THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

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

No. 81. JANUARY 1844.

I.—*Observations on the Structure and Propagation of the genus* Sagitta. By Charles Darwin, F.R.S., V.P.G.S.

[With a Plate.]

THE species of this genus are remarkable from the simplicity of their structure, the obscurity of their affinities, and from abounding in infinite numbers over the intra-tropical and temperate seas. The genus was founded by MM. Quoy and Gaimard*; three species have been figured and described by M. A. d'Orbigny, and lately Prof. E. Forbes has added a species to the British fauna, and has given many particulars regarding the structure of the genus. Scarcely any pelagic animal is more abundant: I found it in lat. 21° N. in the Atlantic, and again off the coast of Brazil in 18° S.; between latitudes 37° and 40° S., the sea, especially during the night, swarmed with them. They generally appear to swim near the surface; but in the Pacific, off the coast of Chile, I obtained specimens from a depth of four feet. They are not confined exclusively to the open ocean, as supposed by M. d'Orbigny; for near the shore of Patagonia, where the water was only ten fathoms in depth, they were very numerous.

All the individuals which I caught had two pair of lateral fins,

* Annales des Sciences Naturelles, tom. x. p. 232. M. d'Orbigny's observations are given in his grand work (Mollusques, p. 140). Prof. E. Forbes four years since made his first communication on this genus before the Wernerian Society, and a second one at the Meeting of the British Association for the present year.

but I do not suppose that they all belong to the same species: those obtained in lat. 37° to 40° S. appear certainly to be the *S. exaptera* of D'Orbigny; and the few following observations, which relate chiefly to their propagation, apply, when not otherwise stated, to this species. M. d'Orbigny and Prof. Forbes have provisionally placed this genus amongst the nucleo-branch mollusca; but the evidence is hardly conclusive.

Head.—The linear-lanceolate head, which is of a transparent, gelatinous and adhesive texture, is separated from the body by a distinct neck. The head when not in action is slightly flattened and of a truncate-conical shape; when in action its basal part assumes a semilunar or horse-shoe form, in the concavity of which lies the longitudinally-folded mouth. On each arm of the fleshy horse-shoe, a comb, formed of eight strong, curved, slightly hooked claws or teeth, is attached. The animal when lively is constantly clasping these bristle-like teeth together, over its mouth; when clasped together, and the head in a state of inaction, they appear to be situated much nearer to the mouth than when their fleshy bases are expanded in action. The middle teeth are the longest; besides their clasping action and the power of movement in their fleshy bases, each separate tooth can move itself laterally further from or nearer to the adjoining ones. The mouth opens on the oblique surface of a part projecting up, between the two fleshy arms. Close to the mouth there are two other rows of exceedingly minute teeth, which have not been noticed by other observers, and which I discovered only with a lens of high power. These two rows of little teeth project inwards and transversely to the two great upright combs of teeth; so that when these latter are clasped over the mouth the minute teeth cross them, thus effectually preventing any object from escaping which might be caught by the longer curved teeth. I could not see any vestige of eyes or of tentacula.

Locomotive organs.—The animal moves quickly by starts, bending its body. The two pair of lateral fins and that on the tail lie in the same horizontal plane: viewed with a lens of small power they appear formed of a delicate membrane, but under a lens of $\frac{1}{20}$th of an inch focal distance they appear to consist of excessively fine transparent rays, touching each other, like the barbs of a feather, but not, as it appeared to me, actually united by a membrane. The tail, besides being used as a locomotive organ, serves as a means of attachment; for the animal when placed in a basin of water sometimes adhered by its tail so firmly to the smooth sides, that it could not be detached by a considerable agitation of the water. Out of the innumerable specimens which I procured, I never saw one fastened by its teeth to the ova of pelagic animals, or to other bodies, as M. d'Orbigny has observed in some of his species.

Internal viscera.—Within the body, in the same plane with the longitudinally folded mouth, there is a flattened tube or cavity, which in the specimens obtained in lat. 18° S. I observed had the power of contracting and enlarging itself in different parts, and within it there was a distinct peristaltic movement. Within this cavity in the *S. exaptera* I could clearly discern in the posterior half of the body a delicate vessel, which I presume is the intestine, for it appeared to terminate on one side of the body at the base of the tail. I could discover no vestige of a nucleus, of branchiæ, of a liver, or of a heart. In some exceedingly young specimens, however, just liberated from the egg, there was a distinct pulsating organ (as will hereafter be mentioned) in the anterior part of the body.

Propagation.—The state of the reproductive system varies much in animals caught at the same time. Taking a specimen with this system in a high state of development, the tail, or the tapering part of the body into which the intestinal tube does not penetrate, is seen to be longitudinally divided by an exceedingly delicate partition, and to be filled with a pulpy finely-granular matter. The column of matter on each side of the central division also *appears* (but whether really so I do not know) to be divided, making altogether four columns, as is shown in the diagram. The whole of this matter is in a state of steady and regular circulation, something like that of the fluid in the stems of the *Chara*. The matter flowed upwards in the two outer columns, and downwards towards the point of the tail in the two middle columns. The circulation in the up-flowing columns was most vigorous on their outer sides; and in the down-flowing columns on their insides, that is, on each side of the central partition: this would be accounted for, if we might suppose that the two surfaces of the central partition were covered with cilia, vibrating in a direction opposite to that in which other cilia situated on the inside of the membrane forming the tail were also vibrating. The stationary condition of the granular matter between the two streams, travelling in opposite directions, perhaps gives the appearance of the partition on each side of the central one. The circulation at the base of the tail was twice as rapid as it was near the apex: where most rapid I found that a granule travelled over the $\frac{1}{250}$th of an inch on the micrometer in five seconds; allowing for the slower rate in other parts, I calculated that in an individual, the tail of which was $\frac{3}{20}$ths of an inch in length, a granule performed its entire circuit in about six minutes. I could distinctly follow the granules descending one column, turning the angle, and again ascending. In specimens with the reproductive system in a lesser stage of development, the tail contained very little granular matter; and in proportion as this was less in quantity, so was the circulation less and less vigorous: in some specimens no granular matter, and perhaps, consequently, no circulation, was visible.

