

Chordate Features and Feeding in Branchiostoma

Cephalochordata (*Branchiostoma*) exhibits the three basic chordate features such as notochord, dorsal tubular nerve cord and pharyngeal gill-slits in the most typical manner and there is no doubt about its chordate nature. However, it exhibits relationships with all the major groups of phylum chordata, and its real status in the phylum remains uncertain.

Feeding in Branchiostoma

Amphioxus, also called lancelet, is member of the invertebrate subphylum Cephalochordata of the phylum Chordata. Amphioxi are small marine animals found widely in the coastal waters of the warmer parts of the world. Both morphological and molecular evidence show them to be close relatives of the vertebrates.

The different parts of the alimentary canal are given below:

Mouth:

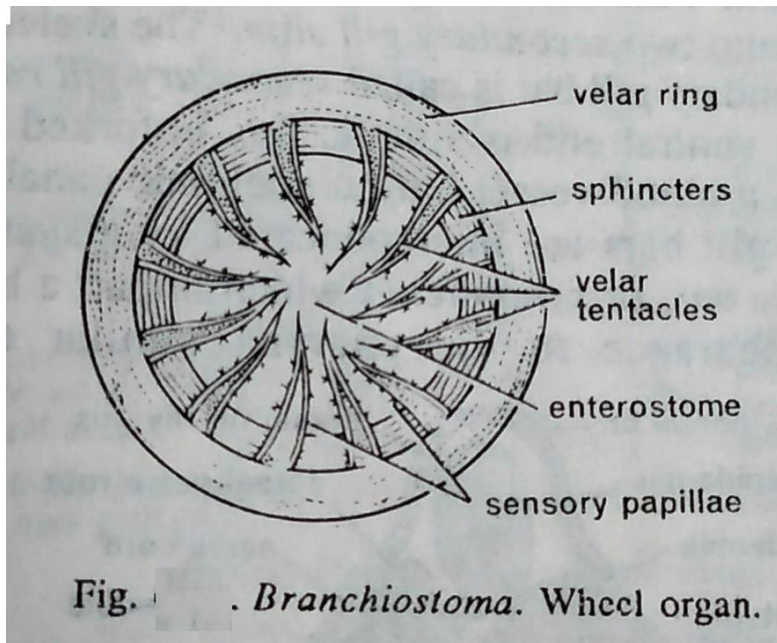
- Mouth is a small rounded aperture situated at the base of the vestibule or buccal cavity of the oral hood. It is surrounded by a membrane, called velum, acts as a sphincter which bears 12 slender velar tentacles on its free edge, and help to close or open the mouth.

Oral hood and buccal cavity:

- A large median aperture is situated just below the pointed tip of the anterior end (rostrum). This aperture is surrounded by a frill-like membrane, called oral hood. The membranous lateral and ventral margins of the oral hood are fringed with buccal cirri.
- The buccal cirri are beset with sensory cells.
- During the inflow of water current, the buccal cirri form a sieve to prevent the entry of large particles. The oral hood encloses a cavity, called vestibule or buccal cavity.

Wheel organ:

- The inner lining of the vestibule produces a complicated ciliated grooves and ridges, called wheel organ. The wheel organ produces a whirling current of water to sweep the food matters into the mouth.



Hatschek's groove:

- There is a ciliated glandular groove running along the roof of the vestibule, called Hatschek's groove.
- It is lined partly by endocrine cells which are believed to secrete pituitary-like hormones into the blood.

Velum:

- There is a ring of finger-like sensory tentacles around the mouth, called velum which separates vestibule from the pharynx.

Pharynx or branchial sac:

- The pharynx is a large laterally compressed tube.
- The lateral wall of the pharynx is perforated by obliquely arranged vertical apertures — the gill-slits or branchial slits.
- The number of gill-slits is about 180 pairs. The gill-slits open into an ‘U’ shaped special cavity, the atrium, which surrounds the pharynx on all sides except the dorsal.
- The atrium is closed anteriorly but opens to the exterior through an aperture, the atriopore which is situated behind the level of pharynx.
- The gill-slits are separated from one another by the portion of the walls of the body and the pharynx. These portions are called the gill- bars or branchial lamellae, i.e., the gill-bars are actually the vertical portions of the main body wall and the pharyngeal wall. Such a portion of the gill-bar which encloses the coelom is called primary gill-bar.
- With the advancement of age, each primary gill-slit is divided into secondary gill- bars.
- The gill-bars are provided with cilia. The gill-bars contain supporting gill-rods.

