XXII. *On the Anatomy and the Affinities of the Family of the* Medusæ.

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1. Perhaps no class of animals has been so much investigated with so little satisfactory and comprehensive result as the family of the *Medusæ*, under which name I include here the *Medusæ*, *Monostomatæ* and *Rhizostomidæ*; and this, not for the want of patience or ability on the part of the observers (the names of Ehrenberg, Milne-Edwards, and De Blainville, are sufficient guarantees for the excellence of their observations), but rather because they have contented themselves with stating matters of detail concerning particular genera and species, instead of giving broad and general views of the whole class, considered as organized upon a given type, and inquiring into its relations with other families.

2. It is my intention to endeavour to supply this want in the present paper—with what success the reader must judge. I am fully aware of the difficulty of the task, and of my own incompetency to treat it as might be wished; but, on the other hand, I may perhaps plead that in the course of a cruise of some months along the east coast of Australia and in Bass's Strait I have enjoyed peculiar opportunities for investigations of this kind, and that the study of other families hitherto but imperfectly known, has done much towards suggesting a clue in unravelling many complexities, at first sight not very intelligible.

3. From the time of Peron and Lesueur downwards, much has been said of the difficulties attending the examination of the Medusæ. I confess I think that they have been greatly exaggerated; at least, with a good microscope and a good light (with the ship tolerably steady), I never failed in procuring all the information I required. The great matter is to obtain a good *successive* supply of specimens, as the more delicate oceanic species are usually unfit for examination within a few hours after they are taken.

Section I.—*Of the Anatomy of the Medusæ.*

4. A fully-developed Medusa has the following parts:—1. A disc. 2. Tentacles and vesicular bodies at the margins of this disc. 3. A stomach and canals proceeding from it; and 4. Generative organs, either ovaria or testes. The tentacula

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vary in form and position in different species, and may be absent; the other organs are constantly present in the adult animal.

5. Three well-marked modifications of external structure result from variations in the relative position of these organs. There is either—1st, a simple stomach suspended from the centre of a more or less bell-shaped disc, the disc being traversed by canals, on some part of which the generative organs are situated, *e.g. Geryonia, Thaumantias*; or 2ndly, a simple stomach suspended from the centre of a disc; but the generative organs are placed in cavities formed by the pushing in, as it were, of the stomachal wall, *e.g. Aurelia, Phacellophora*; or 3rdly, the under surface of the disc is produced into four or more pillars which divide and subdivide, the ultimate divisions supporting an immense number of small polype-like stomachs; small apertures lead from these into a system of canals which run through the pillars, and finally open into a cavity placed under the disc; the generative organs are attached to the under wall of the cavity, *e.g. Rhizostoma, Cephea.*

6. To avoid circumlocution I will make use of the following terms (employed by Eschscholtz for another purpose) to designate these three classes, viz. Cryptocarpæ for the first, Phanerocarpæ for the second, and Rhizostomidæ for the third.

7. In describing the anatomy of the Medusæ it will be found most convenient to commence with the stomach, and trace the other organs from it.

Of the Stomach.—This organ varies extremely both in shape and in size in the Cryptocarpæ and Phanerocarpæ. But whatever its appearance, it will be always found to be composed of two membranes, an inner and an outer. These differ but little in structure; both are cellular, but the inner is in general softer, less transparent and more richly ciliated, while it usually contains but few thread-cells. The outer, on the other hand, is dense, transparent, and either distinctly cellular or developed into a muscular membrane. It may be ciliated or not, but it is usually thickly beset with thread-cells, either scattered through its substance or concentrated upon more or less raised papillæ developed from its surface.

8. I would wish to lay particular stress upon the composition of this and other organs of the Medusæ out of *two distinct membranes*, as I believe that it is one of the essential peculiarities of their structure, and that a knowledge of the fact is of great importance in investigating their homologies. I will call these two membranes as such, and independently of any modification into particular organs, "foundation membranes."

9. When the stomach is attached to the disc, the outer membrane passes into the general substance of the disc, while the inner becomes continuous with the lining membrane of the canals. There is a larger or smaller space between the inner aperture of the stomach and the openings of the canals, with which both communicate, and which I will therefore call the "common cavity."

10. In the Rhizostomidæ the structure of the stomachs is fundamentally the same, but they are very minute, and are collected upon the edges and extremities of

the ramuscules of a common stem; so that the Rhizostomidæ, *quoad* their digestive system, have the same relation to the Monostome Medusæ as the Sertularian Polypes have to the Hydræ, or the Coralline Polypes to the Actiniæ.

11. If one of the ultimate ramuscules be examined, it will be found to consist of a thick transparent substance, similar in constitution to that of the mass of the disc, through which there runs, nearer one edge than the other, a canal with a distinct membranous wall ciliated internally. From this "common canal" a series of parallel diverticula are given off at regular intervals, and run to the edge of the branch, where they terminate by rounded oblique openings. It is not always easy to see these apertures, but I have repeatedly satisfied myself of their presence by passing a needle or other delicate body into them, figs. 28, 29.

12. The difficulty in seeing the openings arises in great measure from the presence of a membrane which surrounds and overlaps them, and being very irritable, contracts over them on being touched. The membrane consists of two processes, one from each side of the perforated edge of the branch, fig. 28. In *Rhizostoma* these two processes generally remain distinct, so that their bases form a common channel into which all the apertures open; but in *Cephea* they are frequently united in front of and behind each aperture so as to form a distinct polype-like cell, figs. 35, 36.

13. Each membranous process is composed of two membranes; the outer of these is continuous with and passes into the thick transparent outer substance above mentioned (11); the other is less transparent, more richly ciliated, and continuous with the lining membrane of the canals through the apertures. The two membranes are continuous at the free edge of the fold, and are here produced into numerous tentacula. The latter are beset with great numbers of thread-cells, and are in constant motion while the part retains its vitality*, fig. 29.

14. *Of the Disc.*—In the *Medusæ monostomatæ* the outer membrane of the stomach is, as I have said, continuous with the thick transparent mass of the disc, as the inner membrane is with the lining membrane of the canals which traverse it. The disc, therefore, is composed of two membranes inclosing a cavity variously shaped.

15. I have examined the minute structure of the disc in *Rhizostoma*. The outer surface of the transparent mass is covered with a delicate epithelium composed of polygonal nucleated cells joined edge to edge. Among these there are many thread-cells. Beneath this there is a thick gelatinous mass which is made up of an apparently homogeneous substance containing a multitude of delicate fibres interlacing in every direction, in the meshes of which lie scattered nucleiform bodies. On the lower

* M. Milne-Edwards, in his "Observations sur la Structure de la Méduse Marsupiale," describes the fringe and its tentacles, but having altogether overlooked the true digestive apertures, he ascribes to the tentacles the function of villi. "Les franges qui garnissent les bras des rhizostomes sont donc bien certainement des organes d'absorption, et leur structure les rend en effet très propres à remplir cette fonction, qui ici dépend probablement tout entier d'un phénomène analogue à celui désigné par M. Dutrochet sous le nom d'endosmose."

surface of the disc, the only difference appeared to be that the epithelium was replaced by a layer of parallel muscular fibres.

16. It might be said that the gelatinous substance here described is a new structure, and not a mere thickening of the outer membrane; but a precisely similar change is undergone by the outer membrane in the Diphydæ, and here it can be easily traced, *e. g.* in the formation of the bracts and in the development of muscular fibre in the outer wall of the common tube.

17. The structure of the inner membrane of the disc and its canals resembles that of the corresponding tissue in the stomach, &c., but in the ultimate ramifications of the canals it becomes more delicate.

In these points there exists no difference between the Monostome and Rhizostome Medusæ.

18. The three divisions, however, vary somewhat in the arrangement of the cavities and canals of the disc.

In the Cryptocarpæ, the common cavity may be either small (*Thaumantias*) or large (*Oceania*); from it there proceed a number of straight unbranching canals which open into a circular canal running round the margin of the disc.

In the Phanerocarpæ the general arrangement is similar, but the canals frequently branch (*Medusa aurita, Phacellophora*) and anastomose in a reticulate manner.

