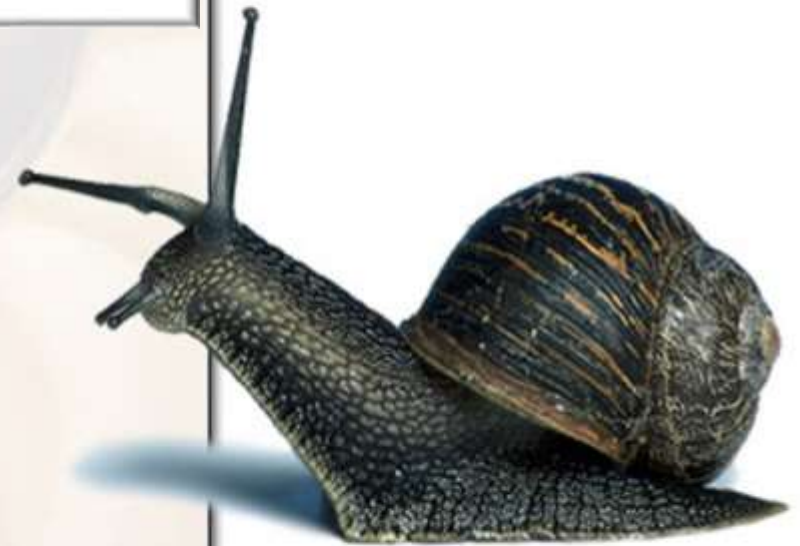
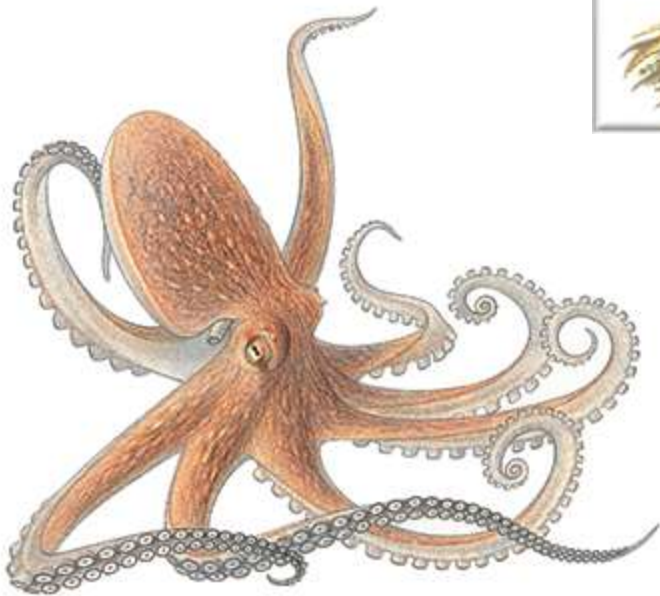


Mollusks

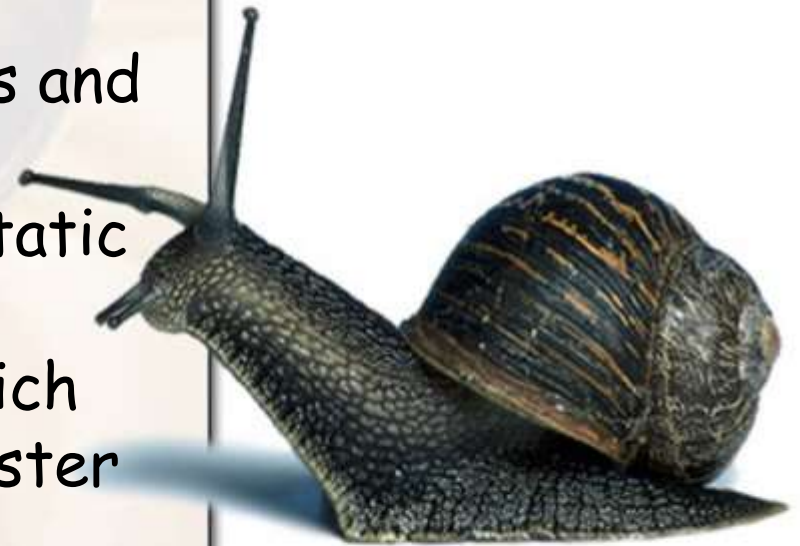


Objectives

Understand the taxonomic relationships and major features of mollusks

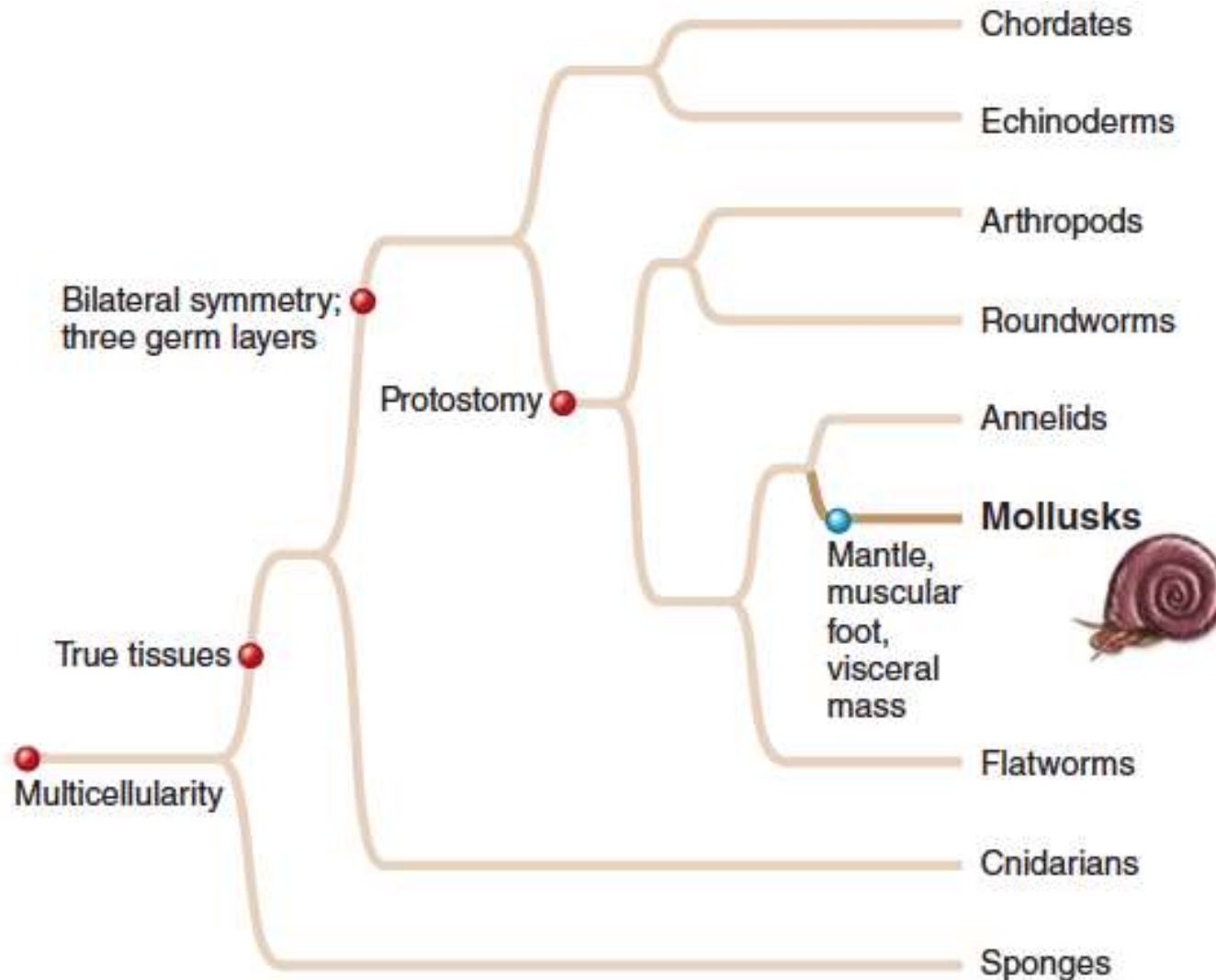
Learn the external and internal anatomy of the clam and squid

Understand the major advantages and limitations of the exoskeletons of mollusks in relation to the hydrostatic skeletons of worms and the endoskeletons of vertebrates, which you will examine later in the semester



Mollusks Are Soft and Unsegmented

Key features



Mollusks Are Soft and Unsegmented

Diversity



Chiton



Scallop (bivalve)



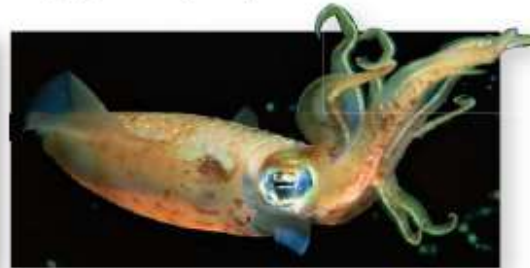
Snail (gastropod)



Slug (gastropod)



Octopus (cephalopod)



Squid (cephalopod)

Phylum Mollusca

- Includes snails and slugs, oysters and clams, and octopuses and squids.



