

hier in einem See annähernd die alpinen Coregonen-Extreme vertreten finden: einmal das Gangfisch-Extrem im Albeli, sodann das *Fera*-Extrem im Balchen. Wie möchte man da wohl den Beweis liefern, dass das Albeli ein junger Balchen sei?

Das Zuger Albeli laicht November — December in der Tiefe des Sees.

Der Fang geschieht mit Tiefstellnetzen.

(Fortsetzung folgt.)

2. Chamisso and the Discovery of Alternation of Generations.

By W. K. Brooks, Associate in Biology and Director of the Chesapeake Zoological Laboratory of the Johns Hopkins University, Baltimore Md., U. S. A.

In the summer of 1875 I enjoyed, through the kindness of Mr. Alex. Agassiz, the privilege of an introduction to the problems and methods of marine zoological work, at his marine laboratory at Newport R. J. As specimens of *Salpa* were very abundant I devoted myself, at Mr. Agassiz' suggestion, and with his assistance, to the study of their development, and my investigations led me to believe that the eggs which undergo development inside the bodies of the chain-salpae originate in an ovary which is contained in the solitary *Salpa*, and that the latter is therefore a female, and the chain-salpa a male.

I therefore gav the following brief statement of the life history of *Salpa* (Bull. Mus. Comp. Zool. No. 14).

The solitary *Salpa*, — female —, produces a chain of males by budding, and discharges an egg into each of them before birth.

These eggs are impregnated while the zooids of the chain are very small and sexually immature, and they develop into females, which give rise to other males by budding.

Since both forms are the offspring of the female, the one by budding and the other by true sexual reproduction, we have not an instance of »alternation of generations«, but a very remarkable difference in the form and mode of origin of the sexes.

While I was writing my paper I received Kowalevsky's paper on the development of *Pyrosoma* (Zeitschr. f. wiss. Zool. 1875), and found in this the statement that the eggs of *Salpa* arise in an ovary which is contained in the body of the solitary *Salpa*, but he fails to see that this makes the solitary *Salpa*, which he speaks of as the Salpen-Amme, a female.

As the animal in which eggs first appear, as eggs, is certainly their mother, the acceptance of my conclusion is unavoidable if my ob-

servations and those of Kowalevsky are correct, but Salensky soon afterwards published three very complete and thorough papers on *Salpa* (Zeitschr. f. wiss. Zool. XXVII. Bd. p. 179—237; Morpholog. Jahrbuch, III. Bd. 4. Heft; and Zeitschr. f. wiss. Zool. XXX. Bd. p. 275—293), and in these he says that Kowalevsky and I are wrong in the statement that the eggs do originate, as eggs, in the solitary *Salpa*. He acknowledges that the eggs can be traced back to a mass of cells at the base of the stolon, but he claims that they do not become eggs until they pass into the bodies of the chain *Salpae*; that what I have called an ovary is not an ovary at all, but simply a mass of undifferentiated embryonic cells which gives rise to the ovaries of the chain-salpae, and also to their digestive organs. He therefore regards the solitary *Salpa* as the sexless, and the chain-salpa as the hermaphrodite sexual form, and holds that we do have in *Salpa* an instance of true alternation.

The U. S. First Commission, under Prof. Baird, collected and preserved, for me, last summer an abundant supply of specimens of a very large undescribed species of *Salpa*, and as they proved to be in excellent condition for microscopic work, I have employed myself this winter, with the assistance of Dr. J. Bermann of Baltimore, in studying the development of the *Salpa* chain, by means of sections. I have verified most of the points in Salensky's account, and find that the general anatomy of the stolon, as seen in transverse sections is about as he describes it, although there are many features which he has overlooked. Upon cutting longitudinal sections of a very young stolon we found that it is very much more complicated than the transverse sections seem to indicate, and that Salensky's account is therefore very imperfect. A transverse section at the stage shown in his figure 12 (Knospung der Salpen) looks very much like his figure, but a longitudinal section at the same stage shows that the mass of cells which is marked Ms. in his figure 12, is not a mass of mesoderm at all, but a series of digestive cavities, arranged as a row of flat vertical parallel pouches, opening into the central tube of the stolon, the Athemrohr of Salensky, and apparently the Darmrohr of Kowalevsky. The walls of these pouches are continuous, at their inner edges with the lateral walls of the »Athemrohr«, and their outer surfaces are separated from each other by infoldings of the ectoderm; the first traces of the constrictions between the chain-salpae. The digestive cavities of the chain-salpae are therefore formed as we should expect from the analogy of other Tunicates, and the »Endoderm« of Salensky has nothing to do with them.

Now as to the microscopic structure and the history of Salensky's

»Endoderm«. This is the same as the »ovary y« of figure 28 of my original paper, and as Kowalevsky's »Eierstocksrohr«.

