

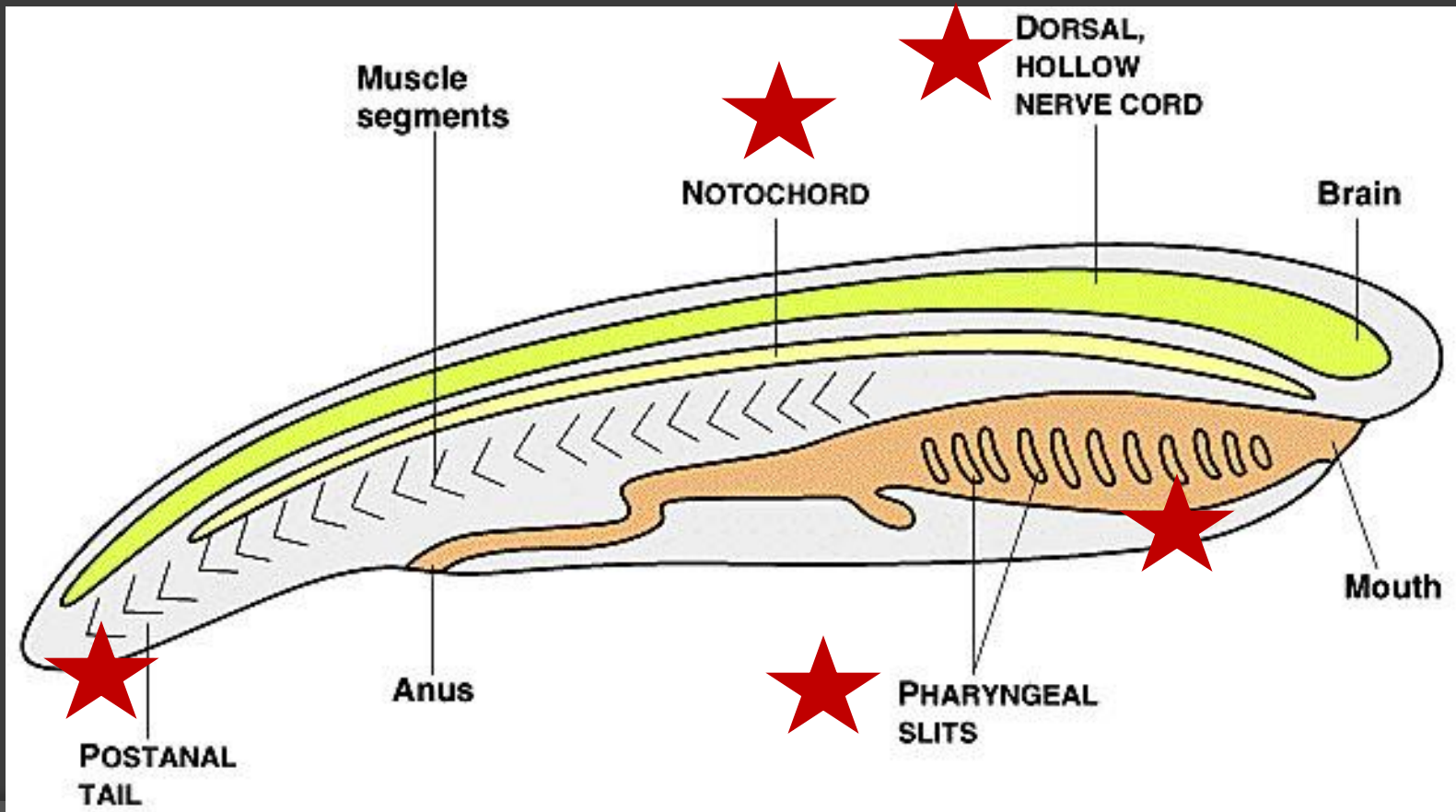
INTRODUCTION TO PHYLUM CHORDATA

Unifying Themes

1. Chordate evolution is a history of innovations that is built upon major invertebrate traits
 - bilateral symmetry
 - cephalization
 - segmentation
 - coelom or "gut" tube
2. Chordate evolution is marked by physical and behavioral specializations
 - For example the forelimb of mammals has a wide range of structural variation, specialized by natural selection
3. Evolutionary innovations and specializations led to **adaptive radiations** - the development of a variety of forms from a single ancestral group