Bivalves



Nautilus

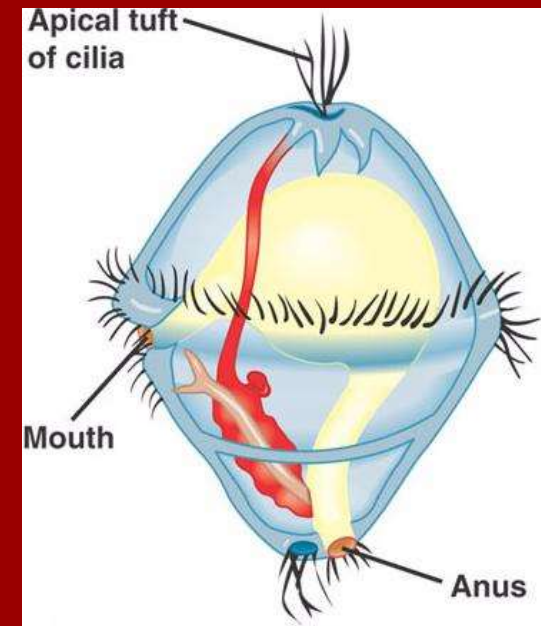
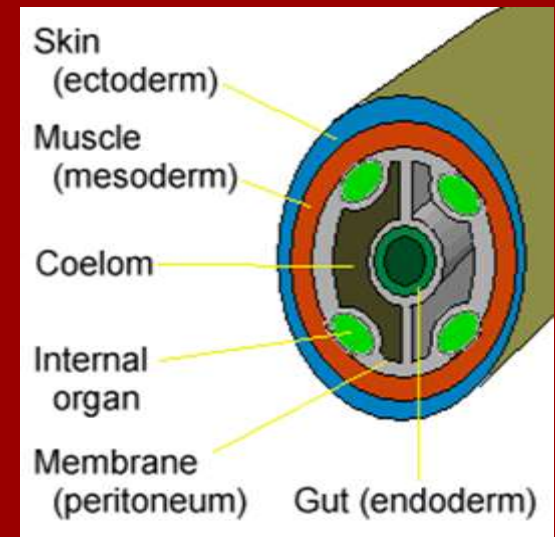
Characteristics

- **Soft-bodied** invertebrate
- Covered with protective **mantle** that may or may not form a hard, **calcium carbonate shell**
- **Second largest** animal phylum
- Have a **muscular foot** for movement which is modified into **tentacles** for squid & octopus



Characteristics

- Complete, **one-way digestive tract** with a mouth & anus
- Have a **fully-lined coelom**
- **Cephalization** - have a distinct head with sense organs & brain
- Have a scraping, mouth-like structure called the **radula**
- Go through free-swimming larval stage called **trochophore**



Phylum Mollusca

- Most mollusks are **marine**
- Some gastropods and bivalves inhabit **freshwater**
- A few gastropods (**slugs & snails**) are **terrestrial**.



Mollusk General Body Plan

All mollusks have a similar body plan:

1. Muscular foot

2. Shell- hard structure can internal or external

3. Visceral mass - containing all internal organs (i.e digestive, circulatory, respiratory and reproductive organs).

Mollusk General Body Plan

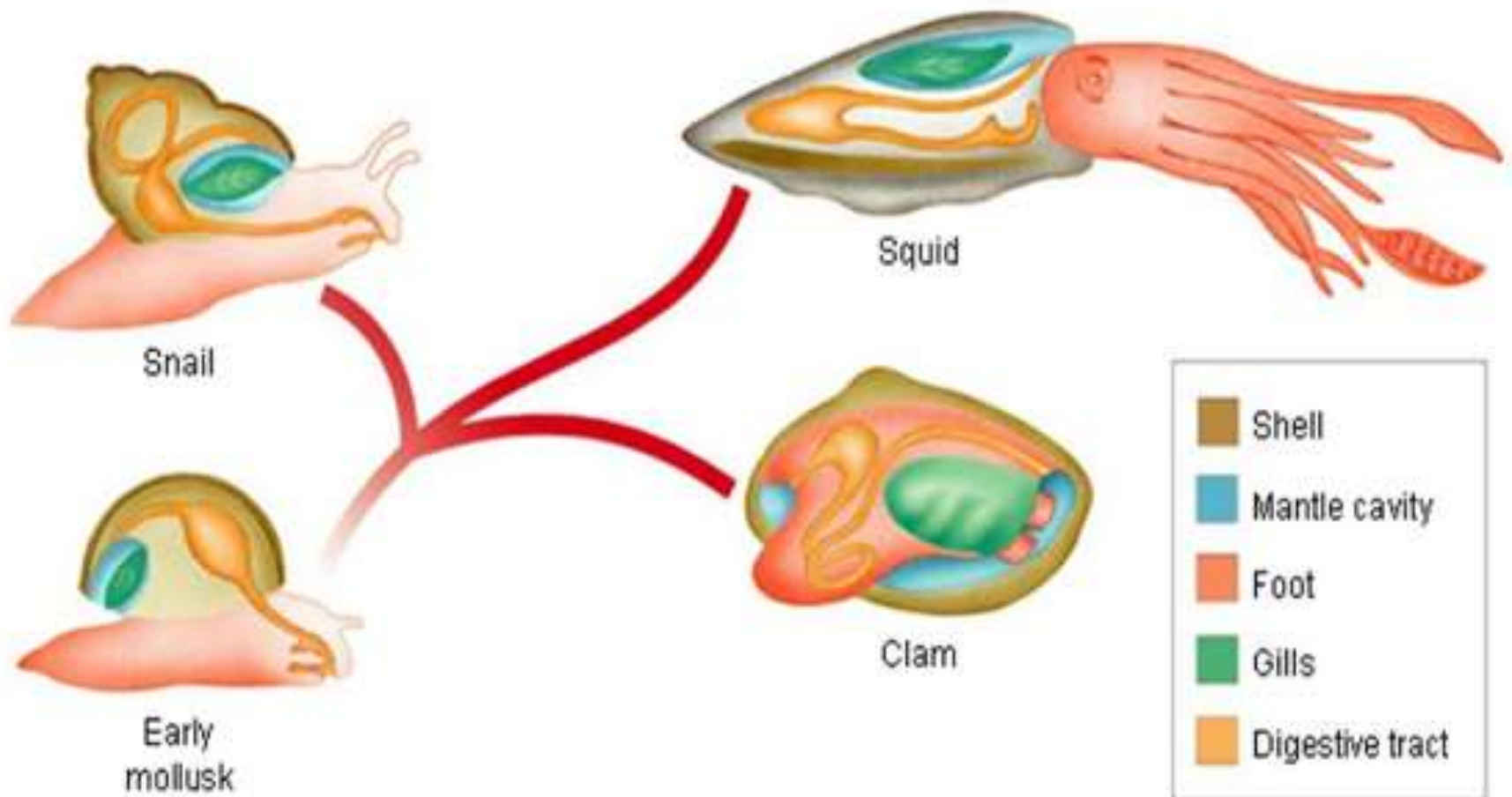
All mollusks have a similar body plan:

4. Mantle - houses the gills and in some secretes a protective shell over the visceral mass.

5. Radula- unique to mollusk in that it is a rasping organ w/ file like teeth to scrape/crush food

6. Gills- to extract oxygen from water and filter food

THE MOLLUSK BODY PLAN



Head-Foot Region

- Most mollusks have well developed head ends with **sensory structures** that may be simple **light detectors** or complex eyes (cephalopods).



Shells

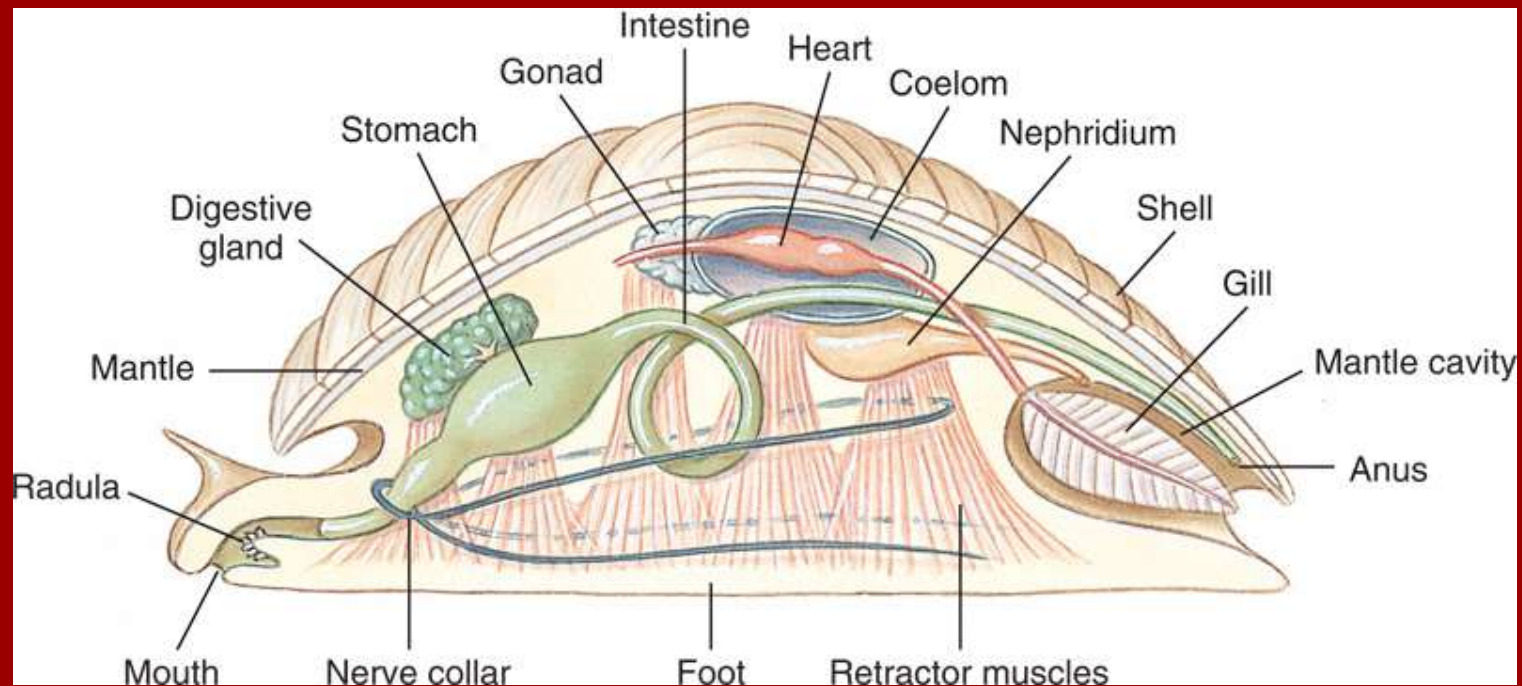
- Found in snails, bivalve mollusks, chitons, and nautilus
- Made of **calcium carbonate** (limestone)
- Secreted by the **mantle**





