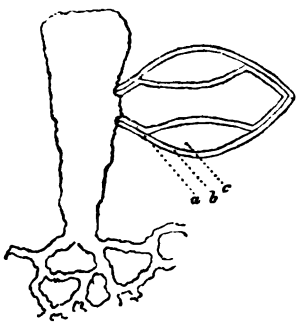
IV. *Observations on British Zoophytes.* By T. Strethill Wright, M.D.

Kionistes retiformis (*κίων-ἵστημι*).

Polypary retiform—alimentary polyps minute, white, with single row of short tentacles—reproductive polyps columnar, thickened towards apex, without tentacles, bearing many generative capsules.

A male specimen of this zoophyte was found growing in an old shell at Granton in May 1857. The corallum consists of a close network of flattened chitonous tubes, from out of which the alimentary and reproductive polyps spring at intervals. The sperm-sacs (one of which is shown in the marginal woodcut) attached to the reproductive polyp differ from those of Hydractinia, in having the endoderm attached to the ectoderm at their distal extremities, as I have figured in the sperm-sac of Eudendrium. This zoophyte approaches the Sertulariadæ in the simple columnar form of its untentacled reproductive polyps, and forms the connecting link between the Tubulariadæ and Sertulariadæ. Thus we have:—



Reproductive polyp of *K. retiformis* with single sperm-sac; *a*, endoderm, *b*, ectoderm, *c*, cavity containing spermatozoa.

Sperm or egg sacs attached to ordinary alimentary polyps, as in	Clava, Coryne, &c.
Sperm or egg sacs attached to reproductive alimentary polyps, which differ from ordinary alimentary polyps in having fewer tentacles, as in	Podocoryna fucicola (*Sars.*)
Sperm or egg sacs attached to reproductive polyps, with rudimentary mouth and tentacles, as in	Hydractinia.
Sperm or egg sacs attached to reproductive polyps, without mouth or tentacles, as in . .	Kionistes, Sertularia.

V. (1.) *On the Vomer in Man and the Mammalia, and on the Sphenoidal Spongy Bones.* By John Cleland, M.D., Demonstrator of Anatomy in the University of Edinburgh.

The remarks which I am about to make will be confined as much as possible to matters of observation. I shall resist the temptation to enter on the question of the constitution of the

mean annual temperature of the lower portion of the county, embracing a series of years, may be stated at 47·2 Fahr.; the rain-fall 24·6 inches. The mean annual temperature of the city of Edinburgh, for the last three years previous to 1860, is 48°·3 Fahr., by the lists of the Meteorological Society. This is equal to if not higher than the annual temperature of any of the Scottish towns, and only 2° lower than London. The annual rain-fall at Greenock, on the west coast, is two-thirds more than that of Mid-Lothian. Mr Rhind concluded by recommending to the members of the Society, of whom there were several eminent in the various departments of natural history, to combine their labours in a complete investigation of the physical history of the county. We owe much, he said, to the labours of our predecessors in this respect; and it is but just that we should endeavour to do something for those who are to succeed us.

A vote of thanks was unanimously given to Mr Rhind for his address, and his valuable services while President of the Society, his term of service having now drawn to a close.

The Secretary was instructed to engross in the minutes of the meeting portions of the President's address referring to the death of Mr William Oliphant; and to send an extract of the minute to his widow, Mrs Oliphant, as a mark of the Society's respect for the memory of its late member and office-bearer, and of sympathy with her in her bereavement.

The following communications were then read:—

I. *Observations on British Zoophytes and Protozoa.*

(1.) *Notice of* Ophryodendron abietina (Corethria sertulariæ). (2.) *On the Reproductive System of* Chrysaora. By T. Strethill Wright, M.D.

(1.) *On Ophryodendron abietina.*—Amongst the lower classes of animals, and especially in the *Protozoa*, the lowest class, numerous and very striking examples of homomorphism occur. "Homomorphism" is an exact similarity in form between animals of different classes, without any corresponding resemblance in their anatomical structure. Some of these examples may be considered fanciful, as the likeness between *Lacrymaria olor* and the fossil

reptile *Plesiosaurus*. But in others the homomorphism is so perfect, that animals belonging to the lower class were long confounded by the most eminent zoologists with those of a higher class. Thus, various species of the *Foramenifera* were classed amongst the *Cephalopoda*. The shells of many of the *Foramenifera* are, indeed, exact copies of those of *Cephalopoda*, both recent and fossil. The recent Nautilus and Argonaut, and the fossil *Baculite*, *Orthoceratite*, *Hamite*, and *Ammonite*, find their representatives in the microscopic *Numulina*, *Polystomella*, *Dentalia*, *Cristellaria*, and *Rotalina*. The shells of the former are inhabited by the highly organised cuttle-fishes; those of the latter by creatures which can scarcely be said to possess any organization. The chambers of their shells are filled with a glairy living mass, which streams like a fluid in and out through the innumerable minute pores with which the shells are pierced. The streams unite together to form widely-spread meshes and expansions, which envelope, absorb, and digest smaller living beings coming in contact with them, and on which the animals move, or rather flow along. But although the forameniferous animal is a mere fluid mass, destitute not only of organs and stomach, but even of the simplest cellular structure, it is yet capable of exercising the most important functions of life—motion, nutrition, and reproduction,—and of erecting for itself edifices mathematically correct in design, which arrest the eye by their exceeding beauty of form and ornamentation, and which, deserted by their tenants through successive ages, have formed no inconsiderable part of the solid frame-work of our globe. A curious instance of "homomorphism" occurs in the subject of the present notice, *Ophryodendron abietina*, which is fashioned after the type of *Sipunculus Bernhardi*, a highly organised Echinoderm. This animal consists of a shapeless oblong mass, immoveably fixed to the corallum of *Sertularia pumila*. From one end of the mass arises a closely wrinkled proboscis, surmounted by a tuft of short tentacles. The proboscis can be entirely withdrawn into the body, or extended to an astonishing length, until it appears as a clear glassy wand,

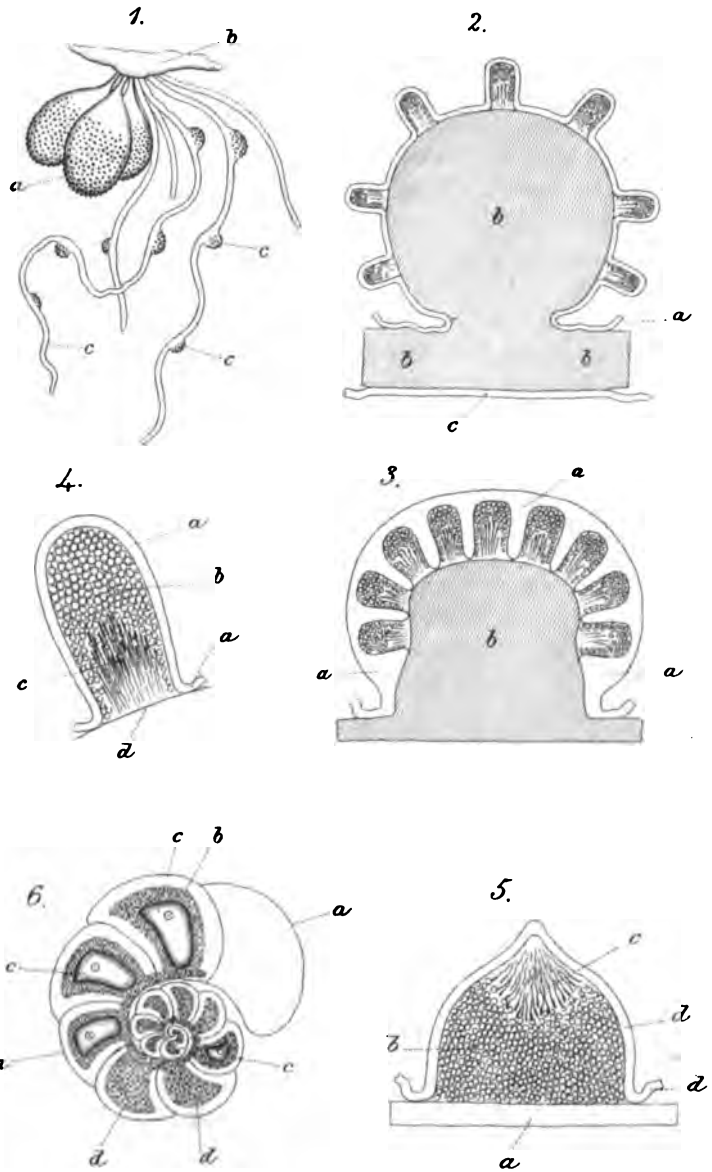
twenty times as long as the animal, and clothed at its upper part by about forty scattered tentacles, which twine about in most violent motion. The animal seems to be constantly searching the water around for prey, and occasionally to press the tentacles firmly against the body of the proboscis, as if to imbed some matter into the soft substance of the latter—the usual mode of feeding amongst the *Acinetiens*, to which class it belongs. It is impossible not to be struck by the extreme similarity in outward form between this animal and the Echinoderm *Sipunculus Bernhardi*. In both animals occur the same shapeless body, the same entirely retractile proboscis crowned with tentacles, and the same peculiar motions in seeking for prey. But with the form, the similarity ends, for the Echinoderm possesses a highly organised structure, while in the transparent Protozoon no structure at all has been detected.

(2.) *On Hermaphrodite Reproduction in* Chrysaora hyoscella. (Plate IX).—Professor Allen Thomson, in his "Treatise on the Ovum,"* states that "the Discophoræ (Medusæ) are of distinct sexes." I have found this to be the case in all the Steganophthalmata and Gymnophthalmata which I have examined, with the exception of the subject of this notice.

Large individuals of *C. hyoscella* are hermaphrodite; but smaller ones are found which are unisexual, the male or female element being suppressed, as in some dioecious plants.

The best method of examining the structure of the reproductive apparatus of this animal is to place the Medusa, in its natural position, in a large basin of sea-water. The umbrella, all but its margin, is then to be cut away. The cavity of the stomach is thus laid open, and we have a good view of the interior aspect of the sub-umbrella. We find that each lip of the mouth divides, at its insertion, into three pillars. The central pillar projects as a large rounded bulb into the stomach, while the lateral ones diverge, pass outwards towards the margin, and afterwards converge and unite together, so as to form, with the bulb of the central pillar, the thickened opening or framework of the ovarian

* Cyclopædia of Anatomy and Physiology, vol. v. p. 129, "Acalephæ."



1-5 Reproduction of Chrysaora. 6. Reproduction of Truncatulina.

pouch. This opening is closed by the ovarian membrane, which consists of three layers—1. the endoderm, or intestinal layer; 2. the gelatinous layer; and 3. the ectoderm, or dermal layer. The ovarian membrane appears as a flocculent mass, from its being corrugated into numerous folds. By injecting air beneath it, it becomes inflated, and the folds are opened out. It then presents the appearance of a large transparent bag traversed by flat convoluted bands. These bands are the ovaries, and contain, between their endoderm and gelatinous layer, countless ova and planuloid larvæ in various states of development.

The ova of *C. hyoscella* do not present, at any stage, a trace of germinal vesicle or spot—objects which are so readily detected in the ova of other polypoid zoophytes.

The planuloid larvæ resemble those of *Medusa aurita;* but the polyps into which they become developed approach more closely to the Lucernarian type, in having a pedicle which is surrounded by a gelatinous covering, and at its foot by a horny corallum, which I have described and figured elsewhere.*

The structure and position of the male organs are remarkable. Attached to the inner surface of the ovarian membrane by delicate pedicles, and projecting into the stomach, are numerous large grape-like bodies of translucent "jelly," accompanied in many cases by fringes of tentacles of the same substance (Plate IX. fig. 1). The surfaces of the first bodies are dotted with minute papillæ, and on the tentacles are found tubercles or thickenings covered with similar papillæ. These papillæ are sperm-sacs filled with spermatic cells and spermatozoa (fig. 4). Smaller bodies, about the size of a hemp-seed, and specked with sperm-sacs, also occur attached to various parts of the lining membrane of the stomach, and even to that of the lips or long oral tentacles, *down to the very tips of those organs.*

The small Chrysaoras (about 4 inches in diameter) have no ovarian bands in their pouches, which only contain masses of the grape-like bodies and tentacles before mentioned. These tentacles are not homologous with the minute, hol-

* Edinburgh New Phil. Journal for 1859.

low, cnidophorous or sting-cell-bearing tentacles found on the inner surface of the ovarian membrane of *Medusa aurita* and *Lucernaria auricula;* they are simply, as are the grape-like bodies, prolongations of the endoderm and gelatinous layer of the ovarian membrane.

Although the *testicles* of *Chrysaora* are apparently not homologous with those of other zoophytes, yet in reality they differ but little from those of *Actinia* and *Lucernaria*. I have given, in Plate IX. fig. 2, a section of the testicle of *Chrysaora*, and in fig. 3, of one of the same bodies in *Actinia mesembryanthemum*. In *Chrysaora*, the thin endoderm (*a*) forms the distant sperm-sacs which project from the surface. In *Actinia*, the thick endoderm (*a*) also forms the more closely aggregated sperm-sacs, and fills up the interstices between them. The testicle of *Lucernaria*, again, resembles in shape and structure fig. 3; but the sperm-sacs are so closely moulded together, that they form hexagonal prisms divided from each other by exceedingly delicate walls of endoderm.

The sperm-sac of *Chrysaora* (fig. 4), as well as of other Steganophthalmatous Medusæ, Lucernarias, and Actinias, is thus always formed of the endoderm or lining membrane of the digestive system, while the sperm-sac of *Hydra* (fig. 5), the Hydroid Polyps, and the Gymnopthalmatous Medusæ is formed of the ectoderm. In the first class of animals the spermatic cells (fig. 4) become first matured into spermatozoa in the centre (*c*), or at the base of the sperm-sac, the part most distant from the endoderm (*a*). In the second class they ripen at the periphery, or at the summit of the sperm-sac (fig. 5), the part also most distant from the endoderm (*a*).

My friend Mr Hincks, in his valuable paper on "Clavatella,"* appears to consider that the ova of that creature may be developed from the ectoderm. But an examination of the embryology of a very large number of zoophytes forbids me to entertain this idea. The endoderm of the generative capsule in these creatures consists of two layers intimately connected with each other. The external layer, or that in

* Annals and Magazine of Natural History for February 1861.

tact with the generative elements, is transparent and structureless. The internal layer, communicating with the cavity of the digestive system, is loaded with brown granules. In *Coryne glandulosa*, the ova are at an early period observed attached to the transparent layer of the endoderm, and separated from the ectoderm by a wide space of fluid. In *Hydractinia*, the reproductive polyps of which possess a muscular coat, that coat intervenes between the ova and the ectoderm.

In the subject of this paper, the ectoderm does not enter at all into the constitution of the sperm-sac. We may therefore conclude that the ova and spermatic plasma are detached or secreted from the external surface of the endoderm, which continues to convey nutriment to the former until they are fully developed.