In many of the Monostome Medusæ the centre of the under surface of the disc projects into the "common cavity" as a rounded boss (fig. 11*a*.), and according to its form and size will seem to divide the former more or less into secondary cavities. This appears to me to be the origin of the multiple stomachs of *Medusa aurita* as described by Ehrenberg.

19. In the Rhizostomidæ, the canals of the branched processes unite and open by four (*Rhizostoma, Cephea*) or eight (*Cassiopea*?) distinct trunks into a wide curiously-shaped cavity, from whence anastomosing canals are given off to all parts of the disc (figs. 26, 26 *a*.). The circular vessel exists, but is not particularly obvious in consequence of anastomosing branches being given off beyond it.

20. In very many of the Cryptocarpæ (*Carybdoa, Oceania* (fig. 5 *a* & *b*.), *Polyxenia*) there is a circular, valvate, muscular membrane developed from the inner and under edge of the disc. In the Phanerocarpæ such a membrane does not seem to be present, but in *Rhizostoma* and *Cephea* it is evidently replaced by the inflexed edge of the disc, fig. 26 *a*.

21. *Of the Marginal Corpuscles.*—In the Cryptocarpæ the marginal corpuscles are sessile upon the circular vessel, figs. 8, 9, 10. They are spheroidal vesicles, containing a clear fluid, and one or more spherical strongly-refracting bodies occasionally included within a delicate cell. The marginal vesicles are placed between the inner and outer membranes of the circular vessel.

In the Phanerocarpæ (*Phacellophora*) the marginal corpuscle (figs. 25, 25 *a*.) is placed at the extremity of a short double-walled tubular pedicle projecting downwards or

towards the ventral surface of the disc; the under margins of the fissure in which it is lodged are prolonged into two overlapping fringes. The cavity of the pedicle is continuous with that of a canal which runs from the common cavity directly towards the corpuscle. Its walls are continuous, the inner with the inner wall of the canal, the outer with the substance of the disc. The pedicle is in fact a mere process of the system of canals, so that the position of the marginal vesicle is relatively to this system the same as in the Cryptocarpæ. A similar remark holds good with regard to the Rhizostomidæ.

22. In *Cephea* and *Rhizostoma* the organ is placed in a notch between two lobe-like processes of the margin of the disc, and looks upwards. On the upper surface a semilunar fold extends from one lobe to the other and covers in the corpuscle; below, the edges of the lobes are thinned and overlap, figs. 33, 34.

23. There are some peculiarities in *Rhizostoma* which deserve to be noticed more fully. On the dorsal surface, behind the semilunar fold above mentioned, there is a large heart-shaped depression (fig. 33) with its base towards the corpuscle. Its surfuce is thrown into prominent arborescent folds, and is very richly ciliated. The deepest part of the depression is towards its base, and seems to take the direction of the base of the pedicle of the marginal corpuscle, which is just below it. I could not pass a needle from the depression into the cavity of the pedicle, but I have no doubt that they communicate, as on a lateral view the deepest part of the depression seems to project into the cavity of the pedicle. Furthermore, on pressure, the granules usually contained in the cavity of the pedicle sometimes passed into the depression.

24. Ehrenberg describes apertures in *Medusa aurita* by which the system of canals communicates with the exterior, but they are *alternate* with the marginal corpuscles, not under or above them. In *Cephea Wagneri*, again, according to Will, the canals open *beneath* the marginal vesicles. I did not observe this in the *Cephea ocellata*.

25. On the ventral surface a much slighter semilunar fold connects the base of the two lobes, fig. 34. In the centre, behind this, there is an elevation of the substance of the disc, to which the muscular bands which run along the under surface of the disc converge.

26. The canal which runs to the marginal vesicle gives off branches on each side, then opposite the base of the vesicle forms a dilatation rather larger than the cordate depression; from this a cæcal process passes off into each lobe, and so terminates. The termination of the canal in *Cephea* and *Phacellophora* is similar, but in the latter the cæca gives off lateral anastomosing branches, fig. 25.

27. In *Rhizostoma* the pedicle is somewhat bent and enlarged at its upper half. The inner membrane is richly ciliated, and the cavity which it incloses usually contains a number of rounded cell-like bodies floating about in incessant motion. There is a considerable space between the inner and outer membranes, which are thick, and

therefore, when viewed by transmitted light, appear like four thick fibres. The vesicle is about $\frac{1}{170}$th of an inch in diameter, more spherical in small than in large individuals; it contains a closely-packed mass of strongly-refracting granules $\frac{1}{2500}$th of an inch, more or less, in diameter. The outer membrane of the pedicle can be traced over the vesicle, and the inner probably passes under it, separating the cavity of the pedicle from the vesicle: the dense mass of granules prevents this from being actually seen, but from analogy with *Mesonema*, &c., I have no doubt of the fact.

28. Ehrenberg, in his description of the *Medusa aurita*, says, "Le pédoncule est attaché à une vésicule, dans lequel on remarque, sous le microscope, un corps glanduleux, jaunâtre lorsque la lumière le traverse et blanchâtre lorsque cette dernière est réfléchie. De ce corps il part deux branches qui se dirigent vers le pédoncule du corps brun jusqu'à son petit bouton ou tête." And further on, "Le corps bifurqué placé à la base du corps brun paraît être un ganglion nerveux, et ses deux branches peuvent être regardées comme des nerfs optiques." I must confess that, judging by what I have observed in *Rhizostoma* and *Phacellophora*, it appears to me that these so-called nervous branches passing on each side of the pedicle towards its head, are nothing more than the optical expression of the thickness of the two membranes of which the pedicle is composed; and a very similar explanation may, I think, be given of his intertentacular ganglia, which appear to be nothing more than the optical expression of the thickened walls of the circular canal.

29. *Of the Tentacles.*—The tentacles of the Medusæ are of two kinds:—1, those which are processes of the outer foundation membrane alone; and 2, those which are processes of both inner and outer membranes, and therefore contain a cavity continuous with the common cavity of the body. Under the former class must be included the knob-like processes on the convex surface of many Medusæ containing thread-cells; the papillæ on the generative and stomachal membranes of *Phacellophora*; the thickened margin of the stomachal membrane in *Oceania*; the buccal tentacles of *Mesonema*; the tentacles of the fringe of *Rhizostoma* and *Cephea*, and probably the marginal tentacles of *Thaumantias*. I will proceed to describe some of these more in detail.

30. The papillæ scattered over the generative and stomachal membranes of *Phacellophora* are spherical, and connected with the membrane by a somewhat narrower neck. The substance of this, as well as of the body itself, is made up of large clear cells, but the surface of the body is covered with an immense number of round thread-cells, figs. 20, 20 *a*.

In *Mesonema*, the perpendicular membrane, which depends from the orifice of the central cavity, is prolonged at its edges into a great number of short tentacles. Each of these is composed of an outer wall, in which immense numbers of thread-cells are imbedded, and a central axis made up of large transparent cells. This cellular axis extends for some distance beyond the base of the tentacle into the substance of the membrane, fig. 7.

31. The tentacles of the fringe of *Rhizostoma* and *Cephea* have already been described, fig. 13. The tentacles which beset the generative membrane closely resemble them, and consist of a single membrane, containing many small thread-cells, $\frac{1}{4000}$th of an inch in diameter. Their cavity is filled with a homogeneous substance, sometimes containing nuclei, similar to those of the disc (15.); the inner membrane takes no part in their formation, fig. 30.

32. The marginal tentacles of *Thaumantias* are very similar (fig. 3) to the buccal tentacles of *Mesonema*; they consist of an outer membrane, in which numbers of thread-cells are imbedded, and an inner axis composed of clear cells arranged end to end; they have a peculiarity, which has been already pointed out by Prof. E. Forbes, in being placed above the marginal vesicles instead of being alternate with them, as in the nearly allied genus *Geryonia*; and from this fact, and from their totally different structure, I believe that they have a totally different origin. In *Geryonia* the tentacles belong to the second class—are processes of the circular canal; in *Thaumantias* they are simple processes of the outer foundation membrane, *i. e.* of the substance of the disc. Perhaps this difference in structure among the tentacles may turn out to be a good means of generic distinction among other members of the class.