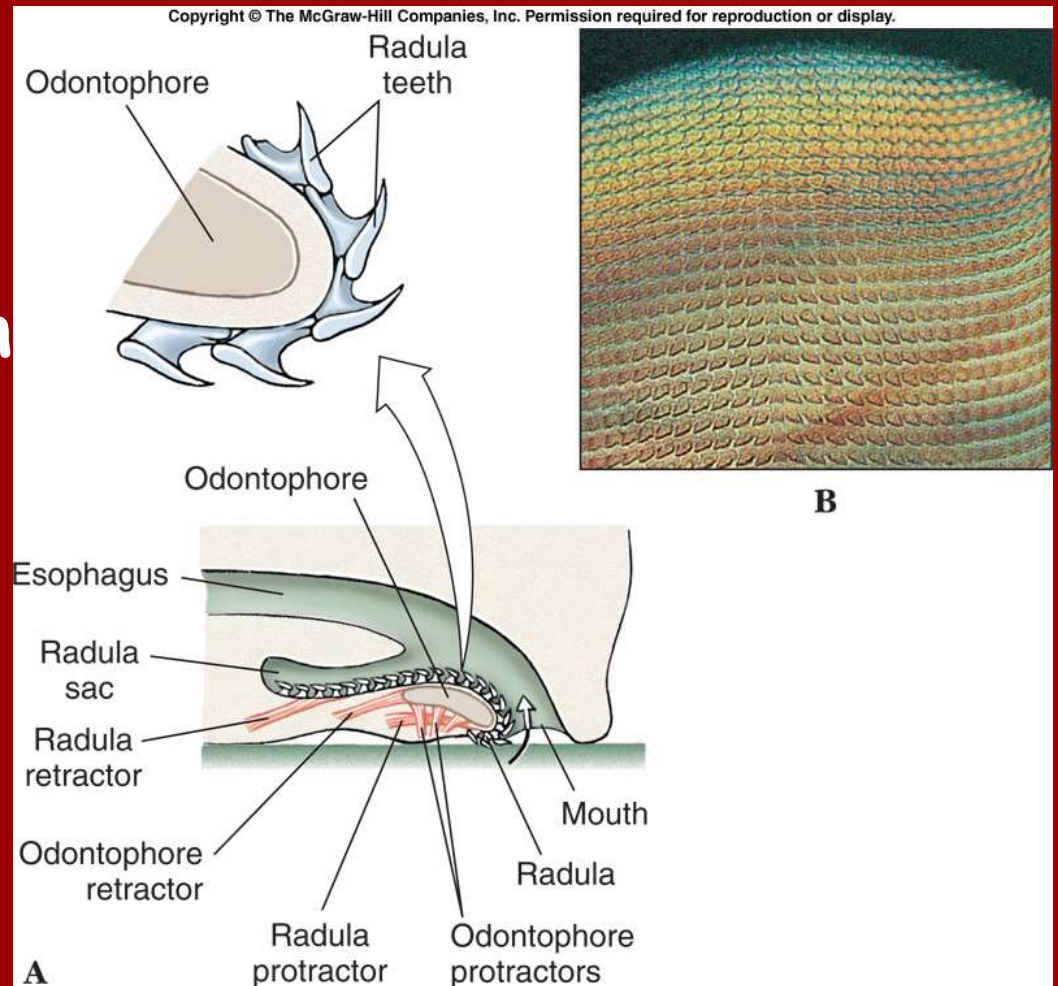
Mantle Cavity

- The space between the mantle and the **visceral mass (body organs)** is called the **mantle cavity**.
- The respiratory organs (**gills or lungs**) are generally housed here.



Feeding

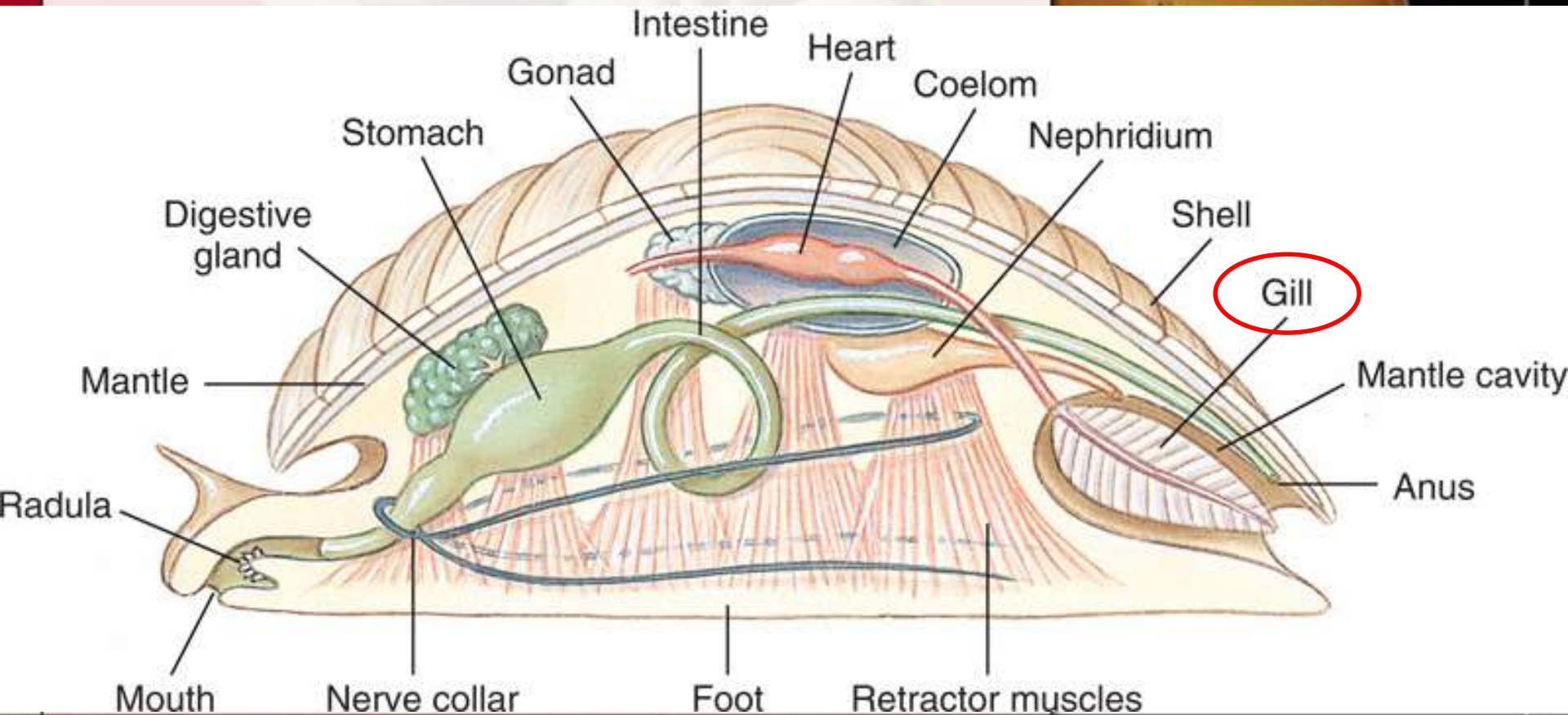
- The **radula** is a rasping, tongue like feeding structure found in most mollusks except bivalves.
- Has **tiny rows of teeth** for scraping.
- Filter feeders use **gills** to sift food



Respiration

- **Aquatic species** use **gills** (found within the mantle cavity to extract oxygen from water
- **Land mollusks** breath via an adapted **mantle cavity lined with blood vessels** and must be kept moist for oxygen to enter (i.e. slimy snails)

Respiration



Circulatory System

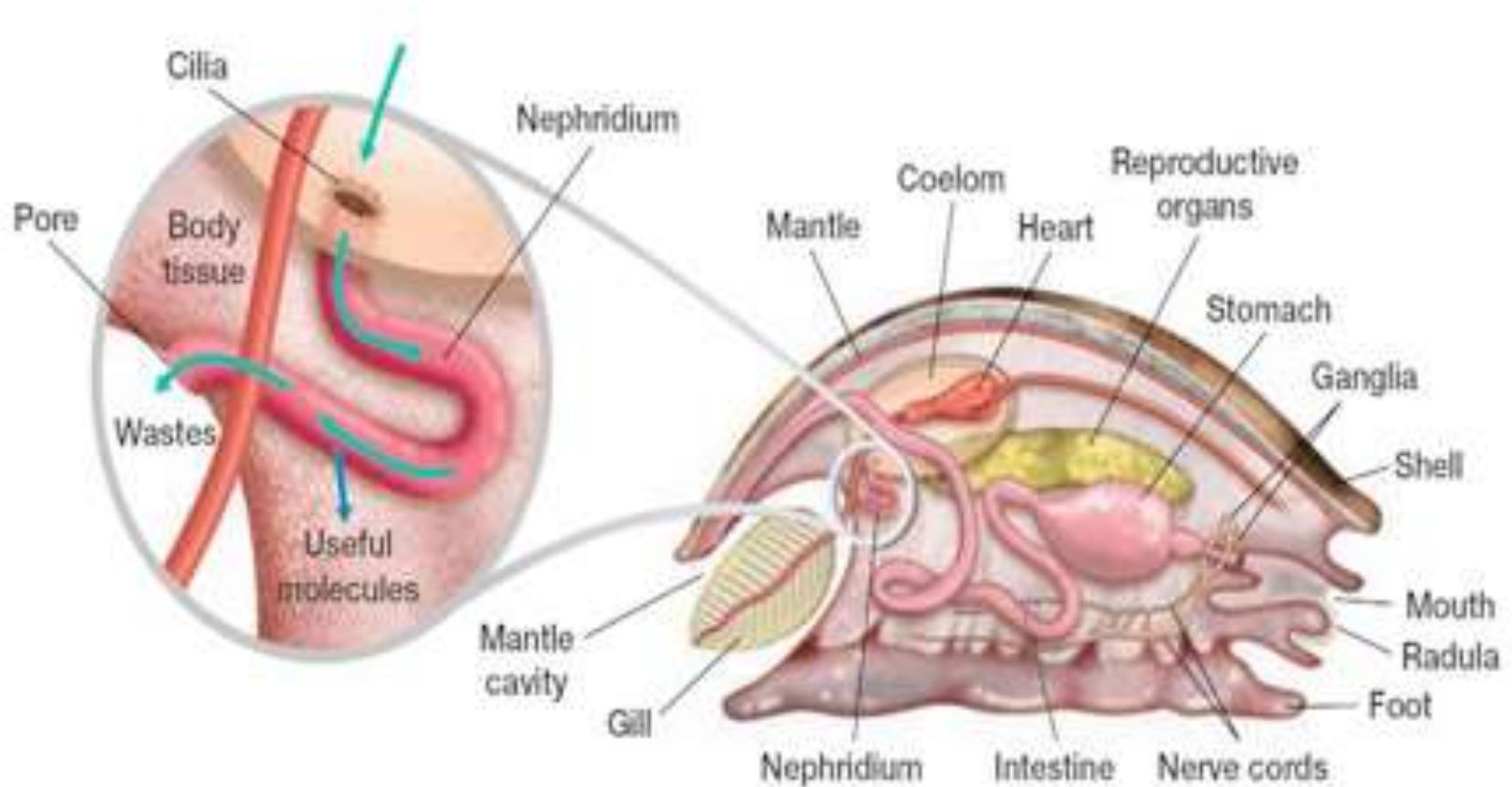
- Slow moving species have **open circulatory system**
 - Blood not always within blood vessel
 - Works through body tissues in open spaces called sinuses
- Faster moving species have **closed circulatory system**
 - Blood always within vessels

