Excretory System in Annelida

B. Sc. Part-1, Paper-1, Group-A

Lecture- 2

Nephridia and coelomoducts in Polychaeta

In the more primitive annelids, the nephridia and coelomoducts are separate. In many Polychaeta coelomoducts are grafted over nephridia forming a nephromixium. The nephromixium naturally functions both as a genital duct and an excretory organ.

In Glycera and Phyllodoce etc., the coelomoduct is fused with the duct of the protonephridium forming protonephromixium. When the nephridium is a metanephridium, the funnel of the coelomoduct may be grafted to the nephrostome itself forming metanephromixium as in Hesione. In some the nephrostome of the metanephridium may be replaced by the grafted coelomostome to form myxonephridium as in Syllis.

In other Polychaete the nephrostome is completely replaced and the double nature of myxonephridium can only be understood by study of its development. The grafting of the coelomostome to the nephrostome may occur only in those segments in some polychaeta in which gonad develop. In Arenicola all the nephridium is represented as myxonephridium. In many Polychaetes egg and sperm are shed outside by rupture of body wall. These forms retain the coelomostome of the coelomoduct as a ciliated funnel on the dorsal peritoneum below the dorsal longitudinal muscle band. This situation is found in Nereis. A ciliated organ and protonephridia are found in each segment in Nephthys. The ciliated funnel loses their primary function of conveying germ cells and are probably phagocytic.

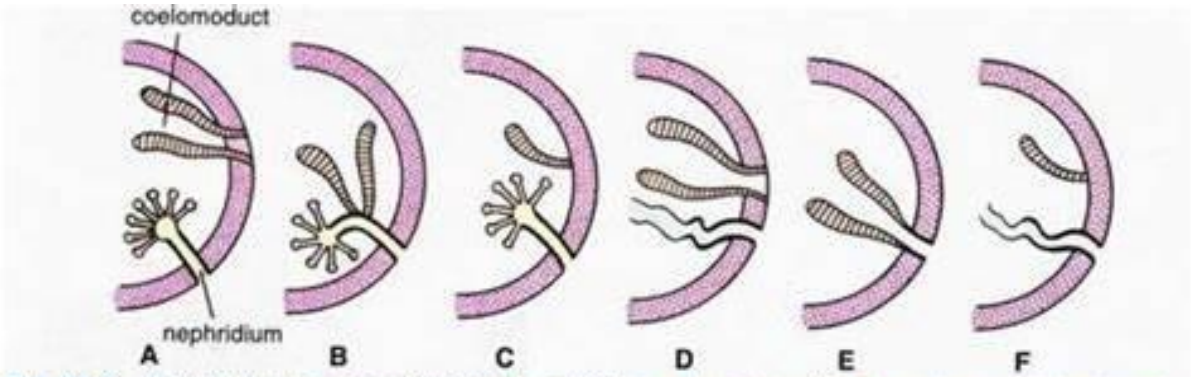


Fig. 69.2. Diagrammatic representation of nephridia and coelomoduct in various combinations in Polychaeta. A—Protonephridium and separate colemoduct (*Vanadis*); B—Protonephromixium (*Phyllodoce*); C—Protonephridium and ciliated organs (Nephthyidae and Glyceridae); D—Metanephridium and separate coelomoduct (Capitellidae); E—Mixonephridium (*Arenicola*); F—Metanephridium and ciliated organ (*Nereis*).

Nephridia and coelomoducts in Oligochaeta

All oligochaetes possess nephridia as well as coelomoducts. The two segmental organs are distinct and separate. As the oligochaetes are hermaphrodite and gonads are found in fewer segments, coelomoducts are also found in fewer segments while nephridia are numerous, found in almost all segments.

The tubule forming the metanephridia are often long, very much coiled having. distinct structural peculiarities in different regions. The tubules open to outside by a sphinctered nephridiopore. The primitive condition of nephridial

distribution is holonephric and meganephric, a single pair of large nephridium is found in each segment as in Lumbricus and Megascolex.

In Pheretima three types of variously modified numerous small meronephridia or micronephridia are found in different segments.