33. As to the second class of tentacles. Such are the marginal tentacles of *Mesonema*, of *Geryonia* (Will), of *Oceania* and of *Medusa aurita* (Ehrenberg); the tentacles of the under surface of *Phacellophora*, and the interbrachial tentacles of *Cephea*.

34. In the specimens of *Mesonema* I obtained, there were not more than eight tentacles, placed at equal distances round the disc, which had attained their full development. The interval between every two was filled up by a series of bud-like rudimentary tentacles, and marginal corpuscles alternate with them. Each tentacle, in its bud-like rudimentary form, is simply a cæcal process of the circular canal, and has therefore, like it, a double wall and an internal cavity, usually filled with granules in rapid motion, produced by the ciliæ of the inner wall; the outer wall contains large thread-cells. The structure of the adult tentacle is essentially the same, but in the course of its growth it has become divided into a lower filamentous portion and an upper dilated sac, by which it communicates with the circular canal, fig. 8.

The marginal tentacles of *Oceania* resemble these in all points; they are double-walled, communicate freely with the circular canal, and contain an immense number of minute thread-cells in their outer wall, fig. 15.

35. In *Phacellophora* there is no distinct marginal circular canal, but the sixteen radiating canals are very wide and sacciform, and communicate only by anastomosing marginal branches. Eight of the canals are narrower and run to the marginal corpuscles. The alternate eight are very much wider, and their outer, under surface is beset with a curved series of long tentacles, fig. 18. Now the lower wall of the canals is composed of the two "foundation membranes," and the tentacles are simply

prolongations of these membranes; they are therefore double-walled, and contain a cavity continuous with that of the canal. At their upper part they are thicker than below, where their outer membrane is developed into spherical processes containing multitudes of thread-cells and closely resembling those on the generative membrane (30.). The inner cavity becomes obliterated at the lower part of the tentacle, fig. 19.

36. The large interbrachial tentacles of *Cephea* are processes of the branched arms. For the greater part of their length they have the same structure as the arms, *i. e.* consist of a dense, thick, transparent outer substance and an inner membranous wall inclosing a tubular canal; but at the extremity they are thickened, and the outer wall is raised into a number of small pyriform processes, $\frac{1}{160}$th of an inch in diameter, thickly covered with minute spherical thread-cells, $\frac{1}{5000}$th of an inch in diameter. At the same time the central canal becomes branched out into a kind of plexus, which occupies the interior of the enlarged end of the tentacle, fig. 37. These tentacles are 2 inches or more in length and $\frac{1}{13}$th of an inch in thickness, but other smaller tentacles, $\frac{3}{4}$ths of an inch in length by $\frac{1}{20}$th of an inch in diameter, depended from the arched concavity of the brachiferous plate. Their general structure much resembled that of the foregoing, except that the central canal terminated in a blind simple extremity, and that the pyriform bodies extended rather further up the stem.

Beside these there was a third small kind of tentacles, which appeared as small blue points among the stomachs. These were clavate bodies placed without any regular order in the axils between the stomachs, and containing an internal cavity which communicated with the nearest branch of the common canal. A series of pyriform processes, exactly resembling in form those above described, was arranged round their hemispherical extremities. As the individual I observed was a young one (the generative organs not being developed), I conclude that these were young forms of the longer tentacles, fig. 36.

37. *Of the Generative Organs.*—It has been already noticed with regard to the Cryptocarpæ by Will (in *Geryonia, Thaumantias, Cytæis, Polyxenia*), and by Milne-Edwards (in *Æquorea*), that the generative organs are connected with some part of the system of canals, but they do not attempt to define the nature of this connection. I shall endeavour to do this, and to show that the generative organs, both in these and in the Phanerocarpæ and Rhizostomidæ, are always portions more or less developed of the wall of this system; and therefore consist of the two "foundation membranes," in or between which the generative elements, whether ova or spermatozoa, are developed.

38. In *Thaumantias* there are four canals radiating from the centre of the disc, at right angles to one another, and terminating in a circular vessel at the edge of the disc. Near its termination each has a rounded body seated upon it. In most of the specimens I examined this body was distended with ova, and its structure was thereby obscured; but in one instance it was replaced by an elongated, somewhat pyriform

body, which on close examination was found to be simply a dilatation of the canal on which it was seated, having double walls continuous with those of the canal, only much-thickened, and a central cavity communicating freely with that of the canal. This was without doubt a young generative organ, fig. 4.

39. In *Oceania* the canals are very numerous, and radiate from the wide central cavity to the circular vessel at the margin of the disc. In young individuals these canals are narrow and nearly equal throughout, but in adults their inferior wall, for the middle three-fifths of their extent, is greatly enlarged and hangs down in folds or plaits, fig. 15. Under the microscope the wall exhibits an immense number of ova, of all sizes and stages of growth, lying in its substance; and if the edge of a fold be examined, these are seen to be placed between the inner and outer membranes. The inner membrane is thick, and composed of projecting cells with very long ciliæ; the outer membrane is dense, thinner, and much more transparent, figs. 16, 17.

40. This account agrees in its general details very closely with that given by M. Milne-Edwards of the generative organs of *Æquorea**; and I regret the less not having been able to obtain male individuals, as he expressly states that in *Æquorea* the spermatozoa are developed in the same position. There is, however, one discrepancy. M. Edwards states that the generative lamellæ "sont tout à fait distincts de la cavité digestive centrale." I think that on repeating his examination he would find this not to be the case. In *Oceania*, at any rate, I could readily introduce a needle from the stomach into the canals, and show that the lamellæ were mere dilatations of their wall.

In *Polyxenia*, where the canals are very short and the central cavity very large, the ova are situated in the under wall of the cavity, according to Will; but this author enters into no particulars as to the structure of the wall.

41. The generative organs of the Phanerocarpæ have been much investigated. The general result arrived at appears to be, that they are plaited tubular bands attached to the concave wall of a depression existing between the pillars of attachment of the stomachal membrane; that they are altogether separate from the central cavity; that the spermatozoa are developed in pyriform sacs opening externally, and that the ova lie free in the substance of the ovarial band.

42. The structure of the generative organs in *Phacellophora* is as follows:—The voluminous folded and plaited stomachal membrane is attached by four thick pillars to the under surface of the disc. The edges of the pillars are connected by a thin membrane, which is concave externally so as to form a sort of shallow depression or generative cavity, but the central and some of the marginal parts of this membrane are produced into long plaited processes, which hang far out of the cavity, fig. 18. Each process is a sort of sac communicating freely at its attached extremity with the cavity of the stomach, air, &c. passing readily from the one to the other. It is in fact

* Annales des Sciences Naturelles, t. xvi., quoted *verbatim* in Lesson's Histoire Naturelle des Zoophytes Acalèphes.

a sort of eversion of the walls of the stomach, or more properly, of the central cavity. It consists in its upper or attached part of nothing more than the two "foundation membranes," and here they are smooth, but at their lower or free edge they become much plaited, acquire a deeper colour, and exhibit the characteristic generative elements. Short tentacles, similar to those of *Rhizostoma* (31.), are scattered over the inner surface of each process, fig. 21.

43. In the *ovarium*, the two membranes develope between them immense multitudes of ova with a dark granulous yelk and clear germinal vesicle. The ova are attached to the outer surface of the inner membrane, the outer membrane passing quite freely over them, fig. 24.

44. The *testis* is similarly composed of two membranes with an intervening space. The inner membrane is produced into a vast number of thick pyriform sacs, which lie between the two membranes, with their blind ends towards the inner surface of the outer membrane; internally, they open each by a distinct aperture on the free surface of the inner membrane.

45. The contents of the sacs are spermatozoa, and cells in every stage of development towards spermatozoa. These stages are—1. Spherical cells, $\frac{1}{1600}$th of an inch in diameter, filled with smaller nucleated cells (fig. 23 *a*). 2. Cells exactly resembling these included cells but free, and about $\frac{1}{5000}$th of an inch in diameter (*b*). 3. Similar cells, occasionally united into masses with long filiform productions (*c*). 4. Similar cells with a short process in the opposite direction also; these swim about freely and sometimes move their tails (*d*). 5. Perfect spermatozoa with elongated heads ($\frac{1}{1250}$th of an inch), rather larger below than above, where they are not more than $\frac{1}{30,000}$th of an inch in diameter, with very long tails of immeasurable fineness, extending from the larger extremity (*e*). From the existence of these different stages, I conclude that the spermatozoa are formed by the elongation of the secondary cells contained in the large cells first mentioned.

