactions.

pate, in this quarter, a rich fund of scientific information; and our expectations were in no small degree heightened when we saw it stated in the last number of the Quarterly, that the work in question would be read with great pleasure by the zoologist, from the valuable accounts there given of the habits of animals of the greatest rarity. It is, however, with a considerable feeling of disappointment that we have risen from a perusal of Capt. Harris's production. The narration he has given us, it is true, teems with observations upon the four-footed denizens of the African wilds, but the points upon which he most frequently and fully enlarges, are, with few exceptions, restricted to such as bear upon his own shooting exploits, and generally of but minor import to the naturalist. If a place is given to a fact of *real scientific* interest, it is rather because it has been forced on the writer's attention, than that he has troubled his brains about anything else than the number of shots required to kill a giraffe, or the precise spot in which a ball should be planted to drop a rhinoceros.

Captain Harris commenced his projectile career at the early age of six, by shooting at sparrows with a blunderbuss; and when but sixteen he found himself in Western India, the possessor of a rifle, before the deadly grooves of which a kite had but little chance at the distance of one hundred and fifty yards; whether *flying* or *sitting* he has left his readers to conjecture. With so precocious a development of the bump of propulsion, it may readily be conceived that the rhinoceroses and giraffes of the wilds of Africa presented targets of no ordinary attraction to the vivid imagination of the youthful officer. "Often" he remarks, "did I see at the extremity of a long vista of years that intervened betwixt me and my furlough, the slender and swan-like neck of the stately giraffe, bowing distantly to our better acquaintance; Behemoth, with his square and mirth-exciting snout protruded from the yellow waters of a vast river, acting the part of master of the ceremonies; whilst a host of rhinoceroses, supported by gigantic elephants, eccentrically horned antelopes, and other fascinating strangers, awaited their turn of presentation with evident impatience."

The dreams so fondly indulged in by our author were destined to be realized. The Bombay Medical Board ordered him to the Cape, with a warm recommendation that he should penetrate into the interior of Africa. And here he begs it may not be supposed that "*sport*" was his only object, having, both from education and taste, an ardent desire to contribute to the Natural History and Geography of the countries he was about to explore. The vast preponderance, however, of our author's "shooting mania" as he terms it, over all other considerations, is but too plainly apparent in the subsequent pages of his work. The learned reviewer in the Quarterly who, if sufficiently at home upon zoological matters to distinguish a sphinx from a griffin, we are sure would feel wofully comflustercated[1] if called upon to define the difference between a rifle and a marling-spike, is in ecstacies with the exploits of *the gallant captain*,—speaks of the shots which leave nothing more to be wished for from eye,—hand,—lead and gunpowder, and is perfectly guiltless of giving him credit for occasionally shooting with a long bow. It is well known in America, that now and then a Kentucky rifle-shooter attains such a degree of certainty in bringing down any object within the range of vision, that at length the expenditure of his powder and ball becomes altogether unnecessary,—racoons and squirrels " giving in" the moment his piece is brought to bear upon them, acting probably on the same principle that induces certain culprits, when they see no possibility of es caping conviction, to plead guilty, hoping to gain a mitigation of punishment for having spared the time and trouble of the judge and jury. If, therefore, we remark, that the recital of some incidents in the present adventurous narrative, has strongly brought to our recollection passages in the travels of the never-yet-rivalled Baron Munchausen, this impression must not be attributed to our ignorance of what has been and may be achieved in the way of ball shooting. The singularly unpleasant situation in which the above celebrated traveller once found himself placed, in juxta-position with an individual of the bruin tribe,—and the extraordinary display of skill and presence of mind by which he extricated himself, when his stock of ammunition consisted of only two gun-flints, —proves how much may be accomplished, even with the most limited resources, if a person will only exert his wits to the best advantage.

The bagging a stately camelopard in his native wilds, by a shot from his favorite rifle, was an object of our author's highest ambition. But the Captain's first essay in giraffe-shooting was not destined to be successful.

" I had shot a hartebeest for the savages, when an object which had repeatedly attracted my eye—but which I had as often persuaded myself was nothing more than the branchless stump of some withered tree—suddenly shifted its position, and the next moment I distinctly perceived that singular form, of which the apparition had ofttimes visited my slumbers, but

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[1] For the precise meaning of the word ' comflustercate, ' see Dr. Peter's Dictionary of obsolete verbs.

upon whose reality I now gazed for the first time. It passed rapidly among the trees, above the topmost branches of many of which its graceful head nodded like some lofty pine—it was the stately, the long-sought giraffe.—Putting spurs to my horse, and directing the Hottentots to follow, I presently found myself, half choked with excitement, rattling at the heels of the tallest of all the mammiferes, whom thus to meet, free on his native plains, has fallen to the lot of few of the votaries of the chase. Sailing before me with incredible velocity, his long swan-like neck keeping time to the eccentric motion of his stilt-like legs—his ample black tail curled above his back, and whisking in ludicrous concert with the rocking of his disproportioned frame, he glided gallantly along, "like some tall ship upon the ocean's bosom," and seemed to leave whole leagues behind him at each stride. The ground was of the most treacherous description; a rotten black soil, overgrown with long coarse grass, which concealed from view innumerable cracks and fissures, that momentarily threatened to throw down my horse. For the first five minutes I rather lost than gained ground, and despairing, in such a country, of ever diminishing the distance, or improving my acquaintance with this ogre in seven-league boots, I dismounted, and had the satisfaction of hearing two balls tell roundly on his plank-like stern. But I might as well have fired at a wall; he neither swerved from his course nor slackened his pace, and had pushed on so far a-head during the time I was re-loading, that, after re-mounting, I had some difficulty in even keeping sight of him amongst the trees. Closing again, however, I repeated the dose on the other quarter, and spurred along my horse, ever and anon sinking to his fetlock; the giraffe now flagging at each stride, until, as I was coming up hand over hand, and success seemed certain, down I came headlong,—my horse having fallen into a pit, and lodged me close to an ostriches' nest, in which the old birds were sitting."

Here we have the first novelty in the way of Natural History,—the male and female ostrich employed at the same time in the act of incubation. Surely our hero might have had the adroitness to have tumbled *into* instead of *outside* the ostriches' nest, and across one of the old birds, which, starting off and bolting a-head, would in a jiffey have brought him alongside of the giraffe. Luckily, both horse and rider found their legs again, without having sustained any serious damage; but the violence of the shock bent the rifle double, and so nearly detached it from the stock, that it hung only by the trigger-guard, a mishap, under such circumstances, sufficient to paralise the energies of any traveller who had not a copy of Baron Munchausen in his pocket. Lions and black rhinoceroses were around, as plentiful as partridges in a Norfolk turnip-field in the month of September, and the Captain was alone, and his only weapon the said unfortunate rifle.

To an ordinary mind, or one unpossessed of a shooting mania, a retreat with all possible dispatch to the camp, would have appeared the most prudent course in such an emergency, but not so thought our author; the object of pursuit was still in sight, and, "nothing dismayed by this heavy calamity," he remounted his jaded beast. But how was the giraffe to be brought down or a rhinoceros despatched, if such a step became desirable? He could make allowance, in taking aim, for the doubling of his rifle-barrel, and grasp it round so firmly at the breech with his left hand, as to prevent its bursting, whilst the percussion cap could be exploded by a blow from his pocket-knife or a stone. The odds were fearfully against him, but "nothing venture nothing have," and he determined to go on. The goal of his ambition was at length within his reach, but;—he was still doomed to disappointment.—

"In vain I looked around for a stone, and sought in every pocket for my knife, with which to strike the copper cap, and bring about ignition, or hamstring the colossal but harmless animal, by whose side I appeared the veriest pigmy in the creation—alas, I had lent it to the Hottentots to cut off the head of the hartebeest. Vainly did I wait for the tardy and rebellious villains to come to my assistance, making the air ring, and my throat tingle, with reiterated shouts—not a soul appeared; and in a few minutes, the giraffe having recovered his wind, and being only slightly wounded in the hind quarters, shuffled his long legs, twisted his tail over his back, walked a few steps, then broke into a gallop, and diving into the mazes of the forest, disappeared from my sight."

On our author's return to the camp, he found that while he was pursuing the giraffe, his companion in the expedition, a brother officer and a devoted sportsman, had also damaged his rifle, by firing it down the throat of an infuriated rhinoceros; an operation by the bye, which we should have felt as shy of, as that of discharging a bent barrel, by rapping the nipple with a pocket knife.

"Richardson shortly returned, having been engaged in close conflict with a rhinoceros. Aroused from a siesta by the smarting of a gun-shot wound, the infuriated animal had pursued his assailant so closely, that it became necessary to discharge the second barrel into his mouth, an operation by which the stock was much disfigured. I employed the rest of the day in repairing my own weapon with the iron clamp of a box, binding it with a strip of green hide from the carcase of an eland."

We should have imagined the *corpus* of his friend Richardson to have stood a far greater chance of being "disfigured" than the stock of the rifle; but had it been so, we don't for a moment suppose the Captain would have deemed *this* a circumstance of sufficient importance to have entered in his journal.

The white rhinoceros was found to be much less dangerous than the black, but every four-legged animal seems to have been pretty much the same to the Captain; for whenever the mammiferes, no matter what their genus or species, evinced the slightest disposition to exceed the rules of propriety, the *coup-de-grace* was certain to follow from the deadly grooves of the Captain's rifle.

"About sunset an unwieldy white rhinoceros approached the waggons, evidently with hostile intentions. There being neither bush nor hollow to conceal my advance, I crawled towards him amongst the grass, and within forty yards fired two balls into him. He started, looked around for some object on which to wreak his vengeance, and actually charged up, with his eye flashing fire, to within an arm's length of me. Crouching low, however, I fortunately eluded his vengeance, and he soon afterwards dropped down dead."

From the abundance in which our author found examples of the king of beasts, it is satisfactory to find that notwithstanding the great rage for establishing zoological gardens, this noble animal will afford sport to African hunters for some time to come.

"On the bank of the river I observed the perfect skeleton of an elephant. Near to it 'Lingap suddenly stopped, and pointing with his assegai to a bush a few yards off, whispered '*Taoo*,' and I immediately perceived three lionesses asleep. Ensconcing himself behind his shield, he made signs to me to fire, which I did into the middle of the party, at the same moment springing behind a tree, which completely screened me. Thus unceremoniously awakened, the three ladies broke covert, roaring in concert, and dashed into the thick bushes, while we walked as fast as possible in an opposite direction. In the course of a few minutes we heard several discharges of musquetry, and an infuriated rhinoceros, streaming with blood, rushed over the brow of the eminence that we were ascending, and was within pistol-shot before we were aware of his approach. No bush presenting itself behind which to hide, I threw my cap at him, and 'Lingap striking his shield and shouting with stentorian lungs, the enraged beast turned off."

On one occasion we find, however, that the Captain's head-dress inspired a feeling of a very different nature, for whilst on another giraffe crusade, he tells us, that—

"A white turban, that I wore round my hunting-cap, being dragged off by a projecting bough, was instantly charged by three rhinoceroses; and looking over my shoulder, I could see them long afterwards, fagging themselves to overtake me."

Had the three rhinoceroses taken into their heads to charge whilst the turban occupied its legitimate position, our hero would have stood the chance of a capsize, the unpleasant consequences of which, even a friendly ostriches' nest might not have averted. So improbable a contingency as this, however, we will answer for it, never suggested itself to the mind of the Captain: he had on a former occasion come off victorious, when simultaneously attacked by three rhinoceroses; but in that one instance, he candidly admits that they were *very troublesome*.

A rhinoceros which one day committed a most unpardonable act of familiarity, by bouncing into the midst of a party of three or four of them, was most unceremoniously despatched by a bullet sent in at his garret-window;—a favorite method, by the bye, with the Captain, of disturbing the meditations of the *Hippopotamus*.

"Garret-window," it may be as well to mention *en passant*, is a *professional* term for the *organ of vision*, though in the absence of this explanation we fear Capt. Harris will have given some of his readers the erroneous impression, that the *Hippopotami*, like the beavers, erect regular habitations.

From the extraordinary success which attended the Captain's rifle in the rhinoceros line, our readers will readily conceive, without going farther into details, that elephants, lions, alligators, and other descriptions of game, large and small, had each in their turn a benefit from the grooves of this formidable weapon. He had taken care to provide himself at starting, with eighteen thousand bullets, besides an abundance of uncast lead; and subsequent sportsmen, who are inclined to follow a route so rich in the harvest it offers, have, we should suppose, merely to track the course of the expedition, by following up the line of skeletons which, thanks to the shooting mania of Captain Harris, lie whitening in the sun on the African plains.

A more decided contrast to the work under notice than that presented by the second on our list, as to general style and character, cannot well be imagined. Never was there a more striking illustration of the way in which impressions, conveyed by physical facts, are modified under the influence of individual temperament and preconceived ideas. Captain Harris is a shrewd, high-spirited, daring, energetic fellow, whose whole soul is wrapped up in the subject on which he writes. The detonating principle, and the organ of propulsion, may be detected in every stroke of his pen. He looks at the lions and gigantic African pachyderms, as only created that he may amuse himself with planting bullets in their garret-windows. The possibility of his being one day honoured by serving as a luncheon to his feline majesty, or as a noseball to a black rhinoceros, fertile as is his imagination, never once comes within the boundary of his speculations. Sir James Alexander's narrative, if we except the texts of Scripture, doggrel rhymes, and Latin phrases of three words and a half, with which it is copiously interlarded, gives you the idea of the rotation of the waggon-wheel regulating the machinery by which the passing events are committed to paper.—Here and there a jolt, or a run down a declivity, occasions a slight variation in the moving power; but a slow, jog-trot pace is the general order of the day. All the rubbishing stories with which the Namaqua grannies send their brats to sleep, are crammed into Sir James, who eagerly gulps them down, and, religiously taking them for gospel, sends them forth in his journal for the edification of his readers. Nothing in the world would induce our knight errant to bathe in the Orange river, for fear of being sucked down the horrific jaws of the *Hippopotamus*, or swallowed by a "dread Leviathan" that was reported to have crawled out of the water on one occasion, and to have devoured a newly-born calf. Nor would he take a solitary ramble along the luxuriant banks of this magnificent stream, lest he should be clawed hold of by a great dog-faced baboon, five feet in height, covered with long black hair, and which he tells us is infinitely more to be dreaded than a lion, or a Boschman's poisoned arrow.

The following awkward adventure with one of these hairy monsters, occurred to Sir James's man-servant.—

"One day, while fishing alone under the trees, he was diverted by the gambols of some young baboons on the opposite cliffs, when suddenly he heard a loud 'quah' behind him: and looking round, he saw a great baboon close to him. Robert had no weapon to defend himself with. The hairy monster cried 'quah' again, when a number of other baboons were seen rapidly descending a neighbouring hill. There was no time to be lost—Robert snatched up a branch which he found at hand, and when the baboon was closing with him, and showing his horrid teeth, with the intention of biting him to death in the neck, Robert struck desperately at his head; the baboon put up his left arm, and received the blow on it, and immediately wrested the stick out of Robert's hands, though he was a strong sailor. Flight was now Robert's only chance, and he took to his heels as fast as he could, followed by the baboon, who, though partly crippled by the blow, still 'quah quahed' after him, till Robert gained the open country, and the Namaqua encampment, from which he had come, appeared;—the baboon then gave up the pursuit."

How gloriously well our travellers would have pulled together, had they only arranged to have united their forces at starting! The gallant Captain espies an elephant in the distance, flapping its huge ears, and whetting its ivories against the trunk of a tree; and, without thinking it necessary to say a syllable to any one of his party, shoulders his rifle and marches singly off, with a determination to scrape acquaintance with the lordly animal. If all the hairy baboons in the universe lay in his way, or were crying "quah" behind him, he would not so much as condescend to whisk his cap at them. At forty yards distance he has brought his piece to bear, and covered the fatal spot behind the shoulder of the noble beast; the trigger is about to be pulled, when he finds that his left foot is treading on the tail of a lioness, and that a ferocious-looking rhinoceros is meditating a rush upon him from a bush on his right. This position of affairs,—"the devil on one side and the deep sea on the other," to borrow the expressive language of Sir James,—disturbs the nervous system of the Captain about as much as the sight of a polecat and hedgehog would that of an English grouse-shooter. He knows that the lioness will trot sulkily off at the report of his rifle, and if his black friend make a lunge at him, he has only to pop down into the long grass, and be as safe as a needle in a hay-stack. The chances are, that he despatches the elephant with one barrel, and with the other gives him a companion in the rhinoceros, to the banks of the Stygian river.

Sir James, in speaking of the river-horse, finding that his own language is not sufficiently forcible to convey an idea of this terrific creature, employs that of the inspired volume,—a plan which we think highly objectionable, unless there were unquestionable evidence of the particular animal referred to in sacred history, as having "bones as strong pieces of brass, and like bars of iron," and even then the figurative language of the Scriptures is anything but appropriately introduced.—Captain Harris's ideas as to the formidable character of this monster, may be pretty well gathered from the following passage.—

> "Of all the *Mammalia* whose portaits, drawn from ill-stuffed specimens, have been foisted upon the world, *Behemoth* has perhaps been the most ludicrously misrepresented. I sought in vain for that colossal head—for those cavern-like jaws, garnished with elephantine tusk—or those ponderous feet with which 'the formidable and ferocious quadruped' is wont to 'trample down whole fields of corn during a single night!' Defenceless and inoffensive, his shapeless carcass is but feebly supported upon short and disproportioned legs, and his belly almost trailing upon the ground, he may not inaptly be likened to an overgrown pig. The colour is pinkish brown, clouded and freckled with a darker tint. Of many that we shot, the largest measured less than five feet at the shoulder; and the reality falling so lamentably short of the monstrous conception I had formed, the 'River Horse,' or 'Sea Cow' was the first, and indeed the only, South African quadruped in which I felt disappointed."

We feel bound to express our unqualified approbation of the greater attention bestowed by Sir James than by Captain Harris upon the habits of the animals which fell under his notice, notwithstanding the eager desire professed by the latter to contribute to the Natural History of the country he was about to explore. A few such notices as the following, scattered through the pages of the Captain's narrative, would have more than justified the lavish encomiums of the Quarterly Review.

The subject of these observations is evidently an animal altogether new to science, but which Sir James mistakes for the black rhinoceros.

"The black rhinoceros, whose domains we seemed now to have invaded, resembles in general appearance an immense hog; twelve feet and a half long, six feet and a half high, girth eight feet and a half, and of the weight of half a dozen bullocks; its body is smooth, and there is no hair seen, except at the tips of the ears, and the extremity of the tail. The horns of concreted hair, the foremost curved like a sabre, and the second resembling a flattened cone, stand on the nose and above the eye; in the young animals the foremost horn is the longest, whilst in the old ones they are of equal length, namely, a foot and a half, or more: though the older the rhinoceros the shorter are its horns, as they wear them by sharpening them against the trees, and by rooting up the ground with them when in a passion.

"When the rhinoceros is quietly pursuing his way through his favourite glades of mimosa bushes, (which his hooked upper lip enables him readily to seize, and his powerful grinders to masticate), his horns, fixed loosely on his skin, make a clapping noise by striking one against the other; but on the approach of danger, if his quick ear or keen scent make him aware of the vicinity of a hunter, the head is quickly raised, and the horns stand stiff and ready for combat on his terrible front.

"The rhinoceros is often accompanied by a sentinel to give him warning, a beautiful green-backed and blue-winged bird, about the size of a jay, which sits on one of his horns. When he is standing at his ease among the thick bushes, or rubbing himself up against a dwarf tree, stout and strong like himself, the bird attends him that it may feed on the insects which either fly about him, or which are found in the wrinkles of his head and neck. The creeping hunter, stealthily approaching on the leeward side, carefully notes the motions of the sentinel-bird; for he may hear, though he cannot see, the rhinoceros behind the leafy screen. If the monster moves his head slightly and without alarm, the bird flies from his horns to his shoulder, remains there a short time, and then returns to its former strange perch; but if the bird, from its more elevated position and better eyes, notes the approach of danger, and flies up in the air suddenly, then let the hunter beware; for the rhinoceros instantly rushes desperately and fearlessly to wherever he hears the branches crack.

"Thick and clumsy though the legs of the rhinoceros are, yet no man, unless possessed of the powers of my chief huntsman, Henrick Buys, can hope to escape him by fleetness of foot on open ground; once he has a man fairly in his wicked eye, and there is no broken ground or bush for concealment, destruction is certain. The monster, snorting and uttering occasionally a short fiendish scream of rage, bears down in a cloud of dust, tearing up the ground with his curved plough-share, kicking out his hind legs in a paroxysm of passion, and thrusting his horns between the trembling legs of his flying victim, he hurls him into the air as if he were a rag, and the poor wretch falls many yards off. The brute now looks about for him, and if there is the least movement of life, he runs at him, rips him open, and tramples him to a mummy!"

It is to be regretted that Sir James did not adopt the precaution of getting some judicious friend, with a knowledge of Zoology, to peruse his manuscript before it went through the press. Here we have the description of an animal, that is certainly for the *first* time introduced to the notice of naturalists, in size and form resembling the rhinoceros, but differing so essentially from that genus, that we can hardly suppose it to belong to the same group. The *younger* it is the *longer* its horns, and these organs are consequently fully developed at the period of birth. In the rhinoceros, the horns are so firmly attached to the bones of the *cranium*, that in the adult animal it is a good half hour's work for a man with an axe to cut them from the skull. In this mammal, which Sir James erroneously calls a rhinoceros, the horns, it appears, are moveable, and he supposes them to be simply attached to the skin, but since their erection as defensive weapons would require the operation of powerful muscles, they must necessarily be more deeply implanted than he imagines.

In our notice of the Report of the expedition for exploring Central Africa, under Dr. Andrew Smith,[1] we had occasion to quote a passage in which this enterprising explorer and talented zoologist looks forward to the time when mind and matter shall alike proclaim the truth of Mr. Swainson's doctrines, and African travellers find little to gather, which does not corroborate the contents of his interesting volumes. Now Mr. Swainson has lately informed us, in Dr. Lardner's 'Cabinet Cyclopedia,' that in the natural system the rhinoceros and cassowary mutually represent each other, from the circumstance of both possessing a dark protuberance about the frontal region. Had Sir James fortunately possessed a copy of Mr. Swainson's work, he must have perceived that this creature, with two dermal excrescences of concreted hair which produce a noise by clapping against each other, was a genus among the *Mammalia* representing the rattle-snake among the ophidians. We are fully aware that the *Crotalus* sounds *its* rattle when *irritated*, and has this organ at the *tail* instead of the *head;* but in the *natural* system reverse conditions, instead of weakening analogies, often serve to render them more *striking*. It would be a most interesting point to ascertain if any particular species of "green-backed and blue-winged fly" holds sentinal guard upon the caudal extremity of the rattle-snake.

Among other matters interesting to the naturalist, Sir James notices, in addition to the common lion, of the usual light brown colour, four others;—one entirely black, with long hair; a third kind, quite white; a fourth, with the neck only white; and a fifth, with legs striped like a tiger. Had he only possessed the artistical skill of Captain Harris, as displayed in

[1] Mag. Nat. Hist. Vol. i. n. s. p. 101.

the beautiful sketch which adorns the last part of the Zoological Society's Transactions, science might perhaps have had the benefit of something more than a mere verbal notice of these novelties.

As a security against lions, Sir James recommends travellers to take up their quarters close to a colony of pig-faced baboons; though from the experience of his man, Robert, we should have thought this would, in real earnest, be jumping from the frying-pan into the fire.

A perhaps less objectionable expedient to avoid the contingency of being made a meal of by the king of beasts, appears to us to arise out of the following relation told by one of the hunters of the party,—Henrick.—

"'One night I was asleep in my hut, when I was awoke by a noise outside. My wife whispered, 'I don't think that is a wolf;' on which I got up, and went out with a keree (or knobbed stick) in my hand, for I had no gun at that time. Below a tree I saw a cow lying, and as I went to it a large animal left the cow and came towards me. I stood my ground, and called out, when a lion (which the large animal was), went off to one side. I went up to the cow, and found it, and another beyond it, dead. The first had been ripped up, and the calf only eaten, because the contents of the stomach of the cow had come out of its mouth and nose, whilst the other cow had its neck twisted round, and its horns fixed in the ground, so that its mouth was kept in the air, to prevent the same ejection of food as in the first cow. I turned its mouth downwards to disgust the lion, and then went to sleep again.'

"In Henrick's word, during some months' acquaintance, I had implicit confidence; and it is quite possible that the lion may feel a peculiar disgust when the above accident happens, and to prevent it could easily with his mighty paws, fix the horns of cattle in the ground. All this, if true, is a new and interesting fact in the natural history of the lion."

So absorbed is our author in the scientific interest attached to this new "fact" in Natural History, as entirely to overlook the *real* value of discovering, that in the event of a peculiar *chain of circumstances arising*, the lion, instead of treating himself to his intended meal, has the self-denial to cut his stick, and march quietly off. Subsequent treaders in his steps, however, will not fail to appreciate the service rendered them by Sir James, in the hint which this piece of information affords. Instead of starting from the cape with half a waggon-load of metal in the shape of leaden bullets, and a score or more barrels of gunpowder, the explorer who intends acting only on the defensive, and not waging war against every animal that crosses his path, will now provide himself with a far more simple and less expensive kind of ammunition.— His store-chest will have one compartment exclusively appropriated to a well-known *powder*, extensively manufactured under the name of "tartar emetic," by a worshipful company whose mills are situated—not on Dartford Common—but within a stone's throw of Bridge St. Blackfriars;—equally to be relied on for the certainty of its *propulsive* operation, although in its *modus operandi* differing materially from that of its *black* congener. And when the shades of evening close round, and the hungry roar of rhe prowling monarch reverberates through the sullen gloom of the African forest, the traveller, having administered a scruple dose to each of the oxen, and primed himself with a few grains of this explosive mixture,—feels that in the possession of an œsophageal canal, nature has supplied him with a *tube*, from the *mouth* of which the midnight intrusion of the tyrant of the woods is effectually repelled,—and in peaceful security takes his siesta, unbroken till the flush of morning, even though the bristly whiskers of the grim feline marauder, should brush the eyebrows of the unconscious slumberer.

Although Sir James does not appear to have contributed so largely as Captain Harris, towards making the rhinoceros a genus of by-gone days, yet that he now and then had the ambition to follow in the Captain's wake, is evident by the following passage.—

"We approached these dangerous animals with some caution, crept upon them, and got two or three flying shots at them; but unless they are taken standing, with deliberate aim at the back-bone, or behind the jaw, good balls are thrown away upon them; not that their hide, though more than an inch thick, is impenetrable in other places to lead and pewter bullets (hard and heavy), such as mine were, but because the rhinoceros runs away with a bushel of balls fired through his ribs. In his side they seemed to make no more impression on him, at the time of receiving them, than so many peas would, though he may die from them afterwards. So our two first rhinoceroses, being continually on the move, escaped from us though we tickled them roughly."

After the hairy baboon story in the first part of the narrative, for our hero, in vol. ii., to speak with such perfect *sang froid* of "tickling" a rhinoceros, or taking "deliberate aim at its back-bone," sounds inexpressibly ludicrous. From the top of a pit-fall, he possibly might so far screw up his courage as to fire down upon the spinal region of some unfortunate beast impaled on a stake at the bottom; but let the rhinoceros be roaming unfettered in his native wilds, with his horns clapping one against the other, and we'll answer for it, *one clickety-click* of these dermal appendages, or even a glimpse of the blue-winged green-backed sentinel, would send Sir James, and his whole *posse comitatus*, down on their marrow-bones before you could say "Jack Robinson."

Although we cannot, like Captain Harris, boast of an initiation into the mysteries of powder and shot at the early age of six, yet, from a moderate share of experience in the use of explosive weapons, were we ever placed in such a predicament, that to save our own bacon, a rhinoceros must be despatched by a single shot, we should certainly feel at a loss which alternative to select, as attended with the least difficulty of accomplishment,—that of sending a bullet through the back-bone of the animal when quietly browsing on the mimosa-leaves, at a respectful distance of forty yards, or allowing it to make its rush, and when ploughing with its horn the ground at our feet,[1] chancing a ball through one of its sky-lights.

Of the many things which excited the surprise of our author in the course of his peregrinations, on no occasion does he express himself in stronger terms of amazement than on learning that it was possible to make a barrel throw a ball straight, when it had previously shot crooked. As he has stated, for the benefit of his fellow officers in Her Majesty's service, how this piece of conjuration was brought about by the natives, we shall take the liberty of availing ourselves of the information, for the benefit of such of our readers, who, being "field naturalists," are necessarily interested in the art of gunnery.—

"This was effected by placing a second sight near the breech, which was raised or depressed, shifted from one side to the other, and then fixed when the ball was found to go straight to the mark."

We have read few passages in the present narrative with more satisfaction than the following :—

"Here I beg to remark that during the whole journey nothing was killed wantonly, or that we did not positively require, either as an article of food, or as a rare object of natural history. I never could, and I trust I never shall, reconcile myself to the notion which some sportsmen entertain, that it is manly to destroy as many animals as one can: this thirst for blood is discreditable. The exploit of which I know some to boast, viz., killing four elephants in one day, or the same number of *Hippopotami*, with the same gun, for mere sport, is surely not praiseworthy."

With a keen relish for the legitimate sports of the field, we certainly do not envy the feelings of the man who can derive enjoyment from seeing the plain strewn with the carcasses of

[1] May we request that Captain Harris or Sir James Alexander would have the kindness to state, through onr own columns, or those of some other Natural-History periodical, what the rhinoceros does with its nose, when at full speed, ploughing up the ground with its horns.

elephants, struggling in the agonies of death, or amuse himself with galloping after a herd of giraffes, and hearing the balls from his rifle tell upon the flanks of these most graceful but defenceless animals.

The favourable opinion, however, which we formed of the sentiments entertained by our author towards the brute creation, were somewhat damped by a remark in a subsequent part of his narrative, in which he tells us "mere sport," as well as a desire to feed his followers, led him to "gird up his loins for the chase, and burn with desire to slaughter some of the larger game."

Did our limits admit of it, we might introduce to our readers the history of a cow with a walking-stick, of an ostrich that put up its foot, and with its great toe-nail tore open a Boschman from top to bottom, and of a hairy pig-faced baboon, that entered into the service of a farmer, and faithfully served him in the capacity of shepherd; but the length to which our Review has extended, reluctantly compels us to bid the travellers adieu.

An Appendix is attached to Sir James Alexander's narrative, in which Messrs. Ogilby, Gray and Waterhouse indicate the new or rare zoological specimens collected in the course of the expedition, and Prof. Lindley those in Botany. Capt. Harris has also inserted at the end of his work, the admeasurements and description of the specimens he shot, and rechristens the *Aigoceros niger*, in honor of its discoverer, *Aig. Harrisii !*

THE

MAGAZINE OF NATURAL HISTORY.

AUGUST, 1859.

It is perhaps hardly necessary to remind our readers, that the ninth meeting of the British Aosociation is to be held at Birmingham during the latter part of the present month. This Association *contemplates no interference with the ground occupied by other Institutions. Its objects are,—To give a stronger impulse and a more systematic direction to scientific inquiry,—to promote the intercourse of those who cultivate science in different parts of the British empire, with one another, and with foreign philosophers,—to obtain a more general attention to the objects of science, and a removal of any disadvantages of a public kind, which impede its progress.* Happily conceived and most successfully carried into operation has been this union of the cultivators of science in each of its numerous departments, to co-operate in promoting one common object,—the diffusion and advancement of knowledge. It is in the highest degree gratifying to contemplate the powers which, in so brief a space, this institution has acquired. In the comparatively short period of eight years, it has appropriated many thousand pounds to the immediate purposes in which it had its origin: whilst the *locomotive* principle involved in its constitution, by which each of our provincial towns becomes in its turn a centre for diffusing the results consequent upon the researches of the previous year, cannot fail to stir up in different parts of the kingdom, a spirit of observation, and give an impulse to inquiry that must be attended with the happiest consequences.

There is one subject on which it may readily be supposed we feel a more than ordinary interest, and which, on the ground of its being an impediment to the progress of science, might, unless previous circumstances should render such a step unnecessary, fairly come under the consideration of the meeting at Birmingham: we allude to the present rates of postage. The proposed bill, if not rejected by the House of Peers, will indeed be a boon to the editors of scientific journals, who, with perhaps treble the amount of correspondence, have not one tenth the circulation enjoyed by periodicals of a more popular description. In its relations, however, at large, to the advancement of science, we are satisfied that the establishment of a uniform low rate of postage, especially if the example were followed by foreign governments, would exercise an influence to an extent it is perhaps hardly possible to conceive, until the measure shall have come into actual operation. Should the question not be disposed of prior to the forthcoming meeting, a petition in its favour from so numerous and influential a body as the British Association, might probably have weight with some members of the Upper House, and thus contribute to the furtherance of an object, which every one, having the interests of science at heart, must earnestly wish to be attained.

It may perhaps be thought that our critique upon the recently-published narratives of Captain W. C. Harris and Sir James Alexander, occupies a larger portion of our columns than the merits of their respective authors entitle them to have received, when other works, of *real* scientific importance, and therefore presenting a stronger claim on our attention, are as yet unnoticed in our pages. In giving, however, so prominent a place to the works in question, we have been guided by the circumstances under which they are introduced to the British public,—circumstances which, we fear, are calculated to invest the contents of these volumes with a degree of consequence that is spuriously acquired, and which, for many reasons it would be desirable to counteract.

Captain Harris's discovery of the beautiful new species of *Aigoceros*, which has recently been purchased by the British Museum; and his drawing and description of this noble antelope, in the last part of the Zoological Transactions, have rendered his name as a "naturalist" familiar to European zoologists. Whilst yielding to him the full share of praise to which he is entitled, for this interesting addition to the Fauna of South Africa, we cannot think the general aspect of his narrative justifies the Quarterly Review, through the medium of its widely circulating pages, in holding up his volume, for its *zoological* excellencies, as a pattern to future African explorers.

Sir James Alexander (the author of the second narrative) went out at the joint expense of the Government and of the Geographical Society; and though *he* may not have been puffed in the Quarterly, the value of his discoveries has been acknowledged, in the honor of knighthood being awarded him on his return.

After witnessing the exciting scenes which must sometimes arise in penetrating through parts of the African continent rarely or never previously trodden by European footsteps, we can readily conceive that the imagination may become so sensible to impressions, as almost unconsciously to blend, in some distant hour of retrospection, the realities of the journey with the adventurous and oft-repeated tales of the native hunters. But he, who has any sincere regard for the interests of Natural History, will bear in mind that the philosophical zoologist is anxious to acquire every possible information respecting the habits of animals which, in comparatively little known portions of the globe, come under the notice of the traveller; and that by the exercise of the most scrupulous fidelity in recording facts which really pass under his own immediate observation, he has it in his power essentially to aid the former in the discrimination of doubtful species, and in the establishment of those generalizations, which must ever be the higher objects of zoological science. We trust however that in future African narratives, an author will not be thought to have been deficient in the use of his eyes, or in his zeal for Natural History, even though he may not have brushed a lion from every bush, or heard the noise of the clicking horns of the pseudo rhinoceros.

Our geological readers will be gratified to see, by a communication from Mr. James De Carle Sowerby, that he has at length determined on the immediate continuation of the 'Mineral Conchology.' As we have already fully expressed our own opinion upon the general question to which his letter is directed, it is unnecessary that we should now make any further allusion to the subject. We may observe, however, that the foreign demand,—one fourth of the entire number,—is much greater than we should have supposed; and we are led therefore to consider the reasons still more urgent, why this demand should not be supplanted by a continental edition. We think the continuation of this work, and also the 'Species Conchyliorum' by Mr. G. B. Sowerby, of such importance, that it would afford us no slight satisfaction if their claims upon the resources of the British Association, were to be taken into consideration at the Birmingham meeting.

We have just received the 10th and 12th livraisons of the 'Poissons Fossiles,'—certainly two of the most beautiful which have yet appeared. Several plates are appropriated to the *Ichthyodorulites* and the teeth of *Hybodus*, but there is nothing bearing upon the subject of the supposed frontal spine in this genus. We perceive that the letter addressed to us by Prof. Agassiz, has been lithographed, and copies inserted in the livraisons of this work.

We have much pleasure in acknowledging the receipt of two portraits, one of Mr. Children, and the other of Mr. Spence, just published by Mr. Raddon, formerly a London Artist, but now a resident of Bristol. We can bear personal testimony to the faithfulness of the first, and we think highly of both as works of art.

Should Mr. Raddon meet with encouragement, we understand that he will publish portraits of other distinguished entomologists.

Letter from Mr.. James De Carle Sowerby, *on the subject of the French Edition of Mineral Conchology.*

Camden Town, July 27, 1839.

Sir,

It is hardly possible that I should remain silent after seeing, from the strictures you have made on the French edition of my 'Mineral Conchology,' the great interest you feel in the cause of that class of authors, whose works are similar in character to this publication. And feeling practically that unless some protection be afforded them by at least their *brother authors*, and the scientific portion of the public, they must soon be reduced to that small number who are sufficiently opulent to pay for the satisfaction they experience in their own minds, in being able to contribute to the advancement of knowledge, I beg to thank you for the manly way in which you have advocated what appears to me to be the true and lasting interest of science,—the encouragement of original publications, in opposition to the specious but fleeting advantages which cheap piracies possess. Such works only tend to convert what would otherwise be a flowing stream, into a stagnant lake, by cutting off the springs which had given it life.

Mons. Agassiz has, however, proposed to revise and correct the work in question; a proposal which, if carried fully into effect, would certainly be beneficial to the study of Geology: but in many instances it will be found that his translation perpetuates the errors of the original.

The following short history of the work will explain why revision and correction are necessary, and also account for the inequalities (justly observed by M. Agassiz) which occur in the execution of the different parts of it. This statement is not offered as an excuse for the errors, many of which have been corrected in the later volumes, but to show that such errors were mostly unavoidable at the time the work was in progress, and also as being likely to interest all who take a part in the discussion you have excited.

The first number of the 'Mineral Conchology' was published by the late Mr. James Sowerby, in June, 1812, two years before Lamarck's 'Systéme' appeared. The author being much more partial to the pictorial department, referred the principal part of the text to his two eldest sons (myself and Mr. G. B. Sowerby), while he executed the plates wholly himself: and he continued his task regularly, even during a long and painful illness, until within three or four days of his death in 1822, when a considerable portion of the fourth volume had been published. For some time previously to this sad event, it had fallen to my lot to describe the whole of the shells, and now I was obliged, in addition, to engrave the plates, a few only having been done in advance by my father. At the conclusion of the sixth volume, circumstances induced me to close the work, with a view to commencing it again in a form more agreeable to the wishes of geologists; and this intention has not been lost sight of, for a continual expense has been incurred in collecting new materials, and many thanks are due to my friends in responding to my request; still however the whole of the indexes are not published, and chiefly because I have been induced to give up my time towards forwarding the immediate objects of the leading geologists of England, by yielding them the best assistance my humble talent would permit.

The sale of the 'Mineral Conchology' has only been about

400 copies, above one fourth of which number has been sent abroad. The encouragement therefore for carrying on the work has hitherto been not very great; but your having directed public attention so strongly to it, and the anxious wishes of my friends, have stimulated me to determine now upon its immediate continuation, which I hope to effect in a month from this time.

I fear I have said too much about myself, but you will perhaps excuse me if I say a few words in reference to the translation. Mons. Agassiz has not always improved the generic characters by the alterations he has made. For instance, under *Solen* he says, "CAR. GEN. Bivalve........longitudinale," instead of transversely elongated. In *Ammonites* the word "dorsal" is inserted, whereas the siphon is truly ventral; &c. Neither has he embodied all the corrections given in the latter part of the work, indeed he seems not to have consulted the index in No. 105 in any case. There *Cassis* is referred to *Cassidaria; Modiola parallela* to *Plagiostoma elongatum; Helicina* to *Rotella; Helix carinatus* to *Pleurotomaria*, whether correctly or not, may be a question, but certainly it is not a *Cirrus*, (he proposes to name it *Cirrus Sowerby*); *Venus* to *Cyprina; Murex* to *Fusus;* and *Vivipara* to *Paludina:* though Agassiz has introduced several of these alterations as his *own*. Still, some of his remarks are good, and will not be lost sight of by me.

I am, Sir,
Your's, &c.
J. D. C. SOWERBY.

SHORT COMMUNICATIONS.

I TRUST I shall have the pleasure of seeing you in London in July, 1840; in the mean time I hope I shall be a little successful in procuring a few more objects in Natural History, worthy the notice of zoologists. The stores I now possess will occupy the Proceedings in the various branches of Zoology, for many years to come.—*H. Cuming.—Manila, Nov.* 18, 1838.

Lycopodium inundatum grows within a hundred yards of the railway station on Woking Common.—*George Luxford, A.L.S., &c.—London, July* 11, 1839.

THE MAGAZINE

OF

NATURAL HISTORY.

SEPTEMBER, 1839.

Art. I.—*Extract from the Proceedings of the Zoological Society, on the subject of the relation existing between the Argonaut-shell and its cephalopodous inhabitant.*

February 26*th*, 1839.—" A highly interesting and valuable series of specimens of thePaper Nautilus (*Argonauta Argo*), consisting of the animals and their shells of various sizes, of *ova* in various stages of development, and of fractured shells in different stages of reparation, were exhibited and commented on by Professor Owen, to whom they had been transmitted for that purpose by Madame Jeannette Power. Mr. Owen stated that these specimens formed part of a large collection illustrative of the natural history of the argonaut, and bearing especially on the long-debated question of the right of the cephalopod inhabiting the argonaut-shell to be considered as the true fabricator of that shell.

" This collection was formed by Madame Power in Sicily, in the year 1838, during which period she was engaged in repeating her experiments and observations on the argonaut, having then full cognizance of the nature of the little parasite (*Hectocotylus*, Cuv.), which had misled her in regard to the development of the argonaut in a previous suite of experiments described by her in the Transactions of the Giænian Academy for 1836.

" As this mistake has been somewhat illogically dwelt on, to depreciate the value of other observations detailed in Madame Power's Memoir, Mr. Owen observed, that it was highly satisfactory to find that the most important of the statements in that memoir had been subsequently repeated and confirmed by an able French malacologist, M. Sander Rang. Mr. Owen then proceeded to recapitulate these points.

" First, with reference to the relative position of the cephalopod to the shell, Madame Power, in her memoir of 1836, describes the siphon as being applied to the part of the shell opposite the involuted spire. M. Sander Rang, who made his observations on the argonaut in the port of Algiers, after having had cognizance of Madame Power's experiments, states, in his memoir published in Guerins's ' Magazin de Zoologie ' (1837), that in all the argonauts observed by him, the siphon and ventral surface of the cephalopod were invariably placed against the outer wall or keel of the shell, and the opposite or dorsal surface of the body next the involuted spire.

" Secondly, with reference to the relative position of the arms of the cephalopod to the shell, and the uses of the dorsal pair of arms, usually called the " sails," Madame Power had described these velated arms as being placed next the involuted spire of the shell, over which they were bent, and expanded forwards so as to cover and conceal the whole of the shell, and from which they were occasionally retracted in the living argonaut: she further made the important discovery that these expanded membranes were the organs of the original formation and subsequent reparation of the shell, and ingeniously and justly compared them, in her memoir of 1836, to the two lobes of the mantle of the cowry. These facts are described as the result of actual observation; but Madame Power, entertaining the common belief of the action and use of the velated arms in the sailing of the cephalopod, enters into considerations respecting their proportional strength in relation to that hypothetical office. The subsequent observations of M. Rang have fully confirmed the accuracy of Madame Power's description of the relative position of the so-called sails of the argonaut to the shell; and he has published some beautiful figures illustrative of this fact.[1]

"Thirdly, M. Rang confirms the discovery of Madame Power as to the faculty possessed by the cephalopod of reproducing its shell, but he was unable to preserve his captive argonaut sufficiently long to witness the complete deposition of calcareous matter in the new substance by which the argonaut had repaired the fracture purposely made in its shell.

"There are other observations in the original memoir of Madame Power, as, *e.g.* with respect to the flexibility and elasticity of the living shell of the argonaut; the great extensibility and pump-like action of the siphon in locomotion; the use of the velated arms in retaining the shell firmly upon the cephalopod; the great voracity of the argonaut; the constantly fatal results of depriving it of its shell; all of which statements are of great interest and novelty in the history of this problematical mollusc, and some of which likewise receive confirmation in the memoir of M. Sander Rang.

"Notwithstanding, however, that so many additional facts had been thus brought to bear on the relations subsisting between the argonaut-shell and its occupant, Mr. Owen observed that the leading malacologists who advocated the parasitic theory, had reiterated their conviction of its truth; and even M. Rang, though evidently biassed by what he had observed in favour of the opposite view, yields so much to the authority of M. de Blainville, as to declare himself in a state of the most complete uncertainty on the subject;—'Nous nous trouvons en ce moment dans le plus complète incertitude.'—*Loc. cit.*

"In this state of the question a collection of specimens of the argonauts, such as Madame Power had submitted to the examination of the Zoological Society, was of the greatest importance, if impartially and logically considered with reference to the points at issue; and Mr. Owen stated, that having studied this collection with much care, he should, in the first place, restrict himself to such observations and arguments as would naturally flow from an examination of the specimens themselves, apart from any history or statement with which they had been accompanied when first placed in his hands by Madame Power.

"The collection of argonauts,—cephalopods and shells,—preserved in spirits, included twenty specimens, at different periods of growth, the smallest having a shell weighing not more than one grain and a half, the remainder increasing, by small gradations, to the common-sized mature individual.

"Mr. Owen's first attention was directed to the relative position of the cephalopod to its shell. In every case it corresponded to that which obtains in the pearly nautilus, *the siphon and ventral surface of the cephalopod being placed next the broad keel forming the external wall of the shell, the dorsal surface of the body next the involuted spire or internal wall.* In most of these specimens the velated arms, which are nearest the involuted spire, were retracted; but in some of the larger examples they had been admirably preserved in a fully-expanded and flexible state, and in their natural position as envelopes of the shell.

[1] See No. 2 of the Sup. Plates to Mag. Nat. Hist.—Ed.

"A second fact, of considerable weight in the debated point of the parasitism of the argonaut, was afforded by this collection, viz., that in ten of the younger specimens there were no *ova* in the shell, but *the body of the cephalopod occupied the whole of the cavity of the shell, to which it accurately corresponded in form.* It was scarcely possible, Mr. Owen observed, to contemplate these specimens without deriving a conviction that the body had served as the mould upon which the shelly matter had been deposited; and with reference to the expanded membranes of the dorsal arms, to which the office of calcification was assigned by Madame Power and M. Rang, these, it should be remembered, were, in fact, essentially productions of the mantle, and possessed the same structure. It was only in the smaller specimens, however, that the body filled the shell; when the *ovarium* begins to enlarge the body is drawn from the apex of the shell, and the deserted place is occupied chiefly by the mucous secretion of the animal, until the *ova* are deposited therein.

"Mr. Owen then reminded the members present, that in former discussions on the nature of the argonaut, he had opposed to the parasitic theory an observation made by himself on a series of young argonauts, of a different species from the *Argonauta Argo*, all captured at the same time, and exhibiting different sizes and degrees of growth, viz., *the exact correspondence between the size of the shells and that of their inhabitants, every trifling difference in the bulk of the latter being accompanied with proportional differences in the size of the shells which they occupied.*[1] Madame Power's collection of young argonauts afforded the means of pursuing this comparison to a much further extent, and Mr. Owen had not only done so in reference to their relative size, but had also weighed the shell and its inhabitant separately of each specimen, from the smallest up to that in which the *ova* were fully developed in the *ovarium.* The following tabular view was given of the weights and measurements of ten of the alternate specimens in this series.

	A	B	C	D	E	F	G	H	I	K
	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.	grs.
Weight of the Shell	1½	3½[3]	3¾	4⅛	7¾	16½	17½	18	19	46
Weight of the Inhabitant[2] ..	18	21	24	41[4]	62	82½	165[5]	179	214	384
	lin.	lin.	lin.	lin.	lin.	lin.	lin.	lin.	lin.	lin.
Length of the Shell[6]	8	11	12	12¾	15	22½	23	24½	27	37

[1] Zool. Trans. Vol. ii. pt. ii. p. 115.

[2] In each case the cephalopod was removed from the shell, and both were placed on blotting-paper, to absorb the superfluous liquor; due care was taken to weigh each specimen under conditions as precisely similar as possible.

[3] The disproportionate ratio in the increase of the shell B arises from the additional portion of the shell being thicker and heavier in proportion to the previously-formed part, than in the subsequent periods of growth, so that the increase of weight is in a greater ratio than the increase of size.

[4] Clusters of ovisacs were conspicuous in D to the naked eye in the *ovarium*, which had already begun to expand under the sexual stimulus.

[5] The *ovarium* has now begun rapidly to enlarge.

[6] This admeasurement was taken in a straight line, traversing the longest diameter of the shell; it was found impracticable to give any constant admeasurement of the cephalopod, in consequence of the varying state of contraction and form of its soft and changeable body.

"Mr. Owen stated that the correspondence in the progressive increase of inhabitant and shell, though not strictly conformable, was so close as to present, in his opinion, an insurmountable objection to the parasitic theory. In every instance the inhabitant of a larger shell weighed more than that of a smaller one, even where the difference in the weight of the shell was but half a grain; while the few irregularities observed in the progressive increase of the two could in each case be accounted for, either by the enlargement of the *ovarium*, which added to the weight, without a proportional increase to the superficies of the individual; or, on the other hand, to a more rapid increase in the thickness of the shell at the earlier periods of its growth, or to a greater development of the angular processes of the mouth of the shell, as an individual peculiarity. In a collection of young parasitic hermit-crabs (*Paguri*), the smaller specimens are commonly seen in shells of various species, and frequently very disproportionate bulk; the contrary is the case in the young of the argonaut. 'Now these young cephalopods (Mr. Owen observed) grow, like the rest of the class, with great rapidity; the differences in the size of many of the young argonauts in question corresponded with differences of age of a few days at the utmost;' so that, if the accuracy of the above observations made by Mr. Owen on two series of two distinct species of argonaut, be admitted,[1] 'a naturalist entertaining the parasitic theory, must be compelled to suppose that the young *Ocythöe* or cephalopod is engaged in a perpetual warfare with the hypothetical nucleo-branchiate constructor of the argonaut-shell, which shell, to produce the correspondences above described, the young *Ocythöe* must change two or three times a week, if not every day. And nevertheless, although each prolific cephalopod of the argonaut sends into the world hundreds of little ones that must be so accommodated, and although, on the parasitical hypothesis, hundreds of the hypothetical nucleo-branchiate constructors of the argonaut-shell ought to swarm about the port of Messina, where Madame Power obtained the specimens with which she stocked her molluscous vivarium, and notwithstanding that M. de Blainville has called the special attention of naturalist-collectors to the hypothetical true constructor of the argonaut-shell, as a chief desideratum in Malacology; and lastly, notwithstanding this hypothetical nucleo-branchiate mollusc ought, on M. de Blainville's theory, to be nearly allied to the *Atlanta* and *Carinaria*, and therefore a floating pelagic species, generally to be met with on the surface of the ocean;—yet had it still evaded the observation of the numerous active collectors engaged in exploring the zoological riches of the Mediterranean in different parts of its coasts.'

"It is in vain to repeat, with reference to the non-discovery of any other inhabitant of the argonaut than the cephalopod,—'Ce que ne peut être rangé au nombre des argumens, parceque ce qui n'as pas eu lieu jusqu' à un moment déterminé, peut se montrer le moment suivant;' that 'what is a fact at the present moment, viz. the non-discovery of the hypothetical true constructor of the argonaut, may be no longer a fact at the moment after.' Such an observation could only possess argumentative force in the absence of other facts showing the high degree of improbability that a floating pteropod or heteropod, sufficiently abundant to have supplied all the argonauts of the Mediterranean with their shells, could have escaped observation.'

[1] They accord with the statement of Poli, and with the observations of M. Prevost, founded on a suite of specimens of the argonant from the size of one and two inches to three or four inches. These are quoted by M. de Blainville in his memoir of 1837 (p. 10), but without the deductions which I have drawn from the same facts.

"Mr. Owen then proceeded to state that he had dissected every specimen in the present collection, in which the absence of *ova* in the shell left the sex doubtful, and that they all proved to be females; this fact rendered it allowable to conjecture that the calcifying brachial membranes, and consequently the shell, might be sexual characters, and peculiar to the female. But, he argued, 'the known paucity of males as compared with females in other species of cephalopods, rendered the conjecture to a certain degree problematical. Should it, however, be hereafter proved that the male argonaut possessed neither a shell nor the organs for secreting it, this fact would not render the hypothesis of the parasitism of the female, which does possess the calcifying membranes, at all the less tenable.'

"With respect to the shell of the argonaut, Professor Owen observed that 'any argument founded on observations on the dried shells in cabinets, could tend only to mislead the observer. Madame Power's specimens having been recently collected, and preserved in alcohol of not too great strength, manifested much of the original transparency and elasticity of the living shell. It was obvious, therefore, that light would act in developing the coloured spots on the contained body of the argonaut; and this fact is important in reference to the seventh argument in M. de Blainville's memoir of 1837, p. 4., in which he asserts that 'those parts of molluscs which are covered with a shell are constantly white or colourless, but the mantle investing the body of the argonaut is highly coloured.' Now, if M. de Blainville's object had been to prove that the *Ocythöe* did not inhabit a shell at all, the force or purport of this observation would have been intelligible; but the question is not whether the body of the *Ocythöe* is or is not covered with a shell, but whether it makes or steals that shell. But perhaps the argument, founded on the supposed opacity of the argonaut shell, was brought forward merely to prove, that up to a certain period of its existence the *Ocythöe* was naked, and that the argonaut-shell was taken possession of only for some temporary purpose, as for oviposition. The observations, however, which I published in 1836 (Cycl. of Anat., Art. Cephalopoda, p. 544), proved that the young cephalopod of the argonaut was provided with a shell prior to the period of oviposition, and that the body entirely filled the shell at that period. The present collection still more satisfactorily establishes the fact, that the argonaut-shell is not assumed by the cephalopod for a temporary purpose; for the shell which protects the young would be wholly inadequate as a nidus for the ova of the mature animal; and for what purpose, then, on the parasitic theory, is the shell assumed by the cephalopod before its *ovarium* has received the stimulus of sexual development?'

"In Madame Power's recently-collected specimens the shell, after a few hours' soaking in water, regained so much of its original flexibility as to demonstrate its power of varying its form with the varying bulk arising from the respiratory and locomotive actions of the inhabitant.[1]

"The inductions, therefore, which the present collection of argonauts of different ages and sizes legitimately sustained, were in exact accordance with Madame Power's belief that the cephalopod was the true constructor

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[1] In M. de Blainville's Letter on the Parasitism of the Argonaut (1837), the following assertion is offered as the tenth argument:—'La mode de locomotion et de respiration de ces animaux par la contraction et la dilatation alternatives du sac, ne permet pas d'admettre qu'il y ait adhérence de la peau avec la coquille, à moins que de supposer que celle-ci soit flexible et élastique, et suive tous les mouvemens de celle-la, ce qui est bien loin de la vérité.'

of the shell, while no contradictory inference had been, or could be, deduced from an examination of the specimens themselves.

"With reference to the second suite of specimens, viz. the *ova* of the argonaut in different stages of development, Mr. Owen entered into a detailed account of the new and interesting facts which they revealed. In the *ova* most advanced, the distinction of head and body was established; the pigment of the eyes, the ink in the ink-bladder, the pigmental spots on the skin, were distinctly developed; the siphon, the beak,—which was colourless and almost transparent,—and the arms, were also discernible by a low microscopic power; the arms were short and simple; the secreting membranes of the shell were not developed, and of the shell itself there was no trace.

"In the second memoir of 1838, published by Madame Power, it is stated that the young argonaut is excluded from the egg, as such, but naked, twenty-five days after oviposition, and that in ten or twelve days more she discovered that they had formed their little shell. Mr Owen regretted that there were no specimens in the present collection exhibiting the commencing formation of the shell;—these were still a desideratum: but he proceeded to say, that the observations on the development of the *ova* of the *Mollusca* in general, which science possessed, would be greatly overstated if one per cent. of the known species of *Mollusca* were allowed to have been subjected to such examination; he could not therefore admit, or indeed understand, the philosophy of regarding the period of the development of a mere dermal production, like the shell, as being subject to so precise a law, that its non-appearance in an embryo-mollusc, prior to its exclusion from the egg-covering, was to be considered proof positive that such mollusc should never thereafter have the power of secreting a shell. Now it was evident, from the observation of Madame Power's specimens, independently of any statements respecting them, that the expanded membranes of the dorsal pair of arms are not formed until the development of the embryo has far advanced: if, therefore, these membranous arms be, as Madame Power states, the organs of the secretion of the shell, that shell may not be formed until after the exclusion of the young argonaut.

