

EXCRETORY SYSTEM

The excretory organs of *Amphioxus* have developed on a non-chordate plan as it consists of a series of paired nephridia. It shows no similarity with the excretory organs of vertebrates where the excretory organs are mesodermal kidneys. In *Amphioxus* the protonephridia are the excretory organs. These are ectodermal in origin similar to those found in polychaetes.

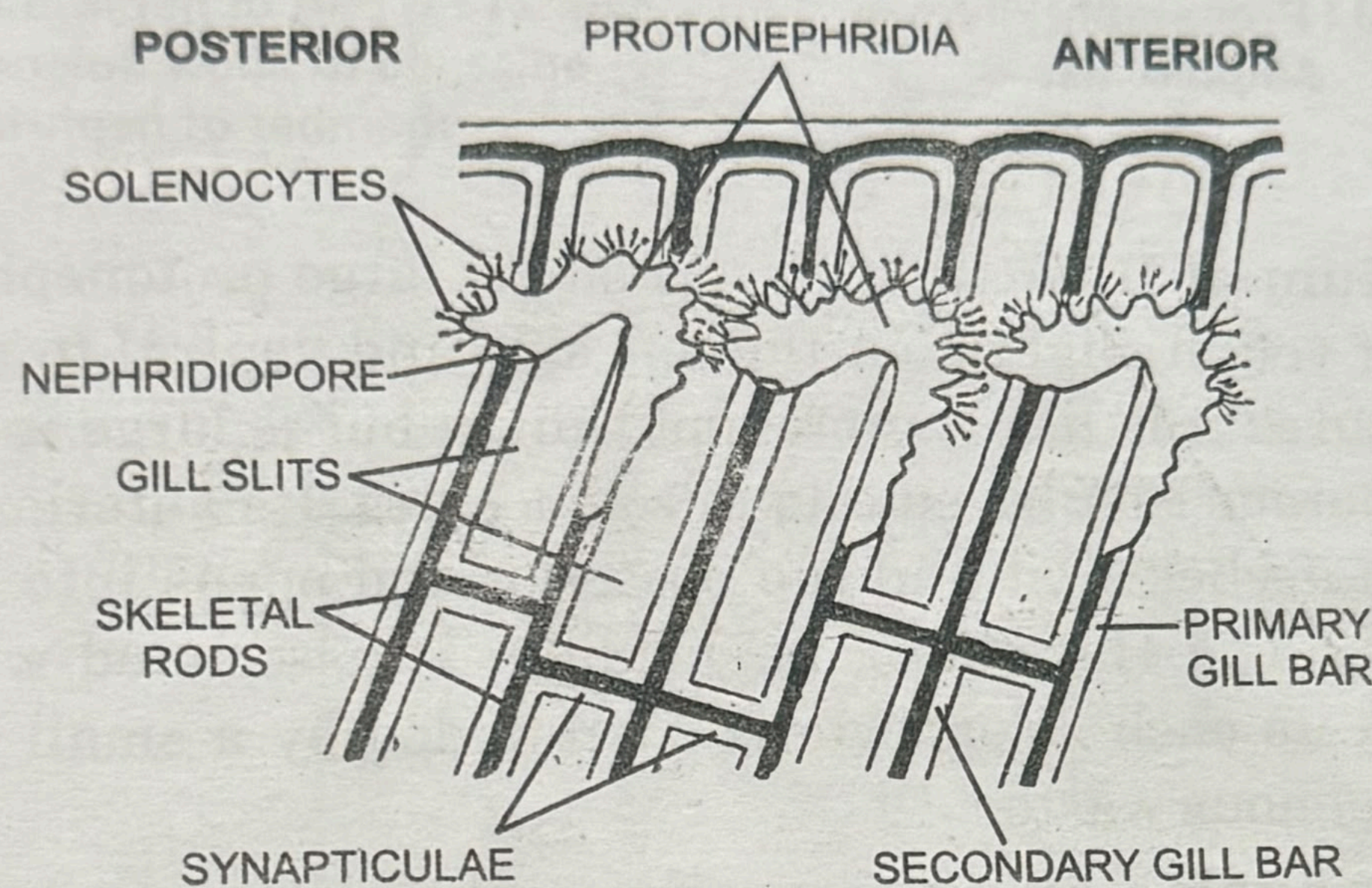


Fig. 19. Location of protonephridia in *Amphioxus*

A variety of organs in *Amphioxus* have been attributed to excretory function. These are :