Three types of metanephridia present in P. posthuman are

1. Pharyngeal nephridia
2. Septal nephridia
3. Integumentary nephridia

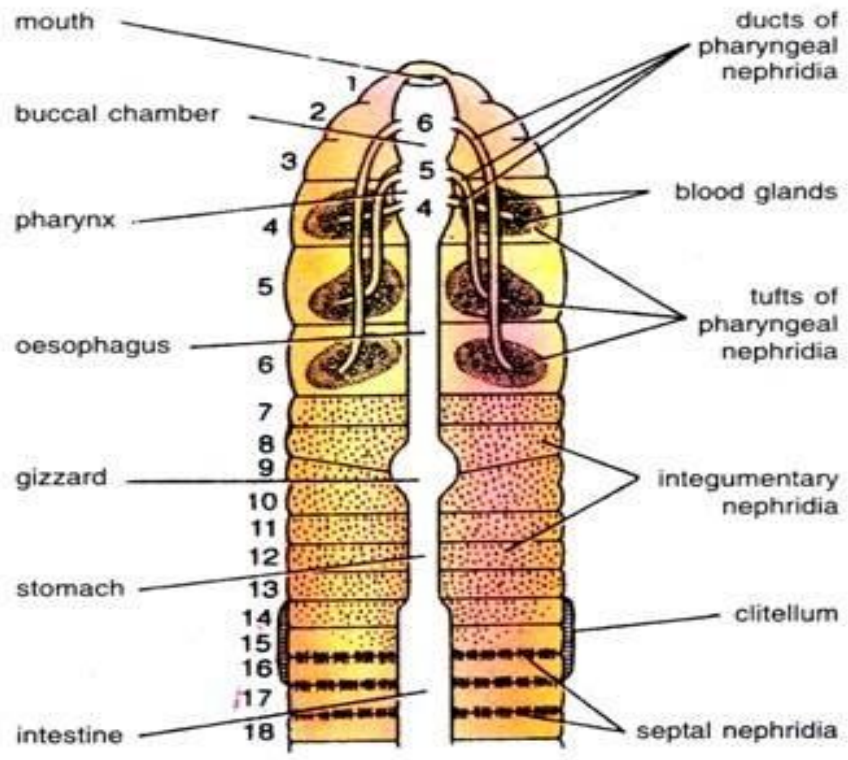


Fig. 66.21. *Pheretima*. Different types of nephridia and general plan of their distribution.

Pharyngeal nephridia- Present in segment 4-6, large in no., arranged into tuft.

Lack a nephrostome, open into the anterior part of the pharynx by three pairs of pharyngeal nephridial ducts. these helps in conservation of water and are enteronephric.

Septal nephridia- largest among all. Present in each segment behind segment 14. Each segment contains about 80-100 septal nephridia. The nephridia have a prominent nephrostome opening into the coelom. The terminal septal nephridia duct open

into septal excretory canal which in turn opens into a pair of supra-intestinal excretory ducts. These ducts drain into the intestine and are thus enteronephric.

Integumentary nephridia- most numerous of all. Usually, 200-250 in each segment. Ten times more numerous in clitellar region. The nephridia also lack nephrostome and the terminal nephridial tubules opens outside on the body surface by independent nephridiopores, hence these are exonephric.

The Coelomoducts in Oligochaetes function as oviducts and vas deferens. The coelomoducts acting as oviducts are very short ciliated funnelled tubes and those carrying sperm to the outside are long narrow tubules. The coelomoducts are permanent structure found even in nonbreeding season.

Nephridia and coelomoduct in Hirudinea

The nephridia in leeches are simpler in structure. The leeches are characterised by a marked reduction in coelom. It is restricted to a system of few channels. The nephrostome of the nephridia consequently opens into a coelomic ampulla. The nephrostome then leads into the main body of nephridium. Like the nephridia, the gonad is also enclosed in a sac opening into a gonoduct which is actually a coelomoduct.

In Hirudinea 17 pairs of nephridia are found in the segment 06 to22 one in each segment. The first five segments lack nephridia. 11 pairs of nephridia located in segments 12 to 22 are associated with the testis sac and are called testicular nephridia. The remaining 6 pair present are not associated with testicular sac hence called pretesticular nephridia.

Structure of Testicular Nephridium:

It consists of following part-

1) Main lobe

2) Vesicle

3) Apical lobe

4) Inner lobe

5) Initial lobe

6) Ciliated organ.

