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XXVIII.—*Notes on British Zoophytes, with descriptions of some new species.* By the Rev. THOMAS HINCKS, B.A.

[With a Plate.]

To the Editors of the Annals of Natural History.

GENTLEMEN,

THE following miscellaneous notes relate to the British Bryozoa. I am not prepared to vouch for the novelty of all the observations which I here record. But in the course of a long and patient study of these interesting beings some facts have occurred to me, which I have not met with in the works of any of the English authors to which I have access, and which I venture to hope may prove of some value as a contribution to the history of the tribe. Even if I should repeat, in some cases, the observations of others, the testimony of one more independent witness may not be altogether worthless.

I have also been fortunate enough to obtain one or two species, which I believe to be new to the British fauna, and which I shall have the pleasure of introducing to the readers of the 'Annals' in the following pages:—

THE AVICULARIUM.

The "Birds'-head processes," with which some of the species of Bryozoa are furnished, have engaged the careful attention of naturalists, and their form and movements have been accurately described. But though we have many conjectures as to their precise function, and relation to the œconomy of the animal, few *facts* have as yet been recorded which throw light on the uses of this curious portion of structure. Such being the case, the following observation may have some interest.

The organ to which I refer bears a striking resemblance to a miniature bird's head, and is mounted on a short pedicle, furnished in most cases with a basal joint, by means of which it can be swayed backward and forward. These 'processes' are distributed in great numbers over the polypidom, one being generally placed on each cell.

The beaks are continually gaping and closing with much vehemence, and the entire organ is frequently swung to and fro. The movements, as it has often been noted, are quite independent of the polypes, and Mr. Darwin has well remarked, that in their functions these bodies "are related rather to the axis than to any of the polypi."

There is something very comical in the energy and earnestness with which these tiny jaws open and close, and throw themselves about, no cause being apparent in general for the outrageous gapings and eccentric jerks in which they indulge. They occur on several British species, as for example, *Flustra avicularis* and *Cellularia avicularis*.

While watching on one occasion a piece of the latter zoophyte through the microscope, a worm passed over it and amongst its branches. It was almost immediately firmly grasped by one of the *avicularia* and forcibly detained. In a short time, one end of it was seized by another, from which, however, by its violent contortions it extricated itself, but not without injury. The first assailant meanwhile kept fast hold, and soon two others caught the unfortunate at different points of the body. Thus it was held securely pinioned, and all its efforts to disengage itself, which were most vigorous, proved unavailing. The *avicularia* grasped the body of their victim most *viciously*, and nearly divided it. When I last observed the contest the worm seemed exhausted by its struggles and scarcely stirred, the *beaks* remaining firm and motionless. These strange police-officers were very systematic in their operations, and in capturing the intruder seemed to be discharging a very ordinary function.

There can be little doubt, I think, that it is the office of these organs to defend the Bryozoon from enemies—to arrest creatures or substances which might injure or annoy it. They are well placed for such a purpose, and their incessant gaping and swinging must enable them readily to detect the presence of trespassers. The *avicularia* then must be regarded as part of the machinery of the axis, charged with the special office of keeping the polypidom free from extraneous matters. An analogous contrivance occurs on others of the Bryozoa, consisting of long bristles attached to the cells by a joint, upon which they move backward and forward with considerable force. These clear away obnoxious matter from the neighbourhood of the cell, and keep the

surface of the polypidom clean. I can confirm from personal observation the remarks which some authors have made respecting the *force* with which the movements of these hair-like appendages are executed.

Membranipora pilosa.

The polypes of this common species are furnished with a singular organ, which has been described by Dr. Farre in his admirable paper on the Ciliobrachiata. It consists of a small oblong body, which is placed between the base of two of the arms, and attached to the tentacular ring. It has a wide circular opening at the top, round which there is a play of cilia. The interior cavity is lined with cilia. The organ becomes narrow towards the base, and is closely united to the sides of the tentacles. Dr. Farre noticed a similar body on the polypes of *Alcyonidium gelatinosum* (Johnston). He states that he was unable to detect any flow of fluids through it, nor could he ascertain with what parts the cavity in its interior might communicate. I had long made this organ the subject of close investigation without gaining any clue to its history; but at length some light was thrown upon it by the following observations. Specimens of the zoophyte were procured in the spring, in which the *cercariæ* of Dr. Farre—filamentous bodies which are found swimming in the visceral cavity in many species of Bryozoa—were present in great abundance. They were also of larger size than any I had previously met with. In one of the polypes I observed a mass of these *cercariæ* wriggling upward from the lower part of the visceral cavity; and each filament, when it reached the base of the organ before referred to, was drawn into it and carried through it by the action of the cilia lining the interior, and then ejected and borne off by the tentacular currents. This expulsion went on for three or four minutes, during which time the filaments were streaming up incessantly from below. A great quantity was ejected. After a while a single filament only made its appearance occasionally, and at last none were to be seen.