- | | |
|-------------------|--------------------------|
| 1. Protonephridia | 2. Hatschek's nephridium |
| 3. Brown funnels | 4. Renal papillae. |

1. Protonephridia : The protonephridia are 90 pairs of segmentally arranged, peculiarly modified ectodermal tubes situated above the pharynx in relation with the main coelomic cavities and corresponding to the primary gill bars. Each protonephridium is a bent tube having thin walls. It is differentiated into anterior vertical and posterior-horizontal limbs. The vertical limb runs parallel to primary gill bar and terminates blindly. The horizontal limb communicates with the atrial cavity through a nephridiopore which lies against the secondary gill bar. Numerous short branches arise from the sides of the body of nephridium and each bears numerous fine tubules, each ending in a **solenocyte** or **flame cell**. There are about 500 solenocytes in a single protonephridium. The **solenocyte** consists of a single long flagellum which vibrates in the tubule of solenocyte and drives the excretory fluid into the body of nephridium. The tufts of solenocytes project into the dorsal coelomic canal by breaking through the coelomic epithelium and extract excretory products directly from the coelomic fluid by diffusion.

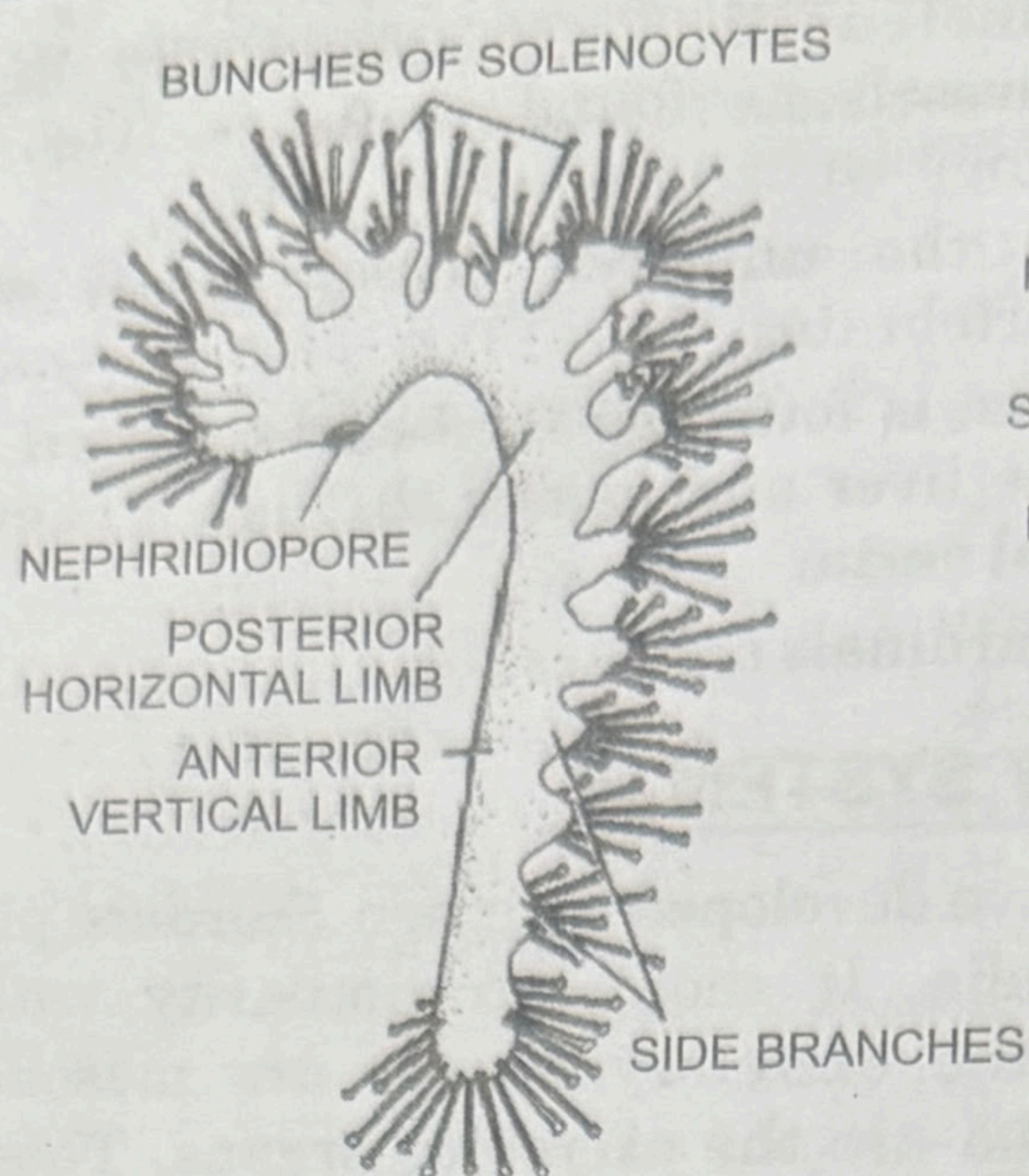


Fig. 20 : Protonephridium of *Amphioxus*.