46. I have not been fortunate enough to meet with any description of the generative organs of the Rhizostomidæ except that of these organs in *Cephea* by Will; and as what I have observed differs somewhat from his statements, I will describe those of *Rhizostoma mosaica* somewhat fully.

In this Acalephe, the eight arms which bear the stomachs are inserted into the lower angles of a thick square plate, which I have thence called the "brachiferous plate," fig. 27. From the upper angles of this plate there arise four pillars, of the same structure as the peduncles of the arms, and are inserted into the under surface of the disc rather external to the middle point between its centre and margin. The "brachiferous plate" has no other attachment to the disc, so that it forms the floor of an arched cavity, with four entrances between the suspending pillars of the plate.

The suspending pillars expand at their attachment to the disc into three thickened ribs or crura, two of which are lateral and external, and one central and internal: these are united by a thin membrane. The central crura meet and form a cross under

the centre of the disc; the lateral crura are continuous with the substance of the disc above, and each meets with its fellow external to the centre of the disc, fig. 26. The central crura are united with these and thence with the disc by the thin membrane only. It thence follows that there exists above the central crura and the connecting membrane a wide crucial cavity; into this the canals of the suspending pillars open, and from it radiate the canals which are given off to the circumference of the disc: the crucial cavity then is only a portion of the great system of canals.

47. The external surface of the outer half of the thin uniting membrane (which is composed solely of the two "foundation membranes"), is produced into a vast number of transverse folds of a grayish-green colour in the male, but of a deep orange-red in the female, fig. 26. These give rise to the appearance of a coloured cross shining through when the disc is viewed from above. The inner side of the folds is beset with a series of tentacles, the generative tentacles described above (31), fig. 30. In young specimens, not more than 3 inches in diameter, the generative organs were undeveloped; the outer portion of the thin membrane being as smooth as the inner, but the series of tentacles already existed*.

In adults the margins of the folds contain the spermatozoa in the male, the ova in the female.

48. In the *ovarium* the ova lie between the inner and outer foundation membranes, which are both ciliated on their free surfaces. The ova are attached to the outer surface of the inner membrane by a kind of pedicle, which expands into the thick vitellary (?) membrane; this chorionic coat is distinctly cellular in middle-sized ova, in larger ones it is thicker and homogeneous. If the inner surface of the inner membrane be examined, a depression will be seen opposite each ovum: the yelk of the ova is granulous and of a bright orange colour. The germinal vesicle is clear and thin-walled, and is $\frac{1}{700}$th of an inch in diameter; the germinal spot is a thick-walled cell $\frac{1}{3300}$th of an inch in diameter, fig. 32.

49. So far as the structure of the inner and outer membranes is concerned, the *testis* resembles the *ovary*. But the spermatozoa are contained in ovoid or pyriform, thick-walled sacs, about $\frac{1}{80}$th of an inch in long diameter placed between the two, fig. 31. In one individual the sperm-sacs were more ovoid in shape, and did not appear to have any particular attachment to either membrane, but in the rest they were all connected with the inner membrane, and when its inner surface was turned towards the eye, the

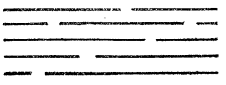
* It appears to me that M. Milne-Edwards must have had a young individual of *Rhizostoma* before him, when he says (Observations sur la Structure de la Méduse Marsupiale), "Nor does the plaited membrane, which forms a sort of partition between the central and the four lateral cavities, appear to be an organ of reproduction. If we examine one of these membranes superficially with the naked eye, we see towards its upper part a kind of woollen fringe, which at first sight might be taken for a series of glandular sacs, but by the aid of the microscope it is found that this appearance is due in fact to a multitude of suckers (*suçoirs*), having the greatest similarity in form to those appendages which are observable in certain parts of the body of different Zoophytes, such as *Vitella*, *Actinia*, &c. From this it would appear that these membranes are much more fitted for absorption or respiration, as is the opinion of M. Eysenhardt, than for the formation of ova."

openings of the sacs could be perceived: the sacs were filled with spermatozoa with triangular heads, about $\frac{1}{10,000}$th of an inch in diameter, and very long, fine, delicate tails, fig. 31 *a*. The course of their development appeared to be as in *Phacellophora*.

50. *Rhizostoma* and *Phacellophora* then agree in having the spermatozoa developed in sacs connected with the inner "foundation membrane" and opening internally. It would appear from this that the exit for the spermatozoa is through the mouth of the animals, though this course in *Rhizostoma* would certainly be a rather circuitous one.

51. The individual of *Cephea* (*C. ocellata*) which I examined resembled, with regard to the generative organs, a young *Rhizostoma*. The line of generative tentacles was present, but the generative organs were undeveloped. According to Will, the structure of the testis in *Cephea Wagneri* closely resembles that of *Rhizostoma*. He says that there is a cavity under the disc into which the canals of the arms and disc open; that the floor of this cavity is formed by a thin membrane covered with fine tentacular appendages, and that the band-like testes are attached to the under free surface of the membrane; they consist of pyriform sacs (*flaschenförmigen Drüschen*) closely applied together, and each opening independently below. The spermatozoa are elongated and cylindrical, and have a very long, fine appendage.

52. With regard to the *muscular system* of the Medusæ, such observations as I have made lead me to believe that the muscular fibres are always developed in the outer "foundation membrane." In *Rhizostoma* the muscular fibres of the under surface of the disc are flat, pale, and from $\frac{1}{1250}$th to $\frac{1}{600}$th of an inch in diameter. They run parallel to one another, but the lines of separation between them are not continuous throughout, but thus: each fibre is made up of very small and indistinct fibrils, which are transversely striated, the striation being most distinct at the edge of the fibres.



53. I have not observed any indubitable trace of a *nervous system* in the Medusæ.

54. Will has described a blood-vascular system, consisting of a system of canals inclosing the water canals and containing a distinct fluid with cells floating in it. I have paid particular attention to this point in all my examinations of the Medusæ, but notwithstanding that I have had species of the very same genera (*Cydippe*, *Cephea*, *Thaumantias*) under my hands, I have never observed any trace of it. I am at a loss even to understand what he means, unless, as I strongly suspect, he has taken the outer foundation membrane, which occasionally is thick and distinct from the inner, especially about the circular marginal canal, for the walls of a distinct vessel. Even if this be the case, what are the blood-corpuscles?

55. The *thread-cells* resemble in all respects those of the Diphydæ, which I have described elsewhere, consisting of a delicate outer cell inclosing another thick-walled cell, with a spiral filament of greater or less length, coiled up in its interior and capable of protrusion on pressure.

SECTION II.—*Of the Affinities of the Medusæ.*

56. Certain general conclusions are deducible from the facts stated in the preceding section. It would appear,—

1st. That a Medusa consists essentially of two membranes inclosing a variously-shaped cavity, inasmuch as its various organs are so composed (7, 8, 14, 21, 22, 29, 33, 38, 39, &c.).

2ndly. That the generative organs are external, being variously developed processes of the two membranes (38, 39, 42, 48, 49); and

3rdly. That the peculiar organs called thread-cells are universally present (7, 15, 31, 32).

Now in these particulars the Medusæ present a striking resemblance to certain other families of Zoophytes. These are the Hydroid and Sertularian Polypes, the Physophoridæ and Diphydæ, with all of which the same three propositions hold good*.

57. But in order to demonstrate that a real affinity exists among different classes of animals, it is not sufficient merely to point out that certain similarities and analogies exist among them; it must be shown that they are constructed upon the same anatomical type, that, in fact, their organs are homologous.

