

Amphioxus - Digestive System

The digestive system consists of an alimentary canal and digestive glands.

Alimentary Canal:

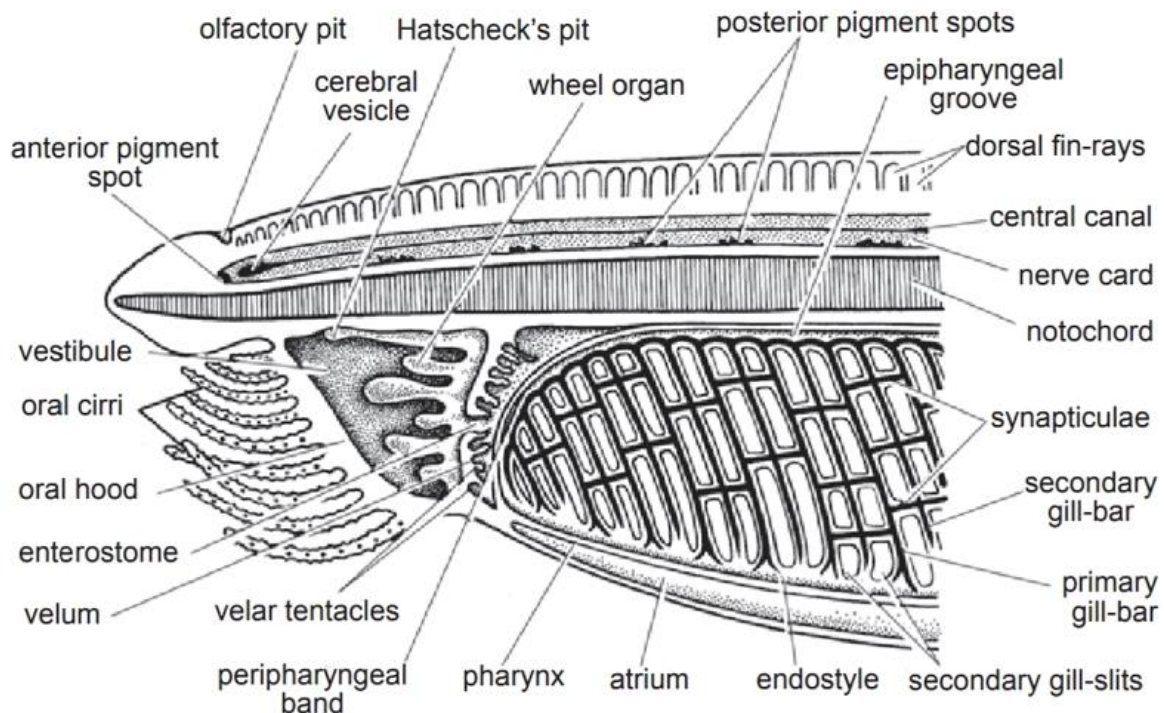
The alimentary canal is a straight and complete tube from the mouth to the anus.

a) Mouth:

The mouth is a large oval median aperture situated anteroventral below the rostrum. It is bordered by a frill-like membrane, the oral hood.

b) Oral Hood and Buccal Cavity:

The oral hood is formed by the dorsal and lateral projections of the anterior end of the trunk. The free ventrolateral margin of the oral hood is beset with 10-11 pairs of stiff, slender and ciliated oral or buccal cirri. The buccal cirri function as a sieve or filter to prevent the entry of larger particles.



The oral hood encloses a large funnel-shaped cavity called buccal cavity or Vestibule. The buccal cavity is lined with the ectoderm. The ectodermal lining of the oral hood forms 6 to 8 pairs of finger-like ciliated tracts. All these tracts are together called wheel organ or Muller's organ. They create whirling water currents.

The Mid-dorsal groove is the largest is called **Hatschek's groove**, which ends in a small depression on the rood of the buccal cavity named **Hatschek's pit**.