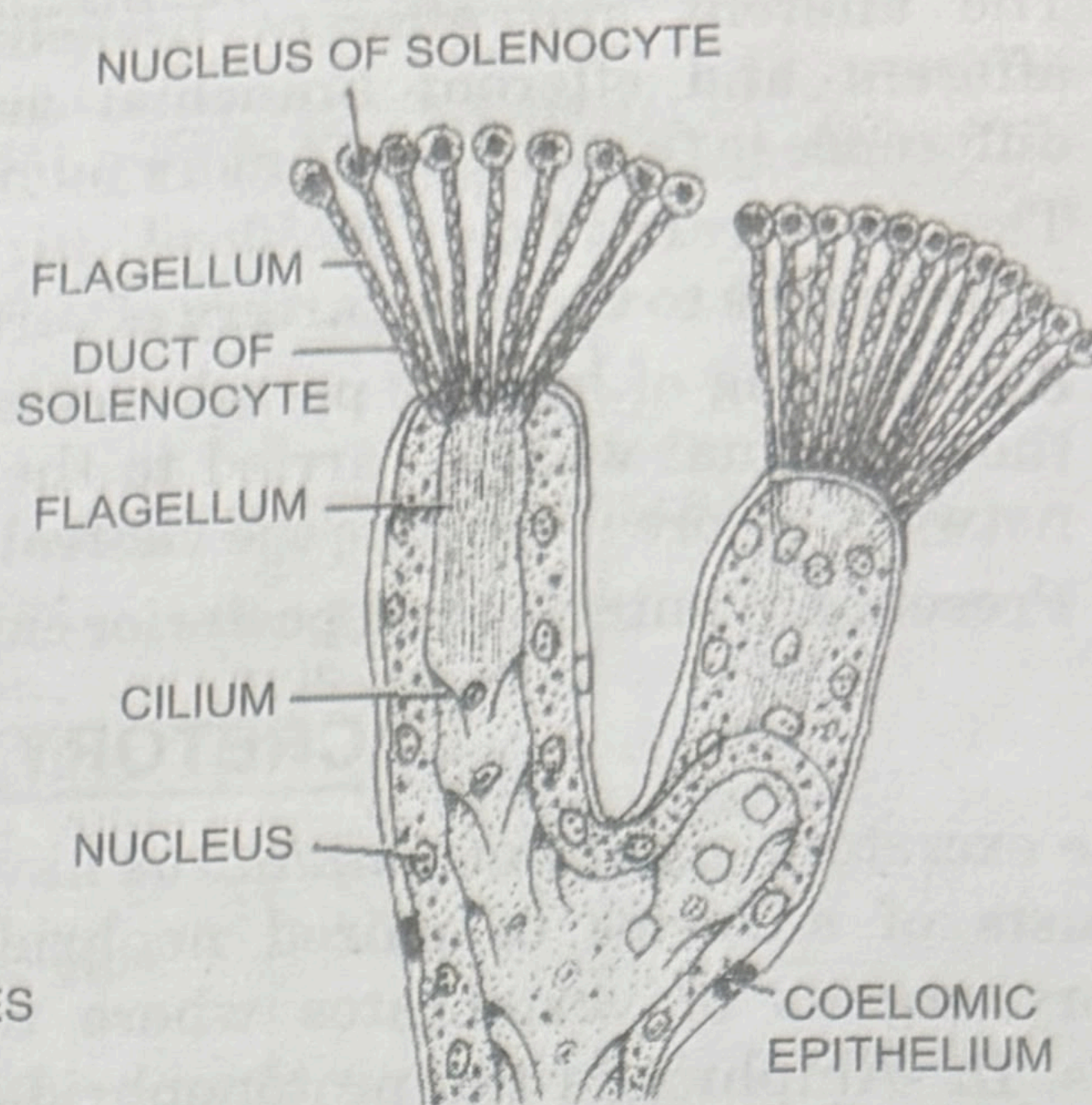


Fig. 21 : A part of nephridium open and enlarged to show solenocytes and chamber of nephridium.

2. Nephridium of Hatschek : It is a single large protonephridium, situated above the roof of velum slightly on the left side and ventral to the notochord. In all essential features it is like a protonephridium but is large in size. It is a bent tube having numerous tubules ending in solenocytes. Its anterior end ends blindly just in front of Hatschek's pit and the posterior end opens into the pharynx just behind the velum. The Hatschek's nephridium is associated with a network of blood vessels and its each solenocyte is surrounded by a small coelomic sac and extracts the nitrogenous waste.

3. Brown Funnels : An excretory function is also attributed to a pair of brown funnels, which are situated on the dorsal aspect of the pharynx at its posterior end. Their narrow anterior ends open into the coelom, while the broad posterior cells communicate with the atrium.

4. Renal Papillae : The floor of the atrium is beset with numerous small renal papillae which are presumed to help in excretion.

■ Primitiveness of Excretory Organs

The presence of nephridia is most peculiar feature in the anatomy of *Amphioxus*. The excretory system of *Amphioxus* differs radically from that of higher chordates and echinoderms, but resembles with that of flat worms and polychaete annelids in having a series