Dr. Farre mentions that on one occasion he observed the *cercariæ* in a specimen of *Alcyonidium* "drifting rapidly to the upper part of the visceral cavity, and issuing from the centre of the tentacula," but from the sudden retraction of the polype he lost the opportunity of tracing their course. He adds, "it would appear from this that there is some external communication with the cavity of the body." My observations show that this communication is through the intertentacular organ, and that whatever purpose it may subserve beside in the œconomy of the Bryozoon, it is at certain seasons the channel through which *cercariæ* are ejected from the visceral cavity. The author before quoted

conjectures that it may indicate a difference of sex, remarking that it is more frequently absent than present. I have not found this to be the case. The instances in which I was unable to detect its presence were very rare. Amongst a great number of polypes examined it occurred on all but a few.

The connexion, however, now proved to exist between the ciliated organ and the *cercariæ*—which must be regarded as spermatozoic bodies—may be accepted as conclusive evidence that it is subservient in some way or other to the function of generation. Professor Owen has pointed out "the analogy of these *cercariæ* with the spermatozoa discovered by Wagner in the tortuous generative tubes of the *Actinia*," and has noted their importance in the generative œconomy of the Bryozoa. I have observed them in *Bowerbankia* as well as in *Membranipora*, and Dr. Farre mentions them as occurring in *Valkeria*, *Alcyonidium*, and others. They are no doubt present in all the members of the tribe.

May not the intertentacular organ be also the channel through which the ova are expelled from the interior of the cell? They germinate, we know, from the inner surface of the lining of the cell, and falling into the visceral cavity are there fertilized by contact with the spermatozoa. It is probable that they find exit through the same passage by which the *cercariæ* were ejected, as before described.

In other species, Van Beneden asserts that he has discovered the termination of the oviduct under the roots of the tentacula.

I hope to be able ere long to report the results of further investigation into this interesting and obscure portion of the history of the Bryozoa.

Anguinaria spatulata.

The mechanism of the cell in this pretty species is interesting. The aperture, which is inferior, is large and oval. In the living state a membranous covering stretches over it of a dirty whitish colour.

At the upper end is a small *trap-door*, which falls when the polype is about to issue from its cell, and is drawn up and tightly closed after it when it retreats.

The polype does not protrude far from the cell. It has about twelve arms.

When retracted they may be seen folded together, and occupying the anterior portion of the cell. The internal structure is simple. There is a long œsophageal tube terminating in a dilated bag or stomach. The polype, when withdrawn, stretches down about two-thirds of the cell, and is not folded upon itself.

Filaments descend from the base of the body to the animal

matter which pervades the creeping fibre. The polypes are very shy and wary, and will remain for a long time without issuing from their cells.

Eucratea chelata.

The polype of this species, which is closely related in structure to *Anguinaria*, is of extreme delicacy and beauty, and remarkable for the vivacity of its movements. In a moment it retracts itself, and the moment after darts from its little cell, bending its arms backward and forward with inconceivable quickness. The number of the tentacles is twelve.

Cellepora pumicosa.

The polypes are of a delicate orange colour, and singularly graceful in their form and movements. They are large, and protrude much beyond the cell when extended. The viscera are marked by dark spots.

Lepralia pediostoma.

Tentacles sixteen, long and slender. The aperture of the cell is covered by a horn-coloured operculum, which, when the polype extends itself, slides back, as it were, within the cell.

Flustra hispida.

