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Kingdom - Animalia

Phylum - Chordata

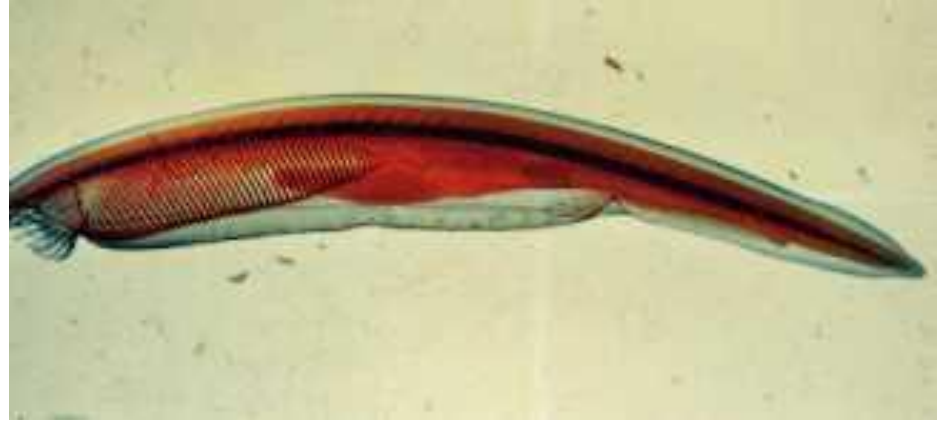
Subphylum - Urochordata (tunicates)

Subphylum - Cephalochordata (lancelets)