EXPLANATION OF PLATE IX.

Fig. 1. Male organs of *Chrysaora hyoscella: a*, grape-like bodies dotted with sperm-sacs and attached to the ovarian membrane, *b; cc*, tentacular processes bearing tubercles and sperm-sacs.

Fig. 2. Section of tubercle bearing sperm-sacs, from the extremity of long oral tentacles: *a*, endoderm; *b*, "jelly;" *c*, ectoderm.

Fig. 3. Section of similar tubercle from *Actinia mesembryanthemum*, showing sperm-sacs formed by and imbedded in endoderm, *a; b*, interstitial tissue.

Fig. 4. Single sperm-sac of *C. hyoscella: a*, endoderm; *b*, unripe spermatic cells; *c*, spermatozoa; *d*, "jelly."

Fig. 5. Sperm-sac of *Hydra viridis: a*, endoderm; *d*, ectoderm; *b*, unripe spermatic cells; *c*, spermatozoa bearing the same relations to the constituents of the sperm-sac as in fig. 4.

III. *On the Serial Homologies of the Articular Surfaces of the Mammalian Axis, Atlas, and Occipital Bone.* By JOHN CLELAND, M.D., Demonstrator of Anatomy in the University of Edinburgh.

In works on human anatomy it has been customary to compare the articular surfaces of the atlas, and the superior articular surfaces of the axis, with those of the oblique processes of other vertebræ, as if they were homologous, notwithstanding the apparently anomalous manner in which, according to that view, the first and second spinal nerves must be considered as emerging from the spinal canal. The

By Professor Balfour.—From the Author. 2. Transactions of the Botanical Society. Vol. VI., Part III. Edinburgh, 1860.—From the Society. 3. On the Tertiary Deposits associated with Trap-Rock in the East Indies. By the Rev. Stephen Hislop.—From the Author. 4. On the Arrangement of the Muscular Fibres of the Ventricular Portion of the Heart of the Mammal. By James Pettigrew, Esq.—From the Author. 5. The Quarterly Journal of the Geological Society. No. 62, May 1860. Vol. XVI., Part II.—From the Society. 6. Jahrbuch der Kaiserlich—Königlichen. Geologischen Reichsanstalt, 1860. XI. Jahrgang, No. I., Jan., Feb., Marz. Wien.—From the Imperial Geological Society of Vienna.

The Communications read were as follows:—

I. *Observations on British* Zoophytes *and* Protozoa.

On Atractylis palliata *and* coccinea (new species). By T. Strethill Wright, M.D.

1. *Atractylis palliata*, n. sp. Pl. XI. fig. 6.

Polypidom creeping, closely reticulate. Polyps fusiform, shortly stalked, minute, white, with eight alternating tentacles; body of polyp clothed with a thick layer of 'colletoderm.' Free medusoids springing from meshes of polypary, with four-lipped peduncle; four lateral canals; two long marginal tentacles and two tentacular tubercles alternately placed.

This zoophyte was found on a shell inhabited by *Pagurus Bernhardus*, at Granton. When first observed, its closely-set and dense white polyps, surrounded by their gelatinous envelopes, were mistaken for a mass of minute ova. These envelopes cover the whole of the body of the polyps up to the border of the mouth, and consist of an exaggerated development of the gelatinous coat which probably exists on the polypidom and body of all the Hydroidæ, in some as a delicate epidermis, in others (as in *Bimeria vestita* and the subject of this notice) as a thick, imputrescible coat—the "colletoderm."

The Medusoids (Pl. XI. fig. 7) are of great size when compared with the very minute polyp, and resemble exactly those of *Atractylis repens*. I have not witnessed any further development in them after their separation from the zoophyte. In those of *A. repens*, when kept alive for some time, the two tentacular tubercles put forth short tentacles,

and four other tubercles appear on the marginal canal, as shown in fig. 8—a change analogous to that undergone in *Bougainvillea Britannica.*

2. *Atractylis coccinea*, n. sp.

Polypidom creeping, widely reticulate. Polyp fusiform, set at an obtuse angle to its stalk, rich crimson or pink, with eight alternating tentacles, four long and four short.

This zoophyte was found at Inchgarvie in August last, growing on the roots of *Laminaria saccharina.* The polypary consists of an open network of milk-white fibres, which closely invests the branches of the root. From this network the polyp-stems are given off, each about a quarter of an inch in length, of a rich pinkish cream-colour, and bearing at its summit a single crimson polyp with a double row of transparent colourless tentacles. The body of the polyp is fusiform, sometimes nearly cylindrical, and consists of an endoderm having its cells laden with granules of the richest carmine-colour, covered by an ectoderm of transparent white—a white blond dress over a crimson satin petticoat. The polyps, like others of this class, have the habit of turning themselves inside out, when the internal surface of the deep-coloured velvety endoderm is readily observed. On such occasions masses of granular matter are frequently ejected, which are composed of small pigment-globules filled with crimson fluid. The tentacles are eight in number, four of which are long and held nearly erect, and alternate with the rest, which are shorter and more expanded. The thread-cells are inconspicuous.

This beautiful little zoophyte, when seen with a single lens, presents a perfect garden of minute animal flowers covering the roots of the sea-weed. The reproductive apparatus was not observed.

3. *On Rhizopod Structure.*

One of the most interesting and important questions of the day to the comparative physiologist is that of the constitution of Rhizopod structure. The Foraminiferous or Rhizopod animals are before our microscopic eye every day. We

see their beautifully chambered shells imitating some of the most graceful objects of nature and art,—the living streams of nearly fluid sarcode, of which they are composed, flowing forth from the almost invisible pores of their shells, uniting with each other, and forming glairy masses, and reticulations, and expansions, which absorb animal matter coming in contact with them,—single and compound animals building their aggregated homes in the most graceful lines and spirals,—single dwellings and populous towns slowly moving along, of which the inhabitants are but patches of transparent slime,—vast Polythalamian cities, where the huge primordial Rhizopods reign, surrounded by the multitudes of their dwarfed descendants, in widening circles and triple tiers. Such is Rhizopod life. At present no true generative elements have been recorded as discovered in the Rhizopods, though Carpenter and Schultze have noticed bodies which they have suspected to be ova. In the autumn of 1859 I was preparing a number of specimens of Hydractinia for the microscope. They were first soaked in whisky for several weeks, then immersed in dilute nitric acid to remove them from the crab's shell, and finally washed in strong spirit, and put up in Canada balsam. On examining one of these preparations under the microscope, it was found that two specimens of Truncatulina had been accidentally prepared at the same time. The development of Truncatulina commences with a single cell; this multiplies by gemmation in series until a colony of animals is formed, each larger than its predecessor, arranged in a spiral, somewhat resembling the shell of the Nautilus. In the Nautilus, the last chamber of the shell only is occupied; but in Truncatulina every chamber contains its tenant, while the whole colony are united by a band of sarcode, which passes from chamber to chamber along the inner curvature of the shell. All the cells or houses in this Rhizopod town are full of minute pores, from which the inhabitants protrude their delicate arms of slime in search of prey, or to move the assemblage from place to place. When the Truncatulina is treated as before mentioned, the shell is removed, and the separate zooids appear united by their connecting band. One of the

two Truncatulinas, when examined by aid of the microscope, was found to consist entirely of homogeneous matter; but the other presented a far different appearance. Its segments or zooids, and their connecting bands, all appeared to be enclosed in a well-defined membrane. Each segment was nearly destitute of sarcode, and contained a highly refractive body, in which appeared, with the utmost distinctness, a germinal vesicle or spot. I can regard this body only as a true egg, which has been developed at the expense of the sarcodal element of the segments, in many of which the reproductive process is occurring simultaneously. Yet it may be objected that the ova in the larger segments are greatly larger than the young or original animals of Truncatulina. In some animals, however, as in Spongilla, Gregorina, &c., many individuals are produced from a single egg; and it is not improbable that a process of great division of the egg or swarming may take place in Truncatulina, by which a great number of animals may be produced from each segment.

II. *Note on the Occurrence of* Trilobites *in the Carboniferous Limestones of Fifeshire.* By R. H. Traquair, Esq. (Specimens exhibited.)

In the neighbourhood of St Andrews, Fifeshire, remains of a trilobite (*Griffithides mucronatus*—M'Coy) are pretty common in the shale overlying the thick bed of limestone worked at Ladeddie, Wilkieston, and Newbigging, and belonging to the Carboniferous Limestone series.

At each of these quarries the limestone itself is hard, blue, and crystalline, and contains but few fossils; but these, consisting of corals, polyzoa, shells, and trilobites, are abundant in the overlying shale, though generally in a very fragmentary condition. This is especially the case at Ladeddie, and, combined with the soft and friable consistency of the shale, renders it difficult to obtain good specimens from that locality. At Wilkieston, however, the shale has assumed a more firm and slaty aspect, and the contained fossils are in a much better state of preservation.

The trilobites occur for the most part in a very disjointed and fragmentary condition, entire specimens with head, thoracic segments, and caudal shield in apposition, being

Fig. 4. *Sacculina triangularis;* external skin and corium reflected: *a*, external skin covered internally by the corium; *i*, ovigerous lamellæ.
Fig. 5. Ovigerous sac, showing the anterior and posterior folds which embrace the internal ovaries.
Fig. 6. Mass of ova from the ovigerous lamellæ.
Fig. 7. Greatly magnified view of one of the vesicles, drawn from a fresh specimen: *a*, the duct of the vesicle; *c*, the structure found in the interior of the vesicle; *b*, the horny substance found at the commencement of the duct.
Fig. 8. The same organ as fig. 7, drawn from a specimen preserved in alcohol: *a*, the convoluted duct; *b*, the horny process.
Fig. 9. The structure found in the interior of the vesicle, removed.
Fig. 10. *Sacculina carcini*, with no ovigerous lamellæ, nat. size: *b*, the peduncle; *b'*, intestine of crab; *c*, ovario-branchial orifice.
Fig. 11. *Sacculina triangularis*, nat. size. (Same references as in fig. 10.)
Fig. 12. *S. carcini* distended with ova.
Fig. 13. Posterior view of fig. 12; *d*, horny attachment of peduncle; *k*, prolonged portion of the same.
Fig. 14. A group of *S. triangularis*.
Fig. 15. *S. inflata* (after Leuckart).
Fig. 16. Enlarged view of the vesicles of *S. carcini*.

II. ***Observations on British Zoophytes.*** 1. Hydractinia areolata, *n. sp.* 2. Atractylis arenosa, *n. sp.* (Plate XIV.) By Joshua Alder, Esq. Communicated by T. Strethill Wright, M.D.

1. *Hydractinia areolata*, n. sp. Plate XIV., figs. 1–4.

Polypary encrusting, consisting of a solid chitinous expansion, from which arise simple linear spines in irregular groups, leaving areolar spaces between them. *Polyps* naked, small, white, columnar, slightly enlarging above, and terminating in a conical mouth, below which is a single circle of from six to ten linear tentacles, appearing of different lengths from their varying contractility. Gonophores (reproductive organs) sessile on the chitinous base, large, globular, or slightly pear-shaped, containing each a single medusoid. Height of polyp about $\frac{1}{10}$th inch.

Medusoid with a moderately deep subglobose umbrella, having four golden-yellow radiating canals, at the bulbous bases of which, on the margin of the umbrella, are four rather short tentacles; four shorter ones alternate with them; and intermediate between these are eight others, almost tubercular. The peduncle is rather long and co-

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J. Alder del. *J. Basire sc.*

HYDRACTINIA AREOLATA, 1–4.

ATRACTYLIS ARENOSA, 5–7.

lumnar, with four tufts of thread-cells surrounding the mouth.

A single specimen only of this interesting little *Hydractinia* was obtained, parasitical on a dead shell of *Natica Alderi* brought in by the fishing-boats at Cullercoats. I have since seen a dead and rather worn specimen, upon *Natica Grœnlandica*, among the Zoophytes collected in Shetland by the Rev. A. M. Norman. The species differs from *H. echinata* in its much smaller size, the simple linear form of its spines, their irregular grouping, and more especially in its bearing medusoids; these latter spring from the encrusting base. No capsule could be detected; but this might possibly arise from its great transparency. The medusoids bear a great resemblance to those of *Podocoryne carnea* (Sars), the only difference being in their having eight intermediate tubercular tentacles. In this respect they also differ from the medusoid of a Hydroid polyp described by Professor Lovén, and referred by him to *Hydractinia*, but which appears rather to belong to the genus *Podocoryne*, as the base was not horny or spinous. As far as I am aware, therefore, this is the only instance in which medusoids have been ascertained to be produced by a true *Hydractinia*.

2. *Atractylis arenosa*, n. sp. Pl. XIV. figs. 5–7.

Polypary minute, consisting of a creeping fibre, from which arise short funnel-shaped tubes, rather irregular in form, but always expanding more or less at the top, from which the polyps issue, generally covered with minute grains of sand. *Polyps* entirely retractile, with long, slender, strongly muricated tentacles, varying in number, according to age, from six to twelve.

The genus *Atractylis* has been established by Dr Strethill Wright for a group of Hydroid Zoophytes resembling *Eudendrium* in many of their characters, but differing in the conical form of the mouth of the polyp, and its retractility (partial or complete) within the tubular polypary. They are generally of small size, and seldom branched. Their reproduction is usually by medusoids; but Dr Wright, who

has lately met with the present species in the Firth of Forth, has ascertained that it produces planuloid young direct from the summit of the ovarian sac. This affords another proof of the difficulty of establishing a genus from the mode of development.

I have met with this species occasionally, for some years past, on stones and the roots of *Laminariæ* at Cullercoats and Tynemouth. From its minute size, it requires to be carefully looked for.