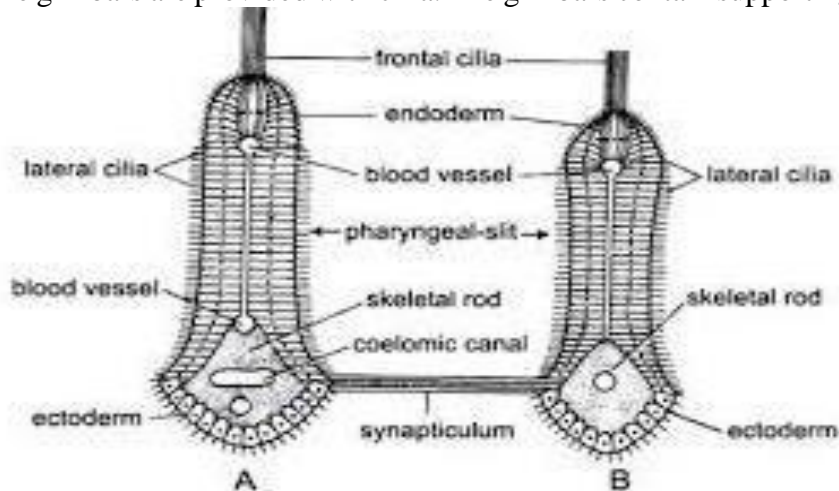


Fig. Branchiostoma. T.S. of gill-bars. A—Primary gill-bar, B—Secondary gill-bar.

Endostyle:

- An endostyle is a ciliary and glandular groove present on the floor of the pharynx.
- The endostyle consists of a few tracts of ciliated cells alternating with mucus-secreting glandular bands.

Epipharyngeal or hyper pharyngeal groove:

- A ciliated median groove is present on the dorsal side of the pharyngeal cavity, called epipharyngeal or hyper pharyngeal groove. The epipharyngeal groove joins with the

anterior end of the endostyle by peripharyngeal ciliated tracts.

Oesophagus:

- The pharynx opens into a short, narrow, ciliated tube, called oesophagus that opens into the midgut. The pharynx and oesophagus constitute the foregut.

Intestine:

- The intestine is a straight ciliated tube which can be divided into two regions — midgut and hindgut.
- The midgut includes hepatic diverticulum and iliocolonic ring.
- At the junction of oesophagus and the midgut there is a large single un-branched out-pouching, lying at the right side of the pharynx, called hepatic diverticulum.

Anus:

- The intestine proceeds posteriorly as a straight hindgut which opens through the anus.

Digestive gland:

- Hepatic diverticulum, referred to as digestive gland in Branchiostoma.
- It contains zymogen cells which produce digestive enzymes (a lipase and a protease) and are carried into the lumen of the midgut by ciliary activity.
-