#efficiencylikeaboss

Excretory System

- Complete digestive system
 - Solid waste expelled through anus
 - Metabolic waste (ammonia) excreted by nephridia (simple kidney-like organ)
 - Nephridia remove wastes and excrete to outside through skin

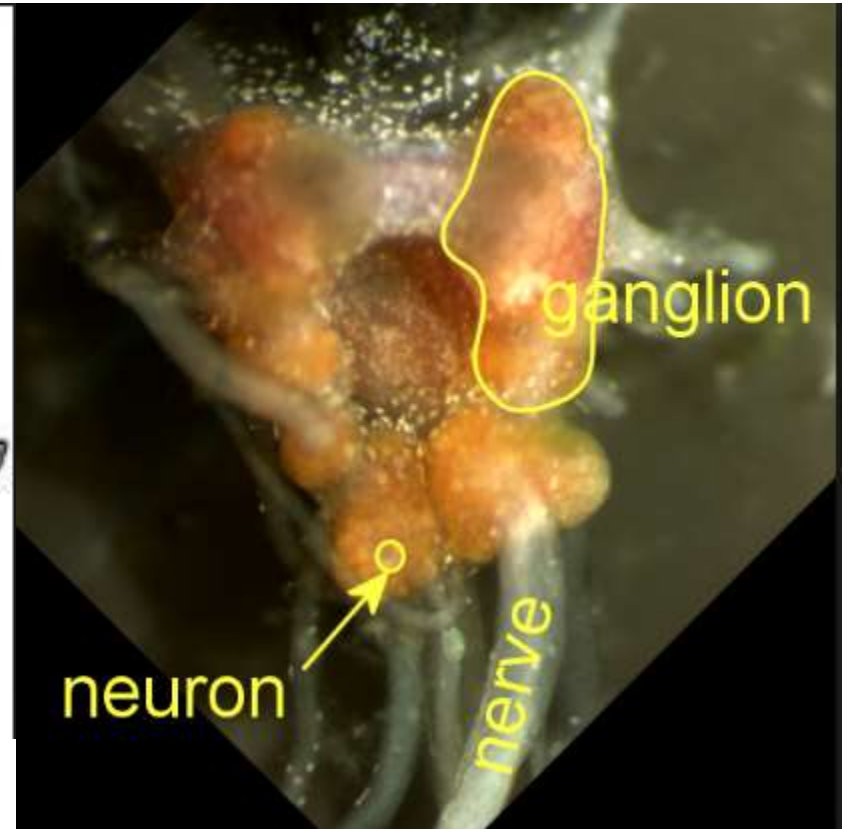
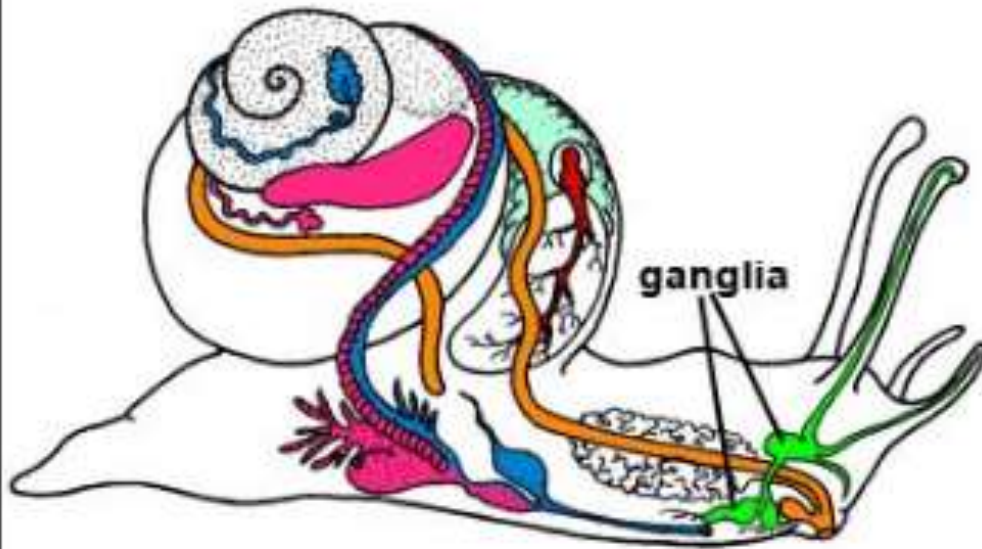
Nephridium- Early Kidneys



Nervous System

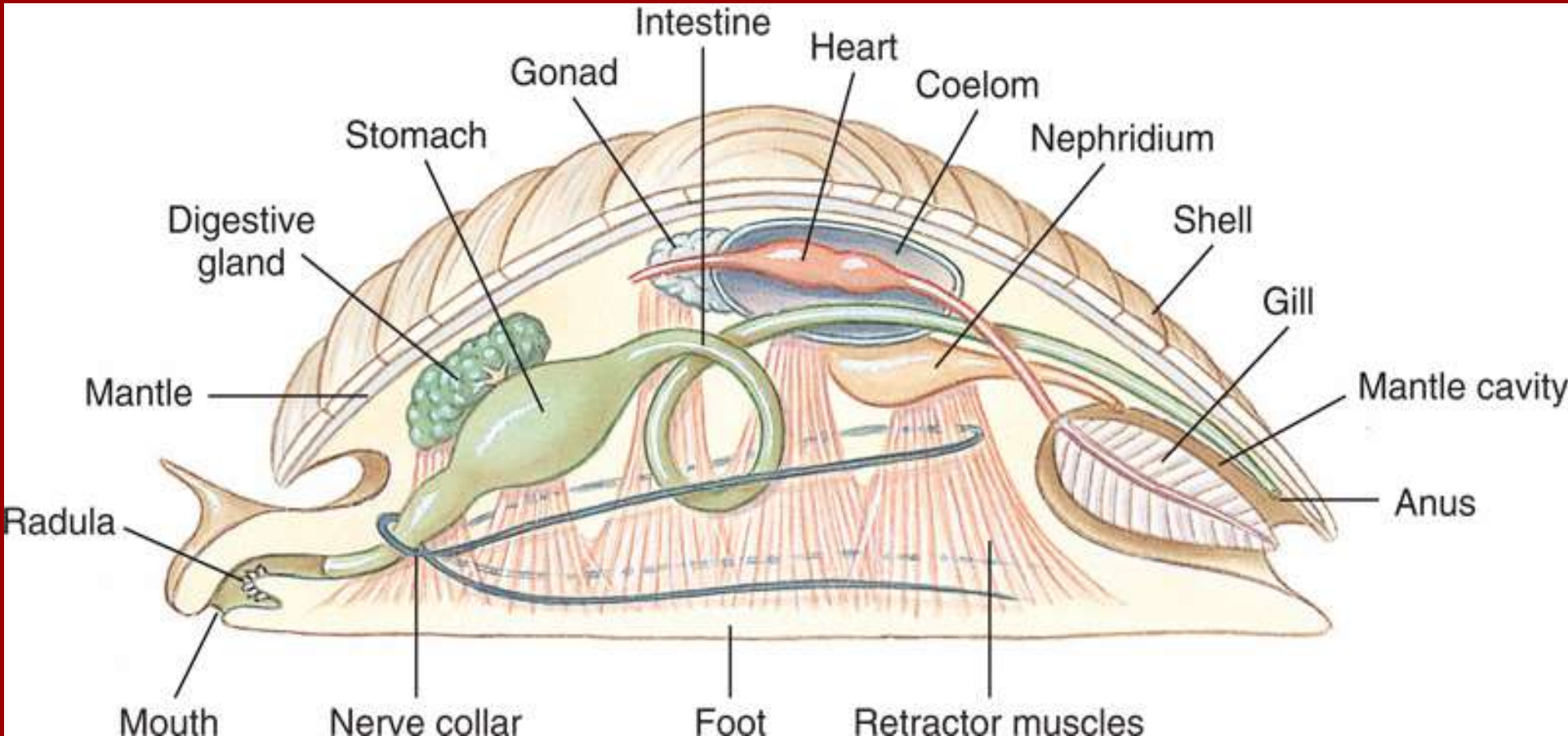
- Varies greatly between species
 - Bi-valves have extremely simple systems consisting of couple ganglia and nerve chords (similar to planarians)
 - Octopi, squid, snails have developed brains with memory and learning capacity