Characteristics of the Chordates

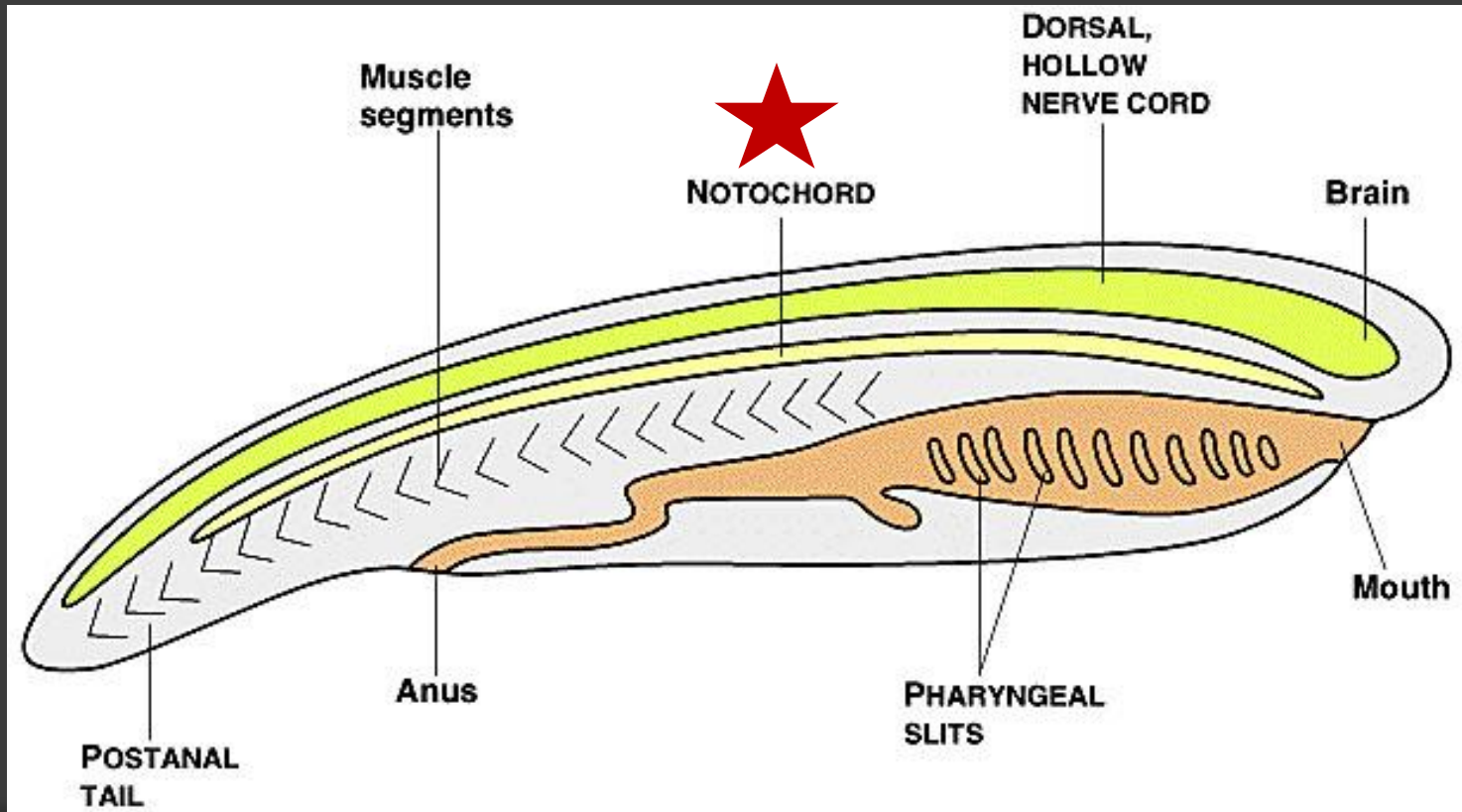
- 1. Notochord
- 2. dorsal hollow nerve cord
- 3. pharyngeal gill slits
- 4. postanal tail
- 5. endostyle



