

# Chordata



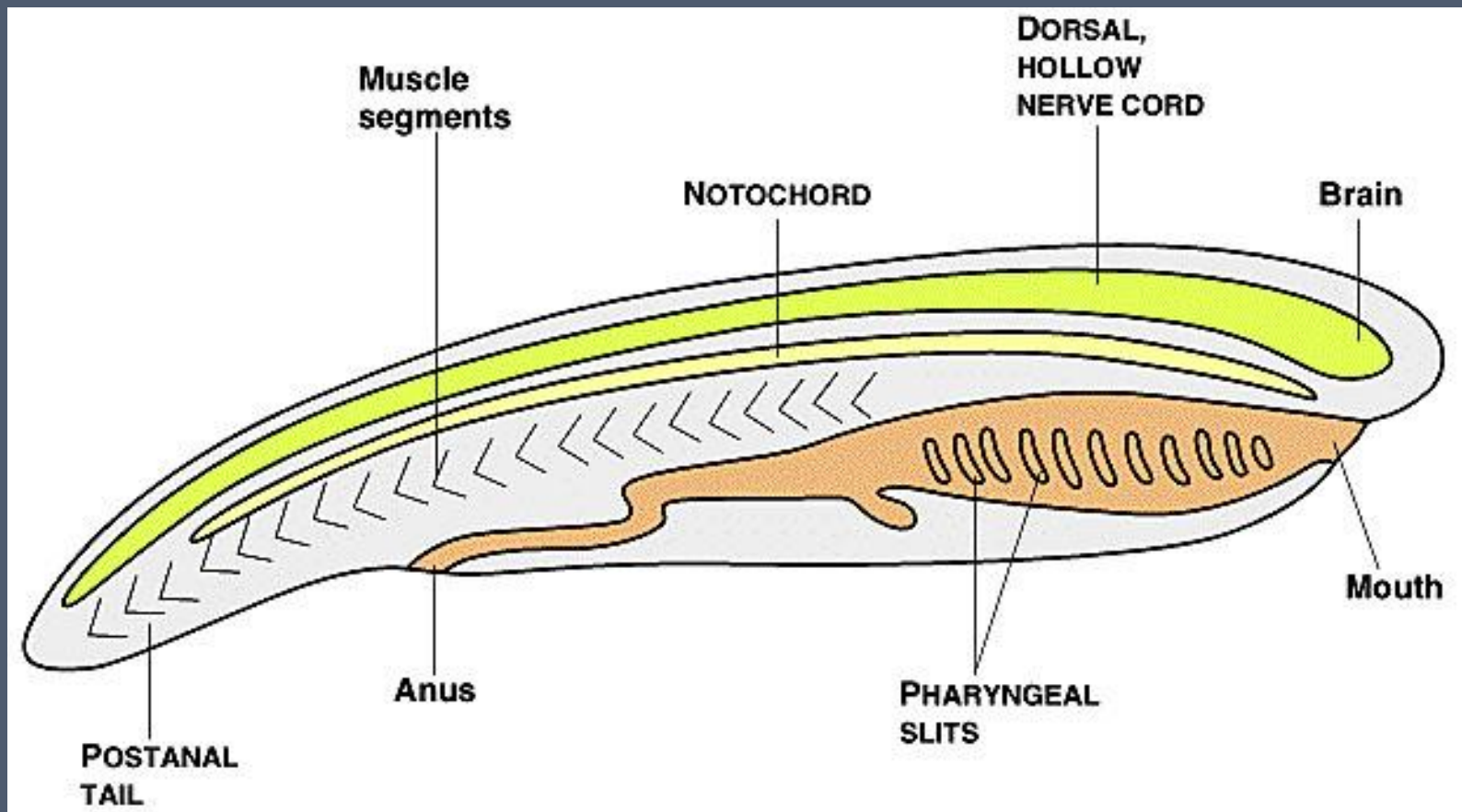
# The Major Groups

- Invertebrate Chordates
- Fishes
  - Class: Agnatha
  - Class Chondrichthyes
  - Class Osteichthyes
- Class: Amphibia
- Class: Reptilia
- Class: Aves
- Class: Mammalia