of paired ectodermal protonephridia. They are in no way comparable to the mesodermal pronephros of higher chordates. There is no trace of any organs in *Amphioxus* which could be compared with the vertebrate kidney. Therefore, the excretory organs of *Amphioxus* are regarded to be of primitive nature.

NERVOUS SYSTEM

The nervous system of *Amphioxus* is simple without brain. Like the dorsal nerve cord of higher chordates, the central nervous system consists of a dorsal tubular nerve cord and various nerves emerging from it.

Dorsal Nerve Cord : The dorsal nerve cord is situated in the mid-dorsal line just above the notochord and is enclosed in a connective tissue sheath. Posteriorly, it tapers to a fine point a little in front of the end of the notochord. Anteriorly, it ends abruptly some distance behind the anterior extremity of notochord. The nerve cord is traversed by an axial cavity, **neurocoel**, which is connected with the dorsal surface by a median longitudinal cleft, known as **dorsal fissure**. The dorsal fissure widens a little behind into a trough-like dorsal dilation, covered only by the delicate connective tissue sheath. Anteriorly, the neurocoel dilates into a cerebral vesicle which contains certain sense organs in its wall (eye and olfactory pit). Antero-dorsally the cerebral vesicle gives out a hollow and pointed pouch-like diverticulum which is ciliated and is supposed to be olfactory in function.