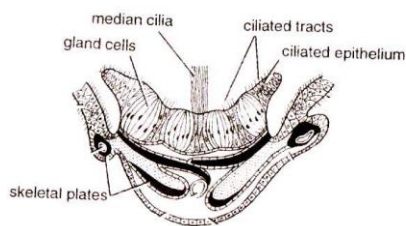
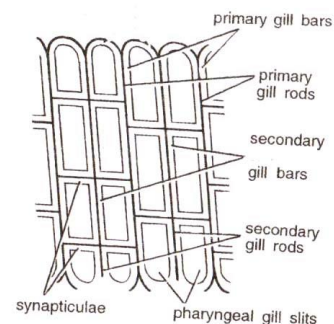
c) Velum and Enterostome:

Posteriorly, the buccal cavity is closed by a circular ring-like vertical membrane, the **velum**. Velum is perforated by a central circular aperture, the **enterostome**, leading into the pharynx. The posterior border of velum is produced into 10-12 slender, ciliated and sensory **velar tentacles**.

d) Pharynx:

The pharynx is a very large, spacious and laterally compressed chamber forming the largest part of the alimentary canal. The lateral walls of the pharynx are perforated by 150 to 200 pairs of narrow and vertical openings called **branchial apertures** or **gill slits**. The pharyngeal wall between two adjacent gill slits is called a **gill bar**. The gill bars are of two types, namely **primary gill bars** and **secondary gill bars**. These two bars regularly alternate with each other.

The gill bars are supported internally by a skeletal rod. The skeletal rod present in the primary gill bar is called the **primary rod**. It is forked ventrally. The skeletal rod present in the secondary gill bar is called the **secondary rod**. It is not forked ventrally. The primary and secondary gill bars are interconnected by numerous horizontal partitions called **synapticulae**.



The floor of the pharynx has a shallow longitudinal groove called **endostyle**. It is lined by 5 longitudinal tracts of **ciliated cells** alternating with 4 tracts of **mucous gland cells**. The cilia of the median tract are much longer than the lateral tracts. The endostyle is supported by a

pair of **skeletal plates**. The endostyle has two functions:

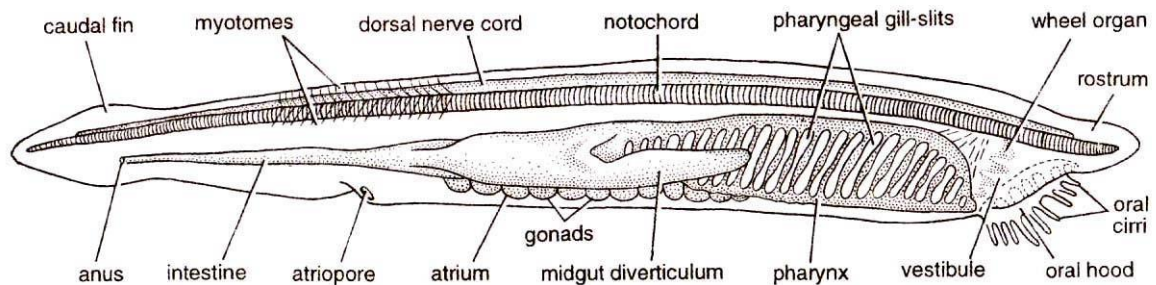
1. It secretes **mucous**.
2. It creates **water current**.

In the roof of the pharynx, there is another ciliated groove called **epipharyngeal groove**. At the anterior end of the pharynx, there are two transverse

ciliated tracts on the inner wall of the pharynx called **peripharyngeal bands**. The peripharyngeal bands are connected to the endostyle ventrally and to the epipharyngeal groove dorsally. The small region of the pharynx lying in front of the peripharyngeal bands lacks gill slits is called as **prebranchial region**.

e) **Oesophagus:**

Posteriorly the pharynx leads into a short tubular **oesophagus**.



f) **Intestine:**

The oesophagus leads into the **intestine** or **gut**. The intestine is as long as the pharynx. The intestine is divisible into an anterior wide **midgut** and a posterior narrow **hindgut**. A large **blind pouch** or **diverticulum** arises from the junction of the oesophagus and midgut towards the right side. The terminal part or **rectum** is heavily ciliated and opens to the outside by the anus.

g) **Anus:**

The anus is a small circular aperture controlled by a sphincter. The anus opens at the base of the caudal fin a little left of the mid-ventral line.