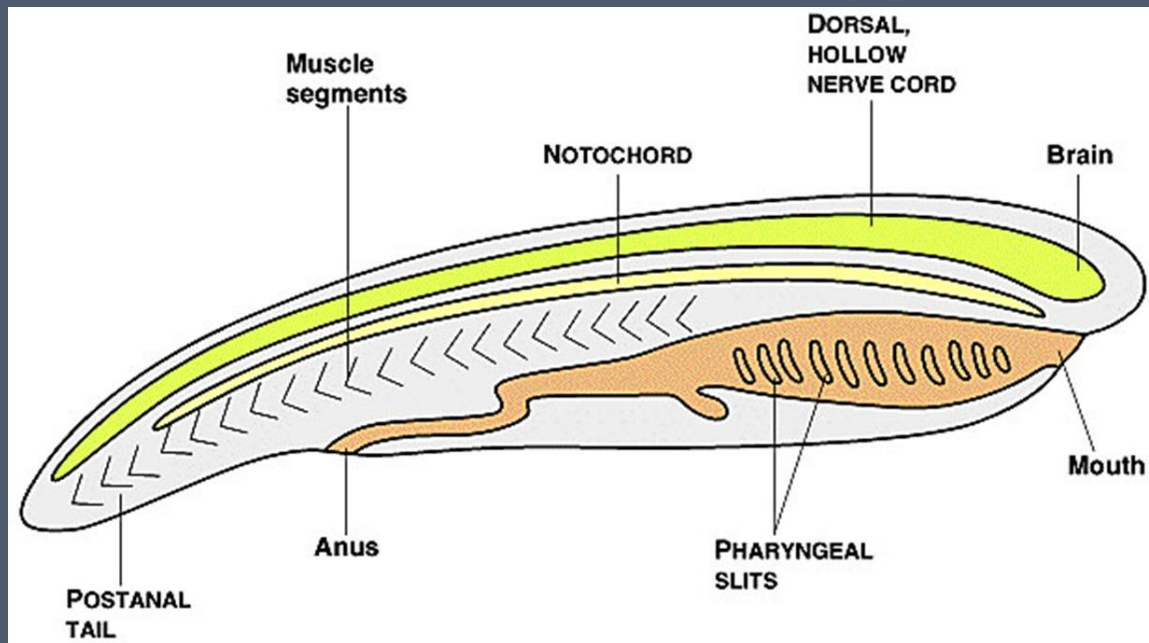


# Body Plan of the Chordates

- Notochord, dorsal hollow nerve cord, pharyngeal gill slits, blocks of muscle, post-anal tail

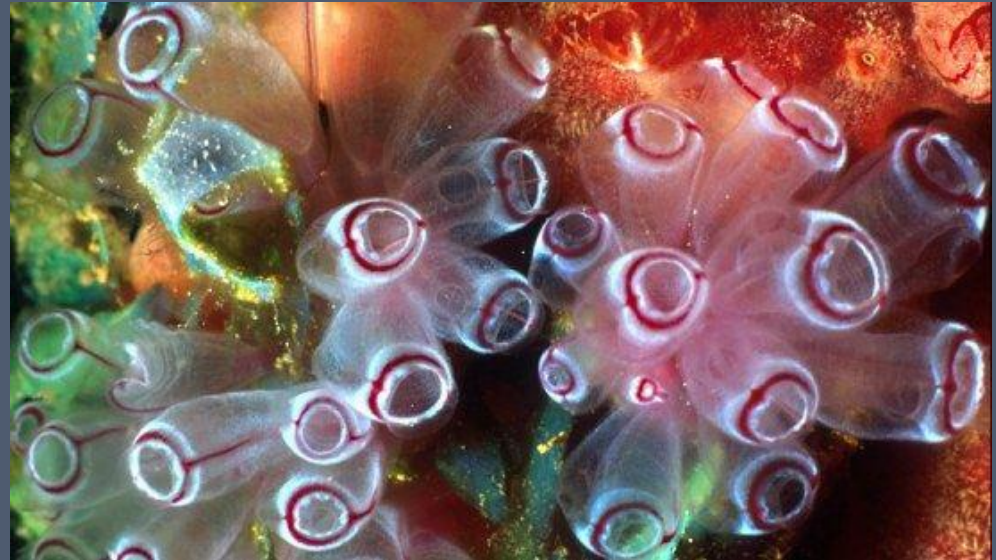


- **notochord** –reinforces body shape
  - **dorsal hollow nerve cord**—modified into brain and spinal cord
  - **pharynx** (feeding “basket”) with pharyngeal gill slits - at least in embryo
    - develop into true gills in fishes, are vestigial (not found in adult form—leftover from evolution)
- segmented musculature and post-anal tail**



# Lower Chordates

- Several subphyla are invertebrates (i.e. lack a skeleton)
- Probably evolved from ancient sea anemones
  - Urochordates
    - Tunicates
  - Cephalochordates
    - Lancets