"The proof that the velated arms possess, like the expansions of the mantle of the *Cypræa*, a calcifying power, was afforded by the third series of specimens on the table of the Society. These consisted of six shells of the argonaut, from which Madame Power had removed pieces of shell while the argonauts were in life and vigour, in her marine vivarium. One of the shells had been removed from the animal ten minutes after the fracture; another argonaut had lived in the cage two months after being subjected to the experiments: the remaining specimens exhibited intervening periods between the removal of a portion of the shell and its reparation. The fractured shell first described had the breach repaired by a thin, transparent, membranous film; the piece removed was taken from the middle of the keel. In a second specimen calcareous matter had been deposited at the margins of the membrane, where it was attached to the old shell. In a third specimen, in which a portion of the shell had been removed from the keel, about two inches from the mouth of the shell, the whole breach had been repaired by a calcareous layer, differing only in its greater opacity and irregularity of form from the original shell. In the specimen longest retained after the fracture, a portion had been removed from the margin of the shell; here the new material next the broken edge presented the opacity characteristic of the repairing substance, but the transition of this substance into the material of the shell, subsequently added in the ordinary progress of growth, was so gradual, in the resumption in the repairing material of the ordinary clearness and striated structure of the shell, that it was impossible to doubt but that the reparation, as well as the subsequent growth, had been the effects of the same agent. The repaired parts of the shell re-acted precisely like the ordinary shell with nitric acid.

"Mr. Owen then observed that the specimens submitted to the meeting by Madame Power, possessed in themselves the means of confirming or refuting her theory of the formative organs of the shell of the argonaut; for if the shell were secreted, as in gasteropods &c., by the edge of the mantle covering the body, the new material by which the breaches of the shell had been repaired, should have been deposited on the inside of the fractured edge; but, on the contrary, it was clearly obvious in two of the specimens, that the new material had been laid on upon the outside of the fractured part—as it must have been, supposing the *vela* or membranous arms to be the calcifying organs.

"Mr. Owen then recapitulated, as follows, the evidence which, independently of any preconceived theory or statement, could be deduced from the admirable collection of *Argonauta Argo*, due to the labours of the accomplished lady who had contributed so materially to the elucidation of a problem which had divided the zoological world from the time of Aristotle.

"1st. The cephalopod of the argonaut constantly maintains the same relative position in its shell.

"2nd. The young cephalopod manifests the same concordance between the form of its body and that of the shell, and the same perfect adaptation of the one to the other, as do the young of other testaceous molluscs.

"3rd. The young cephalopod entirely fills the cavity of its shell; the fundus of the sac begins to be withdrawn from the apex of the shell only when the *ovarium* begins to enlarge under the sexual stimulus.

"4th. The shell of the argonaut corresponds in size with that of its inhabitant, whatever be the differences in the latter in that respect. ('The observations of Poli, of Prevost, and myself, on a series of *Argonauta rufa* before cited, are to the same effect.')

"5th. The shell of the argonaut possesses all the requisite flexibility and elasticity which the mechanism of respiration and locomotion in the inhabitant requires; it is also permeable to light.

"6th. The cephalopod inhabiting the argonaut repairs the fractures of its shell with a material having the same chemical composition as the original shell, and differing in mechanical properties only in being a little more opake.

"7th. The repairing material is laid on from without the shell, as it should be according to the theory of the function of the membranous arms as calcifying organs.

"8th. When the embryo of the argonaut has reached an advanced stage of development *in ovo*, neither the membranous arms nor shell are developed.

"9th. The shell of the argonaut does not present any distinctly defined nucleus.

"Mr. Owen finally proceeded to consider the validity of the best and latest arguments advanced in favour of the parasitism of the cephalopod of the argonaut, and commenced with those published in the Proceedings of the Zool. Society for 1836, p. 122.

"Mr. Gray states, 1st. 'The animal has none of those peculiarities of organization for the deposition, formation, and growth of the shell, nor even the muscles for attaching it to the shell, which are found in all other shell-bearing molluscs; instead of which, it agrees in form, colour, and structure with the naked molluscs, especially the naked cephalopods.'

"To this statement it need only be replied, that the cephalopod of the argonaut possesses two membranous expansions, having the same structure as the calcifying processes of the mantle in the testaceous molluscs, and which Madame Power and M. Sander Rang compare to the lobes of the mantle of *Cypræa;* and that the cephalopod in question, instead of agreeing in structure with the naked cephalopods, differs from them precisely in the presence of conspicuous and largely-developed organs, which present the closest correspondence in form and structure with the calcifying membranes of the cowries and other testaceous molluscs.

"2ndly. Mr. Gray asserts, 'that the shell of the argonaut is evidently not moulded on the body of the animal usually found in it, as other shells are.'

"This assertion, like the preceding, is directly opposed to the fact. But at the time when it was recorded in our Proceedings, Mr. Gray had probably not examined the young argonaut. Yet the analogy of other *Testacea* might have indicated to him that it was essential to see the young mollusc before the degree of correspondence between the animal and its shell could be definitively pronounced upon. Most shell-bearing gastropods, like the nautilus and argonaut, withdraw their bodies in the progress of growth from the contracted apex by which their shell commenced, and differ accordingly in form from that of the original cavity of their shell. The mode in which the vacated part of the shell is dealt with in different molluscs is extremely various, and reducible to no common law; in the genus *Magilus*, *e. g.* it is solidified: in some species of *Helix*, *Bulinus*, and *Cerithium*, the deserted part of the shell, after being partitioned off, is decollated: in the *Nautilus*, &c., it is camerated. Was it at all improbable that in the argonaut some other condition of the vacated spire of the shell should be manifested? Why should it not be made subservient to the generative economy of the species? Yet, because it is neither solidified, decollated, nor camerated, it is argued in the third place, that the argonaut shell must have been secreted by some other mollusc than the cephalopod usually found in it.

"4thly. Mr. Gray observes, 'the young shell of the just-hatched animal, which forms the *apex* of the shell at all periods of its growth, is much larger (ten times) than the eggs contained in the upper part of the cavity of the argonaut.' The argument here founded on a comparison of the size of the supposed nucleus of the argonaut-shell with that of the ovum of the *Ocythöe*, has been quoted with approbation by M. de Blainville; but granting that the shell of a testaceous mollusc is always formed before the embryo is excluded from the *ovum*, (which, as I have already shown, is a postulate, and not an established law) the force of an argument for the parasitic theory, based on this postulate, wholly depends upon another assumption, viz. that the *ovum* of a mollusc never enlarges after it has quitted the parent. Now, the first observation which the promulgator of this argument had the opportunity of making on one of our commonest littoral *Testacea*—the whelk, proved to him that the molluscous *ovum* in that species does enlarge after exclusion, and Mr. Gray was subsequently compelled to admit 'that the size of the nucleus would not offer any difficulty with respect to the *Ocythöe* being the maker of the shell which it inhabits.[1]'

"Whether the other arguments founded by Mr. Gray upon the form of the body, and the want of perfect adaptation or adhesion of the body to the shell, &c., are unanswerable, as that experienced Conchologist states that he considers them to be, must depend upon the degree of weight which the objections above advanced are allowed to carry.

"With respect to the conclusions as to the parasitism of the *Ocythöe*, drawn from observing the relation of the cephalopod to its shell, their in-

[1] Magazine of Natural History, New Series, 1837, p. 248.

sufficiency depends upon the circumstance that in forming them the condition of the mature argonaut has been considered as applicable to every period of its life, and the arguments Nos. 1 and 2 being founded upon that supposition, thereby fall to the ground. In the argument for the parasitic theory deduced from the development of the argonaut-shell, a general rule, applicable to an extensive primary division of the animal kingdom, is assumed from the result of extremely scanty observations, which are altogether inadequate to its establishment.

"'In the Proceedings of the Zoological Society for 1837, Mr. Charlesworth proposed an argument in favour of the parasitism of the *Ocythöe*, which has the merit—not possessed by those above discussed—of being founded on the observation of a new fact in the natural history of the argonaut, viz. that breaches in the shell were repaired by a substance agreeing in every respect with the original shell. Mr. Charlesworth has, however, since admitted that this fact is not valid as evidence of the parasitism of the cephalopod; and it is now proved that the transparent film observed by M. Rang to be deposited by the *Ocythöe* over the fracture of the argonaut-shell, would have been converted into a true shelly material if the subject of his experiment had survived for a longer period.

"'M. d'Orbigny,[1] on the other hand, derived from his observations of the *Argonauta hians*, made during his voyage to South America, a belief in the fallacy of the parasitic theory; the principal argument of novelty which he adduces is founded on the integrity of the delicate and flexible margins of the shell in which the supposed parasite was lodged. M. de Blainville has refused his assent to the validity of this argument, on the grounds that the rightful owner of the argonaut-shell might have been very recently expelled from the specimens described by M. d'Orbigny. As I have elsewhere[2] considered this objection I shall not dwell further upon it, but merely observe that the experiments of Poli and Ranzani, deduced by M. d'Orbigny in evidence of the formation of the shell *in ovo*, are more than suspicious, and are inadequate to enforce a conviction of the truth of the non-parasitic theory.

"'The more recent arguments of M. de Blainville[3] in favour of the parasitism of the argonaut, repose partly on statements which are not based on facts, and partly on the interpretation of actual facts. The false facts are the following: 1st. That the same species of cephalopod is not always found in the same species of shell. 2nd. That the natural position of the animal in the shell varies, the back of the animal being sometimes next the outer wall of the shell, sometimes next the involuted spire. 3rd. That the animal does not occupy the posterior part of the shell—(this being true of the more mature animal only). 4th. That the form of the animal and of its parts offers no concordance or analogy with the shell. 5th. That the shell is too opake to have permitted the influence of light in the development of the coloured pigment in the mantle of the cephalopod of the argonaut.—6th. That it is very far from being true that the argonaut-shell possesses the flexibility and elasticity requisite to harmonize with the locomotive and respiratory movements of the animal. 7th. That the animal suffers no appearance of inconvenience when deprived of its shell. 8th. That a cephalopod has been discovered in the Sicilian seas like that which inhabits the argonaut, but without a shell.

"'With respect to the first six of these statements, it need only to be observed that they are abundantly disproved by the series of specimens now on the table.

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[1] Voyage dans l'Amérique Méridionale, Mollusques, p. 10.

[2] Zool. Trans. vol. ii. p. 114. [3] Ann. d'Anat. et de Physiol. Mai, 1837.

"'As to the seventh statement, its value will be manifest, when the account given by Mr. Cranch, on which it is founded, is carefully analysed and considered. Mr. Cranch's observations, as quoted by Dr. Leach, amount simply to this:—'When the cephalopod (*Argonauta hians*, Solander, or *Ocythöe Cranchii*, Leach) was adhering, with the *vela* retracted, to the side of the vessel of sea-water in which it was placed, the shell could be removed;' in other words, there was no muscular adhesion. 'In this state of captivity some of the cephalopods lost the power of retaining hold of the shell; one which had thus left its shell lived several hours, and showed no desire to return.'

"'Now had the *Ocythöe* been a parasite,—supposing that it had ever before obtained its shell by placing its body in one ready-made,—and had it been in the habit of repeating this act during its whole period of growth, as it must have done to produce the concordance in size which the observations of Poli, Prevost, Madame Power, and myself, establish as a general fact;—then the probability would have been greater that the cephalopod would have returned to, and so manœuvred as to regain possession of, its shell: the observation of such a fact would have told as strongly for the parasitic theory as the phænomena witnessed by Mr. Cranch testify, in my opinion, against it. I have repeated Mr. Cranch's experiment with a true parasite,—the common hermit-crab of our coasts; and I would invite any naturalist to remove a parasitic *Pagurus* from its shell, and place it, with the empty shell, in a basin of sea-water, and see whether the parasite will manifest no desire to return his body into its accustomed hiding place. In my experiments, the *Pagurus* lost no time in regaining possession of its shell. As Mr. Cranch's argonaut survived four hours without showing the least disposition to return to its shell, instead of concluding therefrom that it had stolen it, I infer that such a mode of acquiring a shell was totally foreign to its instincts and economy,

"'Madame Power states that the constant result of depriving the argonaut of its shell, is a gradual loss of vital power, and ultimate death within a few hours at furthest. The experiment of M. Sander Rang was followed by the same result.

"'With respect to the eighth statement, I must say that the weakness of the side of the question advocated by M. de Blainville is clearly betrayed by the dubious notice of the *Ocythöe* by M. Rafinesque having been pressed into the service of the parasitic theory in the disguise of an established fact. M. Rang[1] informs us, that the entire description of the much talked-of *Ocythöe*, as given by its discoverer, is as follows:—'Appendices tentaculaires au nombre de huit, les deux supérieures ailes intérieurement, à suçoirs intérieurs, pedonclés, réunis par l'aile latérale, sans aucune membrane à leur base.' And amongst other just observations on the inadequacy of this meager indication, to the support of the theory that the cephalopod of the argonaut naturally existed without its shell, and was identical with the *Ocythöe* of Rafinesque, M. Rang adds that the description of the *Ocythöe* above cited is equally applicable to any of the species of *Octopus* to which M. Férussac has applied the term '*Vélifères*.'

"'I now come to the consideration of the arguments for the parasitism of the cephalopod of the argonaut, founded by M. de Blainville on undoubted or admissible facts. The first of these arguments reposes on the often-repeated statement of the absence of any organ for muscular adhesion in the cephalopod of the argonaut. I confess, that when I discovered the cephalopod of the *Nautilus* to be fixed to its shell by two strong muscles, and

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[1] Guerin's Magazin, p. 31.

that the corresponding muscles in the argonaut were very feebly developed, and lost in the mantle, the absence of analogy between the two cephalopods inclined me, in 1832, to consider as probable the parasitic theory; subsequently, however, the consideration of the absence of muscular adhesion in the *Carinaria*, and of any adhesion at all in the *Annelides* which secrete shells, deprived this argument of much of its force.

"'Secondly, M. de Blainville observes that 'the muscular integument of the body of the cephalopod is not thinner than that of the naked species, contrary to that which exists in all conchyliferous molluscs.' But what mollusc, we may ask, has its whole body covered with a shell so delicate, so transparent, so flexible and elastic, as is the shell of the living argonaut?[1]

"'The dorsal border of the mantle is not free,' observes M. de Blainville. Granted: and this would be undoubtedly strong proof that the cephalopod of the argonaut did not secrete its shell, if it were not provided with other organs for the purpose. In the pearly nautilus, on the other hand, which has no veliferous arms, the dorsal border of the mantle is so produced that it can be extended from the involuted spire, which it habitually covers, over the whole exterior of the shell, just as the argonaut invests its shell with the transparent films of the dorsal pair of arms: the analogy between these two testaceous cephalopods is perfect, as regards their relative position to the shell, but does not extend to their organs of secreting or of adhering to the shell.[2]

"'The animal does not occupy the posterior part of its shell. This I have ranged in the category of false facts, because the statement is only applicable to the young animal. But granting it were true, as well might we argue the *Helix decollata* to be a parasite, because it does not, like *Magilus*, retain and fill with shelly secretion the deserted spire of its shells; or that *Magilus* was a parasite because it did not secrete *septa* at regular distances, like the *Nautilus*, or *vice versâ*, as argue the argonaut to be a parasite because it fills its vacated spire with mucus and with eggs.'

"Finally, Mr. Owen proceeded to state in detail the points which still remained to be elucidated in the natural history of this most interesting mollusc. Among other experiments he suggested that the young argonaut should be deprived of one of the velated arms, and preserved in a marine vivarium, with the view to determine the influence which such mutilation might have on the future growth of the shell: but in proposing further experiments, and while admitting that the period of the first formation of the shell yet remained to be determined, Mr. Owen stated that he regarded the facts already ascertained to be decisive in proof that the cephalopod of the argonaut was the true fabricator of its shell."

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[1] M. d'Orbigny truly states, "Les coquilles de l'argonaut n'ont pas la contexture vitreuse des carinaires et des atlantes; elles sont, au contraire, demi-cornées, flexibles; et nous n'en trouvons l'analogue dans aucun autre des mollusques."—Loc. cit. p. 11.

[2] "Messrs. de Blainville and Gray conceive me to be in error in the position I have assigned to the pearly nautilus in its shell, but their arguments on this point are based on the same hasty generalization that has led to the hypothesis of the parasitism of the argonaut. Judging from the analogies which have been cited in support of their views, it would have been equally reasonable to have called in question the accuracy of the relative position which I have assigned to the soft parts of *Terebratula* and *Orbicula*, viz., with the ventral surface applied to one valve, and the dorsal surface to the other, because in the lamellibranchiate bivalves one valve corresponds to the right, and the other to the left, side of the animal.

ART. II.—*Illustrations of the Geology of the South East of Dorsetshire.* By THE REV. W. B. CLARKE, A.M., F.G.S.

(*Continued from page* 401).

HAVING taken up thus much space with the pebbles contained in the conglomerate, I now proceed with an examination of the western side of Studland Bay, and shall follow the course of the shore northwards.

From the end of the chalk the cliff continues a little farther to the west, but in a recess or nook more backward than the general direction of the chalk, where the beds composing it are nearly altogether hidden by an accumulation of fallen masses, and a profusion of vegetation, which, however, is decidedly such as to mark a chalky substratum. Indeed, chalk-plants are there in great abundance and perfection; so that we may conclude that the surface of the chalk is not much obscured by other soils. At 22 paces, however, from the chalk, there is a mottled clay under the cliffs—and at 82 paces beyond, the east and west line terminates.

The following measurement will give the character of the cliff from the nook where the junction of the plastic clay beds and the chalk cliffs takes place.

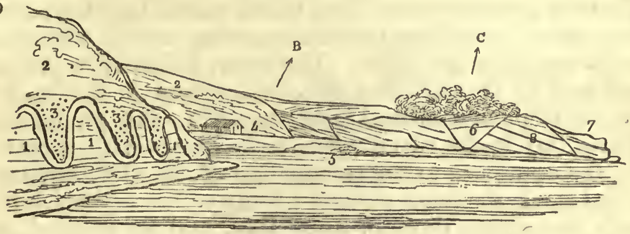
Station No.	1,	73	paces,	path up the cliff, (white sand).
	2,	87	„	boat-house. (White sand).
	3,	108	„	yellow sand at bottom of cliff.
	4,	124	„	road.
	5,	141	„	crack through the cliff from W. to E.
	6,	132	„	gate.
	7,	100	„	yellow clay begins.
	8,	28	„	end of clay.
	9,	17	„	blue clay.
	10,	20	„	end of clay. (Cave in the sand above).
	11,	22	„	red sand.
	12,	23	„	Red Rock end.
	13,	23—24		

In the above enumeration, where no mention is made, the intermediate substance is sand of various degrees of hardness, and changing from white and yellow to red and brown.

The clays also and sands all rise from under each other, being stratified at an angle of about 24°, dipping to the north. At station 4 there is a layer of chalk, embedded in earth and sand, apparently a natural deposit, immediately over the sea beach (which consists of chalk-flints and masses of ferruginous sand rock), but I am unable to account for it, as it does not look like an accidental or a designed accumulation of artificial materials, but like a natural one.

The following diagram (fig. 50) shows the appearance of the coast, and the localities mentioned in the preceding measurement.

50



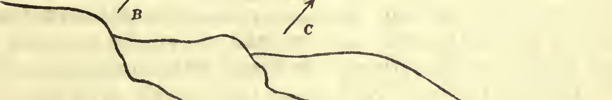
Coast from the Chalk to the Red Rock, Studland Bay.

1, Chalk. 2, Sand. 3, Conglomerate, based on arched iron stone. 4, Boat-house. 5, Raised beach? 6, Ravine leading to Studland. 7, Red Rock end. 8, Clay, yellow sand, mottled sand, ferruginous sand, bright red and yellow sand.

At B and C, fig. 50, (stations 5 and 6 of the enumeration) —also marked in the map between C and Red Rock end,— the arrows point out the occurrence of two cracks through the cliffs, up which there is entrance to the village of Studland. The appearance of these cracks from the beach, and also from the sea off Old Harry, is shown in figs. 51 and 52. It is very evident that they are not mere excavations of the sand, but produced by the action which caused the inclination of the beds.

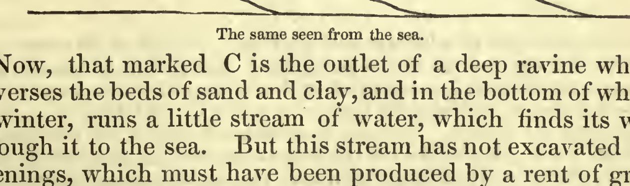
Cracks in the Studland Sand-cliffs.

51



Plan of the ravines.

52



The same seen from the sea.

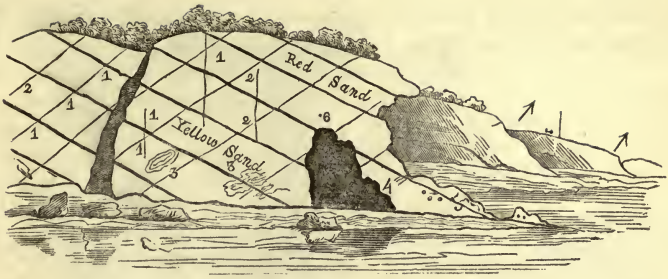
Now, that marked C is the outlet of a deep ravine which traverses the beds of sand and clay, and in the bottom of which in winter, runs a little stream of water, which finds its way through it to the sea. But this stream has not excavated the openings, which must have been produced by a rent of great violence, as the banks are nearly perpendicular, and the top not much wider than the bottom. It is the first of the four similar rents, which occur along this shore, and which are of precisely the same character as the chines of the coast beyond Poole Head, and of the back of the Isle of Wight, although of less importance as a feature of landscape.

There is another feature also which marks the character of these cracks, as well as the chines,—they are all vertical on the side opposite the chalk. The other, which is in the supposed line of descent from the chalk, slopes to the crack.—Thus the slope at Studland is to the north; that on the coast of Poole Bay to the east: this exactly agrees with theory.

At the approach to the termination of the cliff, known as the Red Rock, the sands assume a lively yellow and red colour, closely resembling those of Alum Bay, and are mottled in a variety of forms, the thickness of the beds being about 25 feet. Mr. Lyell has mentioned "concentric stains" upon these sands, "exactly imitating the transverse and oblique sections of trunks of trees."—(G. T. ii. 283). These, however, are not mere '*stains*,' but were produced by different-coloured particles of sand evidently collected around a nucleus, just as they might be formed round a stone, or any other small object, on the present sea-beach,[1] and are a portion of the solid substance of the rock itself, which has been formed by the hardening of the collected sand. The stratification is very perfect, but the rock (for such it may be called) has been subjected to some after-action, since the consolidation of the beds; for the strata are traversed by lines in an opposite direction, which divide the rock (without separation) into superficial parallelograms; these lines ranging through the 'concentric' curves, and occasionally exhibiting, on a minute scale, all the characteristics of a fault,—or rather, perhaps, of a shifted mineral vein. In figs. 53, 53 *a*, 53 *b*, 53 *c*, without attending very minutely to the picturesque or proportional effect, I have represented the bedding lines and joints; and below, one of the shifts or faults, which occurs just above the opening hollowed by the sea, together with some of the concentric curves and a fault in the sand-rock, near the church at Studland.

[1] All sandstones, of whatever geological age, exhibit similar concentric curves. In the new red this is particularly exemplified, and as one good example is sufficient, I would mention the columns of the porticoes of that very magnificent building, the Custom-house at Liverpool, which strikingly illustrate the subject. The rock from which they are built was quarried near the town. So also the old red sand-stone, and the grey-wacké, occasionally show equally striking examples. Various instances of curves which were produced round a nucleus, are traceable in the stones quarried for pavement or building materials in Shropshire, Hereford and Monmouthshire, and may be well seen in the pavement at Ludlow and Leominster, especially in Church street in the latter town.

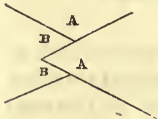
53



Studland Red Rock.

1, Strata lines 2, Joints. 3, Concentric curves.—(53 *b*). 4, Cave. 5, Tubes.
6, See fig. 53*a*.

53 *a*

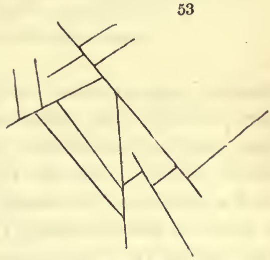


Double shift in the joints at 6, fig. 53, magnified.

53 *b*

Concentric curves.

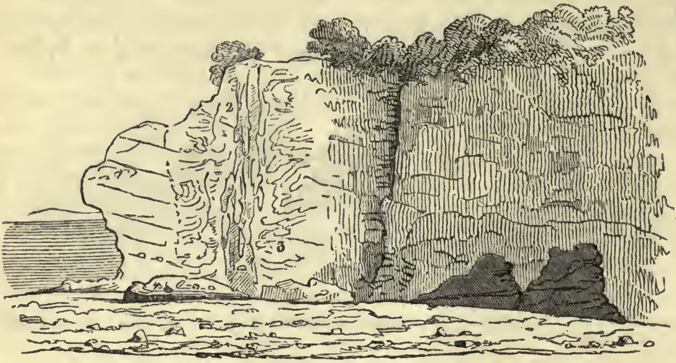
53



Joints in the sand rock behind Studland Church. The joints are lighter coloured.

The shore is strewed with fallen masses of the rock, which are exceedingly hard; and this is also the case with the surface of the sand throughout nearly all the cliff, for inscriptions made in 1809, were quite fresh and perfect in 1837; so that it does not decay rapidly from atmospheric causes. At the extremity of the Red Rock, and in the fallen masses, there are a great number of cylindrical tubes, corresponding, as Mr. Lyell observes, with those of the Isle of Wight and Sussex, but of which he offers no explanation. They are, certainly, extremely curious, but I think the circumstance is capable of solution. On turning round the end of the Red Rock, which projects a little beyond the rest of the coast, the surface of the cliff, in a corner facing the north, is seen perforated by these tubes, many of them of enormous length, and all traversing the rock, *not* perpendicular to the *strata*, *but* to the *horizon*. In two or three instances, these tubes occur in a sort of groove (fig. 54), which descends the whole cliff; and on examining them, the interior is found to be coated with a hard oxidized crust, the sand on each side appearing as if it had been sucked downwards towards the tubes. It would,

54



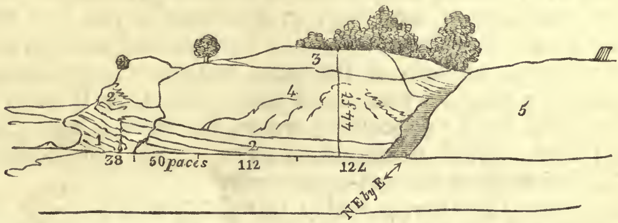
North side of the Red Rock.

1, Tubes in fallen masses. 2, Tubes in grooves in the rock.

thence, appear, that they were produced by the action of water, probably rain water, which had filtered down and through the sand when softer, and coated the surface of its channel with minute particles of iron washed out of the sand. I am not altogether theorising here, for on examining, last winter, a cutting made through Booker's Hill, near Lytchett, (where the strata are plastic clay sands), I found that the rain had dripped down the surface of the banks of the new road, and had entangled in its descent particles of sand, in such a way as to have formed tubes exactly similar to those at Studland, through which (of course, near the surface of the section) the water had run away without spreading. I cannot but conjecture, therefore, that such was the origin of the tubes at Studland, though their date must have been long prior to the present order of things, yet, clearly, since the rock had assumed its present inclined position. If this explanation be held insufficient, we must then have recourse to electrical agency, and it might be easy to find traces of minute veins which seem to have traversed the rock, and which would justify the belief of some electrical or magnetic influence subsequent to, or contemporaneous with, the mechanical changes that have affected it. Only, in this case, however similar the *tubes* may be to the *fulgorites* which are formed by lightning in the sands of Prussia, the vertical direction of the tubes would not accord with that of the supposed electric veins and threads, and it seems scarcely probable that such a development of electrical agency should have taken place, either here or at Shanklin. On the whole, therefore, I am inclined to believe, that these cylindrical tubes are merely rain-channels.[1] The spot where they so thickly occur is represented by the letter A, at the extremity of the cliff in the following section (fig. 55), and the continuation of which is seen in fig. 56.

From the Red Rock to the Preventive Station.

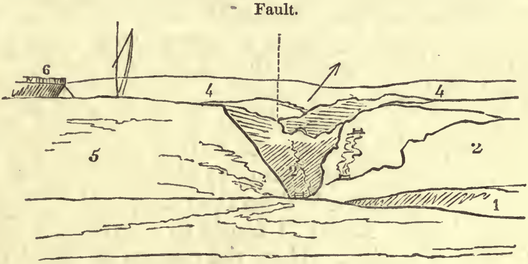
55



1, Red Rock.—Yellow sandstone rock. 2, Red sand rock. 3, Red clay and sand. 4, Indigo clay, with lignite, 18 feet. 5, Yellow sands and clays.

Fault.

56



1, Sand hills. 2, Ravine. 3, Clay and yellow sand. 4, Chalk Downs. 5, Yellow sand and sandstone. 6, Preventive house. The bearing indicated by the arrow is S. W. by W.

[1] The cylindrical tubes of the Isle of Wight are capable of being separated from the green sand in which they occur, but the tubes of Studland cannot be separated; they are evidently portions of the sand-rock itself, whereas the Isle of Wight tubes appear to be casts of some vegetable body.—Such also appears to be the case with certain *calcareous* tubes in the Main Island of the Bermudas. These, however, occur in beds of blown sand, and owe their calcareous incrustation to the infiltration of water, bringing down calcareous matter with it. "The calcareous tubes," says Lieut. Nelson, "are very generally found throughout the islands, *apparently* aggregated around grass or small roots, as nuclei, which have subsequently decayed. They have almost always an earthy matter running down the axis. Beds, nay strata, of these tubular deposits, may be found in various parts, as in the neighbourhood of Tobacco Bay, near St. George's, and in the bank a little to the westward of Harris' Bay, where the cliffs commence; though nowhere to such an extent as at Ireland Island, between Bombay and the south-west point, where the stratum is about four feet thick, and corresponds to a similar formation on Skinner's or Tate's Island.

"The *cliffs* to the westward of Elbow Bay are curiously *perforated* to a great extent by similar tubular holes; but *they are* there *detached from each other*, and are generally *vertical* and *much larger*."—On the Geology of the Bermudas; by R. J. Nelson, Esq. Lieut. R.E. in G. T. v. 101. The latter example best suits the case of the Studland tubes.

The composition of the beds is shown on the diagrams.—The upper part of the cliff contains, in the red sand, which is various in hue, and very thin bedded, nodules of white pipe-clay, which were evidently washed thither from a lower or distant bed, during the formation of the upper beds. They are all water-worn, and vary in size from a pea to a nine-pound shot; the joints of the rock have passed through them as constituent portions of the mass, but there is an ochreous deposit of a brighter hue round their outline, as if the particles of iron in the depositing water, in settling, aggregated round them. Such examples as these explain the formation of the darker lines in sand-stone rocks.

Respecting the lignite bed (4 in fig. 55) which occurs here in connection with red sand, it may be observed, that it well represents the character of all the lignite beds in the district,—the enveloping substance being an unctuous indigo-colored clay when moist, and drying to a brown black,—the particles of wood then appearing as if they had been charred. They are extremely minute, and seem to be the relics of some aquatic plant or *Juncus*, together with the bark and seed-vessels of a species of pine, but it is frequently impossible to detect a portion sufficiently large to discover to what it actually belonged. A similar bed on the other side of Poole Bay, not far from Bourne Mouth, I found to contain the seed-vessels and wood of a pine. Here the masses of fallen clay and sand have heaped up a considerable quantity of debris along the base of the cliffs, and furze-bushes and sand occupy the space intermediate between it and the entrance to Studland, which is by a road that passes up another, though smaller, rent in the cliff, on each side of which there are good transverse sections of the beds of sand traversed by faults, and strata-lines, and joints, on a small but very instructive scale. From this rent to another, just 238 paces more to the north-west, the cliffs of sand are obscured by vegetation, and are defended below by a wide beach, occupied by the beginning of the dunes or sand-hills, which stretch across to the entrance of Poole Harbour, and on the other side of that entrance, as far as Poole Head. Of these hills of blown sand, mention will be made in the proper place.

(To be continued.)

ART. III.—*On the Anatomy of the Lamellibranchiate Conchiferous Animals.* By ROBERT GARNER, Esq., F.L.S.

(*Continued from Page* 304.)

REPRODUCTIVE SYSTEM.

Reproduction in these animals was supposed, by some of the ancient naturalists, to take place by a spontaneous generation, without the existence of *ova;* but this idea has now been justly exploded. Some modern naturalists have maintained, that amongst bivalve species, some individuals are male and others female. Leuwenhoek[1] inferred this, as did also M.M. Prevost and Dumas;[2] and that the *ova* of the female, after their rejection, required to be fecundated by the fluid of the male. Mery[3] supposes the existence of male and female organs in every individual, but that an union of two individuals is required for impregnation. But there appears every reason to believe that there is no difference in the individuals, as to sex, and that the *ova* are discharged from the ovaries in a state fit to develope, without the necessity of the contact of any vivifying fluid; or, in other words, that they are fecundated before they leave the ovaries, by *testes* which must be conjoined with those organs. No distinct male organs appear to be present. Perhaps Home,[4] who mentions their existence, has mistaken the excretory organs for them, as have many other anatomists. From what the author has observed in the *Modiolæ* and *Mytili*, he believes that the organs called *ovaria* do, at certain periods, secrete the seminal fluid, which impregnates the *ova* contained in them, and is then discharged as an excretion by the oviducts.

These ovaries are always voluminous, containing immense numbers of *ova.*[5] They are not always circumscribed, but their ramifications vegetate, as it were, into different parts of the body. Though two oviducts are developed, the *ovaria* are not always distinct from each other, and sometimes, as in the *Pecten*, all the *ova* appear to be discharged by one oviduct alone. When the foot is imperfectly developed, the *ova* at certain periods are seen to distend the mantle, as in *Mytilus*, *Modiola*, *Lithodomus*, *Hiatella*, &c. In the oyster they are found externally on each side of the liver, and also form

[1] Arcana Naturæ. [2] Annales des Sci. Nat. vol. vi.
[3] Mem. Acad. Sciences, 1701. [4] Lectures on Comp. Anatomy.
[5] Poli says the ovaries of a single oyster contain 1,200,000 *ova*.

a triangular process, situated between the muscle and the *branchiæ*. This last is the part we see alone developed in the *Pecten* and *Spondylus*. When the foot is large, the *ova* are contained in it, and do not extend into the other parts.— The orifices of the short oviducts vary in situation, but are always in connection with the excretory organs, as has been mentioned above. In the oyster, according to Home, they open under the mouth,[1] but in the *Anomia* they open farther back, between the *branchiæ*. In *Cardium*, *Solen*, *Pholas*, *Psammobia*, *Mactra*, *Venus*, *Venerupis*, *Mya* and many others, they open by *papillæ* at the posterior part of the foot into the excretory organs. In *Unio*, *Modiola*, *Mytilus*, *Lithodomus*, *Hiatella*, and some others perhaps, the orifices of the eviducts do not open into these organs, and are more or less distant from their outlets. The ratio of these differences appears to be the situation of the ovaries. The ovaries are scarcely visible at some periods: when developed, they often present an agreeable arborescent appearance. The animals, in such a state, are considered in season as articles of food.[2] The *ova* leave the oviducts at different periods of the year in different species; this however generally takes place in spring or at the commencement of summer. Poli asserts that some species discharge their *ova* more than once in the year. The *ova* are contained in the *ovaria*, enveloped by membranes, each of which contains several. At an uncertain time before their discharge, a milky fluid makes its appearance in the ovaries, and is itself ejected from the oviducts some time before the ejection of the *ova*. When this fluid, which is often of a light pink colour, is examined with a lens, it is seen to consist of minute oval bodies, not more, perhaps, than the four thousandth part of an inch long, swimming in a fluid, and having a very perceptible motion. With a lens of upwards of the twentieth of an inch focus, these appear simply oval bodies, without appendages of any sort. Minute species of *Vibrio* abound in this fluid, and these, becoming entangled with the oval bodies, sometimes give the latter the appearance of having appendages.[3] Before the appearance of this

[1] Home, Croonian Lecture.

[2] It is extraordinary that muscles should have a poisonous effect on some persons at certain times, whilst occasionally they may eat them with impunity; and other persons will partake of the muscles which appear so pernicious in certain states of the system, without any bad effects. It appears to be quite unknown to what this pernicious property may be owing; it has often caused death. See Orfila, Moehring, Rondeau, Burrows, and Fodére.

[3] Though the author calls in question the facts recorded by such observers as MM. Prevost and Dumas, with considerable hesitation, he is inclined to think, with M. Raspail, that they have mistaken the vibratile parts of other organs for seminal animalcules in these animals.

fluid the *ova* are small, they soon, however, from its influence, enlarge, and the *vitellus* becomes coloured by the secretion. The *ova* are of different figures in different species. In the *Unio* they are round, about the seventieth of an inch in diameter, consisting of a firm shell, containing a colourless fluid, in which swims a globular yolk. A more transparent spot is seen on the yolk; this appears to become prominent, to enlarge, and to be developed into the young muscle.

A remarkable difference exists in bivalves as to the disposal of the *ova* when ejected from the oviducts. In the generality they are immediately discharged from all further connection with the parent, along with the respired water &c.— In a few species the *ova*, escaping from the oviducts, remain for a time in the spaces left in the interior of the *branchiæ* (oviducts of Home) by the want of apposition in the membranes which form them. This is the case in the *Unio* and *Anodonta*, in which the *ova* may be found for several months in the external *branchiæ* after leaving the *ovaria*, distending these organs in a remarkable manner. It is curious that they are never found in the internal *branchiæ*,[1] along the edge of which they may be seen to be conveyed, enveloped in mucus, from the oviducts to the openings which are the posterior terminations of the internal interbranchial spaces. They are not found in these organs after the approach of spring, being discharged by the anal orifice. In the *ova*, taken from the *branchiæ* at different periods, we find different appearances. In some we see merely the *cicatricula* described above, upon the yolk; in others we see the yolk disappearing between the valves of the animal, and becoming smaller and of a reticulated appearance on its superficies. It is in this stage that the rotation of the embryo within its *ovum*, which has often been noticed, may be witnessed. The rotation varies in quickness; perhaps, when most lively, there are seven or eight volutions in a minute. The valves are developed, and the animal has the power of opening and shutting them before it leaves the shell. At length the *ova* crack, and the young muscles are found free in the *branchiæ* adhering by a *byssus*.[2] These have been considered to be merely parasitical animals by Rathke, who makes of them a new genus under the name

[1] Bojanus says he has found them in the internal *branchiæ*. In a valuable and learned paper by Blainville (Ann. Sci. Nat. vol. xiv.), the author gives an account of all that has been done as to the anatomy of the generative organs of bivalves; and of that paper, as well as of the Bibliography in the Malacologie, the author has availed himself.

[2] Called umbilical vessels by Koelreuter and Mangili.

of *Glochidium.* He is followed in this opinion by Jabobson,[1] who considers their appearance and structure to preclude the possibility of their being the young of the animal in which they are found. The valves are different in shape, being triangular, with the ligament at the short straight side, the other two sides terminating in a point, at which, in each valve, we see a process of membrane, dentated on its exterior surface. Two pointed processes also appear projecting from the inner surface of the valves. There is no foot developed, and the muscles are situated on the dorsal edge of the valves, and allow them to be opened to a great extent. On inspecting a very young *Unio* we see the valves commenced by triangular *nuclei*, of the same shape as described above in the embryo; and it is by the greater development of the posterior extremity of the valves, that they gain the form of the full-grown muscle. The membranes at the points of the valves may be incipient *branchiæ* and tentacles, the other processes are probably the *nuclei* of the teeth of the valve. Home does not seem to have known the true oviducts, as he considers the interlaminar spaces of the *branchiæ* to be such. Bojanus considers the *branchiæ* as *uteri*, or receptacles for the *ova.*—Joerg[2] calls the internal *branchiæ ovaria*, and the external ones *testes.* The *Anodonta anatina* and *An. cygnea* are both viviparous, as well as the *Uniones*, though Draparnaud,[3] on the authority of Poiret, denies that the former is so. In the different species of *Cyclas* we find from ten to twenty of the young, some very minute, others much larger, situated in the internal *branchiæ* on each side. They are discharged one by one, when they attain about the sixth of an inch in diameter. The oviducts, in the *Cyclas*, open over these internal *branchiæ*, and they are only accessible to the water from behind, as are the external ones of the *Unio.* Three or four of these young animals are inclosed in a membranous case, but the largest are found separate. They sometimes also adhere by a *byssus* to different parts of the body of the parent. Turton[4] says that in the month of June he has found the old animals of the *Kellia rubra* containing about twelve perfectly formed young ones; the author knows of no other instances than those mentioned, of viviparous bivalves. Some species seem to employ the foot for fixing the *ova.*

In no case are the *ova* discharged by the mouth,[5] or by the anus.[6] Nor is there, in those which are viviparous, any duct

[1] See paper by Blainville, Ann. Sci. Nat. vol. xiv.
[2] Meckel, Comp. Anat. par Jourdain, vol. i. [3] Hist. des Mollusques.
[4] Fleming, Brit. Animals. [5] Treviranus, Zeitschrift. vol. i.
[6] Carus, Lehrbuch, vol. ii.

or canal leading from the *ovaria* to the cavities of the *branchiæ.* Carus, though incorrect in the opinions formerly published by him on this subject, has, in another work, ascertained the true anatomy and functions; and the author can vouch for his accuracy, as he has obtained nearly the same results.

DISEASES AND PARASITICAL ANIMALS.

One of the most remarkable circumstances relating to these animals is the generation of pearls:[1] the subject has been treated of by Home and many other writers. These calcareous concretions appear to be generally formed around abortive *ova,* as was known to Pliny. The most beautiful ones are obtained from the *Meleagrina margaritifera,* which inhabits the Indian seas. The interior of this shell likewise furnishes the nacre, or mother of pearl. Pearls of value are likewise occasionally obtained from the *Unio margaritifera,* a British species. Pearls are also common in other bivalves, as in the *Anodontæ, Pholades* &c., but are never of any beauty.

Numerous parasites inhabit the bodies of the *Lamellibranchiata.* Baer[2] has described many of those of the fresh water species, but has often considered vibratile parts of the animal to be such.[3] His *Aspidogaster conchicola* is very common in the *pericardium,* secreting organs, &c., of the *Unio* and *Anodonta.* The author found the *ovaria* of an *Anodonta* enormously distended with parasitical *ova,* which, ruptured, were each found to contain several young individuals of a species of *Distoma.* The *Nummulella* of Carus appears to be produced by the rolling upon itself of a branchial particle. The *Peripheres conchilis spermatica* of the same author, abounds in the *branchiæ.* Many other animalcules are also found. In the *ovaria* of another *Anodonta* the author found a parasite in the different stages of its growth. In the mature state its body is more or less cylindrical in shape, but varying much at the will of the animal; at one extremity are two long appendages, which are spiniferous at their termination, and, in some individuals have a row of round bodies attached to one side, for part of their length; these appendages are contracted with great rapidity, and are then very short.

[1] Vogt, 'De Causâ Margaritarum,' Nov. Act. Acad. Nat. Cur. vol. viii.

[2] Nov. Act. Acad. Nat. Cur. vol. xiii. The author has only seen the extracts from the papers of Baer in the Bull. des Sci. Nat. and in the Zoological Journal.

[3] Raspail, Isis, 1827, &c. See also Gaillon, 'Sur les Animalcules des Huitres,' Mem. Acad. Rouen, 1820.

There is an opening by a prominent circular lip, between these appendages. A contraction separates the part on which are situated the opening and appendages from the rest of the body. There appears to be another opening at the opposite extremity of the animal.

ATR. IV.—*Letter from* S. V. WOOD, Esq., *late Curator to the Geological Society, announcing the discovery of Fossil Quadrumanous Remains, near Woodbridge, Suffolk.*

13 *Bernard St., Aug.* 21, 1839.

SIR,

Hearing from Mr. Lyell that a mammiferous tooth had been obtained by Mr. Wm. Colchester, from a clay-pit at Kingston, near Woodbridge, I was naturally desirous of visiting the spot, which I did, not without a slight hope of finding something more, or at least, of inducing a farther search to be undertaken. The bed in which the tooth was found lies immediately beneath a stratum of blue clay, which is used by Mr. Colchester in making bricks; but as the digging and working are only carried on during the winter, I was fearful that little could be done before that period. Hearing however from one of the men that a heap of sand, lying near the pit, had been thrown aside from those beds, I prevailed on Mr. Colchester, who was with me, to employ a boy to sift and search it, thinking it would probably yield something for the trouble, having myself, in the course of a few minutes, found several fishes' teeth upon the surface. I am happy to say that I have since received a letter from Mr. Colchester, accompanied by a fossil, of which the annexed engraving (fig. 57) is a faithful representation. The specimen has been examined by Mr. Owen, who has kindly undertaken to give his opinion respecting it, in a paper to accompany the present communication.

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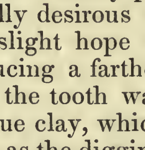

As this is the first notice of a quadrumanous animal having been found in England, it is of great importance correctly to ascertain the age of the bed to which it belongs; the fossil itself contains sufficient internal evidence to remove all doubt of its genuineness, as it has not the least appearance that a recent tooth would have assumed, conceiving such to have been accidentally introduced into the heap, even if Mr. Owen's determination of its extinct character were not a warrant for its originality. I received with it one or two fragments of bone, not yet satisfactorily identified; numerous fishes' teeth, of the genus *Lamna;* and a specimen of *Turbinolia.* The teeth possess the sharpness of recent specimens, and were probably quietly deposited in their present locality, but the coral has undergone so much bouldering as to destroy its character, and defy identification.

The bed whence these remains were obtained is a whitish sand beneath a stratum of tenacious blue clay, situated by the side of the river, about a mile from Woodbridge, in a parish commonly called Kyson. This clay may be traced beneath the crag not more than twenty yards from the pit, and is a continuation of the same bed which extends over a large portion of the eastern side of the county of Suffolk.—Sections of this clay, with overlying crag, may be seen at Sutton, Bawdsey, Felixstow, &c.; and although, in all my searching for fossils I have never been able to detect a single shell in the clay deposit, the *Septariæ* which are dredged up off Harwich contain shells that have been identified with those of the London clay: and it is fair to assume that as part of the bed connecting this clay at Felixstow and Walton-on-the-Naze, there is little doubt of its belonging to the eocene period; but at Kyson, which is one of the western limits of the crag, the beds become more irregular, and the shells are much comminuted; and at Hasketon, scarcely two miles further westward, the clay assumes a different character, being mixed with the detritus of the older rocks. I have there picked up shells of the *Echini* filled with chalk. The only doubt respecting the bed at Kingston would be whether it could at all belong to that extensive diluvial deposit which approaches so near; as this fossil certainly belongs to some quadrumanous animal, there is no formation to which it could be so appropriately assigned as that of the London clay,—the tropical character of the Fauna as well as of the Flora of that period, being such as to justify an assumption of a warmer climate, quite suitable to the existence of our *Macacus.*—However, I have given you the particulars of its discovery, and I consign the details to abler hands.

I am, &c.

S. V. Wood.

Editor of the Magazine of Natural History.

Description of the Fossil mentioned in the preceding Letter. By RICHARD OWEN, Esq., Hunterian Professor at the Royal College of Surgeons.

THE fossil, the circumstances connected with the discovery of which are above described, was submitted to me for examination by Mr. Wood, and it was with peculiar interest and gratification that I found it to present unequivocal evidence that it was a part of the skeleton of a true quadrumanous species. It consists of the *alveolus* of the last molar of the right side of the lower jaw, with the anterior part of the base of the coronoid process, and the tooth entire, in its place.—The crown of the tooth presents five tubercles, the four anterior ones being arranged in two transverse pairs, the fifth forming the posterior heel or 'talon.' This conformation of the crown of the last molar of the lower jaw, is characteristic, as is well known, of two families of catarrhine or Old World monkeys—the *Semnopithecidæ*, including *Semnopithecus* and *Colobus*, and the *Macacidæ*, including *Macacus, Cynocephalus*, and *Papio.*

In the *Semnopithecidæ* the fifth tubercle or talon is large but simple. In most of the *Macacidæ* it presents two cusps, the outer one being much larger than the inner one. This character is well marked in the fossil, which induces me to refer it to the lower group, or *Macacidæ;* and after a close comparison with several recent species, it appears to me to come nearest to the true macacques.

But the fossil exhibits the following differences from the recent *Macaci.* The whole tooth is rather narrower in proportion to its length: the transverse ridge at the anterior part of the tooth, crossing the base of the two anterior tubercles, is a little more prominent, and passes more obliquely from the outer to the inner side: the second transverse ridge uniting the first pair of tubercles, rises nearer to their summits. The portion of jaw is more compressed than the corresponding part of the jaw in the recent *Macaci;* (compare fig. 58, B): the internal wall of the socket of the tooth is flatter and much thinner; (this character of the fossil is well shown in fig. 58, C): the ridge on the outer side of the *alveolus*, which forms the commencement of the anterior margin of the coronoid process, begins closer to the tooth, (as is shown in figs. 57 and 58, A). These characters are sufficiently important and well-marked to establish the specific distinction of the macacque to which the portion of jaw belongs, and are the more valuable as corroborating the evidence already adduced in proof that the fragment in question is a true fossil of the stratum in which it was discovered.

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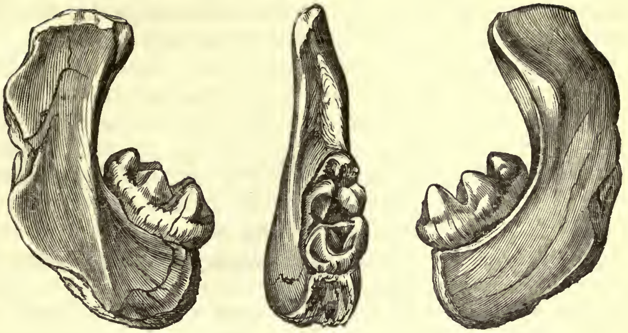

Fig. 57 (p 444) is a view of the fossil showing the outer side of the tooth and jaw, natural size
Fig. 58 A is the same view, magnified two diameters.
B is a view of the fossil looking down upon the grinding surface of the tooth, similarly magnified. It does not show distinctly the inner small cusp of the 'talon' or hinder tubercle.
C. A view of the fossil from the inner side, magnified two diameters.

Fossil remains of *Quadrumana* have been discovered within a recent period in the tertiary formations of India, of the South of France, and of the Brazils.

The Indian remains, discovered by Messrs. Baker and Durand, and those subsequently found by Messrs. Falconer and Cautley, have been referred to a species of *Semnopithecus*, as large as the *Entellus*, and consequently exceeding considerably the present fossil in size.

The portions of fossil quadrumanous lower jaw discovered by M. Lartet in the South of France, indicate a species of *Hylobates*, rather smaller than the *Syndactylus*, but nearly allied to that species.

The South American extinct quadrumanes, discovered by M. Lened in the basin of the Rio des Velhas, it is interesting to find, are referable to a form peculiar to the New World, and are most nearly allied to the genus *Callithrix;* but the extinct species are more than double the stature of any of those which exist at the present day.

Not only therefore is the fact of the existence of quadrumanous mammals at the tertiary periods of the earth's history demonstrated, but we have evidence that four of the modifications of the quadrumanous type at present recognized were in being at that remote epoch : that is to say, the tail-less ape (*Hylobates*), the gentle, vegetable-feeding semnopithecque, distinguished by its complicated stomach ; the more petulant and omnivorous macacque, and the platyrrhine *Callithrix.* Lastly, we have the interesting fact established, that the *Quadrumana* were formerly distributed over parts of the earth's surface, which at the present day, are so far altered as regards the climate and vegetable productions, as to be unfit for their existence.

Art. V.—*Illustrated Zoological Notices.* By Edward Charlesworth, F.G.S. &c.

(Continued from page 353.)

1. *On the discovery of a Portion of an Opossum's Jaw in the London Clay, near Woodbridge, Suffolk.*
2. *On some Fossil Teeth of the Genus Lamna, from the same deposit.*

A visit to the county of Suffolk, made within the last few days, has put me in possession of some fossil remains from the spot in which the fragment of an extinct macacque has been procured by Mr. Wood; and as the subject is one of the highest interest, I am anxious that the additional information which I have obtained should accompany the important communication made by that gentleman to the present number of the Magazine of Natural History.

I believe it was in the early part of 1837, that Mr. William Colchester, of Ipswich, who had then recently directed his attention to the fossils of the crag, showed me the molar tooth of some small mammiferous animal, which had been taken from a clay-pit near Woodbridge, quarried for the purpose of making bricks. From the character of the tooth I saw at once that it could not be referred to any of our indigenous quadrupeds, though I was unable from recollection to determine the genus, or even family, to which it probably belonged.—As the tooth was associated with those of sharks, and the quarry in the London clay district, Mr. Colchester supposed it to be a London clay fossil; and upon going over with him to visit the spot, I saw no reason for suspecting the deposit to be of more recent date, except the then unprecedented fact of mammiferous remains occurring so low down in the tertiary series. Aware of the important nature of the fact, assuming our estimate of the age of the bed to be correct, Mr. Colchester offered to place the fossil at my disposal, in the event of my being inclined to record the circumstances of its discovery in the Magazine of Natural History. I should certainly have done so at the time, had I not felt that before announcing so novel a fact in the history of English tertiary Geology, there were reasons which called for a most careful examination of such sources of fallacy as might be present. The visit which I paid to the quarry was a very hurried one, and as the crag was not here resting upon the surface of the clay, the evidence which would have been decisive—that of immediate superposition, was absent. The clay itself was destitute of fossils, and its thickness was not greater than that which may be sometimes seen in far more recent argillaceous deposits in Suffolk and Essex, and which deposits might readily be confounded with the London clay, in the absence of organic remains. In addition to this, I remarked that the sharks' teeth, at that time the only fossil remains found with the mammiferous tooth, were quite as characteristic of the crag as of the London clay, being all of small size, and of the forms which are common to both deposits.—These reasons made me determine to postpone a notice of this interesting specimen, until I should have satisfied myself, as far as possible, as to the antiquity of the stratum in which it was imbedded. Nearly three years, however, have now elapsed since its discovery was communicated to me, and during the hasty visits that I have subsequently paid to that part of the country, having never put my original intention into execution, or applied to Mr. Colchester for the specimen, it was handed over to Mr. Lyell on one of his late excursions to Suffolk, and I believe will be noticed by him at the Birmingham meeting of the British Association.

In the early part of the present month I received from Mr. Wood the fossil remain which forms the subject of the joint communication from himself and Professor Owen; and as the discovery of an extinct quadrumanous animal greatly added to the importance of no error being committed with regard to the supposed age of the bed,—for the purpose of setting at rest any doubt that might still have lingered in my own mind, I devoted a morning a few days since to the examination of the spot. After thoroughly exploring the geological features presented by the beds in the immediate neighbourhood of the place, I think the quarry may, without any hesitation, be assigned to the age of the London clay. Several quarries of crag occur within half a mile distance; and on crossing the river you have, a little nearer the town, a section of the clay and superimposed crag, similar to that exhibited by the coast line at Walton and Felixstow.

The annexed sketch, fig. 59, without its being drawn to any very accurate scale, will convey an idea of the probable section which the beds of clay and crag would exhibit on either side the Deben, the presumed length of the section being three miles.

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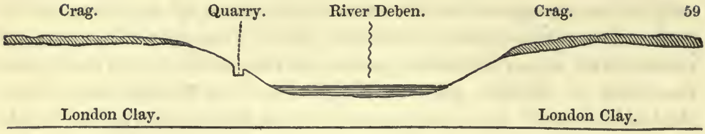

I was much disappointed in this last visit to the quarry to find that the stratum of sand in which the fossils are found was not exposed, owing to its lying below the clay, and the small quantity required in manufacturing the bricks. Some of the sand however had been laid aside, and was being sifted by a daughter of one of the workmen, who picked out the sharks' teeth, which, with about three or four per cent. of fine shingle, formed the residuum. The teeth were plentiful enough, but I could not detect the slightest fragment of a shell. The foreman told me that they had sunk about ten feet into the sand, without passing through it. It would be desirable to ascertain at what depth the chalk is there met with, but this point I had not the means of determining: probably it is not far below the surface, and this sand may perhaps separate the chalk from the overlying clay.

Upon my calling on Mr. Colchester, I found that he had been so fortunate as to have added to his previous discoveries that of the interesting fragment represented at fig. 60, con-

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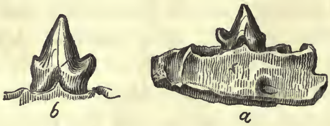

(*a*) Portion of the lower jaw of the fossil Opossum, enlarged one half.
(*b*) View of the crown of the tooth, twice the natural size; (seen from within).

sisting of a portion of the right *ramus* of the lower jaw of an opossum, in which one of the false molars is happily retained. The tooth in its symmetrical form, united with the indication of an anterior as well as posterior heel or talon, does not agree with any species of didelph with which I have as yet been able to compare it, but I think no doubt can be entertained of the generic or family affinities indicated by the characters which it exhibits. Judging from the empty *alveoli* on either side, the tooth appears to be the one immediately succeeding the true molars: its posterior tubercle is strongly developed, and divided longitudinally by a prominent ridge, the continuation of which forms the posterior edge of the body of the tooth. At the base of the anterior root of the tooth the opening of a *foramen* is seen, on the outer surface of the bone.