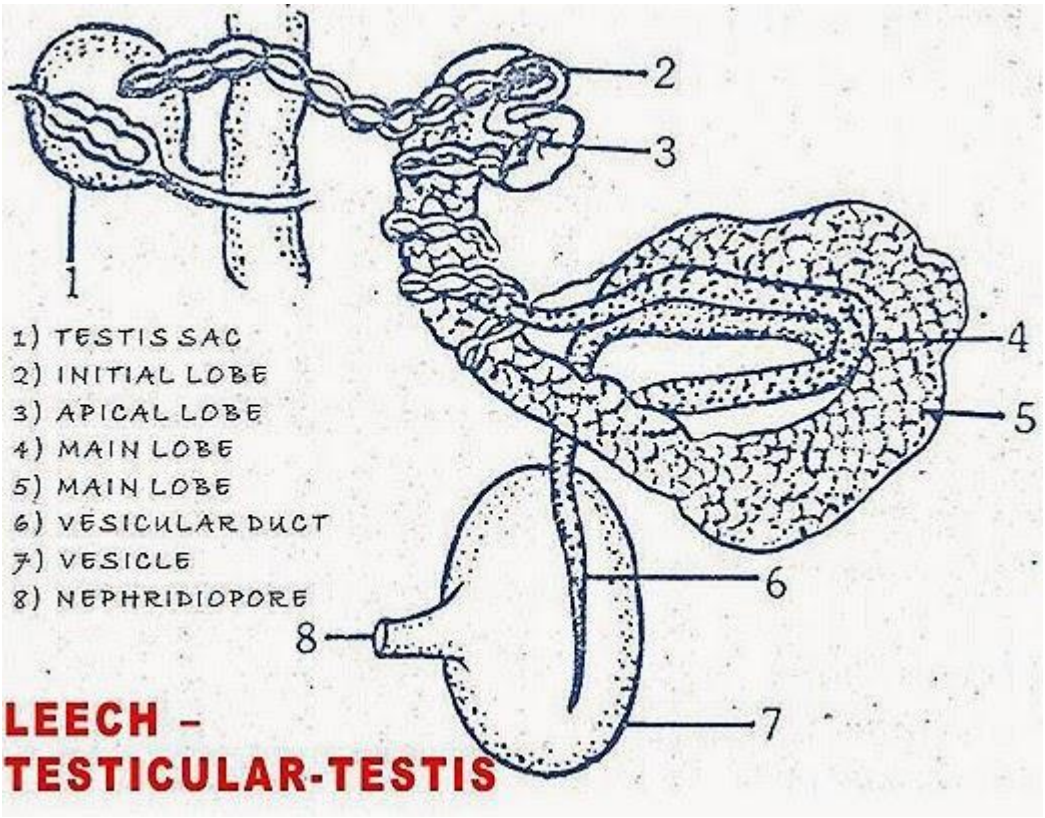
1) Main lobe: It is the bigger part of the nephridium. It is present in between two adjacent crop caecae. It has short posterior and long anterior limbs. They are free in the median axis. They are used externally. It looks like a horse shoe.

2) Vesicle: It is a thin-walled large chamber. It shows inner ciliated epithelium. It is present behind the main lobe. It gets a vesicle duct from the ventral end of the anterior limb of the main lobe.

This vesicle takes up *storage of excretory wastes.* - It gives a small duct called excretory duct. It opens out through the nephridiopore.

Vesicle duct-From the anterior end of anterior limb arises vesicle duct which opens into terminal vesicle.

In leech 17 pairs of nephridiopores are present on the ventral side, from 6 to 22nd segments, one pair in the last annulus of each segment.



3) **Apical lobe:** The posterior limb of main lobe will form an apical lobe. Its anterior end is swollen.

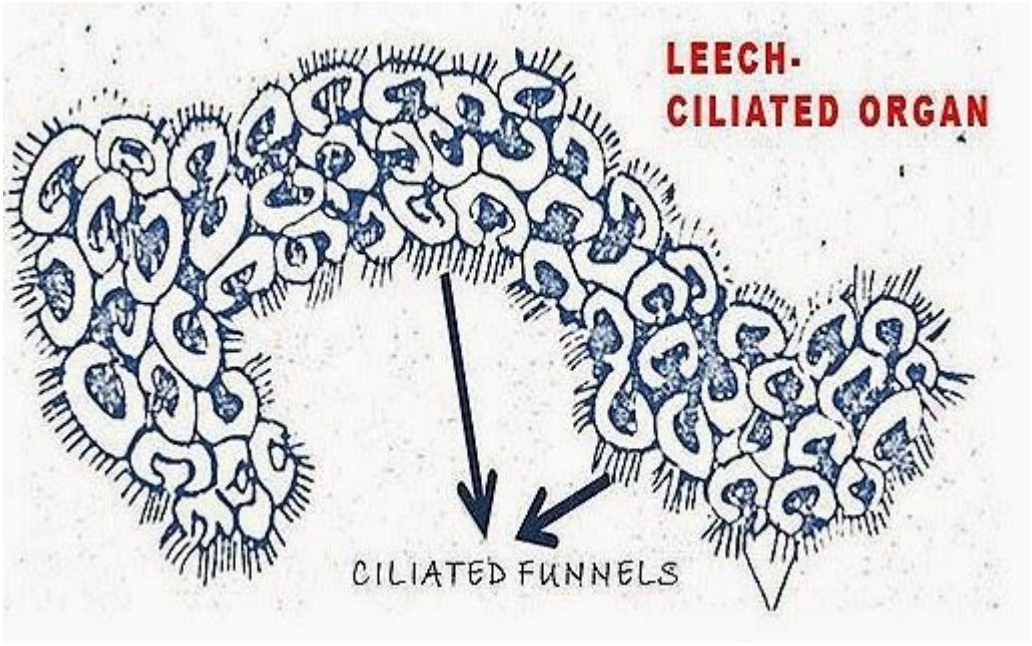
4) Inner lobe: It is thin. It lies all along the concavity of main lobe. It extends out of the apical lobe.

