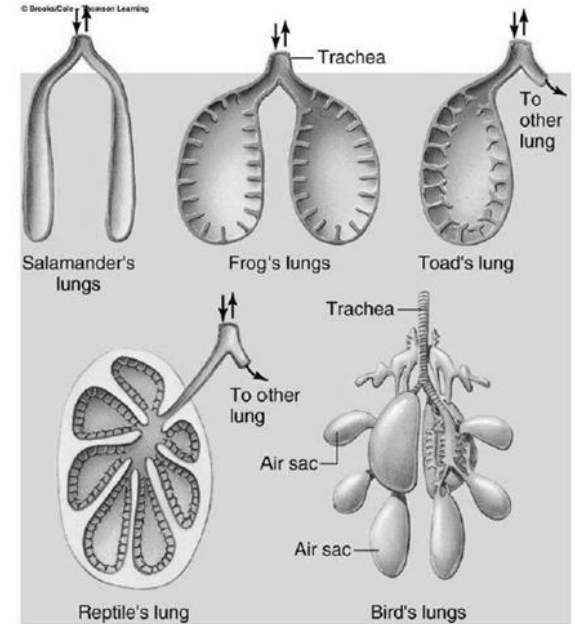
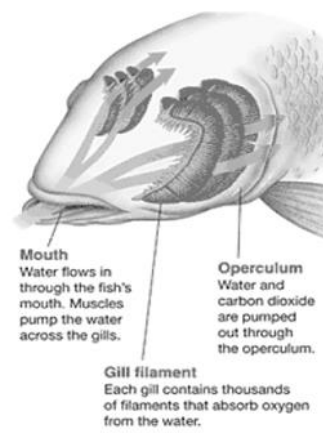
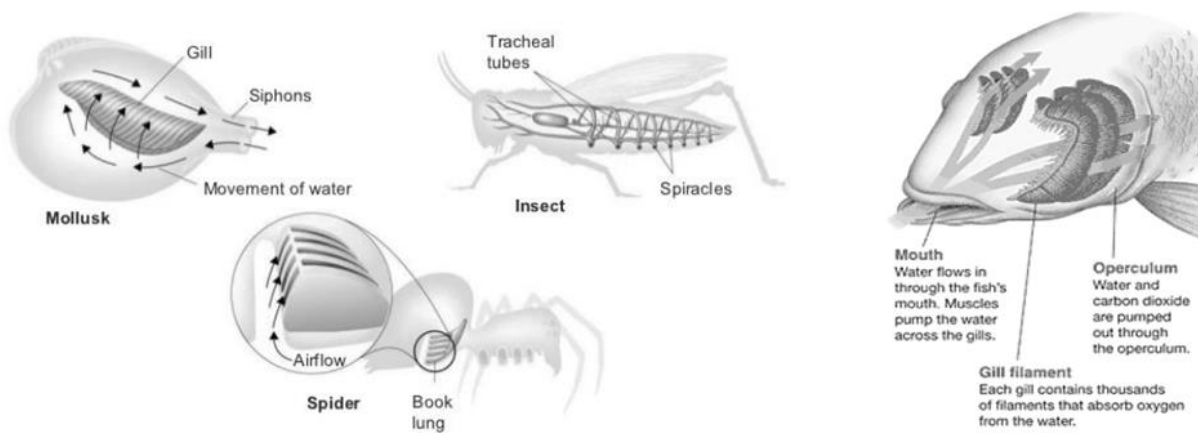


# Comparative Anatomy of Invertebrates and Vertebrates

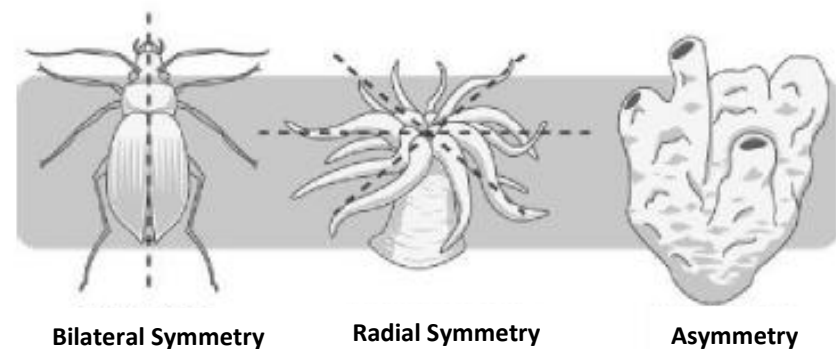
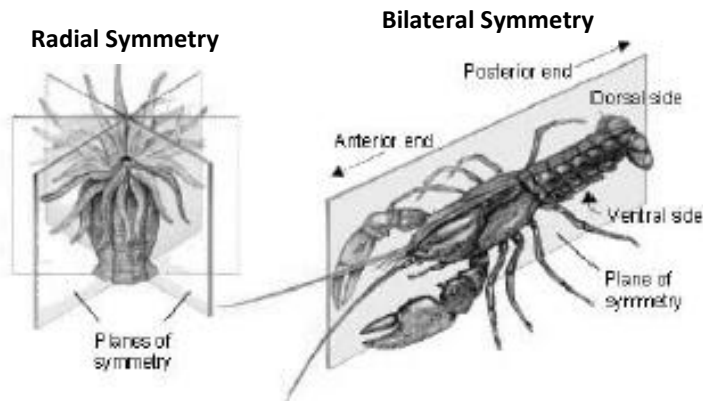
## Respiratory Systems