Now the organs of two animals or families of animals are homologous when their structure is identical, or when the differences between them may be accounted for by the simple laws of growth. When the organs differ considerably, their homology may be determined in two ways, either—1, by tracing back the course of development of the two until we arrive by similar stages at the same point; or, 2, by interpolating between the two a series of forms derived from other animals allied to both, the difference between each term of the series being such only as can be accounted for by the laws of growth. The latter method is that which has been generally employed under the name of *Comparative Anatomy*, the former being hardly applicable to any but the lower classes of animals. Both methods may be made use of in investigating the homologies of the Medusæ†.

58. A complete identity of structure connects the "foundation membranes" of

* "Les parois du tube nutritif sont formées d'une double membrane toujours rondée intimement dans cette partie du polype, l'externe répond aux téguments; l'interne est une continuation de la membrane digestive de la capacité alimentaire."—CUVIER, Org. de Génération des Zoophytes, Leçons d'Anat. Comp. t. viii. 2nd edit.

I have elsewhere pointed out that the same circumstance obtains among the Diphydæ and Physophoridæ.

That the generative organs are external in the Sertularian and Hydroid Polypes has been long known. MILNE-EDWARDS has shown that they have a similar position in one of the Physophoridæ (*Apolemia*). I have observed it myself in the Diphydæ.

The presence of the thread-cells has been determined by WILL in the Diphydæ, by MILNE-EDWARDS in *Apolemia*, by myself (only ??) in *Physalia, Physophora, Athorybia* and other Physophoridæ, and in the Sertularian Polypes.

† The above definitions may be thought needless and even trite, but the establishment of affinities among animals has been so often a mere exercise of the imagination, that I may be pardoned for pointing out the guiding principles which I have followed, and by which I would wish to be judged.

the Medusæ with the corresponding organs in the rest of the series; and it is curious to remark, that throughout, the outer and inner membranes appear to bear the same physiological relation to one another as do the serous and mucous layers of the germ; the outer becoming developed into the muscular system and giving rise to the organs of offence and defence; the inner, on the other hand, appearing to be more closely subservient to the purposes of nutrition and generation.

59. The structure of the stomach in the Medusæ is in general identical with that of the same organ in the rest of the series. The Rhizostomidæ offer an apparent difficulty, but it appears to me that the marginal folds in them answer to the stomachal membrane of the Monostome Medusæ; the apertures to the inner orifice of their stomach, and the common canal to their "common cavity." Just as in a polygastric Diphyes the common tube answers to the chamber into which the stomach of a monogastric Diphyes opens; and in *Cephea Wagneri* (Will) these resemblances are still more striking. He says that each cotyledon "has at its apex a small round opening, the mouth, which leads to an ovate cavity, occupying the whole interior of the cotyledon. I consider this as the proper digestive or stomachal cavity, and believe that the cotyledons have the same relation to the vessels as the so-called suckers (*Sangröhren*) of the Diphydæ to the common tube (*Saftröhre*)*."

60. The disc of a Medusa is represented by the natatorial organ among the Diphydæ and Physophoridæ. Take for instance the disc of *Oceania* or *Cytæis*. It is here a more or less bell-shaped body, traversed by radiating canals, lined by a distinct membrane, united by a circular canal at the margin. In the centre the radiating canals communicate freely with the chamber into which the stomach opens. The inner margin of the disc is provided with a delicate, circular, valvate membrane. The same description applies, word for word, to the natatorial organs of the Diphydæ and Physophoridæ; the only difference being, that in the latter the stomach is *outside* the cavity (fig. 47) of the organ, instead of being, as in the Medusæ, suspended from its centre *inside*, fig. 49. And even if the different texture of the two organs should give rise to any doubt, the genus *Rosacea*, in which the natatorial organ is perfectly soft and gelatinous, furnishes the needful intermediate form.

61. The disc of the Medusæ has no representative among the Hydræ and Sertulariadæ. The cell of the Sertularian Polype rather resembles the "bract" of the Diphydæ than the "natatorial organ" in its structure and function, and in this manner the Diphydæ form a connecting link between the Medusæ and the Physophoridæ.

62. Of the two kinds of tentacles of the Medusæ, the first is represented, in the Physophoridæ and Diphydæ, by the thickenings, richly beset with thread-cells, that frequently occur in the lip of the stomach; in the Sertularian Polypes (*Plumularia, Campanularia*) by the tentacles of the margin of the mouth, which precisely resemble the tentacles of the fringe of *Rhizostoma*, or the marginal tentacles of *Thaumantias*,

* Horæ Tergutinæ, p. 60.

in being composed of a single membrane covered with thread-cells, and having a cellular axis.

63. The second kind of tentacle is homologous with the prehensile organs of the Diphydæ and Physophoridæ with the peculiar clavate processes of *Plumularia*, and so far as I can judge from descriptions of their structure, with the tentacles of *Hydra*.

All the organs here mentioned commence their development as bud-like processes of the two primary membranes, elongating and attaining the forms peculiar to their perfect state as they grow older. The tentacles of the Medusæ are usually developed (as in most Monostomatæ) from the circular vessel of the disc, sometimes (*Phacellophora*)from the diverging canals, sometimes, finally, from the neck of the stomach *Lymnorea, Javonia*). The prehensile organs of the Physophoridæ also have considerable variety in position. In *Porpita, Vitella, Angela* (?), they are developed from the margin of the float; in *Physophora* and many others from the base or the pedicle of the stomach. The prehensile organs of the Diphydæ are always developed either from the base or the pedicle of the stomach. The peculiar clavate organs of *Plumularia* are developed from the common tube independently of the stomach.

64. The adult forms of these organs have all the same structure, being composed of two membranes, with a vast number of thread-cells of larger or smaller size, seated in the substance of the outer membrane or between the inner and the outer.

65. The "clavate organs" of *Plumularia* deserve especial notice, as I am not aware that they have been hitherto described, and as they exemplify in a very beautiful manner the "unity of organization" manifest among these families.

I have found them in two species of *Plumularia* obtained by the dredge at Port Curtis; they were of two kinds, the one attached to the cell of the polype, the other to the pedicle of the ovary, figs. 43, 44, 45. In each species there were three processes of the former kind, two above proceeding from near that edge of the aperture which is towards the stem, the other below from the front part of the base of the cell; they were conical in the one species, club-shaped and articulated in the other, and consisted of an external horny membrane open at the apex, and an internal delicate membrane inclosing a cavity, all these being continuous with the corresponding parts of the stem. At the apex of each, and capable of being pressed through the aperture, lay a number of thread-cells; with moderate pressure the threads only of these organs were pressed out.

I found the second kind of organ in the species with conical processes. It consisted of a stem proceeding from the pedicle of the ovary, bearing a series of conical bodies having the same constitution as those just described, fig. 45. The perfect resemblance between these and the prehensile organs of the Diphydæ cannot be overlooked.

66. The structure of the generative organs is still more instructive. In the Medusæ I have endeavoured to show that there are always processes of the two

foundation membranes, the generative elements being developed between them, figs. 1 *a*, 11 *a*, 18 *a*, 26 *a*.

67. In the Diphydæ (and as I have good reason for believing in the Physophoridæ also) the generative organ commences as a simple process of the common tube (fig. 39 *a*), and undergoing great changes of form in the course of its development (*b*, *c*), it becomes at last exactly similar to an ordinary natatorial organ with a sac composed of two membranes suspended from its centre, fig. 39. In external form it greatly resembles such a *Medusa* as *Cytæis*, and this resemblance is much heightened when, as in some cases, it becomes detached and swims freely about, fig. 41. The ova or spermatozoa, as the case may be, are developed between the two membranes of the sac, the inner of which at any rate is a continuation of the inner membrane of the common tube, fig. 39.

68. The ovarium of the *Plumularia* above mentioned (65.), commences as a dilatation of the apex of its pedicel, which again is a process of the common stem. It then becomes lenticular with a horny outer wall, glassy and transparent externally, but internally coloured by pigment masses. Internally it has an oval cavity communicating with that of the stem and lined by a distinct membrane, fig. 45. Between the two membranes is a thick layer of ova, more or less oval in shape, and about $\frac{1}{350}$th of an inch in diameter, with a germinal spot about $\frac{1}{2400}$th of an inch in diameter, seated in the middle of a clear space about twice that size, which doubtless represents the germinal vesicle.