Digestive glands:

Amphioxus has a single digestive gland called the **midgut diverticulum** or **hepatic diverticulum**. It is in the form of a sac attached to the alimentary canal in the junction of the oesophagus and midgut. It extends forward below the pharynx.

The secretion of this diverticulum contains enzymes like lipase, amylase and protease.

Feeding

Amphioxus is a **carnivorous animal**. It feeds on microscopic organisms like plankton, protozoans, etc. Amphioxus feeds itself in three ways. They are **ciliary feeding, filter-feeding, and mucous feeding**.

The water current enters the pharynx via mouth, buccal cavity and enterostome. From the pharynx, water passes into the atrium through the gill slits.

From the atrium the water passes out through the atriopore. The oral cirri and the velar tentacles function as a sieve and they prevent the entry of large particles into the pharynx.

The mucous gland cells of endostyle secrete mucous. The mucous stream moves upwards along the lateral walls of the pharynx.

The beating of the cilia of the gill bars creates a water current. This water current carries food materials. Food particles carried by the water current are entangled in the mucous. The food-laden mucous stream enters the epipharyngeal groove.

In the epipharyngeal groove, the mucous stream is converted into a twisted **mucous cord** by the beating of the cilia. The mucous cord is then passed into the oesophagus.

From the oesophagus, the mucous cord passes into the midgut. From the midgut it enters the midgut diverticulum for a short distance.

From the midgut diverticulum, it returns to the midgut. Then it enters the hindgut.

Digestive enzymes are secreted by the **midgut diverticulum** and are poured into the midgut. Digestive occurs inside the midgut and the hepatic diverticulum.

Digested food is absorbed in the hindgut. The undigested materials along with the mucous cord are eliminated through the anus.

In Amphioxus, digestion is both extracellular and intracellular. Extracellular digestion occurs in the midgut. Intracellular digestion occurs in the hepatic diverticulum. Here the cells are phagocytic.

Amphioxus - Excretory System

In Branchiostoma, the nephridia develop from the ectodermal cells and have no relation with mesoderm. Thus, they are different from the kidney of vertebrates which are mesodermal in origin.

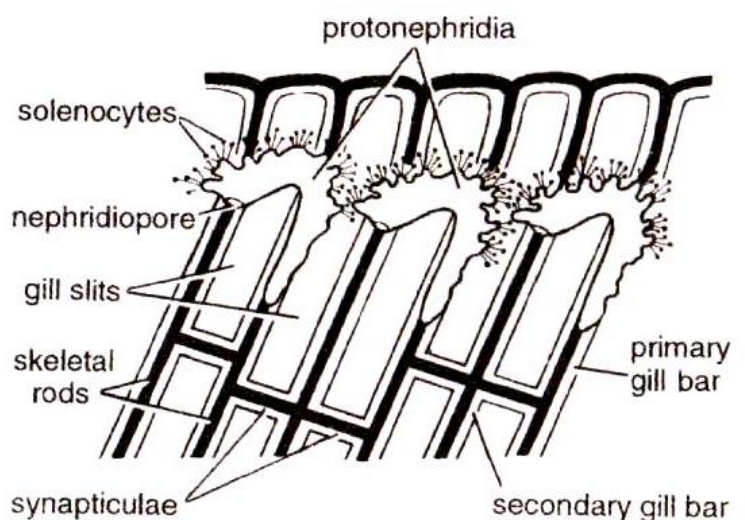
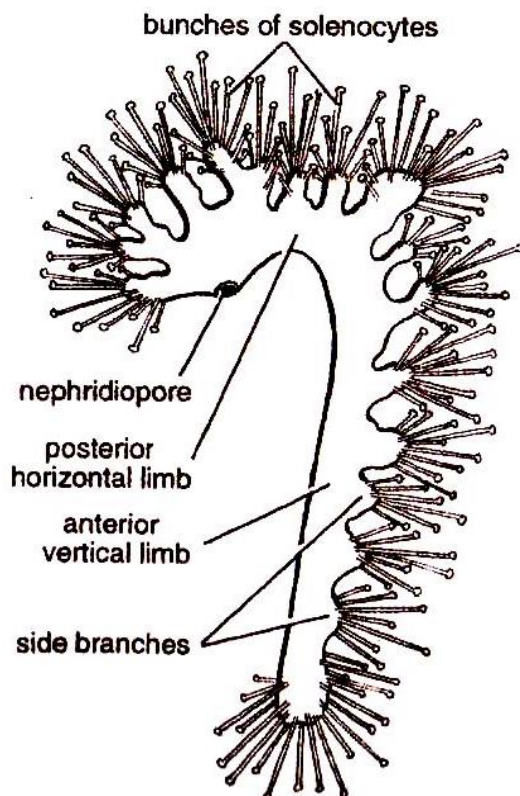
The excretory system is formed of 4 types of organs, namely

