La Valette St. George. The germ cells are very large and the number of chromosomes can be determined with certainty. Normally there are twenty-eight chromosomes although in rare cases we find them to be twenty-six or twenty-seven. They arrange themselves not in two rows as Henking and vom Rath state, but in a single row and their division takes place transversely to their longitudinal axis as Ischikawa first observed in *Diaptomus*. After this division, the daughter cells prepare to divide with no resting stage. In this second division, »each chromosome does not become divided into two as usual, but remains undivided during the division« (Ischikawa), so that fourteen of the twenty-eight go bodily into one cell and the other fourteen into the other. Consequently, the daughter cells of the second division contains only fourteen chromosomes, which is half the number of the original.

IV. The zone of Metamorphosis. After this second division, the chromosomes arrange themselves like a moniliform ring round the periphery of the nucleus and form the head of a spermatozoon.

A large »Nebenkern« also appears and forms together with the cell protoplasm the tail of a spermatozoon. This »Nebenkern« consists of the remains of »Verbindungsfäden« after division, and is different from the »Nebenkern« of the germ cells in the growing zone.

A mitosome is clearly to be seen in preparations stained with Böhmer's Haematoxylin. This is formed from the coalescence of a few small granular spots appearing in the cytoplasm, showing its origin from the cytomicrosomes. Meanwhile, the chromosomes coalesce into a single mass and the »Nebenkern« elongates and a spermatozoon with a spindle shaped head and an elongated tail is formed, while the mitosome gradually becomes fainter and fainter till at last it disappears.

A full account of this investigation with plates will, I trust, be shortly published in the Bulletin of our College.

Tokio, 26th October 1893.

3. On a new Balanoglossus Larva from the coast of California, and its Possession of an Endostyle.

By Wm. E. Ritter, Ph.D., Assistant Professor of Biology, University of California.

eingeg. 12. December 1893.

During the summer of 1893, the marine biological laboratory of the University of California was located at Avalon, on the island of Santa Catalina, about twenty-five miles off the coast of Southern California.

Among the many interesting pelagic organisms taken by the tow net during the course of our work, a *Tornaria*, the first found in this portion of the Pacific waters, has proved of special interest.

But a small number of specimens were taken, and these all within a brief period of time, between the first and the fifth of August. I am quite certain they were not present in the little bay of Avalon, in which our towing was mostly done, at any other time during our stay on the island, since we were constantly on the lookout for them, both before and after these dates. As the number of specimens captured was so small, and as, through an unfortunate accident, several of these were lost, it at first seemed best not to publish any account of the new form until another summer's work should have furnished more material. However, a detailed study of the few specimens preserved has proved the larva to be so interesting that I believe my fellow zoologists will welcome a description of it even though the small number of stages studied leave this description very incomplete. But the facts that I have observed I present with confidence despite the lack of verification by the examination of numerous specimens variously prepared which is ordinarily so essential for rendering valid conclusions in morphological work. I am thus confident because of the excellent condition of the few preserved specimens which I had, and the completeness of the series of sections made from them.

The living larvae were, of course, carefully studied at the sea side; but most of the details of structure here described have been made out by the study of preserved material.

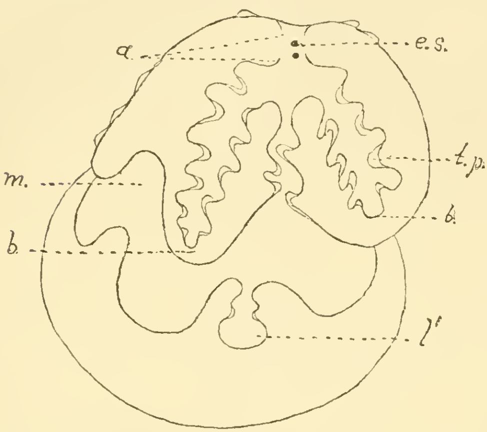
As to transparency, this *Tornaria* forms no exception to the general rule for the pelagic larvae of *Balanoglossus*. Its movements in swimming are somewhat slower than those of the New England species, and the rotation of the body about its long axis as it progresses, as mentioned by J. Müller in the forms described by him, and as is conspicuous in the New England species, seems not to take place here; at least if it does, it is to a much less extent.