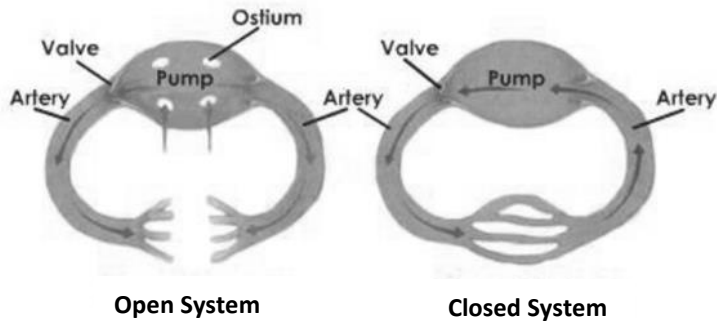
### Respiratory Systems:

- Cnidarians diffuse Oxygen directly into cells
- All worms diffuse Oxygen through their skin
- Spiders (arthropods) have stacked tissue like pages in a book
- Fish and amphibians use gills when young, lungs as adults
- Birds, reptiles and mammals use lungs

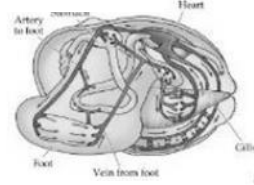
## Symmetry



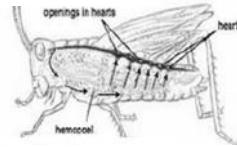
# Circulatory Systems



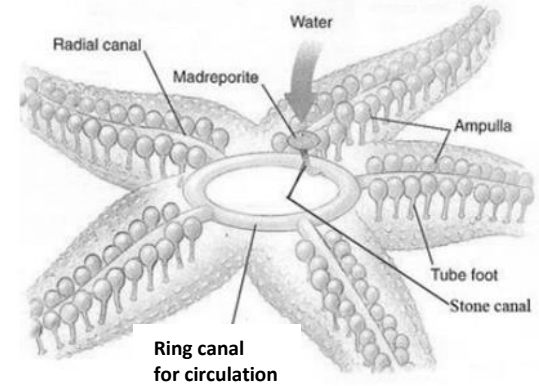
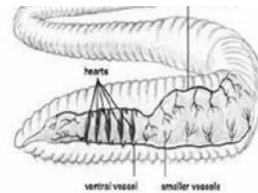
## Open System Mollusk



## Arthropod

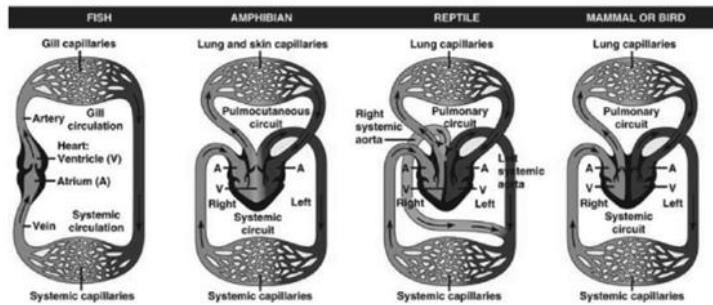


## Closed System Annelid

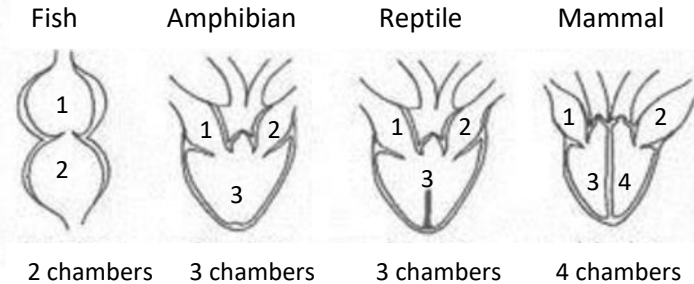


Echinoderms have a very unusual circulatory system. They **do not pump blood** around their bodies. Instead, they use seawater and a complex water vascular system to keep things moving. Their tube feet, also used for movement, are an important part of this circulatory system.

