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MISCELLANEOUS.

A Multicellular Infusorian-like Animal.

By Prof. JOHANNES FRENZEL, of Cordova (Argentine Republic).

After sending to the press a preliminary report upon my investigations into the microscopic fauna of this locality I discovered, on making a fresh examination of a small salt-water aquarium, a really remarkable microscopic creature, exhibiting indeed many relations to the Ciliata, but sharply separated from that group on the one hand by its multicellular character, and on the other by its well-differentiated alimentary cavity, without, however, being directly referable to the Coelenterata, owing to the fact that only a *single* layer of cells is present.

For the investigation of the salt-pit fauna of this region I had procured a few litres of a solution containing about two per cent. of salts, obtained from a salt-pit in the south of the province of Cordova. It was some time before a few Flagellata &c. were developed among decaying matter, and these presented so few noteworthy characters that I abandoned my researches. On casually resuming my studies I found a number of little creatures, of which I would here give a brief description; the animals were met with at the bottom as well as upon the glass sides of the vessel, but not free-swimming.

The external form is that of a tube, somewhat pointed in front and behind, and slightly flattened dorso-ventrally, so that it may be termed bilateral. The ventral surface is flat, the dorsal, on the other hand, tolerably evenly arched, so that the transverse section is approximately semicircular.

The ventral surface is clothed with delicate cilia, by means of which the animal moves actively along, twisting about at the same time like a snake or worm. The dorsal and lateral regions, on the contrary, are not ciliated, but bear a sparser covering of short setæ. In front, nearer the ventral surface, we find an *oral opening*; posteriorly, exactly terminal in position, an anal aperture of smaller size. At the former opening longer and stouter cirri are placed, by the active movement of which particles of food are whirled into the mouth.

A well-developed cuticle or similar firm dermal layer is wanting; nevertheless, as in the Ciliata, the membrane of the cells, or limiting layer, is more strongly developed on the outer side, almost possessing a double contour, though it is always very delicate.

The wall of this tube-shaped organism is furnished by a *single* layer of tolerably large, almost cuboid cells, all of nearly equal size, leaving a cylindrical lumen, which is closely packed with foreign bodies, such as particles of sand, bacilli, diatoms, vegetable matter, &c. This is the *intestinal cavity*, which commences in front at the mouth and terminates posteriorly at the anus.

The cells are all more or less similar in structure, the difference consisting, as already stated, in the fact that those of the ventral side are ciliated on their free surfaces. In all cells the surface which is turned towards the lumen of the intestine is also delicately

ciliated, whereby an active movement is imparted to the intestinal contents.

The oral opening, which is not quite terminal in position, is overtopped by one cell in front. The cirri, which I have previously mentioned, are borne upon this cell, as well as upon the others surrounding the mouth. These cells are therefore well differentiated from the remainder, so that altogether we have to distinguish three different kinds of cells.

The limits of each individual cell are distinctly visible, and almost in the centre of each there is a large roundish nucleus, containing several smaller nucleoli, which may usually be made out even in the living animal. The remainder of the contents of the cell are of a finely granular nature, though it is impossible to determine with certainty whether the nutritive contents of the intestine are received into the cells in solid form. I am inclined to believe that this is not the case. A few globules of fat, on the other hand, are discernible in most of the cells.

I frequently found these animals of different sizes. Growth simply results from the reduplication of cells by division, which takes place in such a way that the nucleus first becomes more homogeneous, since the nucleoli disappear from view. The nucleus, which has become elongated, then constricts, as does also the cell almost at the same time, whereupon complete division ensues, the nuclei first separating from one another and then assuming a rounded form. They subsequently become clear again and exhibit the nucleoli. Whether during this apparently direct division of the nucleus morphological changes take place in its interior it was impossible to determine in living specimens. Similarly it has not yet been possible to decide whether a true nuclear membrane is present, and, if so, how it behaves during the division. At all events, in observing the process no change can be detected at the margin of the nucleus.

Unfortunately I have not yet succeeded in killing the animals successfully, as on the addition of foreign matters they at once melt away exactly like Infusoria, since the cells separate from one another, assuming a spherical shape, and then flatten out after losing their cilia.

With regard to *reproduction*, two methods appear to exist. In the first place, in large individuals, a transverse division takes place, which vividly recalls the similar process in *Catenula* &c. The cells of the middle region usually first divide; a constriction of the animal then sets in at this spot at right angles to the longitudinal axis, while a new mouth is formed in the posterior division, since a few cells upon the ventral surface separate from one another and give rise to an opening, at the same time producing stronger cilia. Upon this the whole is constricted off, and the two animals are set free and swim away.

Besides this, however, we find *conjugation*, with subsequent encystment. Two individuals apply themselves together by their ventral surfaces, and discontinue the movement of their cilia. They then become shortened and rounded into a common spherical mass,

whereupon a cystic membrane is differentiated. As to what happens afterwards and in the interior I am sorry to say that I am unable as yet to give any account. Nevertheless it was still possible to see that the cavities of the intestines disappear, apparently owing to continued multiplication of cells, so that finally the entire contents of the cyst are composed of similar cells. I am inclined to believe that each of these cells represents a *young animal*, which, after being set free, roves about by aid of its cilia like one of the Ciliata, and by further division develops into the adult form; for I observed in the same salt-water small unicellular organisms, ciliated on the ventral surface only, yet bearing a few cirri in front. These are possibly the young forms (larvæ).—*Zoologischer Anzeiger*, xiv. Jahrg., no. 367 (13th July, 1891), pp. 230–233.

On the Growth of the Shell in Helix aspersa.

By M. MOYNIER DE VILLEPOIX.

We know that the growth of the shell in pulmonate Gastropods takes place by the formation, at the edge of the test, of a soft and diaphanous zone, which speedily hardens. I have specially studied this formation in *Helix aspersa*, L.

The epidermis which gives rise to it is particularly interesting owing to the hyaline spherical globules, $10\ \mu$ to $12\ \mu$ in diameter, which cover its outer surface. Their nature is organic; they persist on the oldest shells, and I have reasons for thinking that it is to similar formations that we must attribute the markings which are to be found on almost all the shells of the genus *Helix*.

In animals in course of growth, the thickened border of the mantle is always applied against the peristome, and the free edge of the epidermis, folded inwards, buries itself, but without any connexion with the tissues, in a very narrow cleft which runs round the whole circumference of the collar. Immediately behind this cleft, we observe beneath the epidermis a white zone bounding the mantle in its entire breadth.

The deposition of calcareous matter takes place on the internal face of the epidermis, at some distance from its margin. The origin of these products can be understood by examining sagittal sections of the collar and mantle.

The white zone, or bandelet, is a gland composed of flask-shaped cells, with very long necks, and granular contents, which bury themselves deeply in the subjacent tissue. The action of acetic acid and oxalate of ammonia discloses the presence of calcareous matter in these cells.

Behind this bandelet the mantle is clothed with a columnar epithelium, containing pigment or colourless granulations.

Immediately in front of the bandelet the epithelium invaginates to form the groove in which is lodged the free extremity of the epidermis. The bottom of the groove is occupied by an irregular plexus of cells, which, in a sagittal section, present the appearance of epithelial cells cut obliquely and extending to a greater or less distance into the connective tissue. These cells contain transparent spherules, presenting all the characters of the globules of the epidermis.