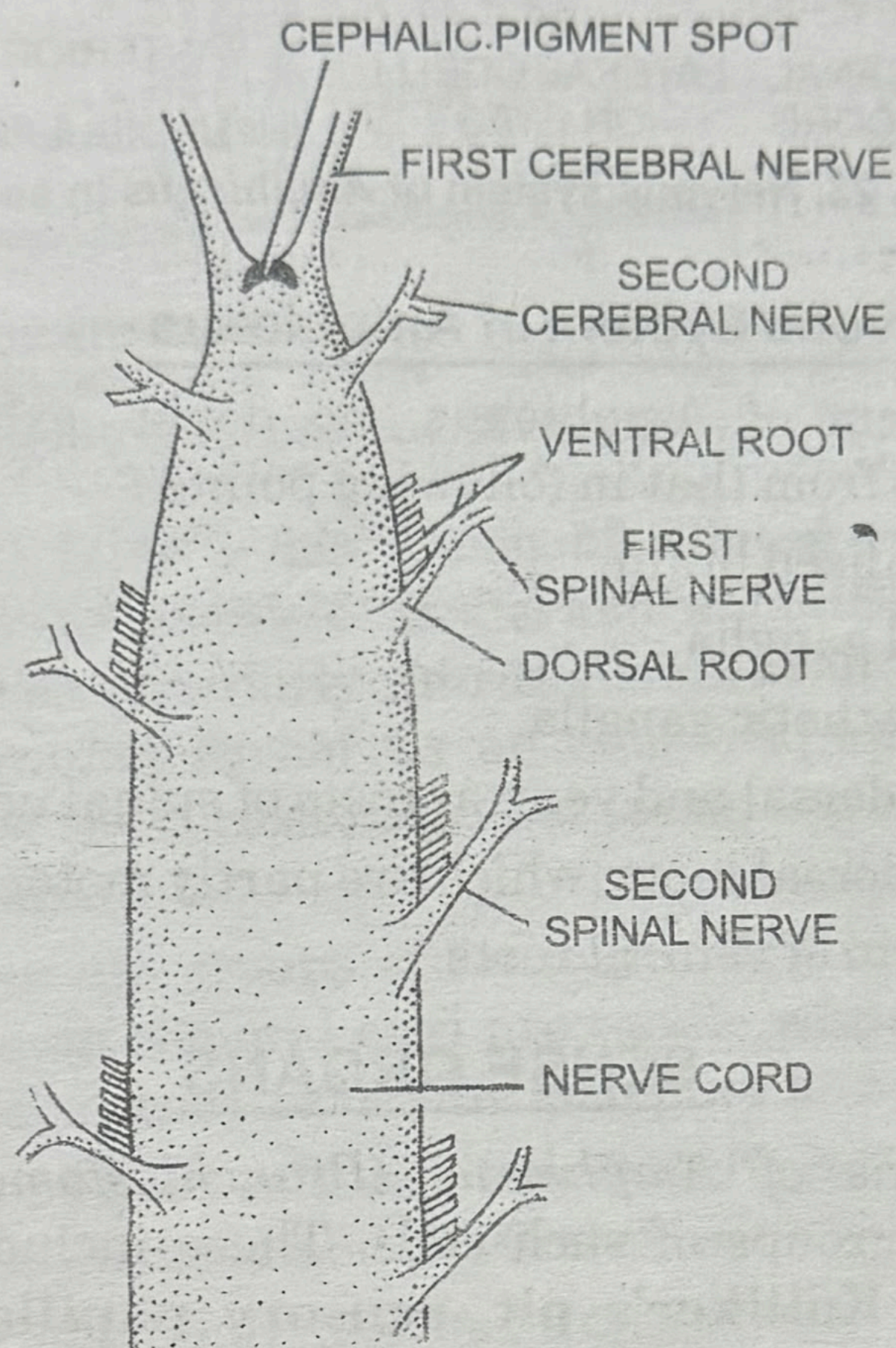


Fig. 22. Nervous system of *Amphioxus* in dorsal view

The nerve cord is chiefly composed of longitudinal nerve fibers with abundant nerve cells. The nerve cells are placed around the neural canal and the nerve fibers arising from the nerve cells are peripheral and more superficial. A few **giant cells** and **giant fibers** are found at intervals in the dorsal wall of the neural canal.

Peripheral Nerves : Two pairs of the so called 'cranial nerves' or the **cerebral nerves** arise from the cerebral vesicle. The first pair of cerebral nerves arise from the anterior end and the second pair from the dorsal side. These enervate the snout and are sensory in nature. Behind these the spinal cord gives out a series of segmentally arranged **spinal nerves**. In , corresponding with the disposition of myotomes the nerves to the right and left side are arranged alternately. In each segment there are two nerves on each side, a dorsal nerve root which arises by a single root and a ventral nerve root arising by a number of roots. The two do not unite to form a single nerve as in vertebrates. The ventral nerves are motor and supply the skin and transverse muscles. These extend

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between the myotomes. The dorsal nerves are sensory and arise from the receptor organs in the skin. A distinct autonomic nervous system in the form of two nerve plexus occurs in the gut wall.