The development of the ciliated gemmules has been described by Sir John Dalyell and others. I venture to add a few notes to their interesting observations. From a specimen procured in the month of May a large number of gemmules were excluded. They were found clustering about the surface of the fleshy mass. I was not fortunate enough to see any of them actually excluded, but there can be little doubt that they escape through the skin. The gemmule is a very beautiful object. It is of a semioval form, white, and thickly fringed with cilia round the border. It consists of a transparent case, inclosing an opake nucleus. The margin is broken into lobes, which bear a multitude of long and somewhat coarse cilia. At each extremity there is a tuft of very delicate hairs, which I have noticed in motion some time after the rest of the cilia have ceased to play. At the top of the back, between the nucleus and the outer case, is a small projection (Pl. XIV. fig. 1 *a*), or handle, which seems to disappear when the gemmule attaches itself. Towards one end of the nucleus I have repeatedly observed a curious movement quite independent of the cilia, such as might be produced by a number of *setæ* sweeping backward and forward. At the same point there was an appearance of structure, but I have not been able to arrive at any certain conclusions about it, and may very possibly have

been deceived. I have observed very vigorous contractions of the mantle at one extremity of the body. The movements of the gemmule are irregular. Sometimes it creeps along, using its cilia as feet; at other times it swims pretty rapidly through the water; at others it tumbles over and over. Occasionally it floats on its back with its cilia upward, and in this state resembles a miniature boat. After a short time the cilia suddenly cease to play, the creature becomes attached, and is gradually developed into the cell and polype, which are to be the nucleus of an extensive colony.

In about twelve days from the time of attachment I have seen the polype issue from its cell, but the development probably proceeds more rapidly under favourable circumstances. Imperceptibly the body of the polype shapes itself within the mass. The tentacles are first visible. Soon violent convulsive movements are seen within. The front part of the cell is frequently pushed out with much apparent force, so as to form a neck of considerable length, and then suddenly retracted. There is no appearance of an opening at this time. The tentacles become very restless, and bend themselves about as if trying their powers and impatient of confinement. Gradually the parts become more defined; the elongation and retraction of the fore part of the cell continue, and at length the polype breaks from its captivity. The number of arms at first I have found to be twenty-four or twenty-five.

In the cases which came under my observation a narrow band of the granular matter, which composed the substance of the gemmule, remained round the body of the newly-formed polype. Some time before the development of the latter was complete a small swelling appeared on one side,—the rudiment of a second cell. A portion of the granular matter just referred to seemed to pass into it and fill it. This swelling gradually increased, extending down the side of the original cell. Before development had proceeded far, a third cell began to germinate from the second. A fourth was also in process of formation on the other side of the primitive cell (Pl. XIV. fig. 3).

The internal structure may be studied to great advantage in the newly-formed polype (Pl. XIV. fig. 4). The particles of food are borne down the œsophagus at once (there is no gizzard) into the stomach. There they are kept in constant agitation—whirling to and fro incessantly—and after a while are expelled and driven upward again by the sudden contraction of the walls of the stomach. This goes on *with much regularity*. The contractions of the stomach are very vigorous, the opposite sides almost meeting when the expulsion of the food takes place. A mass of undigested material gathers near the pyloric orifice, and is kept

rotating by the action of cilia before escaping into the intestine. The intestinal tube shortly after leaving the stomach expands into a kind of sac.

New Species of Vesicularian Zoophyte.

The production which I am about to describe I believe to be quite new to the British fauna. Whether it be known or not to foreign authors I am unable to say.

It belongs to the family Vesiculariadæ of Dr. Johnston's work, and is much the most beautiful of its tribe. The peculiar structure of the cells renders necessary the formation of a new genus for its reception. In general character it is allied to *Vesicularia*.

Family Vesiculariadæ.

Genus *Mimosella* (Hincks).

Polypidom rooted, confervoid, horny, jointed and variously branched; cells ovate, biserial, opposite, with a basal joint, by means of which they can be moved to and fro, and folded together on the branches; polypes with eight tentacula.

Species *Mimosella gracilis* (Hincks).

From a creeping fibre which spreads over the surface of *Fuci*, rise graceful, tapering stems, pinnate, much attenuated towards their extremities, and running out into filamentary, tendril-like prolongations. These stems are commonly from an inch to an inch and a half in height. They are jointed at intervals; and immediately below each joint spring two opposite pinnæ, also jointed, tapering and slightly curved.

The pairs of pinnæ do not all lie in the same plane. Along these are set the cells, which are ovate, elongate, biserial and opposite. Each cell is attached to a small prominence on the side of the pinna, which is perforated. A circular orifice on one side of the cell near the base fits over this, and a *joint* is thus secured, by means of which the polype can move its dwelling forward in one direction and back again. This is frequently done. The polypes are continually swaying their cells to and fro. Sometimes all the cells on the pinna are folded together on the upper side, just as the leaflets close on the leaf of the sensitive-plant (*Mimosa*), and hence the generic name. When specimens are dried or preserved in fluid, the cells are generally in this condition, and on slight inspection might be pronounced unilateral. Towards the base of each pinna the cells are long and oval; as they approach the apex they become short and globose, and at last are nothing more than little round excrescences.

