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XXXVIII.—*Notes on the Structure and Development of* Myriothela phrygia. By Professor Allman, M.D., LL.D., F.R.S., Pres. Linn. Soc.

In the structure and development of *Myriothela phrygia* are many hitherto unrecorded points of high morphological and physiological interest. The following notes contain some of the more important results to which I have been led by a recent study of this remarkable and little-known hydroid.

1. The tentacles when extended are by no means the short papilliform organs which we usually meet with in specimens confined in our aquaria. They present, on the contrary, when in complete extension a thin, cylindrical, and very motile stem nearly a line in length, and a large terminal capitulum very well defined and distinct from the stem.

2. The animal is attached to fixed objects, not by the general surface of hydrorhizal offsets (as is usual among the Hydroida), but by the sucker-like truncated ends of short fleshy processes which are given off from the basal extremity and, clothing themselves with chitine, become permanently adherent to the object which gives it support.

3. The *endoderm* of the body is composed of numerous layers of large spheroidal cells composed of clear protoplasm, enclosing a nucleus with some brown granules and refringent corpuscles. Externally it is continued in an altered form into the tentacles, while internally it forms long villus-like processes which project into the cavity of the body. Towards the free ends of these processes there are abundantly developed, among the large clearer cells, smaller easily isolated spherical cells

filled with opaque brown granules. Where the endoderm passes into the tentacles it loses its large-clear-celled condition, and consists of small round cells so loaded with opaque granules that the axis of the tentacle appears nearly white under reflected light.

4. The free surface of the endoderm carries long, very slender, sluggishly vibrating cilia, and is overlaid with a thin layer of transparent homogeneous protoplasm, which on the villus-like processes becomes especially distinct, and which develops minute mutable pseudopodia which are being constantly projected and withdrawn. Indeed the vibratile cilia appear to be but a modification of these pseudopodial processes of protoplasm.

5. Interposed between the endoderm and the ectoderm is the *fibrillated layer*. It is extremely well developed, and consists of longitudinal muscular fibrillæ, closely adherent to the outer surface of a structureless hyaline membrane—the "Stützlamelle" of Reichert. The fibrillated layer, with its supporting membrane, is so strong as to remain entire in a section of the animal after the tissues on both sides of it have been broken down.

6. The *ectoderm* is composed mainly of two or three layers of small round cells containing yellowish granules. Among these cells the thread-cells may be seen, lying chiefly near the outer surface of the body. Two forms of thread-cells may be here distinguished—one ovate with the invaginated tube occupying the axis, the other fusiform with the invaginated tube oblique. The whole free surface of the ectoderm is overlaid with an exceedingly thin, transparent and structureless pellicle.

7. The deeper part of the ectoderm consists of a very remarkable tissue composed of peculiar membraneless cells, each of which is prolonged into a long fine process which can be directly traced into the fibrillated layer. I am thus enabled so far to confirm the observations of Kleinenberg on cells of apparently the same significance in *Hydra*. In *Myriothela*, however, these caudate cells do not, as in *Hydra*, reach the surface. They form a deep zone interposed between the muscular layer and the superficial layer of the ectoderm. Though the caudate cells are in intimate association with the fibrillated layer, I did not succeed in tracing a direct continuity of the individual fibrillæ with the processes of the cells as described by Kleinenberg in *Hydra*. While the deep zone may, in accordance with Kleinenberg's views of the caudate cells in *Hydra*, be regarded as a nervous layer, the superficial zone of the ectoderm will represent an epidermis.

8. The structure of the tentacles is in the highest degree interesting. In their narrow stalk-like portion the condition of the endoderm departs widely from that of this tissue in the tentacles of other marine hydroids; for it presents no trace of the septate disposition so well marked in these. It is, on the contrary, composed of a layer of small cells loaded with opaque granules and surrounding a continuous wide axile cavity.

9. It is, however, in the terminal capitulum of the tentacle that the structure of these organs departs most widely from any thing that has as yet been recognized in the tentacles of other hydroids. Here a very peculiar tissue is developed between the muscular layer and the proper ectoderm, where it takes the place of the zone of caudate cells. It forms a thick hemispherical cap over the muscular lamella and endoderm of the tentacle, and is composed of closely applied exceedingly slender prisms, with their inner ends resting on the muscular lamella, to which the prisms are perpendicular, the whole structure forcibly suggesting the rod-like tissue associated with special sense-apparatus in higher animals. It appears to be but a modification of the tissue which elsewhere forms the zone of caudate cells.