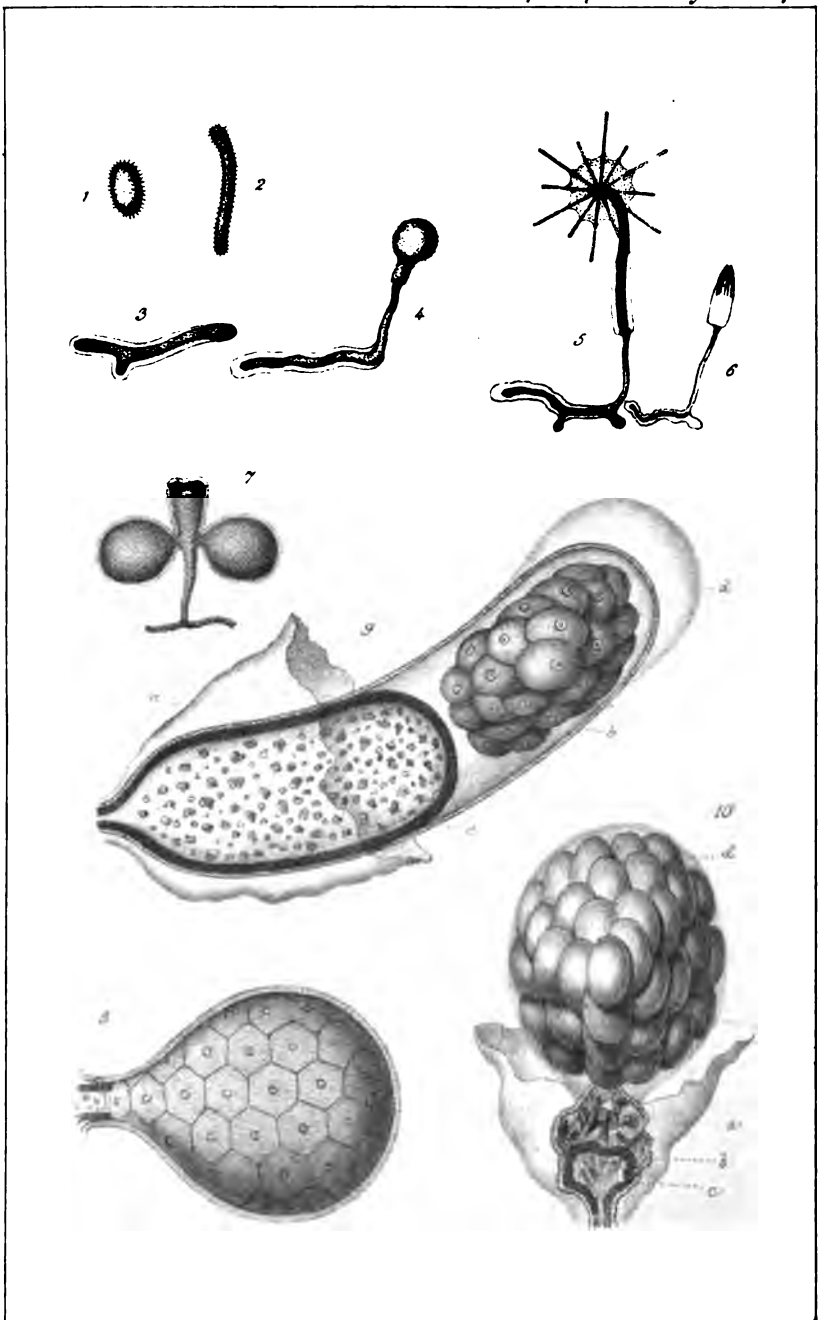
Explanation of Plate XIV.

Fig. 1. Polypary of *Hydractinia areolata* on *Natica Alderi*, natural size.
Fig. 2. *Hydractinia areolata*, highly magnified.
Fig. 3. A portion of the polypary of the same, highly magnified.
Fig. 4. Medusoid of the same, highly magnified.
Fig. 5. *Atractylis arenosa*, natural size.
Fig. 6. The same, highly magnified.
Fig. 7. A tentacle of the same, much enlarged.

III. *On Reproduction in* Æquoria vitrina. By T. Strethill Wright, M.D. Plate XV.

In vol. i. of Agassiz's "Natural History of the United States," the following passage occurs:—"As to the Æquoriadæ, I have no doubt that they are genuine hydroids, though I have not been able to trace with certainty the origin of the Æquoria of our coast to any true hydroid. But the structure of Æquoria in its adult Medusa state is so strictly homologous to that of all the naked-eyed Medusæ, that even if it were ascertained that it undergoes a direct metamorphosis from the egg to the perfect Medusa, I would not hesitate to consider it as a member of the order of Hydroids, since it has simple radiating aquiferous tubes, a circular canal, and marginal tentacles closely connected with it, and provided with minute pigment spots at the base." Agassiz was doubtless correct, and he might also have predicted that it belonged to the genus Campanularia or Laomedea, as it corresponded with those genera in the presence of otoliths. In the beginning of this month (November) Mr Fulton sent me two living specimens of *Æquoria vitrina*, one about three inches in diameter, the other about six

PLATE XV.



T Stoothall Wright, del.

W.H.M.c Farlane Lith.r Edin.r

1-6. Æquoria vitrina. 7-10 Atractylis arenosa

inches and a half. The number of lips of the latter was about forty, the radiating canals, each having a long ovisac, about eighty, and the marginal tentacles, by estimation, four hundred. On examining the ovaries, I found that the eggs were hatched, and the young, in the form of almost invisible planulæ, were issuing from the ovisacs. These were gently extracted with a glass syringe, an instrument so useful to those who practise the obstetric art amongst the hydroidæ, and were placed about three weeks ago in glass tanks of clean sea-water prepared for their reception. Many thousands of larvæ were placed in the tanks, and of those, about a score have been developed into Campanularian polyps; about a hundred are still progressing to that end, and the rest have disappeared. It was with no little impatience and anxiety that I saw the Planula during a fortnight fix itself to the glass, spread itself out into a short thread, secrete its scleroderm, put forth its polyp-bud—this last slowly swelling day by day, until at last it opened, and a polyp appeared, furnished with twelve alternating tentacles, joined together for about one-third of their length by a web, the polyp enclosed in a cell terminating in many acuminate segments. It is now about six years ago that I was watching, in like manner, the slow evolution of a bud from a Campanularian Zoophyte, the *Laomedea acuminata* of Alder—the Campanulina of Van Beneden—the bud opened, and a bright green medusoid issued forth, having four lips and two tentacles. The polyp form of *Æquoria vitrina* is, as far as I can determine, identical with that of *L. acuminata* in shape; but is so excessively small—quite invisible to the naked eye—that we must wait for further development before we can determine their identity. Geganbaur has proved that the Medusoid of Velella acquires a further number of canals and tentacles; and I have elsewhere recorded the successive changes which occur in the Medusoids of several species of Atractylis. It is also certain that such increase in the number of elements does occur in *Æquoria vitrina*, for the smaller specimens have always a less number than the larger. Meantime, the question as to the larval state of *Æquoria vitrina* is settled. This, the

largest of all the naked-eyed Medusas, is the reproductive phase of one of the smallest of all the Hydroidæ.

Explanation of Plate XV. *Æquoria vitrina.*

1. Planula directly after leaving the ovary.
2. Same a week old.
3. Same after having fixed itself to the glass and developed its scleroderm, —now become a polypary.
4. Polypary putting forth bud.
5. Same with young polyp.
6. Empty polyp cell.

IV. *The following Objects of Natural History were exhibited by* Edward Charlesworth, Esq., *York.*

A stuffed specimen of the Frilled Lizard *Chlamydosaurus Kingii*, from Port-Nelson, New Zealand, believed to be the best example yet seen of this most extraordinary reptile. It was purchased at the sale of the late Dr Mantell's Museum.

A small but extraordinary coral from the Chinese Seas, believed to be undescribed.

A series of small fossil tertiary shells from Barton, in Hampshire, illustrated by magnified figures.

A collection of small recent British Marine shells, illustrating a new mode of mounting and exhibiting very small specimens, intended to insure safety with effective display. The shells were fixed on cards with *gum tragacanth*, which can be freely brushed across the surface, and thus save much time in mounting, as it does not shine when dry, like gum arabic. The cards are then put in small boxes with glass lids.

A specimen of *Mactra Helvacea*, and other shells from the Channel Islands; several rare fossils of various kinds were also exhibited.

Monday, 16th December 1861.—Alexander Bryson, Esq., President, in the Chair.

The Office-Bearers for the Session 1861–62 were elected as follows:—

Presidents.—Alexander Bryson, Esq.; James M'Bain, M.D., R.N.; John Coldstream, M.D.

Council.—William Rhind, Esq.; David Page, Esq.; William Turner, Esq., M.B.; Thomas Strethill Wright, M.D.; George Berry, Esq.; A. M'Kenzie Edwards, Esq.

Secretary.—John Alexander Smith, M.D.

Treasurer.—George Logan, Esq.

Assistant Secretary.—James Boyd Davies, Esq.

Honorary Librarian.—Robert F. Logan, Esq.

Library Committee.—W. H. Lowe, M.D.; John Anderson, M.D.; John S. Livingston, Esq.

The following gentlemen were elected ordinary members of the Society:—

Murray Thomson, M.D., F.C.S., Lecturer on Chemistry; A. G. H. Cameron of Lakefield, Esq., Inverness-shire; Thomas Chapman, Esq.,

invariable largeness, always superior to that of our herrings of the Channel, of which the small dimensions are equally constant." Now, he said, it was true that considerable shoals of large herrings do appear on the Norway coast in the winter and spring; but the author seems not to have been aware that there is always in summer considerable shoals and a large fishery of small herrings, generally of a superior quality, but of a smaller size on the average than those caught in the English Channel (*La Manche*) or on the Scottish coasts; and he exhibited a specimen of each size, the one a giant of 13½ inches, and the other a dwarf of about 9 inches, each with the ova fully developed, and said that any number of each size could be obtained. He alluded to the statement in the same work as to the exceedingly deciduous nature of the scales of the herrings, and said that this was an exaggeration, as was evident even from the specimens he produced, which were covered with their scales. It is stated in this work, that the herring spawns apparently indiscriminately, without selecting any position, even in the middle of the sea—"au milieu de la mer." But this is not the case; for Mr Mitchell had ascertained that the herring always selects rocky, stony, or gravelly ground, on which to deposit its spawn. He would also point out that at page 62, vol. xx., it is said, "c'est pendant l'hiver qu'ils appairissent sur les côtes d'Europe." Now, it is well known that great shoals of herrings approach the coasts of Europe in summer and autumn, and are fished then, as already stated, in great quantities.

II. *Observations on British* Zoophytes *and* Protozoa. By T. Strethill Wright, M.D.

1. *On the Reproductive Elements of the Rhizopoda.* Plate IX.

We have, as far as I am aware, no definite observations as to the reproductive elements of the Rhizopods. All who are accustomed to the observation of minute marine life know that these creatures increase with great rapidity; but *how* they increase is at present a mystery.

Professor Carpenter* has recorded and figured a peculiar

* Phil. Trans., vol. cxlvi. p. 212.

state of the *sarcode* as occurring in spirit specimens of *Orbitolite*, which appeared to be broken up into little spherules, though still retaining the structure of unchanged sarcode. He also states that similar spherules are figured by Ehrenberg in several of the cells of *Sorites orbiculus*, and by Schultze in the chambers of *Rotalia*. Dr Carpenter is inclined to believe that these bodies are gemmules. I have repeatedly noticed bodies, apparently similar to those figured by Carpenter, in *Gromia;* but I have considered them to be of the same nature as the coloured spherules which are found within the endoderm of the Hydroid Zoophytes.

Besides these spherules, however, Dr Carpenter has met with other bodies, apparently imbedded in the sarcode, which he considered might be gemmules in a later stage, or ova. These were of a deep-red colour, and exhibited various stages of binary division. He has also figured a third object, found in an imperfectly closed shell of *Orbitolite*, which, with his usual caution, he considered might possibly have been introduced from without.

It is under these circumstances that I bring forward the following observations.

With regard to the female element, it will be necessary first to ascertain the essential characters of an ovum. Professor Allan Thomson* defines it as "a detached spheroidal mass of organised substance, of variable size, enclosed in a vesicular membrane, and containing, in the earlier periods of its existence, an internal cell or nucleus." But the presence of a nucleus is not essential to the constitution of an ovum; for in the ova of *Chrysaora hyoscella* and some of the Ctenophora (*Beroë*) it cannot be detected at any stage. The ova of these animals may be defined as "detached masses of highly refractive substance." Such appears to be the simplest definition of an ovum—a definition which will apply also to the first stage of the ovum of *Rhizostoma* as figured by Professor Thomson,† where he shows, first, the "primitive ovum" destitute of germinal vesicle and spot; secondly, the appearance of the germinal vesicle; thirdly,

* Cyclopædia of Anat. and Phys., vol. v. p. 128.

† *Op. Cit.* p. 128.

the advent of the macula within the vesicle; and, lastly the formation of the enclosing membrane.

On examining a great number of specimens of *Gromia*, *Miliolina*, *Rotalina*, and *Orbulina*, I have repeatedly discovered bodies which correspond in all respects with the "primitive ovum" defined above. They consist of transparent spheres or ovoids formed of a finely molecular substance, but in which the molecules are masked or rendered indistinct by the highly refractive matter in which they are imbedded. No germinal vesicle or spot appears in the living specimens. It may be masked in a similar manner to the molecular structure; but in a specimen of *Truncatulina* (Pl. IX. fig. 6) which has been hardened in spirit, decalcified by dilute nitric acid, and mounted with strong heat in Canada balsam, four of the segments or zooids contain each an ovum which shows a germinal vesicle and spot with the utmost distinctness, while the rest present the usual appearance of granular, low-refracting sarcode.*

I have not been able to trace the development of the ova of Rhizopods. Bodies similar to those I have considered ova in *Gromia* are found attached to Algæ in vessels where that animal abounds. The ova of *Gromia* are very small; and young Gromias slightly larger than the ova also occur. In *Gromia*, therefore, the ova may be at once transformed into young, and directly acquire an envelope. Such is the mode of development in the ova of most of the Hydroidæ, which are transformed into planuloid larvæ without undergoing fissure. In *Orbulina*, however, the ovum is of very large size, and consists of a colourless spherule of sarcode enclosed in a membraneous test and covered by a thin glairy layer. Here the sarcode presents traces of fissure, though these are lost when it is pressed out of its envelope. In both this genus and *Truncatulina* it is impossible that the full-sized ova can obtain exit from the animal, except by the destruction of the chambers of solid shell in which they are enclosed. In the case of *Truncatulina*, moreover, the ova are at least ten times as large as the primordial segment or

* I shall be happy to lend this preparation to any gentleman who may take an interest in it.

zooid of the adult. It is therefore probable that the ova of these genera undergo a "polymorphic" development of many months' duration, similar to that described by Carter as occurring in *Amœba verrucosa*,* and that each ovum becomes transformed into numerous Amœboid zooids, which escape through the openings of the shell and form the primordial segments of future Rhizopods.

With regard to the male element, I have only one observation to record. Amongst a large number of dark-brown Gromias which I have possessed for many months, one appeared filled as to its upper part with a milky matter, which, when pressed out, proved to be a congeries of cells and large active molecules, such as are obtained from the sperm-sacs of *Hydra viridis*. I was not able to make out the tails of the spermatozoa; but there could be no mistaking the characteristic shape and movements of the cells and molecules. The sarcode of the body in Rhizopods is itself finely molecular in structure, and, when crushed, exhibits slight molecular movements; but these movements are altogether different from those of the objects which I am persuaded are the spermatozoa of *Gromia*.

