

# Mollusks- “soft bodied”

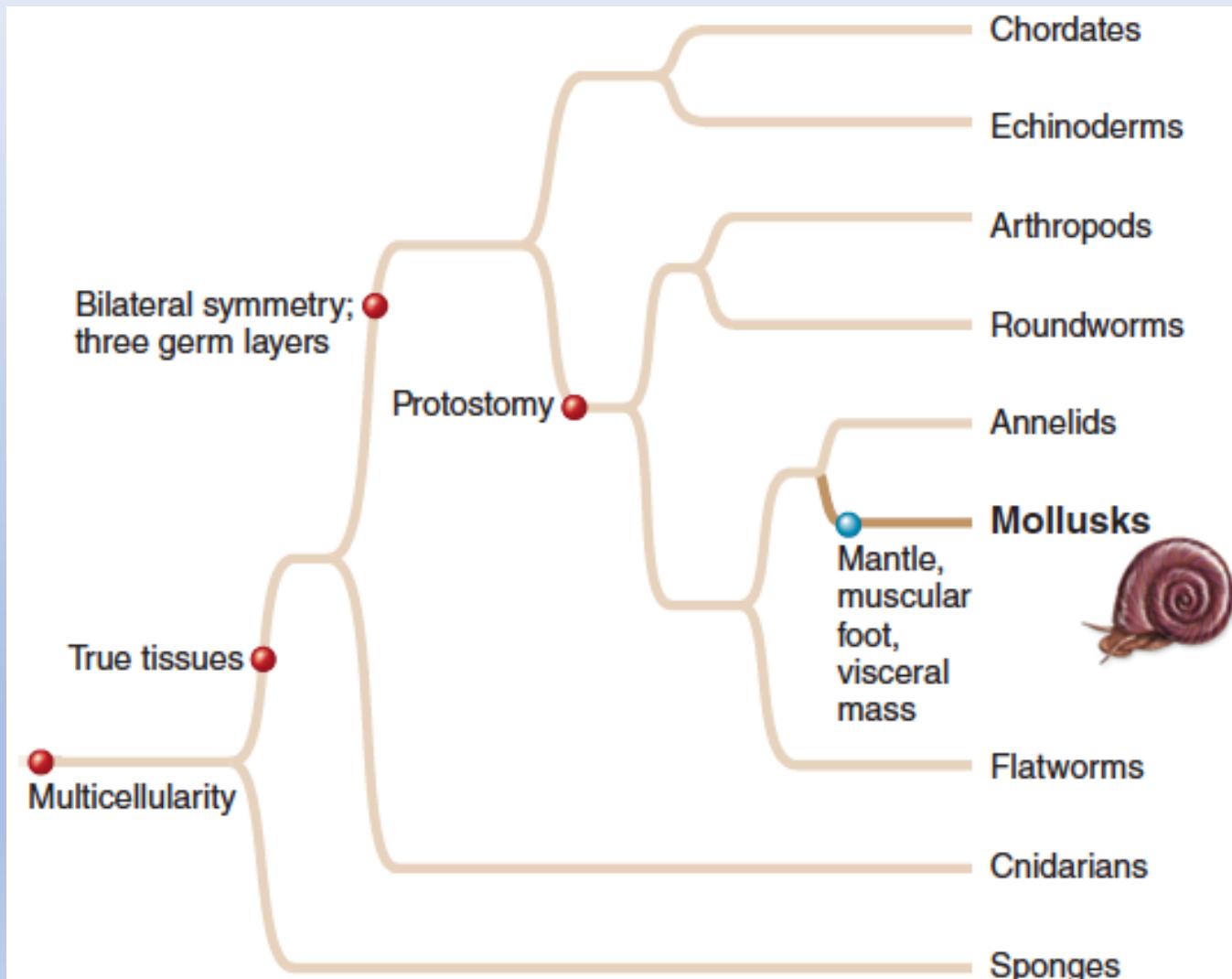


# Objectives

- 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)



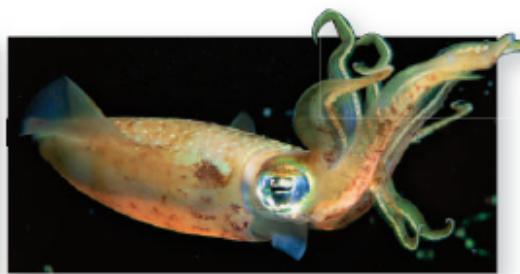
Snail (gastropod)



Slug (gastropod)



Octopus (cephalopod)



Squid (cephalopod)

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# Phylum Mollusca

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



Bivalves



Nautilus

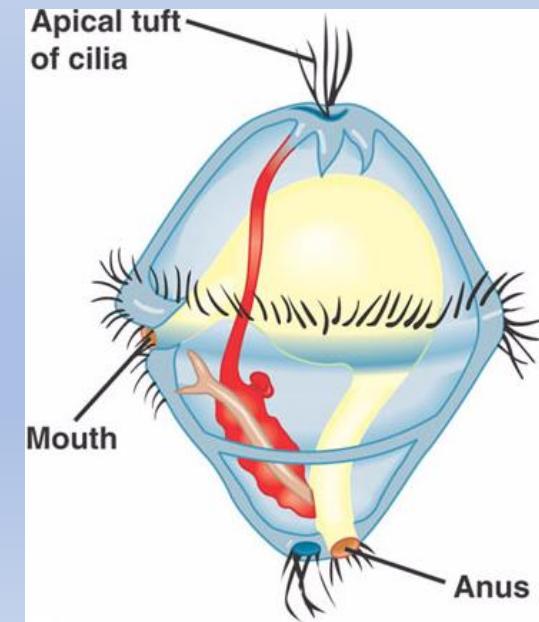
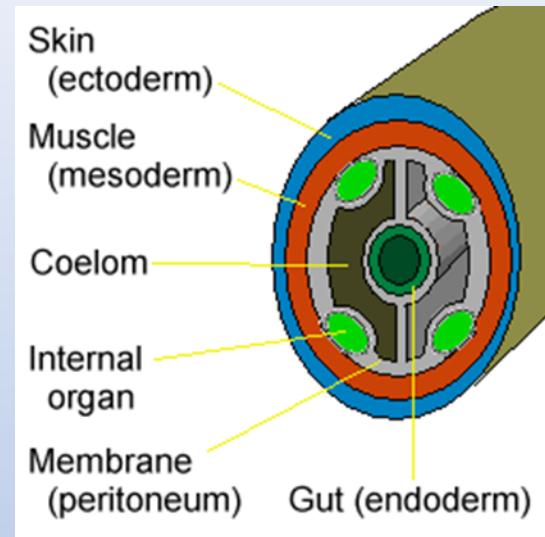
# Characteristics