Brain Development



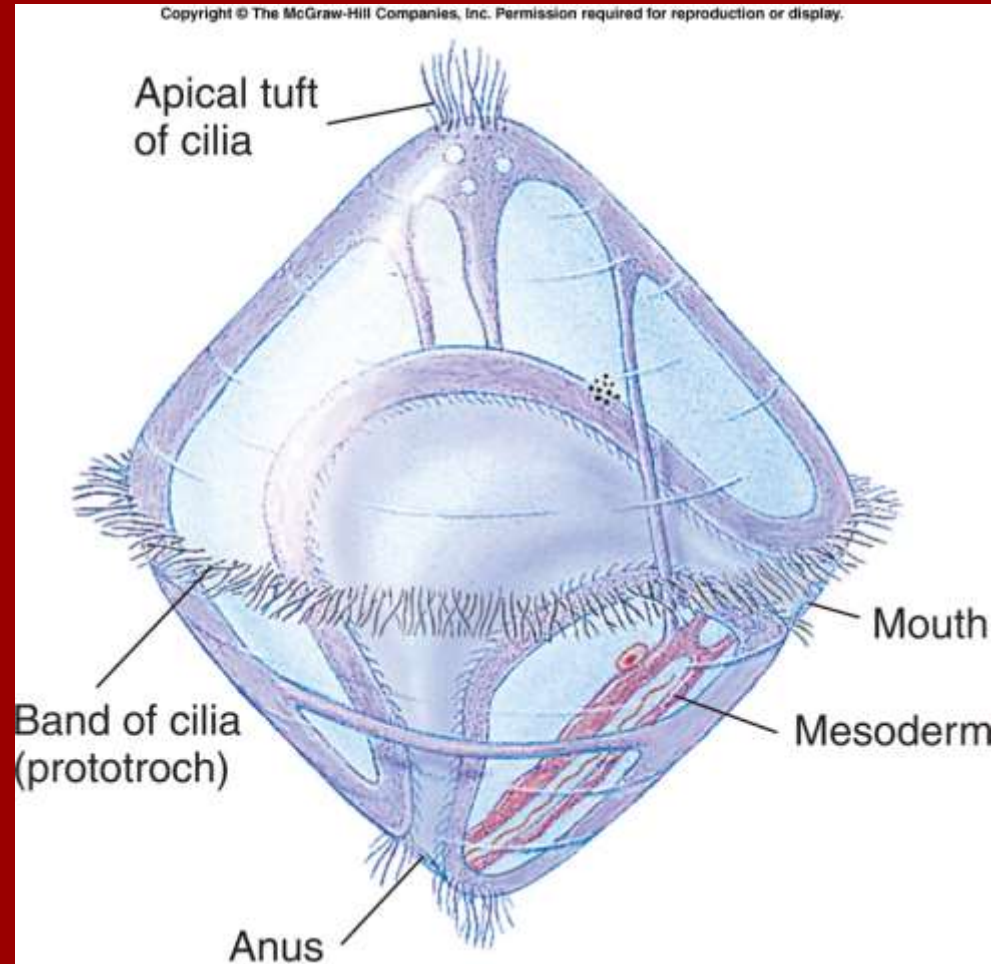
Reproduction

- Most mollusks have **separate sexes** with **gonads** located in the visceral mass.



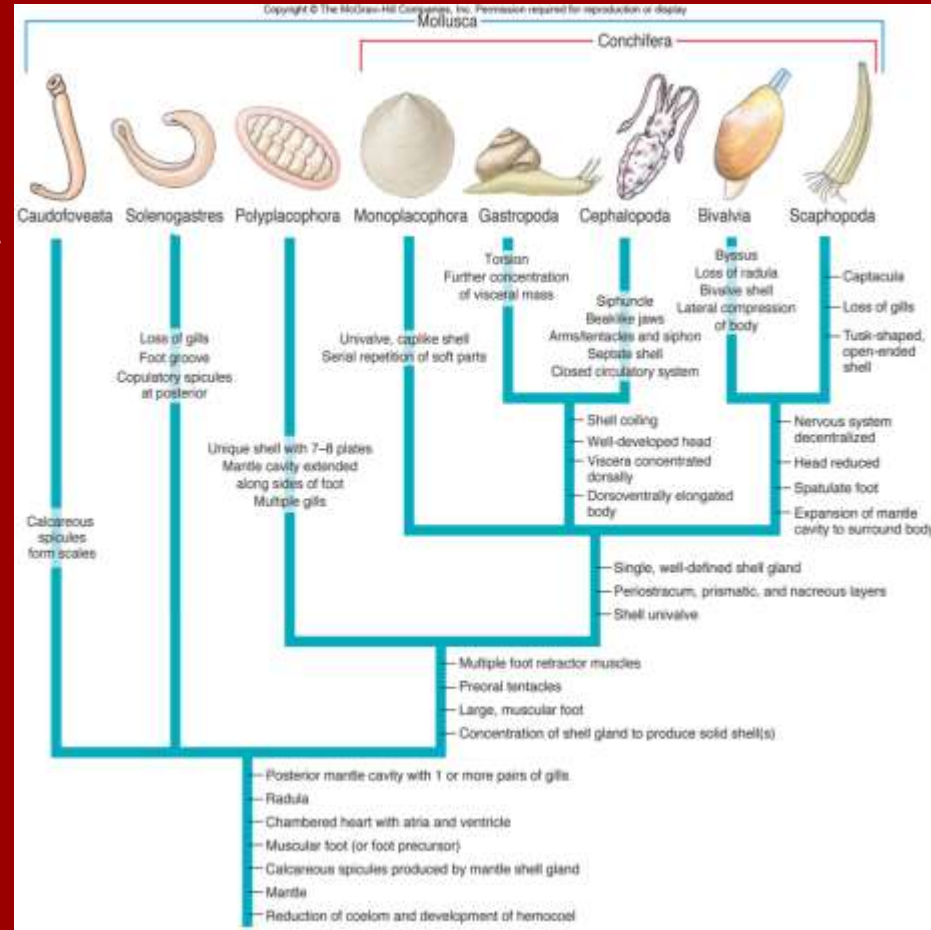
Mollusk Life Cycle

- Most mollusks are **dioecious (separate sexes)**
- Some are **hermaphroditic**
- The life cycle of many mollusks includes a **free swimming, ciliated larval stage** called a **TROCHOPHORE**



Major Mollusk Classes

- Four major classes of mollusks:
 - Class **Polyplacophora** - the chitons
 - Class **Gastropoda** - snails & slugs
 - Class **Bivalvia** - clams, mussels, oysters
 - Class **Cephalopoda** - octopus & squid



Class Polyplacophora

- Includes the **chitons**
- **Eight overlapping plates**
- **Can roll up**
- Live mostly in the rocky intertidal zones.
- Use **radula to scrape algae off rocks.**
- Water flows over **gills** to respire



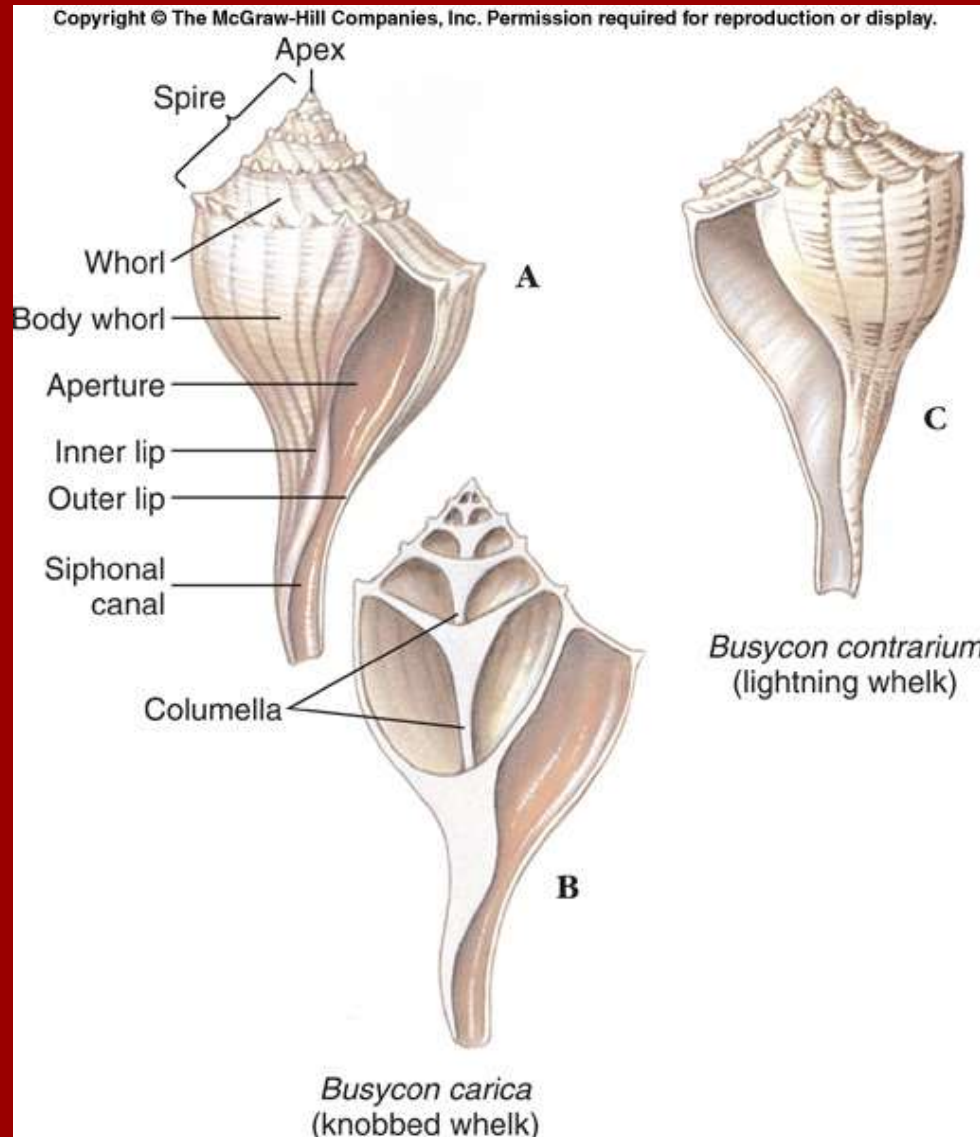
Class Gastropoda

- *Gastro* = stomach
Podos = foot
- Gastropoda is the **largest** of the mollusk classes.
- 70,000 named species.
- Include **snails, slugs, sea hares, sea slugs, sea butterflies.**
- Marine, freshwater, terrestrial.
- **Slugs** lack a shell!