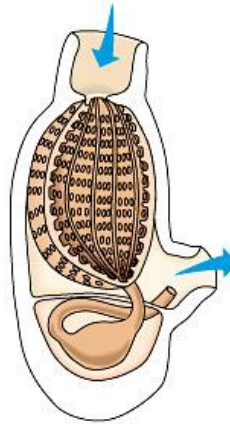


# Tunicates

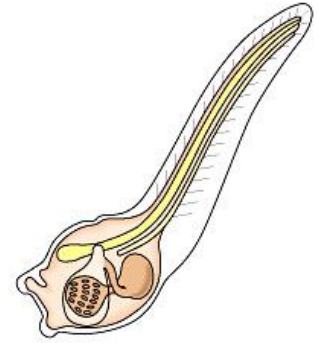
- “tail chordates”
  - notochord only in tail
- Example: sea squirts
- adult loses chordate body plan and becomes a sessile filter feeder or predator
- Breathe using gill slits
- Closed circulatory system with vanadium-rich blood
- Full digestive system with an endostyle for waste
- Hermaphrodites, External



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Adult

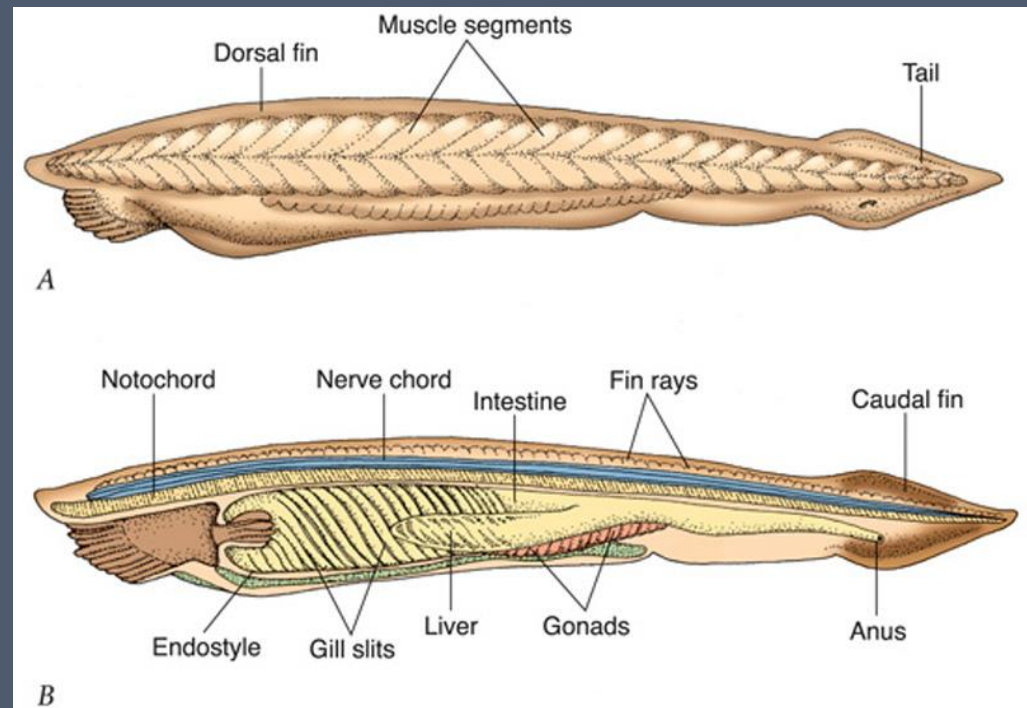


Larva



# Cephalochordates

- “head chordates”
- Example: *amphioxus*
- adults can swim
- Feeding: filter food  
endostyle secretes mucus into gills
- breathe using gill slits
- excretion = kidneys
- Circulation = closed, but no heart or blood cells
- external fertilization



<u>Phylum:</u>	<u>Chordates</u>
Examples/Habitat	<i>Invertebrates (Tunicates, Cephalochordates, Urochordates), Fish, amphibians, reptiles, birds, mammals</i>
Body Plan (symmetry, special cells)	Notochord, dorsal hollow nerve cord, pharyngeal gill slits (at some point in life), blocks of muscle, post-anal tail
Feeding	All groups
Respiration	<u>Gills</u> , skin, some times <u>lungs</u> used for breathing
Circulation	Closed system, aortic arches, dorsal and ventral vessels
Excretion	Digestive waste excreted through anus—complete digestive tract
Movement and Response	All have dorsal <u>nerve cords</u> , some have simple eyes and chemical receptors, many have very complex systems Muscles and skeleton allow directional movement
Reproduction	Most have male and female sexual reproduction, some are hermaphroditic
Human Concerns	