It is unnecessary to offer any comments on the interest of the additions now made to the extinct Fauna of this island, by the discovery of *Quadrumana* and marsupials in the London clay. These additions probably constitute only the commencement of a series of discoveries, which will be brought to light in the same quarter; as Mr. Colchester, who holds the quarry, has made arrangements for the careful examination of all the sand which shall be subsequently removed. The connection of this enquiry with the subject of M. d'Orbigny's papers in the Journal of the French Academy, and the Bulletin of the Geological Society, should not be overlooked. It seems as though the phenomena in the present case would admit an inference very similar to that which he drew from an examination of the beds above the chalk in the neighbourhood of Meudon, and respecting which he remarks,—" Qu'il existe, à la partie inférieure de l'argile plastique, des caractères nouveaux démontrant surtout que divers genres de mammifères vivaient à l'époque où cet étage s'est formé."

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(a & d) Teeth of *Lamna* agreeing in form with species abundant in the London clay & red crag.
(b) Tooth probably of the same genus, but of an undescribed species, provided with quadrate lateral denticles.
(c) Tooth of *Lamna* with two pairs of denticles.
(e) A tooth, of which the form probably depends upon its situation having been near the termination of the series.

I selected a few of the sharks' teeth found in this deposit, from several hundred in the possession of Mr. Colchester, for the purpose of illustration. I believe all yet discovered may be referred to the genus *Lamna*, and to species which occur in both the crag and London clay, so that at present the identification of the bed from the evidence furnished by organic remains, must be looked upon as a desideratum. The teeth of the genus *Otodus*, though not uncommon in the London clay of Suffolk, have not been noticed in the present deposit, whilst, on the other hand, there are no traces of the genus *Carcharias* to favor the opinion of its age agreeing with that of the crag. The average size of one hundred teeth, if compared with the same number from the Harwich cliffs, will be found about one third smaller. Their colour and general aspect corresponds most closely with the appearance presented by the small sharks' teeth from Malta, and some of the continental tertiary deposits, and presents a singular contrast to those found in the red crag, or the ordinary beds of the London clay formation. As Mr. Wood has remarked, they do not appear to have been subjected to the slightest bouldering, a circumstance satisfactorily established by the perfect condition of the lateral denticles.

Art. VI.—*A Systematic Catalogue of the Fossil Plants of Britain.* By John Morris Esq.

The study of fossil Botany, equally interesting and important as any other branch of Natural History, is rendered more difficult in consequence of those parts which, in a recent state, afford the most ready means of generic distinction, being rarely preserved: however, Botanists, well acquainted with the structure of existing vegetation, have, by an attentive examination of the best-preserved portions, been enabled to decipher many of the characters of the ancient Flora. In the present catalogue I have included not only the fossilized remains peculiar to Britain, but many of the more interesting specimens which have hitherto been found only in continental deposits. The general arrangement of the greater portion of this catalogue, as well as the generic characters, have been adopted from the views entertained in the works of Messrs. Lindley and Hutton,[1] Witham, Brongniart,[2] Sternberg,[3] &c., and for the cryptogamic part, more especially the *Filices*, to

[1] Lindl. and Hutt. 'The Fossil Flora of Great Britain,' by Lindley and Hutton. London: 1831—1836.

[2] Brong. Prod. 'Prodrome d'une Histoire des Végétaux Fossiles,' par M. A. Brongniart. Paris: 1828.

Brong. Hist. 'Histoire des Végétaux Fossiles.' Paris: 1828.

[3] Sternb. 'Versuch einer geognostich-botanischen Darstellung der Flora der Vorwelt,' C. von Sternberg. Leipsic and Prague: parts i.—iv. tab. 1—58, 1820; parts v. and vi. tab. 1—26, 1833.

a valuable memoir lately published by Prof. Göppert,[1] as well as to some suggestions of Professor and Mr. G. Don.

PLANTÆ CRYPTOGAMICÆ.

Confervites, Brongn.

Filaments simple or branched, divided by internal partitions.

Conf. fasciculata, Brong. Hist. tab. 1, fig. 1. *Chalk,* Lewes, Steyning, Norwich. *Chalk marl,* Hamsay, Isle of Bornholm.

Conf. ———. Mant. Geol. Suss. tab. 9, fig. 12. *Chalk,* Lewes.

Fucoides, Brongn. (*Algacites,* Schloth.)

Frond continuous, never articulated, usually not symmetrical or subcylindrical, simple, or oftener branched, naked, or more commonly leafy; or membranous, entire, more or less lobed, with no ribs or imperfectly marked ones, which branch in an irregular manner, and never anastomose.

Fuco. Brongniarti, Mant. tab. 9, fig. 1. *Chalk,* Lewes.

—— *Targioni,* Brong. Hist. tab. 4, fig. 2. *Upper green sand,* Bignor, Sussex.

—— *furcatus,* Brong. Hist. tab. 5, fig. 1. *Stonesfield slate,* Stonesfield, Oxon.

—— *arcuatus,* Lindl. and Hutt. iii. tab. 185. *Ool. shale,* Gristhorpe Bay.

—— *granulatus,* Brong. *Lias,* Lyme Regis. Boll, Wurtemburg.

—— Mant. Geol. Suss. page 83. *Gault,* Norlington, Blechingly.

Tympanophora, Lindl.[2]

Tymp. simplex, Lindl. and Hutt. iii. tab. 170 A. *Low. ool. shale,* Cloughton Wyke, Scarborough.

—— *racemosa,* Lindl. and Hutt. iii. tab. 170 B. *Low. ool. shale,* Cloughton Wyke.

Chondrites, Sternb.

Frond cartilaginous, filiform, dichotomously branched, branches cylindrical; compressed in the specimens.

Chond. trichomanoides, Göpp. page 268, tab. 30, fig. 2 *b.*—*Coal measures,* Attendorf.

[1] Göpp. 'Systema Filicum Fossilium,' H. R. Göppert. Novorum Actorum Academiæ Cæsariæ Leopoldino-Carolinæ Naturæ Curiosorum Sup. vol. xvii. 1836.

[2] Generic characters not determined.

FUNGI.

Excipulites, Göpp.

Sessile, naked, and cup-shaped; *perithecia* horny, nearly closed, and finally opening with a rounded entire mouth.

Excip. Neesii, Göpp. page 262, tab. 36, fig. 4. *Coal measures,* Waldenburg, Silesia.

Polyporites, Lindl.

Polyp. Bowmanni, Lindl. and Hutt. i. tab. 65. *Coal measures,* Denbighshire.

No fossil *Hepaticæ* or *Musci* at present known in England.

FILICES.

Ferns, *the stems only known.*

Caulopteris, Lindl.

Stem cylindrical, closely marked by large, oblong, convex, uneven scars, wider than the tortuous depressed spaces that separate them.

Caul. punctata, Göpp. page 449. *Lepidodendron punctatum,* Sternb. part i., page 13, tab. 4 & 8, fig. 2. *Coal measures,* Kauritz, Bohemia.

—— *primæva,* Lindl. and Hutt. tab. 42. *Sigillaria Lindleyi,* Brong. *Coal measures,* Radstock, Bath.

—— *Phillipsii,* Lindl. and Hutt. tab. 140, page 161. *Coal measures,* Camerton, Somerset.

—— *Singeri,* Göpp. tab. 41, fig. 1, 2. *Sandstone,* Giersdorf, Silesia.

Karstenia, Göpp.

Caudex even, covered by cicatrices which are arranged in a spiral manner; cicatrices orbicular, convex, and teated in the centre, each girded by an elevated or flattish ring, and often destitute of any ring.

Kars. omphalostigma, Göpp. tab. 33, fig. 1. *Coal measures,* Charlottebrunn, Silesia.

—— *mammillaris,* Göpp. tab. 33, fig. 4, 5. *Coal measures,* Charlottebrunn.

Cottæa, Göpp.

Stem even, probably ascending, clothed by the lower parts of the *stipes,* which are disposed spirally.

Cot. danæoides, Göpp. page 452; Jäger, tab. 7, fig. 6. *Keuper,* Stuttgard.

Tubicaulis, Cotta.

Stem composed of larger and smaller tubiform *fasciculi*, and surrounded by a brown sufficiently conspicuous tunic; the larger tubes converging, distant, inclosing vescicles, and surrounded by the smaller tubes, which are arranged without any order; the vescicles in a transverse section of the stem presenting a regular form.

Tubic. dubius, Cotta,[1] page 25, tab. 1, fig. 3, 4; Göpp. page 456. Locality unknown.

—— *primarius*, Cotta, tab. 1, fig. 1, 2; Göpp. page 454. *Endogenites solenites*, Spreng. page 32. *Red sandstone*, Freyburg.

—— *ramosus*, Cotta, tab. 3, fig. 1—3; Göpp. page 455.

—— *solenites*, Cotta, tab. 2, fig. 1, 2, 3; Göpp. page 454. (*Endogenites*, Spreng.) *Red sandstone*, Freyburg.

Psaronius, Cotta.

Fasciculi parallel, seated on the stem, and surrounded by brown conspicuous tunics, which are either cylindrical or tubular, or wider, resembling a *copula;* these last are filled by a thick cellular tissue, the former containing small angular columns.

Psar. Asterolithus, Cotta, page 29, tab. 4, fig. 1—4. *Endogenites Asterolithus*, Spreng. page 33, fig. 1; *Starry stone*, Parkinson, i. tab. 8, fig. 3—6; Göpp. page 456. *Neue Paka*, Bohemia.

—— *Helmintholithus*, Cotta, page 31, tab. 5, fig. 1, tab. 6, fig. 1—3, tab. 7, fig. 1, 2; *Endogenites Psarolithus*, Spreng. page 37, fig. 5; Parkinson, i. page 410, tab. 8, fig. 1, 2, 5, 7; Göpp. page 457. *Red sandstone*, Chemnitz, in Saxony. *Neue Paka*, Bohemia.

Ad. Brongniart considers the affinity of *Psaronius* to arborescent ferns as very doubtful, and that its internal structure is more analogous to the base of the stem of some gigantic and arborescent *Lycopodium*, the two species above named being only different portions of it; *Psar. Helmintholithus* representing the fibro-vascular axis of the stem of the *Lycopodiaceæ*, the *Psar. Asterolithus* corresponding to the exterior cellular tissue of the same stems. Hist. des Végét. Foss. ii. pp. 57—67.

Porosus, Cotta.

Stem covered with tube-formed fascicles of vessels, which are conspicuous in the cuticle, the inner part filled with a porous mass destitute of structure.

Por. communis, Cotta, page 39, tab. 8, fig. 1—3; Göpp. page 458. Dresden and Chemnitz.

—— *marginatus*, Cotta, page 41, tab. 8, fig. 4, 5; Göpp. page 458. Locality unknown.

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[1] Die dendrolithen in Beziehung auf ihren inneren Bau von C. B. Cotta, Dresden, 1832.

Endogenites.

End. erosa, Mant. Geol. South East Eng. page 236, tab. 1, fig. 4, 5, 7. *Hastings sand,* Tilgate, &c.

—— *striata,* Lindl. and Hutt. tab. 227 A. *Coal Measures,* England.

This genus has been placed here on the authority of M. Brongniart, who considers it has more affinity to the arborescent ferns than to the palms.

The fronds only known.

VARIABLE FERNS.

Bockschia, Göpp.

Fronds stemless? fan-shaped, with parallel veins; fertile fronds with 5 or 7 plaits, sterile flat. Sori oblong, in two rows, seated on the plaits, which are bluntly triangular.

Bocks. flabellata, Göpp. tab. 1, fig. 1, 2. *Coal measures,* Waldenburg, Silesia.

Pachypteris, Brong.

Fronds pinnate or bipinnate; leaflets entire, coriaceous, ribless or one-ribbed, contracted at the base, not adherent to the midrib.

Pach. lanceolata, Brong. Prod. page 50; Brong. Hist. i. page 168, tab. 45, fig. 2; Göpp. tab. 1, fig. 4; Sternb. part v. and vi., page 55. *Sphenopteris lanceolata,* Phillips, tab. 10, fig. 6. *Oolite shale,* Saltwick, Yorkshire.

—— *ovata,* Brong. Prod. page 50; Hist. i. page 168, tab. 45, fig. 2; Sternb. part v. and vi., page 55; Göpp. page 180. *Neuropteris lævigata,* Phillips, tab. 10, fig. 9. *Oolite shale,* Saltwick, Yorkshire.

Anomopteris, Brong.

Fronds pinnate; leaflets linear, entire, somewhat plaited transversely at the veins, marked with a midrib; veins simple, perpendicular, curved.—Fructification of doubtful form.

Anom. Mougeotii, Brong. Prod. page 50; Ann. Sci. Nat. vol. xv. page 439; Hist. i. page 257, tab. 79–81; Göpp. tab. 1, fig. 5. *Grès bigarré,* Sulz-les-bains, Wapelonne.

DANÆACEÆ, Göpp.

Fronds pinnate, veins transverse. *Sporangia* adnate to the lower surface, approximating to the margin, and opening by a fissure.

Glockeria, Göpp.

Frond pinnate. *Sporangia* oval, seated on the secondary veins at the margin of the frond, and probably dehiscing longitudinally.

Glock. marratoides, Göpp. tab. 39, fig. 2, 3. *Coal measures*, Charlottebrunn, Silesia.

DANÆITES, Göpp.

Sporangia linear, parallel, seated on the forked secondary veins; *indusium* doubtful.

Dan. asplenioides, Göpp. tab. 19, fig. 4, 5. *Coal measures*, Charlottebrunn.

GLEICHENIEÆ, Göpp.

Frond pinnate or bi-pinnate. *Sporangia* 3—6 angled.

GLEICHENITES, Göpp.

Frond forked, pinnate. Fructification unknown.

Glei. Linkii, Göpp. tab. 2, fig. 1. *Coal measures*, Charlottebrunn, Silesia.

—— *Neesii*, Göpp. tab. 3, fig. 1, 2. *Fetid limestone*, Ottendorf, Bohemia.

—— *artemisiæfolius*, Göpp. page 184. *Sphenopteris*, Sternb. part iv. page 15, part v. and vi. page 58; Brong. Hist. i. page 136; α, *tripartitus*, Sternb. part iv. tab. 54, fig. 1; β, *dichotomus*, Brong. Hist. tab. 46; γ, *minor*, Brong. Hist. tab. 47. α, *Coal measures*, Yawdon, Northumberland; β and γ, Newcastle.

—— *crithmifolius*, Göpp. page 185. *Sphenopteris*, Lindl. and Hutt. i. tab. 46, page 46; *Sphen. dichotoma*, Sternb. part v. and vi. β, *affinis*; *Sphen. affinis*, Lindl. and Hutt. i. tab. 45; Sternb. loc. cit. *Coal measures*, Bensham, Burdie house.

—— *neuropteroides*, Göpp. page 186, tab. 4, 5. *Greywacke*, Landshut, Silesia.

ASTEROCARPUS,[1] Göpp.

Frond bi-pinnate. *Sporangia* 3 or 4, adhering by their sides, appearing altogether like a 3- or 4-celled capsule.

Ast. Sternbergii, Göpp. page 188, tab. 6, fig. 1—4. *Coal measures*, Saarbruck.

—— *lanceolatus*, Sternb.; Göpp. page 382. *Keuper*, Rheindorf, near Bamberg.

—— *heterophyllus*, Sternb.; Göpp. page 382. *Keuper*, Rheindorf.

(To be continued.)

[1] Should a closer inspection of these fossils prove that the stellate-like capsule is rather an ideal than a true form, they may more probably belong to *Cyatheites*, the disposition of the *sori* resembling the recent genus *Cyathea*; the stellate appearance being produced by the pressure they have subsequently undergone.

Art. VII.—*Notes on the Pensile Nests of British Wasps.* By W. E Shuckard, Esq., Librarian to the Royal Society, V.P.E.S., &c.

At the last meeting of the Entomological Society Mr. Barraud exhibited the small nest of a wasp, which had been found near Croydon, built in a sparrow's nest, and attached to the feathers within it. The smallness of the nest, and of the tier of cells, as well as the peculiar material of which it appeared composed, led to a discussion, the tendency of which seemed to support the opinion that it was most probably the nest of *Polistes,*—a social wasp not yet found in this country; but if not of *Polistes,* yet certainly of some new species not yet determined or known. Feeling curious about it, I obtained the nest to examine, and the following is the result of my inspection of it.

The nest consists of three shells, with a space about a line wide between each, viz., the rudiments of a basal external one, commenced in a spiral direction, the widest portion of which is about half an inch only. The enveloping one, which gives the form to the nest, and is ovate, about an inch and a half long, and an inch broad at its widest diameter, and has a circular aperture at its apex, rather more than $\frac{3}{8}$ of an inch across. Within this case, at the base, there is the commencement of another spiral one, which at its widest part laps laterally, scarcely farther than the base of the cells; and within this, in the centre, is placed the tier of cells, originating from a common pedicle, consequently, as usual, the central ones are the most advanced in structure: altogether there are fifteen *perfect hexagons*, the central ones being nearly four lines deep, and all a little more than two lines in diameter.

The nest appears to be constructed of the agglutinated particles of a soft white wood, probably willow, very imperfectly triturated, which gives it externally a rough granulated appearance. It is sprinkled with black specks, arising perhaps from the intermixture of more decayed portions of the wood, and is of a very fragile texture.

The nature of the material, and its unfinished execution, as well as the situation in which it was found, appear to me to be its only peculiarities, and I must necessarily consider it merely an accidental deviation in material and locality from the usual nests of the *Vespa Britannica* of Leach, one of which is in my possession, and differs only in the following particulars. I must, however, premise, that I am sure of the identity of the wasp, as the builder of my nest, for the female was captured within it.

Mine is more globular, and about an inch in diameter every way; it also consists of three shells, the internal one however envelopes it entirely, excepting the aperture for egress, which is of the same width as the above; the second shell also is entire, and extends to the plane of the mouth of the inner one; the external one is, as above, also merely rudimental, and constructed only on one side, and at its widest part is about the same size as the former. The tier of cells within is in about the same state of advancement as the preceding, and consists of only, apparently, eleven cells,—*also perfect hexagons*, and of the same diameter. Its substance is a highly elaborated *papier machée*, of a brilliant silvery grey colour, smooth, and worked spirally, and in consistence it is much tougher than the above.

It was found suspended from the roof of a summer house at Hoxton, and given to me by Mr. Norman. The following is the description of the wasp taken with it, and which I consider to be the *Vespa Britannica* of Leach.

It is eight lines and a half long. Expansion of the wings fifteen lines: diameter of abdomen three lines.[1] Back covered with long yellowish pubescence: the *clypeus*, inner edge of the eyes as far as their emargination, a patch behind the eyes at their apex, a quadrate anteriorly emarginate mark between the *antennæ*, the basal joint of the latter in front, and the mandibles,—all yellow; the *thorax* has a broad line on each side of the *pro-thorax*, a small spot on each side, beneath the origin of the superior wings, and two large semicircular marks on the *scutellum*,—yellow. The *abdomen* is yellow, with the base of the first to the fourth segments black, rather broader in the centre, where it is angulated; on the second to the fourth segments there is, on each side, an obscure spot, separated from the black basal band: the legs are yellow, with the *coxæ*, *trochanters*, and base of the *femora*, black. The wings are obscure, anteriorly fuscescent, and their nervures pitchy.

The situation in which the first nest was found, is certainly very singular. The wasp must have concluded the sparrow's nest deserted, or may it have confided in its means of defence? But I have no doubt, as I have said above, that it is merely an accidental deviation, in structure and locality, from the ordinary nests of the *Vespa Britannica*.

[1] I give these dimensions particularly to show the relative sizes of the wasp and of her nest.

There are two British wasps which suspend their nests in exposed situations;—the one above, and the *Vespa Holsatica*, Fab. The nest of the latter is, however, much larger, usually about the size of a man's head, or somewhat smaller. These are of a firm texture, and are attached to shrubs; in the north they frequently occur in gardens, fixed to gooseberry-bushes. As to the number of wasps which are natives of this country, I much doubt if there are as many as cabinets are made to contain, from their being separated according to the markings of the abdomen; for I have myself taken three of these varieties, going in and out of one nest: but I shall shortly publish the facts which I have collected upon this subject, and my opinions as to their specific identity and diversity, will be strengthened by differences of structure as well as of markings, and indeed I strongly suspect that the *Vespa Holsatica* and *Vespa Britannica* are identical.

31, *Robert St.*, *Chelsea*,
July 15*th*, 1839.

Art. VIII.—*On the Fossil Shells of the Crag.* By S. V. Wood, Esq. late Curator to the Geological Society of London.

In publishing the following additions to the British tertiary fossils, some reason should be assigned for classing under one genus such diversity of forms as is here represented, and which might otherwise have been distributed among four proposed genera, viz., *Bullæa*, *Bulla*, *Bullina*, *Bullinula*. It was my intention so to have arranged them, but upon examination I found the gradations from the depressed and hidden spire to one that is highly elevated, to be so minute and almost imperceptible, that I knew not where to admit the one character and reject the other. Mr. G. B. Sowerby, in his 'Genera of Recent and Fossil Shells,' No. 39, has united *Bullæa* and *Bulla*, at the same time remarking the changes from one to the other to be so gradual, that a distinct generic line of separation cannot be drawn between them, and thinks the union of the two genera to be fairly warranted. I fully concur in this opinion, and in my present descriptions have only given the genus a little more extension, so as to include shells whose spires are quite visible, and more elevated than those which have generally been restricted within the limits of Lamarck's generic character.

The discordance among conchologists respecting the boundary line between different genera, is a subject of little im-

Fossil Bullæ.

J.D.C. Sowerby fecit.

portance to the geologist, the permanent establishment of species being all that is required for the purpose of identification; but upon this point it is certainly to be regretted that there should be any dispute, and until we are well acquainted with a shell in all its varieties and monstrosities, this must and always will be the case. The following are all the *Bullæ* belonging to the crag that I have seen; the descriptions will always be given from my own specimens, unless when otherwise expressed.

Bulla quadrata, Nob. Suppl. Pl. No. vii. fig. 1.

Shell quadrangular, finely striated, aperture wide, outer lip nearly straight, inner lip folded back, muscular impression marginal. Apex depressed, visible. Length $\frac{1}{7}$, diameter $\frac{2}{15}$ of an inch.

Coralline crag, Sutton.

Only one perfect specimen of this pretty shell has fallen into my hands, therefore I presume it rare; a few imperfect ones have assisted me in drawing up its character. The quadrate form of the outer lip renders this shell very distinct, and not liable to be confounded with any other species. A slight compression round the upper part of the body-whorl takes a little from the straight line of the outer lip, which is much expanded; the inner lip is not only folded back, forming a small *umbilicus*, but leaves an elevated ridge inwards, which produces a flattened depression on that side. Muscular impression large and conspicuous; *striæ* fine, numerous, and diverging.

I have included this very expanded shell among the *Bullæ* for the reasons above stated, conceiving the expansion of the aperture alone, to be insufficient for generic distinction.

Bulla catenata, Nob. Fig. 2.

Shell obovate, spire depressed, visible, aperture large, lip arcuated, vertex truncated, inner lip projecting: sub-umbilicated, striated, *striæ* numerous, ornamented; muscular impression indistinct. Length $\frac{1}{6}$, diameter $\frac{1}{8}$ of an inch.

Coralline crag, Sutton.

Two or three specimens only are in my possession, one of which is sufficiently perfect to exhibit all the characters above described. The elegant chain-like markings that ornament this shell are similar to those of *Bulla catena*, but in other respects it differs from the description of that species. The inner lip stands prominently forward, causing a depression behind it; the outer one is sharp and arcuated, which gives an oval contour to the shell. The upper part of the outer lip is truncated, leaving the spire visible, though depressed, with a slight compression around the upper part of the body-whorl. The whole marked with *striæ* diverging from the summit.

Bulla dilatata, Nob. Fig. 3.

Shell subcylindrical, vertex truncated, spire depressed, visible, aperture large, expanding towards the base; striated, *striæ* diverging, muscular impression large. Length $\frac{3}{8}$, largest diameter $\frac{3}{16}$ of an inch.

Coralline Crag, Sutton.

The spire is visible although depressed, the upper part of the whorls convex, producing a deep suture or subcanal round the vertex. The aperture is much expanded, showing the muscular impression imperfectly divided, being deeply seated around the base, and slightly visible along the edge of the outer lip, and again deeply impressed at the upper part.—The *striæ* are visible at the apex, running round the convolutions of the shell, but diverging towards the base, where they are almost at right angles with those above. Under a lens it shows externally a very elegant chain-like appearance, produced by small oval depressions, similar to those of *Bulla catenata:* it has a slight depression behind the thickened edge of the inner lip, running to the base.

A recent shell from the coast of Bute, given to me by Mr. Lyell, is perfectly identical with the above; but in its recent state is beautifully transparent, the chain-like *striæ* being visible on the inside.

Bulla lignaria, Auct. Fig. 4.

Shell ovate, thin, spirally striated, vertex depressed, aperture wide.

Coralline Crag, Ramsholt and Sutton.

Four or five entire specimens, with a few fragments sufficient to allow of a careful comparison, have enabled me to decide upon the identity of this shell with the well-known recent species. Nothing that I could imagine to be the testaceous gizzard, or even a part of it, has ever come under my observation. I have only one fragment from the red crag, but its tenuity is ill adapted to withstand the bouldering of a littoral deposit, and also its comparative rarity in the coralline crag may account for its non-appearance in the upper bed.

Bulla ventrosa, Nob. Fig. 5.

Shell ovate, globose, striated, spire concealed, aperture suboval, extending to the apex, narrow above, expanding towards the base, umbilicated.—Length $\frac{2}{15}$, diameter $\frac{1}{8}$ of an inch.

Coralline crag, Sutton.

A shell figured by Brown, in his Illustrations of British Conchology, called *Diaphana candida*, pl. 38, fig. 13, 14, somewhat resembles this in outline, but the spire is visible; and as there is no accompanying description, little can be said respecting it. The inner lip is slightly folded back, forming behind it a small *umbilicus*, and the outer one expanding towards the base, forms a compression round the upper part of the whorl, a character not unusual in many species of this genus. The aperture diverges from the upper part, assuming a suboval shape. Externally striated, and the outer lip thickened, behind which is seen the muscular impression.

Bulla conulus, Desh. Fig. 6.

Bulla conulus, Deshayes, Coq. Foss. des Env. de Par.; pl. 5, fig. 34, 36.

Shell ovato-conical, striated, *columella* subuniplicated, aperture linear, base dilated, spire hidden. Length $\frac{1}{4}$, diameter $\frac{1}{8}$ of an inch.

Coralline Crag, Sutton.

This is one of the few eocene shells found in this deposit. I presume it to be identical, according to Deshayes' figure and description, except that he says "basi tenuissimè striata," whereas the crag shell (when not eroded) is striated all over. There is a shell figured by Brown, called *Volvaria pellucida*, which may perhaps be the same, but according to the figure the upper part is too much truncated.

Bulla concinna, Nob. Fig. 7.

Shell subcylindrical, spirally striated, apex concealed, aperture linear, slightly gaping at the base, inner lip at the lower part folded over an *umbilicus*. Length $\frac{1}{8}$ of an inch, diameter $\frac{2}{3}$ of its length.

Coralline Crag, Sutton.

All my specimens have the outer lip broken, but the shell is very distinct in many points. It is shorter and more gibbous than *Bulla cylindracea*, with the aperture wider. The distinct lines of growth cut the deep-seated *striæ* at right angles, giving the shell a pretty cancellated appearance; the rounded volutions of the upper part of the shell produce a funnel-shaped *umbilicus* in the place of the spire, and the fold of the inner lip forms a distinct *umbilicus* at the base.—Twenty specimens of the shell present not the least variation.

Bulla cylindracea. Fig. 8.

Bulla cylindracea, Montague, Test. Brit. tab. 7, fig. 2.
,, *convoluta*, Min. Con. tab. 464.

Shell cylindrical, spirally striated, aperture linear, narrow, vertex umbilicated. Length $\frac{1}{2}$ an inch.

Coralline Crag, Sutton. Abundant.

In Montague's description of this shell it is stated to be smooth, with considerable gloss, as it is also in Fleming's British Animals, p. 293; no mention is made of its having *striæ*. Nine out of ten of those from the crag are so much eroded as not to show them, but they are very visible in perfect specimens; this, however, is the case with the recent shells, it is only in some specimens that the *striæ* can be there seen. The recent shell appears in general to be rather more cylindrical, but it corresponds in all other respects.

Bulla subtruncata, Nob. Fig. 9.

Shell cylindrical, smooth, aperture linear, slightly expanded at the base, vertex depressed, visible. Length, $\frac{1}{7}$, diameter $\frac{1}{15}$ of an inch.

Coralline Crag, Sutton.

This differs from the young of *Bulla cylindracea* (for which perhaps it might be mistaken) in having the spire visible although depressed; it has a slight contraction in the upper part of the body, which gives an apparent expansion to the lower part of the outer lip. The whorls are carried rather above the spire, causing it to be depressed, but distinctly visible; outer lip nearly straight; no *striæ* to be seen in any of my specimens, however, that may be from erosion or decomposition.

It appears intermediate between *Bulla cylindracea* and *Bulla obtusa*, differing from the former in having the spire visible, and from the latter in being longer and more slender. I am induced to consider it a distinct species, having twenty specimens presenting the same characters; there is a possibility of its being the young of *cylindracea*, with a visible spire, only that shell is never contracted in its whorls.

Bulla obtusa. Fig. 10.

Bulla Regulbiensis, Turt. Linn. iv. p. 351.
„ *minuta*, Woodward, Geol. of Norf. tab. 3, fig. 3.

Shell subcylindrical, aperture linear, widening at the pillar, outer lip slightly incurved, vertex elevated, obtuse. Length, $\frac{1}{8}$, diameter $\frac{1}{16}$ of an inch.

Mammaliferous Crag, Bramerton.

This shell, I believe, is peculiar to the newest bed, at least I have never seen it from either the red or coralline crag.—The spire of the fossil does not appear, from the few specimens I have seen, to be quite so elevated as that of the recent shell.

Bulla olivula, Nob. Fig. 11.

Shell cylindrical, smooth, aperture linear, spire elevated, obtuse, separating line canaliculated? Length $\frac{1}{7}$, diameter $\frac{1}{14}$ of an inch.

Coralline Crag, Sutton.

Unfortunately among thirty specimens of this shell which I have found at the above locality, not more than one possesses the spire, and that not in the most perfect state; therefore I give the characters with some degree of uncertainty.— The specimen which is least mutilated has a small canal running round the apex, at the juncture of the upper part of the body-whorl, similar to that which gives a character to the genus *Oliva*. The specimens are much eroded at that part, (a circumstance not unusual in the slender covering of the sutures in many of the crag shells), independently of which there appears a small canal remaining where the covering is in parts perfect.

A shell of the same size from China, in the possession of Mr. G. B. Sowerby, much resembles this in having an elevated obtuse spire, with a canal around it, but it has a fold upon the lower part of the inner lip that I do not observe in the crag species. It differs from *Oliva* in not having a plicated *columella*, and in wanting the notch at the base, peculiar to that genus. It more resembles, and may hereafter prove the same as *Bulla terebellata*, pl. 1, fig. 8, 9, 10, Dubois, Conch. Foss. du Plat. Wolhyni-Podolien; but a comparison with the shell is necessary for such decision.

Three or four shells of this kind are figured by Brown in his Illustrations of British Conchology, pl. 38, but as they are without descriptions, it is impossible to say whether they are intended for representations of shells in their natural size or magnified. If they be faithfully represented, they present some intermediate forms, and show the very gradual elevation of the spire, which renders it so difficult to separate the species, and will, I hope, afford additional evidence to justify me in retaining all these shells (now figured) in the above Linnean genus.

With the exception of *Bulla lignaria* all the figures are enlarged, but the natural dimensions of the specimens are indicated by an annexed cross.

SHORT COMMUNICATIONS.

Teeth *of the Mastodon*.—I have great pleasure in sending you a cast from the molar in my possession, which I imagine to belong to Cuvier's species of the narrow-toothed *Mastodon*. I have had the cast painted as nearly as possible to the color of the original, which is, as you will see, nearly perfect, and weighs three pounds and three quarters, good weight; it was dredged up off Easton Cliff, Suffolk, in June, 1839, between two and three miles from land.

The half of a molar of a *Mastodon*, which was found last year on the beach at Sizewell, and is in my collection, had every appearance of the crag adhering to it, which, with the beautiful dark Vandyke colour of these two fossils, the peculiar characteristic of crag osseous remains,—induces me, since my conversation with you on this subject, to adopt your opinion that these teeth were originally from the crag; and in further evidence, all the teeth, and fragments of teeth, of the *Mastodon*, which have been found, are from the mammaliferous or Norwich crag.

Till within the last five years it was doubted whether the remains of the *Mastodon* had been discovered in England; I therefore think it as well to state the order in which these teeth have been found, and their number, as near as I can remember, and by whom discovered. One tooth, figured by Dr. Wm. Smith, found at Whitlingham. One presented to the Geological Society by the Rev. J. Gunn, found at Horstead. A fragment found by the late Mr. Woodward, of Norwich, at Bramerton. An interesting fragment found at Bramerton, which I presented to the Norwich Museum. One found by Mr. Fitch, in Thorpe pit, near Norwich.[1] Two others found by myself at Bramerton. Two by Mr. Wigham, both, I believe, from Postwick. A fragment found by myself at Easton, now in the collection of the Geological Society.—And one from Easton cliff, of which I send you a sketch, but which I could not preserve owing to its rotten condition.—This last was fixed in a large portion of the jaw; and, with the two marine ones in my cabinet, makes a total of thirteen. The tooth found by Mr. Fitch, and the two by Mr. Wigham, are particularly interesting from their perfect condition; and the large marine one in my possession, although not quite perfect, is a splendid specimen.—*H. Alexander.—Southwold, July 19th*, 1839.

[1] A second very perfect tooth has lately been obtained by Mr. Fitch, from the crag, near Norwich.—*Ed.*

Capture of rare Birds.—To the instances of the rose-coloured pastor mentioned by Mr. Yarrell, I have to add another (in mature plumage), which occurred in the beginning of last month at Gwithian, about twelve miles from this place, on the north coast.

On the 29th April I obtained a fine specimen of the grey-headed wagtail—a male—having the slight mixture of olive green in the grey feathers of the head, which Mr. Yarrell states to be characteristic of the bird of the preceding year. It was first noticed on the margin of a pool near the sea, between this place and Marazion.

Two instances of the little gull in this neighbourhood have come to my knowledge. The first, in St. Ives' Bay, on the 26th of December last, was a young male in moult, and I suppose in transition to the mature plumage, as several grey feathers appear among the brown of the back. It seems to be a rather large specimen, the total length being 12 inches; wings from tip to carpal joint, $10\frac{1}{2}$ inches; total extent, 33 inches: *tarsus* $1\frac{1}{4}$ inch; middle toe and claw $1\frac{1}{4}$ inch; gape $1\frac{1}{2}$ inch. The central feathers of the tail are 1 inch shorter than the outermost.

The other was also a male, but in the adult winter plumage, and of great beauty. It was shot here, in the harbour, March 4th, and is said to have been accompanied by another, which escaped. The only respect in which it differs from Temminck's description is the colour of the legs and feet, which were a delicate flesh colour.—*D. W. Mitchell.—Penzance, July*, 1839.

On Fieldfares breeding within the British Islands.—Having seen various eggs presented by Mr. Fairholme to the British Museum and Zoological Society, as those of the fieldfare and redwing thrushes, I cannot but observe that both have *exactly the appearance* of slight varieties of those of the common missel thrush, and are totally unlike others which undoubtedly were laid by fieldfares and redwings abroad.

I have recorded, however, in former numbers of this Magazine, two instances of the redwing propagating in the southern counties of England, and can now add to them a case of the fieldfare breeding at Merton, Surrey. About the end of last May, a friend residing in that neighbourhood, and who is as well acquainted with the common British land birds in a state of nature, their notes, flight, habits, &c., as any person well can be, sent a message to me to the effect that a pair of fieldfares were then breeding in a field belonging to some grounds which he superintends: it appears that he had been crossing the field in question, when he was startled by the chatter of a "pigeon-felt" long after the flocks of this well-known winter visitant had disappeared for the season; and suspecting, therefore, that it might possibly have a nest in the dense hawthorn tree from which it flew, he was not long in finding it there. The fieldfares, however, though daily observed after this, were not disturbed, my friend (who is no collector) expecting that I would first like to visit the nest as it stood: but unluckily his message to me was forgotten to be delivered, and it was only when I chanced to call on him some weeks afterwards, that the circumstance accidentally transpired, when we soon proceeded to the spot, in the expectation that the young were then about half-fledged. They had flown, however; but the structure of the nest, which was then taken, was of itself sufficient to remove all doubt of the matter, being quite different from either that of the blackbird, song, or missel thrush, (of all three of which, I may remark, *several* nests were shown to me as we passed through the garden), so that every evidence, except that of positively handling the birds or eggs, concurs to substantiate the specific determination; and what is more, the old birds have from time to time been seen subsequently, but never shot at, in the expectation that they would have built another nest, which there is reason to believe has not been the case. The nest (which may be seen by calling at Mr. Bartlett's, 47, Museum St., Holborn) is chiefly remarkable for the great quantity of mud with which it is plastered, rendering it extraordinarily heavy; in other respects, it agrees nearly with some of those of the blackbird, and is plentifully lined with coarse dry grass; but it is considerably deeper, with more solid and better constructed walls, than I remember ever to have seen a blackbird's nest, with a rim of plaster, half an inch thick, forming its upper margin: it was placed nearly ten feet from the ground, upon a thick secondary branch of a densely foliaged hawthorn-tree, which stands alone at a considerable distance from the hedge and from any other tree. As for missel thrushes, song thrushes, and blackbirds, each and all of these species may be seen at any time in the locality; where, some years ago, I knew of four missel thrushes' nests in a short double row of oaks and elms bordering the same field: and I repeat (on account of the scepticism which certain hearers have expressed to whom I communicated the incident with its circumstances) that there is not the slightest probability of a mistake being made concerning the identification of the species.—*Edwd. Blyth.*—*Aug.* 15, 1839.

Observations on the Wild Fowl in St. James's Park.—It is remarkable that among the numerous species of wild fowl which ornament the fine sheet of water in St. James's Park, the only species of the duck tribe—excluding the geese and swans—which have propagated, besides the common mallard duck, is the tufted pochard (*Fuligula cristata*), a single brood of which, consisting of five, one of which was soon after destroyed, was hatched in July, 1838: the rest of the brood (two of each sex) were reared, and, with some of the old ones, have been in the habit of taking daily flights to the Serpentine ever since. This season there are three large broods,—one the progeny of the same female which bred last year, and which is known by her being pinioned, and the others the produce of the two young females that were bred on the spot: so that a single brood once raised in the locality, would seem to be all that is necessary to secure a permanent stock of other species. It is curious that the young pochards scarcely ever follow their parents from the time they are three or four days old, but disperse all over the lake, emitting continually a loud piping cry, which is characteristic. Far less dependent on the parents' vigilance and care than the young mallard ducks, or indeed than any other species so far as my observation has gone, they seem wonderfully capable of taking their own part, and scramble for food among the full-grown larger species, with an alacrity and amount of impudence that is highly amusing, diving the moment they give offence by their uncommon boldness, and appearing the next moment at an inconsiderable distance, quite unabashed, and ready to renew the affront if occasion should tempt them. These little creatures in general lie close under the bank of one of the islands when their appetite is sated, so that a person may look for them in vain, though it seldom happens that some of them are not visible and sufficiently audible; they as often occur solitarily as together, and their down is of a dusky black colour, with the usual pale markings (such as are seen in a common duckling) not very distinct: the eggs are dark olive green.

So domesticated do various species become in this favorable spot for observing their manners, that on regaining the use of their wings after these had been merely clipped, many have shown no desire to fly away; and during the very long protracted frost of January, 1838, a flock of widgeons and pin-tails long lingered circling over the skaters for hours every day, but at length disappeared, and were probably destroyed from their want of shyness, as none returned: during the same period, many of the pochards (*cristata* and *ferina*) were commonly to be seen in the Thames about Westminster and

Vauxhall bridges, where they were much shot at, but with little or no effect, as they were there singularly shy of approach; and others disappeared altogether and returned in the spring, as did also one of the coots, and some teal. A pair of bean geese, with the full use of their wings, and previously supposed to be male and female, each produced nine eggs which were unimpregnated, but on which they sat for some weeks: it was supposed that they might possibly have produced hybrids from a male Canada goose, which constantly associated with them, and posted himself in defence of one of them while it was incubating; a circumstance the more worthy of notice, as an odd female Canada goose of the preceding year (which species does not breed, however, till the second season), might have served him at least for a companion, if not mate. One of these bean geese was stolen early in last spring, and the other laid and sat again to no purpose; for she very rarely associated with a fine new pair of the same species, introduced last winter, and which will most probably rear a brood next year: the latter may now generally be seen in company with a male of Mr. Bartlett's new species,—the *Anser phœnicopus;* closely allied, but readily distinguishable by the colour of its legs, inferior size, and certain other characters of equally invariable occurrence: the old female bean goose always affecting the society of a flock of knobbed geese (*Anser cygnoides*).

It is to be regretted that the spoonbills and other interesting large birds for a considerable while located to the spot, and which as they soared on wing were certainly an interesting attraction to visitors, have been shot down one by one in the suburbs of London (both the spoonbills from coming within range of pigeon-matches), to the discredit of even cockney sportsmen, who could scarcely have missed so large and slow-winnowing an object. As a general rule, however, the *Cultirostres*, Cuv., were disposed to snap up the ducklings, &c., as might be expected; but it would hardly have been anticipated that a bittern would have smashed all the eggs it found, with intent to pick out, I should suppose, the half-formed chick, if such existed, which act has been witnessed on more than one occasion, and suspected on numerous others.

The wholesale destruction of eggs, then, effected by five or six bitterns, and several herring-gulls, may well be imagined; and it is therefore satisfactory to know that the collection will henceforth be confined to the *Lamellirostres*, with the addition of a few other harmless species, such as coots, from which no mischief need be apprehended.

The vast stock of fish which everywhere abound in this piece of water, rendered it particularly well calculated to support a few of those very elegant birds—the mergansers, of which a solitary male smew has now lived there for three years, acquiring the female colours after midsummer without shedding any of its feathers, and resuming its breeding dress at the autumn moult, (none of the diving ducks changing their plumage twice a year, like the others, although they all undergo an analogous mutation of colour immediately at the close of the season of propagation). This smew generally associates with two females of the *Clangula vulgaris*, and appears well disposed to breed if it had a mate of its own species equally tame; expressing its desires by a very peculiar low rattling note, during the utterance of which the neck is gradually stretched backward, with the beak pointing forward: it will readily feed on bread, at least at times, for which it is a particularly able scrambler; and I have repeatedly seen it come on shore, and preen its feathers within a few yards of me, indeed it has taken food from my hand. The brilliancy of its white nuptial livery renders its rapid evolutions under water comparatively easy to follow with the eye.—*Id.*

Note on the Fossil from Marychurch, figured in 'Geolog. Trans.'—Last winter I took no little trouble to procure specimens of the singular fossil of which a figure is given by M. De la Beche, in the 'Geol. Trans.' as having been found at Marychurch, in this neighbourhood. At that time all my endeavours were unsuccessful; the very first visit, however, which I paid this winter to a quarry at Barton, near Marychurch, I procured two fragments, one of which apparently shows the internal structure, but still so obscurely that I do not think it worth while to send you a sketch. My friend Dr. Battersby, however, in the course of the past summer, obtained three specimens from a quarry near Newton Bushel, which, being "*weathered*," show something of the interior surface. As it is mentioned in a note to De la Beche's paper, that a recent specimen allied to the fossil is deposited in the museum of the Zoological Society, presented by an officer in the navy,[1] you will probably be glad to have a sketch of the interior surface of the fossil to compare with the recent specimen.

The plates, when most perfect, are hexagonal and radiated on the outside (fig. 62). The interior is divided into a number of little squares by raised lines; those running in one direction always pass over those in the contrary direction, and

[1] On enquiring at the Museum of the Zoological Society, we could not meet with, or obtain any information respecting, the above specimen.—*Ed.*

the point of crossing is always immediately underneath the raised dots in the centres of the plates on the outside.—*John Edw. Lee.—Torquay*, 1838.

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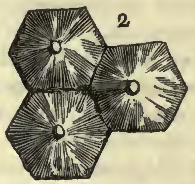

Interior. Exterior. Each magnified 4 or 5 times.

New Metal.—Mr. Kersten, Professor of Chemistry at the College of Freiberg, in Saxony, has lately received a letter from Prof. Berzelius, in which it is stated, that Prof. Mosander of Stockholm has discovered, in the ore called cerite, a new metal, to which he has given the name of *Lantanum.* Its colour is grey, and it appears to be soft and ductile. It is also contained in the oxide of *Cerium* which Prof. Kersten has lately found in Monazite, a new mineral from the Ural mountains, which was determined by Breithaupt, and sent by Mr. Kersten to Berzelius for further analysis. Prof. Kersten has since discovered the same new metal in an ore from Sweden, called Godolinite. This fifty-fifth elementary body has therefore been found already in minerals coming from very distant localities, and it is somewhat remarkable that the north of Europe has come in for so large a share in furnishing the simple bodies of modern chemistry.—*W. Weissenborn.—Weimar.*

An immense erratic block of Granite has been floated on the ice, during the winter 1837-38, from Finland to the Island of Hochland. It weighs about a million of pounds, according to the estimation of M. de Baër, who lately communicated the circumstance to the Academy of St. Petersburgh.—*Id.*

An Entomological Society has just been formed in Stettin, whose chief object is to promote our knowledge of the *habits* and *economy* of insects. It is partly on account of this peculiar feature of the Society, and partly as one of the most recent instances of the liberality with which the Prussian government encourages every scientific undertaking, that this Society appears to deserve being more generally noticed. For M. de Altensheim, the Minister of the Cultus, besides other liberal support which he has given to it, has carried the measure, that the Society *do not pay for postage throughout the kingdom.*—*Id.*

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NATURAL HISTORY.

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Art. I.—*On the Natural History of the German Marmot (Hamster).* By W. Weissenborn, Ph. D.

Having been engaged, at different periods of my life, in studying the habits of the German marmot, I have made various communications on this curious animal to foreign scientific societies, more especially to the Zoological Society of London; in consequence of which Mr. Charlesworth did me the honour of wishing me to draw up a more complete article on a creature which presents so many interesting and uncommon features, both in its organization and habits, and with which the English, luckily for their agricultural population, have, in their own country, no opportunities of becoming acquainted. I have, therefore, arranged all the materials I could collect on the subject from authentic sources, especially from Dr. Sulzer's monograph, as far as it has not become obsolete, adding to them such of my own observations as I thought sufficiently substantiated and interesting, and now venture to submit my article to the readers of the Magazine of Natural History.

I shall begin with a general statement of the most prominent features which render the epithet of "curious" applicable to the German marmot.

1. Its peculiar outward form, in which that of several other rodents is blended. It has the truncated snout, cleft upper lip, and downcast under lip, of the hare; the shape of the trunk approaches to that of the rat, though it be fuller, whilst the hamster possesses the short tail of the *Hypudæus arvalis*, Illig. As to the relative size of the head, it stands between the rat and the guinea-pig (*Cavia Cobaya*, Illig.)

2. The colour of its hair, which presents the great peculiarity of being *black* all over the belly, and of a *much paler*

tint (greyish brown) on the upper part of the body, in the common variety.[1]

3. The buccal pouches, which the German marmot has in common with but few animals, and which in it are comparatively larger than in any other.

4. Its subterranean habits, which besides present many curious peculiarities.

5. Its hybernation. And

6. Its moral disposition, especially the courage in defending itself, which it has in common with the badger; and its ferocity in devouring its congeners, which it has in common with the mole.

Synonyms.—Both the zoologist, and the more general amateurs of knowledge, may, in many instances, feel interested in knowing the different names which apply to the same animal in different countries or writings. These synonyms often clearly indicate the localities where the creature is indigenous, and where it is not so. Such as German marmot, or marmotte de Strassbourg, will at once show, that our animal is originally neither found in England, nor in France proper. In the latter country it was once even exhibited in a strolling menagery, under the curious name of "un animal sauvage d'Allemagne, nommé, 'Fruges consumere nati.'" The German name 'hamster' has found its way into the Scandinavian (as also into the Dutch) languages; and the great Linnæus procured his first specimens from an illiterate herbalist, named Dietrich, residing at a little village called Ziegenhain, near Jena, whom Linnæus took for a member of the university, when he wrote to him,—"Mittas mihi, quæso, animal *Hamster* dictum." As to the true vernacular names of the German marmot, we may distinguish two sets, viz., those which are an imitation of the yelling sound uttered by the animal when irritated; as *Krictsch*, Germ.; *Krziczieti*, Illyr.; *Skrzeczeck*, Pol.; *Sskrecek*, Boh.; *Schurks*, Serb.; *Gringie*, Hung.; *Surka?* Tartar; the Latin name of *Cricetus*, which Albertus Magnus appears to have first used, is perhaps derived from

[1] This feature would stand quite isolated among all our indigenous quadrupeds, but for its existence in the badger, which coincidence, in my opinion, deserves the attention of the physiologist, as both these species are crepuscular, winter-sleepers, and live underground. The cause of this peculiar coloration in these two animals, may perhaps he traced to some general law of nature, the more so as the mole, which is strictly subterraneous, is altogether black, although the exclusion of light be, in general, a hindrance to the development of pigments. Also in the German marmot, there is a great tendency to become black all over the body, and the black variety is extremely common in some localities, whereas albinoes have been met with only in a few instances.

κρίζω, I scream:—and such as have, or appear to have, a different origin, as *Arlan*, Tart.; *Bakuk*, Bashkir; *Tsharligan*, Osljak; *Chomäk*, *Karbush*, Russ. In Germany the animal has several names of that class, as *Kornferkel*, corn-farrow; *Kornhamster*, corn-storer; and is most commonly called *Hamster*.

CRICETUS, Cuv. Gen. Char.—Teeth much like those of the rat; tail short, hairy; buccal pouches, as in some of the apes, widened into large bags, which serve for carrying home food.

Cricetus *frumentarius*.

Description.—*Length* of the largest male specimens from the tip of the nose to that of the tail, up to 15 inches Eng. of which the tail measures scarcely more than 2, the grown female being smaller by about one fourth. *Weight*, up to $1\frac{3}{4}$ ℔. *Shape*.—Trunk rather broad than high,[1] clumsy; head oval, nose truncated, upper lip cleft, under lip short and hanging down; incisor teeth partially exposed; eyes moderately large, as well as projecting and almost circular; ears large, rounded; feet rather short, formed more for digging than for running, with five toes, the thumb being very short in the fore feet, and furnished with an obtuse nail, whereas the other nails are long, hooked, and grooved below; five callosities in the sole of the fore feet, and six in that of the hind feet; tail short, tapering, and becoming rather bare towards the point. *Colour*.—Greyish brown (hare-coloured) above, and black beneath, with three large yellowish spots on each side occupying the flanks, the regions above the shoulders, and that behind the cheeks, the latter spot being continued towards and round the mouth. Cheeks, regions round the ears, and anus russet; feet white. There is a black variety, rather common in several neighbourhoods,[2] with only the nose and feet white, and a mixed breed of the common and black variety is said to exist, and to be grey. Albinoes are very scarce, but have been occasionally met with.

Senses.—The organ of *vision* is moderately developed; the iris is dark brown, and it is difficult to distinguish it from the pupil, so that the whole visible portion of the eye-ball appears of a dark colour. As it is protected only by a few short bris-

[1] A fresh-killed hamster, when thrown at random on the ground, will lie on its back or belly, whilst a rat will more commonly lie on one of its sides.

[2] The black variety was very scarce near Gotha about 1770, when a specimen was exhibited at court as a great curiosity; whereas in the beginning of this century they were of rather common occurrence there. Among three dozen which I procured about eleven years ago from the vicinity of the borough of Buttelstädt, five English miles from Weimar, there were four or five black ones.

tles, forming eye-brows, we must suppose that the animal digs with its eyes shut; whereas above ground it must keep them wide open, as they are the chief instruments for finding food in the dusk. The *smell* is very obtuse, as indicated by the truncated nose. The *hearing* is acute, as indicated by the large *conchæ*, and it is by the assistance of the ear that the hamster is chiefly warned of the approach of its enemies, when it will directly rise and sit in an erect posture, like the hare. The *taste* is probably the most developed of the senses, the tongue being very voluminous, and the animal very fond of varying its food. The *touch* is rather nice, as the hamster will grasp nuts &c. with its fore-paws, and open or eat them in the manner of the squirrel, though far less skilfully. As to the *common feeling*, it must be extremely obtuse, as the hamster does not show the least pleasure in being caressed, and though it flies into a passion at the least touch, and screams when wounded, these are symptoms of ill temper and fury rather than of sensibility.

Movements.—The locomotion of the hamster is slow, particularly if compared with that of animals of the same size and order, for instance, the rat. It is easily overtaken by man, even when making towards its burrow with all possible speed. When fighting, its movements are violent and heavy, often missing their object. They are most appropriate to its subterraneous habits, as digging, creeping, and climbing up and down perpendicular tubes.

Anatomical peculiarities.—The *buccal pouches* are two membranaceous sacs which have a wide communication with the cavity of the mouth, from whence they extend between the skin and the muscles, along the neck and the shoulders, in a somewhat converging direction, so that the shut ends are nearer each other than the open ones in the buccal cavity.—These bladders are attached along their inner sides, by cellular fibres and membranes, to the muscles beneath, and by more delicate ones to the skin. Their posterior end is surrounded by flat muscular fibres, which unite to form a flat and rather strong muscle. These two muscles continue to converge, and are attached, close under the *musculus quadratus*, to the *fascia* of the *latissimus dorsi*. The membrane of these bladders is very thin and permeable to the air, wherefore they soon become shrivelled when blown out and tied by a ligature. Their outer surface is perfectly smooth, but the inner one is closely covered with longitudinal and parallel dotted lines, the dots being almost square, and constituting mucous cells or glandules; wherefore the inside of the bladder is constantly wet and slippery, or it would easily be torn by its contents, which often present rough or sharp surfaces. Between their two attachments these bladders, when empty, extend like two loose narrow canals; but when full, they are oval, $2\frac{1}{2}$ inches long, and $1\frac{1}{2}$ broad, wherefore their periphery, where it is widest, measures about $5\frac{1}{2}$ inches.—When these pouches are filled with food, or blown up by the animal, its head and neck look as broad again. I scarcely need say that these pouches present the convenient means of carrying home food; they contain about $1\frac{1}{2}$ ounce of corn each, or a corresponding quantity of green fodder. The animal empties them by stroking them from behind with its fore paws; the muscle which has been mentioned perhaps facilitates this operation by its contractions. The anatomical characters do not, however, show the possibility of these pouches being contracted in the manner of the urinary bladder; nor could anything like peristaltic motion be discovered in fresh-killed specimens, which were still convulsed. They may serve as a sort of craw or first stomach, as in almost every hamster that has been dissected, there were found in them a few grains in a state of maceration; and I have also observed that the hamster fills its pouches with animal food, of which he never lays in a store at home. However, the animal often eats the grain just as it finds it, and therefore this use of the pouches is not absolute. The *stomach* is double; the first or left one, into which the *œsophagus* opens, offering nothing peculiar in its form, except that the mouth of the *œsophagus* is situated at the right extremity of it, which is in the mesial line, whilst the whole of that stomach is situated to the left of it. The valve of the *cardia* or *œsophagus* shuts so closely upwards, that the stomachs may be inflated from the *pylorus*, and dried in that state, after tying the *duodenum*, without a ligature being put round the *œsophagus.*—This is a sure proof of the hamster not being a ruminating animal, although his stomach is double. Near the *cardia* the first stomach opens to the right into the second, which is more rounded, reddish, smoother and more shining outside, and has thicker coats than the first; it is situated to the right of the mesial line, rather higher than the first, and is a little smaller. The two unite by the first being, as it were, inserted into the second, into which it sends two processes, and there is a rudimentary valve between them, which cannot, however, effectually prevent the regurgitation of the chyme, which is much more fluid in the first than in the second stomach. The *rugæ* are much more prominent in the first than in the second, which, on its right and upper side, communicates with the *duodenum*, without the intervention of a valve. The *intestine* is thin and narrow, presenting almost the same width throughout; the inner coat is much furred, and the *cœcum* is very large in proportion, as when pulled out it is half as long as the animal, and its capacity twice that of the stomachs.—There is no *gall-bladder* in the five-lobed liver, but the bile empties itself directly through the biliary canal, which is formed by the union of five branches; this structure appears to bear some relation to the irritable nature of the creature. The *glands* are in general very large and numerous. One, which is situated in the groove between the shoulders, is particularly remarkable for its size and relations. It is often more than 1 inch long, $\frac{1}{2}$ an inch broad, and 2 or 3 lines thick in the middle. The *vein* which comes from it penetrates between the fifth and sixth ribs, on the right side of the spine, and opens into the *vena impar*, which is ascending there, and which in the hamster, as in some of the *Amphibia* and *Ruminantia*, is *paired*, one branch being to the right and the other to the left of the spine, but the latter branch is much larger than the former. The *artery* of the said gland is comparatively small, and the same may be said in general of the arteries in proportion to the veins. The weight of the *brain* is to that of the whole body about as 1 : 193; this organ is therefore very small. The *cerebrum* is about three times the weight of the *cerebellum*; its surface is smooth and without sinuosities, which bears a relation to the great stupidity and stubborn disposition of the creature. The *testes* are eight or nine times as large, from May to August, as they are at other seasons; they are nearly the size of pigeons' eggs when fully developed. The animal can draw them within the cavity of the *abdomen*, which provision is necessary, as they would otherwise be often exposed to dangerous pressure in their enlarged state.