Class Gastropoda

- The shell of a gastropod is always one piece - **univalve** - and may be coiled or uncoiled.
- The **apex** contains the oldest and smallest whorl.
- Shells may coil to the right or left - this is genetically controlled.



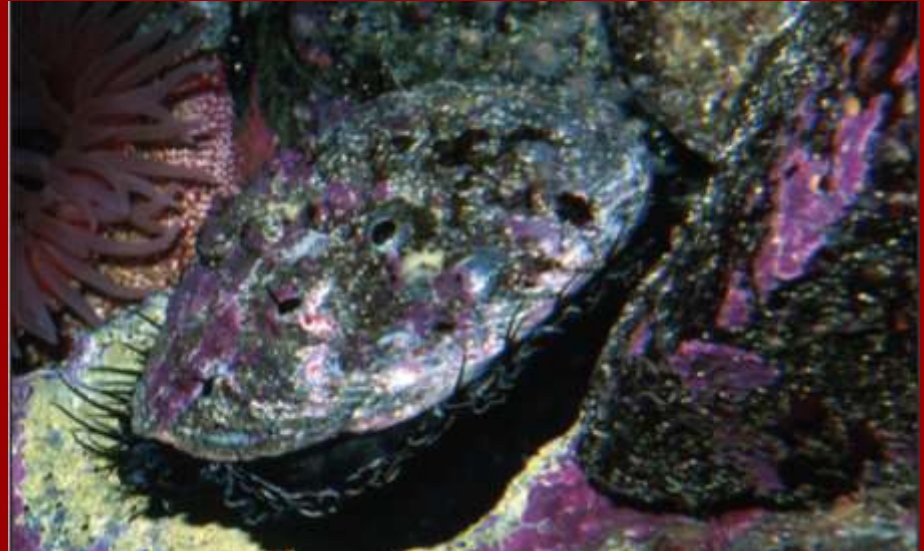
Class Gastropoda

- The foot has a hard plate (**operculum**) on it that protects the body when it withdraws into the shell.



Gastropod Feeding Habits

- Most gastropods are **herbivores** and feed by scraping off algae using the **radula**.
- Some are **scavengers** of dead organisms
- Others are **carnivores** that drill into other mollusks



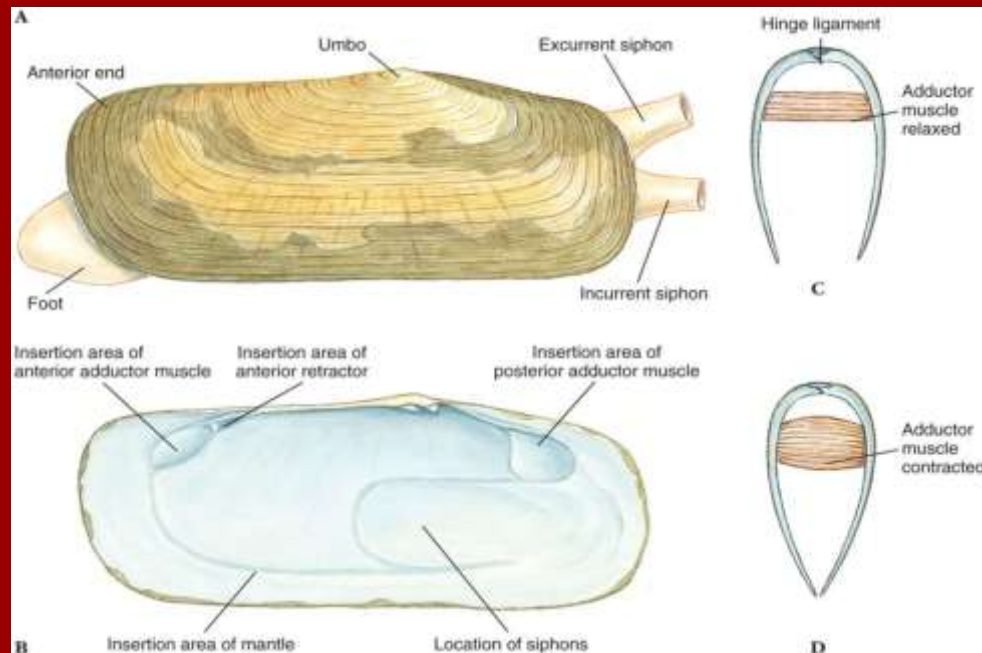
Class Bivalvia

- Bivalve mollusks have **two shells** (valves).
- Mussels, clams, oysters, scallops, shipworms.
- Mostly **sessile filter feeders**.
- No head or radula.



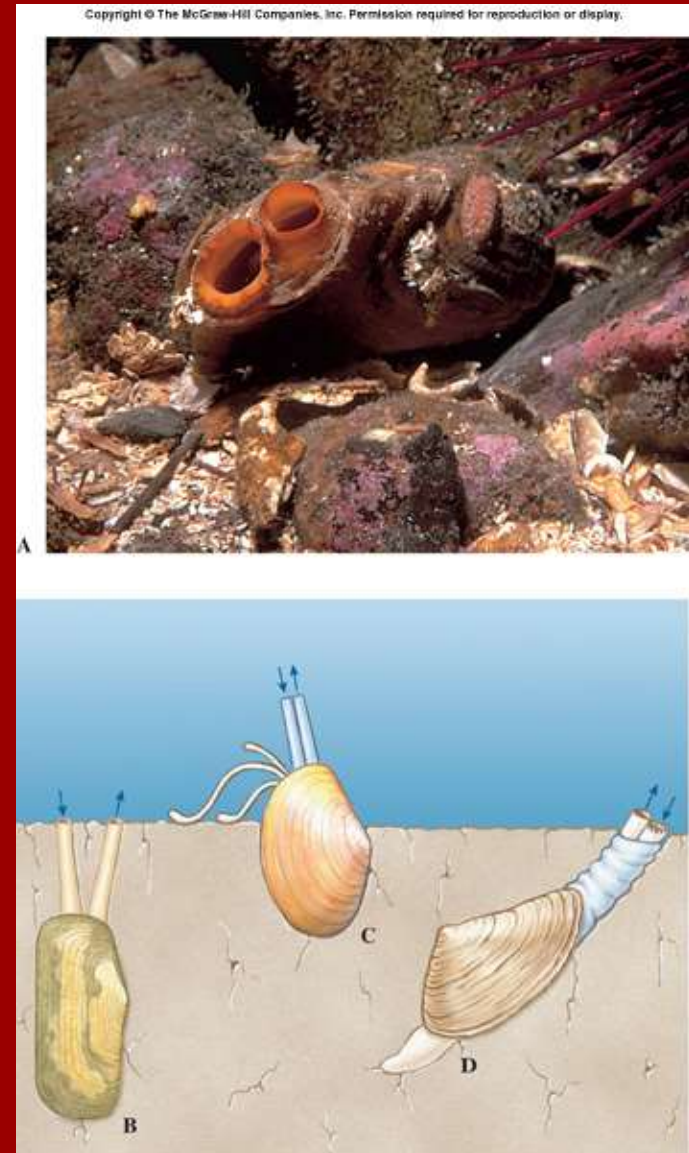
Class Bivalvia

- Laterally (right-left) compressed shell
- Shells are held together by a **hinge ligament**
- **Umbo** is the oldest part of the shell
- Growth occurs in **concentric rings** around it.



Class Bivalvia

- **Incurrent and excurrent siphons** are used to pump water through the organism for:
 1. **Gas exchange**
 2. **Filter feeding**
 3. **Jet propulsion.**



Class Bivalvia - Locomotion

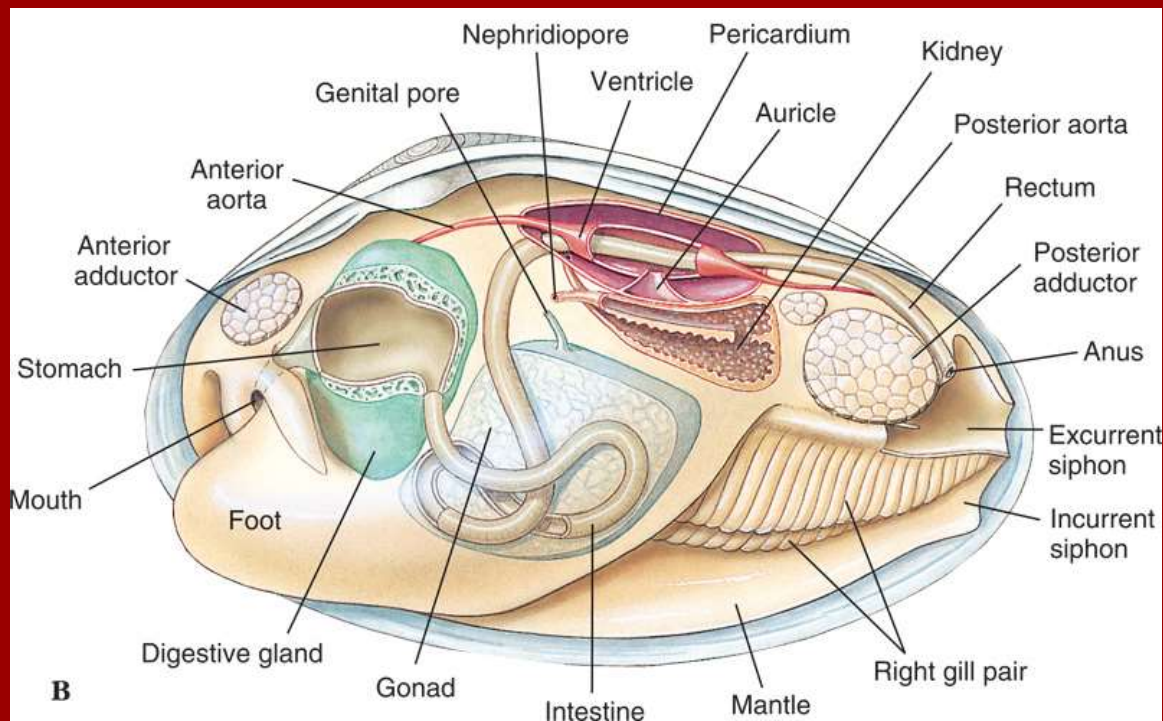
- Bivalves move around by **extending the muscular foot** between the shells.
- Scallops and file shells swim by **clapping their shells together** to create jet propulsion.



