Summary

Although *Phoronis ovalis* Wright, 1856 was the first phoronid described, it is one of the least well studied. Its external features are very different from that of other phoronid larva. The lecithotrophic, slug-like larva possesses a distinct rim around the mouth opening on the ventral side. A blunt outgrowth grows on the ventral side of the larva and posterior to the mouth opening, which contains the opening of the anus. Tentacles are not developed during the whole larval life.

In this study, the internal development of the early larva of *P. ovalis* is described for the first time. The late blastula of *P. ovalis* short before gastrulation is spherical in shape. With the invagination on the vegetal pole the embryo is transformed into a gastrula. The two sheets of ecto- and endoderm reduces the blastocoelic space to a narrow slit. In the dorsal roof of the archenteron the opening of anus occurs. From here a short hollow tube, the future intestine, leads into the mass of endodermal cells in the posterior area of the larva. Going further dorsad, this in cross section round tube becomes a slit in the center of the larval body, in the same manner like the developing pharynx. During further development both slits meet and fuse in the centre of the larva in order to form the digestive tract. The intestinal anlage is not functional; but all cells of the larva contain a large amount of yolk vesicles, which nurish the larva.

The coelom of *P. ovalis* arises out of one compact mesodermal anlage, which originates from a compact mass of cells, which migrate into the blastocoelic space short before gastrulation. After gastrulation, a compact mesodermal band surrounds the archenteron. From here, a cell sheet grows apicad between the cell sheets of ecto- and endoderm. Lateral, the mesoderm becomes double layered, and coelom formation is accomplished by fluid ingression and diverging of the cell layers. Later in development, this coelomic anlage becomes separated into one anterior coelomic compartment, encompassing the pharynx from anterior, and a second posterior, still compact mesoderm, which encircles the intestine. A subepidermal neuropil is formed on the apical end of the larva, sending two processes lateral and caudad alongside the anterior and posterior coelom and coelomic anlage. A third neuropil process courses dorsal alongside of the anterior coelom up till the dorsal center of the larva.

Lateral to the posterior mesoderm two protonephridia are formed, which consists of an unbranched terminal complex, and an angled duct.

The development of *Phoronis muelleri* de Selys-Longchamps, 1903 starting from the time of gastrulationis is depicted in this study, in order to obtain comparable data for the origin

of the mesoderm in the Phoronida. In *P. muelleri*, precursors of mesoderm cells occur on the edges of the invaginating archenteron in the blastocoelic space. By the same time the stomodeum is formed, these cells taper the inner wall of the blastocoelic space. These cells acquire polarity and differentiate into myoepithelial cells around the mouth opening and underneath the apical plate. They do not form a complete epithelial lining. According to other authors, they form a complete lining of the coelom in the episphere later in development. In comparison to *P. ovalis*, the coelom is therefore formed from single cells, which transform the blastocoelic space into a coelomic cavity.

The position of the protonephridia in larva of *P. ovalis* and *P. muelleri*, as well as the location of the apical neuropil is used to homologize both larval types. The anterior coelom of the *P. ovalis* larva corresponds to the tentacle coelom formed late in the life of the actinotroch larva. There is no episphere formed in the larva of *P. ovalis*. The actinotroch trunk coelom is in accordance with the position of the posterior coelomic anlage in *P. ovalis*. The ventral extension from the larval body of *P. ovalis* has no correspondence in the actinotroch larva.

The systematic of the Phoronida and their position in the metazoan tree is unresolved. In this study an elaborate morphological matrix is compiled, containing characters from Phoronida and Brachiopoda. An analysis using the parsimony criterion is conducted using this matrix and a matrix from 18s rRNA sequences. The Phoronida appear monophyletic in this analysis, with *P. ovalis* as sistertaxon to the rest of the Phoronida. The results further indicate the monophyly of the genus *Phoronopsis* Gilchrist, 1907, as well as a monophyletic grouping of *P. hippocrepia* Wright, 1856, *P. australis* Haswell, 1883 and *P. ijimai* Oka, 1897. The Brachiopods form the sistergroup to the phoronids.

The results of this analysis, as well as the examination on the origin of the coelom and the structure and position of the protonephridia of the phoronid larvae allows advanced statements about the type of larva in the stemlineage of the Phoronida. The results are further used to reconstruct a hypothetical representative in the stemlineage of the Phoronida.