Since the foregoing paper was sent to the press, I have received the April Number of the "Annals," in which Schultze's discovery of living young in the chambers of *Rotalia* is brought before the readers of this Journal. Professor Williamson, in his "Treatise on Recent Foraminifera" (Ray Soc. Publ.) states, in regard to his *Spirillina perforata*, "He (Professor Ehrenberg) assigns to it the trivial name of *vivipara*, owing to the circumstance that just within the septal orifice of his specimen he found two small spiral shells, which had obviously found their way there by accident; from this unimportant circumstance, he concluded that the shell was viviparous." *S. perforata* is plentiful in the Firth of Forth, on *Fucus serratus*. Immediately after reading Schultze's paper, I examined a quantity of the seaweed, and found two large specimens of *S. perforata* surrounded by a multitude of very small ones. In one of the large specimens three small living *Spirillinæ* existed. Eh-

* Ann. Nat. Hist., ser. 2, vol. xx. p. 87.

renberg was doubtless right in considering this animal viviparous; but it remains to be determined whether the young are produced by gemmation or ovulation. In *Spirillina foliacea* I have found the highly refractive bodies I have above described as "primitive ova."

Explanation of Plate IX.

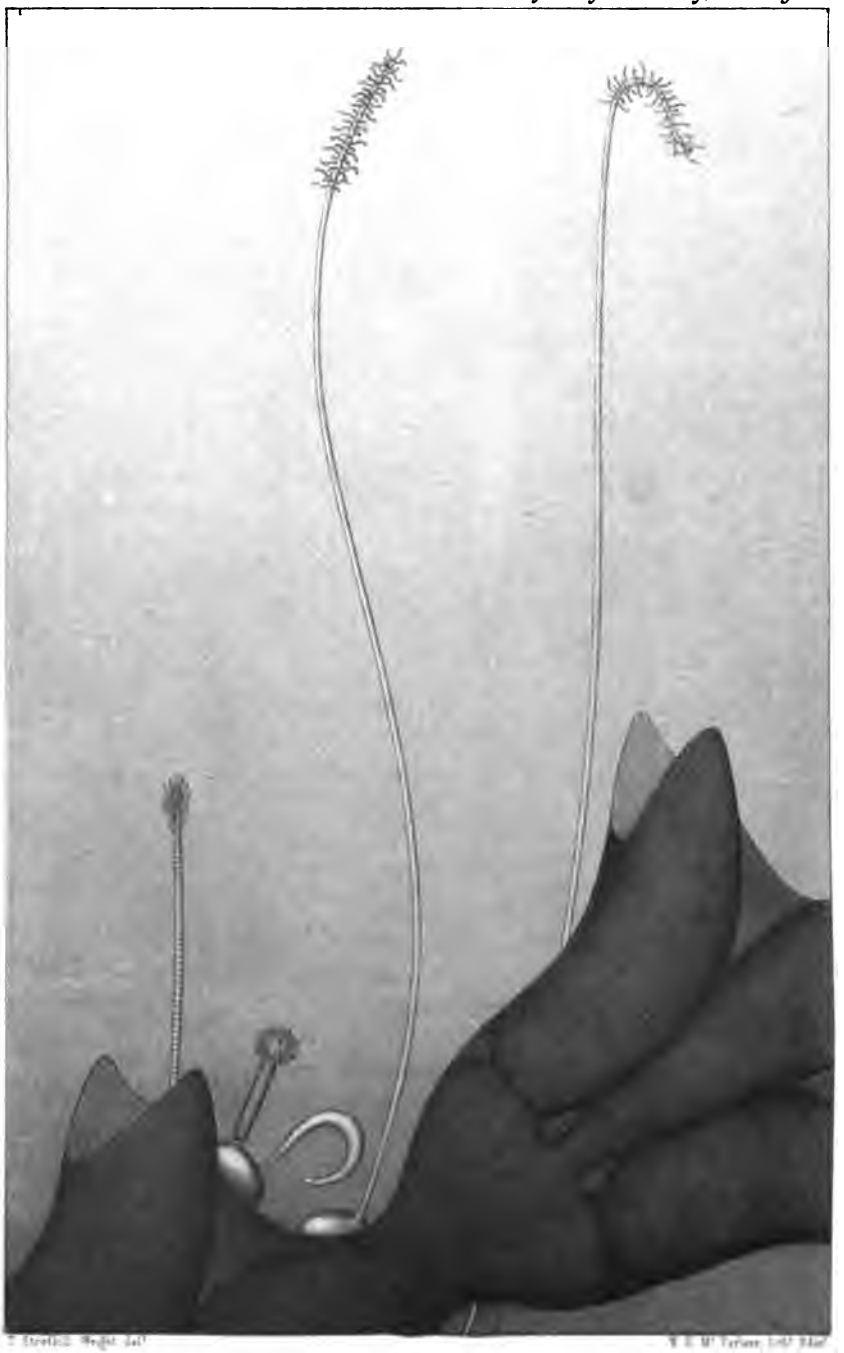
Fig. 6. Specimen of *Truncatulina*, decalcified; *a*, membranous basis of shell; *b*, sarcode; *c*, ovum, with germinal vesicle and spot; *d*, segment or zooid destitute of ovum.

2. *On the Reproduction of* Ophryodendron.

Ophryodendron abietinum, which I have figured in various attitudes in Pl. X., has been noticed elsewhere by Claparède and Lachmann* and myself† several years since; but it was not until the spring of the present year that I was able to discover its mode of reproduction. The animal presents the appearance of an oblong sac filled with homogeneous and finely molecular matter, and is found attached to the corallum of *Sertularia pumila*. From one end of the body or sac arises a proboscis, generally appearing as a short and closely-wrinkled club, but capable of being produced to a remarkable distance as a glassy ribbon surmounted by numerous twining tentacles. The sac usually shows no trace of a nucleus or contractile vesicle, nor are its contents differentiated into an external and internal tissue (ectosarc and endosarc), as in *Actinophrys* and others of the class ("Acinétiens") into which it has been introduced. The structure of the proboscis differs from that of the sac in the development within it, of a clear and highly refractive tissue, corresponding to the muscular element in the branches of *Zoothamnium*, and in the more directly contractile pedicle of *Zooteirea*. In the proboscis of *Ophryodendron*, as in the body of *Epistylis*, the contraction of the muscle throws its outer covering into close folds. The tentacles are formed of a continuation of the contractile tissue of the proboscis, and are covered to within a short distance of their tips by the integument. The proboscis, when extended, hangs

* Etudes sur les Infusoires et les Rhizopodes, par Edouard Claparède et Johannes Lachmann.

† Edin. Phil. Journal, July 1859.



Ophryodendron.

suspended or floating in an erect position, or slowly swims about in large curves by the continuous and very active motion of its tentacles. This animal may be called the homomorph, amongst the Protozoa, of *Sipunculus Bernhardi*. I have never been able to satisfy myself as to its mode of feeding, though portions of matter are occasionally seen entangled amongst the tentacles, and apparently pressed in contact with the substance of the proboscis.

In the sketch of this animal appended to my notice of 1859, I figured several globular bodies within the sac, which my friend, M. Claparède, to whom I showed it, had not observed; and on further observation, I was led to consider the figure erroneous. In March last, however, the *Ophryodendra* (Pl. XI. fig. 1) again contained these bodies, and by a somewhat "meddlesome midwifery," I was enabled to force them from the sacs, and to find that they were living young, from four to nine in number.

The young thus obtained consist of ovoid bodies of higher refractive structure than the body of the parent, and contain olive-brown corpuscles, shaped like the chlorophyll-granules of *Hydra viridis*. At a later stage, when the wrinkled trunk of the parent hung lax and dead, the young larvæ assumed a pyriform shape, flattened on their inferior surface (Pl. XI. fig. 2). This surface was also marked with longitudinal striæ, carrying short, soft, slowly-moving cilia or processes. Their natural mode of extrusion was not observed; but several families of them were found, each enveloped in a soft gelatinous ball, and attached to the *Sertularia* and other bodies. Single individuals were seen slowly moving on the zoophyte, and others attached were putting forth the rudiments of the proboscis. The proboscis was at first finely molecular, like the contents of the sac, unwrinkled and non-contractile. A few tentacles were presently put forth from its summit (fig. 3), and it gradually assumed the structure of that of the adult.

The body of *Ophryodendron* frequently bears fusiform bodies, from one to four in number, which I have already described, and which appear to be gemmæ.

Explanation of Plates X. *and* XI., *figs.* 1–3.

Pl. X. Two cells of *Sertularia pumila*, on which *Ophryodendra* are attached,—the figure on the left side of the centre with gemma and contracted proboscis, that on the right side of the centre with proboscis extended; the trunks of two others are shown in various stages of extension.

Pl. XI. figs. 1–3. Young of *Ophryodendron* in various stages of development.

3. *On* Dendrophrya radiata *and* D. erecta (nov. gen. et sp.).

The Rhizopodous animals to which I have given the name of *Dendrophrya* are found plentifully on Sertularias, Flustras, Fuci, and stones, in low water pools at Granton Quarry, near Edinburgh. There are two species, *D. radiata and D. erecta.*

D. radiata.

Its general appearance is that of a small shelly mass, from the borders of which radiates a system of branched membranous tubes, more or less coated with mud or other matters. In young specimens the central shell is absent, and the animal presents the appearance of an irregular system of branches radiating from a centre. The shape of the adults is very various, and depends on the surface to which they are attached; they attain sometimes a diameter of nearly a quarter of an inch, though generally much smaller. The shell is not acted on by acids, and is therefore siliceous. The animal itself can seldom be detected, as it lies concealed within its central flinty stronghold and the complicated system of earthworks surrounding it.

D. erecta.

In this species, found on stones, the branched, membranous, and mud-clothed tubes, instead of creeping over the surface to which the animal is attached, spring upwards and outwards, as in Pl. XI. fig. 4. Delicate pseudopodia, linear or forked (figs 4. and 5), are readily observed to protrude themselves from the extremities of the branches, accompanied sometimes by lobular processes of the sarcode of the animal. The patelloid shell of *D. erecta* may be easily detached from its seat, and its tenant, a small patch of semitransparent sarcode, scooped out with a flat-pointed needle and transferred to the stage of the microscope. It

PLATE XI.

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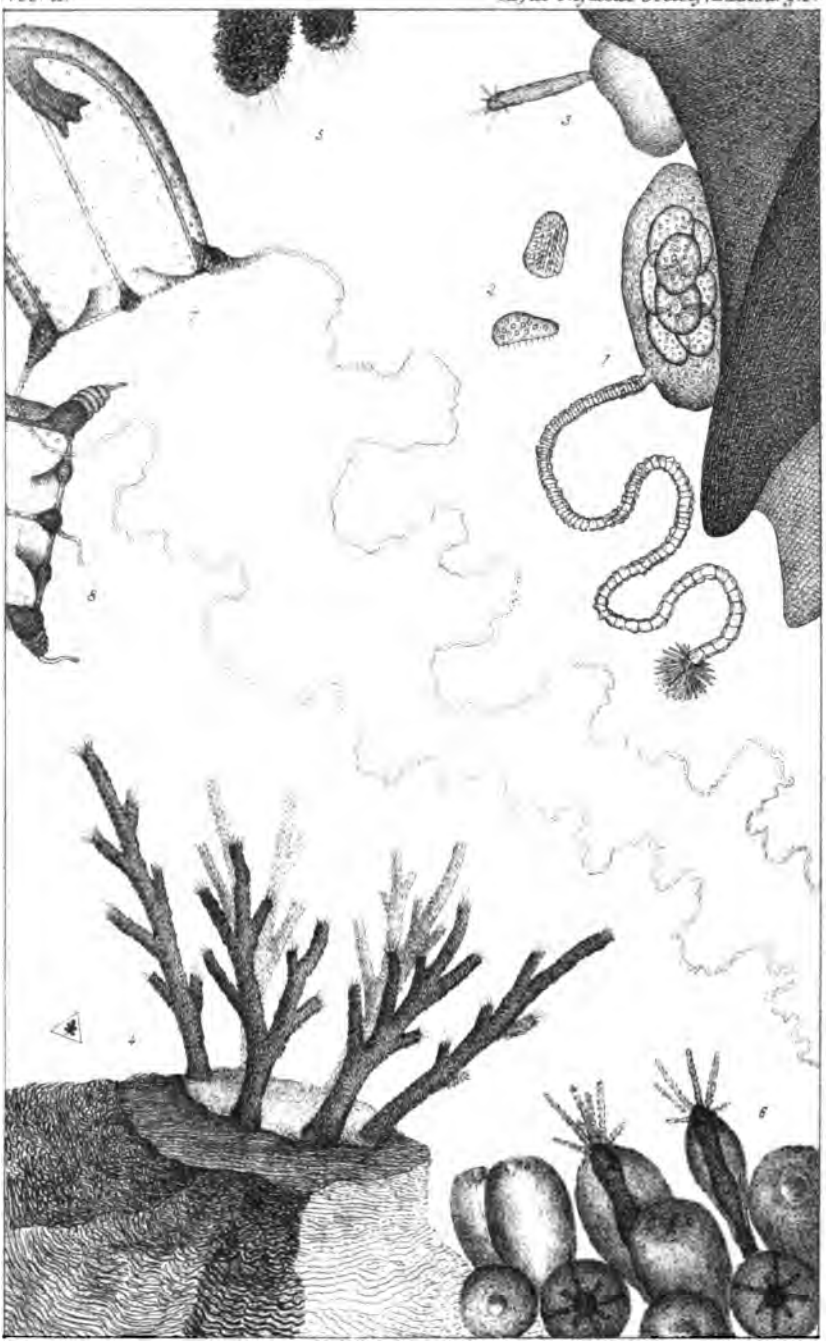
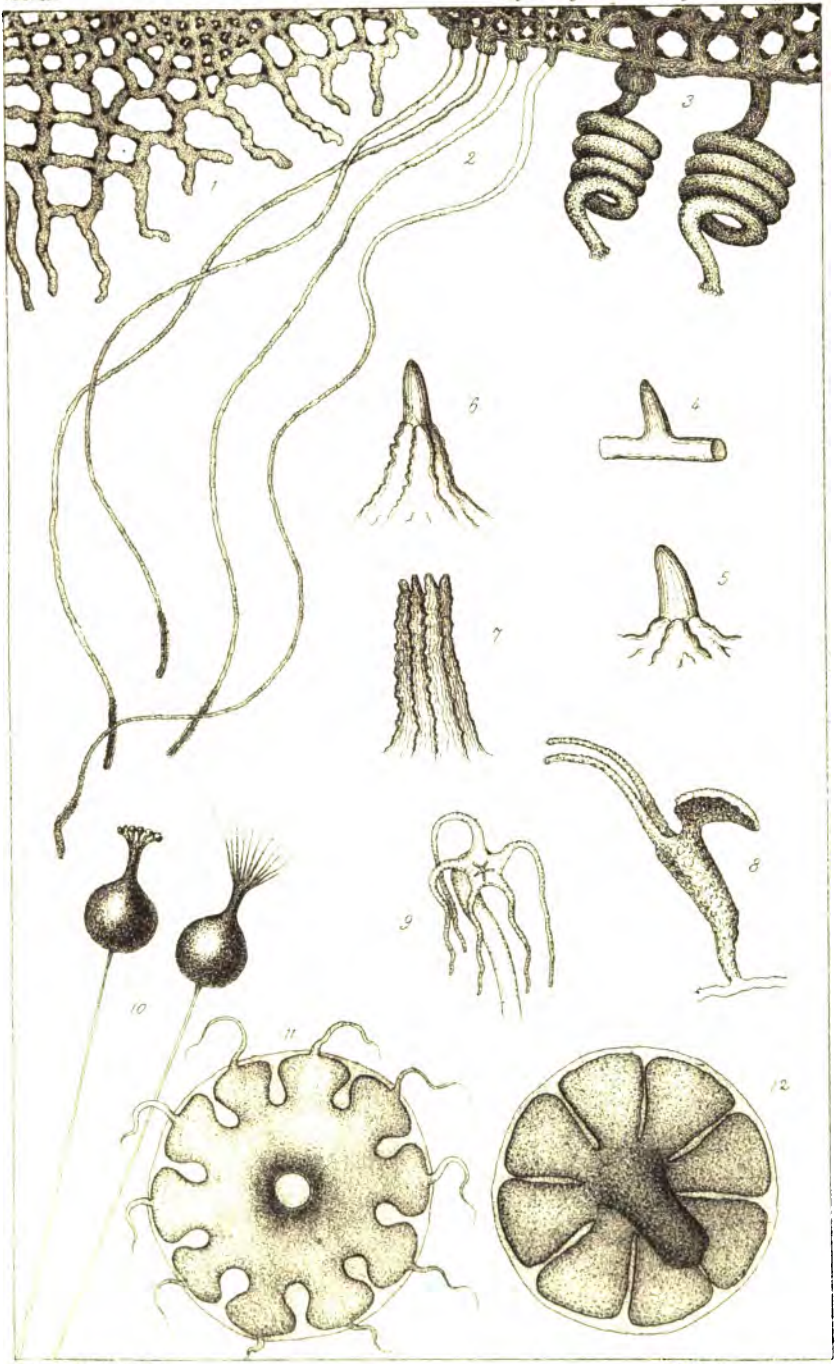


T. Strethill Wright del. et lith. W. H. M.c Farlane, Lith. Edin.

1-3. Ophryodendron. 4-5 Dendrophrya.
6-8. Atractylis palliata.