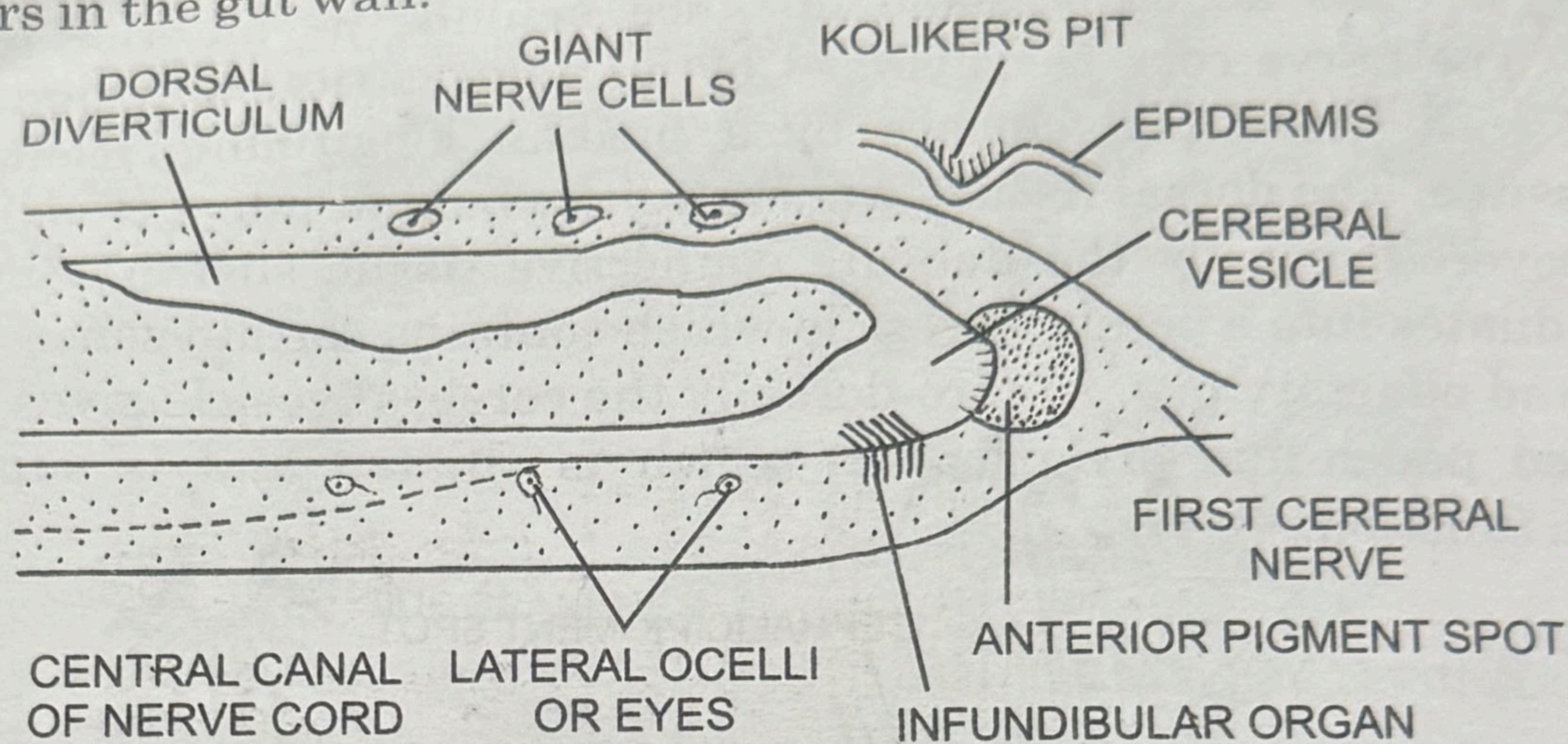


Fig. 23. Nervous system of *Amphioxus* in section

■ Peculiarities of Nervous System of *Amphioxus*

The nervous system of *Amphioxus*, no doubt, exhibits chordate plan of construction but differs from that in following points :

1. Absence of specialised brain.
2. Absence of spinal ganglia.
3. Absence of sympathetic gangila.
4. Independence of dorsal and ventral roots of spinal nerves.
5. Mixed nature of dorsal roots, which are partly motor and partly sensory.
6. Multi-rooted origin of ventral roots.