Characteristics of the Chordates

Notochord

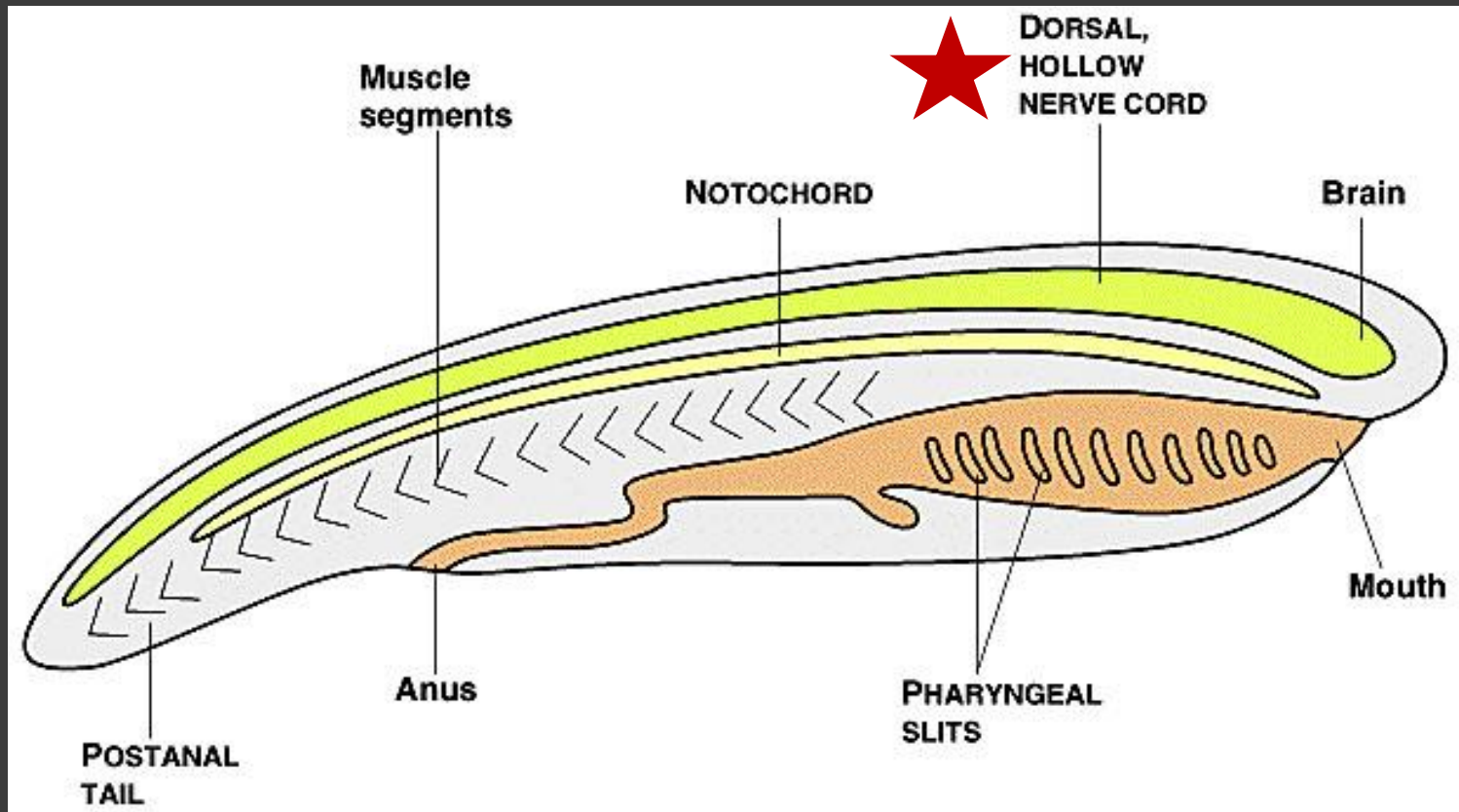
- stiff, flexible rod, provides internal support
 - Remains throughout the life of most *invertebrate* chordates
 - only in the embryos of *vertebrate* chordates



Characteristics of the Chordates cont.

Dorsal Hollow Nerve Cord (Spinal Cord)

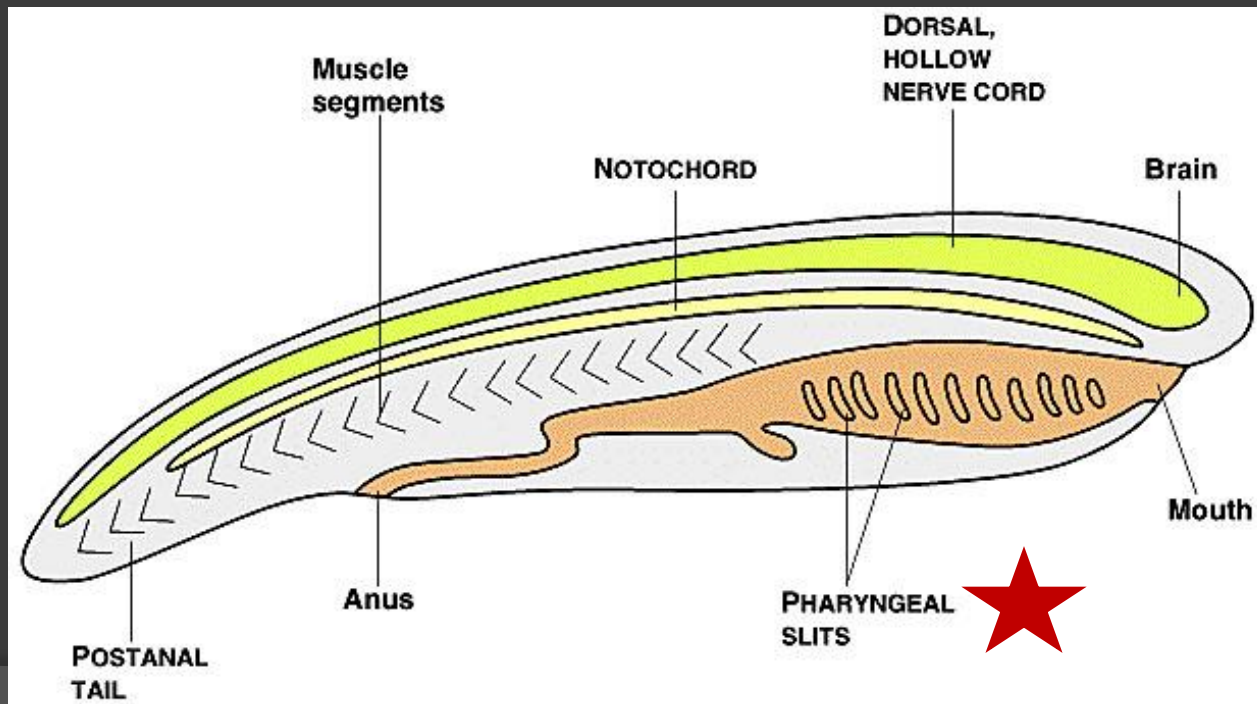
- fluid-filled tube of nerve tissue, runs the length of the animal, just dorsal to the notochord
 - Present in chordates throughout embryonic and adult life



Characteristics of the Chordates cont.