The polypes have eight arms, and are furnished with a gizzard.

They are very vigorous in their movements. It is very interesting to watch the little creatures manœuvring their cells. Every now and then, as if some common impulse stirred them, all the polypes on a single pinna will move forward their cells, and the frond close, like the *Mimosa*-leaf when touched. More commonly they are independent in their movements. A single cell here and there will be seen in motion, while the rest remain quiet.

The mouth of the cell is furnished with the characteristic *setæ* of the family. When the cells are detached, the circular opening near the base may easily be detected.

The foregoing is a description of the simpler form of the zoophyte. Fine, proliferous specimens occur in which the polypidom is irregularly branched; the pinnæ are often trifid at their extremities, and are sometimes themselves pinnate and much prolonged.

This beautiful production was dredged in Salcombe Bay, Devon, profusely investing a bunch of sea-weed (Pl. XIV. figs. 5, 6, 7, 8).

Pedicellina.

Dr. Johnston records one species of *Pedicellina* (*P. echinata*) as British; stating at the same time that the *P. gracilis* of Sars and the *P. Belgica* of Van Beneden "may be expected to be found" on our coasts. The former has lately occurred to me at Fleetwood. Fine and abundant specimens were procured from a buoy that had been moored near that port. I am not aware that an *English* locality for this species has been published; but in a paper in the Number of the 'Annals' for June 1845, it is described by Mr. Goodsir and mentioned as occurring in Scotland. I have figured the *P. gracilis* (Pl. XIV. fig. 9). The most marked character is the expansion of the stem towards the base. The *Pedicellinæ* are amongst the most hardy of zoophytes. I transported specimens in a small bottle from the coast of Lancashire to Exeter, a distance of 300 miles, and though I was unable to renew the water, they lived with me after their long journey for two or three days. At the end of that time they showed signs of a disposition to get rid of their heads,—which is by no means a *suicidal* act in a *Pedicellina*,—and were therefore at once secured in Goadby's invaluable fluid!

I have also the pleasure of adding the *P. Belgica* to the list of British Bryozoa. Van Beneden's description is as follows:—"Tentacula twelve, equal in length, a little shorter than the body: stem and pedicle smooth." I have recently found this species at Exmouth on weed in rock-pools, near low-water mark. The small number of arms (eleven or twelve) and the freedom

from spines are characteristic. The 'bulging' about the middle of the stem, as represented in Van Beneden's figure, was wanting in my specimens; but this can hardly be accounted an essential character.

Farrella.

The Fleetwood buoy which yielded the *Pedicellina gracilis* also supplied me with specimens of a zoophyte which must be referred to the genus *Farrella*, but which differs remarkably from the *F. repens* of Dr. Farre. I have not met with any description of it.

Species *F. producta* (Hincks).

Cells oblong, on a pedicle, as long as the cell or longer; tentacula twelve.

The cells, which are more slender than those of *F. repens*, are produced below into a long, gently tapering pedicle which connects them with the creeping fibre. This is equal to the cell in length or exceeds it; it becomes much attenuated towards the base. A thread of matter passes down from the bottom of the stomach through the pedicle. The cells are generally set a little obliquely on their stalks. The polypes have twelve arms, and exhibit a structure like that of the *F. repens* as described by Dr. Farre.

This is a very pretty species, and may be known at once by its long and tapering pedicle (Pl. XIV. fig. 10).

Apologizing for the length to which these notes have extended,

I remain, Gentlemen, your obedient servant,

Thomas Hincks.

Exeter.

P.S.—Since writing the foregoing pages I have had an opportunity of examining the *Cycloum papillosum* of Hassall in a living state, and of witnessing the escape of the gemmules from the ovarium. In this species the ovaries appear as yellowish *papillæ*, scattered irregularly over the surface of the polypidom. Within these the ova are arranged circularly. At the top of each ovarium is a slight depression marked by a small dark spot. At this point, when the gemmules are about to escape, an opening appears, and a little tube is gradually pushed forth to some distance. Through this tubular orifice the gemmules may be seen working their way by means of their *cilia*. As soon as they have effected their escape they begin to move with great activity through the water. I have seen seven pairs from a single ovary in the course of a few seconds, and very interesting it was to watch them struggling through the tubular passage, and launch-

ing themselves into their new sphere of being. As the sunlight falls upon the *cilia* they are tinted with a most lovely violet colour.