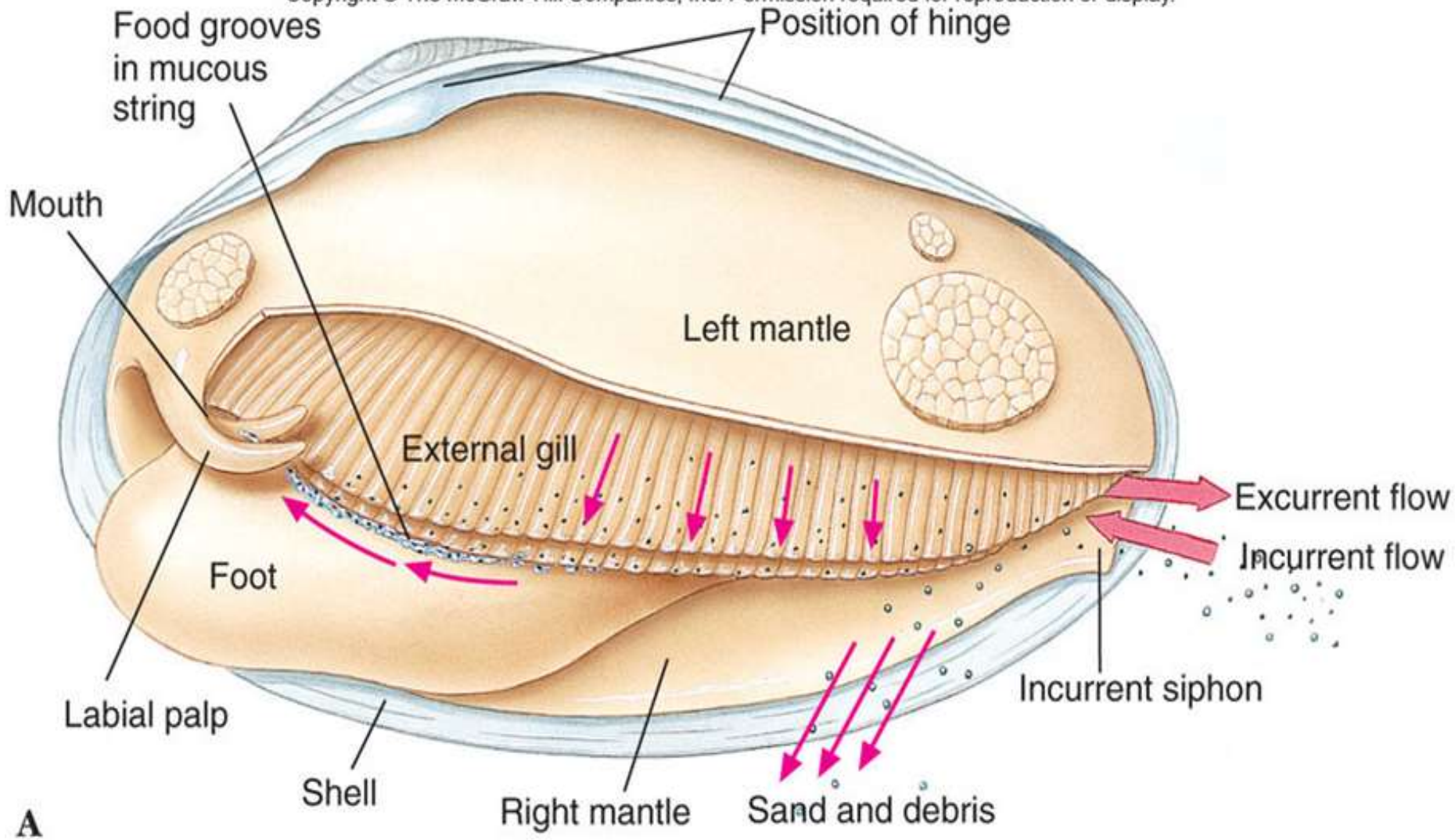
http://www.youtube.com/watch?v=vmi_I8QW5eo

Class Bivalvia

- Like other mollusks, bivalves have a **coelom** and an **open circulatory system**.
- They breathe through **gills** and **filter feed**



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Class Bivalvia

- **Scallops** have a row of **small blue eyes** along the mantle edge. Each eye has a cornea, lens, retina, and pigmented layer.



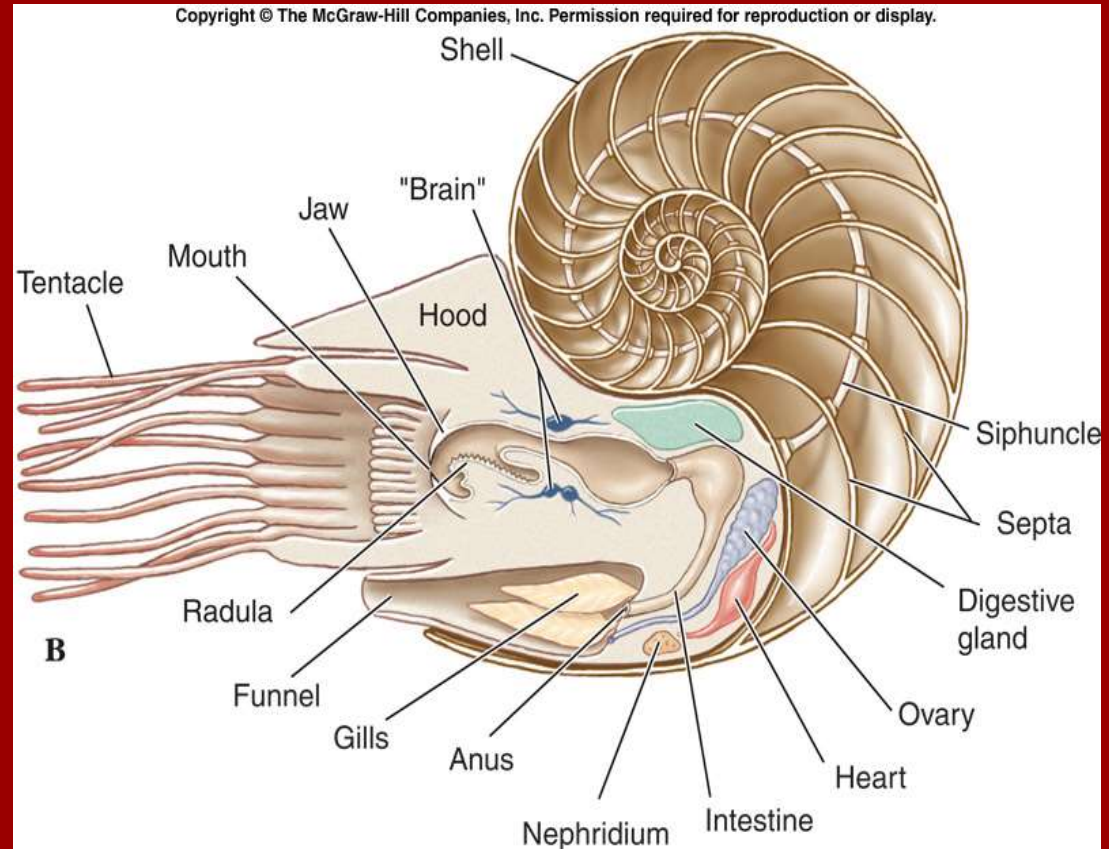
Class Cephalopoda

- *Kaphale* = head *Podos* = foot
- Cephalopods include **octopuses, squid, nautilus** and **cuttlefish**.
- Marine carnivores with beak-like jaws
Surrounded by tentacles modified from their
foot



Class Cephalopoda - Shells

- Shells of the **Nautilus** are made buoyant by a series of gas chambers.