When the tail is filled with vigorously circulating matter two large *cul-de-sacs* or gut-shaped ovaries are invariably present, extending, as represented (*o o*) in the diagram, from the base of the tail along each side of the intestinal tube. These are filled with ova, which in the same animal are in different stages of development, and vary in length from $\frac{1}{100}$th to $\frac{1}{50}$th of an inch; their shape is pointed oval (Plate I. fig. B), and they are attached by the pointed end in rows to the sides of the ovaries: those of full size are detached by a very slight touch. When the ovaries contain many eggs nearly perfect (but not at other times), a small conical and apparently perforated protuberance can be seen on each side (A A) of the body, through which without doubt the eggs are expelled. In different individuals the ovaries are of different sizes and the eggs in different stages of development: before any of the eggs are perfected the ovaries are merely filled with granular matter; but this is invariably of a coarser texture than that within the tail. The ovaries when not containing granular matter are contracted into a very small size* (B). In great numbers of specimens taken in latitude 18° S. and between 37° and 40° S., I invariably observed that there existed a close relationship between the quantity of circulating matter within the tail and the size of the ovaries; from this circumstance, and from the similarity of the granular matter in the ovaries, before any of the eggs are perfected, with that in the tail, except that the granules are in this latter part of less size, I think it almost certain that the granular matter is first formed within the tail, and that it then passes into the ovaries, where it is gradually developed into ova. I could not, however, trace any opening from the one part into the other, but at the bottom of each ovary there was a space, where a closed orifice might have been situated.

A well-developed egg presents, when liberated by a touch from a torn open ovary, the appearance represented at (B) in the diagram. The egg is transparent, and contains within it an exceedingly minute globule. Twice on one day and once again a week afterwards, I clearly observed the following curious phænomenon take place: the apex of the egg, a few minutes after having been liberated from its attachment, began and continued to

* I also remark in my MS. notes, that the granular matter within the tail is sometimes contracted into small kidney-shaped bodies; I cannot help suspecting that I ought in every case to have written that the ovaries were contracted into this form.

swell, and soon assumed the form shown by (C). Whilst this was going on, the small internal globule also appeared to be swelling, and at the same time the transparent fluid with which the ovum and its enlarged apex were charged, became more and more opake and granular. The apex continued enlarging until it became of nearly the same size with the ovum from which it proceeded; and as this took place, all the granular matter was slowly expelled from the original capsule into the newly-formed one, in a manner which seemed to show that it was effected by the contraction of a lining membrane as represented at (D). Directly that this was completed the two balls slowly separated; one being left a mere empty husk, and the other consisting of a spherical mass of granular matter, within which a minute globule could be discovered. I presume that this was the same globule as seen within the egg in its first state (as at B), and that the appearance of its swelling was caused by the transparent fluid round it being first converted into granular matter. I have reason to suppose from what follows that this little globule contains only air. The whole phænomenon was effected in about ten minutes; and in one case I watched the entire process without taking my eye from the microscope.

On the 27th and 29th of September 1832, we passed* through the same tract of sea (off Bahia Blanca on the coast of northern Patagonia) where twenty-five days previously I had observed such great numbers of the *S. exaptera* with their ovaries distended with eggs, and I now found infinitely numerous ova floating on the surface. They were in different states of maturity; those least developed presented a sphere of granular matter contained within a larger spherical case. In the next stage the granular matter collects in a linear manner on one side of the inner sphere, and projects slightly beyond its outline; it then soon forms a distinct prominent rim, extending round two-thirds of the circumference of the inner sphere. This prominent rim is the young animal; a fine vessel is seen extending within its entire length, and one extremity enlarges into a head: the tail is first liberated from its attachment on the surface of the inner sphere, and lastly the head: the young animal, when thus released, lies in a curved position within the outer case, with the inner sphere, on the circumference of which it was developed, pushed on one side, and its function apparently ended. The central intestinal vessel is now much more distinct: an excessively fine membrane-like fin is discernible round the end of the tail; and the young animal being liberated from the outer spherical capsule, progresses by a

* I may add, that in the beginning of April, off the Abrolhos, on the coast of Brazil, in lat. 18° S., numerous specimens of a four-finned *Sagitta* had their ovaries filled with eggs apparently ready to be expelled.

starting movement like that of a full-grown *Sagitta*. At the anterior extremity, near the head, a pulsating organ can be distinctly seen. The ovum in all these stages contains a minute globule, which causes it to float on the surface of the water, and apparently is formed of air: I presume that it is the same globule with that seen in the egg, when first released from the ovary. The change in the floating ova from the state in which the inner sphere consists of granular matter without any trace of a young animal to the succeeding states must be rapid; for on the 27th of September all the ova were in this first state, whilst on the 29th the majority contained partially developed young ones. These floating ova were $\frac{1}{14}$th of an inch in diameter, whereas the spherical balls of granular matter which I saw expelled from their pointed oval cases were barely the $\frac{1}{30}$th of an inch in diameter; but as the eggs within the ovaries were of different sizes, according to their states of maturity, we might expect that their growth would continue after having been expelled from them. I will conclude by expressing a hope that these few observations on the propagation of this curious genus may aid more competent judges than myself in ascertaining its true affinities.

EXPLANATION OF PLATE I.

I. Intestinal tube.
o o. Ovaries.
A A. Apertures of the ovaries, and lateral fins.
T T. Tail divided into four columns of circulating granular matter, the course of which is shown by the arrows.
B. Egg just liberated from the ovary.
C. Egg in first state of change.
D. Egg in a succeeding state.

II.—*On the Marine Algæ of the vicinity of Aberdeen*. By G. Dickie, M.D., Lecturer on Botany in the University and King's College of Aberdeen.

[With a Plate.]

In the present and subsequent communications it is proposed to enumerate the marine Algæ which have been found in the vicinity of Aberdeen, and also to record such observations on their structure as may seem of most interest.

Although no great merit attaches to mere local lists, still such are not to be entirely rejected as useless, more especially when we consider their utility to those whose attention is directed to the geographical distribution of plants, a very interesting and important branch of their history.

All the species to be mentioned have been collected on the Kincardineshire coast, the southern part of the Aberdeenshire coast being for the most part sandy; the rocky part commencing only on the north side of the estuary of the Yethan, a distance of about sixteen miles from Aberdeen.

The part of the Kincardineshire coast which has been examined is chiefly composed of granite and gneiss; it is much exposed to the action of heavy seas, and presents few sheltered coves or even calm pools of any extent, and hence probably we may account for the absence of some of the more delicate species. I regret that my records of the temperature of the sea at this place are so few and little trustworthy as to be undeserving of record.

The arrangement given in Harvey's 'Manual of the British Algæ' will be followed, although his divisions, founded on the colour of the seeds, are not strictly applicable in all cases.

Melanospermeæ.

Halidrys siliquosa, Lyngb.—Both varieties of this plant occur in considerable quantity; it is invariably found in pools, mostly at high-water mark, and is generally, or more probably always submersed.

Before proceeding to notice the species of *Fucus* occurring here, it will be requisite to direct attention to the fructification of this genus, more especially in reference to Dr. Montagne's paper in the 'Annales des Sciences Naturelles,' October 1842; in which work that profound cryptogamist has published observations on his new genus *Xiphophora*, and in connexion with it has discussed at considerable length the question, whether the *Fucaceæ* may not have two modes of propagation?