Vol. II. Royal Physical Society Edinburgh.



1-7 Hydractinia. 8. Lar Sabellarum. 9. Trichydra pudica.
11 Cunina globosa. 12. Sertalaria pumila.

differs from the sarcode of other Rhizopods in being filled with delicate short fibres instead of the usual molecular matter, and contains, both within the shell and tubes, the highly refractive bodies I have mentioned in a former paper as ova.

Explanation of Plate XI.

Fig 4. *Dendrophrya erecta* seated on a portion of stone, and showing pseudopodia projecting from summits of branches.

Fig. 5. Summit of one of the tubes of *D. erecta*, with projecting lobes of sarcode and pseudopodia.

4. *On* Lecythia elegans (nov. gen. et sp.)

This animal, of which I give drawings in Pl. XII. fig. 10, is found on *Sertularia pumila*. It is exceedingly minute, and requires high microscopic power and careful adjustment of light for its accurate definition. The body is flask or carafe-shaped, mounted on a long, fine, rigid pedicle, and enclosed in a closely fitting envelope. The summit of the body is dilated, and furnished with a variable number of long, slender, divergent processes or tentacles, which appear to correspond with those of *Actinophrys*. When the tentacles are contracted, they become capitate, and assume the form of a bossed crown, as shown in the figure.

Appendix to Cionistes reticularis (Kionistes retiformis), printed at p. 91.

This zoophyte resembles the Sertulariadæ in the simple columnar form of its non-tentacled reproductive polyps, and forms the connecting link between these organs in the Tubulariadæ and Sertulariadæ. It exhibits the most degraded form of the reproductive polyp, previously to the latter being altogether dispensed with and the generative sacs being developed directly from the polypary. Thus we have, in the chain of degradation,—

Generative sacs or medusoids attached to ordinary alimentary polyp, as in	*Clava*, *Coryne*, &c.
Generative sacs attached to reproductive alimentary polyp, which differs from ordinary alimentary polyp in having fewer tentacles	*Podocoryna fucicola* (Sars).
Generative sacs attached to reproductive polyp with rudimentary mouth and tentacles, as in . . .	*Hydractinia echinata*.

Generative sacs attached to reproductive polyp without mouth or tentacles; summit of polyp surmounted by a cluster of large thread-cells, as in	*Eudendrium confertum* (Alder).
Generative sacs or medusoids attached to reproductive polyp without mouth, tentacles, or cluster of thread-cells, as in	*Cionistes*, *Sertularia*, *Campanularia*.
Reproductive polyp divided longitudinally into several portions, each surmounted by its cluster of large thread-cells; sperm-sacs formed, as in *Hydra*, by simple dilatation of the ectoderm; each division of polyp transformed into a "moniliform" sperm-sac, as in . .	*Eudendrium arbusculum* (T. S. W.), *E. capillare?* (Alder).
Generative sacs or medusoids attached to the polypary, as in	*Atractylis* (T. S. W.), *Hydractinia* (Alder and T. S. W.), *Cordylophora* (Allman).

It will thus be seen that there is a very gradual transition from the alimentary polyp to the reproductive polyp, and from the latter to the simple generative sac. Professor Allman's term "blastostyle," applied to the reproductive polyp, is apt to mislead, as it indicates that the alimentary and reproductive polyps are not homologous parts. Still more decidedly does that accomplished naturalist confuse the homology of these parts by applying the same term to the branched pedicle of the aggregated generative sacs of *Tubularia indivisa*, which is merely formed of the conjoined and elongated pedicles of the individual sacs.

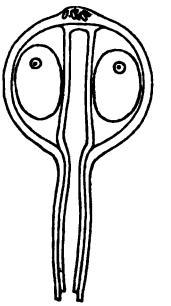
It is impossible to construct any classification of the Hydroid Zoophytes on the form or position of their generative sacs or medusoids, as these vary not only in different species of the same genus, but also in males and females of the same species. Thus, in *Eudendrium rameum* the sperm-sacs are moniliform, the egg-sacs single; the former are attached to the alimentary polyp, the latter to the polyp and also to the polypary. In *Hydractinia*, although the generative sacs generally spring from the reproductive polyps, they are also found attached to the polypary; and in a most interesting species of this genus lately discovered by Mr Alder, medusoids spring from the latter part of the zoophyte. In *Atractylis ramosa*, T. S. W. (*Eudendrium ramosum*, Van. Ben.), the medusoids, the males and females of which differ in shape, spring from the polyps, from club-shaped bodies, and from

the polypary; in other species of *Atractylis* they arise from the reticulated base of the zoophyte. In certain species of the genera *Sertularia* and *Campanularia*, marsupial forms occur which bear no homological relation to each other.

The gradual transition in the Hydroidæ from the simple generative sac to the perfect Medusa is exceedingly interesting. I attempt to indicate it in the following sketch:—

Generative elements (spermatozoa or ova) contained in a simple generative sac or dilatation of the ectoderm; *placenta* formed of endodermal floor of sac, ...	*Hydra.*	Simple generative sac.
Placenta protruding into generative sac, and forming "spadix" (Allman) surrounded by generative elements, . .	*Coryne.* *Hydractinia.*	
—or branched and permeating them,	*Campanularia lacaerta* (male).	
—or folding round single ovum, .	*Eudendrium rameum* (female).	
Placenta adherent to summit of generative sac; summit of sac furnished with cluster of large thread-cells; sac the equivalent of the peduncle of *Coryne gravata*, ...	*Eudendrium arbusculum* (male). *E. confertum* (female).*	Generative sac become a peduncle ("manubrium," Allman).
Summit of sperm-sac furnished with a row of tentacles indicating the presence of a non-differentiated subumbrella, ...	*Laomedea Loveni* male).	Subumbrella present, but not differentiated.
Generative sac transformed into a free walking medusoid; peduncle furnished with branched tentacles, as in *Bougainvillea*; subumbrella not differentiated, its presence indicated by eye-specks and otoliths; umbrella absent,	*Eleutheria*, medusoid of *Clavatella* (Hincks).	
Ovisac fixed, enclosed in a differentiated subumbrella with lateral and circular canals and tentacles, . . .	*Laomedea Loveni* (female).	Subumbrella differentiated.

* In the ovisac of *E. confertum* (see figure in margin), which I have had an opportunity of examining through the kindness of Mr Alder, the endoderm and ectoderm at first adhere together at the summit of the sac, and at this point a few large thread-cells occur in the ectoderm. A similar occurrence of adhesion and thread-cells is found in the sperm-sac of *E. arbusculum*, and also in the false and mouthless peduncle of the medusoid of *Coryne gravata*.



Sperm-sac surmounted with large thread-cells, and forming the peduncle of a fixed medusoid with differentiated subumbrella and umbrella, . .	*Coryne gravata.*	Umbrella differentiated.
Imperfect free medusa; peduncle with tubular mouth, and united with a single-cavitied generative sac .	Medusa of *Coryne decipiens, Sarsia.*	Peduncle or alimentary polyp and generative sac not differentiated from each other (see *post*).
Perfect free Medusa of low type; peduncle four-tentacled or lipped, and containing eight generative sacs coalescing into four, which are situated alternately with the tentacles or lips,	*Bougainvillea Britannica,* the Medusa of *Atractylis ramosa* (female). *Turris neglecta,* the Medusa of *Clavula Gossii* (female).	Generative sacs differentiated from alimentary polyp, but situated on it.
Perfect free Medusa of low type; peduncle four-lipped or tentacled, with eight distinct generative sacs, one placed on the side of each lip, .	*Oceania episcopalis,*	
Perfect free Medusa of higher type; peduncle four-lipped or tentacled; eight generative sacs, one on each side of lateral canals, . . .	Medusa of *Laomedea geniculata.*	Peduncle and generative sacs differentiated. Alimentary polyp taking no part in reproduction.
Medusa of highest type, with 4-6 lips and 8-12 lateral canals, each canal carrying a single generative sac, .	*Stomobrachium octocostatum.*	Generative sacs on separate canals; two canals corresponding to each lip.

Of the generation of *Stomobrachium* we know nothing. Claparède has shown that gymnophthalmatous Medusæ may produce Medusæ without the intervention of the polypoid phase; but it is impossible to draw any line of distinction between a Medusa and the medusoid phase of the Hydroid polyp. *Tubularia indivisa* produces its young as perfect polyps without the intervention of the planuloid phase, *Clava* with the intervention of that phase. In the life-history of

the Hydroidæ, any phase—planuloid, polypoid, or medusoid —may be absent.

The perfect several-lipped Medusa appears to be a symmetrical organism composed of eight or more elements, each element corresponding to the half of a lip. Each of these elements is composed of three subelements, the alimentary, reproductive, and prehensile, any of which may be suppressed, or unite with others of different value on the same element, or of the same value belonging to neighbouring elements. Thus, in *Sarsia* the peduncle appears to consist of a single alimentary subelement, and the single reproductive element or generative sac extends around and along the whole of it except the single trumpet-shaped lip. This lip is occasionally placed on one side and at some distance from the extremity of the peduncle, indicating the asymmetrical character of the latter organ in this genus. In *Euphysa* and *Eleutheria* the ovisacs coalesce, and are placed within and at the base of the peduncle. *Steenstrupia* and *Saphenia* furnish examples of the suppression of certain of the marginal tentacles or prehensile subelements, and the exaggeration of others.

The Polyp of the Hydroid Zoophyte must also be considered as composed of one or more elemental zooids. Thus we have the zooid of a single element in the 'tentacular polyp' of *Hydractinia;* the zooid of two elements in the two-tentacled and two-lipped *Lar Sabellarum* (Gosse) (Pl. XII. fig. 8), and in the minute two-lipped and non-tentacled polyp which occurs on the Antennularias and others; the zooid of several elements in the five-lipped polyp of *Trichydra* (T. S. W.); that of many elements in the polyp of *Tubularia indivisa*, which I have elsewhere shown to be formed by the confluence of the several distinct tubes of which the polypary or cœnosarc is composed, each of which tubes may be traced, by its coloured endodermal ridges, to the mouth of the polyp, and bears its own system of tentacles and reproductive apparatus.

The compound character of the *polypary* is also seen in *Halecium* and *Antennularia*, and in a very beautiful manner in the very early state of *Sertularia pumila*, which (after it

had been kept a few days in fresh water) I have figured with the camera in Pl. XII. fig. 12. Its resemblance to Carus's figure of the Medusa, *Cunina globosa* (Esch.), which I have copied in fig. 11, is very striking.

As the Medusa is a multiplex organism, we must inquire how far it is homologous with the generative sac of the Hydroid Zoophyte.

Prof. Allman, in his paper on *Cordylophora* (Phil. Trans. vol. cxliii.), advanced the doctrine that the generative sac was homologous with the whole Medusa—a doctrine based upon an erroneous conception of the cavity in which the generative elements are contained. In a "Note on Dicœcious Reproduction in Zoophytes" (Edin. New Phil. Jour., vol. iv. p. 88), I stated that "the reproductive buds [generative sacs] (of *Coryne*) were filled with ova developed from the exterior of a hollow central stalk, a diverticulum of the alimentary canal;" and further, "The *peduncle* of the Medusa-bud [or budded Medusa] appears to me to be homologous with the entire reproductive capsule [generative sac] of *Coryne glandulosa*, &c." This view is now adopted by Prof. Allman, who writes, in "Annals of Natural History," (vol. vi. ser. 3, p. 4), "The manubrium is the whole of the 'peduncle,' 'stomach,' or by whatever other name it may be called, which depends from the centre of the umbrella in a Medusa or medusoid; and I apply the same term to what I consider the homologous part in a sporosac, namely, the whole sporosac *minus* the ectotheca and mesotheca." Now, the 'sporosac,' less the 'ectotheca' and 'mesotheca,' is the simple generative sac, which, therefore, Prof. Allman has agreed with me in considering homologous with the peduncle.

But I would now very much modify the above view. We must keep in mind that each of the eight elements of a medusoid has three distinct functional subelements; that the single reproductive subelement of the Medusa exists, as in *Stomobrachium*, uncombined; that where the peduncle is the reproductive organ of a *free* Medusa, as in *Sarsia*, it consists of two subelements of different function combined, each exercising its separate function, alimentative or reproductive; that an organ composed of a single subelement (a

generative one) having only one function, cannot be homologous with one composed of two subelements (peduncle of *Sarsia*), each having its distinct function, or with an organ of sixteen subelements (peduncle of *Bougainvillea*), eight of which are alimentary and eight reproductive. I would therefore now state—

That the simple generative sac of *Coryne* is homologous with the reproductive subelement or single generative sac as it exists on the lateral canal of *Stomobrachium*.

That the peduncle-like sac of *Eudendrium confertum* is homologous with the *reproductive* subelement in the peduncle of *Sarsia*—not with the whole peduncle.