Pharyngeal gill slits

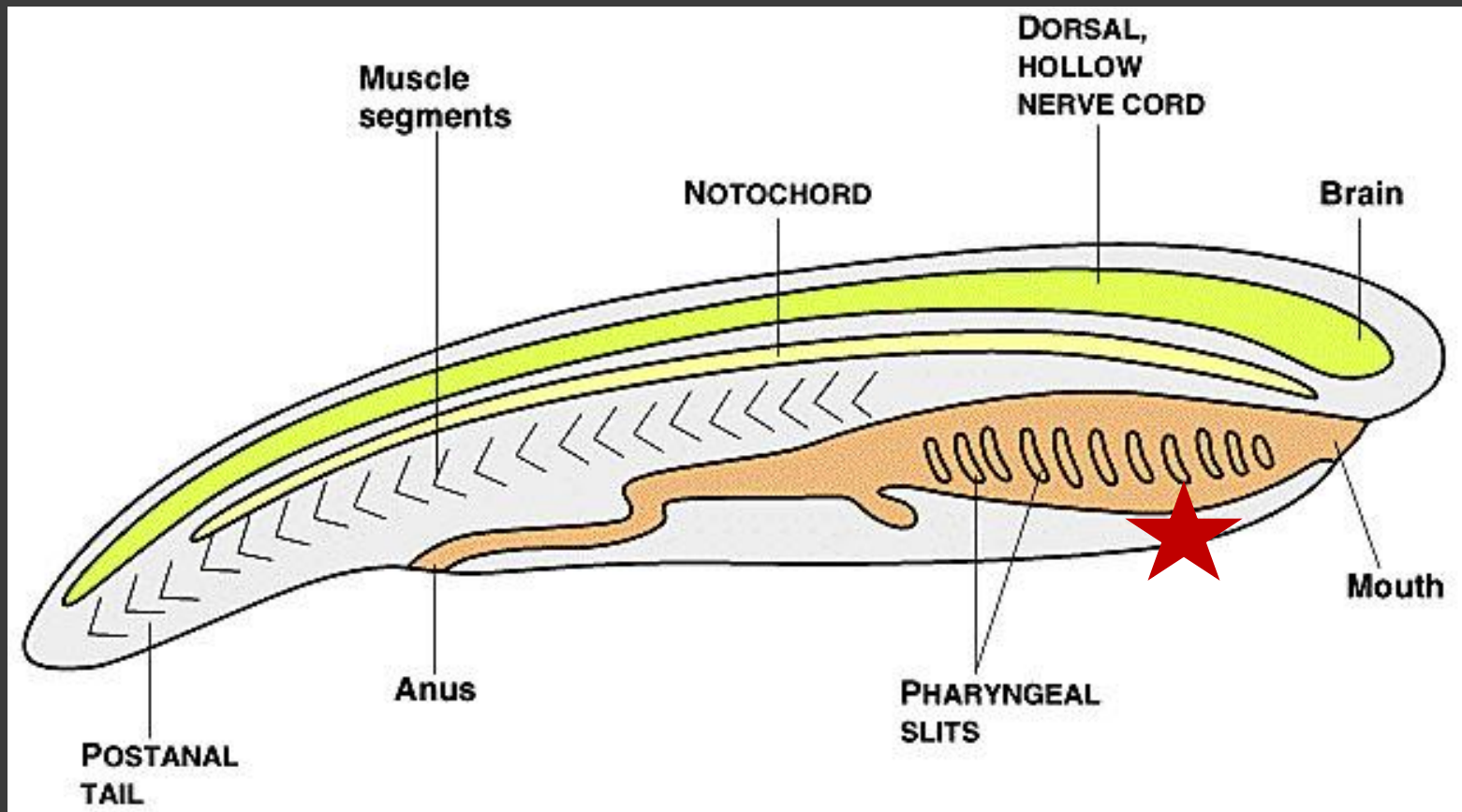
- Pairs of opening through the pharynx
 - Invertebrate chordates use them to filter food
 - In fishes the gill slits develop into true gills
 - In reptiles, birds, and mammals the gill slits are vestiges (*occurring only in the embryo*)



Characteristics of the Chordates cont.