In Harvey's work the fructification of the *Fucoideæ* is defined as "consisting of spherical clusters of opake seeds, imbedded in distinct gelatinous receptacles, and finally escaping by pores;" of *Fucus* more particularly it is said, that "the receptacles contain tubercles imbedded in mucus, and discharging their seeds by conspicuous pores."

On dissecting these so-called tubercles in different stages, more especially in the earlier, it will be found that they are in reality small sacs, or inflexions of the surface of the frond, having distinct walls composed of condensed cellular tissue and each opening by a small orifice, and having a close resemblance to the perithecia of a *Sphæria*, or the so-called anthers of *Marchantia*. From the walls of the sacs originate numerous jointed filaments, in some cases simple, in others branched; the apices of many of these protrude from the orifices of the sacs, and present no great obstacle to the emission of the seeds, but prevent the entrance of any small body from without. Dr. Montagne's account of the structure of *Xiphophora* corresponds exactly with this: the sacs he calls *conceptacles*, and compares the filaments to paraphyses.

In the sacs containing *simple* filaments and at their bases, we find the seeds properly so called. These Montagne calls *basisperms,* from their position in relation to the filaments, and in order to distinguish them from the other kind of fructification. The seeds are usually imbedded in a gelatinous secretion. In some *conceptacles* we find *branched* filaments which are also jointed, and in the upper articulations of which we observe the other kind of reproductive bodies called *acrosperms* by Montagne, the microphytes of De la Pylaie, alluded to also by Meneghini, and figured by Lyngbye (Montagne, *loc. cit.*). It must not be supposed, however, that the acrosperms are invariably contained in the terminal joints of the filaments; the term is, however, sufficient to express the general difference in position of the two kinds of bodies, in relation to the filaments.

On the surface of the frond in many of the *Fucoideæ* are numerous pores, from which issue, as Greville remarks, "little tufts of filaments, the use of which has not been discovered." These I believe to be *barren conceptacles*; both the barren and fertile are in reality mere inflexions of the surface of the frond. The nature of the fructification in *Asperococcus* appears to be in favour of this opinion; in the *A. fistulosus* we have in reality the *basisperms and simple filaments* of a *Fucus* completely exposed, there being no inflexion of the surface.

Turner states that Reaumur considered the tufts of fibres arising from the pores on the frond as corresponding to the anthers of Phænogamous plants.

Fucus vesiculosus.—This species is abundant, and particularly near high-water mark and at estuaries. Dr. Montagne has only found *basisperms* in three specimens which he examined. It however possesses also *acrosperms,* the two kinds occurring on different plants.

F. ceranoides.—In this vicinity it is only found at the mouths of the Dee and Don, and also some distance up these rivers. It in some instances makes a close approach to *F. vesiculosus,* and is probably only a variety of it, produced by the action of fresh or brackish water. Like the former species also, it possesses both kinds of reproductive bodies, which are found on the same plant, but on different fronds.

F. nodosus.—This species is found in great profusion. Montagne and Pylaie have only found on it *acrosperms,* Lyngbye detected *basisperms*; Turner says that both occur in the same conceptacles. I have found both, but on different plants, and have been unable to confirm Turner's observations.

F. serratus.—Abundant. This species possesses both kinds of reproductive bodies on the same plant, but on different fronds.

F. canaliculatus is very common; for the most part an occasional moistening with sea-water is all that is necessary for the development of this species, and hence it is mostly found at high-water mark. Dr. Montagne has found both kinds of fructification in the same receptacle. The basisperms in the course of their development undergo several changes: these may be easily traced in *F. serratus* and *F. canaliculatus*. In the former we first observe large cells with several nuclei in their interior; these rapidly increase in size; the parent cells now appear compound and in course of time disappear, the young cells becoming free. Figs. 1, 2, 3, 4 in Plate I. represent these stages in the species alluded to. In *F. canaliculatus* the young cells are not so numerous as in the former case.

Some time ago a few experiments were made for the purpose of ascertaining the mode of germination in the last species. A considerable quantity of its seeds were placed on slips of glass, to which they readily adhered; these were kept immersed in sea-water, which was renewed every four or five days. The experiments were conducted in a room at a moderate temperature, and in the month of December. In about three weeks the seeds were found to have undergone a change of form; from triangular with rounded angles they had become spherical. In the next stage a slight swelling was observed on many of them, and at a more advanced period there issued at this place several minute transparent filaments, never exceeding four in number from the same seed; one or more of these had usually made greater progress than the others. In their interior was seen a granular matter of a pale yellow colour. The observations were interrupted at a more advanced stage, when the filaments appeared to have become coherent at their bases. By careful examination under the microscope, it was found that each seed consists of two coats, the inner the most delicate of the two and containing a granular matter; the filaments appeared to be prolongations of it, and to have burst the outer and stronger membrane.

Figs. 5, 6, 7, 8 represent the germination at different periods. The receptacles containing the acrospermal conceptacles, generally when newly collected, have an orange-yellow colour, and after some hours an orange mucus exudes from the pores, which on examination with the microscope will be found to consist of acrosperms. The cell in which each of these bodies is included is for the most part so transparent, that it is difficult to detect the presence of any enclosing membrane, more especially if viewed in a drop of sea-water, the medium which ought always to be used in examining the structure of marine species. On placing them in fresh water the containing cell is seen to burst, and the enclosed acrosperms are expelled with considerable force. Each body is composed of a simple membrane containing small granules which are usually regularly arranged. There is some difference in their form at different stages, as well as in the different species of *Fucus*. Figs. 9, 10, 11 represent those of *F. vesiculosus*; fig. 12 those of *F. nodosus*.

The presence of these bodies being so constant, it is not unreasonable to suppose that they perform some important function. Those who believe that impregnation is necessary in cellular plants, in the same sense at least as in the higher tribes, may probably consider that they are representatives of the anthers, and perform similar functions.

A few attempts were made for the purpose of ascertaining if they would germinate, by treating them in the same way as the *basisperms* of *F. canaliculatus* already mentioned. The experiments failed, and the difficulty seems to be to preserve the water at a proper and uniform temperature, for, owing to the delicacy of their structure, they are easily affected by changes. I believe, however, that they afford one means by which the Fuci are propagated, for the reason that the structure of the reproductive organs of *Alaria, Laminaria*, &c. is essentially that of *acrosperms*: this will be more particularly alluded to in a subsequent paper. The true species of *Fucus* may be considered as *heterospermous*, and it will be shown afterwards that other genera are *basispermous* and others *acrospermous*.

[To be continued.]

III.—*Descriptive Catalogue of the Zoophytes from the Crag.* By S. V. Wood, Esq., F.G.S.

Mr. Richard Cowling Taylor, in a very valuable paper upon British "Antediluvian Zoology and Botany," communicated to the 'Magazine of Natural History' in 1830, was, I believe, the first to draw attention to the variety and interesting forms presented by the Corals of the Crag, and many very good figures are given by him in the above periodical, but unaccompanied by generic or specific characters.