Ex. *Branchiostoma*

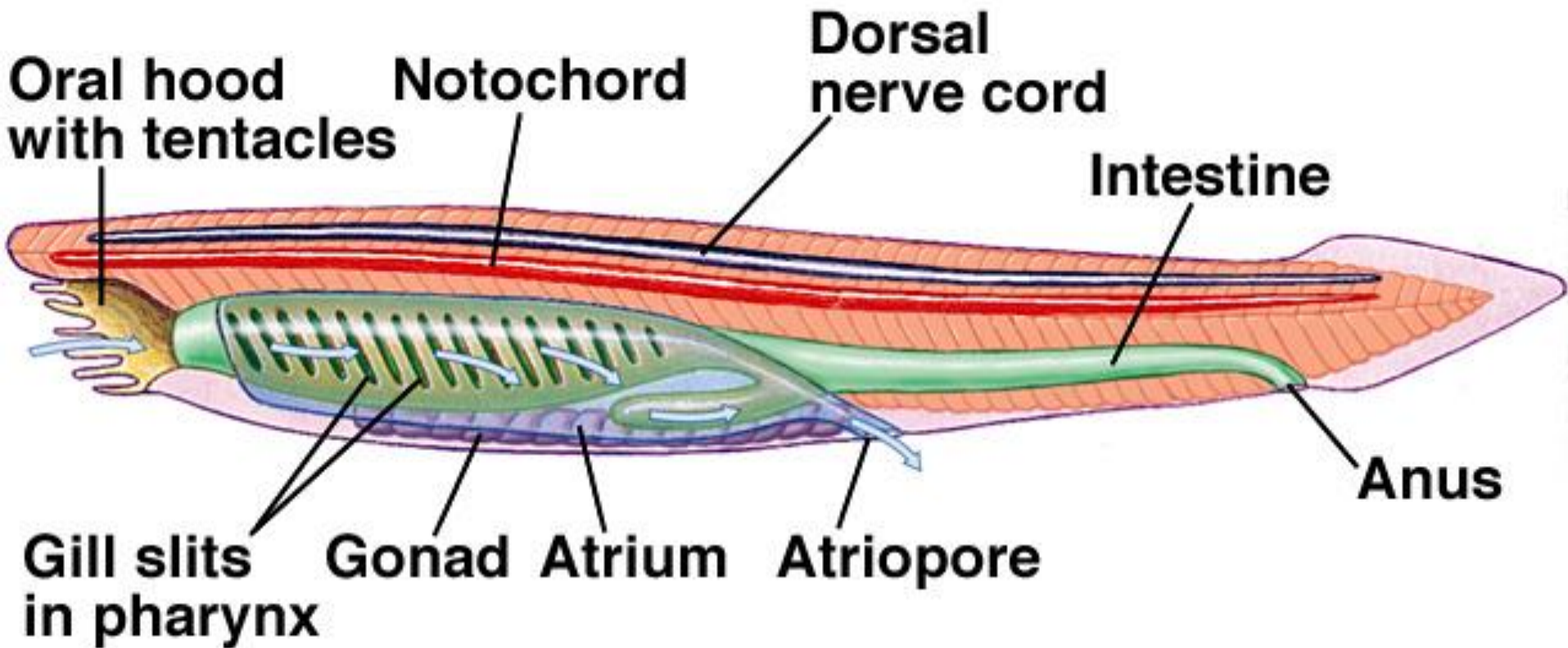
Subphylum Cephalochordata

- *Amphioxus*
- Notochord length of body
- Dorsal hollow nerve cord
- Gill slits
- Segmented muscles



Lancelet Structure

Amphioxus



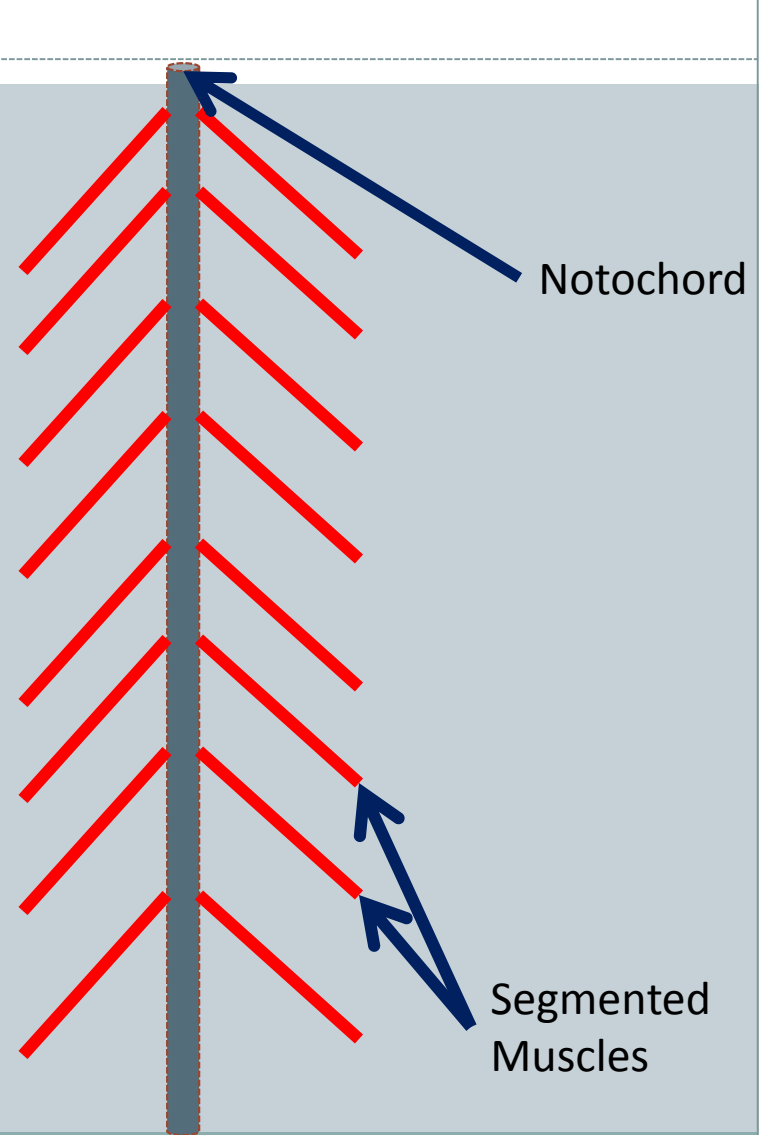
Cephalochordata

- Lancelets: Get their names from their bladelike shape
- As larvae alternate between swimming upwards and passively sinking to eat plankton
- After metamorphosis into adults, they burrow into the sand and leave their head exposed to filter in food