Endostyle

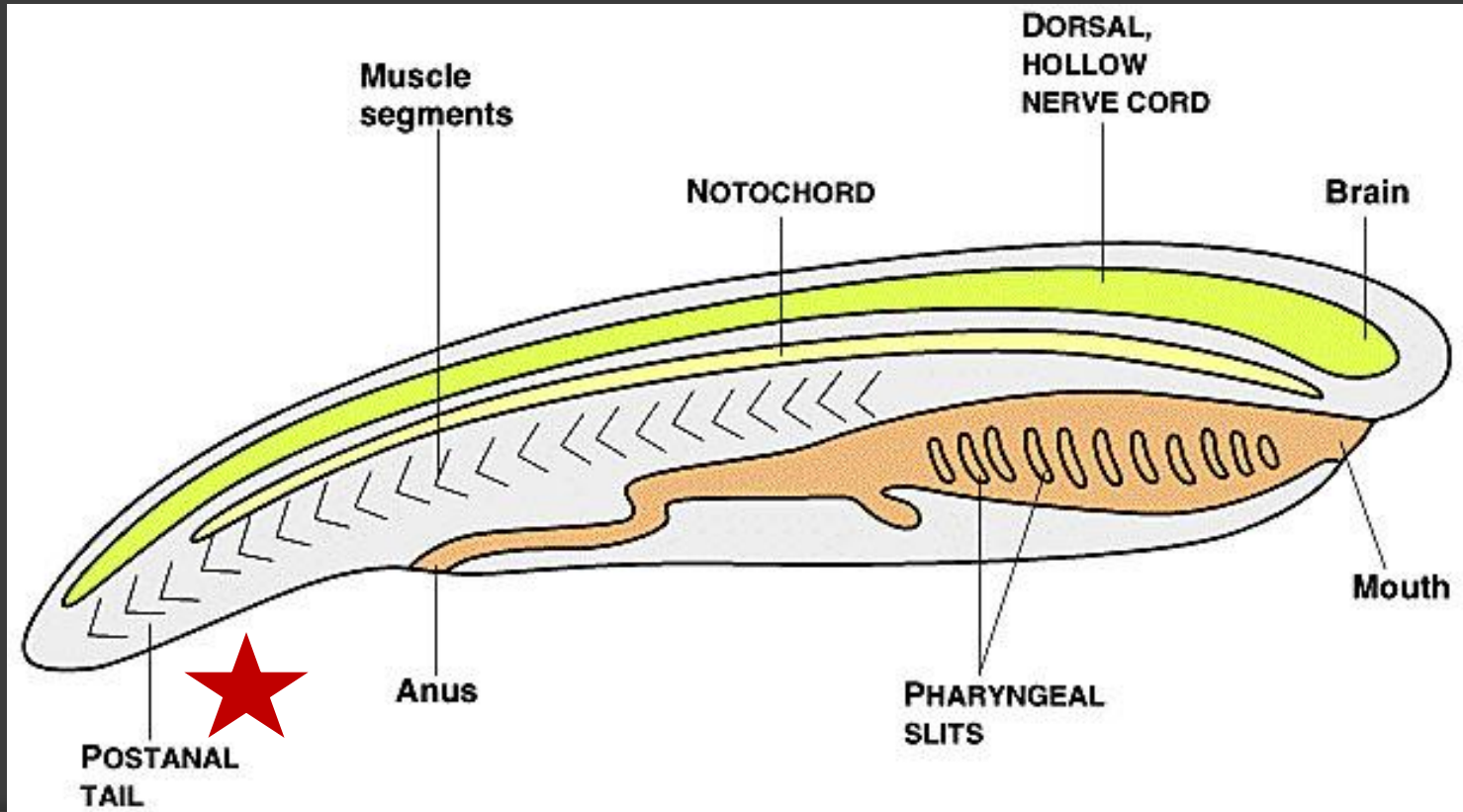
- mucous secreting structure found in the pharynx floor (traps small food particles)



Characteristics of the Chordates cont.

Postanal Tail

- works with muscles (myomeres) & notochord to provide motility & stability
- Aids in propulsion in nonvertebrates & fish but vestigial in later lineages