These are the most remarkable anatomical features which are peculiar to the German marmot: the dental system presents nothing anomalous, there being 12 molar and 4 incisor teeth, as in the rat. I ought not, however, to pass over in silence two oblong spaces in the integuments, one on each side of the spine, and parallel with it. They are situated at a short distance in front of the thighs, and are not always directly perceptible, as the common hair often closes over them. But if the hair be blown aside or divided with the fingers, two spots may be observed, each about an inch in length and $\frac{1}{5}$ of an inch in breadth, slightly tapering towards their extremities, where the hair is much shorter than on the other parts of the body, and of a dusky brown colour, rather stiff, and lying close to the skin. In very young specimens, when the hair is just beginning to appear, these *bristly spots* are distinctly visible from their blackish colour, the hair being there in a more advanced state and of a stronger nature. These spots may also be perceived on the flesh-side of the skin, by the roots of their stiff hairs: at a later period the relation is inverted, the rest of the body becoming covered with denser and longer hairs, so as to make these spots appear paler on the flesh-side of the skin. The physiological cause of these spots it is difficult to point out, the skin being there of the same thickness and consistency, and not more firmly attached than anywhere else. As to their end, Dr. Sulzer, whose excellent observations on the hamster were published in 1774, confessed that he could not imagine what it might be. Agricola was aware of their existence, but did not trouble himself about knowing their purpose, as he took them for the effect of an accidental cause. In treating on the hamster, he says, "In terræ cavernis habitat angustis, et idcirco pellis, quâ parte utrimque coxam tegit, a pilis est nuda."—(De re metallica et animalia subterran. Basil, 1657, folio, p. 486). In my opinion, the end of these spots is very evident, as they appear destined to protect, by their bristly hair which lies close to the skin, the very portions of the latter which would be most exposed to being chafed in the burrows, on account of the proximity of the hip-bones, if left without some special defence. The furriers know these spots very well, and are obliged to cut them out and repair the fur, lest it should look unseemly.

Habitat, Habits, &c.—The hamster is met with in the whole tract of countries extending between the Rhine and the Ural mountains, and between the German sea and Baltic to the north, and the Danube to the south, wherever it finds its congenial soil. It is said also to exist in Siberia, but is nowhere more common than in Thuringia. Its proper soil is a deep alluvial mould, with a substratum of clay; districts where the ground is dry, strong, and stony, have nothing to fear from the ravages of the hamster. In the former description of land it is sometimes found even on the slope of low hills, but there it never multiplies to any extent.

Daily course from the beginning of March to the middle or end of October, (the period of active life).—During the day the hamster sits in its burrow, rolled up like a ball, with the head bent under the chest; so at least we must conclude from the observation of specimens kept in captivity. About sunset the animal begins its first ramble, which lasts till about midnight, when it rests till an hour before sunrise, in order to take then a second ramble, which it continues until the glare of morning drives it back into its dark habitation. It is only in dark and gloomy weather that the hamster is ever found above ground whilst the sun is fairly above the horizon.— During these rambles the movements of the animal are commonly slow; its digitigrade walk is uncouth and creeping, almost like that of the hedge-hog, and its first object is to procure grain and other vegetable food, wherewith to fill its pouches. But as soon as it hears a noise, it raises itself upon its hind legs, and stands plantigrade, like a bear;[1] and if the object of its attention be some living prey, as a mouse, it quickens its pace into a gallop, or "ventre-à-terre." Whilst quietly walking about its occupations, it is sometimes heard to utter a succession of short growling sounds; but when irritated, even only by some noise, its voice is squeaking and shrill, and in the height of passion it is not unlike that of a pig when about to be killed. In collecting food, when the fore-part of its pouches becomes filled, it strokes them backwards with its paws, to make room for a new supply. It does not thrash the ears with its paws, as has been advanced, but picks them very dexterously with its teeth, whilst holding them between its fore paws. When the pouches of the hamster are full, the animal walks home, to add their contents to its store. When surprised on its way by an enemy, it empties its pouches by quickly striking that region with its fore paws, whereby the corn is projected to the distance of a few feet, whereupon it is ready to fight. When the pouches are full it cannot fight.

Food.—The hamster, like several of the rodents, is omnivorous, but it is more so than any other. Its vegetable diet, during the summer, consists of green fodder of very different descriptions, especially *Medicago sativa*, and other species of that genus, *Hedysarum Onobrychis*, the different common species of *Vicia*, *Lathyrus*, *Convolvulus*, *Veronica*, *Potentilla anserina*, *Papaver Rhœas* and *Argemone*, *Alsine media*, salads, cabbages, &c.—these are also found in their burrows at that season. Roots or bulbs are never met with there, although the hamster will readily eat carrots, turnips, potatoes, &c., as well as fruit, in captivity. In autumn and winter the vegetable food of the hamster consists exclusively of seeds, as rye, wheat, oats, barley, peas, vetches, horse-beans, millet, &c. and these are stored up for hybernation. Notwithstanding this great variety of vegetable food with which nature and

[1] In this posture the hamster will stand five minutes or longer, staring attentively, but with a very stupid expression, at some object before him, for instance, the flame of a candle. One of the fore paws then generally hangs down lower than the other.

agriculture spread his table, the hamster is even more carnivorous than herbivorous; that is to say, he prefers animal food whenever he can have it. His own species, rats, mice, small birds, lizards, May-bugs and other chafers, caterpillars &c., are greedily devoured by him. In eating vertebrated animals he always begins with the head. When a sparrow or other small bird, whether alive or dead, is presented to the hamster, the first and evidently instinctive action of the latter is to break the wings. I have kept several dozens of this animal in large rooms, providing them with a great variety of green fodder, seeds, and artificial dishes, yet every night the weakest of the company were devoured, and others so severely wounded that they had no chance of escape the next night. By this fondness for animal food the hamster in some degree makes amends for his depredations, for there is no useful animal to which he is dangerous, not even to the partridge, as the same fields near Gotha in which the hamsters swarm, are well stocked with that bird. Besides, in captivity he eats, with great delight, all sorts of pastry, bread, butter, cheese, broth, &c., and is apt to become a great gourmand. On the other hand, he is not at all addicted to drinking, nor particular in the choice of it. He can live four weeks without water, and his health will not suffer; and in the fields, as his rambles do not extend far, he must often content himself for long periods with dew and the juices of succulent herbs. In this he is, no doubt, greatly assisted by being underground about twenty hours out of the twenty-four, which must prevent perspiration in a great degree.

Disposition.—The celebrated Professor Blumenbach used to say in his lectures, when treating on the *Mus decumanus*, "Thank heaven, gentlemen, that species is not as big as an elephant; if it were so, the human race would have ceased to exist long ago." The same might not be said, it is true, with an equal degree of probability about the hamster, as he is greatly deficient in that cunning and agility which would render the ferocity of the *Mus decumanus* so dangerous and destructive, if great physical power were superadded to its other qualities; yet in point of brutal ferocity the hamster surpasses even that rat. The latter is more sociable, more gregarious in its habits; it will not kill and devour its congeners, though of an exceedingly sanguinary disposition, except when hard pressed by hunger; whilst the hamster never falls in with another individual of its own species, without trying to make it its prey, the weaker, if not killed, generally making its escape more or less severely wounded. Even the two sexes live together and in peace only during the few days of each breeding season.[1] With this single exception the hamster may be said to be constantly at war with every living creature or moving object which happens to come near him. It will jump with equal fury at a waggon-wheel or at a horse travelling along a road which a hamster is about to cross in the same place, and a young hamster will sometimes do so as well as an old one. Horses have now and then been frightened by the screams and bites of this little animal in the dusk of the evening, so as to run away. From men or dogs the animal will commonly, though not always, try to escape; it then takes the nearest course to its burrow, from which it is seldom at a great distance. When its pouches are full, it always takes to its heels at first, and if its burrow be only at the distance of twenty or thirty yards, it tries to regain it with its cargo, but never fails to pop its head out of the hole, screaming furiously in defiance. If the burrow be farther off, it tries to get a little a-head of its pursuer, in order to have time to empty its pouches; whereupon it rises upon its hind legs and faces its enemy, blowing (whereby the pouches become distended), squeaking, screaming, and jumping against the intruder to the height of from one to two feet. When the enemy retreats a little, the hamster hops after him like a frog. At such times the animal is quite beside itself with fury, caring for no wounds, and fighting till death.[2] Old hamsters do not usually retreat before man, when sitting before their burrows with their pouches empty; I have myself killed several under such circumstances.

Some breeds of dogs, as pointers and large terriers, soon acquire a knack of killing hamsters at one bite, by catching them by the middle of the chest; but when the animals are better matched, the combat is protracted, and the hamster often succeeds in gaining its burrow, after repeatedly beating back the dog. This obstinacy in fighting, in spite of all wounds not absolutely mortal, makes the hamster gain the victory over the rat. A combat between old individuals of the two species, lasts very long, but ends with the death of the rat. In short, as far as my own experience goes, I must believe the hamster to be the most courageous animal. Unfortunately there is no other commendable feature in his dis-

[1] For further proofs of the ferocious and reckless disposition of the hamster, see also below, under the head of *Propagation*.

[2] The bites of the hamster penetrate to the depth of half an inch, but are not particularly dangerous, even when the animal is furious.

position; he is perfectly untameable, and cannot be broken by any sort of education.[1]

(To be continued.)

Art. II.—*Illustrations of the Geology of the South East of Dorsetshire.* By The Rev. W. B. Clarke, A.M., F.G.S.

(Continued from page 238.)

From this examination of the composition of the coast line, we have now to advert to the phenomena presented by it, in connection with the underlying chalk. And I have, first, to remark, that if my attempt to explain the singular conformation of the curved and vertical chalk beds at Ballard Head (see Mag. Nat. Hist. Sept. 1837) needed any further elucidation, we have the fullest evidence of the vertical up-cast of the whole of the chalk between the Ballard Head fault and Old Harry Point, not only in the derangements on the Studland side, and in the perpendicular rents or fissures through the nearly horizontal chalk beds, but in the inclination of the plastic clay beds at the Red Rock cliff. For there is no means of explaining that inclination, but the supposition of the chalk having been bodily up-heaved, and lifting with it the plastic clay beds, which became, in consequence, tilted up at the point of contact and for some little distance, and broken into portions by the giving way of the soft strata at those parts now occupied by the ravines which lead from the sea to the village of Studland. It is also clear, that if such were the case at a distance from the chalk, the beds would, beyond the last point of fracture, retain their original horizontality, which is the case farther off from Studland. This will appear very plainly, if we see by the map that the plastic clay abuts upon the chalk on the north side of Ballard Down, far away from the vertical chalk, and, therefore, nothing but an elevation of the chalk *en masse*, or a depression beyond Studland, subjecting the northern end of the inclined beds to a down-cast motion (for which there is no evidence in the vicinity), can have produced the phenomena presented by the Red Rock and adjacent cliffs.

In order to explain this more fully, it must be mentioned that the Studland rock is, in some degree, a separate portion of the plastic clay. Seen from a distant elevation, such as the hills on the north side of Poole Harbour, Studland appears to be a small table-land lying on the edges of the east and north slopes of the chalk, and separated from the moun-

[1] Mr. Lens quotes an instance of an albino which became very tame.

tainous declivities of Studland Heath by a valley. Now such is actually the case, for between the chalk and Studland there is a deep diluvial excavation, which, in short, is continued all along under the chalk, thereby insulating all Studland Heath and Studland itself by dry straits, one of which now affords a bed for a winter stream that finds its way through one of the cracks in the cliffs into the sea. This fact would, I know, be used differently by some geologists, who contend that running water scoops out its own channels, even in the hardest rocks, and, therefore, say they, sand but lightly agglomerated must give way. Thus, the chines along the shore of Poole Bay, are by Mr. Lyell said to be the result of the streams that flow through them to the sea. If so, of course, the Studland 'cracks' or chines have no right to be deemed worth notice. But how stands the case? A violent and powerful torrent, bearing with it gravel and fragments of angular rock, tosses these extraneous matters about in the hollows of its bed, and they, acting like a mechanical machine, bear away the moistened bed, till they cause that bed to descend deeper and deeper in the solid rock below;—and, *therefore*, it is said, a *sluggish* stream must, of necessity, bore away *in sand* with less trouble and more effect!

Now, I am not unaware that there may be cases found, where the torrent has assisted in eating out a deeper channel to *a certain limited extent*,—but I am not satisfied with the assertion that this extent may be *unlimited*. The river Sioule in France is quoted as an example. That river now runs at a level through nearly vertical walls of basalt and gneiss, much below what it formerly did; and this is shown by a ledge of gravel much above its present bed. This gravel-deposit marks a period, it is assumed, when the river had only eaten down so deep in the solid rock. It is said, that the Sioule has cut through more than 100 feet of compact basalt, and at least 50 feet of gneiss.[1]

But if the theory of these stone-eating waters be true, there ought never to have been any gravel above, left on any ledge, or else there ought to be a slope of gravel all the way down. The river has descended certainly, but it must have suspend-

[1] See Messrs. Lyell and Murchison 'On the excavation of valleys, as illustrated by the volcanic rocks of Central France;' G. P. i. 39, and Edin. Phil. Journal: also Prof. Sedgwick's Address to the Geol. Society, Feb. 19, 1830, for facts and comments. After giving a luminous account of the different modes of excavation, the latter distinguished author and observer sums up with an allusion to the Auvergne rivers. These are great authorities, and it may be presumptuous to dispute their judgment,—but geological doubts often lead to geological truth.

ed its consumption of rock in order to have left its old bed to accumulate,—and then eaten away most furiously to have got so low without any trouble or traces of its progress. Suppose, however, we assume the case of the Sioule to be the counterpart of the examples presented by raised beaches,—or what, perhaps, is nearer the fact, that after its old channel was blocked up by a lava-flood, *as was the case*, a convenient operation of volcanic forces suddenly burst open this barrier, and split the rock vertically downward, and the whole mystery is solved. And if any person will carefully consider the thousands of examples that are scattered over the surface of England,—nay, if he will confine himself to known and familiar cases, those of the chalk range, which is everywhere fractured to give way to rivers that had no other outlet,—or those of Herefordshire, which pass through similar openings in the old red sandstone,—it will be found that rocks of every formation exhibit one and the same phenomenon respecting rivers and streams, and that these occupy beds *made for them* by disruptions of the strata, and not beds which they have made for themselves by their own action. And why should these sandy chines be an exception?

It is urged that the sand is full of springs, and that, near Bourne Mouth, under the signal-staff, the cliffs do visibly founder through the continual action of land-springs. No doubt such is the case; but where is the parallel between this foundering of a whole surface of cliff, and the regular gradual hollowing out of one deep and deepening channel? Moreover, it can be shown (and will be) that these chines are nothing but *diluvial furrows*, which gave direction to the diluvial waters, because they were *suddenly formed*, and which now afford a similar passage to the springs that are seen to well out, not at the level of the top of the sides of the valleys, but at some distance vertically below that level,—the valleys being excavated above and beyond their origin. Such also is the case at Studland. The puny streams that occupy an inch or two in depth of the ravines through which they flow, rise a considerable way vertically above the height of the walls of the ravines, and before they reach the ravines have *not excavated* the sand over which they run, but follow the natural declivity of the ground. It may, finally, be said,—look at Niagara!—(sic parvis componere magna)—see how it has eaten its way *backward* towards Lake Erie! The reason of this retrograde reform—this '*advancing* of three steps *backwards*'—is obvious. The soft marl is destroyed, and, therefore, the limestone interstratified with it is destroyed;—but has Niagara, since the day it left its old fall at Queenstown, eaten a deeper and deeper bed *vertically* down by its own mighty powers? If it has not accomplished such a purpose, what is to be said of the solvent powers of our English rivers, that have, without any display or any thunder, chiselled out such enormous gorges and ravines, many hundred feet deep, through solid masses of the very hardest quartzose rock, as is the case in the border district of England and Wales with those diminutive rivers the Teme, the Onny, and the Wye, where they break through the escarpments presented to them? Those rivers I quote purposely, because it can be shown that where they so break through, there are great dislocations of the strata from causes which are not at all doubtful, but clearly volcanic in their origin,—and the channels of the rivers themselves occupy cracks *transverse* to the direction of the rocks they traverse. And if we compare the two examples—making allowance, of course, for the great difference in every item between the condition of the old red sandstone and plastic clay districts, we shall see that on a small scale, the same phenomena were acted over again in the tertiary epoch which did such great things at the period when the older secondary and transition rocks were ruptured.

That these cracks at Studland are regular fissures, and not accidental channels for rain water, is shown by following them to their source, and measuring their direction. That for instance which is marked 6 in fig. 56, opens upon the shore in continuation of the passage through the lofty plastic clay hills behind, and the opening through the chalk at Three-forked Down, by which the road is traversed from Swanage to Studland, and its direction ranges from S.W. by W. and N.E. by E. Just under the signal-house, where the cliff is from 16 to 20 feet high, the hard beds of sand stone are split vertically down, leaving a space of about three feet between

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Fault in the Ravine to the right of the signal-house, Studland.

the walls; on the south side the beds dipping to the N.E. at about 24°, exactly agreeing with the dip at the Red Rock, of which they are a prolongation. The right side of this crack forms the left of an insulated mass, filling up the middle of the ravine, on the right of which the beds are horizontal (fig. 63).

The farther end of the ravine closes abruptly, but the view beyond it is given in fig. 64.

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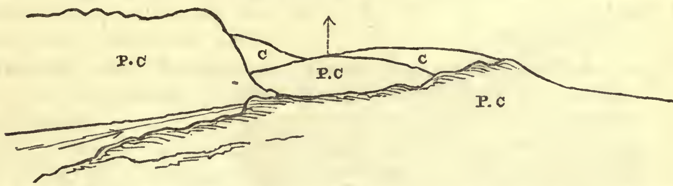

C, Chalk. P C, Plastic clay. The arrow shows the direction of the ravine. The dotted arrow points out the opening in the chalk at Three-forked Down.

Continuing the examination of the surface along this table-land, we discover that a declination of the level takes place from the head of this ravine to the head of that on the south side of the Red Rock, which passes under a cliff of yellow and red sand, extending from under the church-yard, and capped by a bed of whitish sandy clay (used for walls of buildings), which is naturally split into quadrilateral fragments; the dip of these beds being from the southern chalk of Ballard Down. So that Studland may be considered as a square mass of country, leaning upon the chalk on the southern and eastern sides, and dipping from it in those directions, as it would naturally do upon the supposition of its having been deposited upon the slopes of the chalk, and afterwards subjected to the forces of elevation by which the chalk has been deranged.

That this must be the exact state of the case is confirmed by the condition of the country intervening between Studland and the chalk ridge of Ballard Down. The plastic clay behind Studland ranges, in Studland Heath, to a level nearly as high as the summit of Ballard Down itself, but it has been subjected to violent denudating agents, and a deep valley,

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Studland Heath.

C C, Chalk Downs. 1, Devil's night-cap. 2, Pipe-clay beds. 3, Opening at Three-forked Down. 4, Shore.

rising in the centre, but trough-like on each side, marks the space between the two formations.

The appearance of this district from the coast is shown in fig. 65, and the transverse section across the diluvial hollow is given in fig. 66. It is premature to allude to the connec-

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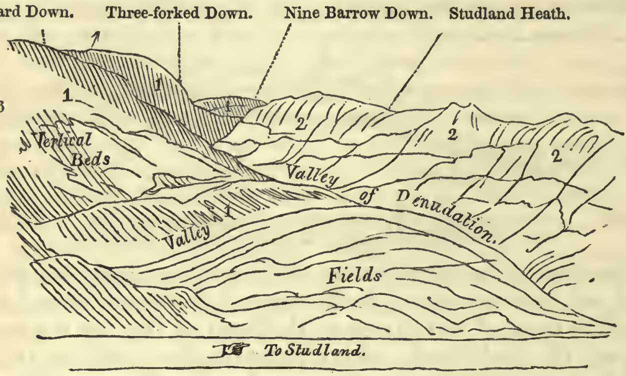


Valley between the Chalk and Plastic Clay,—between Studland and Ballard Down.

1, Chalk. 2, Plastic clay.

tion between the diluvial and the uplifting forces, but it may be here safely mentioned, that the very aspect of the district about Studland, from the summit of Ballard Down, and from various stations in the ascent thither, demonstrably convince the observer, that though violent denuding forces have excavated the deep valleys and hollows between the chalk and the sea, these valleys and hollows, whether longitudinal or transverse, owe their primary development to preceding causes, that uplifted, split, and convulsed the lower beds of chalk, and the superimposed tertiary deposits that now only exist in part.

And since we have seen in this investigation, that the lines of direction in these dislocations coincide with the longitudinal and transverse directions of the chalk elevation—and these again with those of the sub-cretaceous formations, it follows, that the derangements in the plastic clay of Studland owe their existence to the very same phenomena as have, in the same linear directions, produced such striking alterations in the arrangement of the country beyond the area of the chalk-field.

Subsequent investigations will more fully explain the extent of these derangements, but sufficient has now been said to illustrate the phenomena of the plastic clay, at its junction with the chalk at Studland Bay;—all of which are, evidently, the result of elevating forces, that in this district have left proofs too palpable to be denied.

Presteigne, Radnorshire.

ART. III.—*On* Hymenotes, *a Genus of exotic Orthopterous Insects.* By J. O. WESTWOOD, Esq., F.L.S. &c.

THE philosophical principle that Nature, ever ready in resources, arrives at the same result in various methods, is nowhere so capable of demonstration as in the insect tribes, where, owing to their immense numbers, far exceeding in fact the number of all the rest of the species of the animal kingdom taken together, it must necessarily happen, from the necessarily great modification of form exhibited amongst so many animals, that the great functions of existence must be carried on in different ways.

The preservation of the creature, one of the great primary objects of all its energies, as well as of its organic structure (necessary for the display of such energies), is not only effected by active operations, but also by those passive means of resistance afforded by the peculiar structure and shape either of the body or of its different parts. It would carry me into too wide a field to give examples in support of this principle, which must be strongly perceived by all who take more than a superficial view of the workings and works of the creation. The particular group of insects which is the subject of this paper, exhibits an interesting instance of it which it will be worth while to notice, proving as it does that where one organ, having a particular function necessary for existence, is either atrophied or diminished in extent, another organ takes up such function, and thus supplies its place, while at the same time it retains its normal, or as we may say original function. Ordinarily speaking the back of insects is not generally of a solid texture; where solidity is given to it the wings are more particularly membranous; where it is less solid the wings, or more strictly speaking, one pair, become thickened, so as to defend the real wings, which from their large size require to be packed up, (of which the common earwig forms a beautiful example), as well as the back of the abdomen. Such is especially the case in beetles, where the wing-covers attain their strongest consistence, and serve unitedly to form a powerful shield or case, whence the very name of the order, *Coleoptera*, or wings in a case. In other instances we find this shield consisting of a single piece, being then named the *scutellum*, and which in some tribes of *Hemiptera* becomes so large as entirely to cover the back of the abdomen, wings, and wing-covers. Such is the case in a singular degree in the genus *Coptosoma*, the peculiar structure of which I have described in this Magazine (vol. ii. n. s. p. 26). Such is also the case in other portions of the family of *Cimicidæ* thence named *Scutelleridæ*, and in some singular Hymenopterous insects forming the genus *Thoracantha*, in one of which (*Thor. Latreillei*, Guérin) this *scutellum* exhibits all the appearance of two *elytra* soldered together. In other tribes, again, we find this shield composed of a piece still nearer to the head, namely the *dorsum* of the *prothorax*, which is immensely developed backwards, covering not only the back of the *abdomen*, but also the whole of the *mesothorax* and its *scutellum*, *metathorax*, and wings. This structure is of much rarer occurrence than either of the former, occurring in various species of Linnæan *Cicadæ*, where the armature of this part is most anomalous, and in a few genera of Orthopterous insects, including that which is the subject of this paper: this peculiarity, in conjunction with the saltatorial powers of the insects, their musical talents and herbivorous habits, evidently prove that the order *Homoptera* of Latreille (to which the *Cicadæ* belong) is the true analogue of the order *Orthoptera* to which these insects are to be referred.

Linnæus, in the earlier editions of the 'Systema Naturæ,' proposed a division in the genus *Cicada* which he named *Foliaceæ*, with the character "thorace compresso-membranaceo;" the insects belonging to this division are truly Homopterous, and now constitute the genus *Membracis* of Fabricius. The *dorsum* of the *prothorax* is of immense size, compressed, not thicker than writing paper, and elevated over the entire body, extending in fact considerably in front of the head.

Felton described two remarkable insects in the Philosophical Transactions for 1764 (vol. liv. p. 55, published in 1765), in a paper entitled "An Account of a singular species of Wasp and *Locust*," which he had met with in Jamaica. The following is his description of the "locust."

"Rhombea *Cicada*, thorace compresso, membranaceo, foliaceo, subrhombeo, posticè latiore.

"The *thorax* is like a leaf that is raised perpendicularly from the body, and is three times as broad as the body, but the same length. This leaf is very near of a rhomboid figure, a little broader or rather higher over the back, it is membranaceous, probably brownish; (when alive half pellucid, with two spots that are more pellucid or transparent; the larger one is very near the middle, but the smaller lower). The margins are waved, especially towards the hind angle; over the fore part of the body the leaf is double. The *abdomen* is a little longer projected backwards than the leaf of the *thorax*.

"The insect had not yet got its *coleoptera* and wings.

"The hind thighs *that are thicker* have on the upper side an additional narrow membrane added to them.

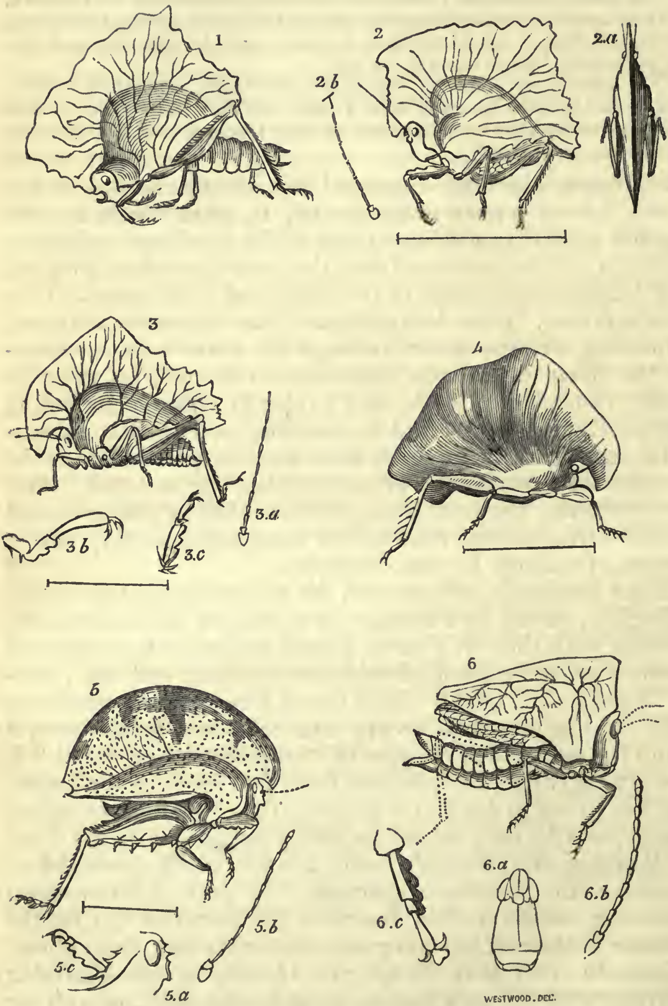
"The head and *maxillæ* [mandibles] are very like those of the gryllus's; but there is such an affinity between this and the *Cicada foliata*, Linn. Syst. Nat. 435, 6, that I should think it the same species if the *thorax* of this was not broader behind towards the end.

"The *antennæ* are broke off, else from their length, one might learn to what genus the tribe Linnæus calls *Cicadæ foliaceæ* (Syst. Nat. p. 435) should be referred, for I am in doubt whether Linnæus ever has seen perfect specimens of them."

The figure which accompanied this description (pl. 6. fig. sinist.) I have copied in my fig. 67, 1; from which, in conjunction with Felton's description of the hind legs and mandibles, it will be perceived that the insect is in fact a locust, or at least that it belongs to the saltatorial *Orthoptera*. Linnæus however, in the last edition of the 'Systema Naturæ,' introduced Felton's insect amongst his *Cicadæ foliaceæ*, under the name of *Cicada rhombea*, erroneously referring to Backer instead of Felton, and evidently either considering that the English author had inaccurately described and figured his insect, which ought to have been represented with the structure of *Membracis*, or overlooking the manifest differences between the true Homopterous *Cicadæ foliaceæ* and Felton's Orthopterous insect, thus confounding a very strong relation of analogy for one of affinity.

In the Banksian collection in the possession of the Linnean Society, named by Fabricius, is contained an insect nearly agreeing with that of Felton, placed at the head of the true *Membraces*, and named *Membracis rhombea*, with the locality "Jamaica. Poore." This insect I have represented at 2 in fig. 67, together with its appearance as seen from above, 2 *a*, and the part which remains of its mutilated *antennæ* at 2 *b*. It is evidently not the specimen described by Felton, because that was given to the Royal Society, the collections of which Society, as I learn, were subsequently transferred to the British Museum, and Felton's insect is most likely destroyed.—Moreover, the Banksian specimen has part of its *antennæ* remaining, whilst Felton describes his insect as having the *antennæ* broken off. I am particular in making these observations, in order that the specific identity of the Banksian specimen with Felton's may be proved, especially as both are from the same island in the West Indies, and the general outline of the thoracic shield is very similar in both, The foliaceous structure of the thighs notched like edges of a leaf, in the Banksian specimen, seems to indicate a different species,

67



1, *Hymenotes rhombea.* 2, *Membracis rhombea.* 2 *a*, same seen from above. 2 *b*, remains of *antenna.* 3, *Hymenotes triangularis.* 3 *a*, basal joints of *antenna.* 3 *b* anterior *tarsus.* 3 *c*, posterior *tarsus.* 4, *Hymenotes Sagrai.* 5, *Hymenotes platycoris.* 5 *a*, head seen sideways. 5 *b*, *Antenna* magnified. 5 *c*, posterior *tarsus.* 6, *Phyllochoreia unicolor.* 6 *a*, head seen in front. 6 *b*, *antenna.* 6 *c*, anterior *tarsus.*

especially as Felton describes his insect as having an additional *narrow* membrane on the upper side of the hind thighs, without noticing that it is notched, or representing any such character. The *antennæ* of the Banksian specimen are very slender, and although there are only nine joints remaining, they extend considerably beyond the front of the thoracic shield, the two basal joints being very short and thickened.

Having discovered amongst the insects collected at Manilla by Mr. Cuming, an insect closely allied to the preceding, I communicated a description of the two species to the Zoological Society, on the 14th November, 1837, and which was published in the Proceedings of the Society of that date.— The following are the characters of the genus which I proposed for their reception.

"HYMENOTES. Genus novum e familiâ Locustidarum, Tetrici affine.— *Corpus* valdè compressum. *Caput* mediocrè obliquum. *Antennæ* breves gracillimæ filiformes, articulo 1mo crasso, rotundato, 2ndo multo minori, reliquis longitudine sensim crescentibus. *Prothorax* maximus, foliaceus valdè compressus, folium aridum exactè referens, supra et ante caput angulariter porrectus, valdè elevatus et posticè supra abdomen protensus; parte postica subtùs, pro receptione alarum et abdominis, canaliculata, prosternum in collare pro receptione oris formatum. *Pedes* inter se basi longè distantes, femoribus præsertim posticis foliaceis, tarsis posticis 3-articulatis," articulo 1mo subtùs sub-biarticulato, articulo 2ndo minutissimo; quatuor anticis sub-biarticulatis, articulo 1mo subtùs sub-biarticulato. Ungues longi subtùs dente minuto armati. Pulvilli nulli.

Species 1.—*Hymenotes rhombea*. *Rhombea cicada*, Felton in Phil. Trans. 1764, p. 55, pl. 6. *Cicada rhombea*, Linn. Syst. Nat. 2, 704. *Membracis rhombea*, Fabr. Ento. Syst. 4, 8, 2. Syst. Rh. 7.—Alata. Habitat Jamaica. (Fig. 67, 1).

Species 1*, (an distincta). Insectum in Musæo Banksiano (Mus. Soc. Lin.) suprà delineatum. Habitat Jamaica. (Fig. 67, 2).

Species 2.—*Hymenotes 3-angularis*. *Hym.* fusca, prothorace sub-triangulari, margine, e fronte ad medium integro et curvato, dein ad apicem obliquo, serrato, femoribus anticis vix foliaceis, posticis latioribus, suprà irregulariter incisis.

Corp. long. lin. 5½. Long. prothoracis lin. 8. Habitat Manilla, D. Cuming. (Fig. 67, 3; 3 *a*, basal joints of *antennæ;* 3 *b*, anterior *tarsus ;* 3 *c*, posterior *tarsus*).

Subsequently M. Serville, unacquainted with my memoir above referred to, published the description of another species of the same genus, for which he proposed the admirable (but synonymical) name of *Choriphyllum* (dancing leaf) in his volume upon the *Orthoptera* in the 'Suites à Buffon.'— The following are its specific characters.

Species 3.—*Hymenotes Sagrai*. Long. 8 lignes, mesuré de l'origine de la membrane à son extremité. Il est entièrement d'un gris terreux, la membrane qui recouvre le corps s'éleve au dessus du thorax, d'environ quatre lignes; chaque face laterale presente de six à sept nervures transversales saillantes, assez également espacées: cette membrane est d'un brun feuille-morte, transparente dans son premier tiers, opaque ensuite, son bord supérieur est presque arrondi, sinueux dans quelques endroits; la partie qui déborde la tête, finit en pointe et forme une sorte de grande crochet, la partie postérieure de la membrane dépassant l'abdomen est tronquée droit et carrément, à son extremité. Antennes et pattes de la couleur du corps; cuisses postérieures fortes, élargies: carènes supérieures des deux derniéres jambes munies de fines épines. Je n'ai pas pu distinguer le sexe.

Un individu unique communique par M. De la Sagra, qui l'a rapporté de l'île de *Cuba*.

Syn.—*Choriphyllum Sagrai*, Serville, Hist. Nat. Ins. Orthopt. p. 755, pl. 8, fig. 5. (Fig. 67, 4; copied from Serville).

Another species from Africa has also recently been presented to the British Museum by the Rev. D. F. Morgan, of which the following are the characters.

Species 4.—*Hymenotes platycorys*. *Hym.* fusca, granulosa, pronoto suprà in folium maximum integrum rotundatum elevato, angulo postico inciso, femoribus foliaceis posticis margine supero, (nisi ad apicem) integro.

Corp. long. lin. 6½. Habitat in Africâ occidentali (Sierra Leone).—D. Morgan. (Fig. 67, 5).

The colour, in one specimen, is entirely of a dark rusty brown, with the tips of the thighs darker; but in the other, the elevated leaf of the *pronotum* is varied with paler colour, as in my figure. The head is elevated into an irregular toothed ridge between the eyes, the centre being impressed, (fig. 67, 5 *a*, the head seen sideways). The *pronotum* is elevated into a nearly semicircular leaf, produced into a deflexed point before the head, and extending considerably beyond the extremity of the body behind; it is very finely granulose, and with slight irregular veins; its edge at the posterior part is finely serrated, and the posterior angle is notched: its lower division is composed of two leaves, which slightly open for the reception of the back, but in its upper portion these two leaves are soldered together into one plate. The *antennæ* (fig. 67, 5 *b*) are short and 14-jointed, very slender, except the two basal joints, which are thickened, and the two or three terminal joints, which form a very slight club: they are considerably shorter than in *Hym. rhombea*. The *prosternum* is produced like a cravat over the hinder part of the mouth.—The four anterior *femora* are dilated and scalloped on the lower edge, the two posterior are much thicker, serrated on the under side with several larger blunt teeth; they are entire on the upper side, except near the tip, where they are irregularly spinose: the four anterior *tibiæ* are dilated at the base;

the posterior *tarsi* are 3-jointed, the basal joint having, on the under side, the appearance of being composed of three joints, (fig. 67, 5 *c*).

The Rev. F. W. Hope has communicated to me a singular Indian species belonging to the family *Locustidæ*, having the *pronotum* elevated into a large and compressed leaf, but which belongs to the section containing the locust, the *tarsi* having a large *pulvillus* between the *ungues*, but the *prosternum* has no point. It is very nearly allied to the Indian species described by Serville under the name of *Chorotypus fenestratus*, but differs in several particulars. It may be thus characterized.

Phyllochoreia. *Corpus* valdè compressum. *Facies* (fig. 67, 6 *a*) plana verticalis, parte inferâ latiori, lateribus angulatis, suprà oculos rotundato-elevata. Oculi magni laterales. *Antennæ* (fig. 67, 6 *b*) breves gracillimæ 14-articulatæ, articulis discretis, 2 basalibus crassis, terminalibus paullo crassioribus. *Prothorax* in folium compressissimum ultrà dimidium abdominis extensum elevatus, antice suprà caput truncatus, postice acutus et ex apice ad basin pedum intermediorum obliquè truncatus. *Alæ* ultrà apicem pronoti extensæ. *Prosternum* inerme. *Pedes* 4 antici simplices, tarsis 3-articulatis, articulo 1mo subtùs sub-triarticulato; pulvillo magno inter ungues, (fig. 67, 6 *c*). *Pedes* 2 postici detereti.

Species 1.—*Phyllochoreia unicolor.* Tota pallidè luteo-fusca, pronoto brunnescenti, lineâ tenuissimâ nigrâ utrinquè inter oculos et mandibulas ductâ.

Corp. long. lin. 13. Habitat in Indiâ orientali. D. Whithill. In Musæo D. Hope. (Fig. 67, 6).

In addition to the preceding insects there are several others belonging to the family of the locusts (*Locustidæ*, Leach, *Acridi*, Latr.) which have the *pronotum* elevated into leaf-like appendages over the back, but in none is this structure so conspicuous as in those figured above. Such are the genera *Monachidium* of Serville, so named from the cowl-like appearance of this appendage, and composed of Brasilian species; *Teratodes* of Brullé, formed for the reception of the Indian *Gryllus monticollis* of Gray, figured in the English translation of the 'Animal Kingdom,' pl. 64, (but previously described by Thunberg under another name), and to which Serville also unites the *Gryllus scutatus* of Stoll; and *Dericorys* of Serville, the type of which is an Egyptian species.—In the neighbouring family *Gryllidæ*, (including the grasshoppers with long *antennæ*), the genus *Hyperhomala* has the hind part of the *pronotum* extended backwards entirely over the wings and body, but depressed, with a longitudinal suture, exactly like a pair of *elytra*.

Art. IV.—*A Notice of some undescribed Organic Remains which have recently been discovered in the London Clay Formation.* By Nathaniel Thomas Wetherell, Esq., F.G.S., M.R.C.S., &c.

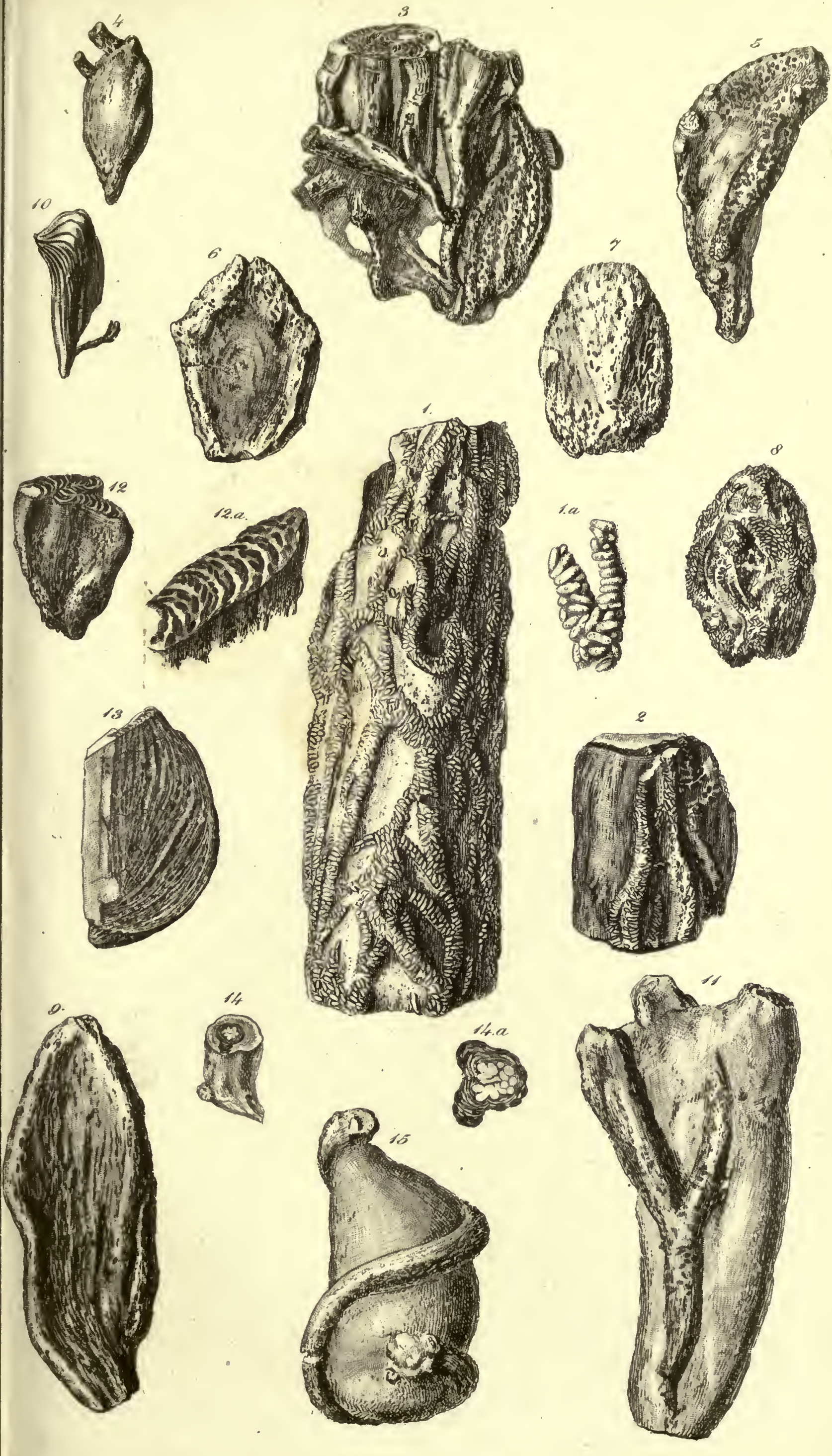
The fossil bodies represented in plates viii. and ix. of the Supplementary Illustrations, were found between Euston Square and Kilburn, in the excavations for the London and Birmingham Rail-road. They occurred at depths varying from twelve to forty feet; London clay being exposed at this place within a few feet of the vegetable mould. When I first examined these fossils, they appeared so very different from any I had previously seen, that I determined to lose no time in obtaining as good a series of them as possible. There exists among several of my geological friends a difference of opinion as to their real nature; some having regarded them as *Spongites*, while others have supposed them to be of vegetable origin. For my own part I am quite doubtful to what class they belong, and therefore prefer leaving the question open to further investigation, before proposing any generic name. The two copper plates which accompany this notice have been engraved by Mr. J. De C. Sowerby, and I cannot help observing that he has delineated the figures very accurately. I will now proceed to give some account of a few of the specimens, but I must first state that I employ botanical terms, with the view of making my descriptions more clearly understood.

One of the specimens (plate ix. fig. 1) is leaf-shaped, flattened, and curved to one side; width four inches and three quarters, length uncertain, owing to the upper part having been broken off; thickness half an inch. The whole of the anterior and posterior surfaces is studded with a profusion of small bodies, for the most part of an oval form, and a few of them have a furrow down the middle. In one part these bodies are nearly cylindrical, and so regularly placed in relation to each other, that they appear like the lateral arms of a *Pentacrinite*.

Fig. 1 *a.*—Oviform bodies magnified, some of them showing the longitudinal furrow.

Fig. 2.—A fine portion of a large stem dividing into four branches, arising from which may be distinctly seen several smaller ones, diverging in different directions. Like fig. 1 this specimen is covered with the small oviform bodies.

Fig. 3 is also a fragment of a stem, with the bases of two branches, the upper one of the size of a goose quill, the lower one much smaller. Besides having the same kind of ovi-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form bodies on its surface, as are noticed in the descriptions of the two preceding figures, several raised and slightly curved lines pass perpendicularly along the stem and divide at intervals, giving a scabrous appearance to that portion of the surface where they occur.

Fig. 4 is a round stem, two inches long and nearly half an inch in diameter. On this specimen are seen the rudiments of several branches, and in some parts furrows or depressions, along which the branches appear to have passed after being given off.

Plate viii. fig. 1.—This extraordinary and beautiful fragment is in a fine state of preservation. It is quadrangular, nearly straight, and embossed with a number of anastomosing branches, curiously built up of small oviform bodies.—How much farther this fossil extended it is impossible to say, as the broken ends are of the same diameter as the middle.

Fig. 1 *a*.—A portion of the above magnified.

Fig. 2 represents a fragment with similar branches to those of the specimen in fig. 1, ramifying on a thin partly cylindrical portion of the fossil.

Fig. 3.—In the centre of this figure is a slender round stem divided into two branches, which soon expand and become flattened; the terminations have been both broken off. At the upper part is seen a transverse section, showing the internal structure of another portion. It is uncertain whether all these parts belong to one and the same fossil.

Fig. 4.—This specimen is of an oval shape, tapering at its lower part into a kind of leaf-stalk. From its upper part on the left side two branches are given off, and at the top is the rudiment of a third. From the hardness of the matrix the centre is not well shown.

Fig. 5.—This fossil is curved backwards and to one side, having a broad *sulcus* along the centre, which is partly filled with hardened matrix. The inferior termination is rounded, and inclines rather forward. The surface is covered with small oviform bodies.

Fig. 6.—Nearly flat, edges rounded, and slightly raised.—On the upper part of the fossil is a projection on each side; from these projections the edges above and below slant inwards. At the upper termination is a small notch, the lower one is imperfect.

Fig. 7.—Oval, length one inch, breadth three quarters of an inch. The centre of this fossil is shaped like a fan, owing to a depression on each side.

Fig. 8.—Oval, nearly flat, the surface thickly covered with

small oviform bodies. The base of this and the two preceding specimens presents a rough appearance, as if it had been attached to a branch or stem.

Fig. 9.—Leaf-shaped, flattish, edges rounded, upper end rough, length two inches and a quarter, breadth nearly one inch. Dividing at the basis into two flat processes, the upper one crossing obliquely over the under.

Fig. 10.—This singular fossil is remarkably thin. It expands very much at its upper part, which is curved downward and to one side. On its surface are a number of small ribs, passing parallel to each other but at unequal distances, curving with the fossil, and meeting nearly together at the top. From the lower part on the right side a small branch is given off.

Fig. 11.—A flattened stem dividing about midway into two or more compressed branches.

Fig. 12.—View of a polished transverse section, showing the internal structure.

Fig. 12 *a*.—Magnified view of a portion of the above.

Fig. 13.—View of a polished longitudinal section of a leaf-shaped fossil, showing its internal structure.

Fig. 14.—View of a polished transverse section. On examining the centre of this specimen, a magnified view of which is given at fig. 14 *a*, it appears as if a group of the same kind of oviform bodies had been cut through, which, in the descriptions of many of the preceding figures, have so frequently been noticed as occurring on the outer surface. This group is surrounded with curved lines, similar to those represented in the section of fig. 12.

Fig. 15.—Round, about the size of a goose-quill, and curved spirally, terminating at its lower part in four or five small rounded processes. The upper end has a rough surface, as if it had been broken.

This specimen was found near Kilburn, by my friend H. B. Burford, Esq., of Lisson Grove.

At page 17, vol. ii. of the 'Proceedings of the Geological Society,' is a notice of a paper by Mr. Richardson, on the coast-section from Whitstable to the North Foreland. The sketch of this paper which is given in the Proceedings concludes as follows.—"A minute description is given of the *Septaria* which are said to be very numerous, and to have the surface often covered with small ramifications, resembling branches flattened by pressure."

In this sketch no mention is made of anastomosing branches, nor is anything said of the small oviform bodies which have been so constantly met with in my specimens. Again, the branches which I have found do not merely ramify on the surface, but also in many instances pervade every part of the interior of the stone. Still I cannot help thinking, from their being described as "resembling branches flattened by pressure," that they will on comparison be found allied to them; and if so, another locality, many miles distant from mine, must be added.

It will be observed that some of the fossils are almost black. This has arisen from the use of diluted muriatic acid when I first began to clean them, which acted powerfully on the fossil as well as the matrix. It is, however, necessary to notice that in many instances the fossil itself is of a dark colour.

I trust that when the nature of these remains is more fully made out, additional light will be thrown on some of those singular forms of the flint which are often discovered in the chalk formation, and the origin of many of which still remains in obscurity. From several specimens of flint which I have examined, I am of opinion that these curious fossils do actually occur in this formation; and it appears the more probable, from the fact that several of the same genera,[1] and at least one species of shell (*Terebratula striatula*), are found in both strata.

Highgate, *May* 15, 1839.

REVIEWS.

ART. I.—*Monographie des Echinodermes.* Par LOUIS AGASSIZ. Neuchatel. Livraison 1.

IT is with extreme satisfaction that we see Professor Agassiz commencing the publication of an illustrated Monograph upon the *Echinodermata.* The remarkable forms of the *Echinites*, and the excellent state of preservation in which the fossil species are found, have always rendered them objects of interest, and constantly attracted the notice of naturalists. Our own countryman, Dr. Woodward, in the catalogue of his famous collection, was probably among the first who attempted their classification, which was followed by many of the early writers. He adopted a twofold division;—first, the *Spatagi*, having two openings, either both at the base of the shell, or one at the edge or centre of the base, and the other near to, or in, the opposite margin; and

[1] For example, the *Nautilus*, *Pentacrinite*, *Ophiura*, *Spatangus*, &c. I have also found in the matrix, in close contact with my fossils, *Spirolinites*, and a species of *Rotalia*.

secondly, the *Echini*, possessing only one aperture at the base. In 1784, Klein published his 'Dispositio Naturalis Echinodermatum,' which added considerably to the knowledge of these fossils. He classed them according to the situation of the mouth and vent, a plan which has been continued, and in part adopted, in every succeeding arrangement. In dividing them into classes, sections, and genera, he made use of the following nomenclature:—

EMMESOSTOMI.—Mouth in the centre of the base.

APOMESOSTOMI.—Mouth out of the centre.

And the further subdivided classes were,—

ANOCYSTI. Vent in the upper part.
Cidaris, Clypei.

CATOCYSTI. Vent in the under part.
Fibulæ, Cassides, Scuta, Placentæ.

PLEUROCYSTI. Vent in the side.
Arachnoides, Corda marini, Ova marini.

Subsequently Breyne, Van Phelsum, and Leske, assuming for a groundwork the sections of Klein, proposed a different ent classification;—the first reducing the genera to seven,—the second forming them into twenty,—and the last again curtailing them to ten. Lamarck, however, instituted considerable alterations; and without overlooking, as a primary character, the position of the mouth and vent, he established generic distinctions from the size and form of the *ambulacra*. The following is an outline of his division.

1. The vent below the margin; in the lower surface; or in the margin.

* The mouth beneath, always central.

Scutella.
Clypeaster. } *Ambulacra* contracted.
Fibularia.

Echinoneus.
Galerites. } *Ambulacra* complete.

** The mouth beneath, not central, but approaching the margin.
Ananchites. Spatangus.

2. The vent above the margin, and consequently dorsal.
a. The vent dorsal, but approaching the margin.
Cassidulus. Nucleolites.
b. The anus dorsal and vertical; the shell regular.
Echinus. Cidarites.

Several authors have since introduced various modifications of Lamarck's divisions, and in 1839 Agassiz proposed to separate the *Echini* into three natural families—*Spatangi*, *Clypeastres*, and *Cidarites*.

1. SPATANGI.

Disaster. Holaster. Ananchytes. Hemipneustes. Micraster. Spatangus. Amphidetus. Brissus. Schizaster.

2. CLYPEASTRES.

Catopygus. Pygaster. Galerites. Discoidea. Clypeus. Nucleolites. Cassidulus. Fibularia. Echinoneus. Echinolampas. Clypeaster. Echinarachnius. Scutella.

3. CIDARITES.

Cidaris. Diadema. Astropyga. Salenia. Echinometra. Arbacia. Echinus.

With more immediate reference to the part before us, Mr. Gray, in the Zoological Proceedings of 1835, has suggested a subdivision of the genus *Echinus* into what he considers four natural genera, viz.,—*Arbacia*, *Salenia*, *Echinus*, and *Echinometra*, from a belief that some of the characters on which the genus had been founded, such as the number of the *tesseræ* and the pores in the *ambulacra*, were discovered to be inconstant.

The genus *Salenia*, as originally established by Mr. Gray, was characterized by having the ambulacral areæ narrower than the interambulacral; by having only one large imperforate tubercle upon each coronal plate, and of which the ovarial and the interovarial plates (united together so that they cannot be easily separated) form a salient disk, traversed by the anal apparatus (*appareil*), of which the opening is sometimes central, sometimes anterior, and sometimes posterior. Agassiz, however, finding differences in the oviductal apparatus, has been induced to raise the genus *Salenia* into a family consisting of four genera, according to the modifications presented by this apparatus; viz., *Salenia*, properly so called, *Goniopygus*, *Peltastes*, and *Goniophorus*. No recent species are known, and the fossil ones are entirely confined to the cretaceous series.

SALENIA, Gray, Agas.

Having a single plate placed in the middle of the oviductal apparatus, called the superanal plate, and which, according to its position opposite to the anal opening, renders the anus always eccentric, sometimes throwing it in front and sometimes behind. This superanal plate is generally of the same size as the ovarial plates, and forms with them, as well as with the five interovarial plates, a circular disk, variously notched in its contour.

Goniopygus, Agas.

Differs from *Salenia* in the absence of the superanal plate; and the ovarial plates are not united throughout their length to the interovarial, from which it results that the oviductal apparatus constantly presents a decagonal rosette;[1] the interambulacral areæ are much less tubercular than in the other genera of this family; the coronal plates in the upper part of the shell often bear only a single large tubercle; a character peculiar to this genus is the absence of the radiating grooves on the tubercles of the interambulacral areæ.

Peltastes, Agas.

The altogether peculiar form of the oviductal apparatus (resembling a shield) in several species, has induced the author to raise them to the dignity of a genus. The ovarial plates extend over a considerable portion of the interambulacral areæ, surrounded on each side by the interovarial plates, to which they are united throughout their whole length, so that instead of a star of ten rays, there is only a single pentagonal rosette.

Goniophorus, Agas.

This genus is very closely allied to *Salenia*, but distinguished from it, as well as from the two preceding genera, by the peculiar structure of the oviductal plate, the surface of which is covered with rigid and salient ridges, which are not sutures, the latter being scarcely visible to the naked eye; besides the interovarial and ovarial plates there is a large superanal plate, which, placed (as in *Peltastes* and the second division of *Salenia*) between the anterior ovarials and the anal aperture, pushes away the latter backwards; the form of the whole apparatus is that of a pentagon, whose salient angles are formed by the interovarial plates.

The plates of this the first part are neatly executed, and the more important characters illustrated by magnified views. In calling the attention of naturalists to this Monograph, we think but one opinion can be entertained as to its value in relation to the sciences of Geology and Zoology; and we most sincerely trust that success will attend the labours of its author, whose intimate acquaintance with the subject peculiarly qualifies him for undertaking the elucidation of one of the most interesting groups in the whole animal kingdom.

[1] One of the principal characters of *Goniopygus* appears to be the central anal opening, which is sometimes circular, sometimes angular, according to the species.