In a transverse section at the base of a very young Salpa it has the

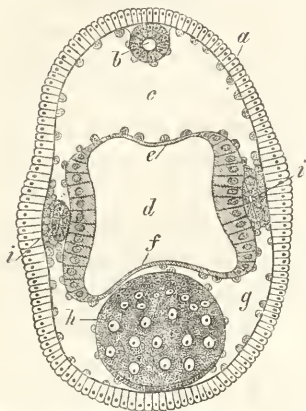


Fig. 1. Transverse section of the proximal end of a very young stolon. *a* Ectoderm, *b* Nerve tube, *c, g* upper and lower blood tubes, *d* central tube, Salensky's Athemrohr, and Kowalevsky's Darmrohr, *h* Ovary, Salensky's Endoderm, *i, ii* Salensky's Mesoderm, Kowalevsky's Cloakalröhre.

general appearance which is shown in Salensky's figures 3, 4 and 7 (Knospung der Salpen), but careful examination of very thin sections of my perfectly preserved specimens showed that the minute details of his account are far from correct, probably because his specimens were not perfectly preserved, or perhaps because they were not sufficiently hardened to furnish very thin sections. He figures the organ as made up of a compact mass of cells, which are in contact with each other, but careful examination shows that the central portion of the organ consists of a granular ground substance, in which oval, transparent cell-like bodies are scattered, at some distance from each other. A high power will show that each of these bodies is a germinative vesicle, with a central nucleus, suspended to its wall by a reticulum of five radiating protoplasmic threads. It will also show that the granular ground substance is divided, by point lines, into polygonal areas, with one of the trans-

parent germinative vesicles near the centre of each. In fragments of very thin sections these bodies separate along the lines, and each is then seen to be an egg, with a layer of granular yolk flattened by the pressure of adjacent eggs, and a transparent germinative vesicle and reticulated nucleolus. A longitudinal section shows that these eggs are gradually pulled out, towards the free end of the stolon, into a single series, but they do not change their character,

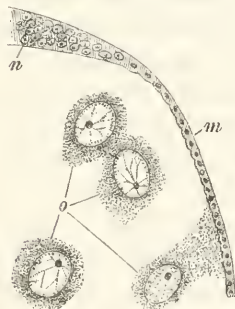


Fig. 2. More magnified view of a fragment of a very thin section of the ovary of Fig. 1.

m surface epithelium, *n* germinal epithelium, *o* eggs.

The mass of eggs which fills the ovary is surrounded by a layer of epithelium which is thin at the sides, but thick in the outer and inner surface. On the outer surface it is only one cell thick, and at a later stage it becomes

and they are as truly eggs, at the earlier stages, as they are after they pass into the bodies of the chain salpae.

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folded into a series of pouches, the egg capsules, or so called ovaries of the chain-salpae. These pouchs are what Salensky has mistaken for the developing digestive tracts of the chain-salpae.

At the top, or inner surface of the ovary the epithelial covering becomes several cells thick, changes its character, and becomes the germinal epithelium, which give rise to new eggs.

Salensky says in his paper on the development of the testis of *Salpa* (Zeitschr. f. wiss. Zool. XXX. Bd.) that the view that the solitary *Salpa* is a female, might be accepted, if the so called ovary contained true eggs instead of embryonic cells, and if it did not also give rise to the digestive tracts.

While his paper on the budding of *Salpa* contains by far the best published account of the stolon, more careful examination shows that the digestive organs are not formed from the ovary, and that this does contain true eggs.

There therefore seems to be no escape from the conclusion that the solitary *Salpa* is a true female, and that Chamisso's discovery of the law of alternation of generations was made in an animal which is not an example of it.

Baltimore, Jan. 27th, 1882.

3. Der Verdauungstractus der Larve des *Tenebrio molitor*.

Vorläufige Mittheilung von Joh. Frenzel, cand. rer. nat. in Berlin.

Die anatomische Gliederung des Darmrohrs beim Mehlwurm ist eine sehr einfache und lässt die einzelnen Theile, den Vorder-, Mittel- und Enddarm sofort erkennen. Der Vorderdarm ist sehr kurz und von geringem Durchmesser. An frischen Zupfpräparaten zeigt sich eine Chitinschicht, deren innere Fläche mit kleinen gleich gestalteten Zähnen und deren äußere Seite mit einem Cyliinderepithel besetzt ist. Die Muskellage ist kräftig. An Präparaten, welche in Chromsäure conservirt und mit Haematoxylin und Carmin gefärbt sind, sieht man acht längslaufende Vorsprünge wulstartig ins Lumen des Vorderdarms hineinragen. Diese Wülste sind als Einbiegungen der Darmwandung zu betrachten und dienen zum Verengern und Erweitern des Lumens. Innen liegt die dicke Chitinintima, an welche sich das Cyliinderepithel als Matrix oder chitinogene Membran anschließt. Während diese Membran bei den Imagines der Insecten meist stark reducirt ist, so dass ihre zellige Structur kaum zu erkennen ist, erscheint sie bei den Mehlwürmern und wahrscheinlich auch bei allen anderen Insectenlarven deutlich und mächtig entwickelt, ein Verhalten, das sich aus dem reichlichen Verbrauch von Chitin erklärt; denn bei jeder den Lar-

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