Locomotion/musculature

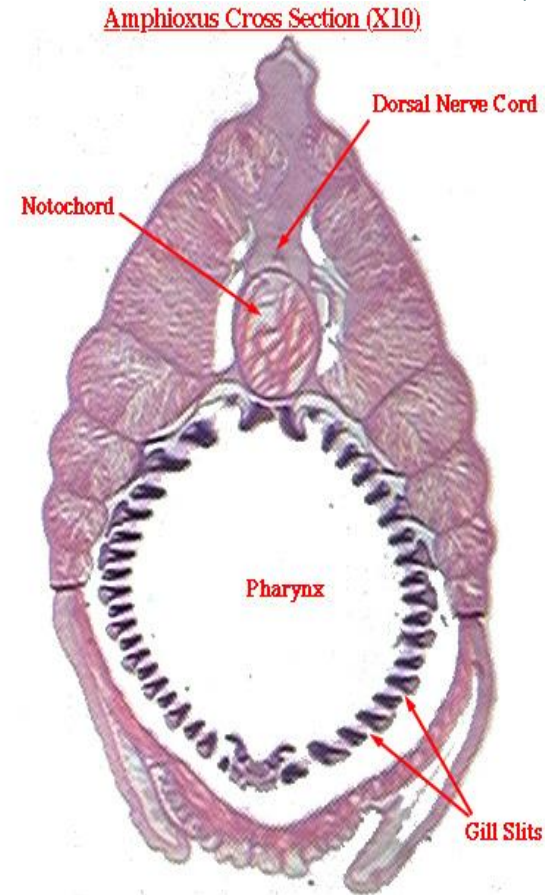
- Lancelets have segmented muscles that allow them to undulate