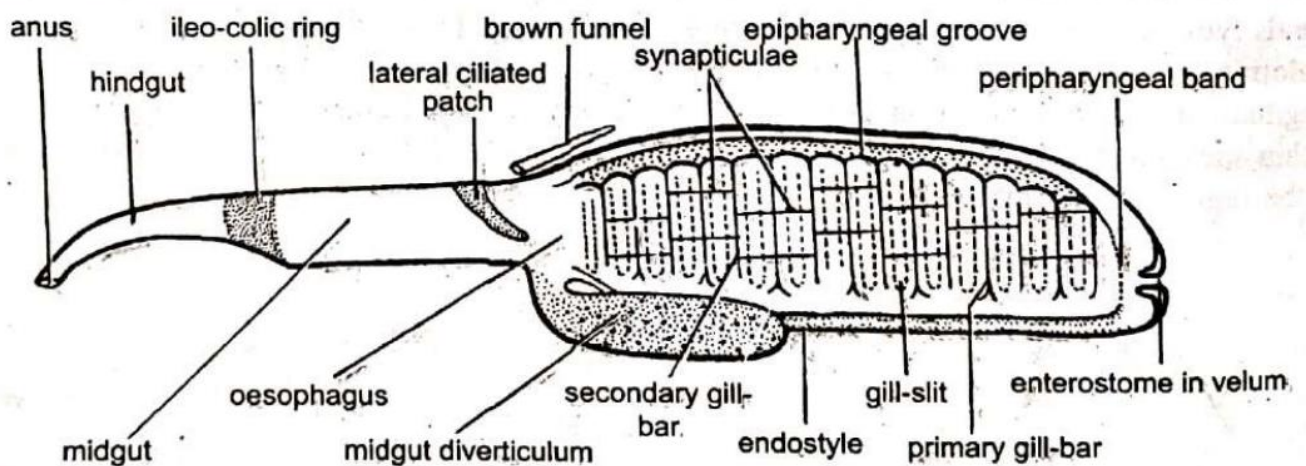


Fig: Alimentary canal of *Branchiostoma*

Mechanism of Feeding and Digestion in Branchiostoma:

- Branchiostoma is a microphagous animal. The food or 'sea soup' consists of protozoans, algae, diatoms and other organic particles.

Feeding:

- Branchiostoma obtains food by filtering the stream of waters that enters the pharyngeal cavity.
- The wheel organ produces a vortex. The buccal cirri become curved to form a sieve to prevent the entry of large particles.
- The sensory papillae in the buccal cirri and velar tentacles act as chemoreceptors and taste the nature of the food particles and also estimate the size of food particles.
- If food particles are large in size or liable to cause toxicity, these are expelled by the forceful expulsion of the water from the pharyngeal cavity.
- The major portion of the water passes out into the atrium through the gill-slits. The cilia present on the gill-bars beat to drive the water out into the atrium and, thus, facilitate the inflow of fresh water current through the mouth.
- The food particles, due to their own weight, begin to fall on the floor of the pharyngeal cavity and are entangled by the sticky secretion of the mucus-secreting cells of the endostyle.
- The cilia in the endostyle and gill-bars beat to produce an upward current to push the mucus-entangled food particles towards the epipharyngeal groove.
- The food is pushed backwards by the backward beating of the cilia of the epipharyngeal groove. The secretion of the glandular cells of the endostyle transforms the boluses of mucus-entangled food particles into a cord-like structure, known as food cord.
- The food cord from the pharynx passes through the oesophagus into the hepatic diverticulum and midgut where this food cord is subjected to the action of digestive enzymes secreted by the hepatic diverticulum.
- Digestion in Branchiostoma is both intracellular as well as extracellular. The intracellular digestion takes place inside the hepatic diverticulum while the extracellular digestion occurs inside the midgut.
- The secretory cells of the hepatic diverticulum contain zymogen granules and they show phagocytosis, i.e., the cells are able to engulf the food particles from the food cord and digest the food.

- The digestive enzymes in Branchiostoma are amylase, lipase and protease. The digested food is absorbed in the hindgut and the undigested particles are expelled through the anus.

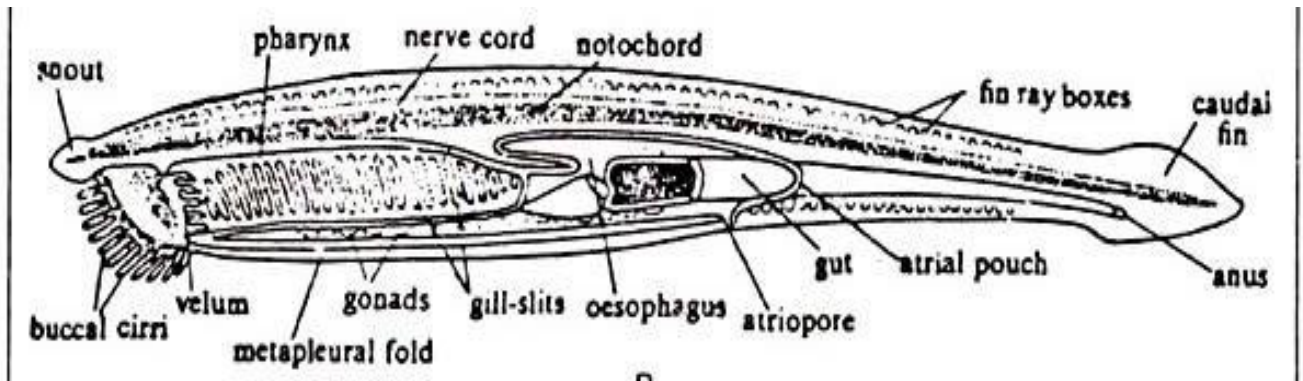


Figure: Digestive system of Amphioxus