The larvae kept in aquaria readily underwent metamorphosis with the usual diminution in size and loss of transparency. As I obtained no young stages, I shall say nothing about the origin or development of the anterior enterocoel, the proboscis vesicle, or the heart. I may say, however, that the dorsal pore is single and situated a little to the left of the median dorsal line as is usually the case in *Tornaria*.

This *Tornaria* is distinguished from all others known, excepting the Bahama form described first by Weldon 1887, and more recently by Morgan 1891, by the possession of tentacles on the longitudinal ciliated bands.

The two species are, however, strikingly different in several respects, particularly in the number and length of the tentacles. Neither Weldon nor Morgan state anything concerning the number on the Bahama species. However, from Morgan's figures 10, 11, and 13, which show in each case portions only of the rows of tentacles, it is certain that they are at least five or six times more numerous in this latter larva than in the Santa Catalina one. Here there are never, so far as I have seen, more than six in each half loop that extends backward from the region of the apical plate, i. e., from *a* to *b* fig. 1. (I should say, perhaps, that the general course of the bands does not differ in any essential respect from that of other species.)

Fig. 1.



Surface view of a fully developed *Tornaria*, seen from the left side, but partially also from the front and anterior. *a* termination at the apical plate of the inner limbs of the longitudinal ciliated band. *b* posterior apex of the loops of the longitudinal ciliated band. *e.s* Eye spots. *l'* secondary loop in the transverse, postoral portion of the ciliated band. *m* position of mouth. *t.p* tentacular processes of the bands.

Concerning the length of the tentacles in the Bahama form, Morgan speaks of the ciliated band as being »drawn out into tentacle-like processes, hanging freely like a fringe from the surface of the larva«. His figures show the longer ones to be seven or eight times as long as they are thick. As seen by fig. 1, the processes of the species here under consideration are in no way fringe like, they being mere stubbs, scarcely longer than thick.

These differences in number and length certainly cannot be due to differences in age, since I have described them as they are in the larva just before its metamorphosis.

The processes are outpocketings of the ectoderm, and hence contain a cavity which communicates with the blastocoel, as can be readily seen upon sections. There are several minor differences between the arrangement of the bands here and in the Bahama species, but for the present brief description I will mention only two of them.

The median limbs of the loops, converging at the apical plate, do not have the long, transversely directed continuations as represented by Morgan's fig. 10 (vd. fig. 1 *a*). They terminate in a manner more nearly like those of the New England *Tornaria*, shown by the same author in fig. 7. The second point of difference that I mention is the small loop in the transverse post-oral portion of the longitudinal band on the side of the larva 90° from the mouth, fig. 1 *l'*. In the narrow neck of this loop there appears to be the anlage of a single pair of processes like those found in the preoral portions of the band. So far as I am aware this loop does not exist in any other *Tornaria*.

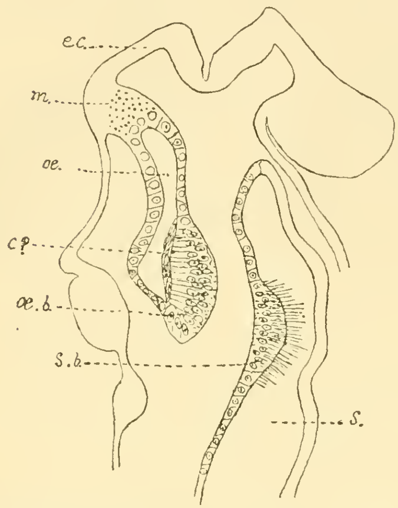
The posterior circular ciliated band, so characteristic of *Tornaria*, is present and bears cilia much longer and stouter than those of the longitudinal bands. And in addition to this there is a second circum-anal band about mid way between the large one and the anus. This second band is quite inconspicuous, and, so far as I have been able to determine, is without cilia. In section the cells of the ectoderm in this second band are found to differ from those of other regions somewhat as do those of the large one. I am inclined to think that this is a rudimentary band. In the possession of a second circular band this *Tornaria* agrees with the one described by Metschnikoff 1870. (The larva represented in fig. 1 is so situated with reference to the observer, that neither of the circular ciliated bands is visible.)