- Bi-lateral & Triploblastic
- Unsegmented as apposed to nearest relative
- Dioecious
- Soft bodied covered by **calcareous** shell that may or may not form a hard, **calcium carbonate shell**
- Second largest animal phylum

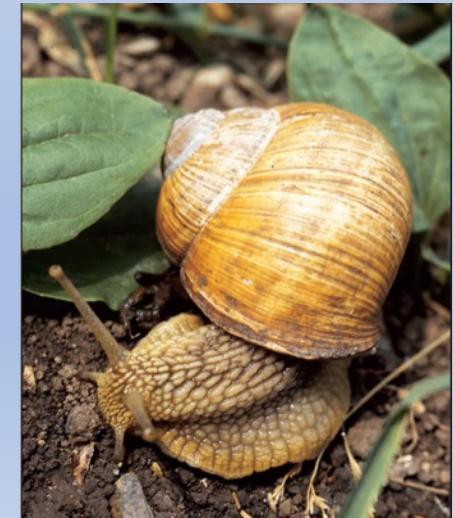


# Characteristics

- Complete, one-way digestive tract with a mouth & anus
- Have a fully-lined coelom, but typically limited to around heart
- Cephalization - have a distinct head with sense organs & brain
- Digestive system is complex & has a scraping, mouth-like structure called the radula
- Open circulatory system (except for cephalopods)
- Go through free-swimming larval stage called trochophore
- Chromatophores- camouflaging pigments in squid & octopi



- 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:

- a) Broad, flat, muscular organ for locomotion
- b) Specialized part of ventral body wall
- c) Snails use for creeping over surfaces
- d) Clams use for plowing in mud
- e) Squids use for catching prey

## 2. Mantle (AKA Shell):

- a) hard structure can be internal or external
- b) Specialized part of dorsal body wall
- c) Mantle contains glands that make shell (in most)
- d) Generally overhangs visceral mass & forms mantle cavity which often contain gills

# Mollusk General Body Plan

All mollusks have a similar body plan:

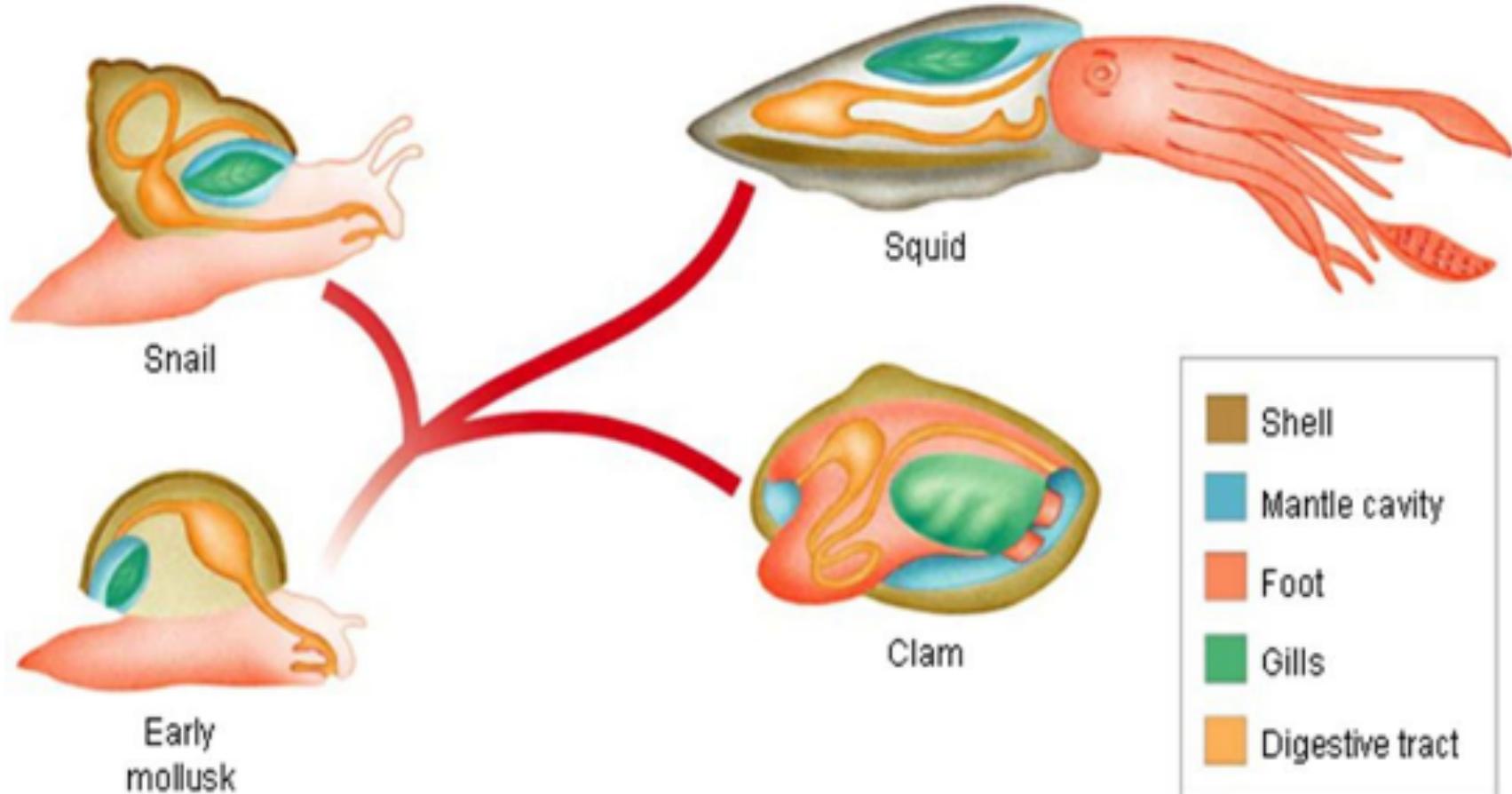
## 3. **Visceral mass:**

- a) Contains all internal organs (e.g. digestive, pair of kidneys, circulatory, respiratory and reproductive organs).
- b) Located above foot

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

## 5. **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

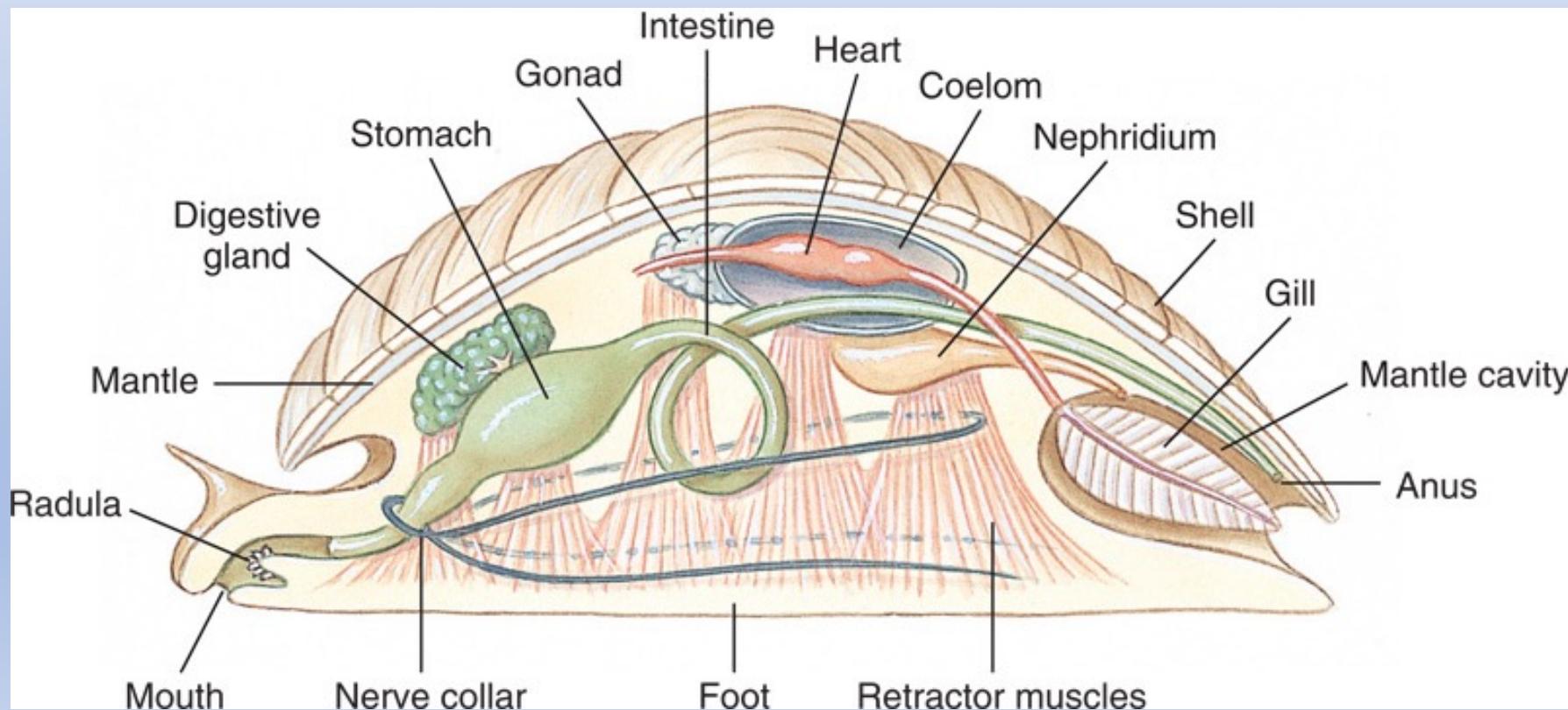
- Found in snails, bivalve mollusks, chitons, and nautilus
- Made of **calcium carbonate (limestone)** secreted by the mantle