That where the generative sac evidently consists of many subelements, as in *Tubularia larynx* and *Sertularia fallax* (evidenced by the four summit-lips or lobes, the symmetrical character of each of which indicates it to be composed of two subelements), it is homologous with the *reproductive* subelements in the octopartite peduncle of *Bougainvillea*, or, rather, with the eight coalescing *reproductive* subelements of *Eleutheria*.

I consider that a four-lobed or branched state of the placenta or spadix indicates a multipartite constitution of the generative sac, and not a rudimentary medusoid form of that organ; for we have, in the fixed female medusoid of *Laomedea Loveni*, a four-lobed condition of the placenta in the peduncle-like ovisac, with the existence of a well-differentiated subumbrella and lateral and circular canals.

My space will not allow me to illustrate the homological relations which exist between the polypary (or cœnosarc) and the polypidom on the one hand, and the subumbrella and umbrella on the other. This must be reserved for a future occasion, when I hope to fill up the gaps in this rough and incomplete sketch of some of the morphological relations of the Hydroidæ and their Medusæ.

Appendix to Hydractinia, printed at vol. i. p. 192.

In the "Annals of Natural History" (vol. iv. ser. 3. p. 50) Prof. Allman has remarked, with regard to *Hydractinia*, that "the solid chitinous polypary [polypidom] is covered

externally by the cœnosarc [polypary], thus reminding us of the sclerobasic corallum of some of the Actinozoa." This doctrine had been previously promulgated by Quatrefages (Ann. des Sc. Nat., xx. 232), who considered the polypidom to be an endoskeleton deposited in the substance of the polypary, like the solid axis of *Gorgonia*. If this view were correct, it would not only remove *Hydractinia* from the Tubulariadæ, but would segregate it from the whole of the Hydroid Zoophytes, not one of which is destitute of an investing polypidom.

In the "Edinb. Phil. Journal" for April 1857, I stated, in a paper on *Hydractinia*, my conviction of the incorrectness of Quatrefages's opinion, and that the mode of secretion of the polypidom of *Hydractinia* did not differ from that of the rest of the Tubulariadæ, as was seen in the development of its young and its propagation by stolons. Since then I have come to the following conclusions, after the examination of a very large number of specimens, some hatched from the egg and adherent to glass, others removed as cuttings from adult specimens and transplanted on glass, to which they readily grow, and others removed entire from the shell of the *Pagurus* by acid, and put up in spirit or balsam.

The *polypidom* and *polypary* are found in the following forms, all of which are frequently combined in the same specimen:—

1. An open network of delicate chitinous tubes without spines, enclosing a polypary composed of several combined endodermal tubes surrounded by a single layer of ectoderm. Found in very young specimens, or in old ones growing on protected parts of the shell. (Analogous to *Clava repens* (mihi), the *C. discreta* of Allman.)

2. An open network as in the last; the tubes of thick brown chitine, with single hollow spines rising from a single tube, or from the confluence of four tubes.

3. A close reticulate plate, as in *Clava cornea* (mihi) and *C. membranacea* (mihi), formed from states 1 or 2 by the continual filling-up of the meshes by anastomosing branches, with or without spines.

4. A fleshy plate of ectoderm permeated by a network of

endodermal tubes, and covered above and below by a delicate investment of chitine. Found on the growing borders of the zoophyte, and especially in cuttings of old specimens transferred to glass.

The *spines* are composed of one tube or many parallel tubes: they may be single (Pl. XII. fig. 4), and developed on a single tube of the polypidom, like those of *Podocoryne fucicola;* single at their summits and of several tubes at their base (figs. 5 and 6); composed entirely of several (8–12) conjoined tubes (fig. 7); reticulate by the lateral anastomosis of their tubes; or consisting of long ridges of tubes reared against each other.

The polyps spring from one or several confluent tubes of the polypary; they are covered at their origin, and for a little distance above it, by a delicate prolongation of the polypidom. This may be detected by dyeing the whole zoophyte with tincture of kino, which gives different tints to its chitinous and fleshy elements, or by steeping it alternately in spirit and water, when the coverings of the polyps and polypary become inflated as in figs. 2 and 3.

The *polyps* are of several shapes and functions, which I have described in the paper cited above. It will be sufficient to enumerate them here:—

1. Alimentary polyps, with mouth and tentacles.
2. Reproductive polyps, with rudimentary mouth and tentacles.
3. Spiral polyps—a modification of the last; generally barren (fig. 3).
4. Sessile generative sacs of the polypary.
5. Tentacular polyps, or great tentacles of the polypary (fig. 2).

In the reproductive organs of *Hydractinia* there is a gradual transition from the reproductive polyp to the sessile generative sac; the polyp loses its dot-like mouth, its tentacles, its head or upper part, and finally dwindles down to a mere sperm-sac. This change is generally seen in those specimens which have long been kept in captivity. In these specimens, too, many of the alimentary polyps are often converted into large inflated sacs destitute of mouth and

tentacles, and showing through their parietes white longitudinal ridges, which indicate the number of zooid elements of which they are composed.

In the natural history of this remarkable zoophyte there are other points of peculiar interest, which, having already described, I need only mention here: the slow development and unique shape of the planuloid larva; the powerful muscular structure of the polyps, especially the spiral ones, the office of which last has yet to be discovered; and the intimate sympathy and combined action which subsist between the various parts of the whole animal.

III. *Notes on Deep Sea Soundings.* By E. W. Dubuc,* M.D., R.N. Communicated by Mr James B. Davies.

The deposits now forming at the bottom of the ocean possess a peculiar interest from a zoological as well as from a geological point of view, especially when we consider the importance of the natural processes upon which they are capable of throwing light.

It is only of late years, however, that we have been enabled with any degree of accuracy to sound the vast depths of the ocean, to map out the varying configuration of the solid substrata, and to examine into the nature of the latter. We owe this in great measure to the invention of an improved form of sounding apparatus by Mr Brooke of the United States Navy.

Specimens thus obtained from great depths were sent to Professor Ehrenberg of Berlin, and Professor Bailey of New York. The latter submitted samples of the sea bottom from that part of the North Atlantic which covers the telegraph plateau to microscopical examination, and found them to be filled with minute organisms, and to contain neither sand nor gravel. The organisms were mainly calcareous, consisting of the shells of various genera of *Foraminifera* (*Polythalamia* of Ehrenberg). There were besides a small number of the siliceous shields of *diatoms*.

* I observe, with much regret, a notice of the death of Dr Dubuc on board H.M.S. Cossack, at the Cape of Good Hope, on the 10th of January 1862, at the early age of 24.—J. B. D.

office-bearers,—a young naturalist whose talents and extensive acquirements had given promise of much usefulness. Dr Coldstream said, that long and intimate acquaintanceship with the deceased enabled him to bear testimony to the thoroughness of his habits as a student; to his carefulness in research; to his probity and moral worth. Of his capacity for acute generalisation, the Society had been favoured with a striking proof in the able paper "On the State of our Knowledge respecting Metamorphism in the Mineral Kingdom," which he read in March last. This, along with a memoir on the effects of anæsthetics on plants, made Mr Livingston's talents widely known, and led him into extensive correspondence with men of science. His modesty and courtesy of manner were as remarkable as his acquirements, and endeared him to a large circle of attached friends. Dr Coldstream then submitted for the inspection of the members a large collection of drawings in water colours, of various Indian animals, chiefly insects, which had been made at the instance of Walter Elliot, Esq., lately a member of the Supreme Council of Madras. These remarkably beautiful drawings were executed by native artists, under the eye of Mr Elliot. The accuracy and elegance of the drawings were much admired, and a hope was expressed that many other residents in India would avail themselves, as Mr Elliot had so successfully done, of the talents of the natives, to extend our knowledge of the beautiful productions of our eastern empire.

II. *Observations on British Zoophytes.* 1. Atractylis arenosa. 2. Atractylis miniata. 3. Laomedia decipiens. By T. Strethill Wright, M.D. (Plate XV.)

1. *Atractylis arenosa.*

This zoophyte was described by Mr Alder at the last meeting of the Society. In September last I found a large female specimen at Largo, and was fortunate enough to have an opportunity of studying its anatomy and reproduction. The polyp-stems are, as Mr Alder has shown, funnel-shaped and expanding at the top. From them the milk-white polyps issue, each furnished with an alternating row of long tentacles. The scleroderm, or corallum, is

covered by a thick layer of colletoderm, which is continued over the body of the polyp, and which, when the polyp retires within its tube, fills up the top of the tube by its cushiony folds, so that the polyp is completely hidden, and the funnel appears as it were closed by a valve. The colletoderm in my specimen was coated and impregnated with mud. Mr Alder's specimen was covered with grains of fine sand. I was at first inclined to believe that this zoophyte was merely a variety of *Atractylis repens*, which, with its medusoids, I have already described to the Society; but after it had been in captivity a few days, I found that it was beginning to put forth ovisacs, one on opposite sides of the polyp-stems (Plate XV. fig. 7).

The mode of reproduction in this zoophyte is unique amongst the Tubulariadæ, though I have noticed and described it in the Sertularias and Campanularias.

The female generative sac of *Atractylis arenosa* resembles that of Hydractinia; it is a simple sac formed of ectoderm, or the outer layer of the cœnosarc, enclosing a similar sac of endoderm, the "placenta," the whole being covered by a layer of scleroderm and colletoderm. Between the placenta and the ectoderm a large number of ova are developed, each showing a germinal vesicle and spot (fig. 8). When the ova are sufficiently advanced for extrusion from the generative cavity, the investments of the sac are ruptured, the sac assumes a long, cylindrical form (fig. 9), and a most laborious process of parturition commences. With each *pain* the ectoderm of the sac contracts laterally, like the bell of a Medusa, and at the same time the placenta (fig. 9 *c*) is dilated by fluid pumped into it from the somatic cavity of the zoophyte, so that the ova, which are floating in a milky fluid, are forced against the summit of the generative sac. Meanwhile, another process has been going on,—the external surface of the summit of the sac has been secreting a thick cap of gelatinous colletoderm (fig. 9 *d*), which is to form a *nidus* for the further development of the ova. The contractions become still more violent, until the ova are confined in a mass at the dilated upper part of the sac; this last is ruptured, and they are forced into the gelatinous cap,

which still remains attached to the summit of the empty generative sac (fig. 10 *d*). The ova now undergo fissure, and are developed into planulæ within their nest, then at last escape, and, after swimming in the water, doubtless become fixed and converted into polyps.

Atractylis arenosa, although it gives off an immense number of young, is one of the rarest zoophytes on our coast, probably on account of the low viability of its planulæ. While *Sertularia pumila*, one of the commonest species, and which produces its young in the same way, will quickly line the vessel in which it is kept with forests of young zoophytes, not a single planula of *Atractylis arenosa*, of the immense number that were given off by my specimen, ever attained the polyp stage.

We have in this zoophyte the reappearance amongst the Tubulariadæ of a mode of gelatinous nidification, which obtains in various orders of the animal kingdom,—in the Protozoa, the Mollusca, the Annelidæ, the Insecta, and even amongst the Vertebrata, as in the common frog. We may ask, How is it that the ova of Hydractinia and Coryne are discharged into the water to float about without any protection, while those of *Atractylis arenosa*, the *Sertularias* and *Laomedias*, require such various provisions for their protection? but we do not find anything in the physiology of the zoophyte to answer the question.

2. *Atractylis miniata.* (New Species.)

Polypary yellow dendritic, branches given off at an acute angle from the stem, crooked, wrinkled but not ringed. Polyp with eight alternate tentacles, buccal cavity silvery, endodermal lining of stomach bright red-lead coloured. Reproduction not observed.

This zoophyte was found on stones at Largo, in little gnarled shrubby trees about an inch high, exposed at the lowest tides. The bright yellow colour of the polypary at once strikes the eye, which is also arrested by the gaudy colour of the minute polyps. These appear to be marked by two broad internal patches: one, corresponding to the buccal cavity, of a dense silvery white; the other

to the cavity of the stomach, of a brilliant reddish orange. I have also found very minute specimens of this species at Granton

3. *Laomedea decipiens.* (New Species.)

Polypary minute; stem filiform flexuose, with from one to five branches, each bearing a cell; the stem is annulated with about five rings above the origin of each branch; the branches are annulated throughout; cells widening rapidly towards the top, with even double rims. Polyp, with about sixteen tentacles and trumpet-shaped proboscis.

This pretty little Laomedea resembles much the *Laomedea neglecta* of Alder, except that the margin of the cell is even, and has the appearance of being double for about half its length from the rim, though, from the extreme delicacy of the cell, this character is only made out with difficulty. The reproduction of this zoophyte resembles exactly that of *Laomedea lacerata*, except that each gelatinous nest of *A. decipiens* contains only three ova, while that of *L. lacerata* contains six or eight.

Description of Plate XV.—*Atractylis arenosa.*

Fig. 7. Polyp-stalk with two ovaries, the scleroderm covered by layer of colletoderm.

8. Ovary with colletoderm and scleroderm removed, showing layer of ova between endoderm and ectoderm.

9. Advanced stage of same: *a*, ruptured scleroderm; *b*, ectoderm; *c*, endoderm; *d*, layer of colletoderm.

10. Same, with ova extended into gelatinous nest.

III. *On the Geological Age of the Pagan Monuments of the Outer Hebrides.* By Captain F. W. L. Thomas, R.N.

Some recent observations made upon the geological changes that have taken place since the so-called Druidical circles were erected in the Long Island, will, it is presumed, be interesting to the Society; although any conclusions from these observations can only be valued as first approximations to a knowledge of the era of the unknown founders of these gigantic monolithic structures.

It forms no part of the present subject to describe these monuments farther than to state, that, as in the Orkneys, in one locality of the Lewis several of these circles are placed

V. *Observations on British Zoophytes and Protozoa.* 1. Clava nodosa. 2. Acharadria larynx. 3. Zooteirea religata. 4. Freya (Lagotia) obstetrica, Freya stylifer. 5. Chætospira maritima. 6. Oxytricha longicaudata. By T. Strethill Wright, M.D. (Plate XVII.)

1. *Clava nodosa* (n. sp., T. S. W.)

"Polypary creeping. Scleroderm membranous, 'Polyps single, small, aurora-coloured, each springing from a small knot of convoluted tubes.' This zoophyte was found on the fronds of *Delesseria sanguinea* at Queensferry and Largo."

The very delicate threads of the polypary creep over the fronds of the seaweed, and at intervals twine themselves into a convoluted knot of membranous tubes, from which a single polyp arises. The species occurs only at low tide mark; while *C. repens*, for which it may be mistaken, is found in shallow rock pools.

2. *Acharadria larynx.* (Pl. XVII. figs. 7, 8.)