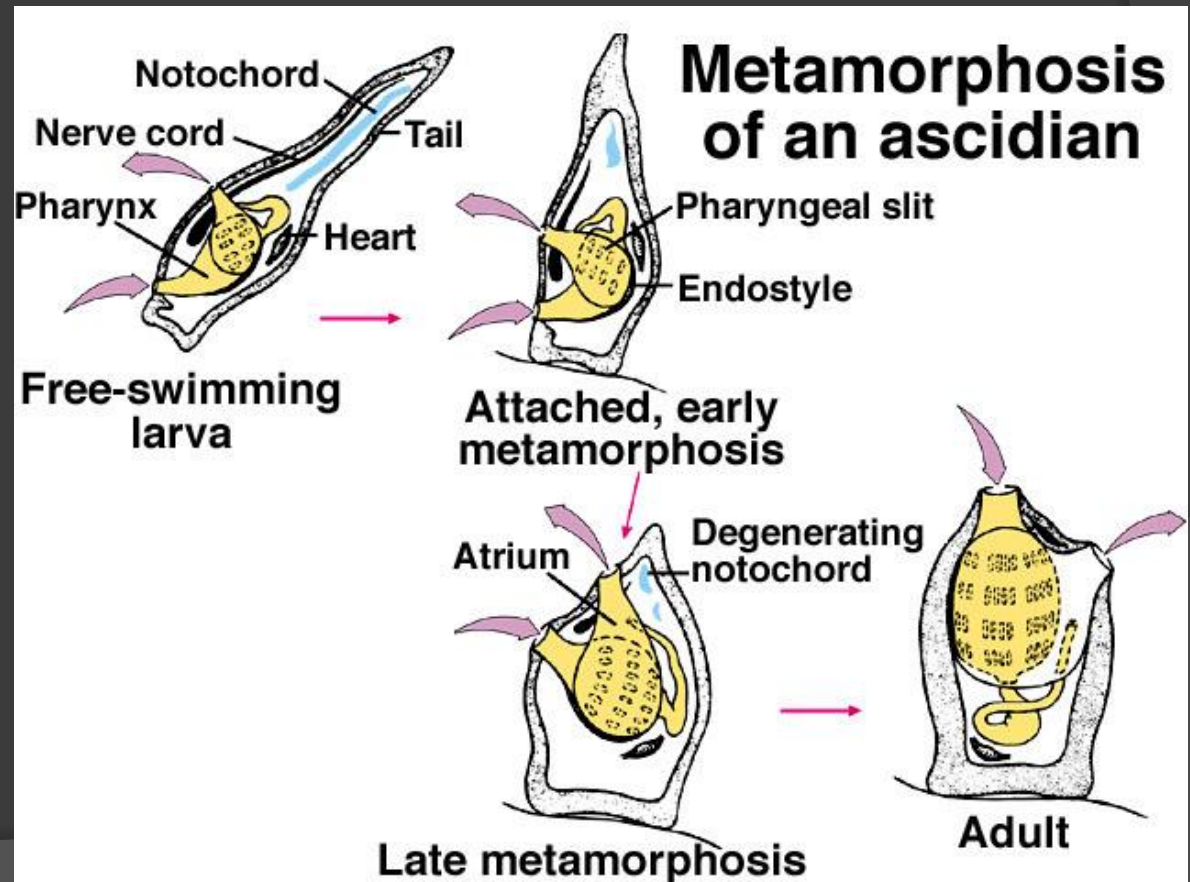


INVERTEBRATE CHORDATES

SubPhylum Urochordata

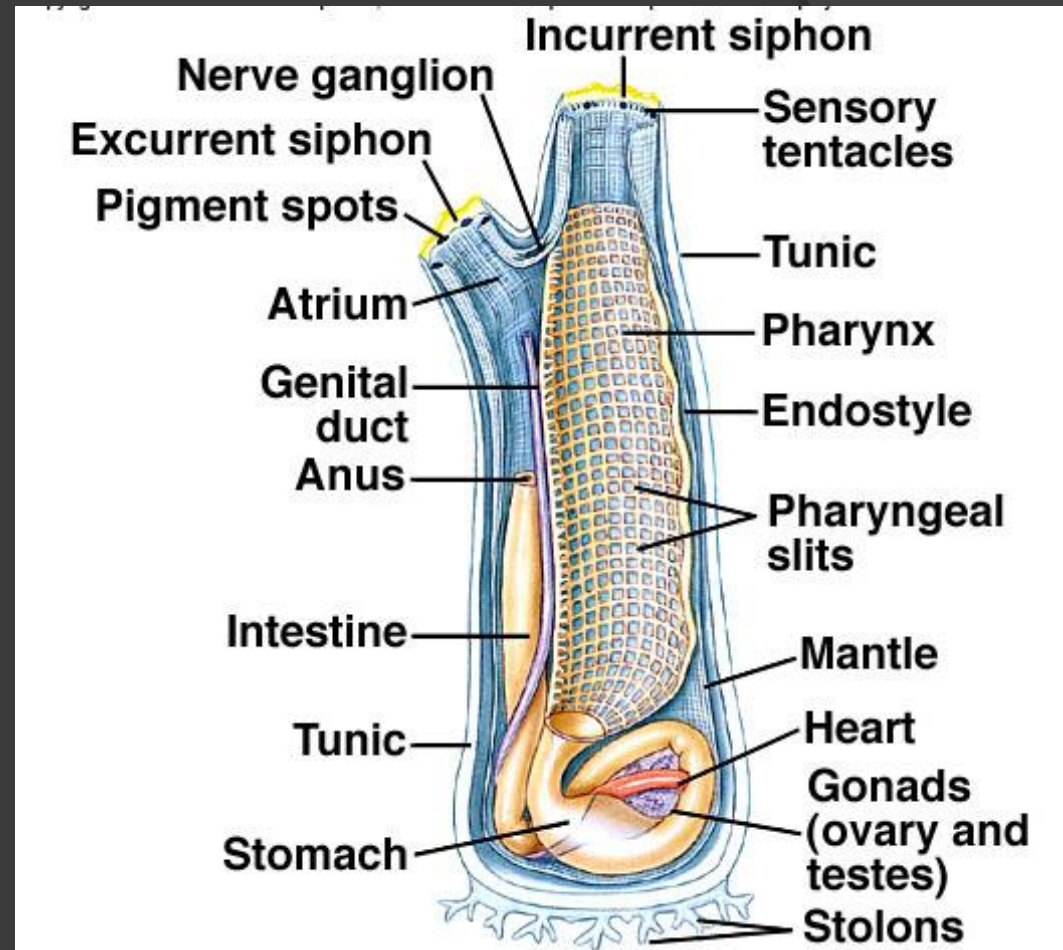
Ex: tunicates or sea squirts

- Sessile as adults, but motile during the larval stages
- Possess *all 5* chordate characteristics as larvae
- Settle head first on hard substrates and undergo a dramatic metamorphosis
- *tail, notochord, muscle segments, and nerve cord disappear*



SubPhylum Urochordata cont.