69. The account given by Löwen of the generative organs of *Campanularia* differs considerably from the foregoing. After all however his "female polypes" may be nothing more than ovaria similar to those of *Diphyes* or *Coryne*, but having the production of tentacles from the margin carried to a greater extent than in the latter. If this be a correct explanation, the idea promulgated by Steenstrup, that there is an "alternation of generations" among the Sertularian Polypes, must be given up.

70. In *Hydra**, the ova are developed in similar processes of the lower part of the body. But among the Hydroid Polypes the ovaries of *Coryne*, *Syncorine* and *Corymorpha*, as described by Sars, Löwen and Steenstrup, are most interesting. They commence as tubercles of the stem, afterwards become bodies, precisely resembling the ovaria of the Diphydæ, and finally (fig. 42) detaching themselves develope regular tentacles from their margin. The ova are formed between the two membranes of the inner sac†.

* M. Dujardin, Annales des Sciences Naturelles, November 1845, states on the authority of Ehrenberg, Corda and Laurent, that the ova of the freshwater Polype are "produits dans l'épaisseur même du tissu sans ovarie ni ovule préalable."

† "The axis of the bell is occupied by a membranous sac, which is a prolongation of the nutritive canal, and answers to the alimentary cavity of the alimentary Polypes. The ova are developed in regular series in the interval between this alimentary capsule and the parietes of the outer sac, in an intermediate membranous sac, distinguished by its yellowish brown colour."—Cuvier, Leçons d'Anat. Comparée, t. viii. Organs de Génération des Zoophytes, p. 860. See also Duvernoy, Annales des Sciences Naturelles for November 1845.

71. What has now been advanced will perhaps be deemed evidence sufficient to demonstrate,—1st, that the organs of these various families are traceable back to the same point in the way of development; or 2ndly, when this cannot be done, that they are connected by natural gradations with organs which are so traceable, in which case, according to the principles advanced in 57, the various organs are homologous, and the families have a real affinity to one another and should form one group.

72. Perhaps the view that I have taken will be more clear if I throw it into a tabular form, placing opposite one another those organs in the different families, for the homologies of which there is, I think, sufficient evidence, thus:—

Stomachs identical in Structure throughout.

Medusæ.	*Physophoridæ.*	*Diphydæ.*	*Sertularidæ.*	*Hydræ.*
Disc	Natatorial organ	Natatorial organ.		
Canals	Canals of natatorial organ	Canals of natatorial organ.		
Common cavity / Canals of branches (*Rhiz.*)	Common tube	Sacculus and common tube.	Cavity of stem.	
		Bract	Polype-cell.	
Tentacles, 1	Thickened edge of stomach		Oval tentacles.	
2	Prehensile organs		Clavate organs	Tentacles (?).
Generative organs	Generative sac		Generative organ	Generative organ.
	Natatorial organ of generative sac			Natatorial organs (Coryne).
Marginal vesicle	?	?	?	

73. It appears then that these five families are by no means so distinct as has hitherto been supposed, but that they are members of one great group, organized upon one simple and uniform plan, and even in their most complex and aberrant forms, reducible to the same type. And I may add, finally, that on this theory it is by no means difficult to account for the remarkable forms presented by the Medusæ in their young state. The Medusæ are the most perfect, the most *individualized* animals of the series, and it is only in accordance with what very generally obtains in the animal kingdom if in their early condition they approximate towards the simplest forms of the group to which they belong.

74. I have purposely avoided all mention of the Beroidæ in the course of the present paper, although they have many remarkable resemblances to the animals of which it treats: still such observations as I have been enabled to make upon them have led me to the belief, that they do not so much form a part of the present group as a link between it and the Anthozoic Polypes. But I hope to return to this point upon some future occasion.

Sydney, April 24th, 1848.

*** Since the above was written I have had an opportunity (by the kindness of W. MacLeay, Esq., to whose advice I am much indebted) of reading M. Dujardin's "Mémoires sur le Développement des Méduses et des Polypes Hydraires," contained

in the Annales des Sciences Naturelles for November 1845. This author has, as it appears to me, been misled by the great analogy between the structure of a Medusa and that of the generative organ of a Coryniform Polype, into taking the detached organ of the Polype for a real Medusa. He does not hesitate to say that the Claviform Polypes are "only a first stage of development of the Acalephæ." He hints that each clavate Polype has its corresponding Acalephe, and he does not hesitate to give the latter distinct names as independent genera (*Sthenyo*, *Cladonema*).

Here, as in many other instances, the study of the Diphydæ throws light upon the matter. The detached free-swimming testis or ovary of a species of *Sphenia* has just as much claim to a distinct generic name as has *Sthenyo* or *Cladonema*, and yet in what respect does this differ from the persistent ovary of *Eudoxia*, which surely is an organ, and nothing but an organ?

Would it not be as reasonable to give a distinct name to NEEDHAM's sperm-sacs because they exhibit certain independent motions external to the body of the Cephalopod?

The point is of consequence, because it is anything but desirable that *true polypes* with *medusiform* generative organs should be confounded with the *Polypiform larvæ* of true Medusæ.

DESCRIPTION OF THE PLATES.

*** In all the sectional diagrams the letters have the same meaning, viz. *m*. Stomach. *n*. Common cavity. *o*. Canals. *p*. Generative organ. *q*. Natatorial organ. *t*. Tentacle. *u*. Marginal vesicle. *x*. Outer membrane. *x'*. Bract. *x''*. Valvular membrane.

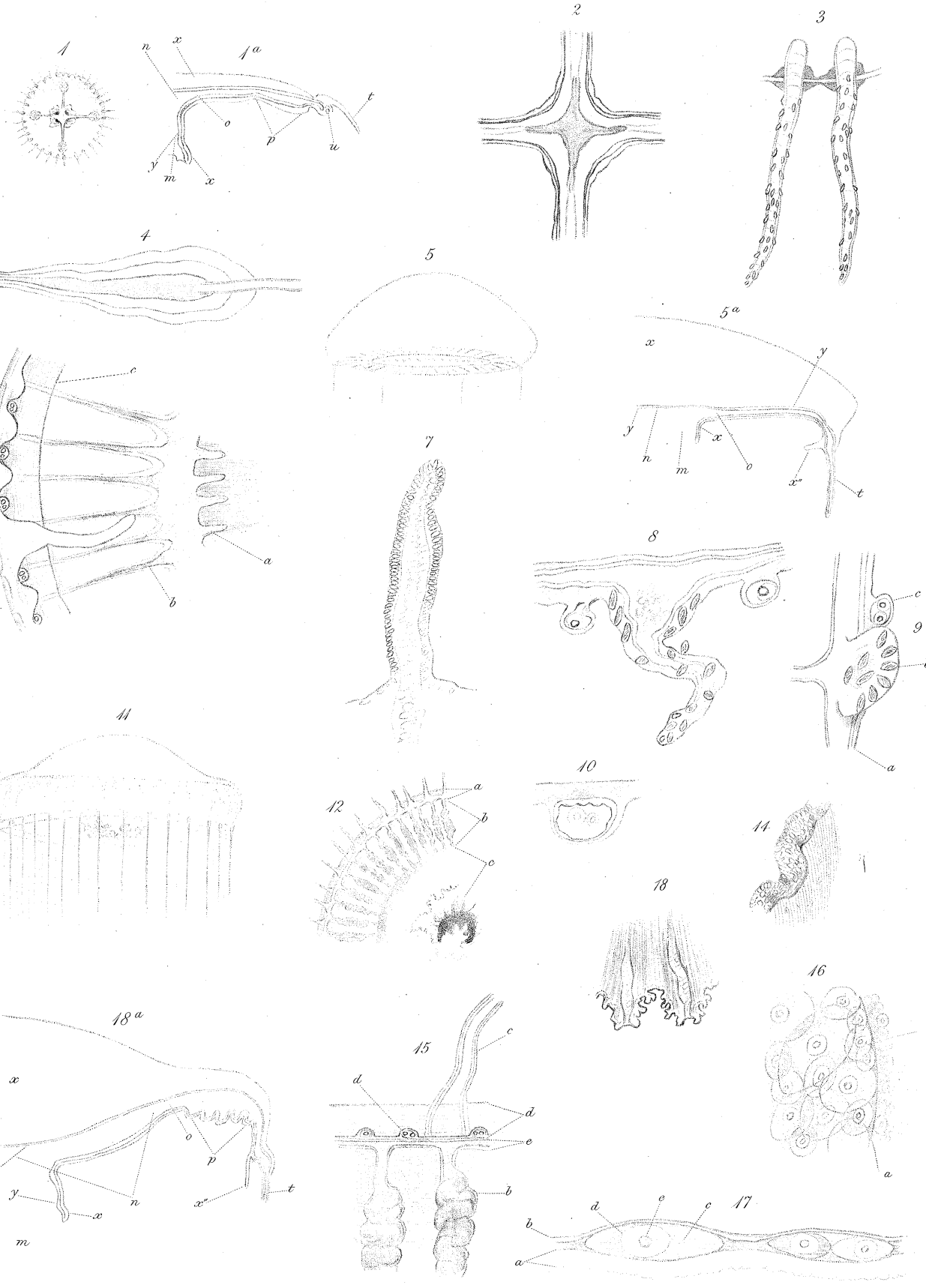
PLATE XXXVII.