# Subphylum Vertebrata

Fill all habitats and all feeding types

Fossilized skeleton of *Diplodocus carnegii*



# Vertebrate Chordates

- Follow basic developmental pattern of chordate anatomy
- Have a backbone made up of vertebrae which protects the notochord
- Endoskeleton for support & growth

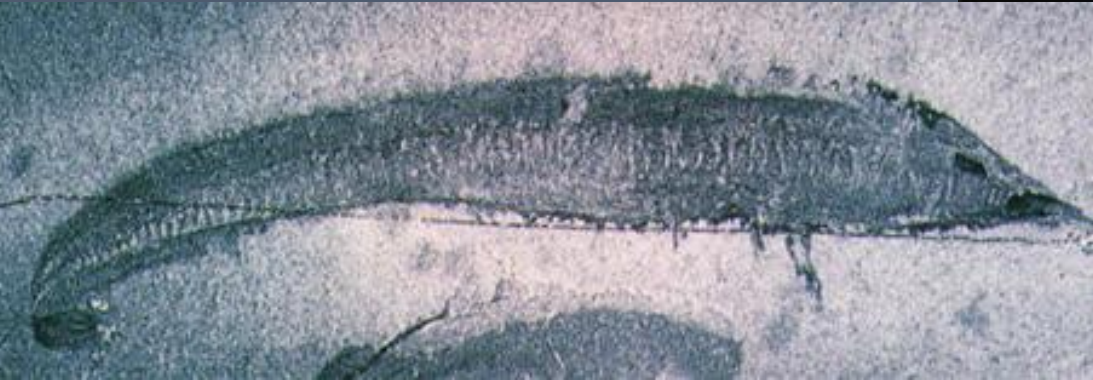


# Body Plan

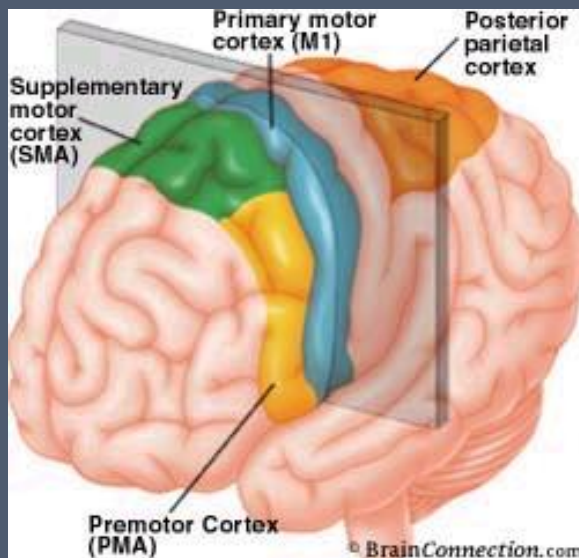
- Usually well **cephalized**, including a well developed brain and a number of anterior sensory structures
- Brain is usually encased in a **skull** In most vertebrates
- the embryonic notochord is replaced by a **vertebral column.**
- **endoskeleton** consisting of vertebral column, limb girdles
- **two pairs of jointed appendages**, and a head skeleton
- **Muscles** are attached to the skeleton to provide movement