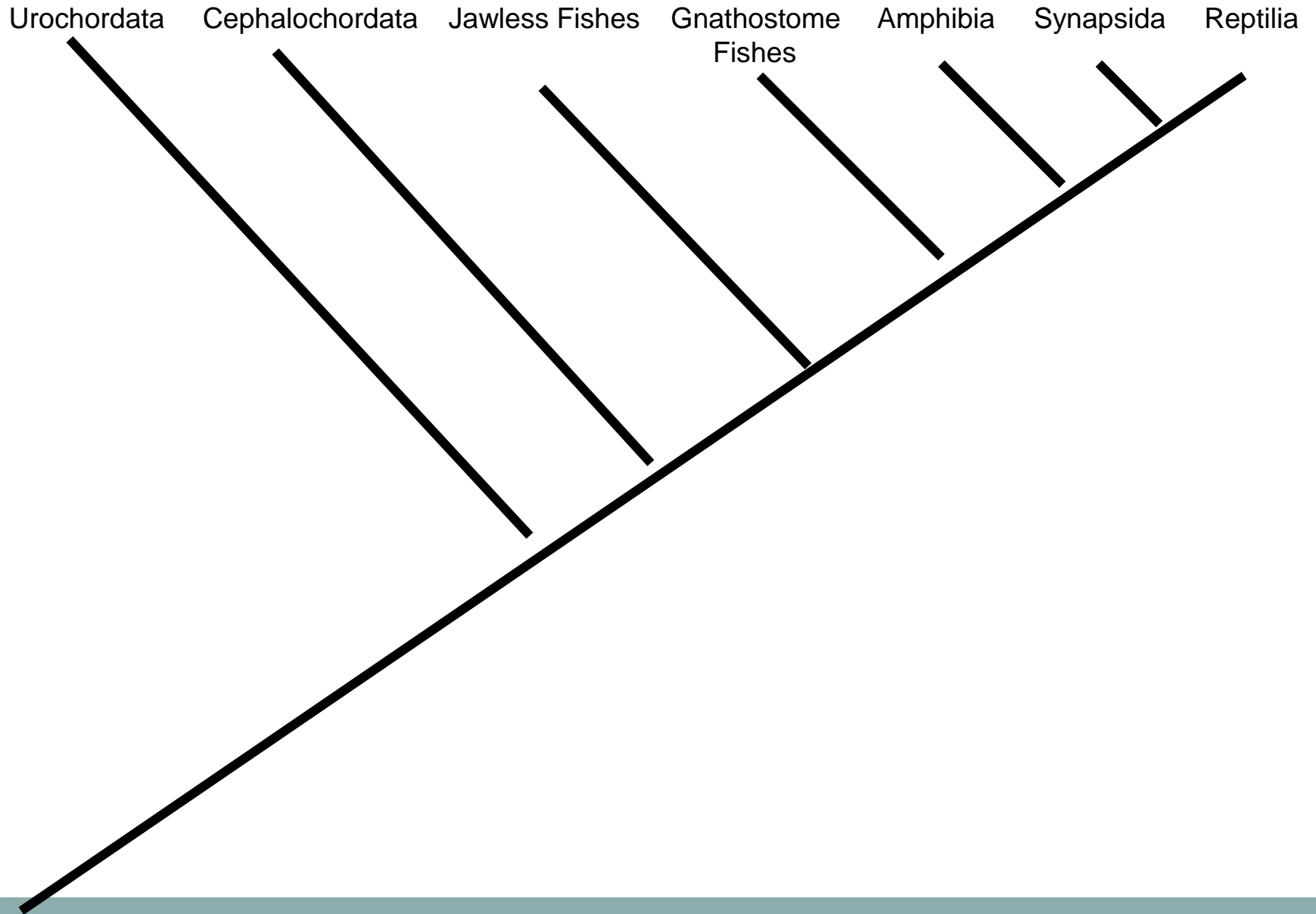
SKELETAL SYSTEM

The main musculature can be seen through the thin skin to be divided into about sixty pairs of muscle-segments (myotomes) by means of comma-shaped dissepiments, the myocommas, which stretch between the skin and the central skeletal axis of the body. These myotomes enable it to swim rapidly with characteristic serpentine undulations of the body, the movements being effected by the alternate contraction and relaxation of the longitudinal muscles on both sides. The back of the body is occupied by a crest, called the dorsal fin, consisting of a hollow ridge, the cavity of which is divided into about 250 compartments or fin chambers, into each of which, with the exception of those near the anterior and posterior end of the body, projects a stout pillar composed of characteristic laminar tissue, the fin ray. Even in external view, careful inspection will show that the body is divisible into four regions, namely, cephalic, atrial, abdominal and caudal. The segmental arrangement of the axial musculature is readily apparent through the translucent integument. The muscles are arranged in 50-75 V-shaped segmental bundles called myomeres.

Successive myomeres are separated from each other by connective tissue partitions called myosepta.



EVOLUTIONARY RELATIONSHIP



Amphioxus



- Amphioxus is interesting because it displays the basic chordate characteristics in a simple and obvious form because of its transparency.
- Amphioxus is considered to be the closest living relative of the vertebrates because it shares several characteristics with vertebrates that Urochordates do not possess.

Amphioxus characteristics shared with vertebrates



- **Characteristics Amphioxus shares with vertebrates include:**
 - Segmented myomeres (blocks of striated muscle separated by connective tissue)
 - Dorsal and ventral aortas
 - Branchial (gill) arches (blood vessels running over the gills).

Amphioxus characteristics not shared with vertebrates



- Amphioxus however **lacks** several characteristics that biologists think the ancestor of vertebrates possessed. These include:
 - **Tripartite brain** (with forebrain, midbrain and hindbrain) protected by a **cranium (skull)**
 - **Chambered heart**
 - **Closed circulatory system**
 - **Muscular gut and pharynx** (food moved through gut by **ciliary action not peristalsis**)
 - *List continues on next slide*

