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Publisher: Taylor & Francis

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## Annals and Magazine of Natural History: Series 5

Publication details, including instructions  
for authors and subscription information:  
<http://www.tandfonline.com/loi/tnah11>

### On the process of digestion in Salpa

Dr. Ch.S. Dolley

Published online: 09 Oct 2009.

To cite this article: Dr. Ch.S. Dolley (1884) On the process of digestion in Salpa, Annals and Magazine of Natural History: Series 5, 14:79, 72-74, DOI: [10.1080/00222938409459769](https://doi.org/10.1080/00222938409459769)

To link to this article: <http://dx.doi.org/10.1080/00222938409459769>

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and regularly formed, is folded longitudinally; the folds are very small, invisible to the naked eye, and in this respect resemble those of the branchia of the *Phallusia*. The transverse branchial sinuses are united to the longitudinal sinuses by an anastomotic branch, which does not project into the interior of the branchial cavity beyond the longitudinal sinuses, to produce papillæ like those possessed by most of the simple *Ascidia*. The dorsal raphe is constituted by a series of papillæ; it terminates in front, not far from the vibratile organ, and in this region the pericoronal groove sends towards it a small prolongation analogous to that which that groove bears in the *Cionæ*. The peribranchial cavity does not communicate with the empty spaces left between the viscera in the posterior region of the body, lacunæ which may be regarded as forming by their union a reduced general cavity; it is stopped immediately behind the branchia by a peritoneal lamina, like that of *Ciona*.

The other organs are constituted nearly in the same way as in the *Cionæ*. The only important differences relate to the arrangement of the sexual organs, which are collected into a single mass surrounding the intestinal cavity, and to the greater length of the œsophagus and rectum. With the exception of these not very important distinctions, the digestive tube, the nervous system, the hypoganglionic gland and its excretory duct, the heart, and the principal sinuses &c. present the same fundamental structure as in the *Cionæ*.

The relations of the *Rhopalææ* with the other forms of *Ascidia* are multiple. By their general facies, it is true, they approach the *Clavelinidæ*; but we cannot place them in that family, for they do not reproduce by gemmation and possess a more complex organization. We must class them among the *Phallusiadæ*, and regard them as establishing a close connexion between the simple and aggregated *Ascidia*; by their viscera situated behind the branchia and a certain number of less important characters, they are more nearly allied to the *Cionæ* than to the true *Phallusia*; but they nevertheless approximate to the latter by the presence of longitudinal folds in the branchial wall. The affinities of the *Rhopalææ* are therefore numerous, and they form as it were a bond of union between several different groups; in the general arrangement of their organs they show a certain resemblance to the *Clavelinæ*, while at the same time they are simple *Ascidians* very nearly allied to the *Cionæ* and also presenting some relations to the *Phallusia*.—*Comptes Rendus*, May 19, 1884, p. 1294.

*On the Process of Digestion in Salpa.*

By Dr. CH. S. DOLLEY.

The author remarked that, preliminary to giving the full results of a somewhat extended study of the histology of *Salpa*, he desired to make a few remarks in reference to certain statements