The eye spots are well developed, and are farther apart than those of the Bahama species, figured by Morgan. The following measurements were made on a larva nearly ready to undergo metamorphosis. The specimen had been preserved in chromic-osmic solution: Length 1,9 mm; greatest thickness 1,33 mm. This is very nearly if not quite, the maximum size. It is, therefore, considerably smaller than the Bahama form, this latter being 4 mm long, according to Morgan.

This larva presents two points in its internal structure that are particularly worthy of note. The oesophageal evaginations which are the beginnings of the first pair of gills, do not appear until the metamorphosis sets in. In the oldest *Balanoglossus* that I succeeded in getting, but two pairs have yet appeared, and neither of these has yet fused with the ectoderm, preparatory to breaking through to communicate with the outside world. Of these two pairs the first is much the further advanced, the formation of the tongue-bars having begun. In this respect it agrees essentially with several other species, but differs strikingly from the New England form in which, as is well known, four pairs of gills have begun to develop by the time the metamorphosis begins.

The second point that I mention, and the one of most interest, is the presence of a band of high epithelium in the floor of the oesophagus, beginning near the mouth and extending the entire length of this portion of the digestive tube. A similar band on the floor of the stomach is found in other species, and is also well developed here. Whether the two bands are in reailty but two parts of one band, I am not certain. As in other species so here there is an annular thickening of the wall of both the oesophagus and the stomach at the junction of the two, and both the ventral longitudinal bands merge into these; but whether they are to be regarded as passing through it to become continuous with each other, I have not been able to decide. It is certain, however, that there is some difference in structure between the oesophageal and the gastric bands. The most marked of these differences is in the character of the cilia found on each, those of the latter being much longer and heavier. Indeed, I am in some doubt about the presence of cilia on the oesophageal band at all. If they are present they are very small, and are much obscured by some kind of a secretion that does not seem to be found on the gastric band.

Fig. 2.



Transverse section of the *Tornaria* shown in fig. 1 (see text for statement concerning the position of this section). *c?* cilia on the oesophageal band. *ec* ectoderm. *oe* Oesophagus. *oe.b* band of thick epithelium in floor of oesophagus. *m* anterior border of mouth. *s* Stomach. *s.b* thick epithelial band in floor of stomach.

Furthermore there is a difference in the cells of the two bands, those of the gastric band being rather larger and more distinct; their nuclei appearing in the sections considerably less crowded. The points discussed in connection with the structure of the two bands are illustrated in fig. 2, which is reproduced from a drawing made by the aid of an Abbé camera lucida. The specimen from which this series of transverse sections, of which this represents one, was made, had become somewhat flattened dorso-ventrally in killing, but the series is complete and there is no difficulty in identifying the several parts in their relation to one another. Owing to the upward direction taken by the first portion of the oesophagus, a cross, though somewhat oblique, section of this is produced, and at the same time the wall of the stomach posterior to the entrance of the oesophagus is cut as the figure represents. The obliquity of the section causes the oesophageal band to appear somewhat thicker than it is in reality, though not greatly so.

I think it highly probable that the oesophageal band is, functionally at least, an endostyle, meaning by this that it performs the same office as the similarly situated and similarly named organ in Tunicates. That it is a ridge rather than a groove as the endostyle in both Tunicates and Amphioxus is, does not, I think, present any serious objection against supposing, it to have such a function. If such be its nature, it is certainly in a very primitive stage, and embryology makes us familiar with many instances where a local thickening of an epithelium is an initial step to the formation of a pit or furrow. It will be noted that I have said that functionally this ridge may be an endostyle. Whether it be homologous with this organ in the Chordata, that is quite another matter. In view of the several remarkable chordate characters possessed by *Balanoglossus*, the possibility of such an homology inevitably suggests itself. A decided opinion on the subject would certainly be premature till the fate of the ridge after metamorphosis, is more fully studied. There certainly does exist an area of modified epithelial cells on the floor of the branchial section of the digestive tube of the young *Balanoglossus* — this attracted my attention before I had made any sections of the *Tornaria*. However, I have not stages enough to enable me to obtain definite knowledge as to the relation of these to the ridge in the larval oesophagus.