The gemmule is circular in form, white, opake, and bears a striking resemblance to *a low-crowned hat*. The margin is fringed with cilia. There is an orifice beneath opening on the edge of the disc, about which there are cilia, which play down into it.

Occasionally a cup-shaped organ is protruded near this aperture on which I have frequently observed a mass of fæcal matter.

There is great difficulty in examining these beings with the microscope, but I have been able to determine the above points with tolerable certainty.

The number of gemmules produced is immense. On a small specimen, incrusting both sides of a piece of weed, which did not exceed an inch and a quarter in length, and half an inch in breadth at the widest part, about 120 ovaries were reckoned. Each of these would contain about nine ova, so that more than a thousand altogether would be liberated from this inconsiderable fragment.

EXPLANATION OF PLATE XIV.

Fig. 1. The gemmule of *Flustra hispida*.
— 2. The same, as it appears shortly after having become attached.
— 3. A cluster of the cells of *F. hispida* in various stages of development.
— 4. Cell and polype recently developed from the gemmule.
— 5. *Mimosella gracilis* of the natural size—the cells folded together on the pinnæ.
— 6. A portion of a pinna magnified, showing the cells expanded.
— 7. A single cell, with the circular orifice near the base.
— 8. A cell just separated from the pinna.
— 9. *Pedicellina gracilis* of Sars.
— 10. *Farrella producta*.

XXIX.—*A List of all the Mosses and Hepaticæ hitherto observed in Sussex.* By William Mitten, A.L.S.

[Continued from p. 324.]

Tribe IV. Funariaceæ.

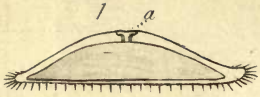
Genus 1. *Ephemerum*, Hampe.

118. *E. serratum* (Schreb.), Hampe.

Phascum serratum, Schreb. Eng. Fl.

Frequent in autumn and early spring.

119. *E. cohærens* (Hedw.), Hampe; "dioicum; basi filis protothalli instructum, subacaule; folia ovali-lanceolata serrata,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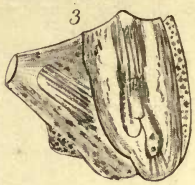
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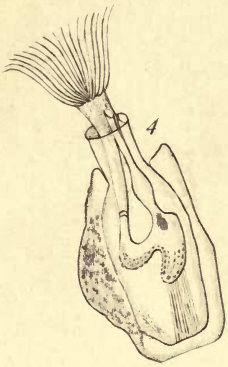
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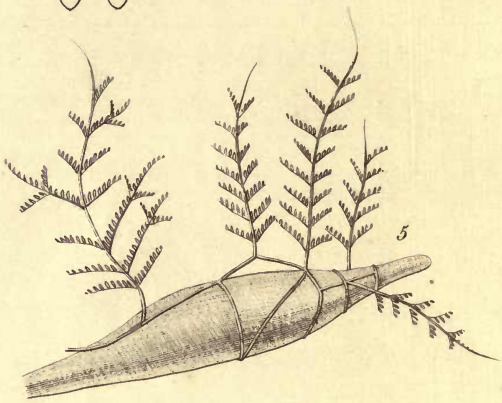
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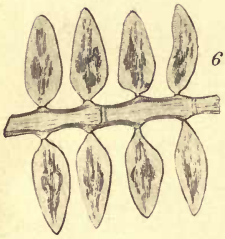
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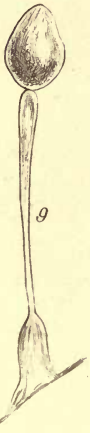
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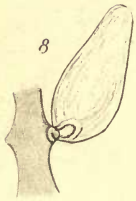
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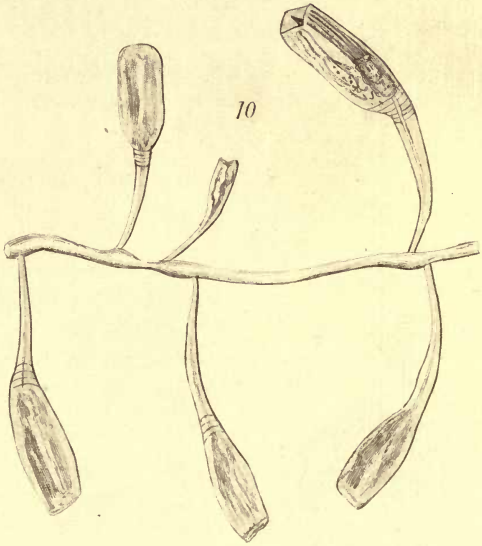
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