- Adult body is covered by an outer envelope or **tunic**
- Tunic encloses a basket-like **pharynx**, that is perforated by gill slits



- **Tunicates** are filter feeders; plankton is trapped in a sheet of mucus and cilia direct the food-laden mucus to the stomach
- Water leaves the animal via an excurrent siphon

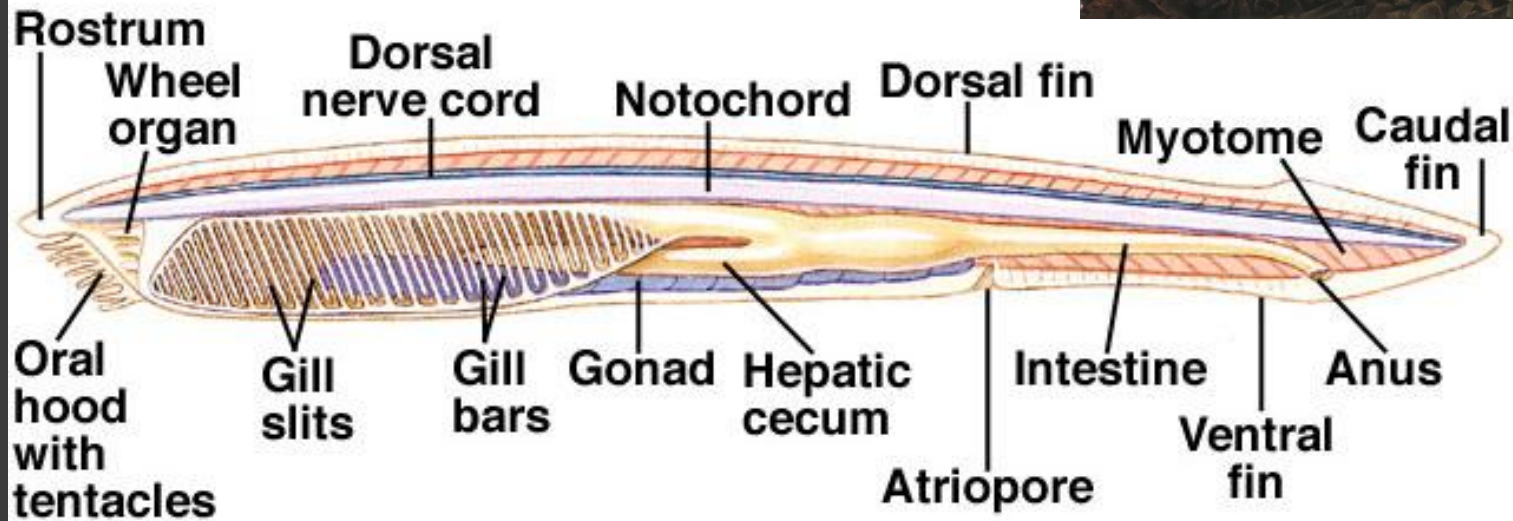
Chordate Metamerism

- Body segmentation (i.e. metamerism) appears to have evolved in two lineages of the chordates:
 - Cephalochordates and Vertebrates
 - probably occurred after divergence from the Urochordates
- However, segmentation in the chordates does not involve the coelom
- The cephalochordates and the chordates movement is accomplished by contraction of muscle fibers that are arranged in segmented blocks - myotomes
- Presumably, segmentation of muscles developed as an adaptation for undulatory swimming and rapid burrowing