Art. II.—*Elements of British Entomology; containing a General Introduction to the Science, a Systematic Description of all the Genera, and a List of all the Species, of British Insects, with a History of their Transformations, Habits, Economy, and Distribution, with outline figures of the Families, and their Larvæ and Pupæ, an explanation of the technical terms, and full directions for collecting.* By W. E. Shuckard, Libr. R. S., Author of the "Essay on the Fossorial Hymenoptera." Part I. illustrated with 50 wood-cuts. London: Bailliere. 1839. 8vo. pp. 240.

M. Macquart, in the introduction to his new work upon exotic *Diptera*, speaks of the recent progress which Entomology has made in this country as most singular. "En Angleterre" says he, "l'Entomologie a pris un essor trés-remarquable, graces aux travaux si connues de Kirby," &c.; and the work whose lengthy title is given above will, when completed, add considerably to the grounds for the eulogium of the French dipterologist.

The present first part commences with the technical description of the order *Coleoptera,* leaving the general introduction to the science, including the primary distribution of the insect tribes, for a future number. As the paging of the present number commences with 1, we would suggest that the promised introduction should be paged in a different type, so as to allow of its being placed at the commencement of the volume, its legitimate situation, rather than at the end.

Three pages are devoted to the general sketch of the order of beetles, in which the author states his conviction "that the advantages to be derived from the tarsal system, in its general application, by facilitating a familiarity with the order, much more than counterbalance the inconvenience of regarding as exceptions to the rule, those genera which do not harmonize with it, but which their affinities will not allow to be displaced." He accordingly adopts the four primary divisions of Latreille, for which he retains the names *Pentamera, Heteromera, Tetramera,* and *Trimera,* notwithstanding the acknowledged incorrectness of the two latter names, and the alterations suggested by some recent authors for their correction.

As some variations are suggested in the arrangement of the families and subfamilies of the *Pentamera,* it may be useful to give the following sketch of the distribution which is here proposed. The Pentamerous beetles, or those which have five joints in each of their six *tarsi,* are divided into five subdivisions, namely, the *Adephagi, Brachelytra, Helocera, Petalocera,* and *Prionocera.* The first four of these five divisions, constituting the first of the four divisions of the first order (*Coleoptera*), entirely occupy the present part.

The first subdivision, *Adephagi*, forms two tribes, the *Geodephaga* and the *Hydradephaga;* the first of these consists of two races, 1st, the *Eupterina* (comprising the single family *Cicindelidæ*), and 2nd, the *Eutrechina* (given as the nomenclature of Kirby and Spence[1]), composed of six families, *Brachinidæ*, *Scaritidæ*, *Harpalidæ* (divided into six minor groups, *Harpalini*, *Pœcilini*, *Amarini*, *Anchomenini*, *Trichini*, and *Licinini*), *Carabidæ*, *Elaphridæ*, and *Bembidiidæ*.—The *Hydradephaga* in like manner consist of two races, 1st, the *Eunechina*, composed of the single family *Dytiscidæ*, divided, after Erichson, into two subfamilies, *Haliplites* (composed of two groups, *Haliplini* Erichs., and *Pelobini*, Erichs.), and *Dytiscites* (formed of three groups, *Hydroporini*, Er., *Colymbetini*, Er., and *Dytiscini*, Er.), and 2nd, the *Gyronechina*, composed of the single family *Gyrinus*.

The second subdivision, *Brachelytra*, comprises seven families, *Omalidæ*, *Oxytelidæ*, *Stenidæ*, *Staphylinidæ*, *Tachinidæ*, *Aleocharidæ*, *Pselaphidæ*.

The third subdivision, *Helocera*, comprises three tribes; 1, *Clavicornes*, composed of the fourteen families, *Scydmænidæ*, *Agathidiidæ*, *Scaphidiidæ*, *Cholevidæ*, *Sphæritidæ*, *Necrophoridæ* (given as that of Shuckard, but first proposed by Kirby, in the 'Fauna Boreali-Americana'), *Silphidæ*, *Nitidulidæ*, *Engidæ*, *Dermestidæ*, *Byrrhidæ*, *Heteroceridæ*, *Parnidæ* and *Elmidæ;* 2nd, the *Palpicornes*, composed of four families, *Spercheidæ*, *Helophoridæ*, *Hydrophilidæ*, and *Sphæridiidæ;* 3rd, the *Fracticornes*, consisting of the single family *Histeridæ*.

The fourth subdivision, *Petalocera*, is composed of two tribes; 1st, the *Pectinicornes* (or family *Lucanidæ*), and 2nd, the *Lamellicornes*, forming two races, *Saprophaga*, consisting of the four families, *Geotrupidæ*, *Scarabæidæ*, *Aphodiidæ*, and *Trogidæ;* 2nd, the *Thalerophaga*, composed of two families, *Melolonthidæ* and *Cetoniidæ*.

In placing the *Brachelytra* immediately after the aquatic beetles, a situation not assigned to them by English writers, our author has followed the views of Latreille, and Kirby (in the 'Fauna Boreali-Americana'). He has, however, given no reasons for such an opinion, and he even objects (p. 118) to the affinity suggested by Dr. Heer between the *larvæ* of the *Staphylini* and *Dytisci*. Of all the recent arrangements relative to the location of the *Brachelytra*, that suggested by

[1] Kirby and Spence (Introd. to Entomol. vol. iv. p. 392) employ the name *Eupodina* for the whole of the Linnæan *Carabi;* Mr. Kirby, in the Fauna Boreali-Americana, uses the word *Eutrecha* for part only of the Linnæan *Carabi*. These authors have not employed the name *Eutrechina*.

Dr. Erichson appears to us the most natural, namely, its immediate connexion with the *Silphidæ*. Mr. Shuckard also strongly objects to the introduction of the *Gyrinidæ* amongst the Hydradephagous *Adephagi*, advancing various reasons against their relation, such as the possession of four eyes, the different position of the legs, and structure of those limbs, the great dissimilarity in their *trophi* and *antennæ*, and to crown all, the total dissimilarity in their *larvæ*, &c. Notwithstanding these strong peculiarities, we cannot however but consider that the *Gyrinidæ* are properly located amongst the *Adephaga*, the activity of their motions and their strong powers of voracity, eminently qualifying them for such a relation, and far outweighing, in our opinion, structural variations of minor import.

We are glad to find the great mass of the clavicorn beetles, including the *Xylophaga*, continued *en masse*, contrary to Latreille's plan of separating the latter from the more evidently Pentamerous clavicorns. The situation of the *Sphæridiidæ* at the end of the palpicorn aquatic beetles, succeeded by the *Histeridæ*, and these by the *Lucanidæ*, is very natural, although these various relations had been pointed out by preceding writers.

The great value of the work however consists in the characters of the genera, of which three hundred and thirty-two are described in this first part, (being about half of the order of beetles); indeed it would have been more correct to have styled the work a systematic description of the genera of British insects, rather than to have designated it by its present more comprehensive title-page. Each genus, on an average, occupies about half a page; the characters being about as long as (and often very similar to) those of Stephens' Illustrations:[1] in like manner also the genera in each family are tabularized, the table being however in English instead of Latin. The derivation of generic names is also given, a very advantageous plan pursued by Brullé and others, and which serves in a much more certain manner to fix a long series of names in the memory, than when given without any such definition. Under each genus are given short details of the natural history of such of the species as may have been noticed, but it may be readily conceived how many genera there are which are destitute of any such observations, and of which the mere existence of the few cabinet species is all that is known of the genus; hence the superiority of the plan pur-

[1] Compare for instance the characters of *Medon* in p. 104, with those given by Stephens, Mand. vol. v. p. 273.

sued by Mr. Stephens and others, of giving these details of natural history under the family rather than under the genera. The account of each genus is terminated by a list of the names of the species belonging to it, but not a single species is described, so that the student has no means of identifying a single insect.

Owing to the indefatigable researches of our late writers, Curtis and Stephens, and the still more recent generic Synopsis of Westwood, much novelty was not to be expected in the list of genera, a few have however been added[1], not indicated by the writers above mentioned; they are as follows, namely, *Pelecyphorus*, Nordmann, (allied to *Ocypus* and *Goerius*,[2] type *Staphylinus picipes*, Gyll.[3]); *Ocalea*, Erichs., (allied to *Bolitochara*, type *Ocal. castanea*); *Cryptarcha*, Shk., (separated from *Strongylus*, types *Str. strigata* and *imperialis*); *Pithyophagus*, Shk., (separated from *Ips*, type *Ips ferruginea*); and *Pediacus*, Shk., (separated from *Cucujus*, from which we think it is improperly far removed, type *Cuc. dermestoïdes*). In addition to these novelties, there are various remarks scattered through the book deserving of notice, and proving a careful spirit of observation; as for instance in the arrangement of the genera of *Brachinidæ*, the observation on the rank of *Cychrus*, (we cannot however agree that this genus, although so strikingly characterized, is to be considered as equivalent to the entire family *Cicindelidæ*, comprising as it does such diverse forms as *Colliuris*, *Cicindela* and *Manticora*); the remarks on the anomalous *Dytici* with double-formed females, the author being of opinion that there must be a recondite character not yet discovered, whereby the males [of the smooth and furrowed backed females] may be separated, thus confirming Mr. Kirby's genus *Leionotus* for the smooth-backed females; an observation with which we cannot coincide; the remarks on the specific names of *Goerius olens*, *Bolitobius lunulatus*, *Lomechusa emarginata* (which must be rejected from the British Fauna); &c.

[1] Some additional genera as well as species might have been added, had the author consulted other recent periodical works, as for instance the 'Bulletin' of the Moscow Natural-History Society, wherein Chandoir published a new distribution of part of the *Harpalidæ*, or the 'Naturalist,' in which Mr. Rylands has described some new British species of *Amara*.

[2] In a note to this genus is a sweeping condemnation of "modern entomologists" for adopting the learning of Mouffet without acknowledgment; the author might have made one exception at least, by referring to the Introd. to Mod. Classif. of Insects, p. 163.

[3] In introducing this, and some other interesting insects to which we might allude, it would at least have been satisfactory to have mentioned their locality, time of capture, &c.

The work is carefully printed; the outline woodcuts are chiefly copied from Panzer, and are by no means satisfactory; and more than half of the families are not illustrated by figures of their preparatory states. The work is announced to be completed in three parts, but the genera alone, on the plan here pursued, will occupy at least five such parts as the present, independently of the other portions of the work proposed to be given in the the title-page.

Art. III.—*British Coleoptera Delineated; consisting of Figures of all the Genera of British Beetles.* Drawn in outline by W. Spry, M.E.S.—Edited by W. Shuckard, Lib. R. S., author of "Essay on the Fossorial Hymenoptera," and the "Elements of British Entomology."

The prospectus of this useful work correctly observes, that "whilst the most elaborate description must fail to convey a distinct idea of the great variety that occur[s] in the forms of the genera of *Coleoptera*, neither can the best drawing give the requisite detail of all particulars; hence the pen and pencil must lend each other mutual help. With this object therefore in view, and with a wish to supply the deficiency of *one* of these desiderata, the present work, consisting of outline figures of the whole series of the *genera* of British beetles has been commenced." These figures are exceedingly characteristic, six or eight being placed upon each plate, conveying a very satisfactory notion of the forms of the genera intended to be represented; in fact we know of no figures which surpass them in this respect, except those of Mr. Haliday published in the 'Entomological Magazine.' The pencil has done its part well and laboriously—the pen has contributed descriptions, *not of the genera*, *but of the species* represented. If the work be intended as a supplement to the 'Elements of British Entomology,' it answers its purpose completely; if not, then descriptions, or at least, descriptive tables, of the genera, ought to bave been added. And we would strongly recommend Mr. Spry, who has evidently taken so great a share of the labour of the work, to have a second set of text printed, in which the pen may so lend its help to the pencil, that *both* the desiderata above mentioned may be obtained, and the work rendered what it deserves to be, independent of any other, and not as it now is, a mere supplement to other works.

The work appears in parts, each containing six plates illustrating nearly fifty genera. The plates appear irregularly, and amongst the *Xylophaga* we find the *Lyctus nitidus*, Gyll.

(a species not hitherto recorded as British) introduced, and formed into a separate genus named *Teredus*.

ART. IV.—*Die Infusions thierchen, als vollkommene Organismen; ein Blick in das tiefere organische Leben der Natur. Nebst einem Atlas von* 64 *col. Kupfertafeln, gezeichnet von Verfasser.* Von PROF. EHRENBERG. Royal folio. Verlag von Ludw. Voss, Leipzig.[1]

THIS work, which may truly be looked upon as marking an epoch in Natural History, contains on 133 printed sheets the results which the most skilful and successful observer with the microscope has obtained during many years of laborious and persevering research, in different parts of the globe. It may be said that the microscope has become, in the hands of Prof. Ehrenberg, a means of information not less important than the telescope has been, and still is, in those of the Herschels. And as Sir John Herschel did not restrict his inquiry to our hemisphere, so has Prof. Ehrenberg studied the minute organic productions of nature in distant parts; in Africa and Arabia (1820), and in the North of Asia (1829), thus arriving at important conclusions as to the geographical distribution of the *animalcula.* Any one, besides, who is at all familiar with the discoveries made in this branch of science during the last twenty years, must be sufficiently convinced that the work, whose title is given above, is not the production of some fortunate combination of circumstances, but the slowly-matured fruit of steady and deep inquiry.—Thus the author has succeeded in establishing two great natural laws, which may have been anticipated by some, but which have never been proved before. 1. *That the animal organization is perfect, in all its principal systems, to the extreme limit of vision assisted by the most powerful microscopes;* and, 2. *That the microscopic animalcula exercise a very great and direct influence on inorganic nature.*

One of the inferences drawn from the first law is the great improbability of these *animalcula,* as well as organic bodies in general, being ever produced by spontaneous generation.

In the *Infusoria* themselves Prof. Ehrenberg has either confirmed or first established a considerable number of very curious qualities and relations, which are highly interesting in a physiological and other points of view, the most important of which we briefly enumerate.

[1] The Infusoria (microscopic animalcula) as perfect Organisms; a glance into the deeper organic life of Nature. With an Atlas of 64 coloured plates after drawings executed by the author, &c.

1. Most (probably all) microscopic *animalcula* are highly organized animals. 2. They form, according to their structure, two well-defined classes. 3. Their geographical distribution in four of the parts of the world follows the same laws as that of other animals. 4. They cause extensive volumes of water to be coloured in different ways, and occasion a peculiar phosphorescence of the sea by the light they develope. 5. They form a peculiar sort of living earth; and as 41,000 millions of them are often within the volume of *one cubic inch*, the absolute number of these *animalcula* is certainly greater than that of all other living creatures taken together; the aggregate volume is even likely to be in favour of the *animalcula*. 6. They possess the greatest power of generation known within the range of organic nature; one individual being able to procreate many millions within a few hours' time. 7. The *animalcula* form indestructible earths, stones, and rocks, by means of their siliceous *testæ;* with an admixture of lime or soda they may serve to prepare glass; they may be used for making floating bricks, which were previously known to the ancients; they serve as flints, as tripoli, as ochre, for manuring land, and for eating, in the shape of mountain meal, which fills the stomach with a harmless stay. They are sometimes injurious by killing fish in ponds, in making clear water turbid, and in creating miasma; but that they give rise to the plague, *cholera morbus*, and other pestilential diseases, has never been shown in a credible manner. 8. As far as observation goes the *animalcula* never sleep. 9. They exist as *Entozoa* in men and animals, the *Spermatozoa* not being taken into consideration here. 10. They themselves are infested with lice as well as *Entozoa*, and *on the former, again, other parasites have been observed.* 11. They are, in general, affected by external agents, much in the same manner as the larger organic beings. 12. The microscopic *animalcula* being extremely light, they are elevated by the weakest currents, and often carried into the atmosphere. 13. Those observers who think they have seen how these minute creatures suddenly spring from inert matter, have altogether overlooked their complicated structure. 14. It has been found possible to refer to certain limits or organic laws, the wonderful and constant changes of form which some of these *animalcula* present. 15. That the organism of these *animalcula* is comparatively powerful, is evinced by the strength of their teeth and of their apparatus for mastication; they are also possessed of the same mental faculties as other animals. 16. The observation of these microscopic beings has led to a more precise definition of what constitutes an animal, as distinct

from plants, in making us better acquainted with the systems of which the latter are destitute.—*W. W.—Weimar.*

THE

MAGAZINE OF NATURAL HISTORY.

OCTOBER, 1839.

AMONGST the Short Communications in our present Number, will be found some brief particulars relating to the death of Dr. William Smith, whose sudden decease took place, on the 28th of August last, whilst visiting at the house of George Baker, Esq., the author of the well-known work on the History and Antiquities of Northamptonshire. Having but a short time since seen this acknowledged founder of the English school of Geology, in the apparent enjoyment of the most robust health, and in the possession of bodily and mental powers that rendered him still fresh and eager for employment in the field of scientific research, it was with no small share of painful surprise, that we received intelligence of the melancholy event.

The attention of our readers has been so lately drawn to his history, in the biographical sketch of his life and writings which appeared in this Journal a few months since, from the pen of Professor Phillips, and the great geological importance of his early observations is so universally admitted, that it is not necessary for us to extend our tribute of respect to his memory, beyond a passing allusion to his decease. We cannot, however, refrain from expressing the high gratification which we feel that it should have been in our power to give publicity to so faithful a representation of the 'Father of English Geology,' as the admirable likeness which accompanied the above-mentioned Memoir.

The columns of the 'Athenæum' have on this, as on former occasions, for several weeks been principally occupied with reports of the Proceedings transacted during the late assembling of the British Association; and though the Birmingham meeting, from peculiar circumstances, had its proportion of attending members reduced, there appears to have been a very fair supply of communications brought under the consideration of the different sections. In the Natural History department we observe that Messrs. Forbes and Goodsir furnished a joint account of a visit paid by those gentlemen to the islands of Shetland and Orkney, during which they appear to have made some particularly interesting additions to our marine invertebrate Fauna, in the discovery of a very large *Tubularia*, referrible to a new genus, and many undescribed species of *Holothuria*, *Eolida*, &c. Mr. Lyell made some observations upon the marsupial and quadrumanous remains from the London clay near Woodbridge, and mentioned the discovery of some teeth belonging to the larger *Carnivora* in the red crag of the same neighbourhood; — a tertiary deposit in which traces of terrestrial mammals had not previously been recorded.— Some little doubt appears to have existed in the mind of Mr. Lyell, as to the contemporaneous deposition of the red crag and the stratum from which the mammiferous teeth were taken, the possibility of their having been subsequently introduced through fissures in the quarry being suggested. This part of the crag has been so extensively explored without any traces of land animals being observed, that the question is one which should be examined with extreme caution; as, however, the remains of quadrupeds occur abundantly in the mammaliferous crag, and occasionally, as it now appears, in the London clay of the same neighbourhood, we may anticipate that sooner or later indications of their existence will be found in the whole of the tertiary rocks which occupy that district.

Professor Schönbren of Basle informed the Geological Section that Agassiz had just commenced the publication of a supplement to his 'Poissons Fossiles', which he had dedicated to the British Association, as an acknowledgement of his gratitude for the assistance afforded him by that body. This announcement completely nullifies the proposition not very shrewdly, as we think, put forward by Agassiz in his late vindicatory epistle, wherein he intimates his perfect willingness that cheap fac similes of his plates should be published in England, as the completion of his own work, and the removal of the drawings from the lithographic stones, would render such a proceeding beneficial to science, without being injurious to his own interest. The 'Poissons Fossiles' and the 'Mineral Conchology,' from their nature, are necessarily continuous publications, unless a want of means or inclination on the part of their respective authors to carry them forward, puts a temporary or final interruption to their progress.[1]

Among the recommendations resolved upon by the Association, we notice one from the Geological section, recommending, " that application

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[1] The attempt to obtain a sale in this country of the French edition of the 'Mineral Conchology,' has been a total failure. We learn from M. Agassiz's Agent, that only one copy has been disposed of, and that to the author of the original work!

should be made to the trustees of the British Museum, to have the shells in that institution so arranged as to facilitate comparison of the actually existing shells, with fossil remains and impressions in rocks." From the manner in which this recommendation is worded in the Athenæum Report, its precise meaning is not clearly apparent. The systematic arrangement and naming of the collection of British *testacea* in the national collection, would be of the most essential aid to the geological inquirer, and, as this has been a consummation long and most ardently hoped for, but as yet in vain, we understand the above recommendation as a roundabout but ingeniously delicate way of attempting to get so important an object effected.

We see with pleasure in the leading article of the Athenæum, a few brief but well-timed observations on the abuse directed by the Times newspaper against the British Association as a scientific body. That the attack in question has originated in the grossest ignorance on the part of its promulgators, of the constitution and real objects of the Association, there can be little doubt; and the regret with which we must confess we have seen the course pursued by the latter journal, has arisen more from witnessing such a prostitution of the talent and extensive influence which it commands, than from the apprehension of any injurious effect being produced in the quarter against which its hostility has been pointed.

Sir James Alexander has paid us the same compliment with which, on a late and somewhat similar occasion, he favoured the editor of the Athenæum, having written us a letter expressive of his displeasure at our late review of his exploring expedition.[1] He has the incivility to style our very handsome notice of his original discoveries, "a disparaging critique upon those portions of his narrative which relate to Natural History."—We are sorry to find that we did not give the narrative that attentive perusal which was certainly incumbent upon us in our editorial capacity, for it appears that had we done this, we might have seen that Sir James "repeatedly entered the waters of the Orange, and wandered along its banks, in spite of the dread Leviathan and hairy monsters." Furthermore, Sir James tells us, "He [the reviewer] strangely concludes that because my attendant fled from the attack of a five-feet high baboon, I must also have had a salutary dread of these animals. I never was attacked by a baboon, and never fled from one."

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[1] The letter is given verbatim on the wrapper.

The positive assurance in Sir James Alexander's own hand-writing, that he never did fly from a baboon while on his African expedition of discovery, is so completely satisfactory, that it was altogether unnecessary to render it doubly so, by connecting it with the circumstance of his *not having been attacked by one.* In truth, we must candidly admit, that our first impression was too hastily formed, for although Sir James, upon the strength of facts of which he was immediately cognisant, states that these baboons murder travellers by biting them to death in the neck, and that they are more to be dreaded than the poisoned arrows of the Boschmen, our assumption nevertheless, that *he* had a salutary dread of these monsters, cannot be supported by a course of legitimate induction, although in these times of liberal criticism we think the inference to that effect will not be regarded as very far-fetched.

Sir James goes on to observe,—"Again he sneers at my assertion that when the rhinoceros is quietly pursuing his way among the mimosa-bushes, his horns strike against each other. It appeared to me they did so, —the natives confirmed this,—and will your reviewer maintain that both horns are so firmly fixed in the bone of the head that they cannot touch each other at any period of their growth, and when the skin of the rhinoceros is not stiffened with passion?" We cannot help feeling that this is rather a delicate subject to handle, because it involves the personal observation of Sir James; from the specimens however of the two-horned rhinoceros which have come under our own notice, we should certainly have inferred that if the animal were *quietly* moving amongst the mimosa-bushes, a clapping *noise* would *not* be produced by the horns striking together, but the individuals examined by us unfortunately happen, in all cases, to have had the skin *stiffened,* and though not exactly from the same cause as that alluded to by Sir James, yet, as it appears that this condition is opposed to the above phenomenon going forward, it would not be fair, upon such data, to throw any doubt upon Sir James Alexander's statement, backed by that of the natives. We do not, however, think much importance should be attached to the latter circumstance, for had it appeared to our traveller during his African peregrinations, that the side of the moon which illumines that portion of the earth presented an aspect very much resembling *green cheese*, it is more than probable that the natives would have coincided in this opinion, had Sir James consulted them upon the subject. To have differed from him indeed, would have been equivalent to calling in question his powers of correct discrimination, and this would have been tantamount to calling in question the discrimination of the Geographical Society, in deputing Sir James to be their representative.

The most important part of the communication with which we have been honoured, is an intimation from Sir James (somewhat obscurely worded), that he deems it necessary to give some public proof of his courage, for which purpose he demands the name of the anonymous *Reviewer*. With that true nobleness, and delicacy of feeling, which ought to be an invariable attribute of knighthood, Sir James scorns to take advantage of the Editor's name being openly placed on the wrapper of the journal containing the offensive critique, and recollecting the motto, '*Palmam qui meruit ferat*,' his indignation is solely directed towards the said anonymous personage. We must, however, tell Sir James Alexander, that in this matter we deem him to be altogether at fault. It will readily be supposed that we feel a proper sort of editorial affection for our establishment of reviewers, and that we do not hand them over to the tender mercies of knight-errants and rhinoceros-shooters, without just and reasonable cause should arise to warrant our so doing. Now, throughout the article complained of, not the most distant suspicion is mooted of any want of courage on the part of Sir James as it respects the genus *Homo;* the "salutary dread" attributed to him, was of a race of gigantic *Quadrumana*, and which he expressly tells us are infinitely more to be feared than the most savage of our own species. We therefore dispute altogether the validity of the grounds upon which Sir James would found his challenge, since it is clear that no possible object would be gained if he had the satisfaction of 'tickling' our reviewer with one of his 'hard and heavy bullets,' for the imputation, as it respects the baboons, would remain precisely as it now stands.

If Sir James be in real earnest about setting himself right with the public upon this point, the obvious course under the circumstances is for him to despatch his attendant, Robert, with proper assistance, to the Orange River, for the purpose of capturing and bringing alive to this country, one of the 'hairy monsters.' Sir James may then, in single combat, have an opportunity of publicly displaying his prowess, and in the event of his success, we should recommend him to add the skin of his vanquished opponent to the collection of *Quadrumana* in the national Museum, or that of the Zoological Society.

We have every reason for believing that in the event of the Geographical Society again availing themselves of Sir James Alexander's services to superintend another African expedition of discovery, that he will receive special instructions to make mention in his narrative of *nothing* that he may *hear*, and only *half* of what he may *see;* and we can assure him that a volume coming before us, written under these circumstances, would not give rise to a *disparaging critique* in the Magazine of Natural History.

SHORT COMMUNICATIONS.

Extract of a Letter from George Baker, Esq. referring to the death of Dr. William Smith.—"My sister and I had long looked forward with pleasure to attending the meeting of the British Association at Birmingham;—we had antici pated finding many of our distant friends there,—and what added still more to our promised enjoyment, Dr. Smith wrote to say he would come and geologize in our neighbourhood with us for a few days, on his way to Birmingham.

"He came to us from London on the Tuesday before the meeting He seemed slightly indisposed with a cold, but we drove about thirty miles the next day in a direction suggested by himself, to examine a point of doubtful stratification. On Thursday he walked with us nearly two miles, to see some fossil bones. On Friday a bilious diarrhœa came on, and much against his inclination I consulted my friend Dr. Robertson, who hoped he would be sufficiently well to accompany us to Birmingham on Monday. He went a short drive with us that evening, and even on Monday morning, the attack having subsided, we thought he would be able to go with us by the rail-road; but when he came down stairs (for he had not been confined to his bed) he was evidently too weak to bear the journey, and we began to be alarmed. I went immediately to Birmingham for his nephew, Professor Phillips, and returned with him early the next morning, when the Doctor appeared so comfortable, and gave us such a circumstantial and connected account of his movements, and the geological observations he had made during his visits since the Oxford agricultural meeting, that Professor Phillips thought we were needlessly alarmed, and that he might venture to return to Birmingham in the afternoon. But when we went up again after breakfast, an evident and rapid change had taken place; he was in a state of drowsy torpor, from which (although, if roused, he answered questions rationally to the last) he never rallied. The powers of nature were exhausted, and he kept gradually (or rather rapidly) sinking till the following night (Wednesday), when he breathed his last without a sigh or a groan. From the first moment of his attack he suffered no pain, and his constant reply to every inquiry if he felt any pain, was "None at all." The comparative suddenness of his death was a great shock to us, and it seems even now like a dream. May we realise it by attending to its awful warning, "be ye also ready."

"He often expressed a wish that as his geological researches began, so they might end with, and his bones rest on, the *oolite;* and it is rather remarkable that this wish is realised in our church-yard (St. Peter's), where the Professor and I followed his remains on the Monday after his decease".—(*Addressed to the Editor, and dated Northampton, Sept.* 23, 1839).

Great Migration of Dragon-flies observed in Germany.—On the 30th and 31st of last May immense cloud-like swarms of dragon-flies passed in rapid succession over the town of Weimar and its neighbourhood. The general direction of the migration was from South by West to North by East. The migration had been likewise observed in all the villages situated a few miles to the east or west. The insects arrived in a vigorous state, some of the flocks flying as high as 150 feet above the level of the river Ilm, and striking against the windows of a house situated on an eminence; others passing through the streets. The specimens caught there were those of *Libellula depressa,* at least, all that I have seen were of that species.

Being anxious to ascertain the range of this migration, I tried to collect every possible information from various papers, but all I could learn from that source was, that cloud-like swarms of dragon-flies had been seen at Gottingen on the 1st of June, at Eisenach on the 30th and 31st of May (flying from East to West), and at Calais on the 14th of June, on their way towards the Netherlands. Those seen at Eisenach were likewise *Libellula depressa;* those observed at Calais appeared to belong to a different species, as they were described as being thick, and about 3 inches long.

Being rather disappointed in my expectation of finding news from many quarters respecting the same phenomenon, I endeavoured to procure more information by means of a public advertisement; whereby I learned that the swarms of dragon-flies had been seen about the same time as they were here, in the neighbourhoods of Leipzig, Alsleben, Aschersleben, and Halle. The information which Dr. Buhle, the inspector of the Zoological Museum of Halle, had the kindness to impart, was particularly valuable. The specimens caught at that place belong to *Libellula quadrimaculata.* The first swarms arrived there in the afternoon of the 30th of May, a short time before a thunder-storm.[1] They flew very rapidly from South to North. On the 31st of May similar flocks followed their predecessors in the same direction; most of them

[1] I see from my meteorological journal that we had a thunder-storm here both on the 30th and the 31st of May, and two on the 1st of June.

passed at the height of 7 or 8 feet, catching insects as they flew on. On June 1st and 2nd, straggling parties of five or six were observed, always keeping the same direction. Within a league to the east of Halle these swarms were everywhere observed. To the west the whole valley was inundated by the river Saale. *Libellula quadrimaculata* is rather scarce at other times about Halle, as *Lib. depressa* is about Weimar.

As far as the information which I have been able to collect goes, this migration has extended from the 51st to the 52nd degree of latitude, and has been observed within 27° 40′ and 30° east of Ferro. But the instance of Calais renders it probable that it has extended over a great part of Europe, wherever the same meteorological circumstances have prevailed.

Several of the larger species of *Libellula* do occasionally migrate, but the phenomenon is of rare occurrence, and the circumstances which bring about such an uncommonly numerous development of the perfect insect must be very peculiar.

The last migration of dragon-flies (before that commemorated in this article) which was observed at Weimar, took place on the 28th of June, 1816. The insects in that instance also belonged to the same species—*Libellula depressa*. They were then, as recently, taken for locusts by the common people, and the superstitious saw in them the harbingers of famine and war.

The year 1816 was extremely wet, and 1817 equally so, but it appears that the dragon-flies did not migrate that year. Though such migrations must be very destructive to the species, yet this cannot be the reason why the phenomenon was not observed in 1817, as the *Libellulæ* require more than one year to become perfect insects. The difference of the dates of the 30th and 31st of May, 1839, and the 28th of June, 1816, is also remarkable; but I cannot account for it, as I am deficient in regular observations upon the weather during the spring months of 1816: it proves, however, how greatly the time of their development differs in different seasons.

As to the great multiplication of these insects about the end of May in the present year, it is by no means mysterious.—From the beginning of that month to the 21st, the weather had been exceedingly rainy; rivers and lakes overflowed and spread their inundation over immense areas of low grounds, whereby myriads of the *pupæ*[1] of the *Libellulæ* which, under other circumstances, would have remained in deep water, and become the prey of their many enemies, were brought into shallow water, and the hot weather from May 21st to May

[1] Or *larvæ* in the stage answering to that of the *chrysalis*.

29th, converted these shallows into true hot-beds. The numerous thunder-storms (at Weimar there were four) during that week must have greatly encouraged their rapid development into perfect insects, and so those clouds of winged insects rose almost at once from the temporary swamps, and were immediately obliged to migrate in order to satisfy their appetite, as these species are very voracious.

In these migrations they follow the direction of the rivers, and they appear always to fly with the current, to whatever quarter the river may flow, near which they happen to be, although they do not keep close by it, as they must spread over wide districts in order to subsist. If with the directions above mentioned we compare the following statements, I think my opinion will be found sufficiently established. Near Weimar the river Ilm begins to flow from south-west to north-east after having flowed from the north; near Halle the Saale flows due northwards; near Eisenach the Nesse follows a westerly direction towards the Werra.—*W. Weissenborn.—Weimar, Aug.* 27, 1839.

Existence of the Toad without Food.—In the Mag. Nat. Hist. vol. ix p. 316, we have an account of a toad that was immured, by way of experiment, in a block of stone, for the space of thirty-eight years, and at the end of that period was found alive.

On the 10th of September, 1836, I had a living toad put into the ground at a depth of three feet from the surface, in a bed of flinty gravel; a flower-pot reversed was placed over it, to prevent the toad from being crushed by the pressure of the earth above. The hole was then filled up and the surface cropped, the spot selected being a garden.

The pit was reopened on the 29th of last August, after having been closed for three years all but ten days; and the toad was found alive, and used all its exertions to crawl away as soon as the flower-pot was removed. It was not a full-grown animal when taken, neither did it appear to have increased in size during its incarceration, its legs and thighs indeed were very slender, compared with the limbs of toads generally; but this difference probably arose from the disuse of those limbs during confinement.

I have very good reason to think that the animal would have survived after its long imprisonment, had it not been most injudiciously placed in the sun for three days, in a southern aspect, after it was taken out of the ground, for the purpose of gratifying the curiosity of any one who might wish to see it.—*John Brown.—Stanway, Sept.* 12, 1839.

Capture of an immense Saw-fish at Trinidad.—Being in the Gulf of Paria in the ship's cutter, on the 15th of April, 1839, I fell in with a Spanish canoe, manned by two men, then in great distress, who requested me to save their lives and canoe, with which request I immediately complied; and going alongside for that purpose, I discovered that they had got a large saw-fish entangled in their turtle-net, which was towing them out to sea, and but for my assistance they must have lost either their canoe or their net, or perhaps both, which were their only means of subsistence. Having only two boys with me in the boat at the time, I desired them to cut the fish away, which they refused to do; I then took the bight of the net from them, and with the joint endeavours of themselves and my boat's crew, we succeeded in hauling up the net, and to our astonishment, after great exertions, we raised the saw of the fish about eight feet above the surface of the sea. It was a fortunate circumstance that the fish came up with the belly towards the boat, or it would have cut the boat in two. I had abandoned all idea of taking the fish, until, by great good luck, it made towards the land, when I made another attempt, and having about fifty fathom of 2½ inch rope in the boat, we succeeded in making a running bowline knot round the saw of the fish, and this we fortunately made fast on shore, at Point-a-Pierre: when the fish found itself secured it plunged so violently that I could not prevail on any one to go near it, the appearance it presented was truly awful. I immediately went alongside the 'Lima' packet, Capt. Singleton, and got the assistance of all his ship's crew, (mine being away for sugar). By the time they arrived the fish was rather less violent; we hauled upon the net again, in which it was still entangled, and got another fifty fathoms of line made fast to the saw, and attempted to haul it towards the shore, but although mustering thirty hands, we could not move it an inch. By this time the negroes belonging to Mr. Danglad's estate came flocking to our assistance, making, together with the Spaniards, about one hundred in number; we then hauled on both ropes for nearly the whole of the day, before the fish became exhausted. On landing it on the beach we found, to our great surprise, that it was considerably longer than the cutter, which measured 17 feet. On endeavouring to raise the fish it became most desperate, sweeping with its saw from side to side, so that we were compelled to get strong guy ropes to prevent it from cutting us to pieces. After that one of the Spaniards got on its back, and at great risk cut through the joint of the tail, when animation was completely suspended: it was then measured, and found to be 22 feet long and 8 feet broad, and weighed nearly 5 tons. The liver filled a beef-tierce, and on opening the body we found several eggs, the size of 18-lb. carronade shot; these the negroes craved as a great luxury. The only part which I retained was the head, which I cut off below the lower jaw; it is now in a fine state of preservation, and the largest, I should say, in the world.[1] *Wm. K. J. Wilson, Commander, Halifax Packet.—Lombard St. Chambers, 17th Sept.* 1839.

Cuttings of the Eastern Counties' Railway, at Stratford, Essex.—The eastern counties' railway passes near to the church, where there is a deep cutting, and on the east side of the bridge, on the road to Laytonstone, is a stratum of gravel ten feet thick, containing chiefly chalk flints. Below the gravel is a bed of sand, two feet in thickness.

There is a second bridge about a hundred and fifty yards to the east of the first, and at this second bridge, and on the east side of it, in September, 1838, when the sections were fresh, the strata were to be seen more fully developed, being there sixteen feet deep. The upper stratum is the gravel, below which is a yellow and greenish sand, and lower still is a mixture of sand and blue clay, being together the upper part of the London clay formation.

In the bed of sand were many shells, most of them crushed and in fragments, and in some places in great abundance.—Occasionally the sand was consolidated into sandstone, and in the pieces of sandstone the shells were well preserved, and many very perfect specimens were obtained. Immediately under the sand is a mixture of sand and blue clay, in which are masses of shells, some crushed, others entire.

In some places the bed of crushed shells was two feet thick, in others, not six inches. There were also pieces of blueish sandy limestone, in which were masses of shells, and sharks' teeth were also found.

The shells are recognized to be, *Rostellaria Sowerbii*, *Natica glancinoides*, *Ostrea Bellovacina*, *Pectunculus brevirostris*, *Citherea Morrisii*, *Cardium Plumsteadianum*, *Melania inquinata*, and a *Tellina*. The *Ostrea Bellovacina* is the same as *Ostrea pulchra*, also called *Ostrea variabilis*. This shell, as well as the *Cardium Plumsteadianum* and *Melania inquinata* is found on the opposite side of the river, in the Blackheath district. The London clay at Stratford is about 200 feet deep.—*James Mitchell.—June*, 1839.

[1] The head is now being prepared in London for the Wisbeach Museum.

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NATURAL HISTORY.

NOVEMBER, 1839.

Art. I.—*On the Genus* Argonauta. By M. Rang.[1]

It will, perhaps, be thought extraordinary that after all the learned dissertations which have been published upon the poulp of the argonaut, and especially after the lucid and convincing memoir which M. de Blainville has just inserted in the third number of the 'French and Foreign Annals of Anatomy and Physiology,' we should yet undertake to treat anew upon this subject, having, besides, nothing very novel or important to advance.

We thought however, after the reading of the memoir referred to, that we ought to bring forward the note which gave rise to it, and of which M. de Blainville had been able to reproduce only a few sentences. Besides which the memoir itself gives us occasion to offer some remarks, as much with a view to rectify certain facts which concern ourselves, as to state our opinion as observers of some others.

This is therefore, in a few words, the history of the note in question, of M. de Blainville's memoir, and of the present article.

Finding ourselves at Algiers, where the poulps and shells of the argonaut are sometimes to be met with even in the middle of the harbour and along the quays, we were able to study at our ease this curious animal, and to see whether, by thus studying, we could obtain thence such data as would confirm or weaken the widely diverging opinions which men

[1] Translated from an article in Guerin's Magasin de Zoologie, entitled "Documents pour servir à l'histoire naturelle des Cephalopodes cryptodibranches, par M. Rang."

of great merit have put forth on this subject. We were fortunate enough to notice some new facts, and our first impression was, we confess, that our discoveries were perhaps favorable to the opinion that this cephalopod does not parasitically occupy the shell in which it resides; we proposed on our return to France, to present these as simple facts resulting from our own observations, but without adding any reasoning, or drawing from them any exact inferences, to the one among our zoologists who has most especially devoted his attention to this matter, and who has for a long period, and almost singly, maintained his opinion with a power of conviction, which on the part of so learned and enlightened a man is very likely at least to suspend the judgment of others.

We had an interview with M. de Blainville, and he was struck with our remarks; he consented to lay a note from us before the Institute; and was desirous that he should himself, together with M. Dumeril, be charged with the office of reporting upon our observations.

M. de Blainville had then in his hands the interesting observations which Madame Power had just made upon the argonaut, and which had conducted us to new discoveries; he had besides a crowd of documents on the same subject, and we consider ourselves happy to have been the means of inducing on his part, the publication of a memoir which throws so much light upon the subject it treats of, and which has at the same time the advantage, if not of deciding the question, at least of settling more precisely the opinion and the arguments of that naturalist; as well as of awakening and stimulating anew the ardour of travellers, who alone can furnish the means to solve this zoological problem of nearly two thousand years.

The report of M. de Blainville was read by him to the Academy of Science, at the sitting of April 24, 1837, and printed immediately in the next number of the 'Comptes-rendus' and in many metropolitan journals, which were eager to give at least some extracts from it.

M. de Blainville did not confine himself to this; for having added this report to fresh dissertations on the same subject, he formed it into the memoir, or rather the letter of which we speak here, and which is to be found in the third number of the 'Annales Françaises et Etrangêres d'Anatomie et de Physiologie.'

Note.—Upon the poulp of the argonaut. Sent to the Academy of Sciences.—Madame Power, a French lady living at Messina, has just communicated to us the experiment she has made upon the poulp of the argonaut, by means of which she has ascertained that this mollusc repairs the fractures which may happen to its shell. Being ourselves then at Algiers, where these animals sometimes abound, we wished to try the experiment, and in order to accomplish it repeated step by step the mode of procedure which had been so favourable to that lady's observations.

We had also another end in view, that of doing justice, if, as we believed, there was occasion to do so, to all those marvellous things, which, since the time of Aristotle, so many naturalists have so complaisantly repeated, concerning the navigation with sail and oar, of this mollusc.

To arrive at a conviction of the incorrectness of these recitals, we had but one means to employ, which was to find out the true use of the very dilatable elliptic lobes borne by two of the arms of the poulp, and which naturalists had so picturesquely considered as the sailing apparatus of this new species of navigator; a point which no one that we are aware of has yet thought of studying, although many profess to have seen the mollusc in a living state; and which nevertheless, if once well ascertained, may be of great weight in the decision of the question still pending, as to whether the poulp holds its property in the shell by right of birth or by right of conquest.

We shall first remark that we succeeded completely in a repetition of Madame Power's experiment. A fracture in one of these shells, the animal of which lived six days in our basin, was found repaired and completely closed; but notwithstanding our inclination to adopt the poulp with palmated arms as the true constructor of the argonaut, we could not, like that lady, consider the experiment as conclusive, in a discussion which is supported on all sides by so many facts and objections, and in which investigations have gone so far without being able to settle the question entirely. In fact the renovated part is but a thin transparent plate, a mere diaphragm which has neither the texture, solidity, nor whiteness of the rest of the shell, and taking an irregular form as if it had not been produced by the same means and the same organs; in a word it reminds us exactly of what happens among snails when the shell is broken; and we know that in that case, the *collier* [1] of the animal which alone has produced the shell, does not assist in the work of reparation.

However this may be, the fact of which Madame Power has apprised us is new, and an interesting circumstance in

[1] *Collier*'—the thickened and glandular margin of the mantle.—Ed.

the history of the poulp of the argonaut; and the manner in which the experiment has been conducted denotes, on her part, great accuracy of observation, and a laudable zeal for the progress of science.

We now proceed to the second remark we have to make, and which concerns the use of the elliptic lobes of two of the arms of the poulp. We have watched many of these animals in their shells, some at liberty in the sea, which we followed by coasting along near them in a rowing boat; others, as we have already said, in a basin, where they enjoyed a seeming liberty; and after all we must confess that we have seen nothing in the habits and manœuvres of these animals which resembled the things that have been related of them;—positive fables which have been preserved by some authors merely through their love of the marvellous, or their too great confidence in the observations of the ancient naturalists.

We have on the other hand made the following discoveries. In the first place we remarked that many authors have wrongly represented the poulp in the shell, placing the palmated arms in front, that is to say, on the outer edge of the opening; we find even in the beautiful plates of a recent work of M.M. Ferrussac and d'Orbigny, a figure in which the animal is turned one way, whilst in the remainder of the plates it is turned another. If it were true that the mollusc is sometimes situated one way and sometimes another, we might take advantage of this circumstance to strengthen the opinion of those who maintain the poulp to be a parasite; but as among the great number of specimens we have studied, not one has presented to us an anomaly of this kind, we can cite this fact in support of the contrary opinion, for it naturally leads us to suppose that the position of the mollusc in its protecting covering, is not an accidental circumstance, but rather the consequence of their mutual identity, and of an absolute necessity.

The two palmated arms are always behind, that is to say they lie near the retreating spire; and we consider that part of the poulp which terminates in front as being ventral, and the opposite part, which includes the bag and the opening leading to the branchiæ, as dorsal. When the poulp creeps, as we are about to shew that it does, these palmated arms might still be called posterior arms, because it is they which terminate behind the locomotive disc.

We observed that these palmated arms, from the point of coming out of the shell, embrace it, extending from the two margins of the keel, whilst their membranous lobes spread themselves over the two sides, which they carpet entirely, as far as the anterior edge of the opening. Under whatever circumstances we have observed this mollusc, we have seen it thus disposed. It will be enquired perhaps, how then can it raise itself from the bottom and sport about at the surface of the water, as it is sometimes seen to do? It is simply by the ordinary means used by calmars and cephalopods in general; and which consists in alternately admitting and ejecting the sea water into and from the dorsal cavity, producing a backward movement, which is sometimes very rapid.

When the poulp crept upon the bottom of the basin, it presented to us the appearance of a pectinibranchiate gasteropod; the disc which surrounds the mouth and which easily dilates itself to a great extent, being spread upon the surface of the ground like the foot of a gasteropod. The head showed itself above, furnished with lateral eyes and tentacles; the body concealing itself in a covering shell, whose outer edge shelters in front the tube corresponding to the arms, which like the siphon of a pectinibranchiate mollusc is carried backwards. The two anterior arms represent the *tentacula;* and the four lateral arms those tentaculiform expansions, which among the *Monodontes* and the *Litiopes* are disposed in a serpentine manner about the animal during its progression; finally the two posterior arms, carpeting with their lobes the two sides of the shell, merely left between them a narrow space of separation in the median line of the keel.

It is in this state that we have observed the poulp crawling upon its disc; but *this* time it went *forward,* and its speed was so considerable as to clear a great space of ground in a little time. If anything happened to disquiet it, it retreated into the shell, which immediately losing its equilibrium, turned over upon its side.

After this description, should we not be tempted to establish a relation between the cephalopods and the gasteropods, and the poulp of the argonaut on one side, and the *Carinaria, Atlantes,* &c. on the other?

We deceive ourselves perhaps; but it seems to us that the knowledge we have just obtained of the use of these palmated arms comes in to corroborate the opinion of those who make the poulp the constructor of the shell. What inferences may we not in fact be led to draw from these well established relations between the animal and the shell; from the form of these lobes, which exist in no other cephalopod than the poulp of the argonaut; and which have never been wanting in those we have been acquainted with, proving that this disposition is expressly on account of the shell; from the use of these lobes as a mantle, covering the whole in the manner of so many other molluscs,—lobes which would be useless if the animal had not had a shell from its birth; and finally from that remarkable colouring at the base of the palmated arms which is reproduced in so complete a manner upon the corresponding part of the shell?

Such was the note which we remitted to the Academy of Sciences, during one of the sittings of the month of March 1837, a note which, as we have already said, was sent to a commission composed of M.M. de Blainville and Dumeril, in order to make a report of it agreeably to the desire we had expressed; for our object in taking the step, was simply to provoke on the part of these naturalists, but more especially M. de Blainville, the most decided supporter of the parasitic theory, an examination of the new facts we brought into view, in order to deduce from them inferences which might on one side or the other, tend to the determination of the question.

We have related in what an obliging manner this naturalist replied to our request, in undertaking to make the report we desired; and how he afterwards returned to the subject in a memoir in which he examined all that has hitherto been said upon this interesting problem.

It is upon the occasion of this memoir, which resumes so well the past thread of the argument, that we enter into the details which follow, in order to complete our note, and make known in its place and order what further our researches concerning the poulp of the argonaut have enabled us to discover.

We are about in the first place to resume the observations indicated in the note, and then to deduce from them inferences which in our opinion may be drawn from them. We shall then pass on to the examination of some facts or arguments presented by different naturalists; but before commencing we shall divest ourselves of all personal bias as to the parasitic or non-parasitic nature of the poulp; which in conscience, there is but little difficulty in doing, for it seems to us that we are at this moment in the most complete uncertainty. It is the truth that we wish for; and in order to find it we know no other means than to examine calmly and candidly the pro and con of each argument, as well as the value of the observations and hypotheses that have been presented.

The newly detailed facts in the note in question are:—

1st. The belief more or less generally entertained since the time of Aristotle, respecting the skilful manœuvres of the poulp of the argonaut in progressing by the help of sails and oars, on the surface of the water, is false.

2nd. The arms which are provided with membranes in the poulp have no other function than that of enveloping the shell in which the animal lives, and that for a determinate object.

3d. The poulp with its shell progresses in the open sea in the same manner as the other cryptodibranchial cephalopods.

4th. When at the bottom of the sea the poulp creeps upon an infundibuliform disk represented by the junction of the arms at their base, covered with the shell, and the part reputed ventral above; having in this posture the apppearance of a gasteropodous mollusc.

Let us now see what consequences we can deduce from these four established facts.

Fabulous Navigation of the Argonaut.—We shall say but little on this subject, only remarking that in giving a formal contradiction to those persons who have pleased themselves with trumpeting the marvellous recital of the ancients, and who, doubtless not finding it extraordinary enough, have yet more enriched it from the fertility of their own imaginations, our observations bring down the locomotive powers and habits of this mollusc to a normal state, that is to say, to what obtains among other animals of the same class, and it is a reform which no naturalist that we know of has yet dared to make, though we are well persuaded that many among them put little or no faith in these artificial descriptions.

A very natural reflection flows from what we have just said: how could the important question relating to the argonaut possibly proceed in a clear and straightforward manner, when we see that for about two thousand years we have pleased ourselves with going aside into the fields of the picturesque; and that naturalists of high repute even, admitted it all without a previous examination.

If these men had dreamed of verifying facts, they would have discovered the real use of the supposed sails, and the question being earlier carried out would perhaps by this time have been resolved.

Use of the arms furnished with membranous lobes.—In discovering the use of the arms provided with membranous lobes, we thought at the first glance that the solution of the problem lay there; and it was this impression which led us to express ourselves in the manner we did in our note transmitted to the Academy. One of the first sensations we felt was astonishment at what we saw; since so many naturalists who have professed to know the argonaut with its poulp in a living state, had pointed out nothing similar; and this circumstance which led us to reflect earnestly, encouraged us to carry on our observations with the most minute attention.

It seemed to us that we were at that instant enjoying an especial good fortune that we only owed to chance, and which no naturalist had enjoyed before us.

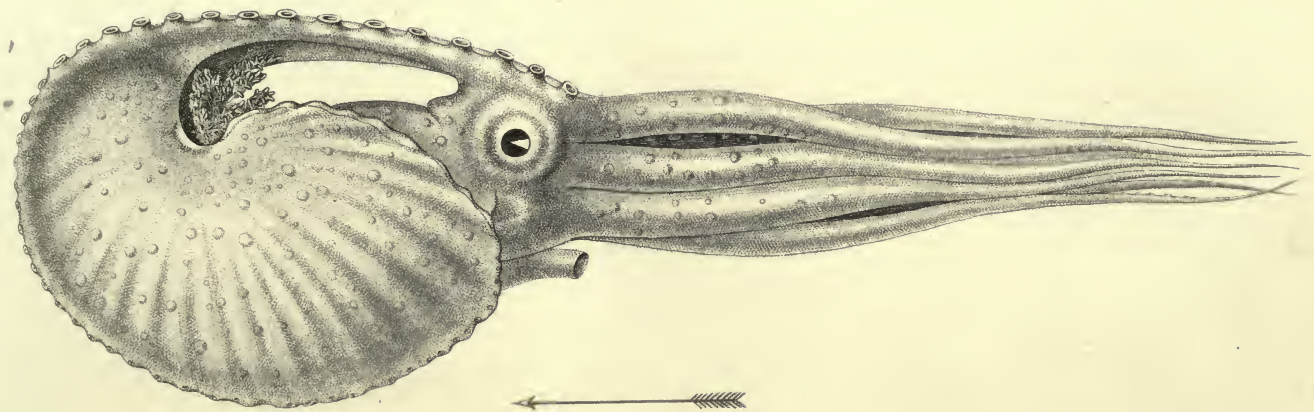
Many days' experience however, proved to us that it was no particular good fortune; for the poulps that we were watching all presented to us the same fact, and that invariably!

In order to be better understood, and to leave no doubt as to the position which this mollusc presents in the shell where it is constantly found, we will give a fresh description of it, following, step by step, that which has been the most perfect of our experiments.

The poulp with its shell, lying motionless at the bottom of the vase in which we had just placed it, struck us first by the brilliancy and richness of its hues, which our sketch is far from conveying. It was little more than a shapeless mass that we had before our eyes; but this mass was all silvery, and a cloud of spots of the most beautiful rose colour, as well as a very fine dotting of the same, heightened its beauty. A long semicircular band, of a vivid ultramarine blue, which melted away insensibly, was very strongly marked at one of its extremities;[1] the shell was nowhere visible, but with a little attention we could easily recognize its general form, and we could even distinguish some grooves of its surface, as well as the tubercles of the keel. A large membrane covered all, and this membrane was that of the arms, which so peculiarly characterise the poulp of the argonaut. The animal was so entirely shut up in its abode, that the head and the base of its arms were very little raised above the edges of the opening of the shell. On each side of the head, between it and the partition wall of the shell, a small space left free allowed the eyes of the mollusc to see what was without, and their sharp and fixed gaze appeared to announce that the animal watched attentively what was passing around it. The slender arms were folded back from their base, and inserted very deeply round the body of the poulp, in such a manner as to fill in part the empty spaces which the head must naturally leave in the much larger opening of the shell. Of these six arms, the two lower[2] (or abdominal) ones descended on each

[1] This band of ultra-marine blue is represented in the drawing which M. Rang has given as extending from the bases of the palmated arms of the poulp, along the course of the keel of the shell for about half its length.—Ed.

[2] To conform to custom, but without admitting the correctness of the principle, we designate the membraniferous arms as being superior, that is to say on the dorsal side, and the two opposite arms as being inferior.



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side the whole length of the carina, leaving a space between them, within which we perceived to open, the extremity of the tube of the animal; whilst the four others were disposed, two to the right and two to the left, in the middle part of the opening, contracted and irregularly bent back. As to the higher arms, their disposition was altogether different from that of the others. Prolonging themselves towards the retreating part of the spire, one on each side, they encountered the keel by the tangent line, and, without again quitting it, stretched out as far as its exterior extremity, insinuating themselves between the tubercles, and in such a manner that there remained in the median line of the keel, only a narrow space that was not covered.

The membranous portions of these arms, dilated beyond anything we could have pictured to ourselves while knowing the animal merely by specimens preserved in spirits of wine, were spread over the two lateral surfaces of the shell, in such a manner as to cover it completely, from the base of the hard edge [bord calleux] to the anterior extremity of the edge of the opening, and consequently the keel. The application of these membranes was direct, and without any puckering or irregularity whatever: the lower part of the two large arms, being completely stretched, formed a kind of bridge over the cavity left between the back of the mollusc and the retreating portion of the spire, in which the extremity of a cluster of *ova* was floating.

We have thought it right to bring forward this new description, in order to make more evident what is wanting in the plate which accompanies M. de Blainville's letter, and in which the artist has not sufficiently pourtrayed the peculiarity which relates to the membranes of the large arms. It, in fact, appears to us, that the animal being represented as contracted in its shell, the six arms which are not membraniferous ought not to float freely about on the outside, but that they should be bent back within, as we have just said, and as we represent them in our third plate;[1] then the siphon ought not to appear, not being of sufficient length to do so; and the large arms, instead of taking the direction along the base of the lateral angle of the shell, ought to carry themselves directly lengthwise along the keel, to follow it to its extremity, and the membrane should carpet the surface of the shell.

It is very true that when the mollusc contracts itself, it frequently draws in, more or less completely, its large arms

[1] Plate 6 of our Supplementary Illustrations.—Ed.

and their membranes, and this is perhaps what they wished to represent; but even then we shall show that they are in error, for when the poulp makes this movement, which appears to be a voluntary one, it draws in its arms backwards, and uncovers the shell only in front, so that the anterior edge of the membrane retires parallel to itself, as well as to the furrows of the shell. As to the reversion of a portion of the membrane which is represented,—we have never observed it, and we must remark with respect to it, that this membrane, which, in the living animal, appears as we have already said closely applied to every part of the shell, merely glides over it when it retires or advances, exactly as do the lobes of the mantle of the cowries and olives, or merely the appendages of the latter. We must further observe that we have never seen the eggs in the place where they are represented in the plate in question, but much more within the opening.