In the following Catalogue I have endeavoured to furnish a list of these Polypifera, which are principally derived, as might be expected, from the deposit that has been termed *par excellence* "Coralline" Crag. This formation in the neighbourhood of Orford presents a close analogy to some of the coral reefs now forming, being composed almost entirely of corals, and sufficiently indurated to serve as a building-stone.

Among the corals of the crag we are presented with as great anomalies as among the Mollusca; recent species strictly British being associated with genera wholly unknown in a living state, as for example, *Fascicularia* and *Theonoa*. Although inferences respecting the temperature of the coralline-crag sea must be highly conjectural where such incongruous forms are associated, I should still be disposed to adhere to the opinion I have already expressed as to the probability of its approximating that of the coast of Portugal. A current of water like that which now rolls through the Gulf of Florida may have introduced *Pyrula, Pholadomya, Lingula* and other tropical forms, or these genera, at the time of the coralline crag being deposited, might have been the only living representatives of a tropical fauna otherwise extinct.

The fauna of the red crag must, I think, be regarded as indicating a temperature much lower than that which existed during the deposition of the coralline crag. The general characters of its Polypifera agree with those of our own seas, for I consider my red-crag specimens of *Theonoa* and *Fascicularia* to have been introduced into this deposit from the underlying coralliferous beds. The greater part of my red-crag corals are attached to the mouths of univalves or the interior of bivalves.

I have not as yet seen any corals from the mammaliferous crag.

Though many of the crag polypidoms are in a very perfect condition, others, particularly among the *Escharidæ*, from various causes, have undergone structural alterations which render their correct determination often a matter of great difficulty. *Flustra membranacea*, for example, is generally found with nothing but the bare walls of its cells remaining, and other species have had prominent parts entirely removed; these alterations are wholly independent of that change which takes place in the external covering of the cells during their progress to maturity, so ably pointed out by M. Edwards in his essay upon the *Escharidæ*, and which may be seen in various cells on the same specimen.

The following are from my own cabinet except where otherwise expressed.

Class ZOOPHYTA.

Fam. Lamelliferæ.

Balanophyllia, n. g.

Polypidom permanently fixed, simple, exterior striated longitudinally; disc stellated, with a central style; lamellæ radiating in trios, converging to a point at the circumference.

This differs from *Caryophyllia* in the tripartite arrangement of the lamellæ, and from *Dendrophyllia* in not being dendroidal.

	Cor. Crag.	*Red Crag.*	*Recent.*
1. Balanophyllia calyculus, n. s.			
		Sutton.	

"Polyp. subcylindrical; disc subovate, cup-shaped, with an elongate central style; lamellæ radiating and fasciculated, sides of lamellæ finely granulate, exterior rugosely striate."—*Mag. of Nat. Hist.* vol. iii. 1830, p. 272. f. 60. *d.*

The disc of this coral is partially bisected by a central style, around which are arranged twelve rays, each ray composed of three lamellæ, which converge to a point as they approach the circumference. In the intervals formed by the divergence of these rays are placed twelve other rays also tripartite, and the smaller spaces between the terminations of these twenty-four rays are each bisected by a single plate. One in every three of the thirty-six lamellæ attached to the style is elevated above those contiguous to it. From the extreme rarity of unmutilated specimens, I am unable to state whether the number of rays be constant in this species, but its form varies so greatly that I should presume some variation in the number of its parts to be very probable. It is occasionally much depressed, the base spreading to more than twice the diameter of the disc; sometimes it is a reversed cone, the disc exceeding the base tenfold, such variation appearing to depend upon its place of attachment; it often occurs much elongated, generally single, never branched, though occasionally three or four individuals are grouped together.

The lamellæ appear promiscuously arranged where the disc is much injured, which is generally the case with crag specimens. The species is also found in the tertiary formation of Touraine: a specimen in my possession, from this locality, has a portion of a thin periostracum remaining upon the exterior.

Cor. Crag. | *Red Crag.* | *Recent.*

1. Fungia semilunata, *Lamk.* (*2nd edit. Hist. des An. sans Vert.* vol. ii. p. 371).

Iken. | |

I am only acquainted with two specimens of this species, one in the cabinet of Mr. Bunbury, and the other in the possession of Mr. Wm. Colchester.

1. Turbinolia Milletiana, *De France* (*Dict. des Sci. Nat.* vol. lvi. p. 93. Turbinolia —— ? *Taylor, Mag. Nat. Hist.* vol. iii. p. 272. f. 60. *c*).

Sutton. | Sutton. |

1. Cladocora cariosa, *Lonsdale MS.* (Madrepora cariosa, *Goldf. Pet.* t. 8. f. 8; *De Blainv. Dict. des Sci. Nat.* t. 60. p. 355).

Ramsholt. | Sutton. |

Class BRYOZOA.

Fam. Crisiadæ.

Cor. Crag. | *Red Crag.* | *Recent.*

1. Crisia eburnea, *Lamx.* (*Expos. Méth. de Pol.* p. 6; *Johnston, Brit. Zooph.* p. 262. pl. 31. f. 3, 4).

Sutton. | .... | Britain.

2. — luxata? *Flem.* (*Johnston, Brit. Zooph.* p. 262. pl. 31. f. 5, 6).

Sutton. | .... | Britain.

Only one fragment, which however differs from the description at the above reference. My specimen has the tubes alternate, depressed, suborbicular; surface rugose, probably porous; the cells are not adnate, but distant from each other rather more than the diameter of the tubes.

Fam. TUBULIPORIDÆ.

	Cor. Crag.	*Red Crag.*	*Recent.*

1. Fascicularia aurantium, *M. Edw.* (*Lyell's Elements*, p. 304. edit. 1838, var. *α*; *Taylor, Mag. of Nat. Hist.* vol. iii. 1830, p. 272. f. 61; *id.* var. *β*. f. 63).

Aldbro'.	Sutton.	

Abundant in the coralline crag. A specimen in my possession measures six inches and a quarter in diameter.

1. Theonoa? globosa (Blumenbachium globosum, *Koenig, Icon. Foss.* pl. 5. f. 69. Theonoa cristata, *M. Edw. MS. Taylor, Mag. Nat. Hist.* vol. iii. 1830, p. 273. f. 64 & 65).

Sudbourn.	Sutton.	

In its young state this coral is of a discoidal form with a very short pedicel of attachment; it then resembles a reversed specimen of *Polyporus*, and rarely attains half an inch in diameter. The upper surface exhibits the openings of numerous subpolygonal tubes which are most abundant towards the margin; these tubes converge towards the pedicel as a common centre, and their direction may be sometimes traced along the under surface, which is smooth and entire. The polygonal form of the tubes is probably the result of lateral compression.