Thaumantias ——?

Fig. 1. Disc seen from above.
Fig. 1 *a*. Imaginary vertical section.
Fig. 2. Opening of the stomach into the canals seen from above.
Fig. 3. Marginal tentacles.
Fig. 4. Young generative organ.

Mesonema?

Fig. 5. Lateral view of the animal.
Fig. 5 *a*. Vertical section.
Fig. 6. View of a segment of the disc; under surface.
a. Buccal tentacles.
b. Canals.
c. Marginal membrane (20.).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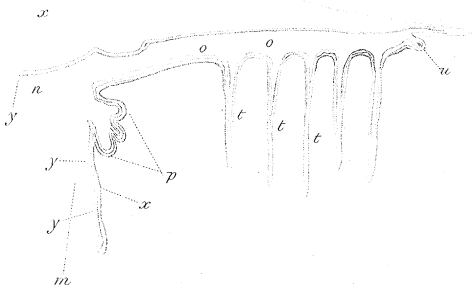

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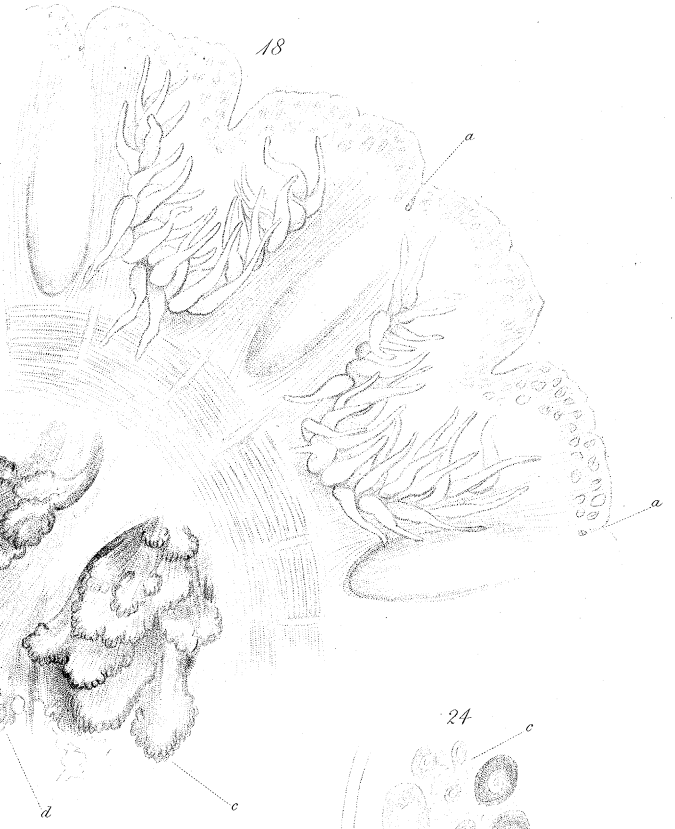

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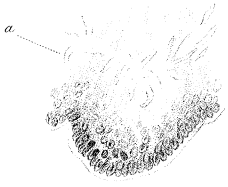

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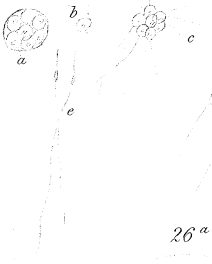

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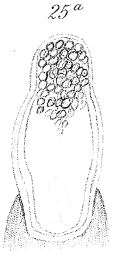

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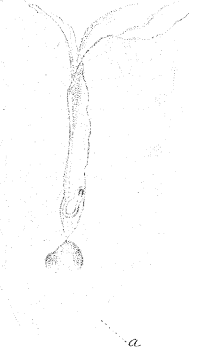

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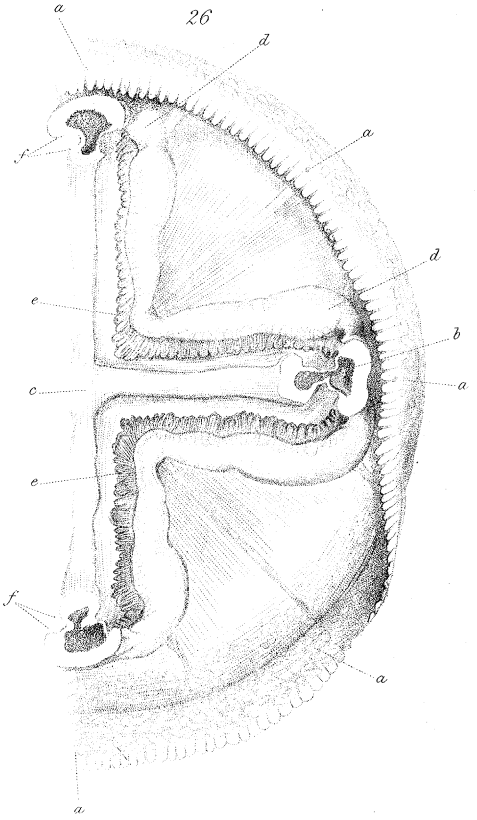

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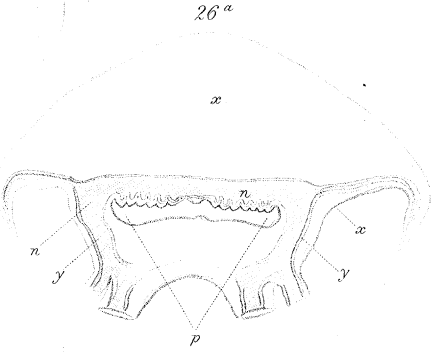

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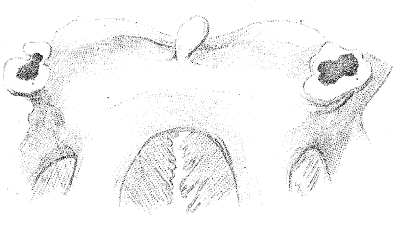

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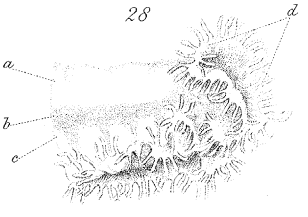

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Fig. 7. A single buccal tentacle much magnified.
Fig. 8. A portion of the marginal canal with a tentacle and two marginal corpuscles.
Fig. 9. Portion of the marginal canal (*a*) with young tentacle (*b*), and a marginal vesicle containing two corpuscles, each inclosed within a delicate cell-wall.
Fig. 10. A marginal vesicle highly magnified; the two corpuscles do not appear to have attained their full development, as they refract less, and the cell appears more opake.

Oceania ——

Fig. 11. Lateral view of the animal.
Fig. 11 *a*. Vertical section.
Fig. 12. Part of the under surface of the disc.
a. Marginal membrane.
b. Canals and generative organs.
c. Common cavity.
Fig. 13. Part of the membrane surrounding the mouth.
Fig. 14. The edge of this much magnified.
Fig. 15. Part of the margin of the disc much enlarged.
a. Marginal membrane.
b. Canal and generative organs.
c. Tentacle.
d. Marginal corpuscles.
e. Circular canal.
Fig. 16. Portion of the ovarium so folded as to have its inner membrane (*a*) outwards.
Fig. 17. Sectional view of the ovarium.
a. Inner membrane.
b. Outer membrane.
c. Ovum.
d. Germinal vesicle.
e. Germinal spot.