To return to the description of our poulp, which we left contracted within the argonaut-shell, and watching, with an attentive eye, whatever took place around it; we now see it extending itself from out its shell, and protruding six of its arms, then it throws itself into violent motion, and travels over the basin in all directions, often dashing itself against the sides. It is easy for us to observe that in these different movements the body leans a little towards the anterior part of the shell; and that the long slender arms, very much extended and gathered into a close bundle, are carried before it, as well as the tube, which shows itself open and very much protruded. The large arms are extended along the keel, and their membranes carpet the whole of the shell. As to locomotion, it is effected in the ordinary manner of poulps, that is to say, it progresses backwards by means of the contraction of the sac, and the expulsion of water through the siphon.—We have endeavoured in our second plate[1] to represent the disposition of the mollusc of the argonaut under these circumstances; and it appears to us easy to see that all is there contrived in a manner the most favorable for accelerating the progression of the animal. In fact the lightness of the shell, its narrow and keeled form, its width, least at the part which, presenting itself first, has to cleave the ambient element;—that membrane, which on each side carpets the shell, like a sheath intended to make its inequalities disappear, and to facilitate the gliding of the water;—this bundle of arms extended behind the animal, to oppose the least possible resistance; and then, lastly, the two arms stretched like a bridge over the

[1] Plate 5 of the Supplementary Illustrations.—Ed.

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cavity of eggs, and appearing as if placed there to prevent the water from rushing into this cavity, and opposing a resistance there:—do not all these things appear exactly adapted for a locomotion which should be effected with quickness and facility? In truth, it must be allowed, that whatever be the fabricator of the shell, it is very appropriate to the wants of the mollusc which to this day we have never ceased to find in it.

We thought we perceived in its movements in open water that the poulp of the argonaut had its back uppermost, and consequently the tube below; it is true however that we have not constantly seen it so: and this last circumstance we have been able to observe with much more certainty in specimens of poulps whose arms had been deprived of their membranes.[1]

Our poulp being fatigued with the useless efforts which it had made in the narrow space where it was confined, and perhaps hurt by the shocks it had sustained against the side of the basin, allowed itself to fall to the bottom, and half contracted itself in order to take some repose; after which it exhibited to us another spectacle which we were far from expecting. Fixing some of the air-holes of its free arms upon the bottom of the basin, it erected itself upon its head, spreading out its disc and carrying the shell straight above it, and in the normal position of the shells of the gasteropods; then beginning to crawl, it presented the appearance of a pectinibranchiate mollusc, as we have said in our note to the Academy of Sciences, without wishing to deduce from it any other relation of agreement than that of a general disposition in the posture and employment of some of its organs. Half drawn back into its shell, this mollusc appeared to crawl upon its disc, the palmatures[2] of which were a little raised to follow the movements of its arms. The body was hid in the shell; the siphon placed in the anterior part of it, was turned forwards; those of its arms which were at liberty were very much protruded, and twisting round, two before and two on each side, like so many appendages or tentacles; and finally, the base of the two large arms seemed to prolong backwards the locomotive surface, then rising along the keel they again

[1] If it be really the fact that the side on which the siphon is placed is ventral, this manner in which the poulp generally swims, namely, with the back upwards, would be an anomaly amongst the pelagian molluscs, all of which swim with the ventral side upwards.

[2] It will perhaps excite surprise to hear us talk of palmatures in these poulps, since they have hitherto been unnoticed. They nevertheless exist, though it is often difficult to see them in specimens preserved in spirits of wine.

covered it with their large membranes, as we saw when the poulp was swimming in deep water.

In this new disposition, it will be seen that the difference is great; for it consists in means and a mode which are no longer the same, and also in the position of the animal, which is such that it finds itself turned over, the ventral surface being uppermost. Thus this mollusc, at once pelagic and littoral, presents a most singular anomaly; when it swims at the surface of the water having its ventral part lowermost, and when it crawls along the bottom having it, on the contrary, uppermost;—two things which are completely contrary to what we see among the pelagian molluscs on the one side, and the littoral molluscs on the other. May not this seeming anomaly arise from the circumstance of habit, rather than a profound study, having led us to designate by the name of the ventral part that in which the siphon and the opening of the branchial sac are found, and by that of the dorsal part that which is opposed to it, whilst perhaps it is just the contrary? However, the learned Professor, whose opinion upon these matters has so much weight with us, rejects altogether this last idea.

In this new locomotive power of the mollusc (in which we are of opinion that reptation, as it is generally understood among the *Mollusca*, was only apparent, the suckers really causing the motion) its progress was slow, and quite different from what we had previously seen. It worked itself forwards, like the gasteropodous *Mollusca*.

To terminate a description already perhaps too long, but which we judged necessary, in order to give a clear idea of our last observations, we will mention that when the poulp was at the point of death, it drew in, by little and little, its large arms and their membranes, and contracted them upon themselves and all the other arms, so as to obstruct the opening of the shell. At this moment we moved the shell, and the poulp immediately separated itself from it, not voluntarily but accidentally, for it no longer held it in any way. It appeared at first to reanimate itself a little, made some movements in the basin, walking upon its head, then fell from weakness, and very soon died. All this passed in less than ten minutes. We should add that we have repeated these experiments upon many specimens.

(*To be continued.*)

Art. II.—*On the Natural History of the German Marmot (Hamster).* By W. Weissenborn, Ph. D.

(Continued from page 483).

Enemies.—Dogs of almost any breed are very eager to destroy the hamster, but never devour it. They are, I believe, in many neighbourhoods the great means of preventing the hamster from multiplying to an injurious extent. Many a plodding citizen is working for the good of the community, in wending his way homewards, accompanied by his dog, from some distant ale-house in the dusk of the evening; for whilst he talks on politics, his dog is more usefully occupied in killing hamsters in the neighbouring fields, which in several instances have been thoroughly got rid of, pro tempore, along the roads leading to places of public resort, where the ale happened to be good. The fox destroys a great many hamsters, but their most inveterate enemy is the pole-cat, which wages the same unrelenting war against the hamster, as the weasel does with the rat. The pole-cat makes its chief food of the hamster during autumn, penetrating into its burrows, and taking up its abode there, if convenient, where he lays up a store of often as many as ten dead hamsters. This is a well known feature in the habits of the pole-cat, as for instance, in the neighbourhood of rivers large stores of eels have been found in the burrow of that animal. The large owls are also among the enemies of the hamster. On the means employed by man to destroy this animal, we shall treat further below. But I ought to mention among its enemies, two parasitic creatures, both discovered by Dr. Sulzer. The first is the *Acarus criceti* (ovalis, albus, pellucidus, pedibus æqualibus, æquè dissitis, obtusis); this mite is about half as large as the head of a flea; it has eight equidistant feet of equal length and thickness, which are as long as the body is broad. The foremost pair has eight joints, those farther behind have more. They are hairy and truncated. Head pointed, very small, with two *antennæ*, that are twice as long as the head, and after embracing the latter converge towards their extremities. They resemble the feet, but are naked. When the insect is replete with blood, its belly, which is bristly here and there, looks red. It runs rather quick, is found on old and young, even sucking specimens, and does not leave the animal during its winter sleep, which it does not share. The hamster diggers are often bitten by these *Acari*, which cause severe burning and itching, as they dig themselves into the skin. After eight or ten hours, however, all pain ceases, and the parasite cannot continue in existence on man for any length of time. Sulzer has moreover found in the *duodenum* a tape-worm, but which he could extract only in fragments. It was extremely flimsy, and its joints were broader than long.

Propagation.—About the end of April the hamsters begin to copulate. The male visits the female in her burrow, and resides with her for a few days only. They then evince sufficient mutual love to defend each other. Sometimes two males meet in the burrow of the same female, when a furious battle begins, which ends in the death or flight of the weaker. The manner in which they copulate is not known, as this act takes place underground, and has never been observed in captivity, although much pains have been taken to make them propagate in rooms. As soon as the act is completed the female drives the male away. The duration of pregnancy is not known, but it is about four weeks. Many females have been taken when the males were with them. They grew big and thin again, without their litter appearing; this is explained by an observation of Dr. Sulzer's, who *saw* a female which he had kept for some time, in the very act of devouring a young one to which she had just given birth. He killed her, and found in the *uterus* six others which were capable of living. When taken out of the fœtal membranes they were blueish, but became almost as red as blood when dry. Six hours after, nascent hairs were distinctly perceived. When a female is caught with her litter, she will continue to suckle them. The young are born blind and naked, but with the full number of their teeth. Their blindness lasts eight or nine days. The number of one litter is from 6 to 18, according to the age and size of the female, which brings two litters at least every year. As the young of the first litter get fit for propagation within the same season, an old female may produce up to 100 individuals of her species in one year. The age to which the animal lives appears to be eight or ten years. The young grow very rapidly, and begin to dig when but a fortnight old. It is a curious fact, that though the male and female, when alone, will make a stout defence, when dug after by men, long before they are driven to the farthest end of their burrows, yet the female, when with her litter, will leave them in the lurch, stop the turn-again passage of her burrow with earth, and dig away as fast as she can, often as many as four or five feet from the place where she has left her young ones, before one can get at her. Were she to dig in a perpendicular, instead of a horizontal direction, she might be almost sure to escape for good.

Burrows.—The subterraneous habitations of the hamster are differently constructed, according to the age, sex and soil. Yet what all the burrows have in common with each other, may be reduced to the following terms. Each burrow has two openings at least, one of which descends obliquely, the other perpendicularly. The former is excavated from without, the latter from within, wherefore the whole of the earth which is carried above ground is lying before the former, which is called the *creeping hole*, whilst the other bears the name of the *plunging hole*, and may often be sounded with a wand, to the depth of 3 or 4 feet. But before it opens into one of the chambers it always bends a considerable way to one side. As the chambers are situated between the creeping and plunging-holes, it is generally found that when a burrow has only two holes, the bend of the plunging-hole is turned towards the creeping-hole. The external openings of the two holes are at the distance of at least 4, sometimes as many as 10, feet from each other. The creeping-hole is not in such constant use as the other, and in an inhabited burrow it is regularly found stopped with earth at about 1 foot from its mouth, for a length of about half a foot. The plunging-hole is never stopped in summer. A hamster-burrow is at once known from either that of the mole or of the *Mus amphibius* by the heap of earth never being hemispherical, but rather flat and spreading, and by its presenting the sub-soil on its surface. The chambers which approach more or less to the oval shape, are more vaulted in the ceiling than in the floor. Their volume is between that of an ox-bladder and four times that size. The one serving for the habitation (the *nest-chamber*) is commonly small, and furnished with a litter of soft and fine straw. It is the nearest to the creeping-hole. It commonly presents three openings, one in the continuation of the creeping-hole, one leading to the plunging-hole, and one communicating with the store chambers, of which there are one, two, three, or more. The passage which leads to the creeping-hole becomes wider at a short distance from the nest-chamber, and there the hamster deposits its excrements. The *store-chambers* contain each from one to twelve pounds of corn or other seeds. Young individuals construct only one, which is not even large; but the old, especially males, which have much leisure to lay up stores, have sometimes as many as five store-chambers of the largest size, containing up to 65lbs. of corn, or 1 cwt. of horse beans together. If large seeds, as horse beans, peas, vetches, &c., be at hand, the store is commonly larger in proportion. The chambers are completely filled with the seeds, which are rammed into them so as to constitute true *silos*. Sometimes the passages leading from one chamber to the other are likewise filled with corn, &c. The corn and other seeds are collected at random, as they present themselves most conveniently during the nightly rambles of the hamster. If the chambers are found filled with a particular kind of seed each, this is merely accidental. Thus sometimes summer corn is found in one chamber, and winter corn in another, but a hamster whose burrow happens to be in a winter field of rye, wheat, &c., will first collect of this, and after the field has been reaped, he will be obliged to resort to some other field, where the harvest is still standing. Often rye, wheat, peas, vetches, flax-husks, &c., are all, or partly, found mixed together in the same chamber. Sometimes, below these store-rooms others are found, into which the seeds have been transported when they have begun to germinate. I need therefore scarcely say that the hamster does not show any sense of order in collecting, nor does he bite out the germ or *corculum* of the seeds, to prevent them from germinating, as has been advanced. The burrow where the female has her young, differs in some essential points. It has but one creeping, but often as many as eight plunging-holes, distributed over a space of 8 or 10 feet in diameter. These plunging-holes all terminate in the nest-chamber, and such a burrow is generally abandoned as soon as the mother drives her young away from her. The young dig, during the first months of their independance, burrows only two feet deep, in which there is but one nest and one store-chamber, the latter containing but 4 or 5 ℔s. of seeds, and which have but one creeping and one plunging-hole. The young of the first litter, which propagate the same season, dig larger burrows in autumn, and all intermediate sizes between the largest and smallest may then be found. The depth of the burrows is determined by the nature of the soil and the seasons. Those in stony and strong land are less deep than those in loose, rich mould. Those constructed in spring, when no corn is collected, are comparatively shallow. The later in the season the deeper they are constructed, and the winter-burrows often descend to the depth of six or seven feet.

(To be continued.)

ART. III.—*Description of two Hemipterous Insects.* By MR. ADAM WHITE, M.E.S., M.B.S.

OF the habits of the *Hemiptera*, except in one instance, little or nothing is known ; a few scattered notices in Wolff's work and a paper by Hausmann being, as far as I am aware, nearly the sum and substance of what has been registered on the economy of an order of insects, numerous in species, ever varied in form, often most beautifully coloured, and frequently curiously sculptured. In the scutellated division, two species of which I intend to describe in this paper, an Indian species, *Plataspis silphoides*, (*Tetyra silphoides*, Fab.) is stated by M. Westermann of Copenhagen, to be found in great profusion in rice fields, upon the crops of which it is believed by the natives to commit great havoc.[1]

It would be difficult to find out the principles upon which entomologists have acted, in assigning the various terms of *Scutellera*, *Tetyra*, and *Thyreocoris*,—three generic names established in the same year, and evidently intended by their respective authors, Lamarck,[2] Fabricius, [3] and Schrank[4], to be applied to that one and the same group of insects, indicated by Linnæus in his 'Systema Naturæ' as "*Cimices scutellati;* scutello longitudine abdominis". Had those succeeding naturalists, who have adopted all three names in their divisions (rendered necessary by the discovery of many new species), proceeded upon the plan laid down by some scientific legislators, of considering the *first* species described as the type of the genus, the matter would have been set at rest; *Cimex nobilis*, L., in that case, would have been universally regarded as the type of *Scutellera ; Cimex imperialis*, Fabr., the type of *Tetyra;* and the beautifully marked *Cim. lineatus*, L., would have *settled down* as the *Thyreocoris lineata* of Schrank.

Dr. Leach, however, applied the first of these names to the set of insects to which *Cim. nobilis, signatus*, &c. belong; the second to the species *lineatus, maurus, fuliginosus, inunctus, scarabæoides* and their allies ; while he restricted the name *Thyreocoris* to Schrank's *last* species the *Cimex globus*,

[1] Silbermann, 'Revue Entomologique,' I. 3e livr. p. 111.

[2] Syst. des Animaux sans Vert. p. 293, (Paris, 1801).

[3] Systema Rhyngotorum, p. 128, (ed. Brunsvigæ, 1803. I have never seen the 1st edition of this work, referred to by Cuvier in the alphabetical table of authors, given in the 'Règne Animal,' and by Percheron in his Bibliographie Entomologique, as being published in 1801).

[4] Fauna Boica, II. abth. 1, p. 67, (Ingolstadt, 1801).

Fabr.[1] He did not include, as Burmeister and Germar do, the broad-headed insects, closely allied to the *globus* division, in his genus *Thyreocoris*, for we find him shortly afterwards publishing in the appendix to 'Bowdich's Mission to Ashantee' a large red-spotted black species as the *Canopus punctatus*.[2] Wolff regarded the *Tetyra lateralis*, Fabr., 'Icones Cimicum', tab. 17, fig. 169, a species near the *Tet. Scarabæoides* as the type of the genus *Thyreocoris*,—see his posthumous MSS. published by his father in the preface to the 5th fascicle of his elaborate and indispensable work. By Burmeister,[3] Spinola[4] and Germar,[5] all three terms are employed, though in many instances in different acceptations.

Hope,[6] Hahn,[7] and Laporte[8] reject, and perhaps very properly, the names of *Tetyra* and *Thyreocoris;* the two first give the name to that division to which the first species to be described belongs, while Laporte applies to the genus the name of *Graphosoma.* I follow the example of Laporte, Spinola, and partly of Germar in the application of the name, for though Lamarck afterwards quoted the *Cimex lineatus* as forming part of his genus *Scutellera*, (Hist. Nat. des Anim. sans Vert. iii. p. 491) his originally described character of the *scutellum* entirely covering the *hemelytra*, would have excluded it. (Systême des Anim. &c. p. 293.)

With regard to the second species, I follow Laporte, Spinola and Westwood, in giving the generic name of *Coptosoma*, Laporte, to that small-headed, 2-jointed-*tarsus* division, of which *Cimex globus* is the type, while to the broad-headed

[1] Zoological Miscellany, vol. I. p. 36 (1814).—The Doctor's MSS. in a very useful compendium of British Annulosa, published by Mr. Samouelle. Encyc. Edin. vol. ix. quoted by Mr. Stephens in the second part of his Systematic Catalogue, p. 338.

[2] P. 496 (Appendix No. 4). Mr. G. R. Gray has published a figure and description of this species in the 2nd vol. of Griffith's Translation of Cuvier's Animal Kingdom, p. 233, pl. 92, fig. 2. It may be mentioned that it is in the 4th Appendix of Bowdich's Mission that Leach instituted the genera *Tefflus* and *Petrognatha*, the *Carabus Meyerlei*, Fabr. being the type of the former, and the *Lamia gigas*, Fabr. of the latter; so that the name *Omacantha* of Serville must give place to *Petrognatha* on the score of priority, Bowdich's Mission having been published in 1819, and the 4th volume of the Annales de Soc. Entom. de France, containing Serville's distinguished labours, in 1835.

[3] Handbuch &c. ii. 1 abth. Berlin, 1835.

[4] Essai sur les genres d'Insectes appartenants a l'ordre des Hemipteres, &c. Genes. 1837.

[5] Zeitschrift fur die Entomologie, heft 1, 1839.

[6] Catalogue of Hemiptera, London, 1838.

[7] Essai &c. in Guerin's Magasin de Zool. 1832.

[8] Wanzenartigen Insecten, Nurnberg, 1831.

division, Laporte's name *Platycephala* would be applied, were it not that, as Mr. Westwood has pointed out, the name has been pre-occupied; I am rather inclined to think that Serville's *Brachyplatys* is synonymous with Laporte's genus, in which case Mr. Westwood's name *Plataspis* must be rejected, on the score of its being given after the publication of Boisduval's 'Faune Entomologique de l'Ocean Pacifique,' p. 627, 1832.

Boisduval, in the work mentioned above, remarks that the extremity of the *scutellum* in the *male* of *Brachyplatys* is notched, Mr. Westwood however, in his excellent paper on *Coptosoma*, published in the 2nd vol. of this series,[1] has pointed out that it is the female that is so distinguished; the transverse folding of the anterior wings seems to me, to be implied by Burmeister in his expression "die Haut zurneckgeschlagen," as is the occurrence of two joints only to the *tarsus*. My inexperienced eyes can only detect four joints to the *antennæ* in the species described below, but this, added to the female having a blunt *clypeus*, as well as notched *scutellum*, and both sexes having the *femora* much compressed, as well as the last joints of the *antennæ*, which are also hairy, with a few other rostral characters, may perhaps indicate that the insect is entitled to generic separation; but I am unwilling at present to give a name, lest *it* should be afterwards quoted as among the things that *were*.

I cannot see how Hahn and Spinola can possibly apply the term *Thyreocoris* to a division, not a species of which is quoted by Schrank as belonging to his genus. I am then of opinion that the *Tetyra scarabæoides*, *lateralis* and *helopioides*, three species figured by Wolff, as well as many of, if not all, the species included by Germar in his definition of the genus *Odontoscelis*, the type of which as given by Laporte himself in his 'Essai' p. 74, is the *Tetyra fuliginosa* of Fabr., (*Ursocoris fuliginosus*) Hahn, *Arctocoris fuliginosus*, Germar, (p. 47.) I propose to name the genus (which seems almost as peculiar to the new world, as *Coptosoma* and *Plataspis* are to the old) *Corimelæna*, the type being the *Tetyra lateralis* of Fabr. and *Cor. scarabæoides*, *helopioides*, *nitiduloides* and *albipennis*, being included in it; it is unnecessary to take up space in describing the characters, as they are already done in such an able manner by Professor Germar, in his 'Zeitschrift,' I. pp. 36 and 37. Our first species, *Graphosoma Wilsoni*, the specific character, merely, of which is given beneath, comes near the *G. semipunctatum* of authors, from

[1] Mag. Nat. Hist. New Series, ii. pp. 28, 29.

which however, it is abundantly distinct. In the elongated form of the head and *scutellum*, as well as in having the sides of the *scutellum* distinctly sinuated in the middle, it more nearly approaches a species from Teneriffe, in the collection of the British Museum, to which I applied the name *Gar. interruptum*, in a paper on several new genera and species of *Hemiptera*, read several months ago before the Entomological Society.

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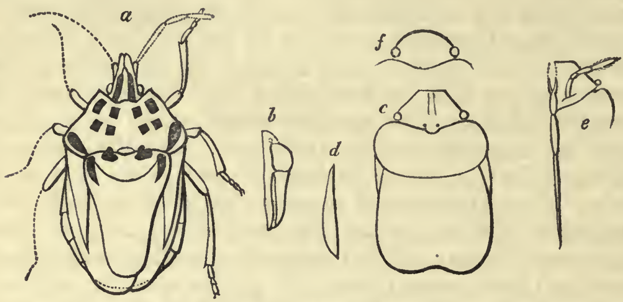

a, *Graphosoma Wilsoni*, magnified. *b*, Ditto, lateral view, natural size.
c, *Plataspis* (?) *coracina*, fem. magnified *d*, lateral view, natural size.
e, part of upper side of head &c. of female. *f*, head of male, viewed from above.

I characterize my species as follows:—

Graphosoma Wilsoni, n. sp. fig. 68, *a*.

G. sanguineum, thorace punctis 8 distinctis, striâque posticâ laterali, nigris; scutello basi punctis 4 nigris, lateralibus elongatis et acuminatis; subtus flavum (in spec. mortuis) nigro punctatum. Long. lin. 6.

Hab. in Persiâ.

In Mus. Dom. Wilson, Edinensis, naturæ, insectorum præsertim, scrutatoris diligentissimi, et 'Entomologiæ Edinensis' cum Dom. Duncan, auctoris.

This species was brought over by Mr. Wilson's brother-in-law, Sir John MacLean, along with many other fine insects and spiders, for the opportunity of examining and describing which, I am indebted to the great kindness of Mr. Wilson.

The second species may be thus described:—

Plataspis (?) *coracina*, n. sp. fig. 68, *c*.

P. æneo-nigra, nitida (pectoreque solum fuliginoso), thoracis lateribus hemelytrorumque basi, abdominisque lateribus fulvo angustè marginatis.
Mas, clypeo anticè rotundato, } long. lin. $5\frac{3}{4}$.
Fœm. „ „ truncato. }

Hab. in Javâ. In Mus. Doctoris Greville, 'Scottish Cryptogamic Flora celeberrimi auctoris, tum insectorum tum plantarum studiosissimi.

I have alluded above to a paper on *Hemiptera*, as yet unpublished; I subjoin the characters there given of the

Graphosoma interruptum.

G. nigrum, thorace lineis tribus, dorsali solum elongato, arcubus partis posterioribus flavis (in vitâ rubris?), scutello lineis tribus, margineque tenui flavis.

I subjoin also the characters of a few of the other species there described, expecting the Society to publish my figures and particular descriptions.

Of the *Cimex costatus* of Fabricius, a species seemingly unknown on the continent, I have made a genus, which, to the remarkably raised edges of the canal for the beak, so prominent in the genus *Solenosthedium* of Spinola, *Cœloglossa* of Germar, (both founded by their respective authors on the same species,—the *Cimex lynceus* of Fabricius, figured in Coquebert's Illustr. Iconogr. tab. 10, fig. 7), adds a thorax semicircularly dilated behind, as well as other characters to be pointed out elsewhere.

I name it *Coleotichus*, the species *Col. costatus*, the original specimen of which is still to be seen in the Banksian collection of insects, bequeathed to the Linnean Society. In the British Museum cabinet there are two specimens of this rare insect, presented by Mr. Children, the officer of the zoological department. Mr. Shuckard tells me he has a second species in his collection, but this I have not yet seen.

Another elongated thick species, kindly lent me by Mr. Newman from the valuable collection of the Entomological Club, would enter, I believe, into Germar's genus *Calliphara*, but not having the specimen beside me, I cannot exactly make out whether it may not more properly belong to *Scutellera*. Its specific character may be given as follows.

Calliphara (Scutellera?) bifasciata, n. sp.

C. luteo-aurantiaca; antennis, capite, thoracis fasciâ posticâ transversâ, scutelli maculâ dorsali fasciâque post medium transversâ, tibiisque, cærulescenti-viridibus. Long. lat.

Hab. in insulâ Maris Pacifici Dom. Newman ignotâ.

An elegant species sent by Mr. Daniel Wheeler to the Entomological Club.

Another species, placed by me in Laporte's genus *Calidea* (*Callidea* Burm. and Germ.), I characterize as follows; it is a most beautiful species, but the *antennæ* unfortunately are wanting.

Calidea parentum, n. sp.

C. suprà ochraceo-rubra, maculis 12 nigris, thoracis 4, prioribus minutis, scutelli 8, 5 basi :·:, 3 post medium ·.·, capite suprà (2 maculis rubris exceptis), pectore, abdominisque maculis lateralibus, pedibusque nitidis, nigro-violaceis. Long. lin. $8\frac{3}{4}$: lat thor. lin. $4\frac{1}{2}$.
Hab. in Australiâ. In Mus. Brit.

Another species is very strikingly marked; I call it,

Tectocoris Childreni. n. sp.

T. luteo-fulva, thorace maculis 4, scutello 11, atris, subtùs nigrescenti-purpurea, pedibus viridibus. Long. lin. $8\frac{1}{2}$; lat. thor. lin. $5\frac{1}{4}$.
Hab. in Nepaliâ?

Found in the valuable collection of insects bequeathed by Major-General Hardwicke to the British Museum, and named in honour of John George Children, Esq., late Secretary to the Royal Society, whose collection, books, and advice have been ever at my service.

Many other species I have described in the paper above alluded to; a rather hairy one from Sierra Leone, of a beautiful dark green colour, with six black spots on the *thorax*, and seven on the *scutellum*, with a dorsal line extending from the base to beyond the second pair of spots, I have named *Calidea Morgani*, after the chaplain of the colony at Sierra Leone, who, amongst many valuable insects sent to the national collection, has communicated a specimen of the remarkable Hymenopterous genus, *Agaon* of Dalman, as pointed out to me by Mr. Westwood.

In that paper I also characterized a genus of *Coreidæ* from Nepal, somewhat connected with *Menenotus* (Lap.), agreeing with it in the lateral dilatations of the *thorax* being bent forwards and upwards, but differing from both it and *Cerbus* in the proportions of the joints of the *antennæ*, the basal joint being longest, the second, third, and fourth differing but little in length, the last slightly bent, and in the veining of the *hemelytra*. The *femora*, in both sexes, more or less thickened, and all the *tibiæ*, in both sexes of the typical species, dilated.

I name the genus, from the "winged" neck, *Derepteryx;* the first species being *Der. Grayii*, of a brown colour, the *thorax* rough with tubercles, while in the second—*Der. Hardwickii*—the *tibiæ*, in our specimen (a female) are simple, the *thorax* above being comparatively smooth. I have named the first species after John Edward Gray, Esq. F.R.S. whose uniform extreme kindness, and assistance in my scientific pursuits, I embrace this opportunity of gratefully acknowledging.

Another very flat genus, the precise locality of which, in the system, I have not yet ascertained, though it may be near *Phytocoris*, wants the *ocelli*, and is of an oblong elliptical form, the head being small and somewhat square, with a distinct neck behind the rather prominent eyes; the *thorax* is narrowest in front, gradually increasing in breadth behind, *scutellum* large, as is the coriaceous part of the *hemelytra;* legs long and fringed with hairs; *antennæ* wanting in our specimen, all but the basal joint, which proceeds from a slightly projecting lobe on the upper side of the head; the beak is short, not reaching far beyond the first pair of legs: the species is 7 lines long, and may be characterized as follows.—

Caliprepes Grayii.

C. virescenti-luteus, thorace maculis 2 dorsalibus posticis triangularibus, scutello 2 basalibus, rubris: hemelytrorum parte coriaceâ, lineâ apicali transversâ, viridi,—membranaceâ, lineâ basali obscurâ.
Hab. in Nepaliâ? Coll. Mus. Brit.

Named in honour of George Robert Gray, Esq. late Secretary to the Entomological Society of London, whose works on insects, but especially on *Orthoptera*, must always rank among the most important Entomological publications of the present day.

Art. IV.—*A Systematic Catalogue of the Fossil Plants of Britain.* By John Morris Esq.

(*Continued from page* 457).

NEUROPTERIDES, Göpp.

Frond simple, pinnate or bi-pinnate. Secondary veins issuing in numbers from the midrib, which does not extend to the apex of the pinnule; or, all the veins are forked, and rise in a fan-shaped manner from the base of the pinnule; the midrib being scarcely apparent.

Neuropteris, Brong.

Frond pinnate or bi-pinnate. *Pinnæ* or *pinnulæ* cordate or subcordate at their base, rarely adnate or decurrent. Midrib thick, not extended to the apex, secondary veins numerous, slender, usually forked and curved. *Sori* lanceolate, even, (with an *indusium*), arising from the veins of the apex of the pinnule, and often placed on the bifurcations.

* *Pinnæ* or *pinnulæ* cordate, rarely subcordate or truncate.

Neurop. attenuata, Lindl. and Hutt. iii. tab. 174. *Coal Measures*, Newcastle.

—— *smilacifolia*, Sternb. part ii. pages 29, 33, part iv. page 16, excluding the synonyme of Scheuchzer; Göpp. page 191; *Neuropt. acuminata*, Brong. Prod. page 53; Hist. i. page 229, tab. 63, fig. 4; Lind. & Hutt. page 143, tab 51. *Coal measures*, Schmalkalden and Dickeberg, Germany; Felling, England.

—— *cordata*, Brong. Hist. i. page 229, tab. 64, fig. 5; Lind. and Hutt. page 119, tab. 41; Sternb. part v. and vi. page 60. *Coal measures*, Leebotwood, England; Alais and St. Etienne, France; Waldenburg.

—— *Scheuchzeri*, Hoffm. iv. page 151, fig. 1—4; Karst. Arch. xiii. tab. 2, page 27; Sternb. v. and vi. page 70.—*Phillites mineralis*, Lluid,[1] page 12, tab. 5. *Osmunda*, Scheuch. tab. 10, fig. 3. *Coal measures*, Osnabruck; Willekesbarre; England.

—— *angustifolia*, Brong. Hist. page 231, tab. 64, fig. 8, 4; Sternb. v. and vi. page 70. *Coal measures*, Bath; Willekesbarre; Radnitz; Waldenburg.

—— *acutifolia*, Brong. i. p. 231, tab. 64, fig. 6, 7; Sternb. v. and vi. tab. 19, fig. 4. *Coal measures*, Bath; Willeksbarre; Bohemia; Waldenburg.

—— *Voltzii*, Brong. Prod. page 54; Hist. page 232, tab. 67; Sternb. v. and vi. page 70. *Grès bigarré*, Strasburg.

—— *crenulata*, Brong. Hist. i. page 234, tab. 64, fig. 2, (excluding synonymes); Sternb. v. and vi. page 71. *Coal measures*, Saarbrück.

—— *macrophylla*, Brong. Hist. i. page 235, tab. 65, fig. 1; Sternb. v. and vi. page 71. *Coal measures*, Dunkerton; Somerset.

—— *Cistii*, Brong. Prod. page 53; Hist. i. page 238, tab. 70, fig. 3. *Coal measures*, Willeksbarre.

—— *Grangeri*, Brong. Prod. page 53; Hist. i. page 237, tab. 68, fig. 1; Sternb. v. and vi. page 71. *Coal measures*, Zanesville, U. States.

—— *rotundifolia*, Brong. Prod. page 51; Hist. i. page 238, tab. 70, fig. 1; Sternb. v. and vi. page 71; Göpp. tab. 1, fig. 6. *Coal measures*, Du Plessis, France. *Alpine oolite*, La Roche Macot; Col de Balme.

—— *flexuosa*, Sternb. part iv. page 16, part v. and vi. page 71; Brong. Hist. i. page 239, tab. 65, fig. 2, 3, tab. 68, fig.

[1] Lithophylacii Britannici Ichnographia, 1760.

2. *Osmunda gigantea*, var. β, Sternb. part iii. page 36, tab. 32, fig. 2; Geol. Trans. 2nd series, vol. i. page 45, tab. 7, fig. 2. *Coal measures*, Axminster and Camerton, England; Saarbrück; France; Waldenburg, Silesia. *Alpine oolite*, La Roche Macot. *(Culm)*, Devon.

—— *gigantea*, Sternb, part iv. page 16, part v. and vi. page 72; Brong. Prod. page 54; Hist. i. page 240, tab. 69; Lindl. and Hutt. page 145, tab. 52; Göpp. page 196.—*Coal measures*, Silesia; Saarbrück, Bohemia; Newcastle, England. *Alpine oolite*, Servoz, Savoy.

—— *tenuifolia*, Sternb. part v. and vi. page 72; Brong. Hist. i. page 241, tab. 72, fig. 3; Göpp. page 197; Bronn,[1] i. tab. 7. fig. 4. *Coal measures*, Saarbruck; Silesia; Newcastle. *Alpine oolite*, Petit-cœur.

—— *Loshii*, Brong. Prod. page 53; Hist. page 242, tab. 73; Sternb. part v. and vi. page 72; Göpp. page 198. *Lithosmunda minor*, &c. Lluid. tab. 4, fig. 189. *Coal measures*, Newcastle, Lowmoor; Willekesbarre; Silesia; Valenciennes; Liège.

—— *heterophylla*, Sternb. part iv. page 17, part v. and vi. page 73; Brong. Prod. page 53; Hist. i. page 243, tab. 71, *Neur. Loshii*, Brong. Hist. i. tab. 72, fig. 1; Göpp. page 198. *Coal measures*, Charleroi; Saarbruck.[2]

—— *Brongniartii*, Sternb. part v. and vi. page 73. *Neur. heterophylla*, Brong. Hist. i. tab. 72, fig. 2; Göpp. page 199. *Coal measures*, Charleroi; Saarbrück.

—— *Soretii*, Brong. Hist. i. page 244, tab. 70, fig. 2; Sternb. part v. and vi. page 73. *Coal measures*, Newcastle. *Alpine oolite*, La Roche Macot, Tarentaise.

—— *microphylla*, Brong. Hist. i. page 245, tab. 74, fig. 6; Sternb. part v. and vi. page 73. *Coal measures*, Willekesbarre.

—— *Gaillardoti*, Brong. Hist. i. page 245, tab. 74, fig. 3; Sternb. part v. and vi. page 73; Göpp. page 200. *Muschelkalk*, Luneville.

—— *Dufresnoyi*, Brong. Hist. i. page 246, tab. 74, fig. 4, 5; Göpp. page 200. *Otopteris Dufresnoyi*, Lindl. and Hutt. ii. page 142. *Red sandstone*, Lodèves, France.

—— *elegans*, Brong. Hist. i. page 247, tab. 72, fig. 1, 2;

[1] Lethæa Geognostica.

[2] The *Neuropteris Loshii* of Brong. Hist. tab. 72, fig. 1, has been placed as a synonym of *Neur. heterophylla* upon the authority of Prof. Göppert, although it appears to differ in decreasing much less rapidly than the latter, and the terminal portion is consequently not lanceolate, which Brongniart considers characteristic of *Neur. heterophylla*.

Sternb. part v. and vi. page 73; Göpp. page 201. *Red sandstone*, Sulz-les-Bains.

—— *plicata*, Sternb. part iv. page 16, part v. and vi. tab. 19, fig. 1—3; Brong. Hist. i. page 248; Göpp. page 201.—*Coal measures*, Bohemia; Silesia.

—— *obovata*, Sternb. part v. and vi. page 74, tab. 19, fig. 2; Brong. Hist. i. page 248; Göpp. page 202. *Coal measures*, Bohemia.

** *Pinnæ* or *pinnulæ* obtuse at the base, (never cordate).

—— *Lindleyana*, Sternb. part v. and vi. page 73; Göpp. page 202. *Neur. Loshii*, Lindl. and Hutt. i. page 139, tab. 49, excluding synonymes). *Coal measures*, Felling, England.

—— *thymifolia*, Sternb. part v. and vi. page 75; Göpp. page 203. *Neur. Soretii*, Lindl. and Hutt. i. page 141, tab. 50, (excluding synonyms). *Coal measures*, Felling.

*** *Pinnæ* or *pinnulæ* adnate, the lower ones sometimes decurrent.

—— *oblongata*, Sternb. part v. and vi. page 75, tab. 22, fig. 1; Brong. Hist. i. page 249; Göpp. page 203. *Coal measures*, Poulton, Temsbury, Somerset.

—— *decurrens*, Sternb. part v. and vi. page 75, tab. 20, fig. 2; Brong. Hist. i. page 249; Göpp. page 203. *Coal measures.*

—— *conferta*, Sternb. part v. and vi. page 75, tab. 22, fig. 5; Göpp. page 204. *Coal measures*, Bohemia; Silesia.

—— *alpina*, Sternb. part v. and vi. page 76, tab. 22, fig. 2; Göpp. page 204.

—— *recentior*, Lindl. and Hutt. i. page 195, tab. 68; Göpp. page 205; Sternb. part v. and vi. page 76. *Oolite shale*, Gristhorpe Bay.

—— *ligata*, Lindl. and Hutt. i. page 197, tab. 69; Sternb. part v. and vi. page 76. *Pecopteris ligata*, Phillips,[1] tab. 8, fig. 14. *Oolite shale*, Gristhorpe Bay.

—— *serrata*, Sternb. part v. and vi. page 76. *Odontopteris crenulata*, Brong. Hist. i. page 254, tab. 78, fig. 2. *Coal measures*, Terasson, France.

—— *lobifolia*, Phillips, tab. 8, fig. 13; Göpp. page 206.—*Pecopteris lobifolia*, Lindl. and Hutt. iii. tab. 179. *Oolite shale*, Haiburn, Yorkshire.

—— *bistriata*, Sternb. part v. and vi. page 76; Göpp. page 206, Maschau, Bohemia.

—— *dickebergensis*, Hoffm. Karst. Archiv. xiii. part 2, page

[1] Illustrations of the Geology of Yorkshire, part 1, 1836.

271; Sternb. part v. and vi. page 77; Göpp. page 207.—*Coal measures*, Osnabruck.

—— *ovata*, Hoffm. loc. cit. page 272; Sternb. part v. and vi. page 77; Göpp. page 207. *Coal measures*, Osnabruck.

Doubtful species.

—— *distans*, Sternb. part v. and vi. page 77; Brong. Hist. i. page 250; Göpp. page 207. *Coal measures*, Eschweiler, Germany.

—— *Martini*, Sternb.; Göpp. page 208. *Phytolithus Osmunda regalis*, Mart. tab. 19, fig. 1—3. *Coal measures*, Chesterfield; Alfreton.

ODONTOPTERIS, Brong.

Frond pinnate or bipinnate. *Pinnæ* or *pinnulæ* adnate by their base to the rachis, or free, generally oblique, midrib wanting or scarcely visible.—Veins very fine, equal, simple or forked, springing from the rachis.

* Veins subparallel, equal, straight, simple or dichotomous.

a. Frond digitate-pinnate.

Odont. digitata, Sternb. part v. and vi. page 77, tab. 23, fig. 3; Göpp. page 209. *Oolite shale*, Yorkshire.

b. Frond pinnate.

—— *undulata*, Sternb. part v. and vi. tab. 25, fig. 1; Göpp. page 209. *Oolite shale*, Yorkshire.

—— *falcata*, Sternb. part v. and vi. tab. 23, fig. 1; Göpp. page 210. *Oolite shale*, Yorkshire.

—— *Schmidelii*, Sternb. part v. and vi. tab. 35, fig. 2. *Neuropt. dubia*, Sternb. part iv. page 17. *Hornstone*, Baruth.

—— *Bechei*, Sternb. part v. and vi. page 78; Göpp. page 210; De la Beche, Geol. Trans. 2nd. series, vol. i. tab. 7, fig. 3. *Oolite*, Mamers, France. *Lias*, Axminster.

—— *Bucklandi*, Sternb. part v. & vi. page 79; Göpp. page 211. *Filicites Bucklandi*, Brong.; De la Beche, Geolog. Trans. 2nd series, vol. i. tab. vii. fig. 2. *Lias*, Axminster.

* * Veins arched, ascending, simple or dichotomous.

a. Frond pinnate.

—— *acuminata*, Göpp. page 211. *Otopteris acuminata*, Lindl. and Hutt. ii. tab. 132. *Oolite shale*, Scarborough.

—— *Otopteris*, Göpp. page 211. *Otopteris obtusa*, Lindl. and Hutt. ii. tab. 128. *Lias*, Memberg; Polden Hill.—*Upper oolite shale*, Scarborough.

b. Frond bipinnate or bipinnatifid.

—— *Brardii*, Brong. Prod. page 60; Hist. i. page 252, tab.

75, 76; Sternb. part v. and vi. page 79; Göpp. page 212. *Otopteris crenulata*, Brong. Hist. i. tab. 78, fig. 1. *Coal measures*, Terasson, France. *Alpine oolite*, Petit-cœur.

—— *minor*, Brong. Prod. page 60; Hist. i. page 253, tab. 77; Sternb. part v. and vi. page 79; Göpp. page 213.—*Coal measures*, Terasson; St. Etienne.

—— *Schlotheimii*, Brong. Hist. i. page 256, tab. 78, fig. 5; Sternb. part v. and vi. page 79; Göpp. page 213. *Neuropteris nummularia*, Sternb. part iv. page 17. *Filicites osmundæformis*, Schloth. Petref. page 412, tab. 3, fig. 5.—*Coal measures*, Manebach, Germany.

—— *obtusa*, Brong. Prod. page 60; Hist. i. page 255, tab. 78, fig. 3, 4; Göpp. page 214. *Coal measures*, Terasson, France. *Alpine oolite*, Col d'Ecuelle, near Chamonix.

—— *Lindleyana*, Sternb. part v. and vi. page 78; Göpp. page 214, tab. 1, fig. 7, 8, var. β. *Odont. obtusa*, Lindl. & Hutt. i. tab. 40. *Coal measures*, Leebotwood; β, Silesia.

—— *Bergeri*, Göpp. page 215. *Lias*, Coburg, Saxony.

(To be continued.)

Art. V.—*Notes on Irish Natural History, more especially Ferns.* By Edward Newman, Esq., F.L.S., &c.

The most trivial notes on any branch of Natural History are always so acceptable to myself, that I am perhaps too confident in supposing that my own careless memoranda may be pleasing to others. On the 28th of last June I landed at Newry, and, with knapsack on back, marched off in a northerly direction, to see with my own eyes a country of which Englishmen in general know something less than of Kamkatcha or South Australia. From Belfast to Fairhead I coasted the county of Antrim, with the exception of a few miles; and although I found nothing particularly striking, yet the fine sea-views, commanding the coast of Scotland, the Isles of Arran, Bute, Jura, Islay, &c., and the singular Ailsa Craig, amply repay the pedestrian for his time. Fairhead is really grand; the basalt is irregularly columnar, quite perpendicular, and of great height: during the lapse of ages it seems gradually to have given way, vast disrupted masses being crowded and jammed together below the cliff, in wild and wonderful confusion. The height of the cliff is about 650 feet above the sea; of this, a portion measuring perhaps 300 feet is perfectly perpendicular, the remainder is a mass of fragments decreasing in height till it reaches the sea.

On this cliff I first saw the red-legged crow, and watched it feeding its young in the fissures of the inaccessible precipice: compared with our crow, rook, or jackdaw, it is a graceful bird; its flight is easy and elegant, and its gait, when perched, very pleasing. The hooded crow and raven are also abundant here, and the latter wonderfully familiar. Ferns were abundant; *Asplenium marinum* occurs in profusion, and grows to a large size, but the fronds of the present year were very immature, and those of last season beginning to decay. In the basaltic cliff is a remarkable fissure, across which a mass has fallen and forms a natural bridge; through this fissure is a foot-way called the 'Grey Man's Path,' leading under the bridge to the top of the cliff; this path is literally "strewed with flowers," and among them the beautiful *Papaver Cambricum* was very conspicuous and abundant.

The singular little island of Carrick-a-Rede, its flexible bridge of ropes, and the neighbouring sea-caves roofed with *Asplenium marinum*, are well worth a visit; and so is the Giant's Causeway a few miles to the westward, for of a surety it is most curious, but when the terms "stupendous," "gigantic," "sublime," &c. are given to this curiosity, they are certainly misapplied. When the guides first tell him "*that* is the Causeway," and point to a low, brown, tame-looking, sea-beach, the most phlegmatic man in the world must inevitably feel disappointed; but as he walks onwards and finds that he is treading on the tops of basaltic pillars, of various but regular figures, triangles, squares, pentagons, hexagons, and heptagons, he cannot but be struck with the *curiosity* of the affair. Compared with Staffa, the Giant's Causeway is so insignificant that I am persuaded that were it on the beach of that magnificent basaltic island, it would never have been noticed up to the present hour. The guides here are a great and insuperable annoyance, and their name is Legion; they are of no use whatever, and by what title they hold the right of worrying strangers I am quite at a loss to ascertain.

Donegal is a fine county for the naturalist; here are vast and unbroken tracts of mountains, and here man, that is, civilized man, has rarely set his foot. The bog is covered with the common ling (*Calluna vulgaris*), and a variety of *Carices* and coarse sour grasses; a few scattered sheep, and an occasional flock of twenty or thirty white goats, may here and there be seen wandering over the boggy waste. You scarcely ever see a tree, although the bog contains the remains of the trees of former ages. The abundant and almost universal occurrence of the remains of vast timber-trees in the wastes of Scotland and Ireland, where trees are now almost as rare as churches, and where indeed they can scarcely be coaxed to grow at all, has never yet been satisfactorily explained. A favourite theory on this subject is, that in time of war the forests were cleared, lest they should form a shelter in cases of pursuit: a second theory is, that copper and lead ore were conveyed from Cornwall and Wales to the coast of Ireland, in order to be smelted, and that whole forests were levelled for the supply of fuel. The fragments of trees remaining appear to be preserved by the bog, and to have suffered little or nothing from the action of moisture. The recent timber must not be confounded with the trunks often found still lower in the bog, and which are fairly entitled to rank as bog fossils, being evidently coeval with the bones of the extinct Irish elks and cattle. The more recent timber is mostly oak and Scotch fir.

The north-western extremity of the county Donegal is wild, grand, and mountainous; the summits are very lofty, white, and perfectly without vegetation. Having selected Arrigal as the highest peak, I made the ascent, which is by no means difficult, a good road having been cut along its shoulder, and passing within a thousand perpendicular feet of its summit. The summit is a sharp crescent-shaped ridge; the descent on the inside of the crescent is very precipitous and remarkably barren: the form of the mountain is what is usually termed volcanic, and deep within the vast excavation which may be regarded as analogous to a crater, is a still lake. The view is very fine; the lakes, mountain-peaks, sea-bays and islands being almost innumerable. The base of the mountains of this district is boggy and very rough, higher up is a belt of heath, and above this is the region of bare stone.

After sleeping in a hut at the foot of Arrigal I turned southward, crossing the Glendoan mountains, and so reached Docharty bridge. The Glendoan chain is of less height, and the summits more rounded: you may often walk forty or fifty yards on an unbroken slab of stone, perfectly bare, and bleached by the action of wind and rain. On reaching the lower country about Docharty Bridge, *Osmunda regalis* appears in profusion, sometimes fringing the margin of the streams like a continuous hedge, sometimes rising from the bog in large isolated bushes. I could not but contrast the fern productions of this wild county with those of Argyleshire and Caernarvonshire, which in their desolate mountainous character are somewhat similar. *Cryptogramma crispa* is nowhere to be seen; of *Polypodium Phegopteris* and *Dryopteris* I did not find a single frond; and of *Aspidium Oreopteris*, the most common fern of the Scotch and Welch mountains, I saw a tolerable sprinkling near Milroy Bay, and one single plant at Docharty Bridge; in the mountain tract between these localities it does not once occur. In the mountain lakes *Isoetes* is not uncommon. *Athyrium filix-fœmina* is ubiquitous; *Nephrodium filix-mas* comparatively rare: *Nephr. dilatatum* is common, and of three distinct types of form;—the first elongate, broad, drooping, and nearly flat; the second short, rigid, erect, brownish green, and convex; the third short, less rigid and erect, bright pale green, and concave, not simply as a frond, but every *pinna* and pinnule also concave. The second form I believe to be *Aspidium dumetorum* of Smith; the third is the *Asp. dumetorum* of Mackay, the *Asp. dilatatum* var. *concavum* of Babington, and the *Asp. spinulosum* of the Botanic Garden at Belfast, &c. This form is far more distinct and constant than any variety we possess in England, where the plant is confined pretty much to the first form mentioned above; every botanist selecting one or two fronds broader or narrower, longer or shorter, larger or smaller, more rigid or more pendulous than the rest, and naming them *Aspidium spinulosum* or (happy deception!) *Asp. rigidum.*

(To be continued).

ART. VI.—*On the Fossil Shells of the genus* Modiola *being frequently found in the Bath Oolite, enclosed in the Shells of the genus* Lithodomus. By The REV. H. JELLY.

IN the superior members of the great oolite formation in the neighbourhood of Bath there occur masses, sometimes of considerable size, of a kind of *Astræa*, perforated most profusely by several species of *Lithodomi.* Among these, specimens repeatedly occur in which three or four or even more shells lie encased as it were, the one by the other, in such a manner as leaves it extremely difficult to account for their collocation. Having had a series of these in my possession for several years, and still without discovering any satisfactory solution of the problem, I am desirous of calling the attention of conchologists to the subject, through the medium of your valuable Magazine, and of ascertaining in this way whether any facts in the history of recent shells of this or any other allied family, can be adduced in explanation of what I cannot but think a very anomalous circumstance in the natural history of the tribe. I send you some specimens by way of illustration, and will briefly subjoin such observations as I have made, with a view to explain the appearances they present.

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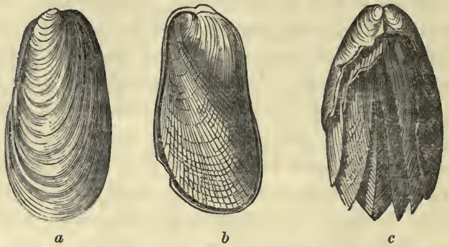

a, the *Lithodomus* containing one or more specimens of *Modiola*. *b*, the opposite side of the same specimen, but with the external shell broken away, so as to show one of the contained *Modiolæ*. *c*, a *Lithodomus* in which, from the gaping of the valves of the inclosed *Modiolæ*, three or four individuals may be distinguished.
The size of the figures is enlarged by half a diameter.

1. It will be observed in the specimen (fig. 69 *a*) that the outer shell is extremely different from that which it contains (see *b*). Now although I have repeatedly detected a similar arrangement—the outer smooth shell (*Lithodomus*) with its strongly-marked lines of growth containing, and the sharp, angulated, reticulated shell (*Modiola?*) being contained—yet I never met with an instance in which this order was reversed. This I conceive to be a particular of some importance.

2. Among the many specimens that have come under my observation, I have never seen a single instance in which the contained *Modiola* (?) could be distinctly shown to be a boring shell. Even when it appears to occupy a perforation by itself, the difference in size between the hole in which it is situated and itself, and sometimes other circumstances additional to this, seem to show that it is merely the inhabitant but not the fabricator of the orifice in which it has existed.

3. In cases in which there are more than one contained shell (as shown by fig. 69. *c*), the additional ones are, I believe, uniformly of the same species with the first-contained shell, which is constantly a *Modiola* and never a *Lithodomus*.

4. Although these shells are almost invariably found enveloping one another like a nest of pill-boxes, yet I have in one instance seen two small ones placed endwise, the one towards the other, filling up the cavity of a much larger *Lithodomus*.

After what I have said it is scarcely necessary to add that I consider the contained shell a true *Modiola*, and consequently not a boring animal:—that it occupied the cavities formed in the coral by the *Lithodomi*, and very frequently filled the unoccupied shells of the *Lithodomi* themselves.—But although it might be supposed that one *Modiola* when young had made its way within the half-closed valves of a *Lithodomus*, it is difficult to imagine that this process could go on in a second, third, or even fourth instance, since in each case the death of the previous inhabitant must have been a necessary condition; and the former occupant, which could have obtained entrance only in a very young state, must have lived long enough to fill the entire cavity with its shell. It is difficult also to account for the fact of the same species only of *Modiola* enveloping each other, upon the supposition of a fortuitous occupation of the empty shell by the young animal; since as there are more than one species of *Modiola* in the same locality, it would have been quite as easy for one of these to have made its way in as the other.

A case somewhat analogous had recently come under my observation through the kindness of a friend, in the instance of the *Saxicava rugosa*, in the interior of which specimens of *Venerupis perforans* are sometimes met with. But in this case the size of the contained shell does not at all correspond with that which contains it, and moreover the one *Venerupis* does not in any instance contain another.

[A series of specimens illustrative of the present communication have been kindly submitted to our examination by Mr. Jelly; and from these we selected the two of which representations are given (fig. 69). We can suggest no other explanation but the obvious one of supposing that the dead shell of the *Lithodomus* was occupied by a *Modiola*, and the *Modiola* itself subsequently occupied by a smaller individual of its own species; the same thing being repeated, in some instances, five or six times. The introduction however of the *Modiola* in the *adult* state would be opposed by the physical condition in which the *Lithodomus* is placed. Any suggestions or observations from our conchological readers, bearing upon this curious fact, would be acceptable.—Ed.]

Art. VII.—*An Account of the Strata of Lincoln, from a recent Survey, commencing North of the Cathedral, and descending to the bed of the River.* Drawn up by Mr. Wm. Bedford.[1]

The strata may be comprised in twenty-six beds, which slightly vary and thin off, in some parts; but lie horizontally, from six to eighteen inches in thickness, (with the exception of the *Upper Oolite*), till we descend to the *Ochry Ferruginous-stone* beds.

1. Alluvial soil, from six to ten inches in thickness.
2. Rubbly stone;—*Cardia* or stone cockles are profusely distributed here.

[1] Communicated by Sir Edward Ff. Bromhead, Bart.

3. Called the *Blue bed*, a hard limestone, wherein spar and crystalline cockles are found.
4. Knobbly or Boss rubble;—contains casts of shells.
   A layer of marle lies underneath.
5. The *Shell* bed;—stone cockles in great variety are found in this bed.
   A layer of marle lies underneath.
6. The *Blue Limestone* bed;—contains the *Mactra*, a kind of muscle.
7. Three beds of the *Grey Limestone*, each bed intercepted with marle;—oysters, *Murex*, the lobster-tailed nautilus or miller's thumb, and the *Chiton*, [?—Ed.] are found in these beds.
8. Three beds of fractured limestone, each bed intercepted with a layer of marle.
9. A strong limestone bed called the *Roof bed*, under which the ancient builders excavated or rather mined, for superior stone for building the Cathedral, which may account for the numerous caverns and subterraneous places to a great extent. A very large portion of the upper part of Lincoln, and nearly the whole of Eastgate, is thus undermined.
10. Three thin knobbly beds intercepted with marle.
11. The *Oolite Freestone* bed;—calc spar occurs here in rhombic and prismatic crystals. Large *Ammonites*, and the *Teredo* or *Lapis Syringoides*, and fossil wood, are found in this bed.
12. The *Silver* bed;—it abounds with cornbrash and Archimedes shells; it is allied to the forest-marble, and when faced, is used for chimney-pieces and for floors of passages; it decomposes oily matters, and is a durable stone for buildings in dry situations;—prismatic and rhomboid calc spar is found in this bed.
13. A bed of good building stone, superior to the silver bed, about sixteen inches in thickness;—this bed abounds in some parts with cornbrash and Archimedes shells, the same as the silver bed; in other parts it is free from cornbrash. Between the fissures in this bed, the agaric mineral occurs in delicate opaque crystals. The dagger shells, razor-sheath, and various other shells, are found in this bed.
14. Two beds of good stone, with oolite disseminated, useful for foundations and building purposes. In the first bed fossilized branches of trees sometimes occur, lying horizontally. Prismatic calc spar in bold crystals occurs in this bed.