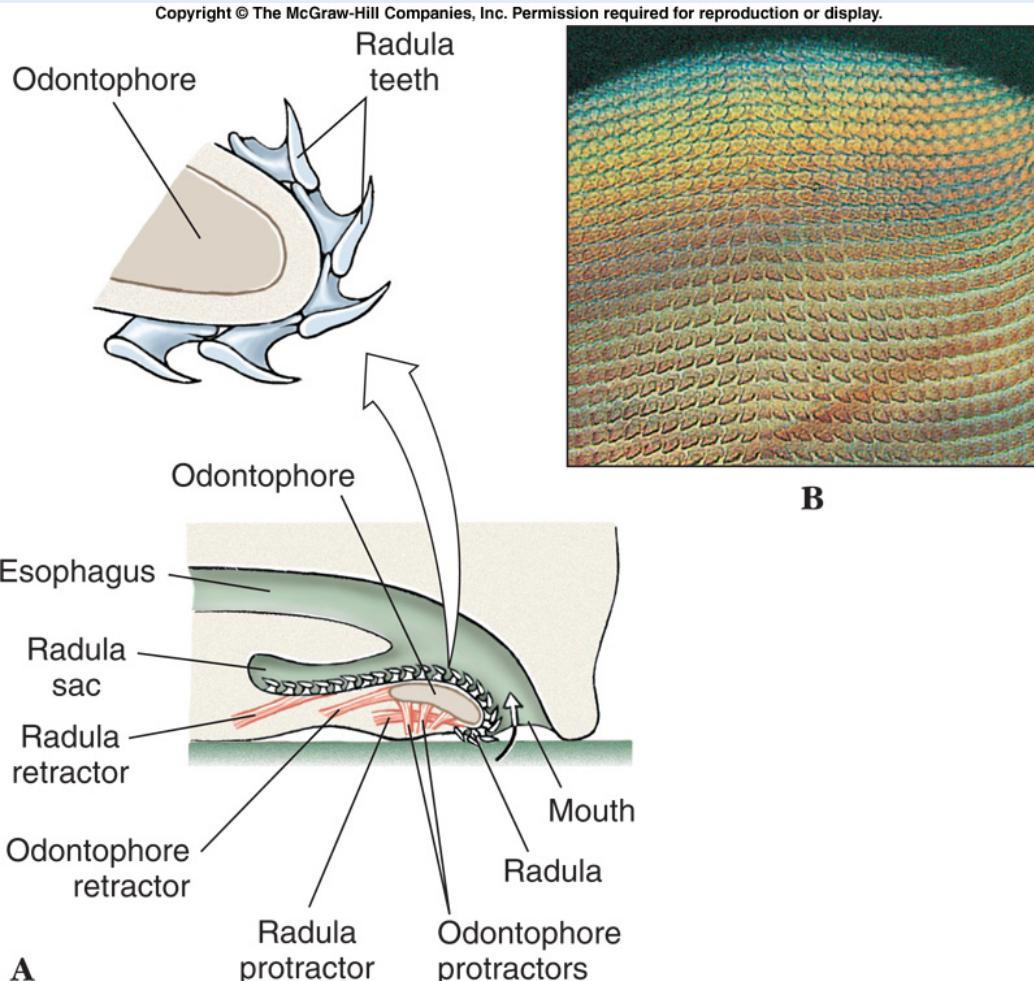
# Mantle Cavity

- 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

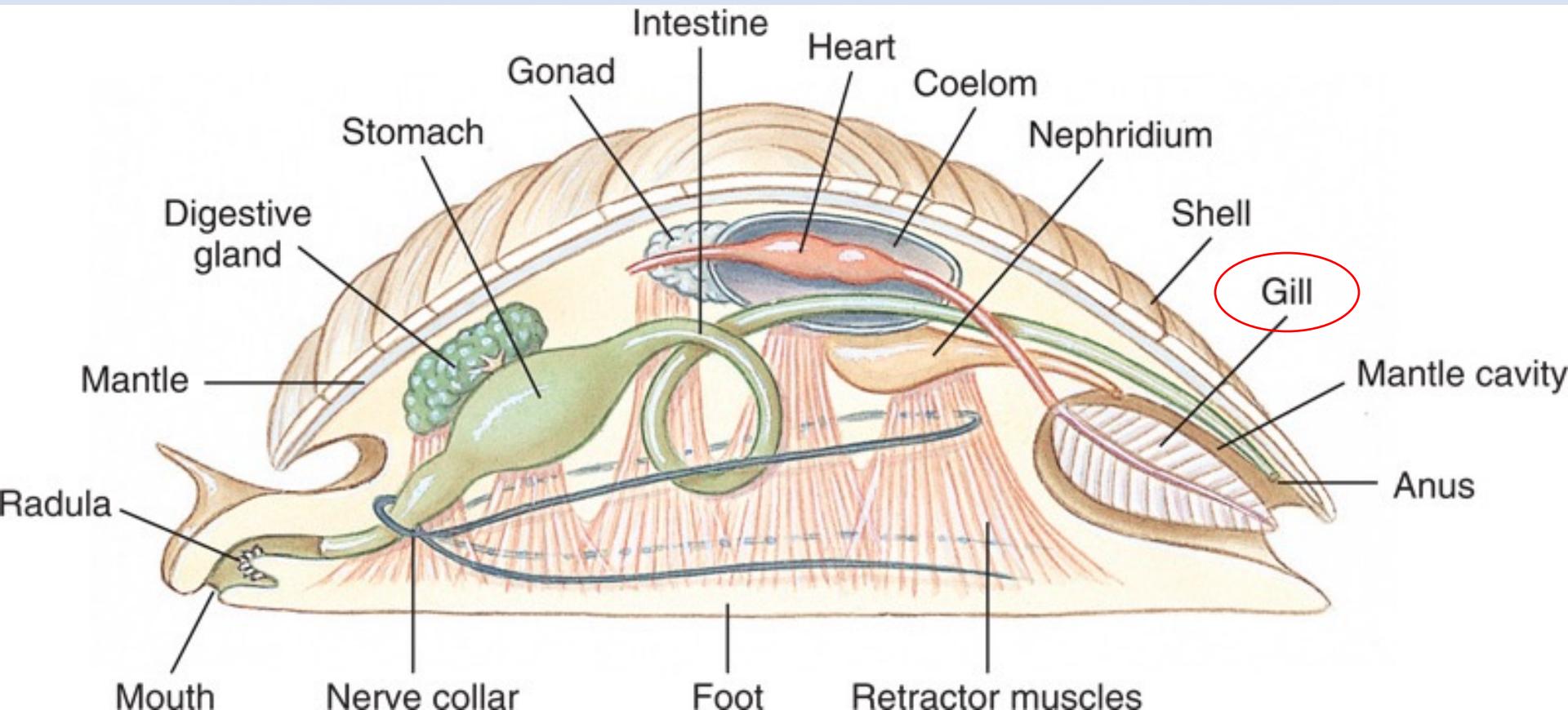
- The **radula** is a rasping, tongue like feeding structure found in most mollusks **except bivalves**.
- Has tiny rows of teeth for scraping.
- Filter feeders use gills to sift food