SubPhylum Cephalochordata

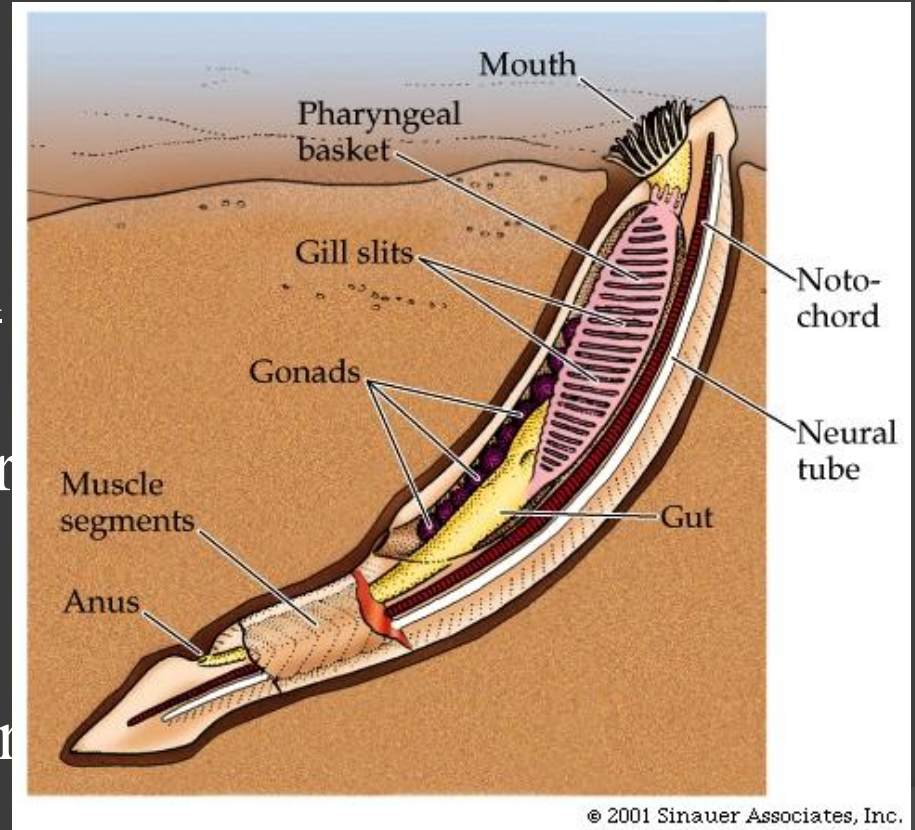
Ex: amphioxus and lancelets

- Exclusively marine animals
- Although they are capable of swimming, they usually are buried in the sand with only their anterior end being exposed



SubPhylum Cephalochordata cont.

- chordate characteristics are present throughout life
- filter feeder: oral hood is lined with a cilia wheel organ
- cilia, plus cilia in the pharynx help generate a water current
- feed by secreting a mucous net across the gill slits to filter out food particles that are present in the water.



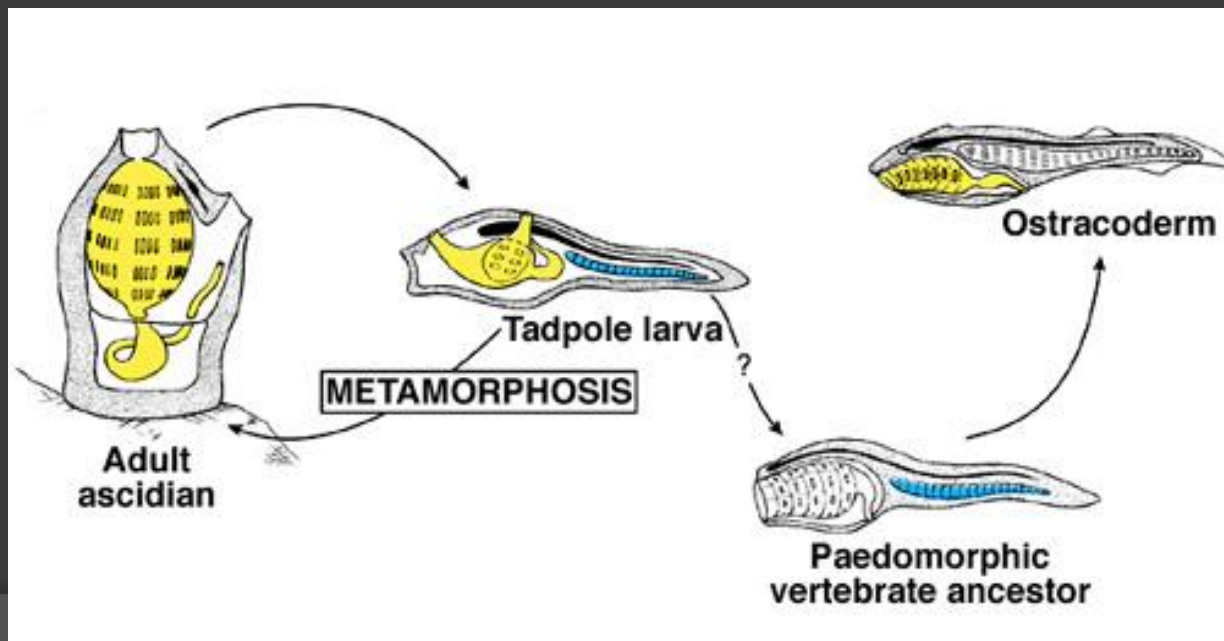
**SUBPHYLUM
VERTEBRATA**

General Characteristics - Vertebrata

- Exhibit all 5 chordate characteristics at sometime in their life
- Usually well *cephalized*, including a well developed brain and anterior sensory structures
- Brain is usually encased in a *skull*, made of hard bone or a cartilage.
- In most vertebrates, the embryonic notochord is replaced by a *vertebral column*.
- Possess a *distinctive endoskeleton* consisting of vertebral column, limb girdles, two pairs of jointed appendages, and a head skeleton
- *Muscles* are attached to the skeleton to provide movement
- Often have a muscular perforated *pharynx*
- *Closed circulatory system* with a well developed muscular heart; blood is oxygenated as it flows through vascularized skin, gills or lungs.

Evolutionary Relationships of the Vertebrates

- Speculations regarding vertebrate ancestry have focused on living cephalochordates and tunicates
- One hypothesis on the evolution of the vertebrates is **Garstang's Hypothesis**
 - sessile tunicates evolved a motile larval stage
 - the larvae failed to metamorphose into an adult, but developed gonads and reproduced in the larval stage
 - continued larval evolution a new group of free swimming animals evolved
- Garstang called this process **paedomorphosis**, a term that describes the evolutionary retention of juvenile or larval traits in the adult body



The above phylogeny reflects the evolutionary history of vertebrates

