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INCLUDING

## ZOOLOGY, BOTANY, AND GEOLOGY.

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CONDUCTED BY

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respects it resembles, in the more sloping dorsal margins, in having fewer and much more elevated costæ, in the style of colouring, and the greater inequality of the auricles.

I have much pleasure in naming this handsome species after Mr. Walter Crouch, the author of several useful papers on the Mollusca and other branches of the zoology of Essex.

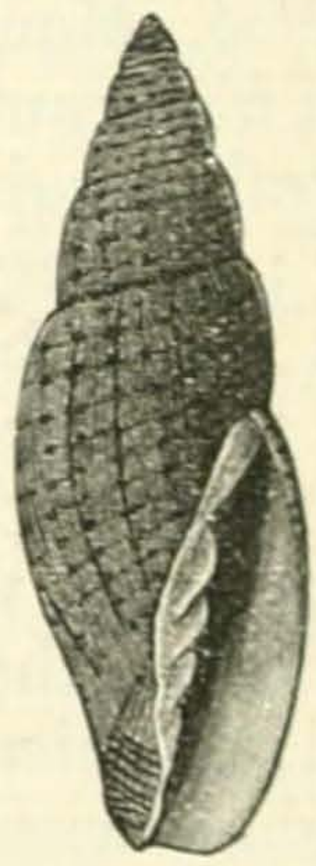
*Mitra Fultoni.*

Testa ovato-fusiformis, omnino nigra, sed ad apicem leviter erosa; anfractus 8, convexiusculi, sutura obliqua sejuncti, lineis incrementi obsolete pliciformibus instructi, sulcisque angustis spiralibus remote sed regulariter punctatis (in anfract. penultimo 5, in ultimo circiter 14) cincti, ultimus infra medium leviter constrictus, supra caudam oblique tenuiter liratus; apertura cæruleo-albida, longit. totius $\frac{1}{2}$ æquans; columella fusca, callo tenui superne albo-calloso induta, plicis quatuor obliquis albidis, suprema maxima, infima minima, instructa.

Longit. 39 millim., diam. 13; apertura $19\frac{1}{2}$ longa, 5 lata.

*Hab.* Point Abreojos, Lower California.

This species is well characterized by the punctate sulci, the punctures falling in regular longitudinal rows, through which pass well-marked impressed lines of growth. It has, I believe, been confounded with *M. orientalis*, Gray, by some conchologists; but from that species it may be sufficiently distinguished by the above-mentioned feature and the difference of form. The whorls are more convex, the epidermis blacker, and the fine spiral striæ which adorn the surface of that species are scarcely indicated in the present form.



*Mitra Fultoni* is named after Mr. H. Fulton, from whom the specimens were obtained, and through whose agency the British Museum has obtained many valuable additions.

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## XL.—*Some Points in the Histology of Cœlenterates.*

By Dr. Karl Camillo Schneider *.

In the comparative investigations of various cells and tissues of Cœlenterates, which I commenced at Naples in the month of March, I arrived at certain histo-morphological results, of

* Translated from the 'Zoologischer Anzeiger,' xiv. Jahrg., 1891, no. 375, pp. 370, 371, and no. 376, pp. 378–381.

which I intend to give a brief provisional account in the following pages. I will first consider the Siphonophora. By employing a mixture of osmic and acetic acid, which agreed pretty closely with that adopted by the brothers Hertwig *, I succeeded in determining the presence of ganglion-cells in the feelers and pneumatophore of *Apolemia uvaria* and in the polypes of *Forskalea contorta*, which in the form of the cell and its prolongations do not differ from those with which we are acquainted in the case of the Medusæ and other Cœlenterates. In the same way the epithelium of the disk of *Velella spirans*, as has already been described by Chun † and others, contains typical ganglion-cells. Sense-cells were found at the anterior extremity of the polypes and feelers of *Apolemia*, likewise in accordance with the well-known arrangement. On the other hand, the stem of the two Physophorids alluded to contains highly remarkable and divergent cellular structures. In this case the epithelium consists of cells of very different kinds, between which, however, transitional forms occur. *Forskalea* exhibits on the sides of the stem transversely elongated cells, which send off a process into the interior, and by means of this, which may again divide, they are connected with the longitudinal muscles. Another Physophorid, which I determined to be a young *Halistemma*, in the stem of which the central canal is extraordinarily wide while the septal ridges of the supporting lamella are very low, exhibited these conditions particularly clearly; it follows from this that in the stem we have to deal with epithelio-muscle cells. Circular muscle-fibres are not found: at any rate the superficial prolongations of the epithelial cells, which run transversely and give a transversely rugose appearance to the stem, are not to be regarded as muscular, in spite of their fineness, length, and often very homogeneous appearance, as I shall show in my detailed paper. Their superficial position is also an argument to the contrary. In *Apolemia*, however, we find muscle-substance enclosed in these prolongations of the body of the cell and likewise in the central processes which lead to the longitudinal muscle; nevertheless this is not the case for all cells of the epithelium, although it is not thereby possible to divide the epithelial cells into those which contain muscle and those which do not. In *Apolemia* especially the development of the cells varies in a perfectly astounding way; we find cells

* O. and R. Hertwig, 'Das Nervensystem und die Sinnesorgane der Medusen,' Leipzig, 1878.