# 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



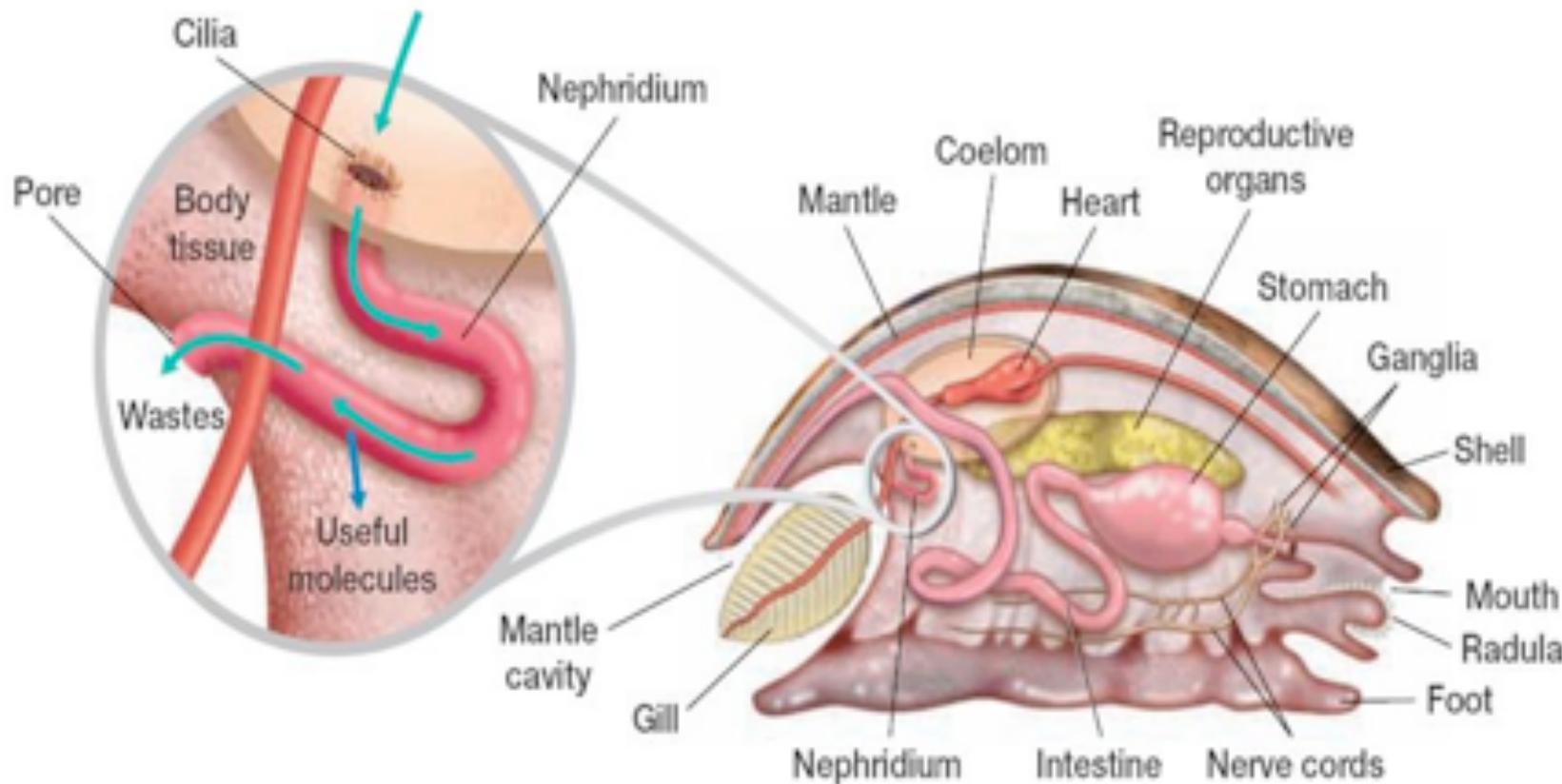
# Circulatory System

- 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 **#likeaboss**

# 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

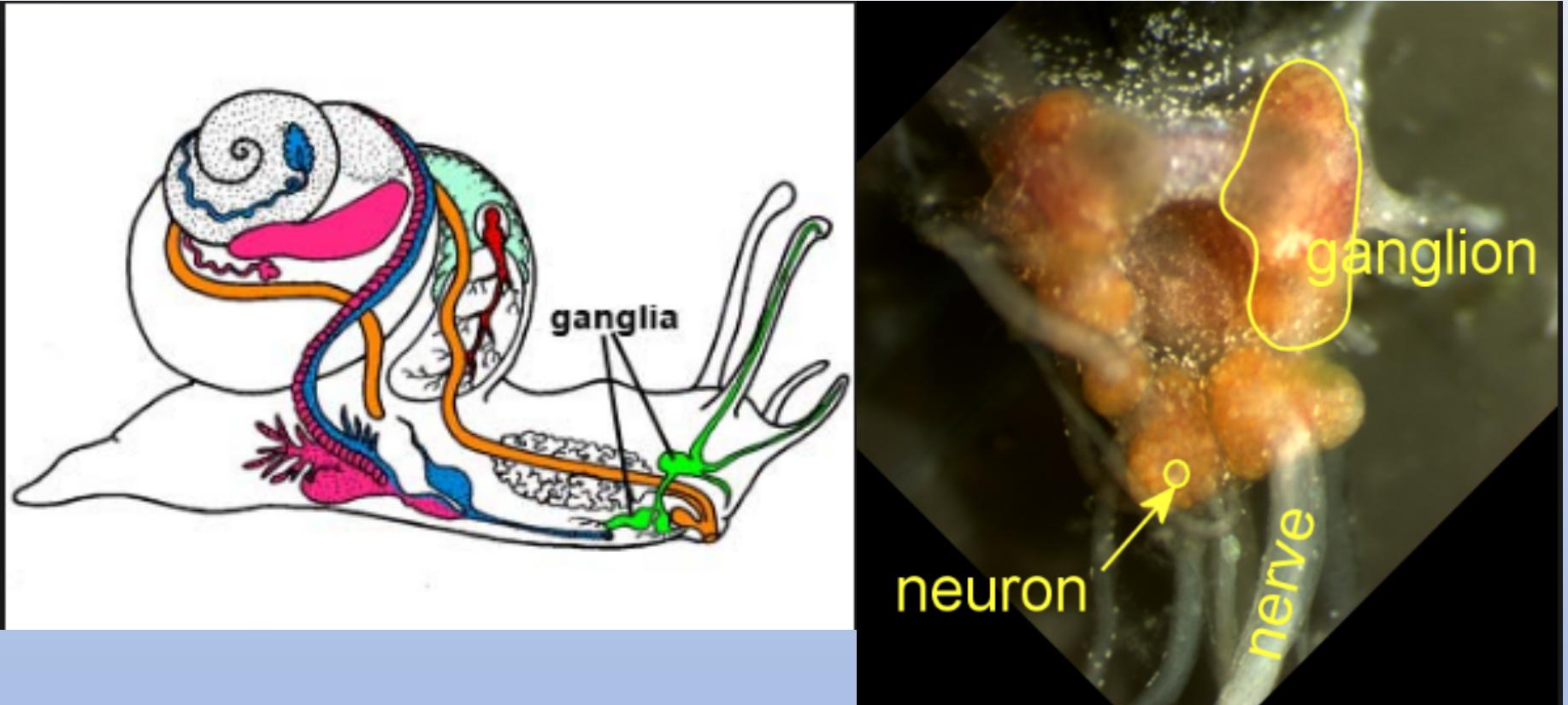