# Evolutionary Relationships of the Vertebrates

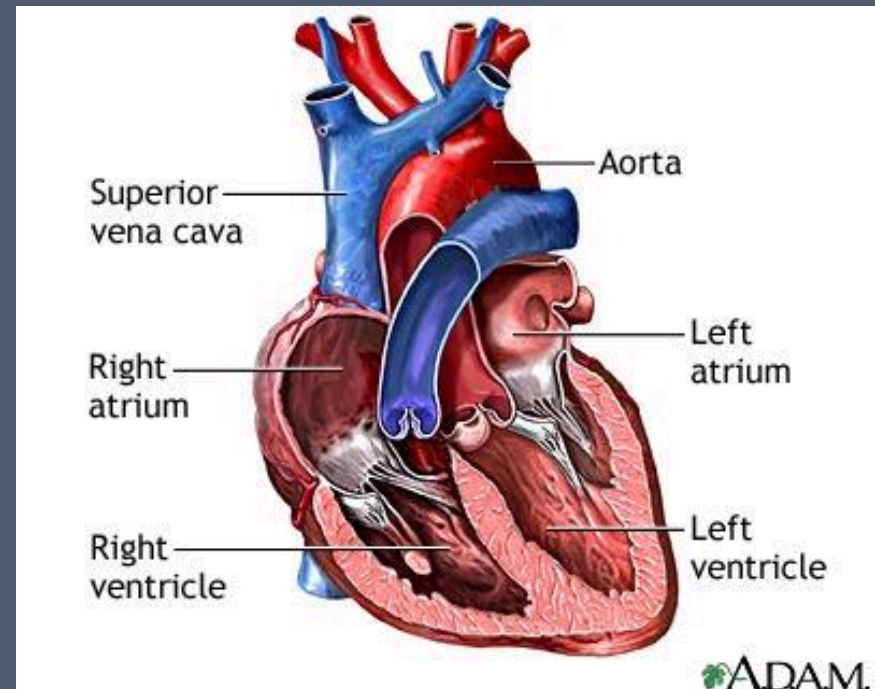
- Earliest vertebrate fossils (jawless ostracoderm fishes; 500 mya) share many of the novel structures observed in the living vertebrates
- Fossilized mid-Cambrian invertebrate chordate from the Burgess Shale formation - *Pikaia*
- A ribbon shaped, somewhat fish-like creature about 5 cm in length
- It possessed a notochord and the V-shaped muscles



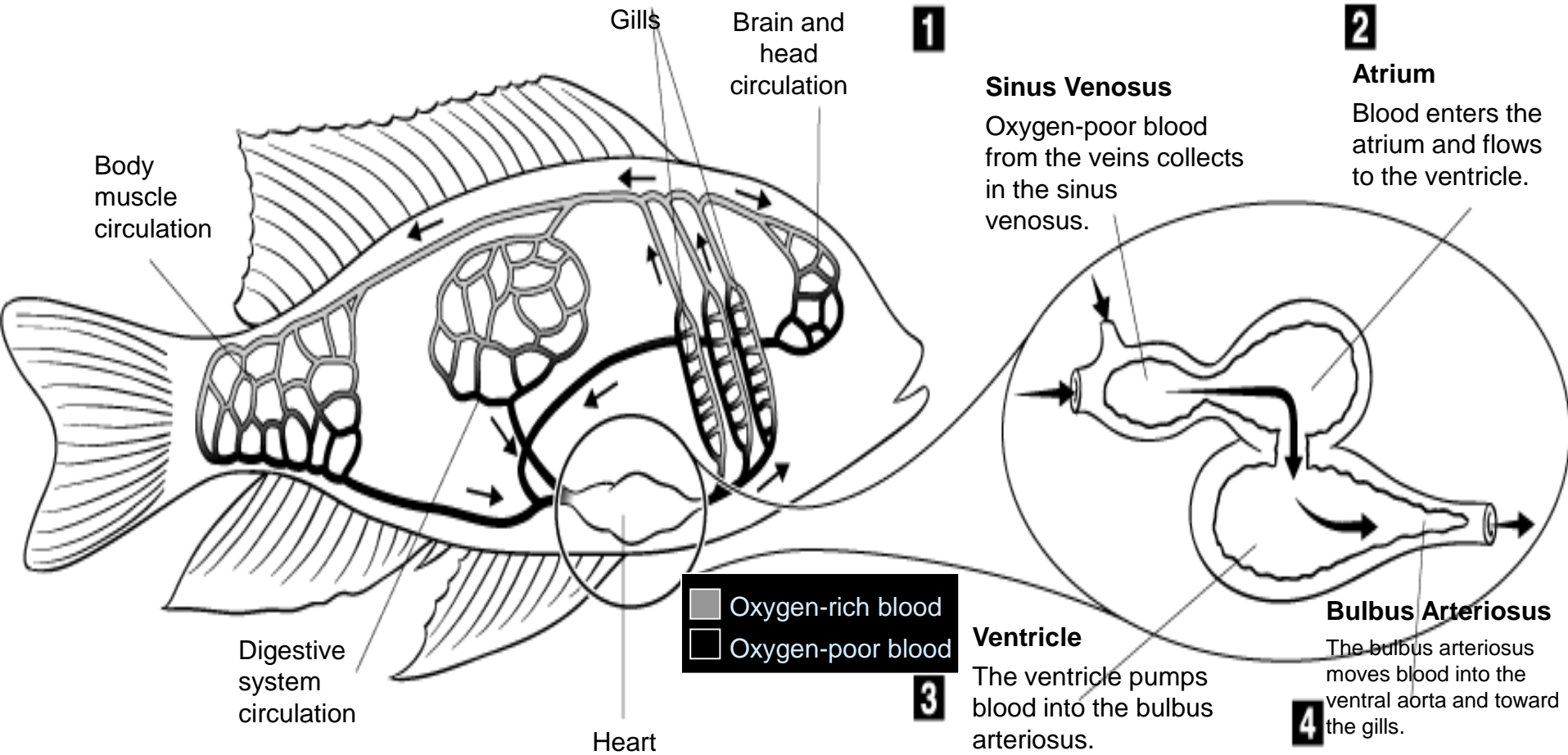
- Well-developed sensory organs
- Brain enclosed in a skull (cephalization)