† C. Chun, 'Die Gewebe der Siphonophoren, II.,' Zool. Anzeiger, 1882, no. 117.

which, besides the longitudinal muscle, also possess muscular formations running in a transverse and perpendicular direction; others, again, are entirely without the transverse processes, and have a rounded termination upon the surface. (Concerning the remarkable muscular formations, which always lie enclosed in the protoplasm of the cell, I refer the reader to my detailed paper.) The peripherally rounded cells are found in the case of *Forskalea* chiefly upon the dorsal surface. In shape they agree tolerably well with the "neuro-muscular" cells described by Korotneff *, but they have an epithelial and not deep-seated position, and are merely special forms of the epithelial cells in general. Other divergent forms of cells, however, occur. Thus here and there the central process is entirely wanting; the cell may then become very similar to a bipolar ganglion-cell, though it lies at the periphery; however, the processes also divide tolerably frequently, and thus cells also appear which look like typical ganglion-cells, and I was able to determine the subepithelial position of such structures. Nevertheless, however great the similarity may become, there is always something in the cell which tells against the supposition of a nervous element therein. In all respects the Siponophoran stem appears to be in little accord with the customary views as to ganglion-cells in Cœlenterates; this is particularly noticeable in *Forskalea*. In this form we find in the middle line of the dorsal side quite colossal cells beneath the epithelium, which are regarded by Korotneff * as the central nervous system (an interpretation which is adopted by Bedot †). This follows from his description, however, just as little as does the nervous nature of his "neuro-muscular" cells, although I believe all the same that his explanation is admissible. I incline to this view, however, only because I succeeded—difficult process though it is—in satisfactorily isolating these cells, for from the figures of sections, as drawn by Korotneff, every other conclusion is really more probable than his own. Nevertheless Korotneff's views as to what is to be termed nervous are in general very far-reaching; the presence of quite irregular protoplasmic processes upon a cell causes him at once to decide upon their extraordinarily sensitive nature. Yet the giant cells in the stem of *Forskalea* possess offshoots which in length, form, and structure really leave nothing to be desired, and enable us, in all probability with justice, to

* Korotneff, "Zur Histologie der Siphonophoren," Mittheilungen Zool. Stat. Neapel, 5 Bd.

† Bedot, "Sur l'*Agalma Clausi*, n. sp.," Recueil zool. suisse, T. v.

regard the cells as nervous. It is impossible to specify a definite form for the cells; indeed, we are really unable to speak of "separate" cells at all, for not only do very broad and short processes connect the masses of protoplasm, which figure as cells, in the longitudinal direction of the stem, but it is usually the case that instead of one nucleus and a correspondingly smaller size the latter is actually very considerable, and a number of nuclei (I counted as many as five) are present in the interior. These aggregates of cells (in which limits are absolutely indistinguishable) lie with their elongated direction crosswise to the stem; they are in continuity with the rest by means of the short thick connecting portions, and from them there also radiate the nerve-fibres, which are often of extraordinary thickness, ramify like processes of ganglion-cells, run transversely to the stem beneath the epithelium, and probably also penetrate down to the muscles beneath. As regards the structure of these fibres, as well as of the cells and cell-masses, I will merely mention that there is a fluid in their interior which exudes in drops when they are crushed and is perhaps comparable to the hyaloplasm of the ganglion-cells of the higher animals. The finer the processes become—and there are very delicate ones which remind us of those of the Medusæ—the more difficult becomes their distinction from processes of the ordinary epithelio-muscle cells, and they are besides frequently just as irregular as the latter (on this point see the complete paper). In general the amount of fluid too appears to be no certain criterion; on the contrary, it only implies that the cells and cell-offshoots in question are thick and rounded, while this is not the case for the majority of epithelial cells, since they appear as if flattened out perpendicularly to their longitudinal elongation in their deeper parts, and above all in the broad basal process; the protoplasm here has often only the thickness of an even tolerably delicate membrane. In spite of all these odd features it nevertheless appears to me that we must regard the large elements of the dorsal side as nervous, for there is nothing else that could otherwise be considered as such; and although the epithelio-muscle cells are here and there provided with cilia (usually two together), we cannot on that account term them tactile cells with Korotneff, with whom a cilium is sufficient to cause a cell to be regarded as sensitive. I shall endeavour to give further support to my interpretation in my complete work.