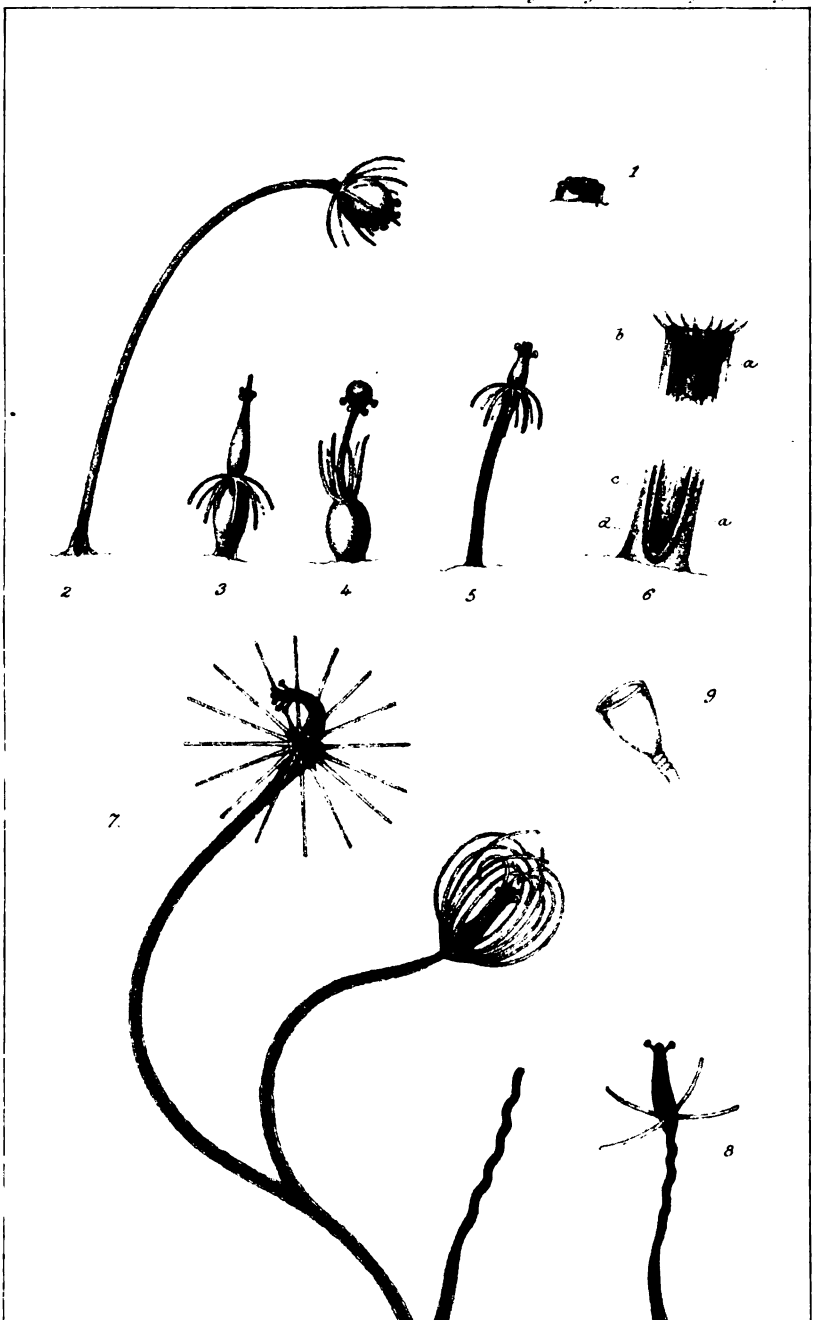
"Polypary branched, spirally twisted. Polyps pale orange, with two rows of tentacles. The lower row from 4 to 12, the upper row from 2 to 8 capitate."

On stones carrying *Caryophyllia Smithii*, received from Ilfracombe. This little Tubularian was about a quarter of an inch high, with three polyps, and resembled in habit *Tubularia larynx*. It bears the same relation to Vorticlava that Corymorpha does to *Tubularia larynx*.

3. *Zooteirea religata.*

I described this animal to the Society about three years ago. It is a stalked Actinophrys. The body, as in other animals of this class, consists of two elemental tissues, to which I have given the term ectosarc and endosarc, —terms which have been adopted by Dr Carpenter. The ectosarc or external tissue is prolonged into a thick brush of the most delicate contractile palpocils or tentacles, like threads of spun glass (Pl. XVIII.), by which the animal is constantly seizing small organic particles, and conveying them to the endosarc or inner tissue, which is the nutritive element. I stated that the stalk was formed of a prolongation of the ectoderm, similar to the tentacles; but, having again discovered large colonies of these animals last summer, and again this winter, I have been enabled to study the structure of the stalk more closely, and find that

PLATE XVII.



1-6 Vorticlava Proteus. 7 8 Acharadria larynx.

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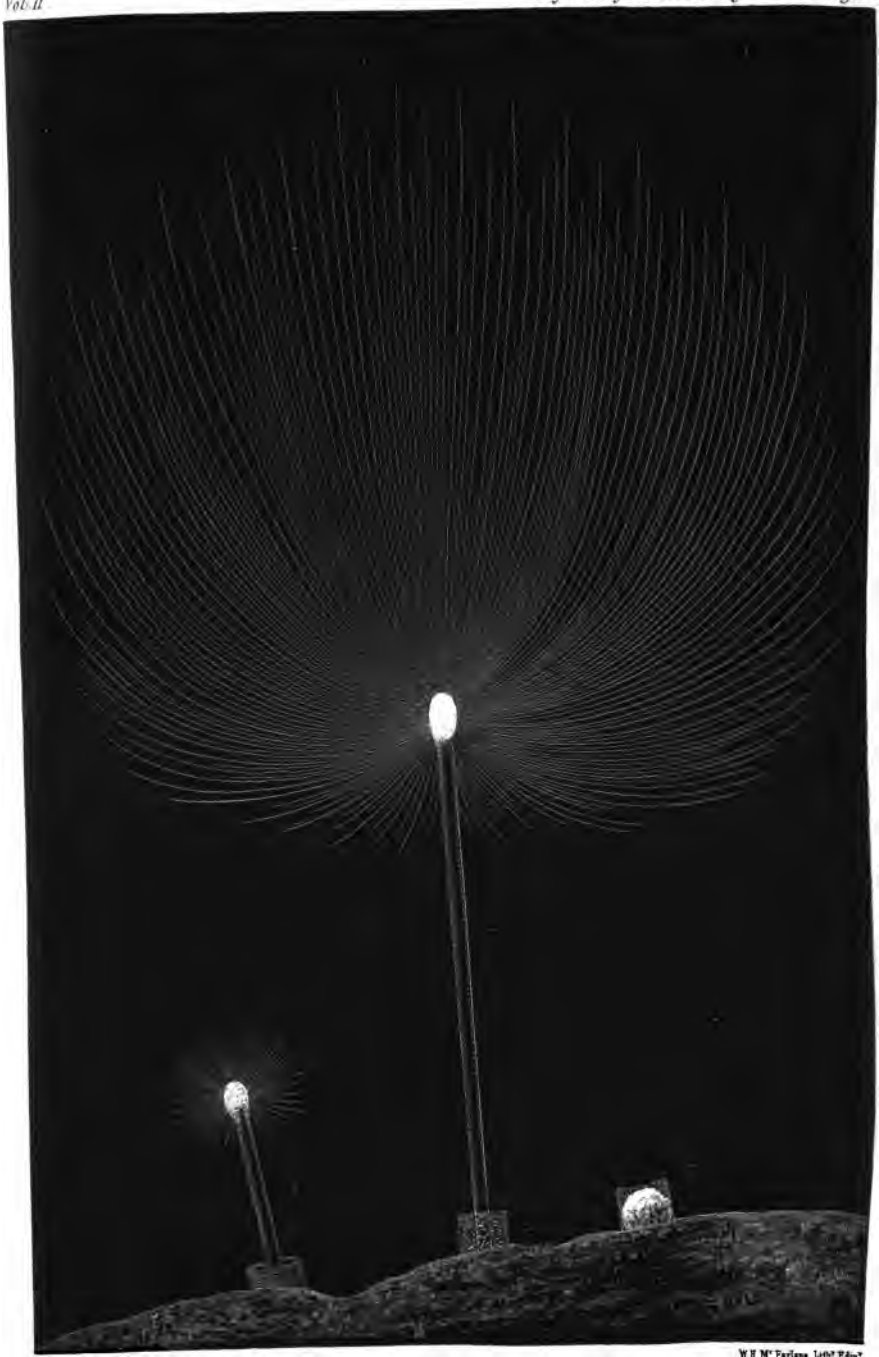


T. Stretill Wright. del.

W. H. M.ᶜ Farlane, 16th Edin.ʳ

Zooteirea reliğata.

it is an elastic tube, which appears to consist of denser tissue than either of the elements of the body. The axis of the tube is occupied along its whole length by a powerful muscular band, which is well seen in the figure (Pl. XIX. fig. 1 *d*), in which the tube is distended with water, as sometimes occurs. The animals are very sluggish, remaining for days motionless, with all their rays extended; but the moment they are touched they vanish, drawn close down by their powerful muscular apparatus into the interstices of the shells in which they are generally found. Zooteirea multiplies by gemmation. The bud, which is given off close to the stalk, separates as a minute Actinophrys, which instantly fixes itself and develops its stalk. The lower part of the stalk is included in a mass of gelatinous tissue into which the animal can entirely retract itself. The long tentacles of *Zooteirea religata* can only be properly brought into "black ground illumination," when they appear like the rays of a silvery star, slightly curving under the influence of currents in the waters.

4. *Freya* (*Lagotia*) *obstetrica*, *Freya stylifer* (n. sp, T. S. W.)

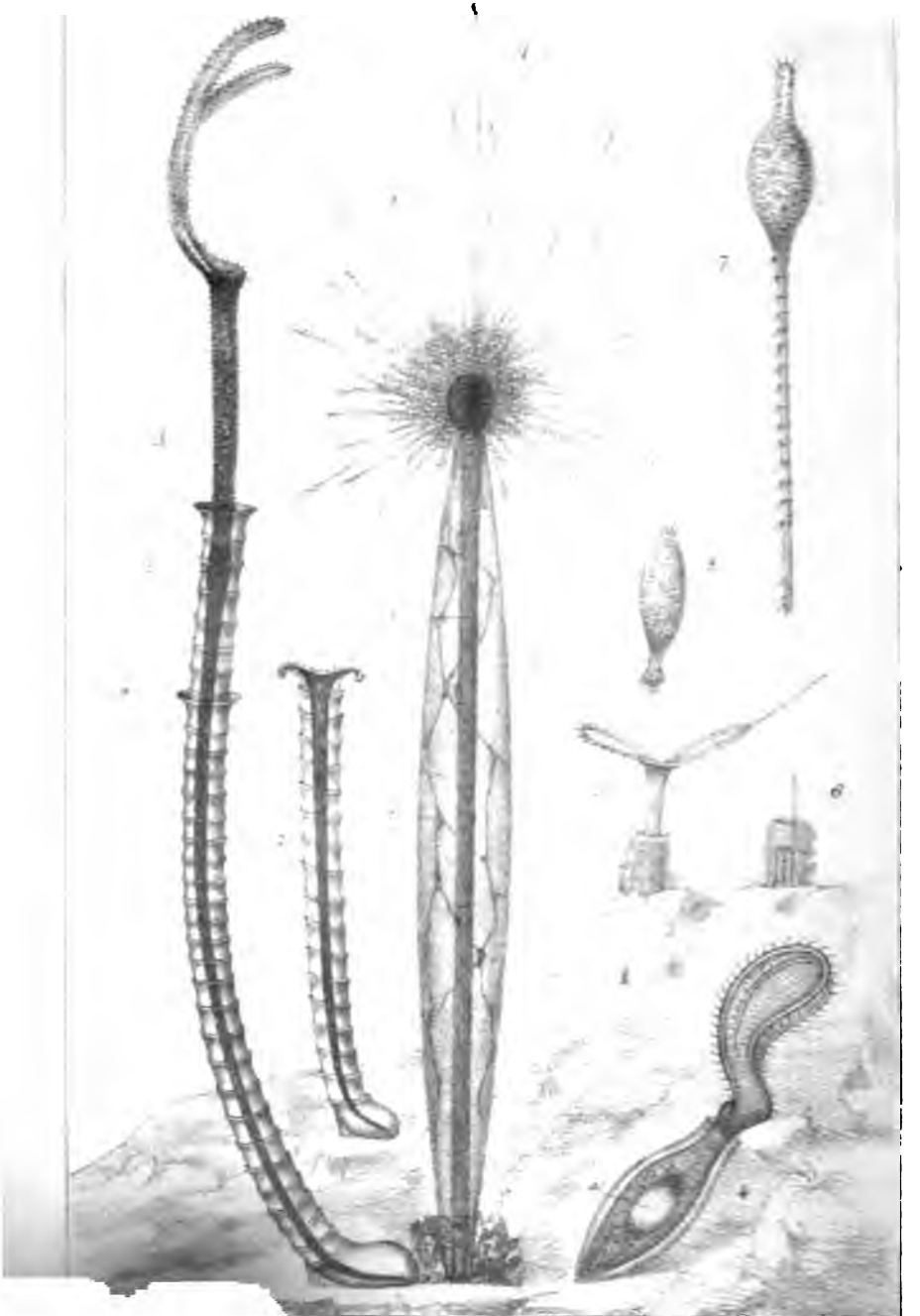
It is now some years since I described several species of the new genus Lagotia to the Society. It appears, however, that Claparede and Lachmann had already constituted the genus Freya for animals evidently belonging to my genus Lagotia, in a memoir which they communicated to the French Academy, which memoir was printed after my communication to this Society. The species of Freya discovered by them differed from any of my species, and I have now to describe two other species of this very remarkable genus. *Freya obstetrica* (Pl. XIX. fig. 4.)—"Lobes of rotatory organ very broad, not folded; the tips bluntly rounded and incurved, so as to resemble very closely the blades of the obstetric forceps. Body fusiform, scarcely longer than the rotatory lobes. Nucleus large, colourless, surrounded by dense green pigment. Body and rotatory lobes covered with striæ, bearing fringes of cilia. Cell flask-shaped, without a trumpet-shaped mouth. Colour of animal and cell pale bluish green." *Freya stylifer* (figs. 5, 6.)—"Rotatory lobes short, narrow, and widely expanded, one of the lobes bearing at its tip a fleshly prolongation or style as long as

the lobe; cell tubular, without trumpet-shaped mouth; cell and animal colourless." *Freya stylifer* is the smallest species I have yet seen of the genus to which it belongs; when contracted within its tube, it projects the curious style, which is doubtless a sense organ, beyond the opening, only entirely retracting it when rudely disturbed.