10. Extending in a radiating direction from the convex surface of this rod-like tissue, towards the external surface of the tentacle, may be seen numerous clear cylindrical rods, each of which, making its way among the cells of the ectoderm, terminates distally in a very delicate transparent oviform sac, which carries near its distal end a minute styliform process. Within this sac, and completely filling it, is an oviform capsule with firm transparent walls, and having immersed in its very refringent contents a cylindrical cord wound upon itself in two or three coils. Under pressure the contained cord may be sometimes forced out through the smaller or distal end of the capsule. Notwithstanding the obvious resemblance of these bodies to thread-cells, their significance is, without doubt, something entirely different. Their assemblage constitutes a zone parallel to the spherical surface of the capitulum, and lying at a slight distance within it. Though it is impossible with certainty to assign to them their exact function, we feel compelled to regard the whole system, including the rod-like tissue to which their stalks can be traced (and which is only a modified portion of the nervous zone), as an apparatus of sense. This is the only known instance of the existence in a hydroid trophosome of any thing which may with reason be regarded as a special apparatus of sense.

11. The male and female sporosacs are borne by the same trophosome.

12. The generative elements, whether male or female, originate in a special cavity, which is formed in the substance of the endoderm of the sporosac.

13. In the female the primitive plasma becomes gradually differentiated into a multitude of cell-like bodies having all the characters of true ova with their germinal vesicle and spot. They are entirely destitute of enveloping membrane.

14. These bodies next begin to coalesce with one another into numerous roundish masses of protoplasm, which develop over their surface minute pseudopodial retractile processes.

15. The masses thus formed still further coalesce with one another; and there results a single spheroidal plasma mass, through which are dispersed numerous small spherical vesicles mostly provided with a nucleus. These vesicles appear to be nothing more than the nucleolated nuclei of the coalesced ova-like cells.

16. About the time of the completion of this last coalescence the resulting plasma mass, enveloped in an external structureless membrane, is expelled by the contraction of the sporosac through an aperture in its summit.

17. Immediately after its expulsion it is seized by the sucker-like extremities of certain remarkable organs (claspers), which are developed among the blastostyles and resemble long filiform and very contractile tentacles.

18. It is apparently now that fertilization is effected; for the plasma becomes again resolved into a multitude of roundish masses. This phenomenon may be regarded as representing the yelk-cleavage of an ordinary ovum.

19. The mulberry-like mass thus formed, surrounded by its structureless membrane, which has now acquired considerable thickness, and forms a firm capsule, continues to be held in the grasp of the claspers during certain subsequent stages of its development. An endoderm and ectoderm with a true multicellular structure become differentiated; a central cavity is formed by excavation; and the germ becomes thus converted into a spheroidal non-ciliated planula. This, after acquiring certain external appendages, ultimately escapes by the rupture of the capsule as a free actinuloid embryo.

20. The actinuloid, on its escape from its capsule, is provided not only with the long arms already noticed by Cocks and Alder, but with short scattered clavate tentacles. The short clavate tentacles become the permanent tentacles of the fully developed hydroid; the long arms, on the other hand, are purely embryonic and transitory.

21. The long embryonic arms originate in the spheroidal planula. They are formed by a true invagination, and at

first grow inwards into the body-cavity of the planula. It is only just before the escape of the actinuloid from its capsule that they evaginate themselves and become external.

22. After enjoying for one or two days its free existence, during which it moves about by the aid of its long arms, the embryo fixes itself by its proximal end, the long arms gradually disappear, the short permanent tentacles increase in number, and the essential form of the adult is soon acquired.

XXXIX.—*Development of the Marine Sponges from the earliest Recognizable Appearance of the Ovum to the Perfected Individual.* By H. J. Carter, F.R.S. &c.

[Plates XX., XXI., & XXII.]

It is now twenty-five years since my figure of the Freshwater Sponges, viz. *Spongilla*, as it grows out of the so-called "seed-like body," was described and published ('Annals,' 1849, Sept., vol. iv. pl. iv. fig. 2), and seventeen years since the observations and illustrations in my paper "On the Ultimate Structure of *Spongilla*" were obtained by following this development ('Annals,' July 1857, vol. xx. p. 21, pl. i.). My military duties at Bombay then compelled me to remain much at home, while in the tanks of the garden about the house where I lived *Spongilla* grew abundantly; so that, although I resided for many years at Bombay, and thus on the borders of the sea, I could only make use of the opportunities which the freshwater tanks of the island afforded.

Time has passed, and I have retired to my native place (Budleigh-Salterton, south coast of Devon), still on the "borders of the sea," but now in Great Britain. The duties of official occupation are over, and I have yet a little time left to study now the physiology of the marine sponges.

This may explain to those who, like Häckel ('Die Kalk-schwämme,' vol. i. p. 28), express wonder that I should have exclusively studied the freshwater sponges while at Bombay, where there is, too, such a rich sponge-fauna on the "coasts of the Indian Oceans" for this purpose. Had I been a German professor, the matter might have been different, and I might have obtained indulgences in the way of "leave" for studying the marine sponges, which the military authorities at Bombay, if they had been appealed to on this behalf, would have laughed at.

But to show that while on "the coasts of the Indian Oceans" I did not entirely neglect the marine sponges, it