At the basal end of the polypes of *Forskalea* there is a thickening of the ectoderm containing structures which at first attracted my attention very forcibly. Subsequently, on

examining the nettle-pad ("Nesselwulst") in *Carmarina hastata*, I realized that the two thickenings of the epithelium correspond to one another. I was also at first inclined to recognize a supporting tissue in them, as the Hertwigs * and others have done; but the observation of the living animal taught me that we here have to deal with a centre for the formation of nematocysts. In point of fact the filaments ("Senkfäden") in *Forskalea* and the tentacles in *Carmarina* are supplied with cnidoblasts by the pad. In *Carmarina* the elements are not large, but in *Forskalea*, on the other hand, where the nettle-buds also contain capsules of very considerable size, the whole course of development could be traced with wonderful clearness in their young stages at the seat of formation. I must admit that this is not exactly a very easy task; nevertheless with regard to the series of consecutive stages, as I shall subsequently figure them, I can affirm with tolerable certainty that it corresponds to the actual course of development. In my paper on *Hydra* † I supposed the thread to arise by ingrowth of the protoplasm into the cavity of the capsule, and thereby took the opposite view to Nussbaum ‡ and Jickeli §, who observed a formation of the thread outside the capsule. At the present time, when I too have been able to confirm the mode of formation described by the two authors, I have read with real satisfaction that Bedot ‖, whose papers I unfortunately omitted to consult before, found a development of the threads of the nematocysts in *Physalia* and *Velella* which agrees with that which I described for *Hydra*. The question might easily be asked, Who is right, or is every body right? I am inclined to think that in the case of *Hydra* I overlooked or misinterpreted something or other—I shall, however, investigate the point afresh—and that Bedot did the same; for it seems to me to be not very probable that important differences of this kind should occur in the course of the development of the cnidoblasts in animals which are so closely allied. This conclusion is strengthened by the fact that I believe I am entitled to assume that the thread develops outside the capsule in the Actinians also, as represented by *Adamsia Rondeletii* (see

* O. and R. Hertwig, *loc. cit.*

† K. C. Schneider, "Histologie von *Hydra* &c.," Arch. mikr. Anat. 35 Bd.

‡ M. Nussbaum, "Ueber die Theilbarkeit der lebendigen Materie: II. *Hydra*," Arch. mikr. Anat. 29 Bd.

§ C. F. Jickeli, "Der Bau der Hydroidpolypen, I.," Morphol. Jahrb. Gegenbaur, 8 Bd.

‖ Bedot, "Recherches sur les cellules urticantes," Recueil zool. suisse, t. iv.

subsequent paper). I therefore believe that, starting from the cavity of the capsule, which has previously been formed with the inner wall of the subsequent perfect cyst, the development of the thread proceeds in the protoplasm of the cnidoblast, and that after completion the thread is introverted, commencing with the tip and ending with the thickened basal portion, so that this enters the capsule last. The development of the outer wall of the capsule is the last to take place, and, as it appears to me, does not occur until the spot is reached at which the cyst comes into operation. The extremely interesting formation of the thread, from its histological aspect, will be described in my subsequent paper. The lamellar arrangement in the protoplasm of the cells of the nettle-pad, as described by the brothers Hertwig *, and as is actually seen in animals macerated in a mixture of osmic and acetic acid, is due to the disposition of the thread around the wall of the nematocyst. I did not clearly grasp this point until I examined the pad, both in its living state and when treated with 50 per cent. acetic acid; the latter reagent causes the thread to become sharply defined, though in the living object it is only to be detected with difficulty (as the tissue dies away it becomes more and more distinct). The young cells pass from the pad to the filament in *Forskalea*, but to the tentacle in *Carmarina*. The same is doubtless true for the cnidoblasts of the peronia of the Narcomedusæ and of the mantle-rivets which are found in the Geryonidæ. Thus the presence of mantle-rivets on the sensory bodies also probably points to the fact that the latter represent rudimentary tentacles.

In conclusion, I would just briefly mention that in the investigation of *Alcyonium acaule* I arrived at definite views with regard to the formation of the spicula. In the ectoderm of this form cells occur to which the term indifferent may be applied; these coalesce here and there into groups, and by fusion give rise to structures which are to be considered as matrix-elements of the spicula. They furnish the form of the future spiculum, and then secrete within themselves the calcareous substance, in which the nuclei are at first still distinguishable, but which finally so completely fills the whole that nothing more is to be seen of the organic base and the structure appears homogeneous and shining. This transformation is accomplished in the mesoderm.

* O. and R. Hertwig, *loc. cit.*