PLATE XXXVIII.

Phacellophora ——?

Fig. 18. View of a segment of the under surface.
a. Marginal vesicles.
b. Tentacles in this individual very much shorter than usual.
c. Ovary or testis.
d. Buccal membrane.
Fig. 18 *a*. Vertical section.

Fig. 19. Tentacle.
Fig. 20. Portion of the buccal membrane.
Fig. 20 *a*. Round processes containing thread-cells scattered over its outer surface.
Fig. 21. Portion of the testis.
a. Generative tentacles.
Fig. 22. Sectional view of part of the testis.
a. Outer membrane.
b. Sperm-sacs.
c. Inner membrane.
Fig. 23. Stages of development of the spermatozoa (45.).
Fig. 24. Ovarium.
a. Outer membrane.
b. Ova.
c. Inner membrane.
Fig. 25. Marginal vesicle from the under surface.
a. Dilatation of the canal.
Fig. 25 *a*. Marginal vesicle and pedicle very much enlarged.

Rhizostoma mosaica.

Fig. 26. View of the under surface of the disc, the brachiferous plate being cut away.
a. Marginal vesicles.
b. Cut extremity of the suspending pillar of the brachiferous plate.
c. Central crura.
d. Lateral crura.
e. Generative folds.
f. Connecting membrane.
Fig. 26 *a*. Vertical section of the Rhizostoma.
Fig. 27. Side view of the brachiferous plate detached.

PLATE XXXIX.

Rhizostoma mosaica.

Fig. 28. Extremity of one of the ultimate ramifications of the arms.
a. Thick substance of the outer membrane.
b. The central common canal.
c. The lateral canals leading to the apertures.
d. The fringes.
Fig. 29. Lateral view of one of the apertures much magnified.
a. Thick outer membrane.
b. Inner membrane.
c. Lateral canal.
d. Tentacles.

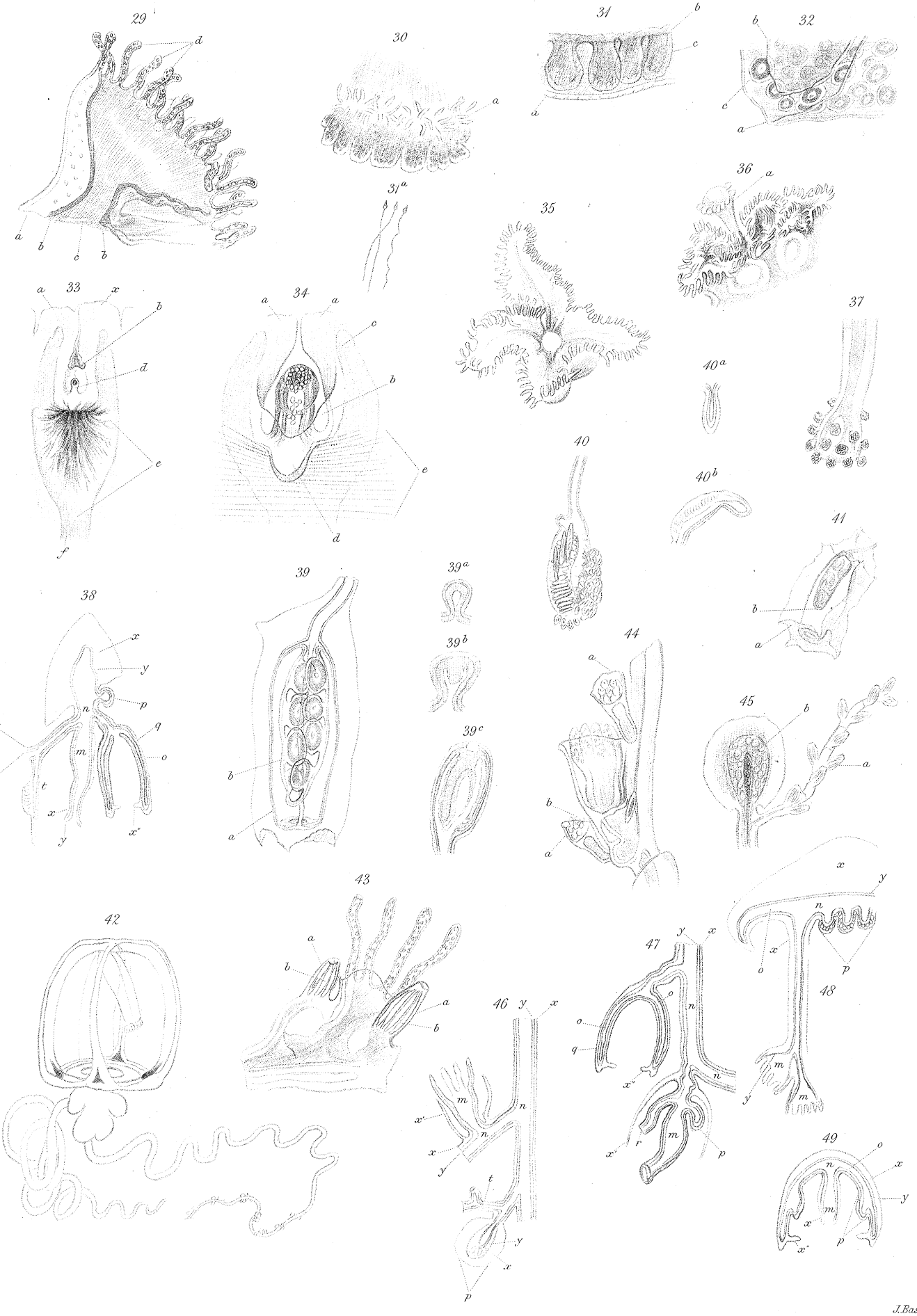
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Fig. 30. Portion of the testis slightly magnified.
a. Generative tentacles.
Fig. 31. Sectional view of testis much magnified.
a. Outer membrane.
b. Inner membrane.
c. Sperm-sacs.
Fig. 31 *a*. Spermatozoa.
Fig. 32. Ovarium.
a. Outer membrane.
b. Inner membrane.
c. Ova.
Fig. 33. Marginal vesicle, upper surface.
a a. Lobes connected by the arched membrane, *b*.
c. Cæca of the canal *f*.
d. Vesicle on its pedicle.
e. Cordate depression.
Fig. 34. Marginal vesicle from below, much magnified.
a a. Lobes.
b. Inferior connecting membrane.
c. Cæca.
d. Elevation of the outer membrane.
e. Muscular fibres.

Cephea ocellata.

Fig. 35. An aperture surrounded by its membrane.
Fig. 36. Portion of the extremity of an arm, with a young interbrachial tentacle (*a*).
Fig. 37. Extremity of one of the large interbrachial tentacles.

Diphydæ.

Fig. 38. Vertical section of a monogastric Diphyes.
Fig 39. Attached ovarium.
a. Natatorial organ.
b. Ovisac.
Fig. 39 *a*. Youngest stage of ovarium.
a. Simple process of the common cavity.
b, c. Ovaria further advanced.
Fig. 40. Prehensile organ.
a, b. Early stages.
Fig. 41. Free-swimming ovarium.
a. Natatorial organ.
b. Ovisac.

Fig. 42. Free-swimming ovarium of Coryne (from STEENSTRUP) to compare with fig. 41.

Sertularidæ.

Fig. 43. Cell of *Plumularia* ——?
a. Peculiar clavate organs.
b. Large thread-cells.

Fig. 44. Cell of another Plumularia, letters as before.

Fig. 45. Ovarium of fig. 43.
a. Organs containing thread-cells similar to fig. 43 *a*.
b. Ova.

Fig. 46. Section of Plumularia.

Fig. 47. Section of Polygastric Diphyes.

Fig. 48. Section of Rhizostoma.

Fig. 49. Section of Monostome Medusa.