# Nephridia- Early Kidneys



# Nervous System

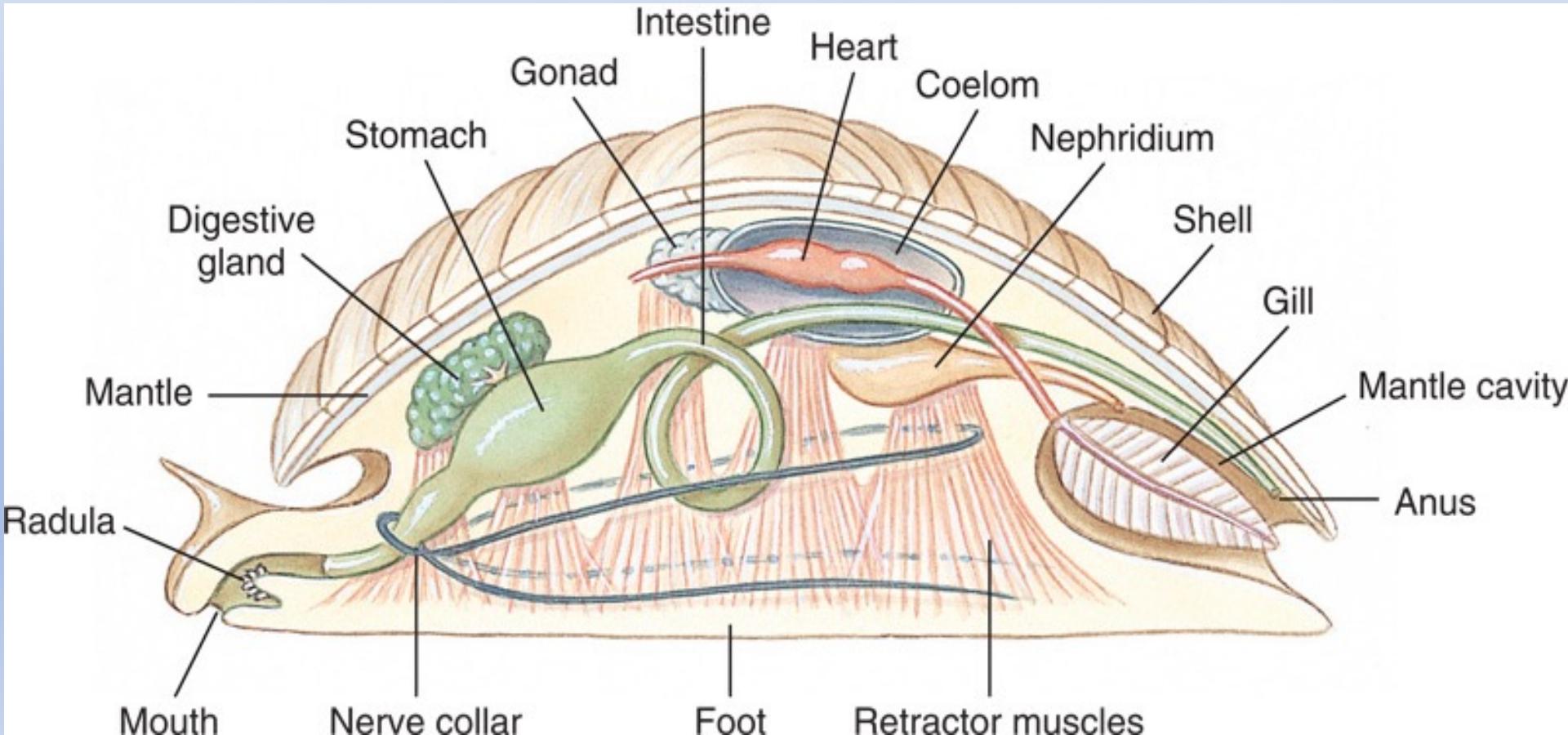
- Varies greatly between species
  - Bi-valves have extremely simple systems consisting of couple ganglia and nerve chords (similar to planarians)
  - Octopi, squid, snails have developed brains with **memory and learning capacity**