The mode of increase appears to be by gemmules formed upon or near the margin of the disc; as these enlarge, their horizontal extension is interrupted by the mutual approximation of their edges, which consequently bend upwards, except at the points furthest from the centre of the disc upon which they are formed; and here, as there is nothing to prevent the free extension of the gemmules, they project beyond the parent disc, and in a slightly downward direction: each disc is thus twisted into a triangular or subquadrangular form, producing a sort of depressed compartment by the union of the under surfaces which project around in the form of a crest. In this manner the shape presented by the adult coral is ultimately produced, and is either hemispherical or subglobular, according to its place of attachment. This polypidom has sometimes a radius of more than two inches.

1. Heteropora dichotoma, *De Blainv.* (*Man. d'Actinol.* p. 417. Ceriopora dichotoma, *Goldf. Pet.* t. 10. f. 9. var. *β. d—f*).

Ramsholt.		

What I conceive to be the young state of this coral is a small attached hemispherical body, consisting of a congeries of tubes radiating from a common centre. This increases cylindrically and branches; a longitudinal section then displays the tubes, arising at the first centrally with a vertical direction, but afterwards bending suddenly at nearly a right angle to reach the exterior; a transverse section would consequently divide the tubes throughout a portion of their extent longitudinally, while in the centre of the branch it would cut them transversely. The tubes are subpolygonal with circular openings, many of which are nearly closed, owing probably to the more extended lives of some of the polypes.

This polypidom attains a height of several inches.

	Cor. Crag.	*Red Crag.*	*Recent.*
2. Heteropora septosa (var. α. polymorpha; var. β. pustulosa).	Sudbourn.	....	Britain.

Polypid. boletiform, irregular, sometimes investing; pores irregular.

One fossil specimen invests an *Emarginula,* and corresponds with a recent British species in my possession upon an *Arca lactea.*

Var. β. is globose and pustuliform; pores irregular, large and small, subpolygonal; a section shows rows of tubes long and straight, with transverse partitions like those in *Chætetes.*

1. Diastopora meandrina, n. s.	Sutton.		

Polypid. globosely foliaceous; foliations anastomosing or meandering with two layers of opposite cells; cells tubular, slightly raised, or rather strongly inclining towards the plane of axis, irregularly quincunxial; aperture orbicular; surface granular; radius one inch and a half.

Sect. *a.* adnate.

	Cor. Crag.	*Red Crag.*	*Recent.*
1. Tubulipora obelia, *Johnston* (*Brit. Zooph.* p. 269. t. 30. f. 7, 8).	Sudbourn.	Sutton.	Britain.
2. — patina, *id.* (*Brit. Zooph.* p. 267. t. 30. f. 1—3).	Sudbourn.	Sutton.	Britain.
3. — serpens, *id.* (*Brit. Zooph.* p. 268. t. 30. f. 4—6).	Sudbourn.	....	Britain.
4. — palmata, n. s.	Sudbourn.	Sutton.	

Polypid. adnate, divergent; branches enlarging, palmate, truncate; surface rugose, porous, with numerous dwarfish tubular cells, increasing in number (as it diverges) from one or two to seven or eight.

Extent of polypidom three-eighths of an inch.

5. — repens, n. s.	Sutton.	Sutton.	

Polypid. adherent by a narrow base, linear, dichotomously or irregularly branched; upper surface studded with tubular curved cells irregularly quincunx, seldom more than three tubes in the width of each branch.

Polypidom spreading one inch, diameter of branches $\frac{1}{20}$.

Sect. β. free.

	Cor. Crag.	*Red Crag.*	*Recent.*
6. Tubulipora ? intricaria, n. s.			
	Sutton.		
7. — ? arborea, n. s.			
	Sutton.		
8. — ? agaricia, n. s.			
	Sutton.		

The above three species do not strictly belong to this genus, but I have placed them here provisionally until better specimens and more information be obtained respecting them.

1. Idmonea disticha, *De Blainv.* (Retepora disticha, *Goldf. Pet.* t. 9. f. 15).			
	Sutton.		
1. Discopora hispida, *Flem.* (*Brit. An.* p. 530; *Johnston, Brit. Zooph.* p. 270. t. 30. f. 9—11).			
	Sudbourn.	Sutton.	Britain.
1. Alecto gracilis ? *M. Edw.* (*An. des Sci. Nat.* 1838, tom. ix. t. 16. f. 2. Alecto —— ? *Woodward, Geol. of Norf.* t. 4. f. 16. Chalk).			
	Sutton.		

My only specimen is not in good preservation.

Filicella, n. g. (*filum*, a thread, and *cella*).

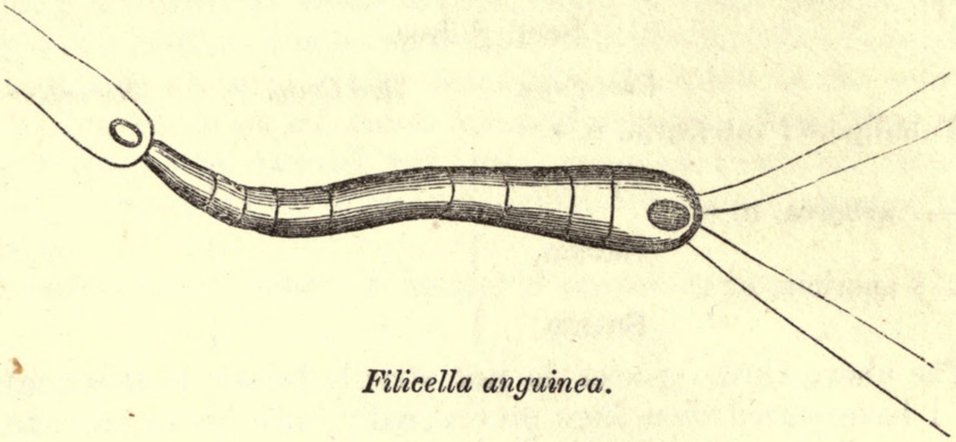
Gen. Char. Cells filiform, distinct, adnate, united at the extremities; dichotomous aperture subterminal, not projecting.

1. Filicella anguinea, n. s.			
	Ramsholt.		

Repent, snake-like, elongated, subcylindrical, or rather club-shaped, tubulous, glossy, united at the extremities, adnate, dichotomous; aperture oval, rather depressed, subterminal.

I propose this genus for the reception of a very minute zoophyte from the coralline crag which much resembles *Alecto*, but differs in being more elongated, less cylindrical, and with its peritreme even with the cell; it does not adhere by an expanded side like *Alecto*, but is filiform throughout, the cells are more distinctly separated, and are but slightly attached (laterally) to the surface of the interior of an *Echinus*. The cell is compact, smooth, not porous. This is the smallest zoophyte I am acquainted with, being scarcely visible to the naked eye.