5) Initial lobe: It is long. It is coiled around the apical lobe. It is the testis-*lobe.* It joins with the anterior limb of the main lobe. Anteriorly it extends towards the testis sac and ends there near the peri nephrostomial ampullae.

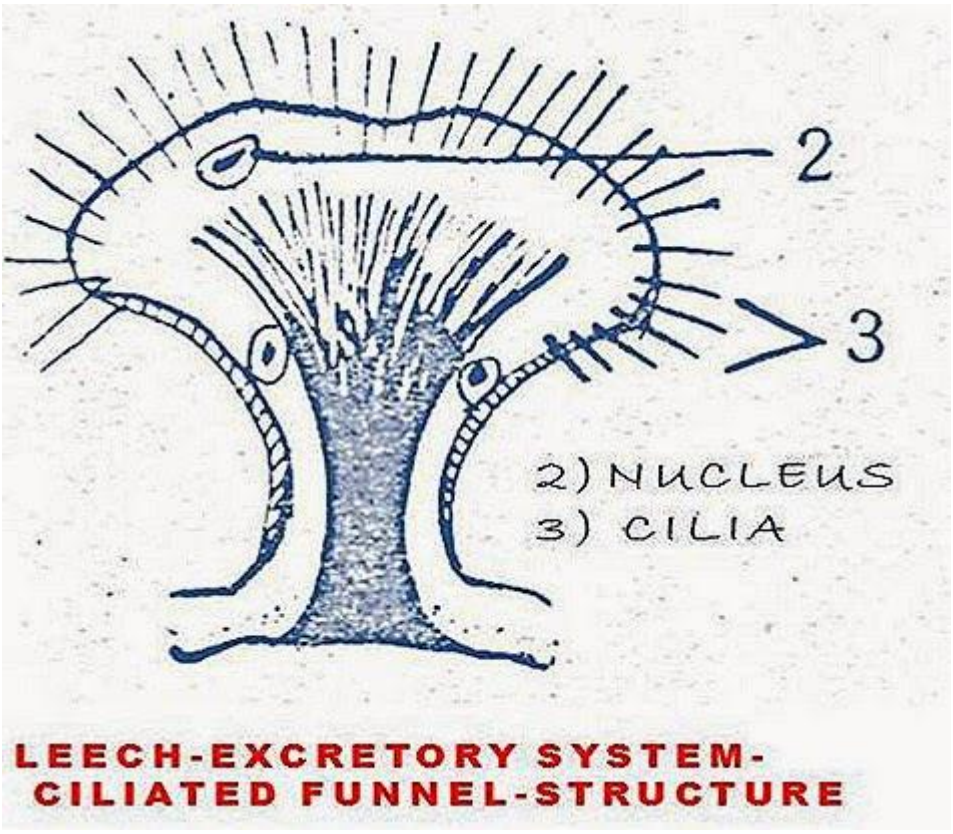
6) Ciliated organ: The ciliated organ has no excretory function.

It contains two parts a) Central reservoir and b) many ciliated funnels.

The reservoir is made by single celled thick layer. This layer shows a number of openings. In these openings funnels are arranged. The neck of the funnel enters the pore. The broader parts of thesea funnels are closely approximated and cover the reservoir. These funnels show cilia.



This ciliated organ is present in the peri nephrostomial ampullae. In the embryo it is connected with the nephridium by cellular cord and takes up *excretory function.* But in adults it has no connection with the nephridium. It plays a role in the haemocoelomic system.



Pre-testicular Nephridia:

These are 6 pairs. They are present in 6th to 11th segments. They are not associated with testis. They resemble the testicular nephridia in all ways, but these pre-testicular nephridia will not show peri-nephrostomial ampullae and ciliated organs. The thin initial lobe ends in the botryoidal tissue on either side of the nerve cord.

Nephridia and Coelomoducts in Archiannelids

Like polychaetes protonephridia and metanephridia both are found in Archiannelids. In Polygordius a pair of holonephric metanephridia are found in most of the segments.

In Dinophilus a short series of paired protonephridia has been reported.

According to Berrington (1979) some Archiannelids possess mixonephridia, but in most coelomoducts are not distinct. Genital products are cast out by dehiscence of body wall.