

6 Abstract

Developmental stages of the “Oligochaete”-taxa Tubificidae, Lumbriculidae and Lumbricidae possess one pair of transitory nephridia, that are situated laterally to both sides of the stomodaeum and the frontal gut rudiment. The position of the organs in the region of the prospective head and their occurrence in early developmental stages suggest, that the transitory nephridia are homologous to the head kidneys in the larvae of Polychaeta and Mollusca. Therefore, it can be expected, that an ultrastructural investigation of the transitory nephridia provide comparable morphological data that help to clarify the phylogenetic position of the Clitellata within the Annelida. Due to the different ontogeny of tubificid and lumbricid “Oligochaetes” the ultrastructure and development of the transitory nephridia is investigated in *Tubifex* sp. (Clitellata, Tubificidae) and *Dendrobaena veneta* (Clitellata, Lumbricidae).

In *D. veneta* the transitory nephridia develop immediately after gastrulation and persist until formation of segmental nephridia is completed in the anterior body segments. In the investigated 10 day old stage each transitory nephridium forms a loop-like duct, that is situated in the primary body cavity between gut rudiment and epidermis. At their proximal ends the nephridia open into a coelomic cavity that surrounds the pharynx. The nephrostomes are situated dorsolaterally to the pharynx. Distally each nephridial duct is connected to a bladder that consists of invaginated epidermal cells. The nephridiopore is arranged ventrolaterally to the pharynx.

The duct of the right transitory nephridium consists of two multiciliary cells, a nephrostome cell and a duct cell. Both cells form about one half of the loop-like duct. In contrast, the duct of the left nephridium consists of only one cell, which also builds the nephrostome, by which the duct opens into the peristomial coelom.

In earlier developmental stages the nephrostomes are situated in a primary body cavity, that is surrounded by cells of the gut rudiment, the epidermis and ectomesodermal tissue. Additionally, the frontal part of the germ band mesoderm provides the ventrocaudal boundary of the cavity. In these stages, the distal parts of the ducts reach into the epidermis. The epidermis forms a smooth invagination around each nephridiopore.

In *Tubifex* sp. both transitory nephridia consist of a nephrostome cell and a duct cell. Each of these multiciliary cells contribute about half to the loop-like nephridial duct. The nephridiopore of each nephridium is build by the duct cell, which distally pierces the epidermis. There is no sign of an epidermal invagination. The nephrostomes of the transitory nephridia open into primary body cavities, which are situated dorsolaterally to each side of the pharynx rudiment. The body cavities are bordered by cells of the gut anlage and ectomesoderm.

On the basis of the congruent ultrastructural data it can be assumed, that one pair of transitory nephridia belong to the ground pattern of the Clitellata. These nephridia build a loop-like duct that consists of two multiciliar cells. Each nephridium possesses an open nephrostome.

The position of the nephrostomes and the structure of the primary body cavities in *Tubifex* sp. and the younger stage of *D. veneta* shows, that the peristomial coelom develops from ectomesodermal tissue and frontal parts of the germ band mesoderm. Thus, the transitory nephridia can be clearly assigned to a head region in front of the segmental coelomic cavities. The composition of the nephridia by only two cells and the degeneration of the organs during development of the frontal body segments further support the hypothesis of a homology to the head kidneys of polychaetes and molluscs.

The nephrostomes and their open connection to a secondary body cavity in older developmental stages are characteristic features of metanephridial systems. Within the Polychaeta, head kidneys with an open nephrostome also occur in developmental stages of some spionid species. In accordance with clitellates these species show a precocious development of the peristomial coelom. The ultrastructural and developmental data suggest, that the sister-group of the Clitellata should be a polychaete taxa with a similar sequence in the development of the head and body mesoderm.