- Closed circulatory system, with a multi-chambered heart



# Circulation in Fish



Fish have a **two-chambered** heart

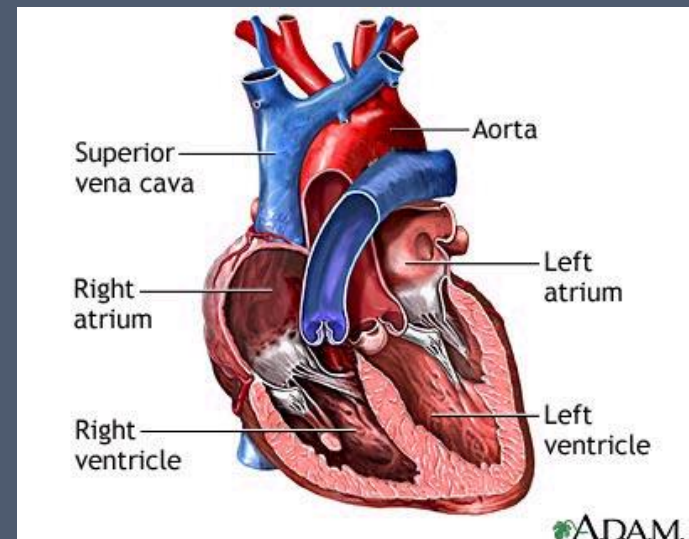
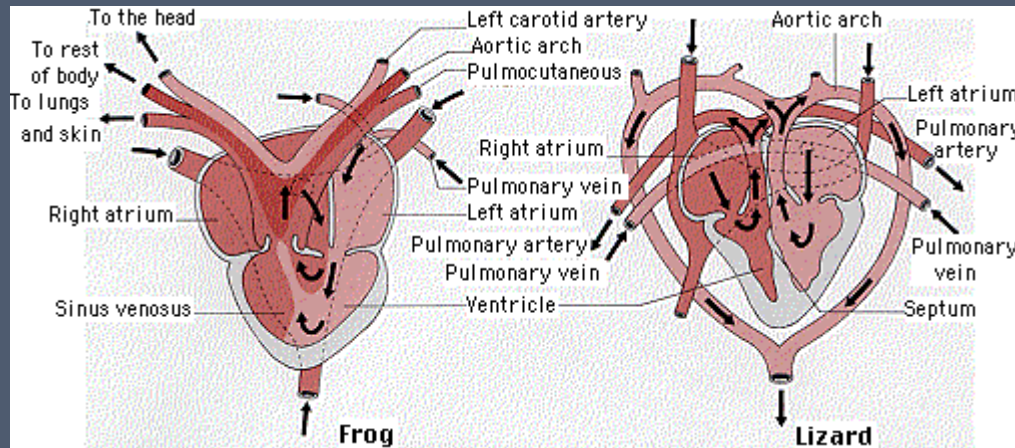
# Circulation in Amphibians, Reptiles & Mammals