## Closed Circulatory System:



## Hearts



## Circulatory Systems:

Porifera and Cnidaria have no circulatory system

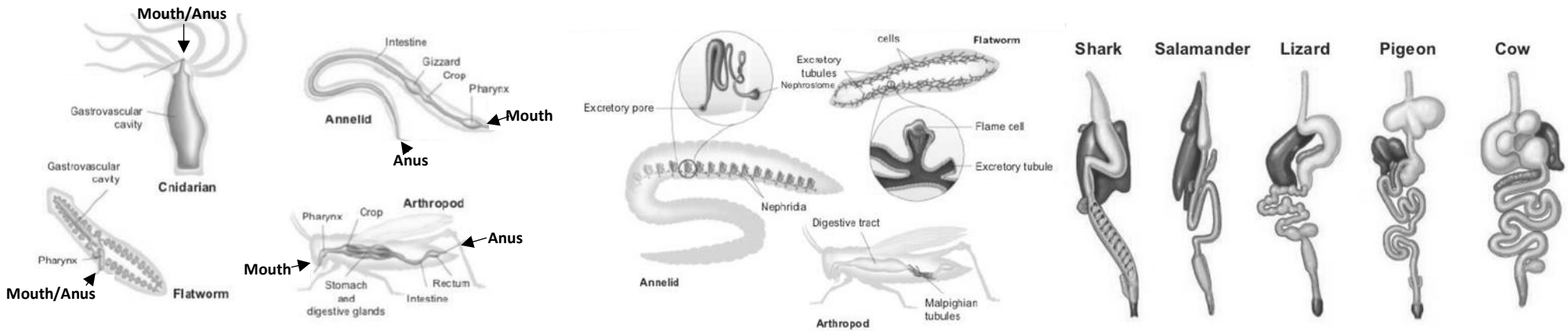
Platyhelminthes, Nematodes and Arthropods have an open circulatory system – blood is pumped directly into the body cavity

Simple mollusks have an open circulatory system, more complex have a closed system

Echinoderms pump saltwater in a closed system (no blood)

Chordates have a closed system (pump and vessels)

## Digestive Systems



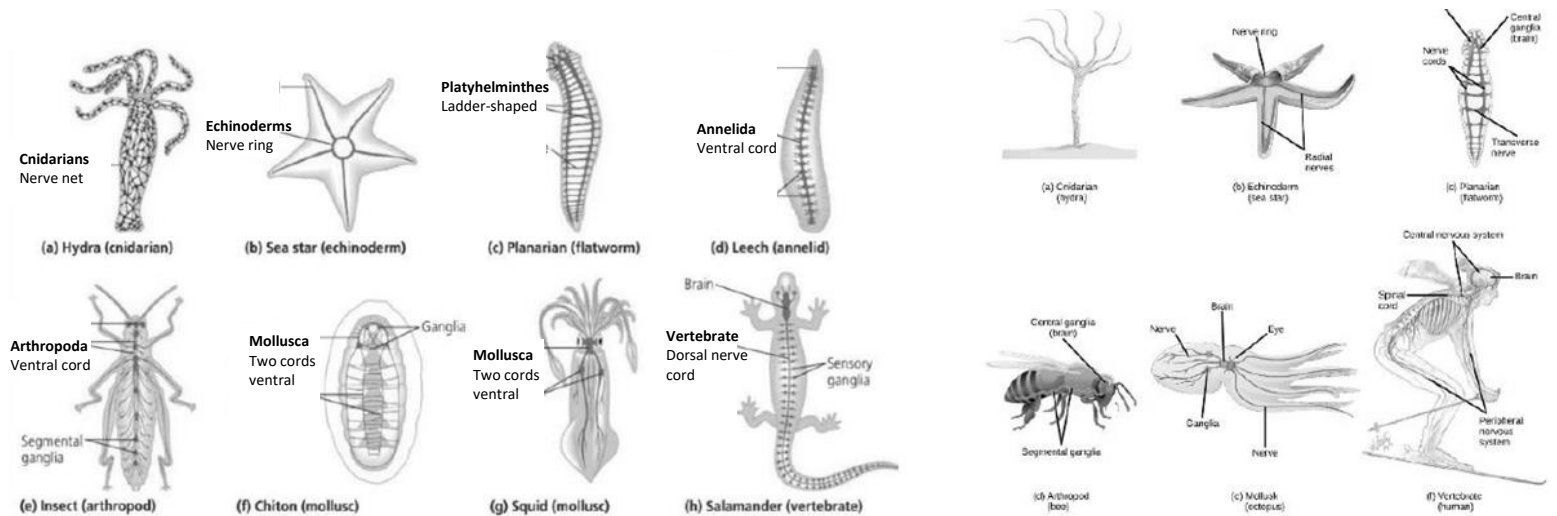
### Digestive Systems:

Porifera have no digestive system, nutrients diffuse directly into cells

Cnidarians and Platyhelminthes have an incomplete system, only one opening, flatworms have a tube (pharynx) protruding from the center of their bodies

Nematodes, annelids, mollusks, arthropods, echinoderms and chordates all have a complete digestive system with two openings

## Nervous Systems



### Nervous Systems:

Porifera have no nervous system

Platyhelminthes have a ladder-like system with 2 nerve cords

Annelids have 2 ventral nerve cords from ganglia (primitive brain)

Arthropods have a ganglia and ventral nerve cord

Chordates have a brain and dorsal nerve cord

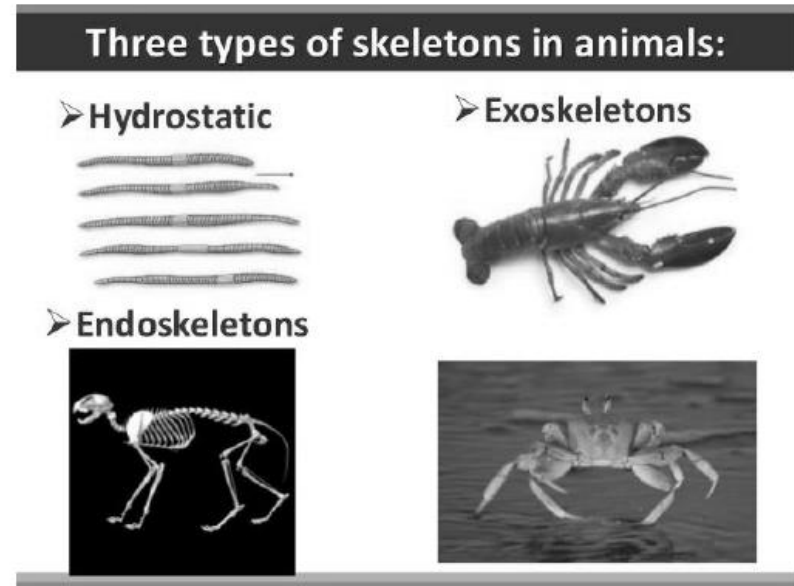
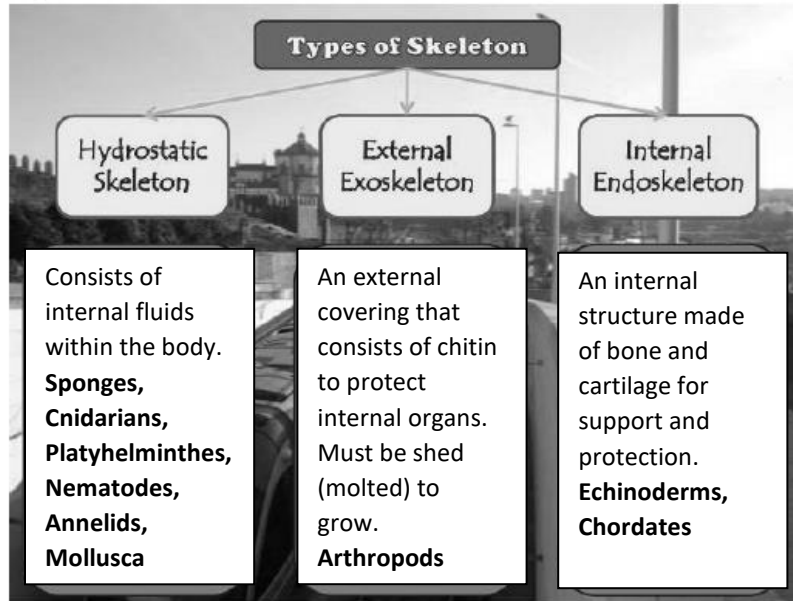
Cnidarians have a net system

Nematodes have a ring and 4 nerve cords

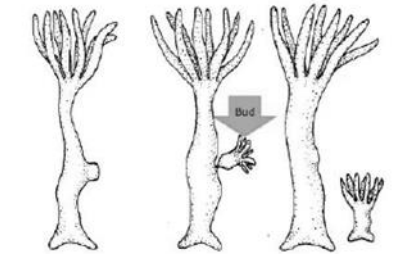
Mollusks have 2 nerve cords and ganglia

Echinoderms have a nerve ring

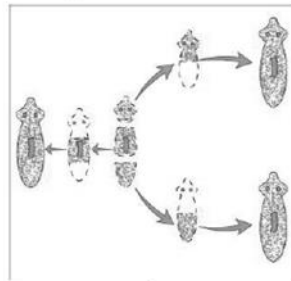
# Skeletal Systems



## Asexual Reproduction – porifera, cnidarian, flatworms



Budding: Sponges & Cnidarians



Fragmentation/Regeneration

## Sexual Reproduction – porifera, cnidaria, all worms, arthropods, mollusks, echinoderms, chordates