Dimensions, one-fifth of a line in length; diameter of the widest part near the mouth of the cell about the eighth part of its length, and this twice the width of the lower portion adjoining its cognate cell. The annexed drawing was made with the camera lucida.



Filicella anguinea.

	Cor. Crag.	Red Crag.	Recent.
1. Hornera reteporacea, *M. Edw.* (*An. des Sci. Nat.* vol. ix. t. 10. f. 2).	Sutton.	Sutton.	
2. — striata, *M. Edw.* (*An. des Sci. Nat.* vol. ix. t. 11. f. 1).	Sudbourn.		

The figure above referred to must have been made from an old specimen in which the intermediate pores are closed up; when young and perfect, the superior surface is striated and porous between the cells.

Fam. Escharidæ.

	Cor. Crag.	Red Crag.	Recent.
1. Retepora cellulosa, *Johnston* (*Brit. Zooph.* p. 297, vignette no. 46. p. 283; *M. Edwards, 2nd edit. of Lamarck,* tom. ii. p. 276; *Lamouroux, Exp. Méth. des Polyp.* pl. 26. f. 2).	Sudbourn.	Sutton.	Britain.

The crag coral corresponds with the British var., and may probably be distinct from that found in the Mediterranean, whose meshes are much larger. This latter is also supposed by M. Edwards to be distinct from the one quoted by him as from the Indian Ocean.

	Cor. Crag.	Red Crag.	Recent.
1. Eschara monilifera, *M. Edw.* (*An. des Sci. Nat.* vol. vi. pl. 9. f. 1).	Ramsholt.	Sutton.	
2. — pertusa, *M. Edw.* (*An. des Sci. Nat.* vol. vi. pl. 10. f. 3).	Sudbourn.		
3. — Sedgwickii, *M. Edw.* (*An. des Sci. Nat.* vol. vi. pl. 10. f. 5).	Sudbourn.		
4. — incisa, *M. Edw.* (*An. des Sci. Nat.* vol. vi. pl. 9. f. 2).	Sudbourn.		

I have not seen this species.

	Cor. Crag.	*Red Crag.*	*Recent.*
5. Eschara foliacea, *Johnston* (*Brit. Zooph.* p. 297. t. 40).			
	Sutton.	....	Britain.
6. — porosa? *M. Edw. An. des Sci. Nat.* vol. vi. pl. 11. f. 7.			
	Sudbourn.		

The cells of this are found open.

1. Ulidium Charlesworthii (Melicertina Charlesworthii, *Ehrenb.* Melicerita Charlesworthii, *M. Edw. An. des Sci. Nat.* vol. vi. pl. 12. f. 19).

	Sutton.		

Melicerta has long been used as a genus in the class Crustacea, *Melicertum* in Acalepha. *Melicerita* as stated by Ehrenberg is not correct. *Melicertina* is objectionable, as the *ina* is generally used for a family termination. I therefore propose the name *Ulidium* (*οὐλίδιον, a scar*), from its close connexion with *Eschara.*

1. Cellaria fistulosa (Tubularia fistulosa, *Linn.* Cellaria salicornia, *Lamx. Exp. Méth. des Polyp.* p. 5. Farcimia fistulosa, *Flem. Brit. An.* p. 534).

	Sutton.	Walton Naze.	Britain.

Articulations cylindrical; cells elongato-rhomboidal, immersed; sides elevated, sharp; larger opening transversely lunate, unarmed; smaller opening above transverse, semilunate; surface of cells porous.

The cells occasionally vary in shape upon different articulations of the same specimen, like those represented by Ellis, Coral. pl. 23. D., some being of a subhexahedral form with nearly parallel sides. The lower part of the larger opening (the operculum) is elevated in the centre, projecting outwards; this in the fossil is occasionally separated into denticulations: the smaller opening above is generally transverse, sometimes lunate, and often orbicular in worn specimens. In those most perfect the smaller opening is a narrow transverse fissure close to the partition, as may be seen in dead specimens of the recent species, and is probably accidental in all. Fragments of this fossil are abundant, but the articulations are generally separated.

2. — crassa, n. s.

	Sutton.	Sutton.	

Articulations ovate; cells rhomboidal, immersed, plain; sides elevated, sharp; aperture transverse, sublunate.

The cells in some are hexagonal, and the aperture appears as if armed with four teeth, two proceeding from the upper edge pointing downwards, and two from the lower, more obtuse, pointing upwards; these are probably produced from decomposition: the smaller opening above the mouth varies in shape, being sometimes orbicular, sometimes lunate, and is also in all probability accidental.

	Cor. Crag.	*Red Crag.*	*Recent.*
1. Lunulites alveolatus, n. s.	Sutton.	Sutton.	

Polypid. cupuliform, convex above, concave beneath, thick; cells radiating in straight lines, open ?, subquadrate; margin without denticulations; surface beneath striated and porous ?

2. — Owenii, *Gray* (*Spicilegia Zoologica*, p. 8. t. 3. f. 15).	Sutton.	....	Coast of Africa.

Fam. Celleporidæ.

1. Cellepora pumicosa, *Johnston* (*Brit. Zooph.* p. 273. t. 32. f. 1—3).	Sutton.	Sutton.	Britain.

Var. α. irregularis.
Var. β. globularis.
Var. γ. pustulosa. This always envelopes a univalve shell.

Some specimens of *irregularis* are pierced the entire length, as if originally grown upon the stem of a sea-weed.

2. — cellulosa (Scyphia cellulosa, *Goldf. Pet.* t. 33. f. 12).	Sutton.		
3. — ramulosa ? *Johnston* (*Brit. Zooph.* p. 274. pl. 32. f. 4).	Sutton.	....	Britain.
4. — coronopus, n. s.	Ramsholt.		

Polypid. dichotomously branched; branches subcylindrical, tapering, terminations not compressed.

1. Lepralia variolosa, *Johnston* (*Brit. Zooph.* p. 278. t. 34. f. 4).	Sutton.	Walton Naze.	Britain.
2. — ciliata, *Johnston* (*Brit. Zooph.* p. 279. t. 34. f. 6).	Sudbourn.	....	Britain.

The spines are gone, but there are five short tubes (which I presume to be their remains) occupying about two-thirds of the peristome.

3. — puncturata, n. s.	Sudbourn.	Sutton.	

Polypid. discoidal, radiating; cells subcylindrical, convex, porous and granular, with generally six rows of punctures; aperture transverse, sublunate, bordered and edentate, with an open ? ear-like process on each side of the mouth.

On various shells.

4. — umbonella, n. s.	Sudbourn.		

Polypid. discoidal, radiating; cells depressed, subtrapezoidal, slightly granular, separated by one row of large oblong perforations, two or three on each facet; aperture transverse, sublunate; operculum worn into denticulations; a prominent umbo below the aperture.