Class Cephalopoda - Shells

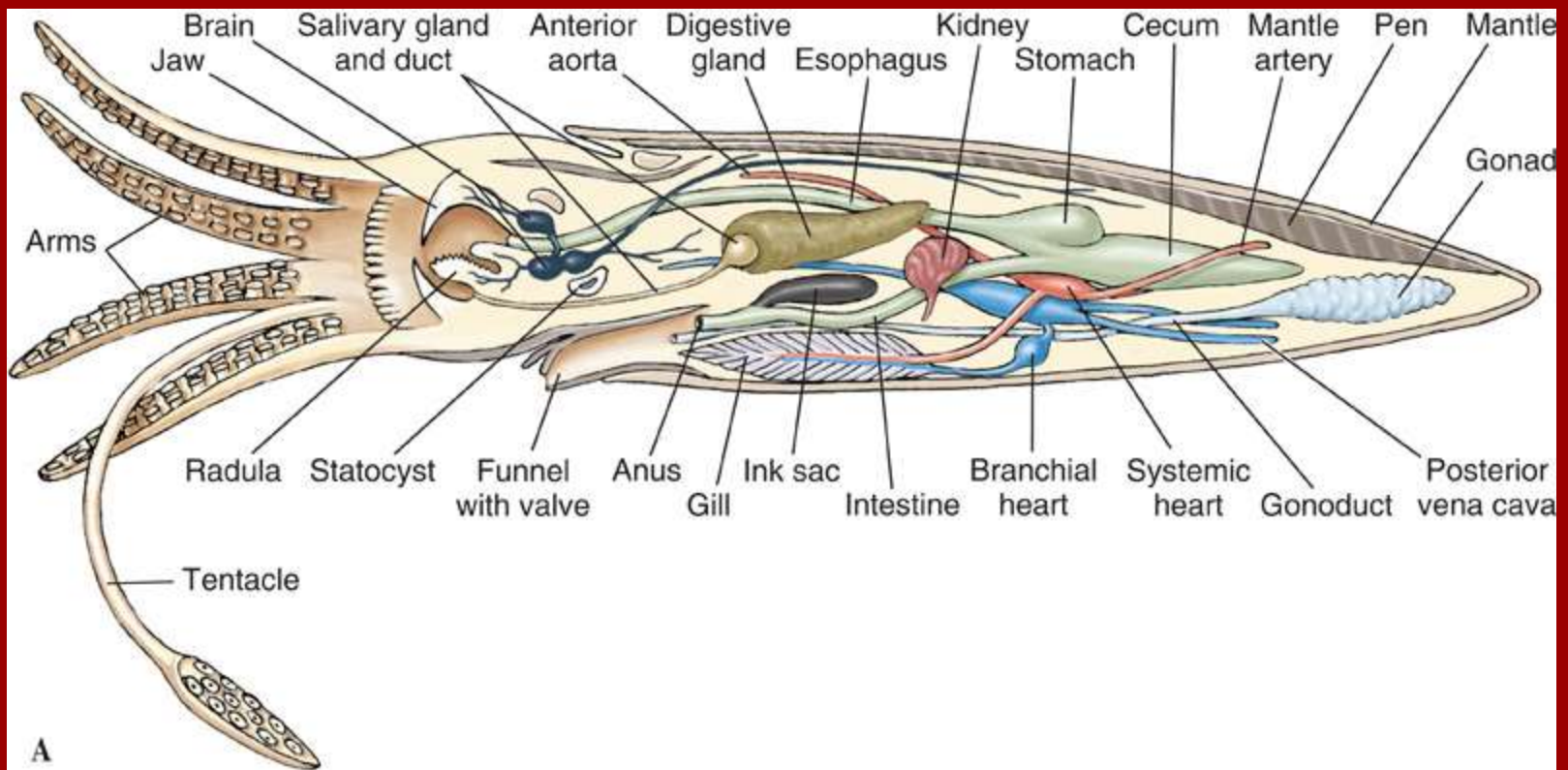
- **Cuttlefish** have a small curved shell, completely enclosed by the mantle and are masters of camouflage.

Did you see that?



Class Cephalopoda - Shells

- In squid, the shell has been reduced to a small strip called the **pen**, which is enclosed in the mantle.



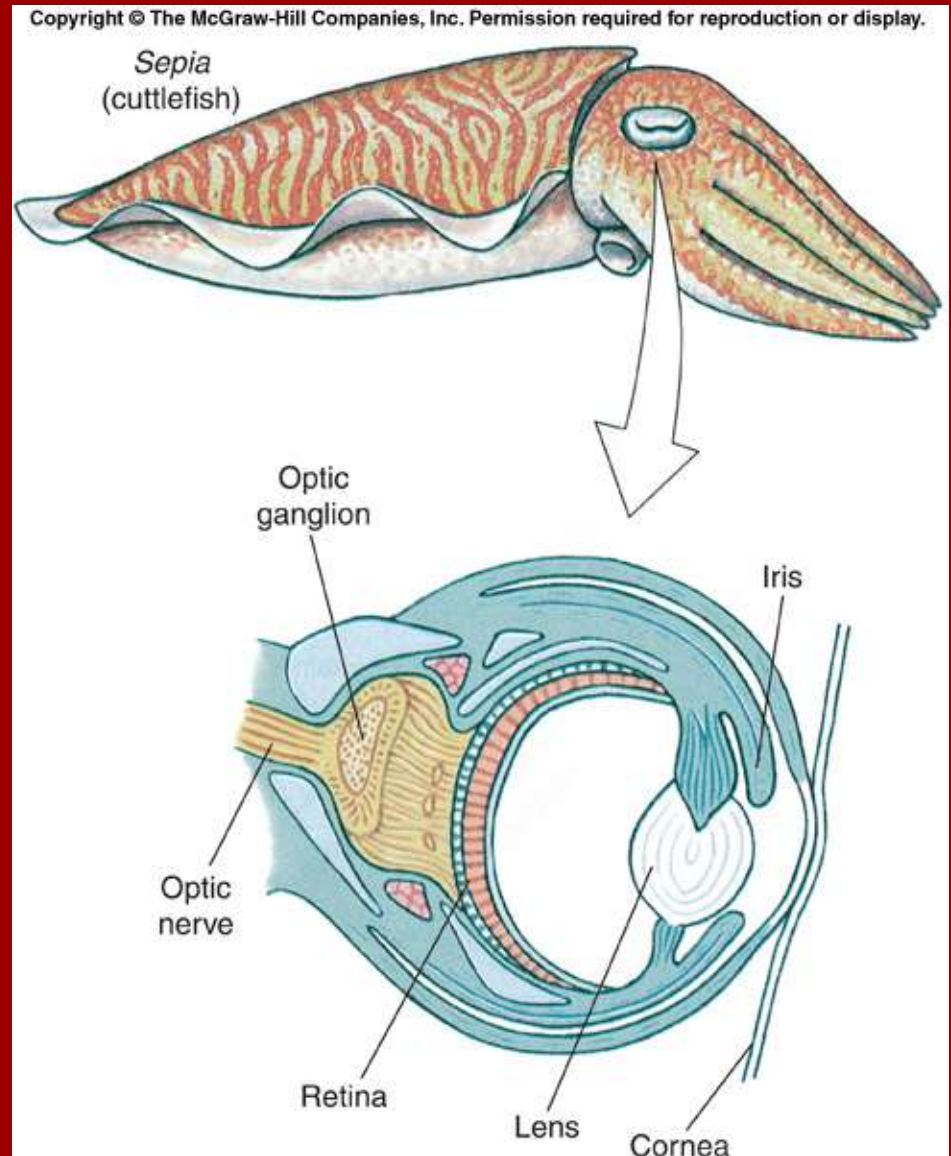
Class Cephalopoda - Locomotion

- Cephalopods swim by expelling water from the mantle cavity through a ventral funnel.



Class Cephalopoda

- Most cephalopods have **complex eyes** with cornea, lens, chambers, and retina.
- **Largest** invertebrate **brain**
- **Closed circulation**



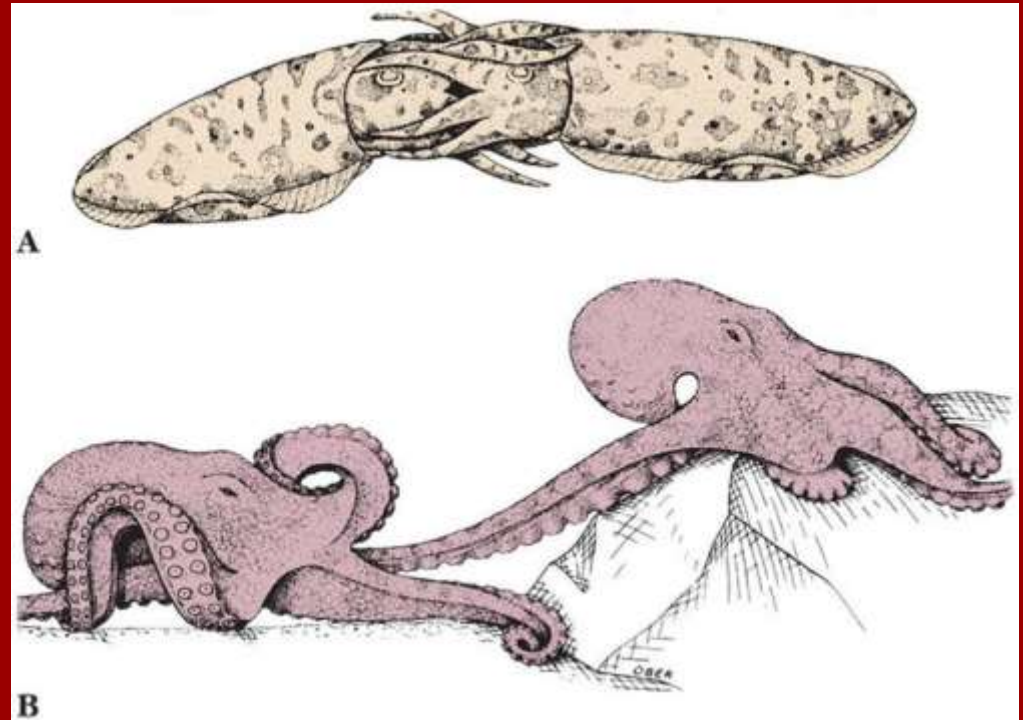
Protection

- Color changes effected by **chromatophores** (pigment cells)
- Allows them to blend into their background
- Squirting out water by **jet propulsion** helps escape predators
- Squids also release an **inky substance** into the water



Class Cephalopoda - Reproduction

- Sexes are **separate** in cephalopods.
- **Juveniles hatch directly from eggs** - no free-swimming larvae.
- One arm of male removes a **spermatophore** from mantle cavity and inserts it into female.



Humans & Mollusks

- Uses:
 - **As food** - mussels, clams, oysters, abalone, calamari (squid), octopus, escargot (snails), etc.
 - **Pearls** - formed in oysters and clams.
 - Shiny inner layer of some shells used to make **buttons**.



Mollusk Pests

- **Shipworms** - burrow through wood, including docks & ships.
- **Terrestrial snails and slugs** damage garden plants.
- Mollusks serve as an **intermediate host for many parasites**.
- **Zebra mussels** - accidentally introduced into the Great Lakes and reeking havoc with the ecosystem.

Check Your Understanding

Understand the taxonomic relationships and major features of mollusks

Learn the external and internal anatomy of the clam and squid

Understand the major advantages and limitations of the exoskeletons of mollusks in relation to the hydrostatic skeletons of worms and the endoskeletons of vertebrates, which you will examine later in the semester