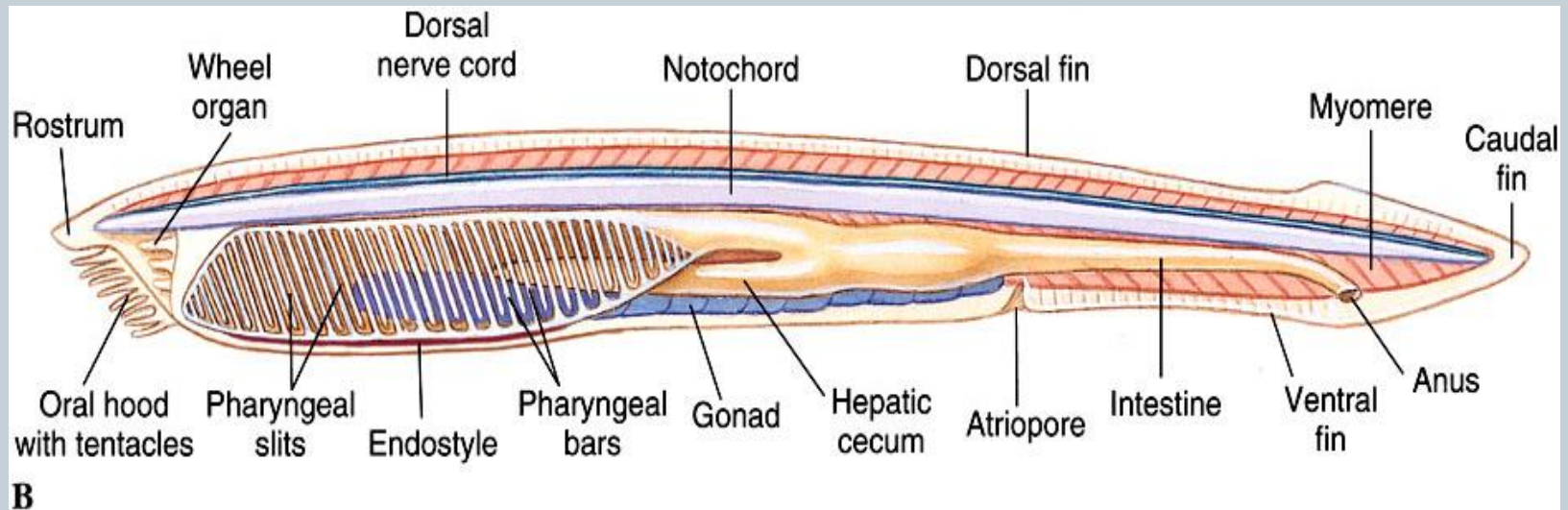
Significance of differences between amphioxus and vertebrates



- The differences between non-vertebrate chordates such as *Amphioxus* and early (and modern) vertebrates are a result of the increased **size** and **activity** of vertebrates.

Digestive system

- The large mouth lies under the rostrum and opens into a spacious buccal cavity. The mouth is surrounded by a ring of tentacle-like buccal cirri (=oral cirri). These are involved in preliminary mechanical sorting of food particles and are probably chemoreceptive as well. The roof and walls of the buccal cavity form the oral hood. The trunk contains most of the gut, including the large conspicuous pharynx and the musculature.



Circulatory system



- Lancelets have colorless blood which moves through a ventral vessel and back through a dorsal vessel



Lancelet (Branchiostoma lanceolatum).

Digital image. Web. 13 Mar. 2010.

<<http://www.daviddarling.info/images/lancelet.jpg>>.

NERVOUS SYSTEM

The cavity of the hollow nerve cord is the neurocoel. Anteriorly, the neurocoel opens to the exterior by a permanent, dorsal neuropore at the base of the rostrum.

Chemoreceptors in the neuropore monitor the water in its vicinity. The lumen of the nerve cord (neurocoel) is expanded anteriorly to form a vesicle sometimes referred to as the brain.

Ventral to the nerve cord is the notochord. It is longer, relative to the length of the body, in these animals than in any other chordate. It is longer than the nerve cord and extends well into the rostrum, presumably as an adaptation to facilitate digging into sand. The appellation "Cephalochordata" for these animals alludes to the presence of the notochord in the head. In vertebrates the notochord extends anteriorly only as far as the middle of the brain (mesencephalon). The notochord is usually yellowish in these preparations and appears to be vertically striated. It is composed of large, vacuolated, disklike epitheliomuscular cells arranged in a stiff longitudinal column and surrounded by a thick connective tissue sheath.

On the dorsal midline of the buccal cavity is a deep ciliated fossa called Hatschek's pit or Hatschek's nephridium. This is an unpaired kidney whose duct opens into the anterior pharynx. It is difficult to avoid attempting to homologize this structure with Rathke's pouch of vertebrate embryos and thus with the anterior pituitary of adult vertebrates. Hatschek's pit is also secretory and releases mucus to entrap food particles.