During the last summer I had an opportunity of watching another species of Freya (*F. producta*) building up its remarkably constructed cell. The cell of this species, which is often immensely prolonged, is formed of a spiral ribbon of chitine, cemented by a thick internal layer of soft green sarcode, secreted by the body of the animal, so that the whole forms a hollow tubular spring, like the spiral wire tubes formerly employed for conveying gas to moveable burners. These tubes will therefore bend aside like a willow twig on any rude contact from the animals which are constantly dashing about, and will instantly regain their proper position. The young *Freya producta*, which is a free swimming larva, fixes itself, and secretes the lower part or body of the cell from the outer surface of its body; it then begins to form the elongated neck by depositing the chitine and sarcode on the upper edge of the constantly lengthening ribbon, carefully moulding the plastic materials with its two short rotatory lobes, which it uses like a pair of hands (Pl. XIX. fig. 2), just as Sabella and Serpula mould their tubes with their hand-like secreting leaflets. Having built its tube to the requisite length, it finishes it off with a handsome trumpet-shaped mouth, and then retires to develop its long rotatory lobes. Occasionally the animal outgrows its dwelling-place, and finds it necessary to lengthen its tube. For this purpose a large quantity of dark green matter is collected in the body of the animal, a little below the rotatory organ (fig. 3 *b*), and from this part chitine and sarcode are secreted, which are instantly moulded into shape by the rotatory lobes, and a new spiral tube rises up from within the trumpet-shaped mouth of the old one (fig. 3 *a*).

5. Chætospira maritima (n. sp., T. S. W.)

Two species of this remarkable animal have been noted by Lachmann—*C. Mulleri* and *C. Mucicola*. Chætospira is defined as a Stentor, in which the ciliary spiral and the paren-



ehfata. 2 3. Freya produrta. 4 Freya obstetrica
reya stylifer. 7 8. Oxytricha longicaudata.

chyma of the body supporting it are drawn out into a long thin process. When the animal issues from its tube, it protrudes its ciliary organ as a fleshy column, fringed on one side by a row of very long motionless cilia, but in an instant the column is twisted into a spiral, and the cilia are set in violent motion, urging currents of water towards the mouth. The marine species approaches in character, as to its rotatory organ, to *C. Mulleri*, while it inhabits a mucous tube like that of *C. Mucicola*.

6. Oxytricha longicaudata. (Pl. XIX. figs. 7, 8.)

This remarkable animal, resembling very much *Oxytricha retractilis*, described by Claparede and Lachmann, was found in great numbers with *Chætospira maritima*. The tail in this species is fully twice as long as that of *Oxytricha retractilis*, and is dragged after the swimming animal like a trailing rope, when suddenly the extremity of the tail is fixed by the long cilia at its extremity, and the Oxytricha, by violent contractions of its tail, jerks itself backwards and forwards in the most violent manner. The structure of tail, under an excellent power of eighty diameters, presents a peculiar striated and plaited appearance, like that of voluntary muscular fibre, but I could not make anything of it under higher powers.

Description of Plate XVII.

Figs. 7, 8.—*Acharadria larynx.*

Description of Plate XVIII.

Zooteirea religata, seen by black-ground illumination, and focussed for the centre of the "endosarc;" *a*, with palpocils extended and curved by an upward current of water; *b*, emerging from its cell; *c*, retracted within its cell.

Description of Plate XIX.

Fig. 1.—*Zooteirea religata*, with palpocils partially extended, and tubular contractile pedicle distended by water; *a*, ectosarc; *b*, endosarc; *c*, tube; *d*, muscular band; *e*, areolar fibres; *f*, gelatinous cell.

Fig. 2.—Young *Freya producta* building its tube.

Fig. 3.—*Freya producta* with lengthened tube; *a*, old mouth of tube; *b*, thickened part of body from which the tube is secreted.

Fig. 4.—*Freya obstetrica*; *a*, nucleus.

Figs. 5, 6.—*Freya stylifer*, extended, and in its cell.

Fig. 7.—*Oxytricha longicaudata*, with tail extended.

Fig. 8.— „ „ with tail contracted.

Body, octangular; fins, pectoral, anal, and caudal, awanting. Length of fish, 19¾ inches; length of head, 1½ inch; point of snout to orbit, ¾ inch; front of orbit to extremity of operculum, ¾ inch; length from snout to anus, 9½ inches; from anus to point of tail, 10½ inches; from snout to first dorsal fin ray, 7⅛ inches; length of dorsal fin, 2⅝ inches; from last ray of dorsal fin to point of tail, 9⅞ inches. The posterior termination of the dorsal fin is therefore nearly in the middle of the fish.

The body consists of twenty-nine rings or divisions, the anus being in the twenty-ninth; the tail of about sixty. No depressions were observed on the abdomen,—probably a female. Dorsal fin, of thirty-nine rays, resting on nine rings of body and two of tail [21st to 31st inclusive]; anus under twenty-eighth and twenty-ninth rays of fin. (For descriptions of other specimens, see pp. 290 and 291).

Professor Fleming, in his "British Animals," described this fish as rare, and called attention to the fact of its being "obviously pointed out by Sibbald, as an inhabitant of the Firth of Forth," in 1684. Yarrell also states that examples of this species are rare.

VI. *Observations on British Zoophytes.* (1.) Vorticlava Proteus. (2.) Trichydra pudica. (3.) *On the Development of* Pycnogon *Larvæ within the Polyps of* Hydractinia. By T. Strethill Wright, M.D.

(1.) *Vorticlava Proteus.* (Plate XVII.)

Scleroderm absent. Colletoderm covering body of polyp. Upper row of tentacles capitate 5; lower row 9.

Several specimens of this zoophyte were found in the "Fluke Hole," Firth of Forth. The body of the polyp is exceedingly extensible. At one time a mere button attached to the stone on which it dwells; at another it transforms itself into the various shapes shown in the accompanying figures. A hard covering to the body would necessarily prevent or impede these motions. The scleroderm, therefore, is absent, and the whole body of the polyp is covered with a layer of transparent "colline," which extends from the foot, where it forms a thick mass, to a ridge

which runs beneath the insertion of the lower rim of tentacles. The zoophyte has the power of changing its place.

Description of Plate XVII. (*Vorticlava proteus.*)

Fig. 1.—*Vorticlava Proteus* contracted.
Figs. 2, 3, 4, 5.—Same in different states of extension.
Fig. 6.—Diagram of the tissues of the polyp of *V. Proteus*; *a a'*, colletoderm attached to subtentacular ridge *b*; *c*, ectoderm; *d*, endoderm.

(2.) *Trichydra pudica.* (Plate XXII.)

This hydroid, which I have already described to the Society, was found completely covering a small shell from the "Fluke Hole." As its mode of reproduction has never been observed, I placed it in a small vessel of carefully-examined sea-water, and exposed it to light, a mode of treatment which often induces the Hydroidæ to assume their medusoid phase. After some time, two small medusoids were found in the water, but I was unable, by the most careful examination, to detect their mode of development, as no "gonophores" appeared on any part of the cœnosarc. The connection of these medusoids with Trichydra is yet open to doubt, although I am convinced that no other zoophyte occurred on the shell, or in the water in which it was placed.

Medusoid of Trichydra pudica?—Umbrella mitre-shaped, covered with minute thread-cells. *Sub-umbrella* with four lateral canals, destitute of ovaries or sperm sacs. *Peduncle* short, cylindrical, four cleft at the mouth. *Tentacles* four, short, with two or four intervening tubercles. *Oolites* absent, eye-specks absent.

Description of Plate XXII. (*Trichydra pudica.*)

Fig. 1.—Polyp extended, showing the lax habit of the zoophyte.
Fig. 2.—Polyp withdrawing itself when disturbed.
Fig. 3.—Young Polyp.
Fig. 4.—Polyp within its tube.
Fig. 5.—Empty cell.
Fig. 6.—Supposed medusoid.

(3) *On the Development of* Pycnogon *Larvæ within the Polyps of* Hydractinia echinata.

In a communication made by Professor Allman to the British Association in 1859, entitled, "On a remarkable form of Parasitism among the *Pycnogonidæ*," the author de-

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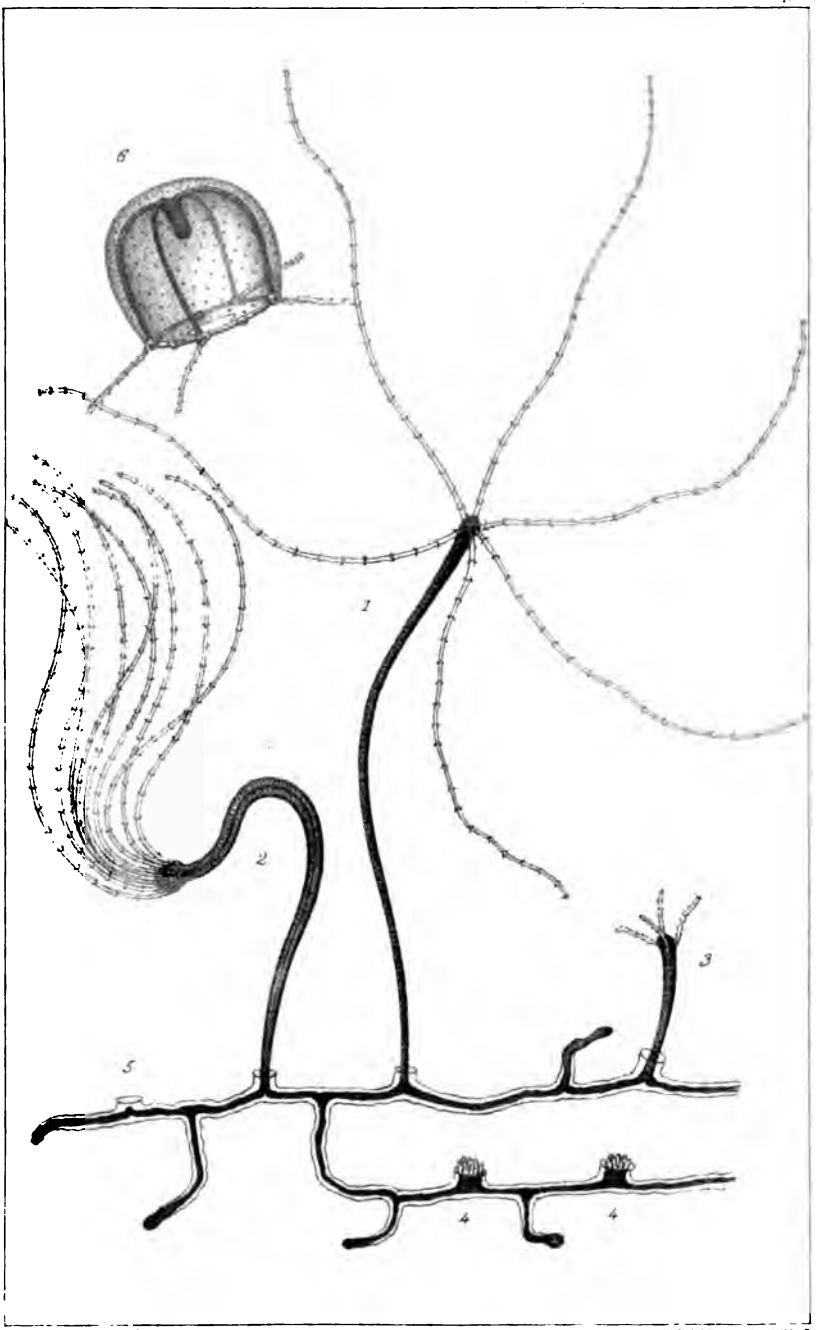

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Trichydra pudica.

scribed the occurrence of certain vesicles on the branches of the *Coryne exima*, which, although possessing a strong resemblance to the reproductive sacs of the zoophyte, and formed of all the proper tissues of the cœnosarc and its coverings, were distinguished from those organs by each enclosing a single living Pycnogon, which, in the smaller vesicles, was embryonic, while in the larger it presented an advanced stage of development. A similar observation was made by Mr G. Hodge (*Ann. and Mag. N. Hist.*, ser. 3, vol. ix.), who considered that the sacs were modified or stunted branches of the Coryne, the development of which had been arrested by the presence of the enclosed Pycnogon. On reading the papers of these gentlemen, I remembered that I had, some time before, been much puzzled by the discovery of armless Pycnogons resembling Mr Hodge's figure (pl. iv. fig. 10, *op. cit.*) in several altered polyps of a specimen of Hydractinia. In this case two or three were found in each polyp, which had assumed the form of a dilated and transparent sac crowned by its usual tentacles. The polyps appeared to be bloated and overgrown under the use of their Pycnogon diet. Mr Hodge's paper at once set me on the look-out for another specimen of Hydractinia tenanted by Pycnogons, and this I at last obtained by the kindness of my friend, Dr Wilson, Demonstrator of Anatomy at the University of Edinburgh. In this, one of the polyps contained three larvæ of a pale yellow colour, which appeared, as far as could be seen without injuring the polyp, to be destitute of legs. When first observed, the polyp was furnished with its proper complement of tentacles; but as the development of the Pycnogons proceeded, the tentacles were absorbed, and the polyp became a long sac pointed at its upper extremity, and fitting closely on its contents, which appeared to be embedded in the longitudinal folds of the highly-developed endoderm. Mr Hodge supposes that the larvæ, at a very early stage, are swallowed by ordinary alimentary polyps of the Coryne, and carried through the tubes of the cœnosarc, until they arrive at a part which is about to become a polyp, which thereupon has its destination altered. And I think there can be little doubt that his surmise is correct,

as in Coryne all Pycnogon sacs, in all stages of development, are not only destitute of tentacles, but are, according to Professor Allman, covered by a layer of the chitinous polypary or scleroderm. Such a mode of *nidification*, however, could not take place in Hydractinia, the cœnosarcal tubes of which are of exceedingly small calibre. Accordingly, we find that the Pycnogon sacs in this zoophyte are formed, not by the arrest or change in development of an immature polyp, but by the degeneration of a tentacled polyp previously perfect.

Perhaps I ought to mention here, that globular sacs are occasionally found in place of the polyp, in *Coryne glandulosa* (Dalyell). These are destitute of scleroderm, and lined with a very dense brown endoderm, arranged in somewhat reticulated folds. As far as I observed, they were empty, and, by constantly undergoing alternate processes of dilatation and contraction, appeared to influence the circulation of the zoophyte. It is possible that minute Pycnogons may have existed in these sacs.

VII. *Report of the Committee on Marine Zoology.* By George Logan, Esq., W.S., Convener. (Specimens were exhibited.)

The Committee had several excursions in the Firth of Forth during the past season, and were occupied in trawling and dredging, and also in sweep-net fishing on the shore. Upon the 11th of May last, among numerous specimens of Mollusca procured off Inchkeith, the following only were worthy of notice; recorded by Dr. M'Bean:—1st, The bivalve, *Cardium norvegicum* of Spengler, alive; 2d, The bivalve, *Montacuta substriata* of Montagu, also alive, on *Spatangus purpureus;* 3d, The univalve, *Apenhais pes pelicani* of Linnæus, alive,—it lived until the 10th of September; 4th, The univalve, *Pileopsis Hungaricus*, or Fools-cap limpet,—it was also alive upon *Modiola modiolus*, and lived until the 20th of June; and 5th, The *Echinus thyone papillosa*, which spawned upon the 18th of June, and died next day.

Mr William S. Young recorded a specimen of the *Psolus phantapus*, which came up upon a baited line near Inch-