On a *Terebratula*.

	Cor. Crag.	*Red Crag.*	*Recent.*

5. Lepralia abstersa, n. s.

		Walton Naze.	

Polypid. ramose; cells elongato-ovate, ventricose, smooth; aperture subterminal, subcircular, depressed.

One specimen on a *Pholas*.

6. — catena, n. s.

	Sutton.		

Polypid. cateniform; cells ovate, costated; costæ five, lateral one terminal; aperture suborbicular, armed; three teeth?

One specimen on an oyster.

7. — geniculata, n. s.

	Sutton.	Walton.	Mediterran.

Polypid. discoidal, radiating; cells ovate, slightly granular, obtusely costated, lines of punctures between the costæ radiating; aperture semiovate, bordered, armed with five denticulations.

On various shells.

The denticulations have disappeared, leaving so many short tubes. This is identical with a recent species brought from the Mediterranean by Mr. E. Forbes.

8. — pyriformis, n. s.

	Sudbourn.		

Polypid. radiating; cells elliptical at the upper part, or rather pear-shaped; aperture transverse, semiovate, unarmed.

On a *Terebratula*.

9. — mammillata (Cellepora mammillata, *De Blainv. Man. d'Actinol.* p. 444).

	Sutton.		

Polypid. adnate; cells subconical, rugose; aperture terminal, suborbicular; peritreme thickened and armed with five long and sharp spines, occupying three-fourths of the anterior portion, one obtuse spine at the posterior part; base of the cell punctured.

On various shells and pebbles. Named by De Blainville but not described.

10. — unicornis? *Johnston MS.* (Lepralia coccinea, *Johnston, Brit. Zooph.* p. 278. pl. 34. f. 1—3, bad).

	Sutton.	....	Britain.

The aperture of this has vestiges of spines.

The ovarian capsule above the aperture, observable in many specimens of this genus, will occasionally alter the shape of the aperture, and is itself sometimes worn into an opening.

1. Catenaria dentata, n. s.

		Walton Naze.	

Cells slender, ovato-lanceolate; aperture oval, margin dentate.

Specimen attached to a *Pholas*. It is dichotomously and divaricately branched, emitting a cell sometimes from both sides, at others only from one; it somewhat resembles *Hippothoa lanceolata*, Gray, 'Zool. Misc.' 35, but differs in having the margin of its aperture armed with eight or nine long denticulations curving inwards. When magnified, the surface of the cells appears finely granulated.

	Cor. Crag.	*Red Crag.*	*Recent.*

1. Flustra distans, *Johnston* (Flustra Peachii, *Couch, Cat. of Zooph. of Cornwall*).

		Sutton.	Britain.

Identified by Dr. Johnston.

2. — membranacea, *Johnston* (*Brit. Zooph.* p. 287. t. 37. f. 1—3).

	Sutton.	Sutton.	Britain.

This is generally found with the cells open and nothing but the partition-walls remaining. Specimens from the coralline crag are however occasionally met with quite perfect, showing the form of the mouth and with the obtuse spines at the corner of the cells.

3. — coriacea, *Esper.*

	Sudbourn.		

Identified by Dr. Johnston.

4. — trifolium, n. s.

	Sutton.		

Polypid. adnate, discoidal, radiating; cells elongato-hexagonal; surface rugose; centre depressed; aperture irregularly tripartite, unarmed.

On various shells.

5. — holostoma, n. s.

	Sutton.		

Polypid. adnate; cells radiating, irregular, bordered; centre depressed; surface rugose; aperture subcircular, unarmed.

The cells in form somewhat resemble those of *F. flabelliformis*, Lamx., 'Expos. Méth.' p. 113. pl. 76. f. 11—13, but it is an encrusting coral, and the interior of the cells are not parallelograms, and the aperture not so central. On various shells.

These last two are probably altered forms.

1. Membranipora pilosa? *Auct.* (*Johnston, Brit. Zooph.* p. 280. pl. 34. f. 10—12).

		Sutton.	Britain.

The perforation through the hollow base is visible, but there are no denticles remaining, and as such I consider it a doubtful identification.

2. — membranacea, *Johnston MS.* (Flustra tuberculata, *Johnston, Brit. Zooph.* t. 34. f. 9. Flustra membranacea, *Müller, Zool. Dan.* Flustra unicornis, *Flem. Brit. An.* p. 536).

	Sutton.	....	Britain.

Fam. Orbitulitidæ.

1. Orbitulites coscinodiscus, n. s.

Sutton.		

Polypid. discoidal, smooth, flat; cells concentric, linear, and radiating in straight lines.

The cells differ in form and arrangement from those of *Orb. complanata*.

Ord. Carnosa.

Fam. Alcyonidiadæ.

	Cor. Crag.	*Red Crag.*	*Recent.*
1. Alcyonidium circumvestiens, n. s.			
	Sutton.	Sutton.	

Polypid. enveloping univalve shells, surface papilliform and rugose.

This covering attains a thickness of more than half an inch, and can be partially removed in layers; in some instances the univalve is entirely absorbed. Not restricted to one species of shell.

Class AMORPHOZOA.

1. Grantia compressa, *Johnston* (*Brit. Sponges*, p. 174. pl. 20. f. 1).			
		Walton Naze.	Britain.

Three very minute specimens, found by Dr. Johnston adhering to the interior of a shell.

Class LITHOPHYTA.

1. Nullipora.			
	Sutton.		

IV.—*On the existence of Branchiæ in the perfect state of a Neuropterous Insect,* Pteronarcys regalis, *Newm., and other species of the same genus.* By George Newport, Pres. Ent. Soc. &c.*

Having been favoured by Mr. Barnstone with a specimen of that magnificent Neuropterous insect, *Pteronarcys regalis*, captured by himself in the high latitude of 54° on the Albany river, North America†, and preserved in spirit, I have been agreeably surprised at finding in the perfect state of this species *a series of thoracic branchiæ*, a condition of the external respiratory organs that is usually met with only in the preparatory larva and pupa states of insects. The persistence of external branchiæ in a winged insect, fitted in every other way for flight in the open atmosphere, like other species of the order to which it belongs, is an anomaly that requires a close attention to its habits to explain. This is the only genus, so far as I am aware, in which the branchial form of the respiratory organs, so common in the larva and pupa of the

* Read at the meeting of the Entomological Society, December 4, 1843.

† It was brought by Mr. Barnstone with a large collection of Canadian insects which he had recently captured, and has since presented to the British Museum.