# Brain Development



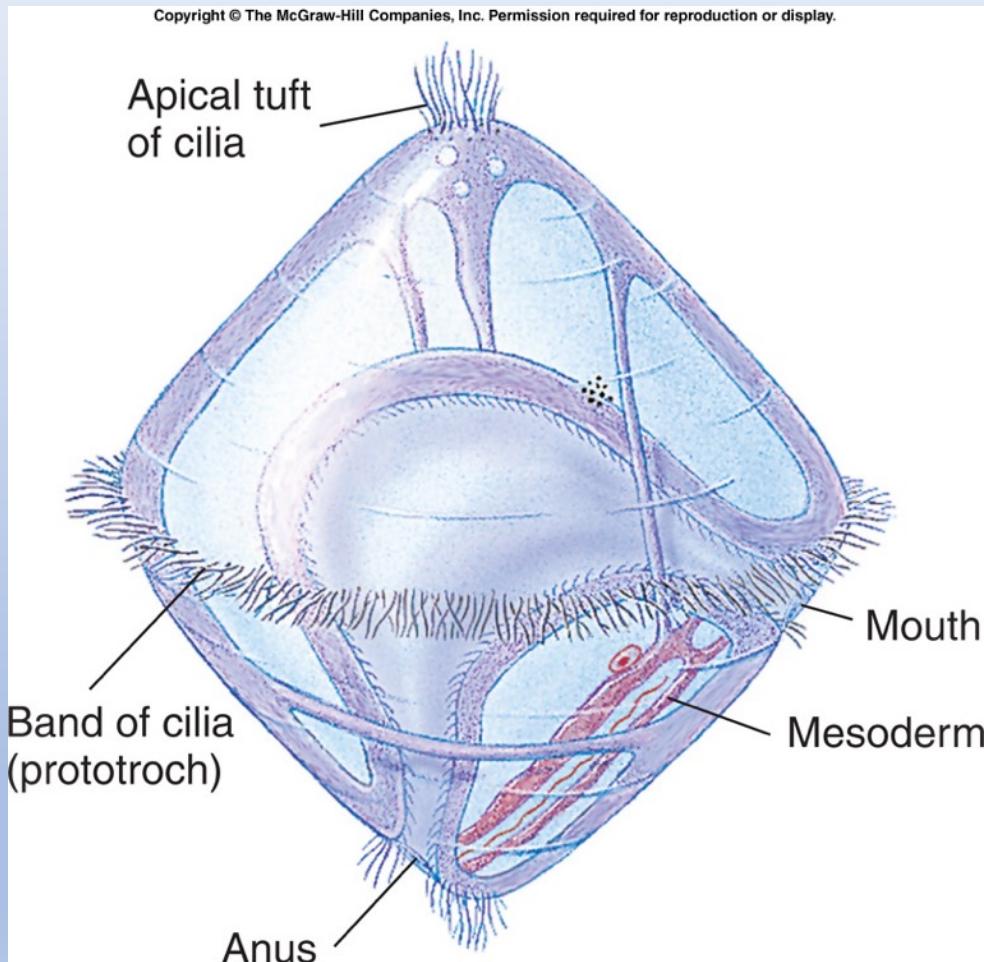
# Reproduction

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



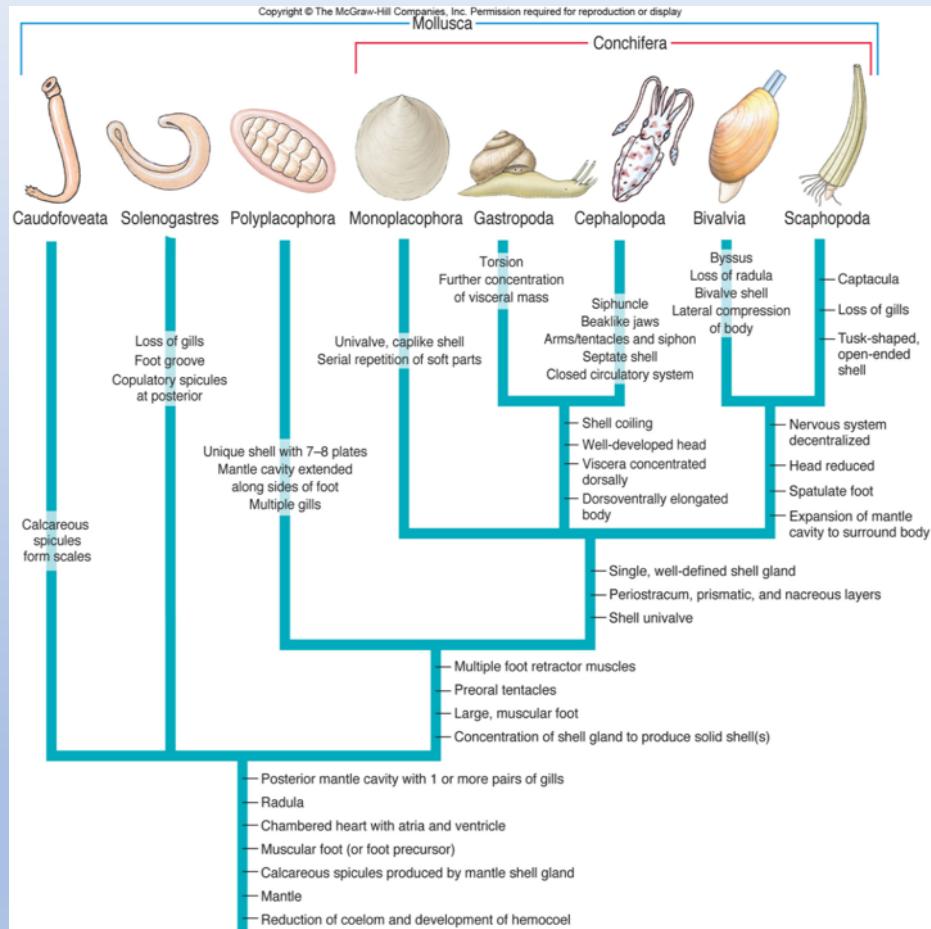
# Mollusk Life Cycle

- 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



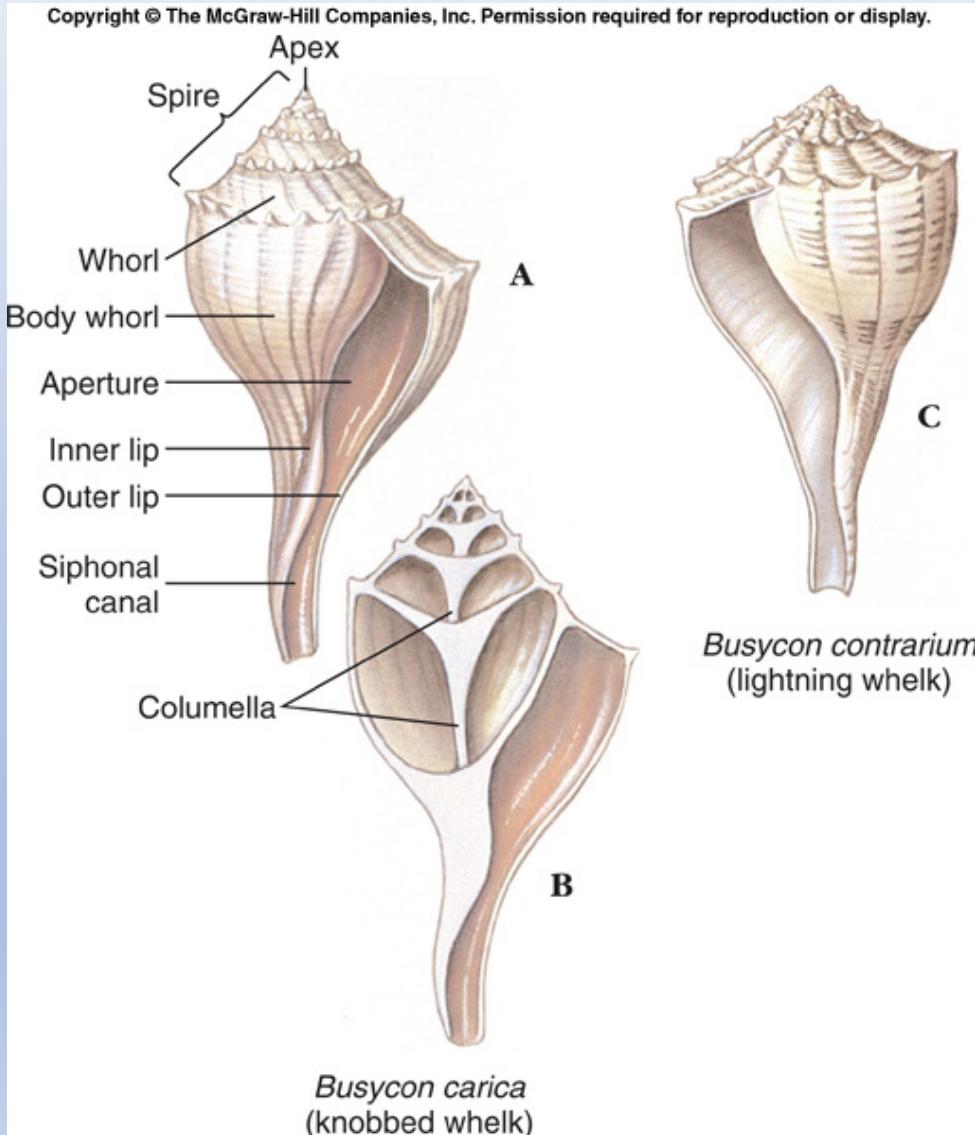