recently made by Dr. A. Korotneff of Moscow\*, which he considered erroneous in so far as they indicate the presence of a huge amœboid cell or plasmodium, in the œsophagus and stomach of *Salpa*, functioning as a digestive organ. Dr. Korotneff describes this cell as arising from the repeated division of a single cell which early in the life-history of the animal is separated from the intestinal wall. This giant cell or plasmodium, acting like a huge rhizopod, carries on a form of parenchymatous digestion of the food taken by the animal, passing the resulting chyle into the walls of the intestine by means of its pseudopodia. Now by reference to an article by Metschnikoff "On Intracellular Digestion in Invertebrates" (in the 'Quarterly Journal of Microscopical Science' for January 1884), it will be seen that such a form as Korotneff describes has never been met with, and his description stands alone and anomalous, both as regards the situation and size of the digestive plasmodium and as to the method of its formation, for in all cases in which such structures have been found in Invertebrates they have always arisen by the fusion of separate cells, not from the repeated division of one cell. In a large number of series of sections made by the new "ribbon" method, the speaker was not only unable to find "the lumen obliterated" by the peculiar structure of the wall of the intestine described by Korotneff, but in a model of the visceral nucleus made after Born's "Plattenmodellirmethode" the lumen of the entire intestinal canal is shown to be completely free throughout. He did, however, get sections which gave pictures almost identical with those portrayed by Korotneff, *i. e.* the lumen filled with what he describes as a large nucleated granular cell, containing various food-particles, and he could trace this so-called "cell," not only back into "the portion of the intestine lying next to the stomach," but through the rectum into the cloacal chamber, and through the œsophagus into the branchial sac. He accounts for it as follows:—The endostyle of *Salpa* has been very carefully studied by Hermann Fol, who demonstrated, by means of carmine suspended in water, that it threw out a constant stream of mucus when excited by the presence of nutritive material in the same water, with a reflex action, like a salivary gland. The mucus is, by an arrangement of cilia, spread out like a curtain over the inner surface of the branchial sac, when it acts as a means for catching the food-particles from the ingurgitated water. By the action of ciliary bands bordering the groove of the endostyle, the mucus is swept towards the œsophagus, and as it approaches this, it is, by means of the stiff cilia on the sides of the gill, twisted into a thread, and carried by a continuation of the aforesaid bordering bands through the œsophagus into the stomach. Now in studying a series of sections of a *Salpa* which had had abundant food, we found as we approached the œsophagus a mass of material answering to the description of Korotneff's "rhizopod." It takes staining readily and may be traced backward into

\* "Ueber die Knospung der *Anchinia*," in Zeitschr. f. wiss. Zoologie, Bd. 40, Hft. i. (1884).

and through the cesophagus, stomach, and intestine. As the sections approach the rectum, however, the mass gradually ceases to take staining, and is much more distinctly marked out from the intestinal wall, having had all the organic matter digested out, and consisting only of the inorganic remains, which do not stain. The alimentary matter of *Salpæ* is composed of animal and vegetal elements in nearly equal proportions, and the microscope reveals the calcareous shells of Foraminifera, the beautifully sculptured frustules of Diatomaceæ, keen siliceous needles, and the sharp armatures of minute Crustacea.

In the fore part of the intestinal canal, the food-mass, staining almost as readily as the wall of the gut itself, seems to merge into the ill-defined epithelium of the latter, and it is scarcely possible to say where the food-bearing mucous thread ceases and the intestinal epithelium begins, especially as this latter has a rugous arrangement. That we have here to do with a form of digestion entirely anomalous and unprecedented, he could not believe, and begged leave to differ from Dr. Korotneff on this point. Fol and others have recognized the endostyle as a sort of salivary gland, and have traced its food-laden mucous thread into the stomach of the living animal, while the speaker had been able to trace the same thing in well-preserved specimens. He had also several series of sections from animals which must have been without food for some time previous to death, in which the lumen of the intestine is not only free of food, but of any obliterating mass of cells or plasmodium. The only protoplasmic bodies not food are certain *Gregarina*-like organisms adhering to the walls of various parts of the intestine, and which he took to be parasites. These give on section the appearance of the large "scattered cells, entirely free from their surroundings," which Korotneff figures and regards as "analogous to the great stomach-cell of *Anchæna*." The first opportunity would be taken to examine these structures in living *Salpæ*; but he was now forced to conclude that Dr. Korotneff has endowed the food-bearing mucous thread with a power it does not possess, that *Salpæ* does not exhibit any unusual form of intracellular digestion, and that there is no immediate cause on its account for questioning the high genetic place occupied by the Tunicates.—*Proc. Acad. Nat. Sci. Philad.*, April 15, 1884, pp. 113-115.

*On a Species of Tachina occurring on the Tracheal System of Carabus.*

By M. N. CHOLODKOWSKY.

In the summer of the year 1882, when I was examining various species of the genus *Carabus* for purposes of comparative anatomy, I found on the abdominal stigmata of some specimens of *Carabus cancellatus* some peculiar small whitish bodies which projected freely into the body-cavity of the beetle. These bodies were of an oval form and about 1 millim. long. On closer examination, after cutting out the stigma with a small piece of skin and with the tracheal stem starting from the stigma, the following proved to