Neuroptera, is retained in the perfect state. On first observing these organs, in the specimen received from Mr. Barnstone, I was disposed to regard them only as an accidental occurrence; but I have subsequently detected the remains of them in every dried specimen I have had an opportunity of examining; and also in the pupa of the same species, in which, however, they are somewhat more developed. They are of the tufted or filamentous form of branchiæ. They consist of eight pairs of branchial sacs, from the exterior of which proceed numerous elongated, setose filaments, which together form a thick tuft on each sac. These branchiæ are situated, as described by Pictet in the larva state of *Nemoura cinerea*, Pictet, over the proper spiracular orifices or entrances to the great longitudinal tracheæ of the body, at the inferior lateral parts of the thorax and basilar segments of the abdomen. The first pair of sacs is in the tegument of the neck, between the head and prosternum; the second and third pairs, each of which is composed of two tufts, between the prosternum and mesosternum, behind the coxæ of the first pair of legs; the fourth and fifth between the mesosternum and metasternum, behind the coxæ of the second pair of legs; and the sixth pair behind those of the third pair of legs, at the junction of the thorax with the abdomen. The seventh and eighth pairs, formed each of single tufts, are attached more laterally, the seventh to the first, and the eighth to the second basilar segments of the abdomen. These latter branchiæ correspond in situation in the segments to that of some apparently closed or obsolete spiracles at the sides of the succeeding segments. The situation of the branchiæ themselves is thus as anomalous as their existence in the perfect insect. In most instances branchiæ are arranged along the sides of the abdominal segments of the larva, and are often employed to assist in locomotion; but they cannot be of use for this purpose in the larvæ and pupæ of these *Perlidæ* which move by means of large and powerful limbs. In *Pteronarcys* the two posterior pairs of legs of the pupa have the tibiæ densely ciliated, for swimming, like those of the *Dyticidæ*, so that the delicate filamentose branchiæ can afford little, if any, assistance in this function. The structure of the filaments themselves differs also from that of the filamentose branchiæ of the *Sialidæ*, in which these organs are said to be quadri- or quinque-articulated, and are employed as organs of locomotion. In *Pteronarcys* they are simple unarticulated filaments. Each filament is soft, delicate and gradually tapered from its base to its extremity, and ends in a slightly obtuse point. Internally each filament is traversed longitudinally by a tracheal vessel, which becomes, like the filament itself, more and more slender, and at last divides into two branches, which may be traced to the extremity of the filament; but I have not been able to discover any orifice in the extremity of the filament itself, nor any direct communication whatever between the external surface and the ramifications of these tracheæ, and I doubt much whether any such direct communication exists.

M. Pictet has found that branchiæ are attached to the thorax of the *larva* in all the species of *Perla* excepting *P. virescens* and *P. nigra,* which circumstance seems to indicate some difference in the habits of these species. Now a like difference exists between the pupa of *Pteronarcys regalis* and that of *Perla abnormis,* Newm., which latter insect has not these branchiæ; and Mr. Barnstone, who has most assiduously observed the habits of these species, informs me that he found the first living constantly in the water at the bottom of streams, but the latter was always hidden in clefts of water-logged timber, the trunks of trees and other places on the banks, and that he has usually found the cast-off exuviæ of the pupa "under stones along the banks of rivers." This difference in the habits of the pupæ leads to further inquiry in regard to those of the perfect insects. *P. regalis* he states is a nocturnal species, being mostly found hidden by day under stones or in damp places, and coming abroad on the wing only at nightfall. Has this habit any reference to the persistence of the branchiæ, and the mode in which the aëration of the fluids is effected? or are these persistent branchiæ merely accidentally retained organs, the functions of aëration being performed by other means? The existence of three pairs of orifices on the sternal surface of the thorax seems at first to favour this latter conclusion; but it yet remains to be shown that these orifices have any communication with the tracheæ, since they are placed in the middle of the sternal portion of each of the segments, between the coxæ, situations in which spiracles do not usually exist. This question, therefore, I leave for the present for closer anatomical investigation.

In regard to the function of aëration being performed by these branchiæ in the perfect insect, I may remark, that it is of little consequence to the preservation of animal life whether aëration of the fluids of the body be effected *directly,* by means of air received *into* the body in lungs, or in spiracles and tracheæ, or *indirectly,* by means of water or vapour, that holds air intermixed with it, through the agency of external branchial organs, in which case the air is brought into contact with the fluids through the surface of these organs in water equally well as in the open atmosphere, when air is taken *into* the body through the spiracles. The function of branchiæ, or aquatic organs, is equally well performed in the open air as in water, so long as the air is charged with a sufficiency of fluid to preserve these organs in a healthy state.

Some circumstances connected with the respiration of larvæ distinctly show this to be the case, and also have reference to the apparently anomalous persistence of branchiæ as respiratory organs in *Pteronarcys*. Mr. Westwood in his 'Modern Classification of Insects*' has quoted, as a remarkable circumstance connected with the respiration of the *Sialidæ*, an observation made by M. Pictet, "that one of these larvæ lived fifteen days in the earth before it changed to the pupa, being," he remarks, "the only instance of an insect furnished with external respiratory organs respiring the ordinary atmospheric air." I cannot perceive, however, what our worthy friend, or M. Pictet, from whom he quotes the fact, has discovered so exceedingly wonderful in this circumstance. There is nothing more remarkable in this fact, than in that of the common caterpillar of the Sphinx remaining unchanged in its cell in moist earth for many days before it enters the pupa state. The truth is, that as the period of change approaches, the respiration of the larva is reduced to its minimum, and is almost entirely suspended; consequently the medium in which the insect is placed, whether it be water, or air saturated with that fluid, as it necessarily must be in a cell of moist earth, is as well fitted for branchial respiration as water itself. That the functions of branchiæ are fulfilled under these circumstances, I need but, in proof, direct attention to the known fact that Crustacea will continue to respire in the open air for an indefinite length of time, so long as their branchiæ are kept moist by fluid retained beneath the folds of the thorax. In closing these remarks I again refer to the question, have the habits of *Pteronarcys* any reference to the branchial structures in the perfect insect? My own opinion inclines strongly to the affirmative. The *Pteronarcys* shun the open day, during which they remain secluded beneath stones or in damp places, where the air is charged with moisture. They come abroad at night, and are constantly in the neighbourhood of streams and rivers, in which localities also the air is saturated with moisture. Under either of these circumstances the branchiæ may be sufficient for all the purposes of äeration.

I may also further observe, that branchiæ appear to be a well-marked generic character of these insects, although hitherto overlooked. In the dried specimens they become shrivelled, and are almost lost; but I have had the satisfaction of detecting the remains of them in the original specimens described by Mr. Newman, and now in the collection of the Entomological Club. They are in so shrivelled a condition as to have been easily overlooked; and would not, probably, have at all been recognised were they not first seen in this recent and well-preserved specimen in spirit†.

* Vol. ii. p. 50, *note*.

† The specimen preserved by Mr. Barnstone in spirit was exhibited at the meeting.