- **Three-chambered heart**

- Amphibians + some reptiles

- **Four-chambered heart**

- Birds + mammals



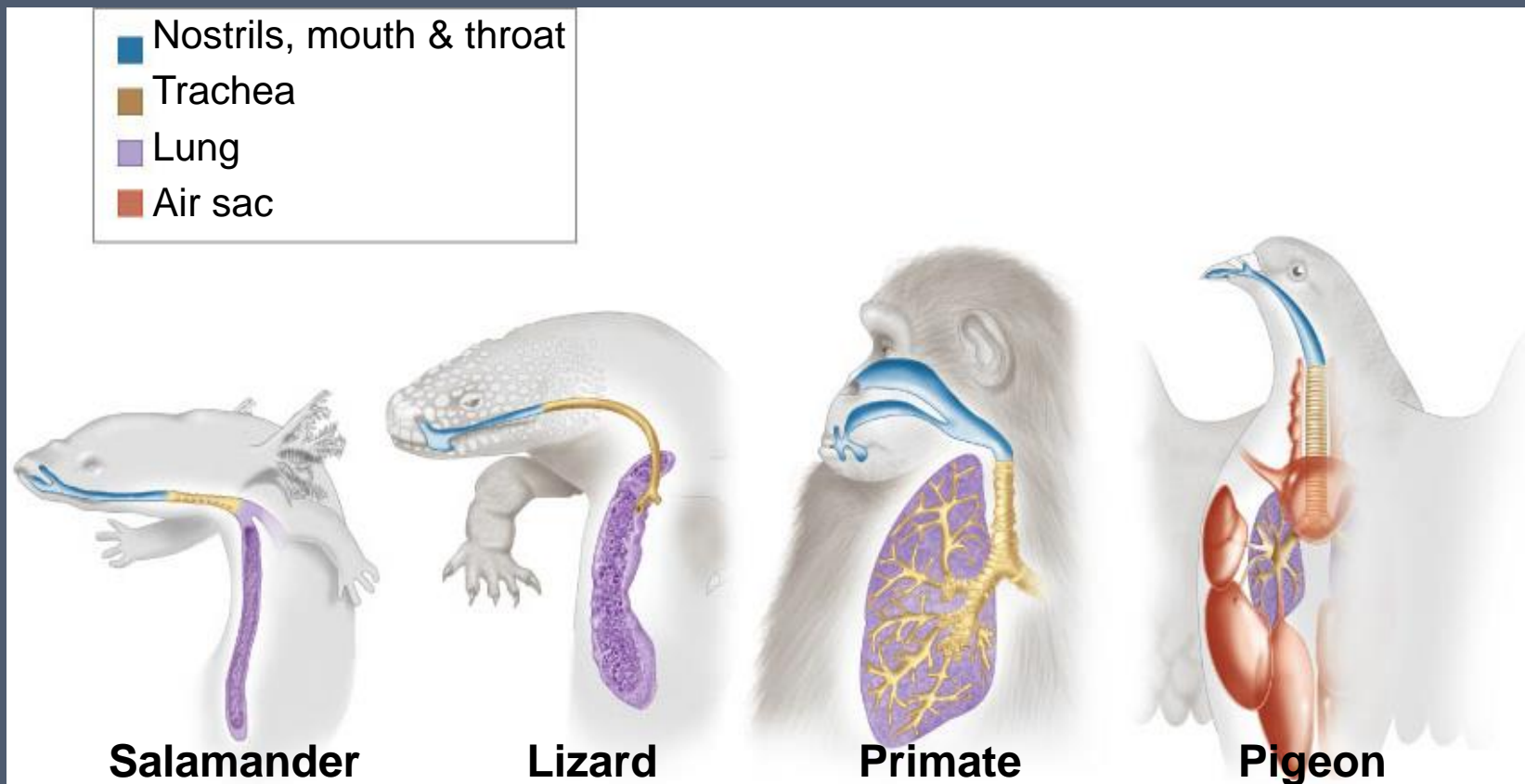
# Respiratory Strategies

- **External Gills**

- Fish, some Amphibians

- **Internal Lungs**

- Amphibians, Reptiles, Birds, Mammals





# Temperature Regulation

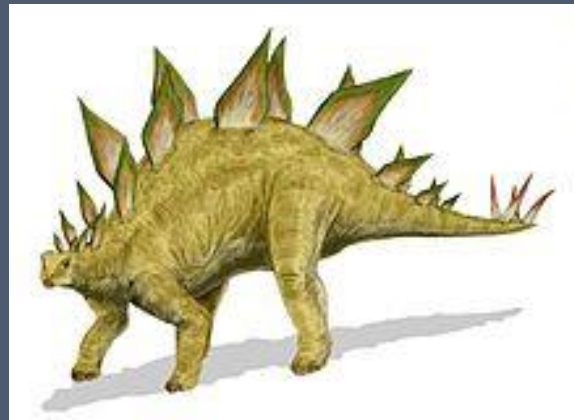
## Ectotherms

- Temperature is regulated by their external environment
- Ex. Fish, Amphibians, Reptiles



## Endotherms

- Temperature is regulated by internal processes
- Ex. Birds, Mammals, possibly Dinosaurs



# Reproductive Strategies

- **External Fertilization**
  - Oviparous (hatch from egg)
  - Requires aquatic environment