The quarrymen in the present day do not work below these beds.[1]

15. The *Oolite*[2] or Roe-stone bed is nearly two feet in thickness. Newport Arch, erected nearly 1700 years ago, and for its Roman origin an object of much interest to travellers, was built of the stone from the oolite bed. It is a hard oolite, and becomes harder by exposure to a humid atmosphere, which may account for its durability. In some parts of this stratum it is *Blue-hearted.* Large blocks of this oolite may be seen in the main street, a little above the Hospital gates, being the remains of the south Roman gate, long since destroyed. The Cathedral is evidently built of the stone from the silver bed—of that which underlies the silver bed—and from the beds now used for foundations and walls, with a portion of the oolite bed. John of Gaunt's house, now a modernized dwelling, and many years the residence of the late Mr. Boot, seems chiefly built of this oolite.
16. A bed of indurated clay, six inches in thickness.
17. A bed of very hard blue stone, which divides itself into two beds, by a flaw passing longitudinally through the middle.

    A bed of very hard indurated clay, four inches thick, divides the above bed from
18. A thin bed of hard fine sandstone, firmly united to
19. The *Grey oolite* bed, which is as firmly united to
20. The *White oolite* bed. These three contiguous beds form indeed one massive bed, nearly four feet in thickness, equal in hardness to the oolite bed of which Newport Arch is built. About an inch of clay intervenes between this white oolite and the
21. *Lower oolite* bed, which is not so hard as the beds above, and which lies upon a bed of yellow ochry earth, underneath which the springs begin to appear.[3]
22. [4]*Ochry ferruginous-stone* bed;—the spring water near Monks' House flows through its fissures, and deposits the ferruginous ochre as it streams along.
23. *Ferruginous gravel* and *sand* bed, underneath which *Pyrites* in masses occur in some parts, just as we enter the

[1] The stone-quarries are the best places for examining the strata.

[2] The oolite will not burn into quicklime.

[3] There are no springs in the lower part of Lincoln, the water obtained there by the sinking of wells, is the river water, which is filtered through the sand bed.

[4] This may be seen to advantage at the north-east corner of the Monk's Leas.

24. Thick bed of *Clunch clay;*[1] *Ammonites, Nautili,* and *Belemnites* occur in this bed.
25. *Ferruginous gravel* and *sand* bed,—intervenes between the two beds of clay, with nodules of iron *Pyrites.*
26. Thick bed of *Blue clay-shale,* an excellent clay, when ground, for tiles and floor-bricks. In this bed are three seams of rubbly ironstone-clay, which dip towards the east, from three to four inches in thickness;—the second seam is two feet below the first, and the third seam between three and four feet below the second. Fossilized oysters, muscles, and periwinkles are found in this bed. This clay bed is of great thickness, and declines with the slope of the hill; it dips beneath the *sand bed* of the river, and rises again as we ascend Cross o' Cliff hill.

The minerals and fossils of the various beds have been carefully selected for the Museum of the Lincoln Mechanics' Institution.

ART. VIII.—*On the Structure and Habits of the* Physalia *(of Cuvier) or Portuguese Man-of-War;* Holothuria Physalis, *of Linnæus.*—By JONATHAN COUCH, Esq., F.L.S.

I HAVE not been able to find in any book to which I have access, such an account of the *Physalia* as affords an insight into its manner of existence, or adequately represents its peculiarities of form or structure. The former, indeed, may be regarded as very simple, as is the case with the greater part of animals which are low in the scale of organization. But wherein they are deficient in extent of endowment, they obtain compensation in the precision of that one function with which their existence is identified; and in this respect our judgment in regard to some of the obscure or ill-understood functions of the organs of higher animals, may be informed and corrected by what is more clearly—because more singly—seen in the actions of these creatures.

In the days of Pennant the *Physalia* had not been recognized in the British seas. Yet it is not of rare occurrence, and sometimes appears in considerable numbers, keeping in a loose arrangement of companies, floating buoyantly on the surface, and carried wherever the wind and tide are disposed to bear them.

[1] In the descent of the Steep Hill, the great thoroughfare of Lincoln, the clay is indurated, and cannot be made plastic. This clay-shale is from 60 to 90 feet in thickness, and must be bored through into the heart of a rocky crust lying below, before water can be obtained. Water can only be obtained above and below this indurated clay.

To a cursory observer the appearance of this animal is that of a bladder filled with air, with a low, longitudinal crest, supposed to resemble a sail both in shape and function, and many tendrils of various lengths hanging loosely in the water below; without a visible orifice or organs of voluntary motion.

More closely examined in its native element, it is found to possess a front which is marked by a small perpendicularly oval space, thinner than the neighbouring surface, and conveying the idea of a mouth; and to the inner side of which is attached an organization presently to be described more at length.

From the margin of what, for the sake of distinction, I have designated the oral space, a number of lines proceed longitudinally along the surface, converging again near the pointed posterior portion, round a space and apparent aperture in a line not exactly straight above the extremity. Examined within, the wall of this membrane is encircled by another set of fibres, which encompass the sides at right angles to the former; and it is by the combined action of these, that the complicated motions are performed of which the creature is capable.

What is denominated the sail or crest, is a plaited membrane passing lengthwise from a short distance above the oral space, to within about an equal distance of the posterior extremity. It varies a little in breadth in different specimens, but in a large individual is about an inch in height, with an edge on the summit, but spreading below like the ridge of a house, and within the cavity is divided into segments. The structure of the inflated body is diaphanous; and viewed by the aid of light on the anterior portion of the right side, rising above the tendrils with which below it is connected, is an extended opacity, irregularly circular above, and well defined, indicating a structure differing from the other portion, though not such as interferes with the arrangement of the muscular fibres.

The tendrils are of three sorts. The first, towards the front, are placed on and under one side of the ordinary line of suspension in the water: they are short, clustering, and tufted on their pedicles. The other two sorts of tendrils are long; some a few inches, and some nearly a yard in length, but none placed behind the middle of the body; and the first elongated ones, placed below, are formed of a thread of membrane accompanied and encircled by a line of flattened beads, which obey the influence of the will in contraction, extension and lateral motion. The third sort are the longest; their base is thick and firm, having the muscular structure continued along their course, and at the end a membranous dilatation, from which springs a thread encircled by a beaded line, which at first is convoluted and doubled on the base, and then accompanies the thread to the end. The peduncles of these latter tendrils, about an inch in length, are fixed higher on the side than the former; but seem exceedingly liable to injury, since it is rare that all of them are perfect. The membranous threads appear to be the *branchiæ,* but the anterior branched tendrils seem rather to be absorbent organs, like the roots of a tree, affording the only source of nutriment, which I imagine to be assimilated in the reddish side of the internal sac; and which, besides its redness, is of a rather thicker substance than the surrounding structure.

In its healthy state the colours of this animal are beautiful; the crest being striped alternately with light blue and crimson or pink, and the sides similarly tinted, with reflections. The tendrils are of a darker blue, and sometimes a dull purple.—Examined within there is a thin membranous structure, which is necessarily pierced when the cavity is opened. On its anterior portion it is firmly attached to what I have denominated the oral space; it is also, but very slightly, attached posteriorly; and along the upper margin there is a varying number of branched appendages, each of which occupies a portion of the chambers of the crest. In some specimens, where the crest is low, they are fewer, less branched, and more obtuse; in others, long, slender and much divaricated. In the living state this membranous structure is so closely applied to the external muscular *parietes,* as not to be discerned through it, the cavity appearing empty. They are also so little adherent, except at the end, as to separate spontaneously; but still between them both is a slight villous coat, adhering to the external or containing portion, and which is the chief, if not the only seat of the colour. It is probable that the chief interchange of vital action is through this structure, which, although so slight and unadherent, is as closely connected as in some other animals or structures in which no more certain mode of communication has been traced. Many morbid growths in the human body have even less connection with the common vitality. This internal sac contains nothing but air, which appears to be secreted into it by the crest, that being its chief, if not the only office. No trace of food can be found, nor any separate organization, except a reddish thickening, already alluded to, at one portion of the surface. It is this which appears externally; and it seems just to owe its appearauce to vascularity, though no separate vessel can be distinguished; it is probably the seat of the vital actions, from which the splendid colours, and the acrid fluid covering the surface, as well as the ordinary supply of nutriment, are derived.

It has been a general opinion that the air in the cavity of the body is collected at the will of the animal, and that it can be expelled at pleasure, or through fear of danger. Neither of these ideas, however, appears to be accurate; for in regard to its accumulation, it is clearly not received from without, and as to the power of expulsion in any manner of haste, especially in storms, and to enable it to sink from danger, common observation proves the contrary; for they are seen floating on the most turbulent waves, and are frequently thrown ashore in tempests. Examination, indeed, cannot fail to persuade any one that a creature with so little of solid substance in its composition, cannot be made to sink without the almost total expulsion of its air, which ordinary mechanical compression does but little towards effecting; and when this expulsion is procured by puncture, which may amount to what the creature can effect by great effort, the animal may be made to shrink into a comparatively small compass, without at all approaching to a condition in which it can sink below the surface. I have discharged nine-tenths of the contained air, thereby causing a shrivelling of the external membrane, without bringing it to a state in which it did not swim buoyantly on the water.

But an examination of the *Physalia* when in undisturbed liberty will show that the real use of the inflated condition is not buoyancy alone. The accumulation of air will then be seen absolutely necessary as a fulcrum or point of support for the action of the muscular structure; and accordingly, the creature, by the contractions of portions of its surface and the relaxations of others, projects the oral extremity into the form of a snout, lifts or moves it towards either side, and depresses portions of the centre, lengthening or shortening itself, and especially dilating towards the side from which the tendons are dependant, according to its pleasure. But perhaps none of its actions are so capable of displaying the management of a complicated intention, as those by which the animal contrives to fall on its side from its more usual position with the crest aloft. The anterior portion is first dilated, by which a basis is formed capable of sustaining the whole bulk: the hinder part, for about a third of the length, is then rendered slender and elevated; in which condition but little of the surface is immersed, and a very small degree of inclination to either side causes it to fall over, with the crest on the surface of the sea: a position perhaps rendered necessary when, from drying winds, the top of the membrane has become rigid.—Its most favourite position in the water is resumed by again taking an elongated shape; and it must be remembered that these actions take place in an animal, in which minute research has not been able to detect a nervous system. These motions also, of a creature inflated with air, derive much interest from the explanation they afford of those faculties of some animals which appear to have received an erroneous or imperfect interpretation. Thus the prehensile organs of *Echinus* and *Asterias*, which are hollow, and capable of being drawn close to or within the body, are described as being protruded by simply propelling a fluid along their course, which fluid, when no longer wanted for this purpose, is again returned to the cavity. At this point the explanation ends; propulsion being regarded as the sole object of the function. Such, however, does not appear to be the case; the distension effected by the propulsion of fluid in the radiate animals, and of air in *Physalia*, being only the first step in the process, and providing a fulcrum for the support of muscular effort the chief object in view. In the tube of the *Lepades* the action is of a similar kind, though more complicated, owing perhaps to its annulated structure. The distension caused by the contained fluid in the latter is less considerable, and the animal sometimes hangs in a flaccid state, at its full length. When about to move, compression of the fluid fixes the centre of motion, which is rendered still more energetic by collecting and fixing it at the root, or in particular departments.

The remarks here offered may be extended to many of the voluntary motions of other animals of soft texture; developing a contrivance by which apparent contrarieties are reconciled, and creatures having so little firmness in their composition enabled to perform motions requiring tense support: the fulcrum which in the higher animals is the heaviest portion of their structure, and acts by gravity as well as strength, being in them no less effective as a moving power, and yet so light as to serve the office of a balloon.

It is well known that the *Physalia*, and several species of *Medusa*, are capable of inflicting a stinging sensation on the hands that touch them. The certainty of this admits of no doubt; the effect being severe even in persons whose skin cannot be supposed endued with remarkable delicacy. A sailor-boy, a short time since, was so severely affected from handling a single specimen, that the skin peeled from the whole surface of his hand. Yet, with the intention of experiencing this, I have repeatedly handled numerous specimens of both genera, swimming at large and out of the water, living and dead, yet without being made sensible of any unpleasant effect.[1]

ART. IX.—*A Catalogue of some of the most interesting Plants collected in the neighbourhood of Swansea, Glamorganshire, during the past Summer* [1839]. By THOMAS BRUGES FLOWER, Esq., F.L.S.

RANUNCULUS *Lingua*. In great abundance on Cromlyn bog and Neath canal.

TROLLIUS *Europæus*. "On the banks of the Dylais, above the waterfall at Aberdylais, and in moist meadows between Pont nedd Vachu and Usgord Eynon Gard."—*Dillwyn.*

HELLEBORUS *fœtidus*. In the woods at Park mill, towards Pennard castle, in great abundance.

DELPHINIUM *Consolida*. I have not been able to detect this plant in Swansea Bay; it is mentioned in New Bot. Gui. as growing there in plenty.

NYMPHÆA *alba*. Abundantly in the canal going to Neath.

MECONOPSIS *Cambrica*. "At the waterfalls about Pont nedd Vachu, in the Dylais Valley above Aberdylais, plentiful."—*Dillwyn.*

GLAUCIUM *luteum*. Frequent about Salthouse point, and in many places by the sea-shore.

MATTHIOLA *sinuata*. On the sands between Swansea and the Mumbles, but is now much less plentiful than formerly.

COCHLEARIA *danica*. Very abundant on rocks about the Mumbles lighthouse.

DRABA *aizoïdes*. "Found growing in the greatest abundance on the walls of Pennard castle, near Swansea, where it was first noticed by the late Mr. Lucas." It was still in great plenty when I visited the spot, August, 1839.

THLASPI *alpestre*. "About Pont nedd Vachu."—*Dillwyn.*

HUTCHINSIA *petræa*. On the walls of Pennard castle.

TEESDALIA *nudicaulis*. "On wastes and roadsides about Swansea, not uncommon."—*Dillwyn.*

LEPIDIUM *Smithii*. Everywhere on the sea-shore.

——— *Draba*, "The station given for this plant is now destroyed, the ground having been built upon."—*Dillwyn.*

——— *ruderale*. "Occasionally found on rubbish-heaps and ballast-banks about Swansea."—*Dillwyn.*

BRASSICA *cheiranthus*. "This interesting plant was detected on the sands near Pennard castle, in the summer of 1838, by Mr. Woods." It was still plentiful in the place mentioned when I visited the spot in company with my friend C. C. Babington, Esq. in August last.

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[1] Some interesting remarks on the *Physalia*, which perhaps may not have fallen under the observation of Mr. Couch, are to be found in the 'Proceedings of the Zool. Society for 1837, page 43, by Mr. George Bennett. —*Ed.*

CRAMBE *maritima*. "Rocks about Port Eynon."—*Dillwyn*.
DIPLOTAXIS *tenuifolia*. Very frequent about Fox-hole, in company with *Dipl. muralis*.
VIOLA *lutea*. "The Black Mountain has been noticed as a habitat of this plant since the days of Merrett; and though generally an inhabitant of mountains, I have found it growing on Cromlyn burrows."—*Dillw.*
HELIANTHEMUM *canum*. On the Worms head, plentifully.
DROSERA *rotundifolia*. Very frequent in many places.
——— *longifolia*. "Cromlyn bogs with *Dros. anglica*."—*Dillwyn*.
HYPERICUM *Androsæmum*. Frequent about Singleton, Neath, and Britton Ferry.
——— *calycinum*. "In Nicholston wood, near Penrice castle."—*Dillwyn*.
DIANTHUS *Armeria*. Banks about Britton ferry.
SAPONARIA *officinalis*. Frequent about the sands at Singleton, and in many other places.
SPERGULA *nodosa*. On the sand-hills between Swansea and the Mumbles.
CERASTIUM *tetrandrum*. "On sand-hills, not uncommon, growing with *Cer. semidecandrum*, of which I am satisfied it is nothing more than a variety."—*Dillwyn*.
GERANIUM *sanguineum*. In abundance on the sands near Pennard castle, and "on cliffs in Gower."—*Dillwyn*.
——— *pyrenaicum*. Between Swansea and Cromlyn.
ERODIUM *cicutarium*. Common. The var. *a*, *incanum*, is also met with plentifully on the sands near Swansea. Although by many botanists considered to be only a variety of the above, I cannot satisfy myself respecting it, and should therefore recommend it to further investigation.
RHAMNUS *catharticus*. Frequent in Cline wood, in company with *Rham. Frangula*.
MELILOTUS *leucantha*. Frequent on the ballast-banks about Swansea.
TRIFOLIUM *fragiferum*. Salt-house point and banks of Neath canal.
——— *glomeratum*.
——— *scabrum*. } "On Swansea and Skitty burrows."—*Dillwyn*.
LATHYRUS *sylvestris*. "About the top of the cliff, on the right of the entrance to Caswell bay."—*Dillwyn*. And about Oystermouth castle.
CERASUS *Padus*. "Pont nedd Vachu, but not so plentiful as it is about Merthyr Tydfil."—*Dillwyn*.
ROSA *spinosissima*. "On the sand-hills between Swansea and the Mumbles, very abundant."—*Dillwyn*.
POTENTILLA *verna*. Above the cliffs, between Port Eynon and the Worms-head.
SANGUISORBA *officinalis*. Common in boggy meadows at Witch-tree bridge, and also at Neath.
PYRUS *torminalis*. "Neath valley, and woods about Penrice."—*Dillwyn*.
EPILOBIUM *roseum*. Cromlyn bog, and by the side of the canal going to Neath.
ŒNOTHERA *biennis*. Naturalized in many places about Swansea and Britton ferry.
MYRIOPHYLLUM *spicatum*. Cromlyn bog.
HIPPURIS *vulgaris*. In boggy places about Cromlyn burrows.
ŒNANTHE *pimpinelloïdes*. Marshy places near Port Tennant, and in other places, frequent.
CARUM *verticillatum*. "In great plenty in meadows near Cocket."—*Dill.*
HYDROCOTYLE *vulgaris*. Frequent in boggy situations.

ASPERULA *Cynanchica.* In plenty at Pennard castle, and beyond the Mumbles.

LOBELIA *Dortmanna.* "Lakes at Pont nedd Vachu and Aberpergam."—*Dillwyn.*

INULA *crithmoïdes.* On the rocks beyond the Mumbles, in plenty.

ASTER *Tripolium.* Marshes about Port Tennant and Salt-house point.

SOLIDAGO *Virgaurea*, var. *Cambrica.* Frequent in the woods about Cwm Neath.

GNAPHALIUM *Margaritaceum.* "Near Clydach, on the road-side between Witch-tree bridge and Neath Abbey, and in other places."—*Dillwyn.*

——— *dioicum.* "On the mountains above Pont nedd Vachu."—*Dillwyn.*

SENECIO *viscosus.* On the wastes a little above high water mark, between the ferry and the entrance to Port Tennant.

——— *erraticus.* Frequent about Singleton. This plant is quite distinct from *Sen. aquaticus*, and well deserving of attention; (see Bab. Flor. Sarn.)

ARTEMISIA *maritima.* About Port Tennant and Salt-house point.

ACHILLEA *Ptarmica.* Frequent in many places.

CNICUS *eriophorus.* "Occasionally found on the road-side between Neath and Pile, and is much more common at the eastern extremity of the county."—*Dillwyn.*

CARDUUS *tenuiflorus.* Fabian's bay, and many places by the sea-side.

LACTUCA *virosa.* On the walls of Oystermouth castle, plentiful.

HIERACIUM *paludosum.* "On the rocky shore of the Neath river, and about Uscoed, Eynon Gard, near Pont nedd Vachu."—*Dillwyn.*

LITHOSPERMUM *purpuro-cæruleum.* "Abundant in several places on the coast of Gower, particularly in Nicholston wood."—*Dillwyn.*

ANCHUSA *sempervirens.* "At Bagland near Neath, and about the ruins of Neath Abbey."—*Dillwyn.*

CONVOLVULUS *sepium*, var. *incarnatus.* Fabian's bay, and frequent about Neath.

——— *Soldanella.* On the sand-hills between Swansea and the Mumbles, frequent.

STATICE *spathulata.* On the rocks between the Mumbles and Casewell bay, in great plenty.

ANDROMEDA *polifolia.* Cromlyn bog, chiefly towards its northern extremity.

ERYTHRÆA *pulchella.* Salt-house point, and frequent beyond the Mumbles.

VERBASCUM *nigrum.* Frequent about Britton ferry.

——— *Blattaria.* In fields near the Infirmary, and about Newton.

UTRICULARIA *minor.* On Cromlyn bog.

BARTSIA *viscosa.* "Plentifully in marshy fields in Cromlyn dingle and other similar situations."—*Dillwyn.*

OROBANCHE *barbata.* On ivy on the walls of Oystermouth castle, and also at Britton ferry.

MENTHA *rotundifolia.* Very abundant about Britton ferry, and "at Penrice castle."—*Dillwyn.*

SCUTELLARIA *minor.* In boggy places, frequent.

POLYGONUM *Raii.* About Neath and Fabian's bay.

——— *Bistorta.* In damp meadows, but not general.

RESEDA *fruticulosa.* Fields near the Infirmary.

EUPHORBIA *portlandica.* Frequent about the Mumbles and Carsewell bay.

MYRICA *Gale.* Cromlyn bog.

ACORUS *Calamus.* "Britton ferry."—*Mr. Player.*

SPARGANIUM *natans.* Frequent about Cromlyn bog and Singleton marsh.

RUPPIA *maritima.* Neath canal and Salt-house point.

ALISMA *natans*. Cromlyn bog and near Singleton.
——— *ranunculoïdes*. Skitty bogs.
NEOTTIA *spiralis*. On the Town-hill and Mumbles.
LISTERA *Nidus-avis*. "In a small wood near Pondandive."—*Dillwyn*.
ASPARAGUS *officinalis*. Singleton marsh.
SCILLA *verna*. "Plentiful about the Mumbles light-house, and the Worms-head."—*Dillwyn*.
JUNCUS *acutus*. Cromlyn burrows and Britton ferry.
NARTHECIUM *ossifragum*. In boggy ground, frequent.
ERIOPHORUM *vaginatum*. Cromlyn bogs.
CLADIUM *Mariscus*. By the side of the canal going to Neath, and on Cromlyn bog.
CAREX *dioica*. "Boggy places about the waterfall at Aberdylais."—*Dill*.
——— *stellulata*.
——— *curta*.
——— *strigosa*. } Cromlyn and Skitty bogs.
——— *limosa*.
——— *ampullacea*.
——— *arenaria*. Frequent between Swansea and the Mumbles.

SHORT COMMUNICATIONS.

ELECTRIC Eel at the Adelaide Gallery.—I feel persuaded that your readers will be interested in hearing that the *Gymnotus* I described in my letter to you, is still living and thriving. Kept in a room daily frequented by multitudes of persons, with only a borrowed light from a skylight, and never feeling the direct rays of the sun; confined in a vessel in which it cannot now stretch itself out at full length; kept warm by water artificially heated; and fed with fish not indigenous to the country it inhabits;—what must be the power of adaptation to external circumstances possessed by the animal which admits of its not only living, but even growing and increasing in strength, under such a total change of habits, food and climate!

I believe you remember that when we first began to experiment on its electrical powers, we could only produce those phenomena which depend on the tension of the electricity, as the spark, &c., by employing secondary currents; now, on the contrary, we have discarded Henry's coil from our apparatus, and invariably succeed, not only in obtaining a direct spark, but even the deflagration of gold leaves, these leaves being mutually *attracted* from a sensible distance and burning on coming into contact: if this arises partly from increased skill in our mode of manipulation, it must also be assigned in an equal degree to increased power in the eel.

Nevertheless, convinced as I am that not even the vital power of this animal can long withstand so total a change in its natural habits, I should be very glad to transfer it to some Institution, where, while it could enjoy fresher air and direct light, it would meet with attention to temperature and cleanliness equal to what it has had from us; and in that case I see no reason why it might not be kept alive for years.—*Thomas Bradley, Director.—Royal Gallery of Practical Science, Adelaide Street, Oct.* 23, 1839.[1]

Young of Loxia curvirostra, *Temm. (Cross-bill.)*—On the 10th of July, 1839, as I was riding under some fir-trees, my attention was attracted by the peculiar note of the *Loxia curvirostra*; my stopping to pry too minutely into their actions caused them to change their quarters to an ash tree, where they and their motions were more distinctly discernible, and I could clearly see, and watched for a considerable time the two old ones, in shabby plumage, and four young ones, full two-thirds grown, which appeared very hungry and exceedingly clamorous for food, fluttering their wings, opening their beaks, and incessantly importuning the parent birds for sustenance; thus proving, if additional proof were wanting, that the cross-bills do occasionally build and breed here, although it is probably of rare occurrence, which is not to be accounted for, as so many do remain during that season of the year when all our other birds are engaged in the usual and necessary occupation of reproduction.—*Joseph Clarke.—Saffron Walden, Oct.* 18*th*, 1839.

Note on Achatina acicula.—Of all the British land shells, the remnants of this species seem to be found in the most singular places. Instances are, I believe, recorded where these shells have been found in Danish coffins, &c. I beg to add another instance of this shell being found in connexion with Danish remains. While carefully examining the *tympanum* of a skull found at Limbury, a hamlet of Luton, Bedfordshire, in conjunction with old pottery, urns and a key, supposed to be of Danish origin, I was rather surprised to find in addition to the perfect chain of *bones*, the lower two whorls and a half of a shell, which upon examinination proved to be the remains of *Achatina acicula*, (Agate shell) a species of rare occurrence at the present time in the vicinity of Luton. How this shell could have found its way into the cavity of the ear I do not pretend to say. I merely bring it forward as another proof of the species having been again discovered in connection with Danish remains.—*Daniel Cooper, Surgeon*, 82, *Blackfriars Road, London.*

[1] For Mr. Bradley's former letter on the *Gymnotus*, see Mag. Nat. Hist. Vol. ii. n. s. (1838), p. 668.

Derivation of the Name of the Adder, (Viper).—Professor Bell in his history of British Reptiles, when giving the etymology of the word adder, as one of the names of the viper, states that it was anciently written *Nedre*, which he derives from the Saxon *Nædre*, nether or lower, in allusion to its creeping position;—a derivation too far-fetched, in my opinion, when there is one much better nearer at hand, viz.—"*Neidr*," the ancient British, and also the modern Welch name of the reptile in question. In the plural form it is much more apparent,—"*Nadroedd*," (the word is used for the common snake as well as the viper); by only altering the Welsh plural termination for the English one,—*Nadrs*,—the name is formed at once. The change of *neidr* into *adder* is not so bad as what has happened to a companion of it, viz., the change of "*glein neidr*" into "*adder' claim*" or "*snakes' claim*," the "*anguinum ovum*" of the ancients, the superstitious virtues of which are not yet lost in the estimation of many of the ignorant country people, although it has sunk very much in its dignity, being now chiefly accounted valuable as a cure for wens or glandular swellings of the neck, instead of insuring to its possessor all sublunary prosperity, as it used to do in ancient days. The manner of forming the *glein neidr*, as preserved by tradition to the present day, and as I have heard it related by several persons, who knew not it had ever been described by any author, differs but little from the account given by Pliny many centuries ago. The modern version being that it is formed of the saliva of adders upon the body of one of their number, which accounts for the perforation in it. After it is fully formed it must be snatched away by the observer (who must have concealed himself from the observation of the adders); as soon as he has obtained it he must fly with the greatest speed he can possibly exert, until he crosses some stream of water, it matters not how small it be, a running drain or ditch will suffice to stop the pursuers: but if he should be overtaken by the adders, it would be instant death to him, as from their excited state their poison would be doubly powerful. I had one of these articles presented to me some years ago, by a believer in its virtues, in whose family it had been for several generations. It is an irregular, roundish bead, about $\frac{5}{8}$ of an inch long and $\frac{3}{4}$ of an inch in diameter; the perforation being about $\frac{1}{4}$ of an inch in diameter. The colour is a bright green and the substance apparently glassy, and it is deeply striated longitudinally.—*James Bladon.—Pontypool.*

Projection of its eggs by the Crane-Fly.—Having seen it stated in some entomological works that the eggs of the crane-fly and some others were propelled to a great distance like pellets from a pop-gun, I could not conceive what power could reside in the ovipositor to produce such effects, as from their conformation it could not be done by the compression of air. I at last caught a gravid female just upon the point of laying its eggs. When it began to lay they were propelled about three inches in a direct line from it. I could then by the aid of a lens perceive by the successive distension and contraction of the last segment of the abdomen, the passage of the egg down the egg-tube. When it came between the valves at the apex of the abdomen it remained a short time stationary, when I observed at the base of the valves a strong muscular contraction, which kept increasing until the egg was forced out by the pressure of the valves upon it. In exactly the same manner we oftentimes see children in sport shooting the pippins (seeds) of apples from between the tips of the thumb and fore finger. It will be evident from the above description that it can be only very hard or smooth-shelled eggs that can be ejected in the manner described.—*Id.*

Count Caspar Sternberg-Serowitz.—(Born on the 6th of January, 1761), died on the 20th of December, 1838, at Brzezina, near Radnitz, in Bohemia. In literature his fame rests chiefly on his Fossil Flora, ('Versuch einer geognostisch-botanischen Darstellung der Flora der Vorwelt, Prag. 1825'), though his other botanical works, as that on the *Saxifrageæ*, the *Asclepiadeæ*, and the Flora of Bohemia, are likewise held in deserved and high esteem. In his country he will always be honoured as one of its greatest benefactors. In 1822 the National Museum of Prague was chiefly founded through his exertions and liberality. He became the president of that institution, to which he had presented his great collections and library, and the existence of it has hitherto so much depended on his individual support, that the Bohemian States must make up the deficiency, or the institution will perish.—*W. Weissenborn.—Weimar.*

Nature of mineral precipitates.—At the meeting of the Society of Friends of Natural History, held at Berlin, January 15th, Mr. Link communicated some observations on the formation of crystals. If fresh precipitates of many of the minerals are examined, they are found to be entirely composed of little globular bodies, which change, under the eye of the observer, into the crystals peculiar to the metal. This, however, is not effected by their juxtaposition, but by their bursting into each other, and uniting like soap-bubbles.—That these globules are hollow is not only proved by their difference in size in the same precipitate, but also by the angular and irregular forms which they present when dried up.—*Id.*

A valuable collection brought together in Borneo for the Dutch government, but whose acquisition was refused by the latter, has been bought by the government of Belgium, and the city of Brussels, for 30,000 fr. It contains eight skeletons and skins of the orang-utang, skeletons of the rhinoceros, tiger, bear, &c., a stuffed crocodile, 30 ft. long, several fossil remains, and 1200 birds. The share of the government has been distributed among the universities of Liege, Louvain, Brussels, and such towns as possess Museums, for instance, Tournay.—*Id.*

Of the Ushar or Abuk, (Asclepias procera) *of the Senaar.* —Dr. Max Koch, a Bavarian traveller, gives the following description in one of his letters. It is a tree with broad leaves of a very bright green, and peculiar to the Sennaar. The seeds of it are enveloped in a fine silk, wherefore it is also called *Asheyr* (silk-tree.) In the plain of Gohr the natives use that substance for the matches of their guns. The milk-like sap which oozes from the young twigs, is collected and sent to Jerusalem, where the druggists prescribe it against inveterate colds. The flower is poisonous. A French physician in Dongola was poisoned with it in coffee, with which the dried and powdered flowers had been mixed. —*Id.*

Extract of a Letter from Mr. Gould, the Ornithologist, dated June 30, *City of Adelaide, South Australia.*—"I wish it were in my power to give you a faithful picture of this famed city of two years standing. People live in tents, and customs are so different from what they have been used to, that I really wonder how they reconcile themselves to their new mode of life. On the whole, however, I think South Australia may be considered as flourishing, and its condition will ultimately be prosperous.

The Zoology here, from what I have already seen, is likely to be of a most interesting description, totally different in its nature from that of Sydney, but probably approaching nearer in its character to the productions found beyond the Liverpool range, or what is more properly called the interior of New South Wales."—*J. Gould.—Addressed to Mr. Prince, Broad Street, Golden Square.*

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NATURAL HISTORY.

DECEMBER, 1839.

Art. I.—*Notes on Irish Natural History, more especially Ferns* By Edward Newman, Esq., F.L.S., &c.

(*Continued from page* 551.)

On the ruins of Castle O'Donnel I found a number of the commoner ferns, and among them a few fronds of *Scolopendrium vulgare.* On the banks of Lough Derg, *Osmunda regalis* again made its appearance in abundance. It was late in the evening when I reached this celebrated lake, and crossed to its wonder-working island, on which hundreds of invalids, and cripples, and sinners, were patiently awaiting miraculous cures for body and mind. This little island is built to the water's edge, and a solitary sycamore is the only tree it nourishes. I passed through Pettigoe, along the east side of Loch Erne, and between the upper and lower lough to Inniskillin and Manorhamilton. In approaching Sligo the country assumed a different appearance to any I had before seen; the hills had rounded summits and rocky precipitous sides. The number and variety of ferns here greatly increased; *Cystopteris fragilis* was most abundant and polymorphous, as it ever is when once established in a congenial habitat.—*Scolopendrium vulgare* hung its bright green streamers from the rocks, and filled the hedge-rows, for near Sligo there *are* hedge-rows. *Asplenium Adiantum-nigrum, Ruta-muraria,* and *Trichomanes* were everywhere abundant, more particularly on the stone walls.

At Ballisodare is a very fine rapid of the Owenbeg. This stream is of respectable width, and roars, foams, and dashes along over a slaty-looking bottom in fine style: the rapid is, properly speaking, a succession of falls; the bed of the river seems to be broken into a series of unequal steps, ceasing only when its waters mingle with those of the Atlantic. I was told that great numbers of salmon annually amuse themselves by leaping at these falls, and that some surmount them all; the majority however find the labour too severe, and are carried back to the sea, or captured, bruised and exhausted, on the shelves of rock. From Ballisodare to Ballina the road is over a dreary bog, and without interest; thence to Crossmolina its character is the same, but here I left the usual track, and, rounding the base of the huge Slieve Nephin, found a way to Newport. Below Nephin is a finely-wooded bog; there appeared to be nothing like cultivation, and the wood seems quite a natural one. Newport is a miserable place; the traveller will find no rest there. It is the only town I had ever entered in which I could find no inn, but here there is none at all; some twenty or thirty filthy spirit-shops, but nothing like an inn.

The next morning there was a wind blowing against which it was all but impossible to stand; it blew clouds of spray off the surface of the river: however I was early on my way, skirting Clew Bay, and gazing on its innumerable islands.—I would fain have gathered some information about these beautiful spots of verdure; but alas! everything here is to be received with hesitation. The number of islands is variously stated by almost every one you meet, but the favourite number is three hundred and sixty-five—one for every day in the year, a number corresponding precisely with the lakes of Glengariff. Of these islands one hundred and seventy are well cultivated and inhabited. Looking over this wilderness of isles, Croagh Patrick fills up the horizon, its summit hidden in the clouds. On the banks of Clew Bay I found *Erica Mediterranea* in the greatest abundance; I first saw it close to the road, after passing the little village of Molyrhany,—a cluster of some dozen or eighteen cabins, and from this spot as you enter Coraan Achill it is scattered in profusion over hundreds of acres: I speak of the heath known at present by our botanists as *Erica Mediterranea*, but I have heard many doubts expressed as to the propriety of this name, and from what I could gather I am inclined to believe that this heath will turn out an undescribed species. In walking among this heath I found it, on the average, up to my shoulders in height, some rather higher, and a good deal much lower. Below the heath the bog was thickly sprinkled with *Pinguicula Lusitanica*.

At Achill Sound there is an inn lately erected, and here a ferry-boat takes you across to the island of Achill. The sea was very rough, the raft had broken adrift with the violence of the waves, and the people said it was "too severe" to attempt the passage. However, there appeared nothing worth waiting for, so, after talking a good bit, the raft was obtained, but directly I was on board a wave gave it a cant, and I unfortunately lost my centre of gravity, fell against a seat, and in an instant lay sprawling on the bottom, having scarified one shin in performing the summerset. I mention this, as a hint to future pedestrians, because the wound was a constant walking-companion the rest of my journey, and a considerable drawback to its pleasure. At night I reached "the Settlement," an establishment for the purpose of inducing the natives to renounce the doctrines of the Church of Rome for those of the Church of England.

The island of Achill is more like a foreign land than any I have visited; the natives reside in huts, which a good deal resemble those of the Esquimaux Indians; they are without chimneys or windows, and the roof seems continuous with the walls: the interior is generally undivided, and is tenanted by men, women, children, pigs and poultry, and often goats and cows. These little cabins or huts are built in what may be called loose clusters, varying from twenty to eighty in a cluster; these clusters or villages are sixteen in number, some of them are summer residences only, and are entirely deserted in the winter;—others winter residences only, and deserted in the summer. The island of Achill is very mountainous: it rises principally towards the west, where it attains a great elevation, and then falls perpendicularly to the sea: it seems like a remote corner of some vast continent, which has sunk for ever beneath the waves: its soil, like that of the greater part of the west of Ireland, is bog, or, as it is termed, turf, and this is covered with heath and sedge, intermixed here and there with a fine velvety turf. The inhabitants possess a good number of cows, sheep, and goats; the latter are almost invariably white, and ramble the mountains in large flocks. The heaths are *Calluna vulgaris, Erica cinerea* and *Tetralix*, of all which I found beautiful white varieties. *Sedum anglicum* occurs in great abundance on the rocks, and *Anagallis tenella* forms, in many places, a pink turf, so profusely does it flower.

In birds the island appears to be poor; it is doubtless visited by a variety of sea birds, but I saw nothing but gulls and terns. Eagles are very abundant, particularly (perhaps exclusively) *Aquila albicilla:* and of hawks I saw several species. The red-legged crow breeds in the cliffs; and I found a colony of this bird in a look-out station, built when our government was afflicted with the Napoleonphobia, but now a mass of ruins: these birds did not seem abundant.—Curlews appeared to be breeding here; their whistle was incessant, and the old ones would constantly rise before me, and counterfeit inability to fly, as if desirous of enticing me away from their nests or young.

The first morning after my arrival in Achill, I walked over the cliffs at Cim to Achill-head. The cliffs at Cim are said to be more than 1000 feet in perpendicular height; Achill-head, the extreme western point, is much lower, I should fancy less than 500 feet: but turning thence northward, I reached the summit of Slieve Croaghan, a height more than double that of Cim, and sliced down perpendicularly to the Atlantic. I imagine this cliff has never been measured; it was variously stated to me at 2000, 2300, and 2600 feet: I am not competent to form an accurate opinion of its height, but as I lay quietly looking over it, I could not hear the huge waves of the Atlantic, as they broke in foam along its base. This might arise in part from the roaring sound of the wind among the rocks around me, or even from the wind sweeping away the sound of the waves in some other direction; but it gave an idea of vast depth that I never before realized. From this point I coasted the north of the island, and found near the margin of the cliff a beautiful little fresh-water lake, surrounded by an amphitheatre of hills. I should think its surface was 600 feet above the sea, and its distance from the edge of the cliff scarcely 300. I doubt whether any Englishman but myself has ever seen this lone and beautiful sheet of water; its singularly round form, the depth of the basin in which it reposes, the precipitous sides of that basin, its height above the sea,—all these are characters of no ordinary interest. As it was not yet evening, and the weather very fine, I ascended Slieve Mor on my way to the Settlement, an operation of an hour and a half, in order to see the sun set in the ocean from that elevated point. It was a glorious sight, but when he was gone night came on almost immediately, and I had to find my way to the Settlement after nightfall, in a country to which I was an utter stranger, where there was no track, and no tree, house, or any other object to mark the way.

The next day I walked along the top of the cliff southward; this height is called Menaan; it is the favourite resort of eagles, hawks, gulls, and red-legged crows. Although magnificent in comparison with any cliffs I have seen in England,—and although the natives collecting sea-wrack on the sands below were visible only as specks, the nature of which

I could not have determined with the naked eye;—yet Menaan is a mere plaything compared with the stupendous Croaghan, and sinks into insignificance. The summit of this cliff is thickly covered with plants, and I doubt not would amply reward the botanist who would carefully explore it. The plants, dwarfish though they be, are not sufficiently humble to escape the power of the Atlantie breezes. There is an extent of miles covered with a dense net-work of vegetation, every twig of which leans away from the ocean; this network or mat springs beneath the feet with great elasticity: it is principally composed of *Salix herbacea*, *Salix repens*, *Arbutus Uva-ursi*, *Juniperus nanus*, *Calluna vulgaris*, *Erica cinerea*, and a variety of *Carices*. Descending from these heights I visited a farm in the bosom of the mountains; it is the only one of any extent in the island, and is occupied by a Mr. Long. I notice this farm as bearing on the extreme productiveness of the soil of Achill; it had abundant crops of oats and potatoes, the former so heavy that the only fear respecting them was that they would be laid by the high winds. The soil will produce oats and wheat, year after year, without manure, but wheat is not a desirable crop on account of the want of a good market. Mr. Long's garden contained cabbages, savoys, sea-cale, broad beans, peas, early potatoes, carrots, parsnips, lettuces, onions and turnips, all of them kept free from weeds, and in a state of vigour and luxuriance that would not be despised by the London market-gardeners. The farm consists of 600 acres. From this farm to the village of Dukinelly the land is well cultivated, although divided into infinitely small patches. The entire island is the nominal property of the Marquis of Sligo, but let for ever to Sir Richard O'Donnel, who, when the land is reclaimed and producing crops, obtains the enormous rent of one shilling per Irish acre from his tenantry.

The natives of Achill are charged with being thieves and murderers; and if I were to place full reliance on all I heard at the Settlement, they would appear to be so. Mr. Long, however, with everything constantly exposed,—walls and hedges being here unknown, and living amongst a population from whom he has no power at all to defend himself, has never lost even a potato. I allude not to this subject politically; but bearing in mind solely the natural history of the island and its capability of improvement, I pronounce without hesitation, that if goodness of soil, lowness of rent, cheapness of labour and safety of property be recommendations,—then that no spot I have ever seen is more likely to reward the emigrant than the island of Achill. Would that some unpolitical and unsectarian philanthropists,—men who took a human view of the human wants and human failings of these poor islanders,—would settle among them, and place in their hands the plough and the spade, teach the children to read and write, the boys to make shoes and coats, to fish, and to dig, and rake, and sow, and reap, and build houses, and the girls to knit, and spin, and make gowns,—use them like brothers, sisters, and children,—then might this island become a centre of happiness and prosperity.

At Mr. Long's, on the banks thrown up to divide the fields, and in land not yet fully reclaimed, I observed *Osmunda regalis* in most luxuriant bushes; he complained of it as a weed that gave much trouble. *Aspidium dilatatum* was equally common: in the former part of my paper, at page 551, I spoke of the Irish concave variety as being the *Asp. dumetorum* of Mackay, supposing that the *Asp. dumetorum* of Smith was different. I have since learned from Mr. Moore, of Dublin, that he has seen the very plants on which Sir J. E. Smith founded his species; they are still growing in the Botanic Garden at Liverpool, and are decidedly of that variety called *dumetorum* by Mackay, *concavum* by Babington, and *recurvum* by Bree, in 'Mag. Nat. Hist.' vol. iv. p. 162, fig. 32,—the figure is a very good one. I saw the specimens myself when at Liverpool towards the end of August last, but not meeting with Mr. Sheppard the curator, I was not aware they were those to which Sir J. E. Smith alludes. I am anxious to correct my error on this subject, as the observation implied an inaccuracy on the part of Mr. Mackay. Mr. Babington's plant (the identical specimen is before me) is elongated, and rendered more vigorous by having grown in the vicinity of a waterfall.

Coasting the island as nearly as I could accomplish it from Dukinelly, I at length reached Achill Sound, and then crossed to the inn on the other side. Near this place I observed a great quantity of heath; some of the *Erica cinerea* being beautifully white. I also gathered what at the time appeared to me an unusual variety of *Erica Tetralix*, the leaves being shorter, broader, and very white beneath; I afterwards learned that this is the *Erica Mackaiana*. I am too shallow a botanist to offer any opinion as to its being specifically distinct, particularly as it is stamped with the weighty authority of Sir W. J. Hooker.

Returning over Coraan Achill to Newport, I bent my course southward to Westport, and thence to the little place called Leenane, at the head of the Killery. The scenery here is wild and picturesque; the rocks are covered with *Saxifraga umbrosa*, I use the name in ignorance, not knowing the genera and species into which that plant has been divided: I had better say "London Pride," for we cockneys, who cultivate the plant in our sooty gardens, generally combine the species under this one familiar term. It is very delightful to see this plant in its native wilds, adorning the rugged rocks with its elegant panicle of flowers; in such situations it seems to possess an interest which we never attach to it in a state of cultivation.

Immediately on starting from the little inn at Leenane, or "Jack Joyce's" as it is usually termed, I found the first specimen I had seen of the Irish heath,—*Menziesia polifolia:* up to that moment I was unacquainted with the plant, and its appearance was as pleasing as it was unexpected. The scenery here is fine; the Killery, a little creek or arm of the sea, runs up to Leenane between two picturesque chains of hills, and travellers usually hire a boat and disport themselves on the water, in order to obtain a better view of these hills. An excellent road has lately been made from Leenane to Clifden, but the day being very fine, I prolonged the journey by turning off to the left, among the hills, and was repaid by some very pretty scenery. Behind me, or rather, to my left, rose that singular group of hills called the Twelve Pins, and before me, through occasional openings, I frequently saw the sea. There is but little cultivation in these parts; the bog appears rich, and capable of producing good crops; the heaths are luxuriant beyond anything I had ever seen; the day was very warm and the walking good, the bog being firm and elastic, and in the best possible state for progression. It was evening when I reached the little inn at Clifden.

The next morning I arrived at Roundstone, a place with which a naturalist must be pleased. On approaching it, an enormous seal (*Halichœrus Gryphus*), apparently 8 or 9 feet long, and of a light or whitish colour, with a black face, and another, much less and nearly black, were basking in the sunshine on a rock in the bay. These seals are most abundant all round the coast of Cunnemara, from Galway to the Killery; indeed I imagine on nearly every part of the coast of Ireland: they are strong, resolute, and ferocious animals, and totally different from the *Phoca vitulina*, which is, in these respects, the very reverse. *Halichœrus Gryphus* grows occasionally to an enormous size, sometimes attaining even the length of 12 feet; and Mr. Ball of Dublin told me of one he had killed at Howth harbour, which he believed to weigh five hundred pounds. *Phoca vitulina* occurs not unfrequently on the north coast of Ireland and among the Scotch islands, but it appears to be nearly expelled from the southern half of Ireland by the more powerful and savage species above referred to, much in the same manner as the old English black rat has yielded to the more powerful animal from Asia, known as the brown or Norway rat.

I ascended Urrisbeg, a rugged little hill at the back of the town, and was very much delighted with the singular view from its summit: the sinuosity of the ocean-coast, and the multiplicity of islands in the sea, and of lakes on the land, is very remarkable. All over this district *Menziesia* grows in the utmost profusion, and at the base of Urrisbeg occurs *Erica Mediterranea*, though not abundantly, and here it was first discovered by Mr. Mackay. This plant has since been recorded as occurring in Erris, and on the side of the Mullrea mountain, near the Killery; but I believe I have the pleasure of first recording its most abundant habitat—Coraan Achill. At the foot of Urrisbeg, on the shore of Lough Bulard, Mr. Babington found *Adiantum Capillus-Veneris*. When at Roundstone, I was not aware of the exact locality, and searched for this rare plant in vain, having no more precise habitat than "near Roundstone." But though unsuccessful in this instance, I was delighted with the variety of ferns which I here found among the boulders by the sea. *Aspidium aculeatum* and *dilatatum*, *Nephrodium filix-mas*, *Athyrium filix-fœmina*, *Blechnum boreale*, *Asplenium marinum*, *Aspl. Adiantum-nigrum*, *Aspl. Trichomanes*, *Aspl. Ruta-muraria*, *Pteris aquilina*, and *Osmunda regalis*, are crowded together in profusion and endless variety. In the evening I dined with some great men's great men, or rent-collectors for land-proprietors, and from them I learned much as to the fishing &c. in this district. The salmon-fisheries are perhaps the best in the world: about four miles from Roundstone is one taken by a Scotchman, in which, the day I was there, two hundred and eighty-seven salmon were taken. The contractor, I was told, had taken the fishery at 2d. per fish. The fishery was the property of Mr. Martin of Ballinahinch.

On our breakfast-table next morning were herrings, two kinds of trout, and salmon, all three in the perfection of freshness; indeed the fish of the west of Ireland is beyond all comparison the finest in flavour that I ever ate; it is *fresh*, and in all probability had been swimming at large within an hour of its being placed on the table. The white trout of the west of Ireland is a fish with which I was before unacquainted; as a species it is perfectly distinct from the salmon or trout Mr. Yarrell, in his 'History of British Fishes,' vol. ii. p. 37, says that the *Salmo trutta* of Linnæus, the sea trout of Fleming, and *his* salmon trout, is the white trout of Ireland; but there is not a close correspondence between the two. In contradistinction to the common trout, the flesh of the white trout is of richer flavour, and of a deeper orange colour; its skin is much thicker and more oily, its colour bright silvery, with the exception of the back, which is darker; it is destitute of orange spots. It is taken abundantly in salt water, and very seldom in fresh.

After breakfast I resumed my knapsack and turned my back on Roundstone, amidst pelting rain. I saw two eagles soaring in circles far above the summit of Urrisbeg, and others sailing majestically on their way to and from the Twelve Pins. I stopped awhile at the salmon-fishery: to this spot the anglers of England—the real knowing ones—find their way, and, enveloped in Mackintoshes, stand for hours at the pools, whipping them with a fly. I saw an extremely fashionable-looking man at this locale; he was accompanied by a Mr. Larry, a very knowing native, who killed the fish of which he—the Englishman—was to be supposed the executioner. The salmon were pounded in, like sheep in a fold, and patiently awaited the evening's hawl; the Englishman threw his fly with untiring diligence, and drew it spinning over the water; the huge salmon leaped around it almost every second, and I saw Larry hawl to shore a fish of at least eight pounds weight; this will doubtless cut a conspicuous figure in my unknown countryman's journal: it was on the 17th of July, 1839.

Ballinahinch, like most of the towns laid down in the maps of Cunnemara, is a single house, the residence of the Martin of Galway for the time being, a man possessing land sufficient for a German principality. It is a pleasant spot, surrounded by the wildest scenery that can be imagined, and the bog half covered with the beautiful *Menziesia*.

(*To be continued.*)

ART. II.—*On the Natural History of the German Marmot (Hamster).* By W. WEISSENBORN, Ph. D.

(*Continued from page* 536.)

HYBERNATION.—About the beginning or middle of October the hamsters shut their burrows, first the creeping-holes and then the plunging-holes. With occasional interruptions, they fill the whole length of the passages, with earth formed into little rounded lumps of the size of a pea or French bean, which, though they be rammed together very firmly, and effectually keep out the cold, yet admit of a partial circulation of air. The nest is of the average size of an ox-bladder, and filled with the softest straw. It communicates with the store-chambers, as before stated; and the animal continues awake for about two months, during which it consumes about two thirds of its stores and becomes very fat, till the winter fairly sets in, when it becomes torpid. After the middle of February one generally finds the first hamsters that are awake;[1] but unless the sun shine very warm, they do not open their holes, but occupy themselves with digging new canals, &c., as it would seem merely for the sake of exercise. At this season one finds but two or three handfuls of corn left. About the middle of March they usually begin to open their burrows, commencing with the plunging-hole, which they throw open very widely, so that it resembles the burrow of a rabbit. They abandon their winter-burrows soon after, and dig new ones; they take rambles and collect young weeds, as well as the fresh-sown summer corn, whereby they become very injurious. The male awakes from his winter sleep sooner than the female; and herein we may observe a very interesting provision of nature. The female, on account of the care necessary to be bestowed on her progeny, not having time to collect so large a store as the male, digs her winter-burrow much deeper, whereby she the sooner becomes torpid, and awakes later than the male; and but for this many would die of hunger. All the hamsters which have been dug out in winter were males, the females lying so deep that the traces of their burrow have been lost before getting at them. They seldom open their holes before the beginning of April.

When a torpid hamster is dug out, it is found lying on one side, rolled up in a lump; the head being under the belly, which is embraced by the fore-paws, the hind-paws being joined above the snout. The animal is perfectly clean, and the hairs, especially the whiskers, beautifully arranged. The hairs are stiff, and their becoming pliant marks the first stage of the animal's awaking. The eyes are closed; and if opened by artificial means, they shut again spontaneously. The animal does not breathe. When opened in this torpid state, it does not show any symptom of feeling pain, although the

[1] As an exception, I have a few times seen hamsters, even at an earlier season, *basking* before the creeping-hole of their burrows, *in the sunshine of a bright winter day.* The *creeping-hole* was thrown wide open on such occasions; the animals retreated on my approach; and had they not, in every instance of that sort, peeped out again in defiance, with their well-known squeaking, I could not positively state that I had seen hamsters behaving thus in the middle of winter.

respiration returns at long intervals; the heart contracts only fourteen or fifteen times in a minute; whereas, in the animal when awake, it does so at least one hundred and fifty times. The blood is far more bright and fluid than in summer, and its surface is covered with oily spots. The intestines are motionless, and neither alcohol nor sulphuric acid are able to make them contract: they are partly filled with chyme and excrements. The fat is rather solid, and the bladder partly filled with urine. A torpid hamster may be carried in the pocket for miles from the fields without awaking. If brought into a moderately warm room it gradually awakes: the feet by degrees assume a more natural position; the breathing begins with deep and rare inspirations; the animal is then sensible to stimuli of various kinds; it stretches itself, utters a disagreeable rattling sound, and at last opens its eyes. It then totters about as if intoxicated, and frequently falls on one side in trying to attain a sitting posture. When this point has been gained it remains quiet for a while, then walks about and directly begins to eat if food be thrown before it. The time in which they become perfectly awake in a moderately warm room, is two hours in very cold weather, when their sleep is proportionately sound, but much less in warm weather.

The principal external cause of the torpidity of the hamster is the lowness of the temperature of the medium in which it happens to be. Underground a temperature of + 6° or 7° Reaum. is competent to effect it; when kept in a box above ground, the animal will fall asleep at a temperature of +5° R., but awake from time to time. In heated rooms the state of torpidity never takes place; but although the hamster will thus sometimes live through the winter, it is drowsy, ill, and often dies. It is evident that the closing of the burrows, by which the external agents are in a great measure excluded, must be instrumental in bringing about the torpid state much earlier than it would otherwise take place. Then, I suspect, the influence of the earth itself has a similar tendency; this opinion I may support by the following observation. In my youth, in company with a few more boys, I once gave chase to a pair of dormice (*Myoxus nitela*). We secured one, the other entered a hole in the slope of a sandy hill. I went home to fetch the necessary instruments and returned in about half an hour, and after digging only a length of a few feet, I found the dormouse fast asleep, though the burrow continued much farther. Thinking I had killed the animal with the pickaxe, I took it carefully in my hand, when, after having handled it a short time, it made its escape so rapidly that only the skin of its tail remained between my fingers. I succeeded however in catching it again, and found that it had sustained no other injury.

As to the physiological points which appear to be most closely related to the hybernation, they are, 1st, the great development of the venous in proportion to the arterial system; 2ndly, the peculiar composition of the blood, which never perfectly coagulates, the more solid parts retaining a certain degree of fluidity, and the more watery portion not becoming transparent and nearly colourless, as in most other animals, but constituting a crimson-coloured fluid; when the hamster is torpid, these qualities of the blood exist to a greater degree than in summer: and lastly, the condition of the fat, which, as in other winter-sleepers, for instance, the badger, hedgehog, dormouse, bat &c. is oily, and chiefly composed of elaine.[1]

Injury and Use.—As the hamsters consume a great quantity of valuable green fodder as well as corn, from the time it begins to ripen, during spring, summer, and autumn,—and as an old one sometimes lays up a winter store of 1 cwt. of horse-beans, or 65 lbs. of corn, &c., which is lost to the proprietor or farmer, it may be imagined what a calamity this animal must be to the agricultural population, where the soil is favorable to its excessive multiplication, and where no extraordinary means are resorted to, in order to check its propagation. It is true that nature herself puts a stop to the hamsters' multiplying to an indefinite extent, by epizootics, or other causes, which cannot be precisely determined;[2] but she does so much later than the interest of man requires.—The parishes which are much infested with this nuisance, have therefore, from an early period, paid premiums out of their public money for dead hamsters which were brought to the proper office. Latterly this has been done in several dominions of Germany with more regularity, and more systematically than before; and as I think it will interest the readers of this journal, I shall communicate here an extract from the official records kept at the mansion-house of Gotha, and comprehending a period of twenty-one years. It commences in 1817, when a general crusade was undertaken, which had the

[1] Haller's opinion, that the right auricle of the heart loses its sensibility latest, among all the organs, is confirmed in a striking manner in the instance of the hamster. If, in a living hamster, the heart be exposed by laying open the chest, it will continue to beat for about seven minutes, then become motionless for a short time, whereupon the right auricle begins to beat alone, the pulsations being at first about 110 in a minute, continuing for an hour and a half or even two hours, and becoming gradually slower, till at last only two are observed within a minute.

[2] Migrations of this animal have never been observed, as far as I know; but in some years it is scarce, without the cause being known.

effect of greatly reducing the number of hamsters; and since that period the magistracy have succeeded in preventing the multiplication of the animal from becoming a public calamity.