This suggestion of the presence of an endostyle in *Balanoglossus* is not a new one. Bateson 1885 has described and figured a groove in the position where the organ would be looked for in the young *B. Kowalevskii*, though he seems not to consider it as having such a significance. More recently, however, Schimkewitsch 1888 has observed a similar groove in *B. Mereschkovskii*, which he regards as homologous with the endostyle of vertebrates. I reproduce his words: »Der Kiementheil zerfällt in zwei Theile, und zwar einen oberen mit der Epibranchialleiste und einen unteren, der die Form einer kleinen Rinne hat, deren Boden mit Papillen besetzt ist. Diese Rinne ist dem Diverticulum des Kragentheiles ähnlich und beide können als Homologon des Endostyles, der Hypobranchialrinne und der Schilddrüse der Cyclostomen angesehen werden.«

The only other point that I touch upon in this communication is the development of the dorsal nerve cord. This is not accomplished by a delamination of an inner portion of the ectoderm along the middorsal line, as described by Bateson for *B. Kowalevskii*, but by a sinking down of the whole thickness of the layer, ultimately to become cut loose and to form a medullary plate with its edges overlapped by the adjacent edges of the ectoderm — in this respect, then, exceedingly like the course that is pursued in Amphioxus. However, the formation begins anteriorly and proceeds backward. In the stages that I have, there is no trace of a canal or neuropore; and the separation of the medullary plate has not extended far back, though in one specimen the whole length of the cord to the posterior extremity of the animal is marked out by the fact that the cells are different in shape from those of the adjacent ectoderm, and also that they receive stain more readily than do these latter.

1870. E. Metschnikoff, Untersuchungen über die Metamorphose einiger Seethiere. I. *Tornaria.* Zeitschr. f. wissensch. Zool. 20. Bd. p. 131—144.

1884. Wm. Bateson, Early Stages in the Development of *Balanoglossus* (sp. incert.). Quart. Journ. Micr. Sc. Vol. XXIV.

1886. Wm. Bateson, Continued Account of the later Stages in the Development of *Balanoglossus Kowalevskii*, and of the Morphology of the Enteropneusta. ibid. Vol. XXVI.

1887. W. F. R. Weldon, »Preliminary Note on a *Balanoglossus* Larva from the Bahamas«. Proc. Royal Society London. Vol. XLII. p. 146—150.

1888. W. Schimkewitsch, Über *Balanoglossus Mereschkovskii* Wagner. Zool. Anz. 11. Jhg. p. 280—285.

1892. T. H. Morgan, The Growth and Metamorphosis of *Tornaria.* Journ. of Morphology, Vol. V. p. 407—458.

Berkeley, California, November 21, 1893.

4. Quelques nouvelles espèces de Thélyphonides.

Par J. Tarnani (du Cabinet Zoologique de l'Univers. de St. Pétersbourg).

eingeg. 16. December 1893.

Dans les collections de Thélyphonides de l'Académie Impér. des Sciences et de l'Université de Moscou, que j'ai reçus à ma disposition, grâce à l'amabilité de MM. Pleske et Bogdanow, j'ai trouvé les espèces suivantes:

Thelyphonus caudatus L. (Blanchard), recueilli par Grombtschewsky sur les pentes orientales des monts Himalaya (?).

Th. linganus Koch recueilli par le Dr. Isaïew près de Batavia.

Th. niger n. sp. recueilli en Chine par le Dr. Piassetzky. 38 mm, noir. Le tubercule oculaire antérieur est haut, étroit, lisse et trois fois plus long que le front. La partie postérieure de la crête, qui se prolonge entre les yeux antérieurs et latéraux, est droite. Les yeux supplémentaires manquent. Les maxilles sont plus longes que les 7 premiers anneaux de l'abdomen.

Le 2e article maxillaire porte sur son bord supérieur 4 épines. La surface antérieure et l'interieure de cet article forment un angle