1. Protonephridium
2. Hatschek's Nephridium
3. Brown Funnels
4. Renal Papillae

1. Protonephridium:

There are about 90 pairs of nepridia arranged on the dorsolateral wall of the pharynx. Each nephridium is a thin-walled bent tube. It has a vertical limb and a horizontal limb. The vertical limb lies in the primary gill bar. The horizontal limb opens into the atrium by a nephridiopore.

Each nephridium has about 500 solenocytes. Each solenocytes is a round cell with a nucleus and long tubule. From the cell, a flagellum arises and it projects into the lumen of the tubule.

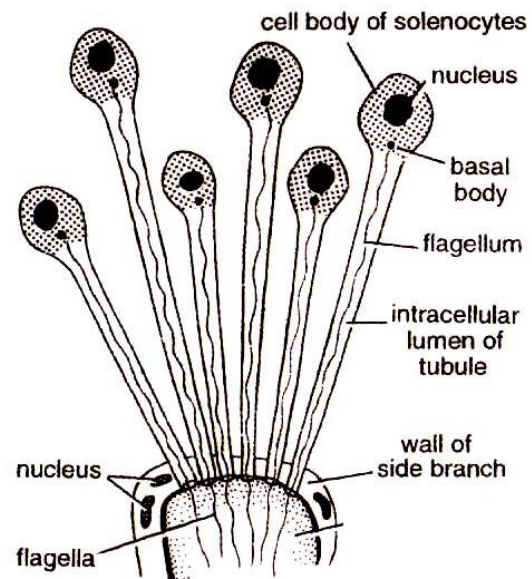


2. Hatschek's Nephridium:

A single long and straight tube, called **Hatschek's nephridium**, lies in the **roof of the oral hood**. Its anterior blind end lies somewhat ahead of the Hatschek's pit, but the posterior end opens into the prebranchial sac of the pharynx. Its surface is covered by a number of solenocytes.

Mechanism of Excretion:

The nephridia are richly supplied with blood vessels and the solenocytes freely project into the coelomic fluid. Excretion occurs by simple diffusion. Nitrogenous wastes are extracted by solenocytes from blood and coelomic fluid, discharged by nephridiopores into the atrium and passed out of the body through the outgoing water current.



3. Brown Funnels:

Brown funnels are **excretory organs** of Amphioxus. They are brown in colour and funnel-shaped. There are **two** brown funnels. They are located dorsal to the **posterior end of the pharynx**. The narrow end of the funnel opens into the coelom and the wide end opens into the atrium.

4. Renal Papillae:

Group of cells present on the floor of the **atrial cavity**, form renal papillae which are probably excretory in function.