Years.	Number of Hamsters delivered at the mansion-house of Gotha.	Sums paid in Premiums. Doll.	Gros.	Pfen.
1817	111,817	2,237	19	7
1818	13,054	197	21	1
1819	22,370	285	14	7
1820	7,331	103	14	6
1821	8,689	122	20	8
1822	19,087	273	14	6
1823	5,429	88	23	1
1824	12,084	181	23	10
1825	14,248	205	15	0
1826	7,002	148	7	10
1827	14,735	320	19	8
1828	6,133	125	13	7
1829	5,686	112	11	3
1830	10,049	234	0	1
1831	18,953	397	7	9
1832	8,288	186	9	8
1833	886	20	19	7
1834	2,692	49	15	9
1835	2,282	39	4	3
1836	1,101	21	3	6
1837	1,923	43	0	0
Total,	286,839	5,396	19	9[1]

During this whole period old females were paid for at the rate of 1 groschen (1½d.) each, old males at 6, 4, or 3 pfennige in different years, and young ones at 1 pfennig[2] throughout.

If we look back to more remote times, we find that in the years 1699, 1710, 1751, and 1761, orders were issued by the government of Gotha to destroy the hamsters. They must have been very numerous in the beginning of the eighteenth century, as in 1721, 54,429 (19,145 old and 35,284 young) hamsters were paid for at the mansion-house of Gotha, as well as 25,707 in the neighbouring villages. After the middle of the same century their numbers had decreased, as the registers kept at the mansion-house of Gotha record 27,574 (6629 old and 20,945 young) from Michaelmas 1768 to Michaelmas 1769, and 22,812 (7244 old and 15,568 young), during the twelve months beginning with Michaelmas 1771.

It ought to be understood that the whole of the fields be-

[1] From this table it appears that very wet years are as favourable to the increase of the hamster as dry and hot ones. For 1817 was a very wet year as well as its predecessor, and yet in the five years of 1822, 1825, 1827, 1830 and 1831, the hamsters contrived to become comparatively very numerous.

[2] There are 12 pfennige to a groschen. One fourth of the premiums was paid out of the public funds, and three fourths by the proprietors or farmers.

longing to the town of Gotha comprise an area of less than 7000 English acres.

Although the injury done by the hamsters greatly overbalances their usefulness, yet the latter is by no means trifling. They firstly destroy a great many field-mice, larvæ, insects, and other vermin; then their fur is esteemed for lining coats, night-gowns, &c., as being light and durable. A good one is paid at the rate of 1½d. Lastly, their flesh is a very good and wholesome dish, and but for the stupid prejudice which prevails against it, the more easy classes of society might relish it as much as the ancient Romans did that of marmots and dormice.[1] However, it is thrown away to rot, and thought fit food only for gipsies or the poorest people, who do consume it in some neighbourhoods. The gardeners of Erfurt do, and the poor people in Silesia are said to eat a great many hamsters. *Hünerwolf* (see Ephem. Nat. Cur. Dec. II. Ao. viii. obs. 16, pag. 59) says that a poor *old* labourer at Arnstadt in Thuringia, who had for some time wholly subsisted on hamster-corn and hamster-meat, died of a sort of leprosy. This is the only instance in which bad consequences have been ascribed to that description of food, and the conclusion is evidently fallacious, as the man in question was probably affected with scabies senilis.

Besides, the stores which the hamsters collect in their burrows are partially reclaimed by such people as possess or farm no land. Where hamsters abound, they effect a sort of equitable arrangement between the proprietors or farmers and the cottagers. The hamster insists on his natural *right* to steal the corn, and the cottager avails himself of the positive law to sacrifice the thief and possess himself of the stolen property. At Gotha the hamster-diggers have to take out a license. They are mostly labourers or soldiers, and if skilled in this branch of their profession they gain a good livelihood. From March till St. John's day, when the fur of the hamster is finest, they dig after the animal merely for the sake of the fur and the premium, which they get on producing the skins at the mansion-house, where the tails are cut off and burnt. The hamster-diggers have the right to dig even in the fields sown with white crops till St. John's day, but they must fill the excavation again with the earth, which they need not do in the stubble fields. Then there is a pause till the winter-corn is cut, when they dig both for the animal and the store

[1] For the table, the hamster should be obtained about the time that the animal first becomes torpid (about the beginning of November), when it is in high condition, and may be killed without exciting its passion.

in the burrows, which however is very small at that season, and never exceeds 8 lbs. But after the summer-corn has been reaped, and throughout the autumn, the trouble of the hamster diggers is much better repaid, as they often find 50lbs. or more of corn in one burrow. The wheat and rye are cleaned and washed by them, and after having become dry they are as good for household purposes as any other. Barley, oats, peas, beans, french-beans, &c., obtained in this manner are commonly sold at half the price of what they cost in the market, and used for feeding pigs or poultry, without the same careful preparation to which wheat and rye are subjected. At the season when the hamsters are persecuted only for obtaining the skins, a skilful hamster-digger may catch (and has often caught) as many as 120, both young and old, on the same day; and in autumn, when two comrades commonly work together, a pair of hamster-diggers have sometimes obtained 400lbs. of corn, &c., within the same time.

Methods of catching and destroying the hamster.—The most usual way in which the animal is caught, is by digging it out of its burrow. For this operation a spade is used, and a peculiar kind of instrument consisting of an iron rod about a foot and half long, and having a sharp hook on one end, and a little shovel or scraper on the other. The hook is used to pull the animal out as soon as it makes its appearance in the course of the operation of digging, which begins from the creeping-hole; the scraper serves to keep the canal clear and to loosen the contents of the store-chambers. Besides, the people have sacks, into which to put the hamsters, corn, &c. They see the burrows at a considerable distance by the heap of earth. When this is small, and the holes are narrow and little distant from each other, they know that the inhabitant is young, that there is scarcely any corn, and that they will get only 1 pfennig for the trouble of digging out such a burrow, as the skin is of no value. Therefore they leave such a hamster alone, that he may grow old and profitable. But if the burrow have many plunging-holes, which are smooth and not mouldy, they know that it is inhabited by a female with her young. It is then worth while to dig after a litter of from five to eighteen young ones, which are got at with but little trouble. Formerly, when only 3 pfen. were paid for the old one at the mansion-house, she was allowed to escape, in order that she might bring more grist to the mill by producing a fresh litter, and she is sure to make the best of her way by digging onward in an horizontal direction; but now, as her price is 1 gro. there is inducement enough to dig after her, and quarter is no longer granted her. If the heap before the creeping-hole be very large, and mixed with much chaff and pieces of straw,—and if a well-trodden plunging-hole exist at the distance of six feet or more,—the burrow belongs to an old male; and the hamster-digger exults in the prospect of a good prize. If the season be not far advanced, the people possess themselves only of the stores, sparing the old knowing fellow, not out of gratitude, but that he may collect another store that very season. No legislation, unless incompatible with true justice can prevent the hamster-diggers from doing what they think most profitable to themselves, so far as the killing or sparing of the animals is concerned.[1]

The hamsters are also easily caught in traps set before their holes. The different kinds of rat-traps will answer the purpose with more certainty for the hamster than for the rat, the former being far less cautious. The trap in most general use is a pot dug into the ground, the cover of which shuts when the hamster enters to take the bait. There is also a very simple trap, the construction of which is founded on the irritable disposition of the hamster. In the middle of a board ten inches square, is made a hole four inches in diameter. A strong nail projects from each side of the board, near the rim of the hole; the sharp points of the nails are bent into the hole, so as to be opposite each other, with a distance of about two inches between them. There are nooses at the four corners of the board, which is fixed over the plunging-hole by means of pegs driven into the ground. In trying to leave or to enter its burrow, the hamster glides over one of the nails and is pricked by the other, upon which the animal gets into a passion, and in rushing violently backwards, after having been repeatedly wounded by the point opposite, he is impaled by the nail over which he first glided.

The animal may also be forced to leave its burrow by pouring into it a large quantity of water, which is perhaps the most convenient method, if a large tun or a cart can be had, and the object be merely to destroy the animal, without obtaining its stores.

Weimar, August 25th, 1839.

[1] The laws which were given for the cercles of Magdeburg and Halberstadt, in August 1696 and May 1714, were more arbitrary. The proprietors were ordered to deliver at the justice's, each year, fifteen hamster-skins for every rood (30 acres) of land; and the cottagers had each to furnish ten skins. For every skin that was wanting in these numbers, they had to pay a fine of 2 groschen.

Art. III.—*Zoological Notes on a few Species obtained from the South West of Scotland.* By William Thompson, Esq., F.L.S. &c.—Vice-President of the Natural History Society of Belfast.

I shall here follow up a few notes commenced in this Magazine in 1838, (p. 18), with reference to the occurrence of some of the rarer, or otherwise interesting species, procured within a limited portion of the south-west of Scotland.

Chestnut Shrew. *Sorex castaneus*, Jenyns., 'Ann. Nat. Hist.' v. ii. p. 43. From the neighbourhood of Ballantrae[1] I have received specimens of shrews, which, from agreement with Mr. Jenyns' description, I am disposed to regard as the *Sor. castaneus.* Some of the species belonging to this genus approach so closely, that it is almost necessary to have a comparison of specimens before a certain conclusion can be arrived at,—in the present instance I have not had this advantage, but judge from the comparison of the individuals under consideration, with others belonging to the most nearly allied species, *Sor. tetragonurus*, of which I possess two specimens (of different ages) so named by Mr. Jenyns,—the one taken at Twizell, and favoured me by P. J. Selby, Esq., the other taken by myself at Leamington, Warwickshire.

Ciliated Shrew. *Sorex ciliatus*, Sowerby; *Sor. remifer* of subsequent British authors. Of this well-marked species I obtained, when at Ballantrae, in August last, an individual taken in the immediate neighbourhood.

Bank Vole. *Arvicola pratensis*, Baillon; Bell's 'Brit. Quad.' p. 330. Of this handsome species, distinguished as British only a few years since, I have obtained two specimens from the vicinity of Ballantrae. Mr. Macgillivray mentions its occurrence at "Kelso and Bathgate, in the county of Linlithgow." 'Naturalists' Library, Brit. Quad.' p. 272.

Pomarine Skua. *Lestris Pomarinus*, Temm. I am indebted to a friend for the examination of a specimen of this bird, which was kindly brought from Ballantrae to Belfast for the purpose; it is a young bird of the year, and was found dead on the beach near this village, in the winter of 1837-8. The following measurements may perhaps enable any one interested in the subject, to judge that it is the species here set down.

[1] To my friend John Sinclaire, Esq. and to Dr. Wylie, I am indebted for all specimens hence obtained.

		IN.	LINES.
Length total		19	9
„	excluding central tail feathers (which are rounded at the extremity)	19	2
„	of wing	14	2
„	of bill above, measuring curve	1	7
„	of bill to rictus	2	3
„	of naked tibia	„	7
„	of tarsus	2	1
„	of middle toe and nail	2	1

Two-spotted Goby. *Gobius Ruthensparii*, Euph. *Gobius bipunctatus*, Yarr.—Of this fish, I, a few years ago, obtained specimens from Portpatrick, through the kindness of Capt. Fayrer, R.N. It is recorded as inhabiting the eastern coast of Scotland, by Dr. Johnston and Dr. Parnell.

Variable Wrasse. *Labrus variabilis*, Thomps.;[1] *Lab. maculatus*, Bloch.; I have seen taken commonly on the rocky coasts of Wigton and Ayrshire. It seems common in such localities around the British Islands.

Montagu's Sucker. *Liparis Montagui*, Flem., has on two occasions been sent me from Portpatrick by Capt. Fayrer. In one instance four individuals were taken at the same time adhering to sea-weed (*Fuci*) after it had been thrown ashore for manure. Dr. Johnston has met with this species on the coast of Berwickshire.

Æquoreal Pipe-fish. *Syngnathus æquoreus*, Linn. I have been favoured with a beautiful and perfect specimen of this fish, 20 inches in length, and which, along with a still larger one, was found dead on the beach near Ballantrae in the summer of 1838. In this specimen, as in the last I noticed, (Ann. Nat. Hist.), a caudal fin, though very minute, little more than half a line in length, is distinctly visible to the naked eye; under the lens five rays are very apparent.

The Worm Pipe-fish. *Syngnathus lumbriciformis*, Jenyns., has been procured at Portpatrick, and thence kindly sent me by Capt. Fayrer. This species, and the *S. æquoreus* have been obtained on the eastern coast of Scotland, near Berwick-on-Tweed, by Dr. Johnston; but to Dr. Parnell, who has so successfully investigated the Ichthyology of the Frith of Forth[1] and other portions of the British coast, neither they nor the *Liparis Montagui* have occurred.

Eight-armed Cuttle. *Octopus octopodia*, Flem. 'Br. Anim.' Penn. 'Brit. Zool.' vol. iv. p. 44, pl. 28, fig. 44. A

[1] See Proc. Zool. Soc. 1837, p. 159.

[1] Here the first British specimen of the *Syng. æquoreus* on record, was obtained by Sir Robert Sibbald.

specimen of this cuttle-fish favoured me by Capt. Fayrer, was found on the shore (I believe) at Portpatrick, in April 1835. The length of body is 3 inches, the breadth $2\frac{1}{2}$, head $1\frac{1}{2}$, arms 7 inches. This individual differs only from that described by Dr. Grant, 'Flem. Brit. Anim.' p. 254, in size, and in the trivial difference of the arms being webbed beyond the twelfth sucker. The specimens which I have seen cast ashore on the opposite coast of Ireland were generally about the size of the present one.

HORRID CRAB. (Penn. Brit. Zool. vol. iv. p. 6, pl. 8, fig. 14.) *Lithodes Maja*, Leach. By Dr. Wylie, of Ballantrae, I have been favoured with a very fine specimen of this crab, which was taken in a herring net there in the summer of 1838, and in water from twenty to thirty fathoms in depth. It was brought to Dr. W. by the fishermen, as a species they had never before met with.

Hyas coarctatus, Leach. In April 1835, specimens of this crab were sent me from Portpatrick by Capt. Fayrer.

LONG-HORNED CRAB. (Penn. Brit. Zool. vol. iv. p. 3, pl. 1, fig. 3.) *Porcellana longicornis*, Edw. Crust. t. 2, p. 257. Received with the last.

PLAITED LOBSTER. (Penn. Brit. Zool. vol. iv. p. 15, pl. 14). *Galathea strigosa*, Fabr. Received with the last.

LONG-CLAWED LOBSTER. (Penn. Brit. Zool. vol. iv. p. 14, pl. 13). *Galathea rugosa*, Edw. Crust. t. ii. p. 274. Received with the last.

All the species here enumerated, except the three first mentioned, have been obtained on the opposite coast of Ireland.

Belfast, Nov. 12th, 1839.

ART. IV.—*On the Monkeys known to the Chinese, from the native authorities.* By SAMUEL BIRCH, Esq. Assist. in the Dept. of Ant. of the Eng. Sec. Brit. Mus.; Assist. Sec. to the Archæological Institute of Rome.

AT a period not very remote the writer of the present article, to aid the researches of a naturalist relative to the monkeys known to the Chinese, undertook a series of translations from the 'San tsae too hwuy,' or 'Pictorial Encyclopedia of the Three Sciences,' of the descriptions annexed to the plates of the various monkeys that are found in the division of Zoology in that exceedingly interesting work. The great Encyclopedia of Ma twan lin did not at that time, to the writer's knowledge, exist in London; and the distractions incident to the business of life have not allowed him the leisure to inspect a copy of it, should it be in the possession of University College, in the splendid library of Dr. Morrison. Although the 'Kang-he tsze teen' was not minutely examined, it was occasionally referred to; but since Chinese plates are far better than descriptions for the general enquirer, the 'San tsae too too hwuy' was the work chiefly consulted, and other works used in a subsidiary point of view, to eke out its deficiencies. Some idea seemed fixed in the naturalist's mind that a higher order of apes than either the oran-otan, or chimpanzee, had been said to exist in China; and accordingly the native authorities were most diligently searched, in order to find the animal in question, and the results, such as they are, are now at the disposal of zoologists.

The oldest work which contains pictorial illustrations, is the 'Shan hae king,' or 'Book of hills and streams,' a very dull itinerary of the empire, full of mythological ideas relating to "dragon-haunted streams and elf-frequented hills," but excessively monotonous and prosy in its general narrative.—It is illustrated with an ample commentary, and was written during the dynasty of Han; being of some archæological interest, but tiring to the patience of the general reader. In this book appears a plate of an animal called *Sing-sing* or *Sang-sang;* and the account, as well as the plate, have been implicitly followed by the Encyclopedia which appeared under the dynasty of Ming. As this is the animal called oran-otan by the Jesuits and Dr. Morrison, a short description of the plate is necessary. As figured, it is essentially *man;* it stands erect, with a broad human countenance, and mass of frontal brain; it has *feet*, not *hands*, on its posterior extremities: in its left hand, articulated as in mankind, it holds a bunch of fruit, in its right, a young animal of the same class. The features are Caucasian, and its hair reaches from the crown of the head, whence it falls in rich profusion, to the earth. "In its exterior appearance," says the Shan hae king, "it is like an ape; it walks with its face down, runs erect, and comes out of the Chaouyaou hills."—(Plate iii. 1). The description annexed to the plate of the 'San tsae too hwuy' states,—"Tseo shan yew show chwang joo yu, luy Me-how, fa-chuy ta; keang-tung shan chung yih yew ming Sing-sing nang yen." "In the Tseo magpie hills there are animals whose external appearance is like an ape's of the Mehow species; their hair reaches to the earth. In the Keangtung hills there are animals called Singsing, that can speak."—(Zoology, Book iv. Art. 39). In the 'Kang-he tsze tsen,' under the article Sing, are collected a number of accounts from other dictionaries relative to this animal; and as this work forms an integral part of every Chinese library, it will be unnecessary to quote the original text, since it is readily accessible to sinologists in general. Sing, (after the usual preliminaries as to pronunciation), "The Yupeen[1] observes that the Sing are like dogs with a human face; the Kwangyun that they are like an ape; the Urh ya shih show that they are small, and addicted to weeping; the Shan hae king, that it has a man's face, a swine's body, can converse, and is found in the Fung ke heen of Keaoule (Cochin China); also that its external appearance is like a Hwan,[2] and that its cry resembles a pig's squeak, or a child's weeping; the Leo ke-le, that the Singsing can speak, but is nevertheless a beast." Nearly similar stories are given of the Sang.

The term "swine's body" does not ill apply to the comparative nakedness of the oran-otan's, when considered in relation with the other apes, as a reference to any specimen will fairly prove. The conversational powers of this animal is a fiction purely Chinese, from its mournful chattering note.—But the most interesting account of it is in the Ching tsze tung Dictionary; where, after narrating at some length the manner of catching them, by means of wine and wooden shoes, the following opinions of ancient works are quoted on the subject. "The Sho wan says that the Sing-sing make a hasty noise, like a dog's bark, and nothing more. Toopo, in the account of the southern hills, gives a plate representing a Sang-sang like a monkey. In the description of the interior southern rivers, it is stated, there are plates representing the Sang-sang like a dog, also a Sing-sing whose external appearance resembles a monkey. It can speak, and each part has three feet. The original representation is like an ape, it runs erect, but walks prone to the earth, like a dog. It is said to be naturally addicted to wine, and fond of lighting a fire. It can speak, that is to say, it can emit a sound like a child, and it knows how to keep up a conversation.—There are two sorts of Sing-sing and Sang-sang, the great and small; and without doubt they can speak as a dog does to a dog, by assuming a kind of angry note. However, Too and the plates are 'at spear and shield' (contradict each other); if they are in the shape of a dog they cannot speak like a man. In the Shan hae king in the account of the interior southern

[1] 'Gems Arranged,' a Dictionary mentioned in Dr. Morrison's preface, as well as the Kwang yun. The Urh ya, a quarto-sized work, is pictorial like the San tsae &c.

[2] This animal is sometimes said to be like a wild swine, at others like a wild dog.

rivers it is stated, that three hundred le up in the woody district of Tsowsze there are male Sang-sang. In the history of the eastern latter Hans, it is said that there exists a tradition among the southern barbarians, that the *Yen-mang* foreigners have birds called Hoke (game cocks?) and Sang-sang." In the Japano-Chinese Encyclopedia entitled the 'Heuen cheuen too hwuy,' or 'Collection of Plates explaining Sounds,' a copy of which is in the possession of the British Museum, and is the identical one brought by Kæmpfer from Japan, purchased of him by Sir Hans Sloane, and from which many of the plates in his work are taken;—is a plate (part xii. 9) of the Sing-sing, here evidently an oran-otan walking erect, with large ears, black body, and short cur-like tail. There is no description attached to it.

From the mass of evidence presented upon this subject,—evidence so totally discrepant and conflicting, comparatively little can be gleaned. The Sing-sing is most probably the oran-otan, elevated by popular tradition into a rank intermediate between man and monkey. In the natural history of a people who have committed errors so gross and ludicrous, as will be shown in the course of this communication,—and who admit into their system every monstrosity that morbid imagination has conceived, the assumption is almost proved. At the same time it comes within the limits of the circle of probabilities, that in the interior, so unexplored, so wild, and so infested by brigandage, there may exist a race of men driven out of the pale of human civilization, like the Cargot or the Guoita, and degraded by popular opinion into animals; or that in a country where infant exposure is tolerated through the maximum of its population, some idiots, whose life has been spent amidst the mountains, may have presented the melancholy spectacle of a humanity so depraved that its fellow-wearers have refused to admit it into their privileges.

Another type that falls into this class is the [1]Joojin, or "man-like." In the 'Shan hae king' it is called Tung yang (eastern sun man), and placed among the races of men; but in the San tsae &c. it is arranged among beasts. If ever it had existence, it must have been man. It walks erect, is not quadrumanous, and the only circumstance that could have given rise to a notion of its being a beast, must have been the extraordinary appearance of the head, which, in the engravings, looks as if an incision had been made in the skin of the forehead,

[1] The Joo jin is apparently the oran-otan, but has the addition of hair. For the indications of the scientific names of the animal, the writer is indebted to John Edward Gray, Esq. of the British Museum.

and the cuticle thrown down over the mouth, entirely covering the eyes, and rendering the visage totally irrecognisable. The plates and descriptions are the same in both, viz.—"Tung-yang kwo yew Yu-yu, Urh ya tso fuh-fuh chwang e jin hih shin pa fa, keen jin tsih seaou seaou, tsih yèn ke-muh Too-po yun fuh-fuh wae show pa fa Sing-suh hwo jin seaou chin-yen kemuh chung nae Kaou-taou fan wei go tsan."—"In the kingdom of Tung yang are inhabitants which the Urh ya calls Fuhfuh; their appearance is human, with black body and straggling hair. When they behold mankind they smile, then become alarmed and screen their eyes. Toopo says that the Fuhfuh are monsters with straggling hair and *Sings' feet*, and that when they catch men they smile, become alarmed, screen their eyes, burst out into a loud wail, and turn back to kill us."

The Tung-yang (eastern sun) kingdom may possibly refer to the Corea. The word Fuhfuh is here written with the substitution of the sixtieth for the ninety-fourth radical of the language, an occurrence not uncommon in Chinese literature. From the term, *Sings' feet*, it is evident that the writer contemplated the hand-shaped foot (to use such a term) of the ape tribe, as distinguished from that of man. Analogous to this monkey is the Fuhfuh, of which some account is given under its name in the Kang he &c.—"The Urhya &c. affirms that it is like a man, with straggling hair, walks rapidly and eats men. The Shan hae king, that in appearance they are like men, with long lips, with black hairy body; they turn back and follow men's footsteps when they see them, and then laugh. In the hills of Keaoukwang, and also in the Nang kang district, are beasts of a large size, ten cubits long, commonly called Shan too. The Shan hae king calls them Neaouyang (vicious goats), and also Kan. In the chapter of kings in the Annals of Chow, the northern provinces are said to call them Toolow (babblers)." Similar accounts are given of this animal in the 'Ching tze tung,' and in the Japano-Chinese Encyclopedia is a plate representing the Fuhfuh sitting upright. The lower extremities of the animal are not visible; but from what is seen, it bears considerable resemblance to the mandrills, or ribbed-nose baboons. It is called in Japanese fi-fi. Fuh-fuh yew tso fuh-fuh ming neaouyang hwo e (?) Shantoo yih tung. "The fuh-fuh,[1] also

[1] See second reduplication in the text. In the preface or abstract of contents, after the character Sing, Zyao occurs some Japanese at the side of Fuh; Fi-fi; by the aid of Mr. Medhurst's Vocabulary the two terms have been made out, but the reading of the Hiragana character is not easy. The Fuhfuh is not very distinct, and is the *Simia Nasutus* or *Papio Maimon.*

written thus, called Neaouyang or Shantoo." (Heuen &c., Part 12, Zoology, page 9).

This closes the chain of evidence collected relative to the animals which have any pretensions to rank in their works with mankind. The observations made with regard to the Sing-sing apply very nearly here. The same difference of native opinion casts the same doubt upon the authenticity of their accounts. Natural History, as a science even of observation, has been, and under the present system always will be, at a low condition among a people, where all knowledge but that of government and morals, ranks scarcely above the mechanical arts. The collection of a few popular traditions,—the rough delineation of objects as vaguely seen, not comprehended,—has been all that China can boast; and the practical and deeply-theoretical examinations and inductions which build up the towering structure of western lore, must be infused into them from without, the Chinese have it not in them, and, with their distaste for innovation, they never can examine the products of nature with the eye of accuracy and generalizing power. The Zoology of the San tsae too hwuy is a glaring instance of this; the fabulous and the true —imagination and observation—are alike blended in a disorder startling to a European eye. The 'Urhya' is rather more correct, for it has at least the merit of arrangement in great classes, wide and abrupt in their transitions, but still holding out sufficient landmarks for future improvement. The 'Shan hae king' is one mass of confusion; it rejects indignantly all arrangement. The Japanese Encyclopedia has a mere glimmering of presenting its animals according to their type;—an idea feebly maintained. The only work in which the writer of the present article has seen any allusion to the modern system, was in one apparently new, where the artist had, in addition to some birds, depicted the claws and beaks, which must have been gathered from some European work, since such was utterly beyond Chinese power. Yet we must still concede to the Chinese that they have observed and noted, to the best of their ability, the animals existing in their own country, and have most signally failed where they have relied on mistaken information afforded from external sources; and that European writers of their date present as little truth.

(To be continued.)

ART. V.—*Observations on the* Rodentia, *with a view to point out the groups as indicated by the structure of the* Crania, *in this Order of Mammals.* By G. R. WATERHOUSE, Esq., Curator to the Zoological Society, Vice-Pres. of the Entomological Society.

(Continued from page 279.)

Family V.—ARVICOLIDÆ.

DENTITION.—Incisors as broad as deep, nearly cylindrical: molars $\frac{3\cdot3}{3\cdot3}$, or $\frac{4\cdot4}{4\cdot4}$, rootless.

Skull.—Ant-orbital opening of moderate size, or small; anterior root of the *zygoma* thrown up from the plane of the palate: temporal bone produced anteriorly and laterally, and encroaching on the temporal *fossæ*: palate more or less contracted in front, the inter-molar portion descending more or less below the level of the anterior portion.

Lower jaw.—Coronoid process large (usually very large); articular surface of the condyles broad,—in some species with the transverse diameter equal to the longitudinal: descending *ramus* with the angles twisted outwards, and situated above the plane of the crowns of the molar teeth.[1]

The genera *Castor*, *Ondatra*, *Arvicola*, *Lemmus*, *Geomys* and *Spalax*, belong to this family.

A transverse section of an incisor tooth, in *Arvicola* presents a nearly circular figure (fig. 70,) and in this respect differs from *Mus*, in which the incisors (*m*) are almost always compressed and deeper from front to back, and where the sides and front are nearly flat. In the molar teeth in the present family the folds of the enamel generally divide the tooth into angular-shaped portions, as represented in the figure of the skull of *Ondatra*, and these teeth are rootless, and continue to grow at the base as they wear away at the opposite extremity; but in aged individuals the supply of pulp decreases, and the base of the tooth begins to divide into two or three false fangs, as in fig. 70, *k*, which represents a molar tooth of very old specimen of the *Muskwash*. I say false fangs, for these roots are of an irregular form and unlike the true fangs of the rat's molars.

[1] The only rodents I am acquainted with, besides the *Arvicolidæ*, in which the descending *ramus* of the jaw is thus raised, are those belonging to the genus *Cricetus*, but here this process is of the same form as that of the rat, and the space occupied by the molar teeth is remarkably small, whereas in the *Arvicolidæ* it is great.

The molar teeth of *Spalax* (*n* and *o*) possess the same irregular-formed and imperfect fangs as are found in old specimens of *Arvicola* and *Ondatra*, but apparently they have these fangs at an early age, and thus evince approach, as regards the teeth, to the *Muridæ*. The *cranium* in the *Arvicolidæ* is usually rather broad, and proportionately shorter than in the *Muridæ;* in *Ondatra, Arvicola,* and *Lemmus,*

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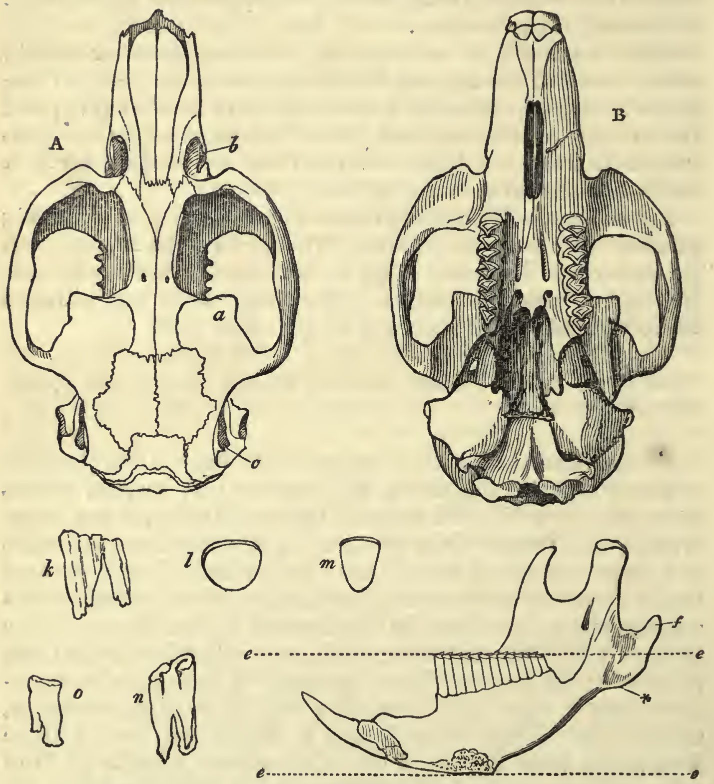

Skull and lower jaw of *Ondatra zibethica.*

(*k*) molar tooth of an aged specimen of *Ondatra*. (*l*) section of incisor tooth of *Arvicola*. (*m*) section of incisor of *Mus*. (*n*) and (*o*) molar teeth of *Spalax*.

the temporal bone is produced anteriorly and laterally, and in some of the species forms an angle, as in *Arvicola am-*

phibia, and *Ondatra* (*a*); in *Lemmus Norvegicus* and many of the smaller species of *Arvicola* this portion is rounded; in the remaining three genera, *Geomys*, *Spalax* and *Castor*, the temporal bone is less produced; it nevertheless encroaches considerably on the temporal *fossæ* in these genera. The superior maxillary bone sends backwards a lamellar process (*b* in the figures), in most of the species of the present family, as in the *Muridæ*; *Castor* and *Geomys*, however, afford exceptions. These two genera differ moreover in having a very small ant-orbital opening, which is situated far forward; in the former there is a projecting fold of bone which protects the anterior outlet of this opening. In most *Arvicolidæ*, the malar bone is broad and vertically compressed; it is immensely developed in the beaver, and unlike other species of the present group, runs up to join the lachrymal bone.[1] On the other hand, in the two genera *Spalax* and *Geomys*, it is small and very slender.

The anterior root of the *zygoma* is in the form of a thin plate, of considerable extent. This plate is oblique in its position, and its lower edge is emarginated as in the rats. The genus *Spalax* forms an exception, this plate being of but small extent.

The incisive *foramina* are tolerably large in *Ondatra*, *Arvicola* and *Lemmus*, but small in the remaining genera; they are always situated partly in the inter-maxillary and partly in the maxillary bones, excepting in *Geomys* and *Castor*, where they are confined to the inter-maxillaries.

The palate is moderately broad and but slightly contracted between the anterior molars, in *Arvicola*, *Ondatra* and *Lemmus*; in *Spalax* and *Geomys* it is narrow, and in the beaver it is much contracted between the anterior pair of molars, but expands posteriorly. The skull in *Geomys* (fig. 71) is remarkable for the peculiar form of the posterior portion of the palate. The two pterygoid bones converge and meet in front, where they expand, and joining with the palatine bones form a horizontal platform, which is situated between the hinder pair of molars, and considerably below the plane of the palate; opening on to this platform are two large *foramina*, which are the outlets of two horizontal canals: these canals run under the palatine bones, and open in front of them, and are then continued forwards on the palatine portion of the superior maxillary bone, in the form of two deep grooves. A similar structure may be seen, but in a less marked degree, in the common water-rat, and some other *Arvicolæ*.

[1] The malar bone of the beaver differs also from other *Arvicolidæ*, inasmuch as it enters into the composition of the glenoid cavity.

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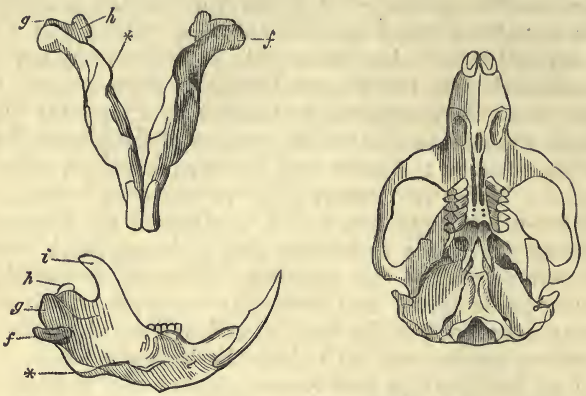

Skull and lower jaw of *Geomys umbrinus* ?

The same skull (*Geomys*) possesses two or three other peculiar characters which are worthy of notice, particularly the broadly expanded and almost flat form of the glenoid cavity of the temporal bone, the very small size of the antorbital *foramina*, which consist merely of two short vertical slits, and the straightness of the nasal bones; these are but very slightly broader at the apex than at the base, and not distinctly expanded in front as in other *Arvicolæ*. The interparietal bone is small and nearly of a semicircular form.

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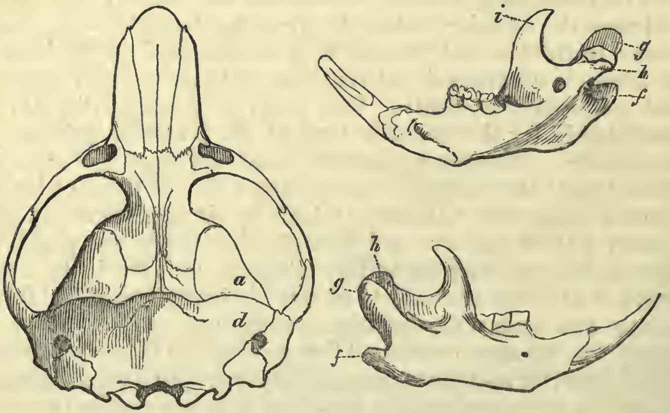

Skull and lower jaw of *Spalax typhlus*.

The skull of *Spalax typhlus* (fig. 72), like that of *Geomys*, has a broad and very slightly concave glenoid cavity to the temporal bone; behind this cavity the temporal bone is dilated, and forms a large and deep hollow, which apparently receives the broad condyle of the lower jaw when it is drawn back. The ant-orbital outlet is larger than in other *Arvicolidæ*. In the skull before me the suture between the nasal bones is completely obliterated in front.[1] But the most remarkable character in this skull is the form of the occiput (*d*), which is enormously large, and instead of being as usual vertical, in its oblique direction[2] reminds us of the occiput in the *Cetacea*, seals, and some other aquatic mammals.

The upper and lower margins of the occipital opening, in nearly all the skulls of *Arvicolidæ* which I have examined, are situated in the same vertical line, that is to say, a straight line touching the upper and lower boundaries of the *foramen magnum* is at right angles with the plane of the skull. Upon first observing this character in the beaver[3] and *Ondatra*, I imagined that having connexion with the position of the head, it might be attributed to the aquatic habits of these animals, being aware that the same character was found also in the seals, whales, and some other aquatic mammals; I perceived however, upon further examination, that in the *Coypus* (*Myopotamus Coypus*) and the *Capibara* (*Hydrochæres Capibara*), two other aquatic rodents, the upper and lower boundaries of the occipital *foramen* did not differ in this respect from the terrestrial species; whereas, on the other hand, in *Spalax*, the lower boundary of this opening projects beyond the upper, and forms an angle of about 93°; it is remarkable therefore, that the great angle formed by the boundaries of the occiput occurs in all the *Arvicolidæ*. In *Arvicola agrestis* and *Geomys umbrinus*? the upper margin of the *foramen magnum* projects slightly beyond the lower, yet in these animals the upper and lower boundaries of this opening approach more nearly to a vertical line than usual.

The form of the lower jaw in the animals of the present family affords an easy character by which they may be distinguished from other rodents, at least from those whose skulls I have examined: the peculiar position of the angle of the jaw, however, is not striking unless the jaw be placed in its natural position, that is, so that all the molars meet those of

[1] In the skull of a species of *Geomys* I find the nasal bones anchylosed in like manner.

[2] In the *crania* of *Arvicolæ* and *Ondatra*, there is a slight approach evinced to this form of occiput, and in *Geomys* the occiput slopes forwards in a considerable degree.

[3] I ought to say the *adult* beaver, for in the young animal the upper boundary of the *foramen magnum* projects over the lower.

the upper jaw, and *not* as represented in Cuvier's plate in the Ossemens Fossiles, vol v. pt. 1, pl. 3. I mention this because being myself in the habit of twisting the jaw of these rodents in an unnatural position when comparing them with others, it was some time before I perceived its peculiar characters, characters which are important, inasmuch as they are combined with numerous others.

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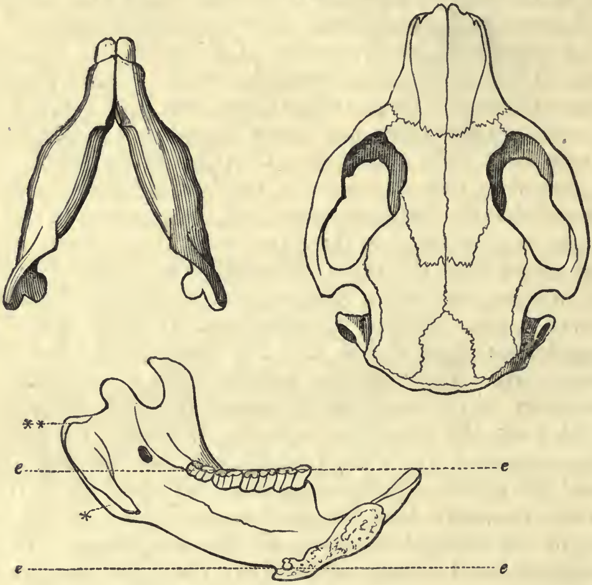

Skull and lower jaw of *Castor Fiber.*

Upon comparing the jaw of the beaver (*Castor Fiber*) with that of other rodents, the most striking characters consist in the large size of the coronoid process and the form and position of the descending *ramus*, or that part (* in the figures) which lies below and behind the alveolus of the inferior incisor. In the species of rodents belonging to the several families already pointed out, the descending *ramus* approaches more or less to a quadrate form, the upper posterior angle being generally acute, but the lower part more or less rounded. The descending *ramus* of the beaver differs in being more extended in the direction parallel with the dental portion of the jaw, and less extended in a transverse direction; and if the jaw be placed in its natural position the angle (*) is situated above the plane of the *symphysis menti*, or above the lower line *e e*, which is drawn parallel with the grinding surface of the molar teeth, represented by the upper line *e e* in the figures; the angle (**) is much elevated, and in fact is situated above the upper horizontal line just mentioned. Now it will be seen upon referring to the figure of the jaw of *Ondatra*, that the same characters exist,—the jaw of this animal differs from that found in other rodents in the same manner, here, however, the angle ** is considerably produced, and somewhat twisted outwards; the transverse diameter is proportionately rather less, and the longitudinal greater. In *Arvicola* and *Lemmus*, with the same general characters, we find the descending *ramus* still more twisted; here the greater portion of this process has assumed an almost horizontal position. The jaw of *Spalax* differs from that of *Arvicola* in the comparatively small transverse diameter of the descending *ramus*, and its greater longitudinal extent; the upper angle is directed outwards, and forms a small nearly semicircular platform, which is oblique in its position; the lower incisor is remarkably long, and extends backwards and outwards with its thin covering of bone beyond the condyle, so that the jaw appears as if it had a double condyloid process. The apex of the coronoid process is situated above the condyle, as in the beaver, in the form and height of the coronoid process however, *Geomys* approaches still nearer to the beaver. The peculiar form of the posterior part of the jaw of *Spalax* occurs also in *Geomys*, excepting that here the lower portion of the descending *ramus* is still narrower, and is merely represented by a slight ridge which runs along the under side of the alveolus of the inferior incisor; the upper portion assumes the form of a semicircular and nearly horizontal platform (the upper surface of which is slightly concave), which is situated on the outer side of the alveolus of the incisor, a little below the level of the articular surface of the condyle. As we view the jaw from above, the condyle is the innermost of three processes: the projecting plate, or angle of the jaw just described, being the outermost, and the bony covering of the posterior portion of the incisor being situated between the two.

The three skulls figured afford types of all the forms which I have met with in the *Arvicolidæ*. The skull of *Ondatra* resembles that of the water-rat, and that of the lemming (*Lemmus norvegicus*) differs only in being proportionately broader and shorter, and in one or two points of minor importance. Like the species of *Arvicola* and *Ondatra*, the lemming has an opening in the temporal bone, situated behind the zygomatic process.[1] This opening is very large in the common water-rat; in the beaver the corresponding opening is small.

Art. VI.—*Description of the Pupa of* Necrodes littoralis. By Henry Buist, Esq.

When collecting insects on the 5th of this month (October) among the sand-hills which stretch along the sea coast to the north of St. Andrews, I picked up the *pupa*—which I suppose to be that of *Necrodes littoralis*—from which the accompanying drawings were made. Fig. 1, represents the *pupa* in its natural position, and shows its under side; fig. 2, represents it spread out in the way that *Coleoptera* are generally set, and exhibits the upper side.

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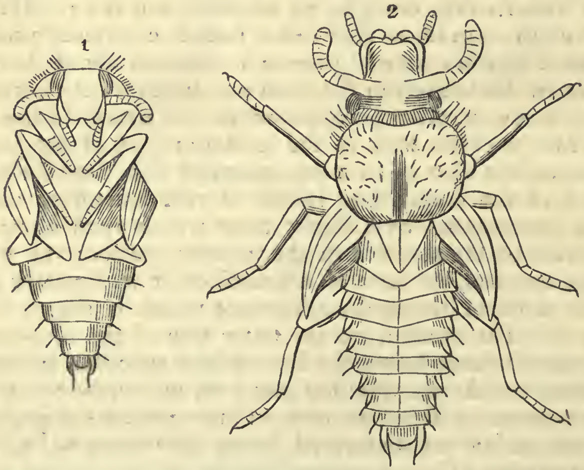

Pupa of *Necrodes littoralis.*

The *pupa* is about an inch in length and entirely of a pale white colour; the head is applied against the breast (fig. 1); the *antennæ* are club-shaped and lie along the sides of the *thorax;* the eyes are represented by a patch of a purplish colour; the *thorax* is covered with scattered brown hairs, and there are three larger ones of the same colour on each of the

[1] A similar opening is observable in the skulls of many rodents.

anterior angles; the *scutellum*, as in the perfect insect, is large; the *elytra* are short and folded over the sides of the body, and marked with three elevated lines, similar to those on the perfect insect; the wings are longer and meet on the under side of the *abdomen;* each segment of the *abdomen* is furnished at the sides with a large brown hair, and there are two anal ones. The two anterior pair of legs are folded over the breast and are quite exposed; the posterior pair are covered by the wing-cases, a small portion of the *tibia* and *femur* only appearing beyond the body. The joints of the *antennæ* and *tarsi* of the future insect are perfectly visible when held between the observer and the light.

That this is the *pupa* of *Necrodes littoralis* I am led to believe[1] from its great similarity to the perfect beetle, and from my having taken almost at the same time a specimen of the perfect insect from the carcass of a horse close by. It is very probable that the *larva* buries in the sand and there changes its state. When handled it moved the *abdomen* in the same way as the *pupæ* of butterflies and moths do. It was infested by a small species of mite (*Acarus* ?).

Mr. Westwood does not appear to be acquainted with the *pupæ* of the *Silphidæ*, for in illustrating the transformations of this family (to which *Necrodes littoralis* belongs) in his truly valuable 'Introduction to the Classification of Insects,' he copies his figures of the *larva* and *pupa* of *Necrophorus humator* from 'Rösel's Insect. Belustig.' vol. iv. pl 1, and states that the *larvæ*, when full grown, "form for themselves a cell under ground, with the inner surface smooth and shining, and in which they assume the *pupa* state, being at first of a whitish colour, and having two strong anal spines, whereby they are enabled to turn themselves about in their cell; as they advance to maturity they gradually assume a darker colour."[2] On comparing my figures with those of Rösel, as given by Westwood, we find the hairs on each segment of the *abdomen*, which are so conspicuous on my specimen, are entirely wanting in his; the apex of the *abdomen* is also different; but the *thorax* appears, as in my specimen, to be covered with hairs.

Law Park, near St. Andrews, Fifeshire,
15*th Oct.* 1839.

[1] Before I reached home the specimen from having met with some injury, was dead, and thus I was deprived of the most certain means of proving that it really is the *pupa* of the insect spoken of. I have not since had an opportunity of visiting the spot, or of obtaining another specimen.

[2] Westwood's 'Introduction to the Modern Classification of Insects,' vol. i. page 138, fig. 10 (8 and 9).

SHORT COMMUNICATIONS.

Remarks on the mode of collecting Land and Fresh-water Shells,—There is, perhaps, no portion of the Fauna of our country of greater interest and more easily collected than the land and fresh-water shells, requiring but little exertion for their capture. The land species are to be found abundantly (particularly after rain, when they ramble forth to feed upon moistened herbage) in hedges, on banks, trees, walls and palings, among moss, under stones, &c., but more especially among the rejectamenta of rivers, when the tide has swept many of the smaller species from the banks, and deposited them again on its receding. In dust collected from various places, such as the tops of old walls, where the leaves of ivy or other plants have formed a bed by their decay, many curious and minute species may also be found.

Those of fresh water are to be found either in slow or running streams, in still waters, on aquatic plants, in mud, in ditches adhering to stones, &c. &c. It has been found necessary, on account of the minute character of some of the species of fresh-water shells, to make use of a net formed either of *wire-gauze*, or the article denominated *lenoe*, to the depth of an inch or more, to collect them. This net being fixed to an iron ring at the end of a staff, can with the greatest facility be made use of in those situations where shells abound. When it is required to search for those species which are generally slightly buried in the mud, or at the bottoms of ponds and ditches, such as the different species of *Pisidium*, the method to be adopted is to skim the surface of the mud so that it may easily enter the net, and by bringing the net to the surface of the water, and gradually moving it from side to side, the superfluous mud will be washed through the meshes of the gauze, leaving the small shells intermingled with pebbles &c. in the net. In this collection it is easy to distinguish the shells from the superfluous matter by means of a lens, and with the assistance of a small pair of forceps, they may be removed from the mass and placed in any convenient receptacle.

Having thus collected both land and fresh-water shells, with their inhabitants alive, it is necessary to destroy and extract the animal, in order to clean the shell for the cabinet. To accomplish this, they must be placed in boiling water, and after remaining in it for the space of ten minutes, decant and add cold water. The extraction of the animal is the next step, and for this purpose a pin or needle (for the smaller species) is to be introduced into the shell, and the animal taken out. The shell must then be well washed with water; if it be of a delicate texture, a camels' hair pencil may be used with much advantage to clear away any small particles of dirt that may adhere to the interior. The shell being cleaned and the species ascertained, the preparation employed for fixing them to the card, is a mixture of gum, sugar, and starch, which has been found to answer the purpose better than plain gum, as being more tenacious.—*Daniel Cooper, Surgeon, A.L.S., Curator B.S.L., &c.*—82, *Blackfriars Road, London, Oct.* 16, 1839.

Notice of some Goshawks in the possession of the late Mr. Hoy.—In the early part of the month of September last, Mr. Hoy visited London on his way to his residence at Stoke Nayland, in Suffolk; he had been on the continent in order to obtain some goshawks, for the purpose of hawking, to which sport he was much attached; and, I believe few persons better understood the nature, habits, and the modes of training and using birds of prey, than himself. He mentioned to me long since, that he kept several hobbies (*Falco subbuteo*) about his residence, giving them their full liberty the whole summer, and allowing them to range about the country as they pleased, but always using them to come to him every day at three o'clock to be fed; at which time he would walk into a field adjoining the house, and, by whistling or waving a glove in the air, although the birds were not before visible, they might be seen coming towards him with great rapidity, and alight one after another upon his arm to take their meal, after which they would fly off, and perhaps not be seen until the following day. Sometimes at a distance of three or four miles from the house, he has seen one or more of them, and by making the usual sign, they would alight upon his hand; but it was necessary to confine them before the season of migration, or they would leave and not return, after they had become wild—as was proved by trying the experiment. During the short stay Mr. Hoy made in September last, I called upon him for the purpose of seeing the goshawks: there were four of them, three males and one female,—the female, a bird of the year, was the largest and most powerful bird of the species I ever saw; Mr. Hoy told me she could secure with ease a full-grown hare.

With regard to using these birds, Mr. Hoy informed me that their habits, mode of flight, &c., were much better suited to an enclosed district like Stoke Nayland, than those of the peregrine falcon. When used or taken into the field, the wing of a bird, or the thin end of an ox tail, is generally held in the hand to engage their attention, which they are constantly biting and tearing without being able to satisfy their appetites, as that would render them unfit for work. They do not require to be hooded, but have bells attached to their legs, (for the purpose of giving notice of their situation when they alight, which would otherwise be difficult to ascertain), and a leather strap by which they are held; it is also necessary to have spaniels to hunt up the birds, upon the appearance of which, the hawk flies from the hand with incredible swiftness direct at the game, taking it generally in the first attempt, but should he fail, he will perch on some elevated situation, and remain until the game is again started, and is rarely known to miss a second time; when the hawk has captured the game, he is rewarded with a small piece of meat, or a pigeon's head, to induce him to give up the prey: if the hawk be allowed to range at pleasure, by whistling it will return with a swiftness truly astonishing, and finding it cannot stop suddenly to settle without striking you with great force, it will glide past, form a circle round you, and alight with the greatest ease, and in the most gentle manner, upon the hand.—*A. D. Bartlett.—Nov. 20th*, 1839.

[The death of Mr. Hoy, whose contributions have often appeared in the Magazine of Natural History, took place about two months since, under peculiarly painful circumstances. He had placed a quantity of damp gunpowder in an oven, for the purpose of drying, and which he unfortunately omitted to remove. The result of this negligence was an explosion, which was expected to prove fatal to one of his servants; and the anxiety of mind naturally attendant upon so distressing an event, brought on an attack of fever which terminated fatally at his residence in Suffolk. M. Hoy devoted his time almost entirely to the cultivation of Ornithology, and was in the frequent habit of visiting the continental localities which are favourable for the resort of the British species during the season of incubation. He was in possession of a large share of valuable information relative to the indigenous birds of this country; and the readiness with which, at all times, he was willing to aid the enquiries of his fellow-naturalists, will render his loss a subject of sincere regret.—*Ed.*]

Note on the Chalk-Ventriculite figured in page 352.—The specimen is clearly the base of a *Ventriculite*, with the radicle-processes attached to an *Echinus*; for I cannot assent to the remark, "that the *Ventriculite* cannot have been growing on a dead shell,"—for the root of the *Ventriculite* is *not* at the smaller extremity, but at the larger. Flints of this shape are very common; the marking * shows the section of the stem of the enclosed zoophyte, the openings, *o*, are the hollows left by the radicle-processes. I fear you will scarcely understand my meaning from this hurried scrawl; but I have so little leisure at my command, that I am compelled to write in great haste. —*G. A. Mantell.—Crescent Lodge, Clapham Common.*

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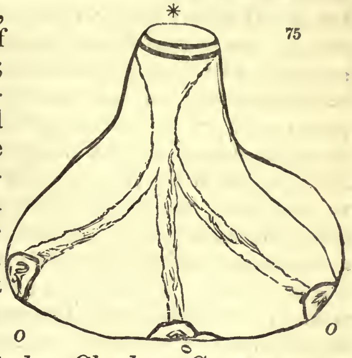

[Our best thanks are due to Dr. Mantell for kindly correcting an error into which we had fallen in our remarks on the Ventriculite, a tribe of fossils to which, as it is well known, he has most successfully given his attention.—E*d*.]

Extract of a Letter from Miss Anning, referring to the supposed frontal spine in the genus *Hybodus.*—"In reply to your request I beg to say that the hooked tooth is by no means new; I believe that M. De la Beche described it fifteen years since in the Geological Transactions, I am not positive; but I know that I then discovered a specimen, with about a hundred palatal teeth, and four of the hooked teeth, as I have since done several times with different specimens. I had a conversation with Agassiz on this subject; his remark was that they were the teeth by which the fish seized its prey,—milling it afterwards with its palatal teeth. I am only surprised that he has not mentioned it in his work. We generally find the *Ichthyodorulites* with them, as well as cartilaginous bones."—*Mary Anning.—Lyme Regis, April* 7, 1839.

[As Miss Anning speaks of 100 *palatal* teeth, she probably refers to the genus *Acrodus*, which may very possibly be furnished with an organ similar to the one possessed by *Hybodus*, as the genera are closely allied. Mr. De la Beche makes no allusion to its existence in the Geological Transactions.—*Ed.*]

On the disappearance of the Mus messorius, *Shaw, (Harvest mouse); followed by a notice of* Mus sylvaticus, *Linn. (Field or Wood mouse).*—These beautiful little red mice (*Mus messorius*) were three or four years ago very abundant, as I used to cause a notice to be given me when a rick in the neighbourhood was to be taken into the barn, as they take refuge in the lowest part of the rick, burrowing in the ground underneath; and I have seen scores of the little tame creatures, for they are the most tame, although not the most familiar of all the tribe, the *Myoxus avellanarius*, Desm. not excepted, never attempting to bite even when hurt. The next sentence will exhibit them in a different light; I have known nine individuals of this species kept in confinement together; they were very voracious, eating any thing which was given to them: although plentifully supplied with a variety of food, the horrible little vermin were such cannibals in disposition, as to prefer eating each other, which they actually did till only one remained, the disposition of the creature thus being a striking contrast to its pretty outward exterior, and otherwise docile habits. These little animals seem to have been almost entirely destroyed by the dry summer and autumn of 1836, perhaps the subsequent and following winters may have contributed, but with all my endeavours, and searchings, and offered rewards, I had never been able to procure one after, and from every person who I supposed knew any thing about the matter, I received the same sort of answer, that they used to be plentiful, but they had not seen one for two or three years.—This autumn, after incessant trouble, I have succeeded in procuring altogether five, old and young, one of which is now alive, very tame. but mistrustful, eating almost any thing; it is very fond of a piece of apple, and has no objection to a little bit of meat, preferring most other things to bread. The whole genus of *Mus* appear to be of sanguine and selfish dispositions, even the *Mus sylvaticus* is not exempt from the latter charge. A nest of the *Mus sylvaticus*, Desm. (field or wood mouse) containing its builder with her progeny, was ploughed out: the man observing the little beast running very heavily and awkwardly, soon overtook and dispatched it, and was surprised to find two young ones clinging so tenaciously to the teats of their dam, as to obstruct her escape, and facilitate her destruction, nor after the death of their parent could they be removed without some force, demonstrating the affection of the young for the spring of life to be very strong, but the desire of escape in the dam stronger than parental affection.—*Joseph Clarke.—Saffron Walden.—Oct.* 1839.

GENERAL INDEX.

CORRECTIONS OF ERRATA.

PAGE.	LINE.	ERRATA.	CORRECTIONS
228	12	intestine	liver.
243	37	displaced	displayed.*
245	41	length	width.*
286	27	Atelycychus	Atelycyclus.
292	32	Apsendes	Apseudes.
292	35	Ancens	Anceus.
292	37	Pranzia	Praniza.
293	2	Leptombra	Leptomera.

In page 239, line 12,—
For "seven eighths of an inch in length and breadth,"
Read "seven eighths of an inch in length, and five eighths in breadth."

* These two errata will not be found in the whole of the impression, as they were noticed before it was all printed off.

END OF THE THIRD VOLUME.

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