Ex. Fish, Amphibians



- **Internal Fertilization**
  - Oviparous or Ovoviviparous (eggs hatch inside mother ex: snakes)
  - Hard, water-resistant shell (does not require aquatic environment)

Ex. Reptiles, Birds

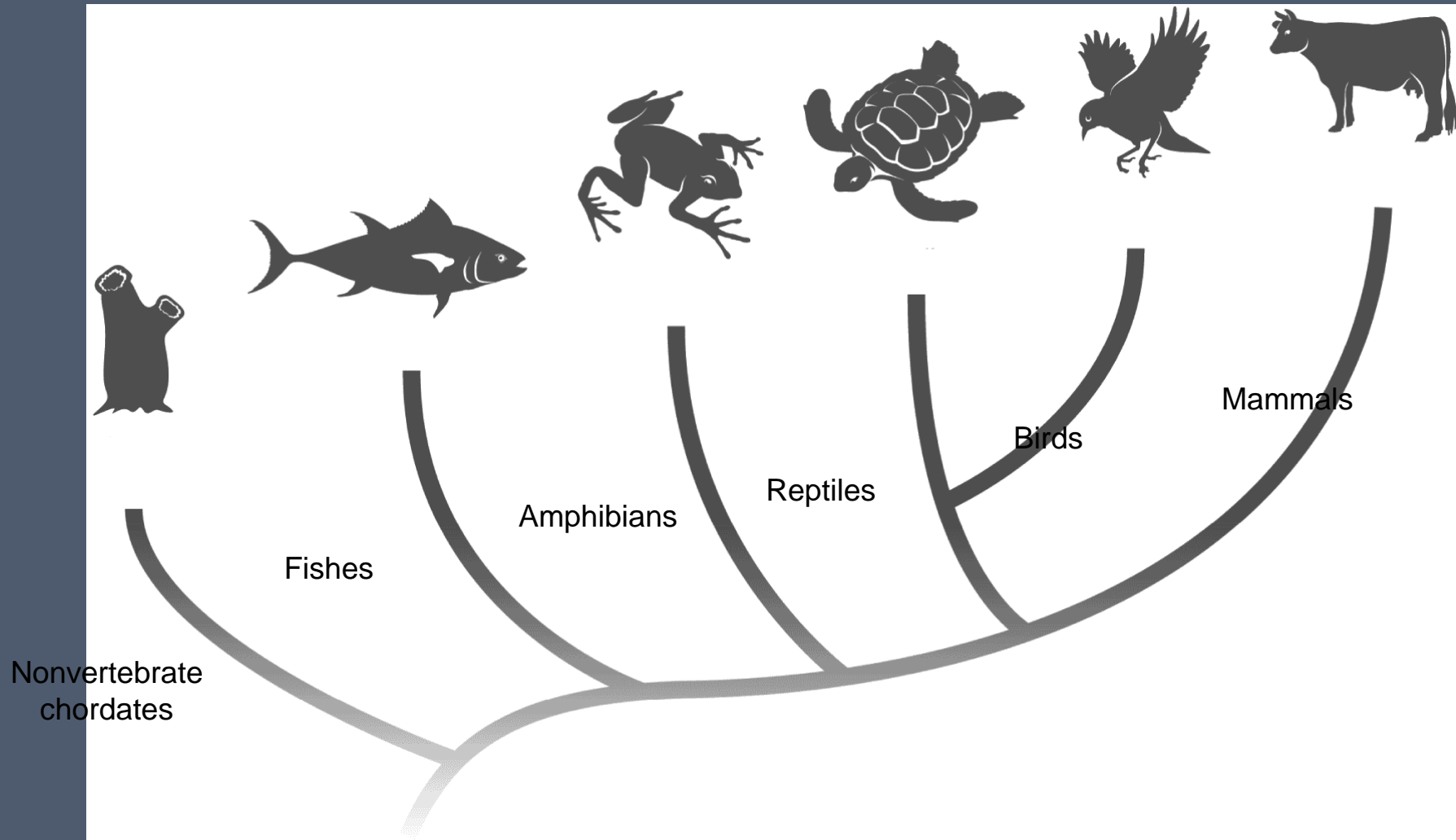


# Reproductive Strategies (cont.)

- Viviparity = “live birth”
  - Fully internal reproduction
  - Embryo gets food from mother
  - Live birth
    - Ex. Mammals + Marsupials



Monotremes =  
mammals that lay eggs  
Duck-Billed Platypus!



Invertebrate ancestor