# Class Gastropoda

- *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

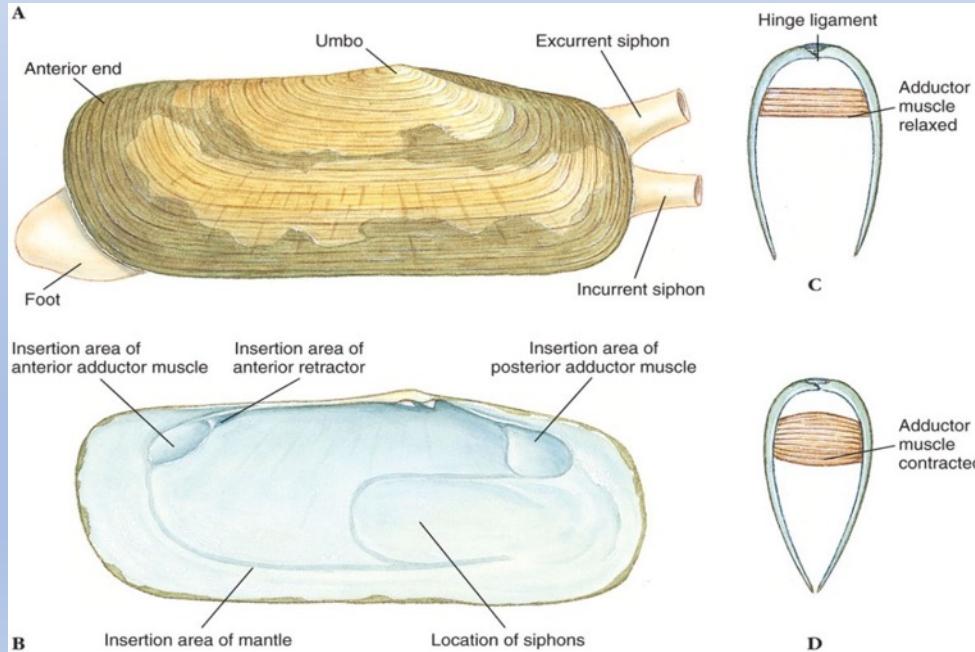
- Bivalve mollusks have **two shells** (valves).
- Mussels, clams, oysters, scallops, shipworms.
- Mostly **sessile filter feeders**.
- No head or radula.



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# Class Bivalvia

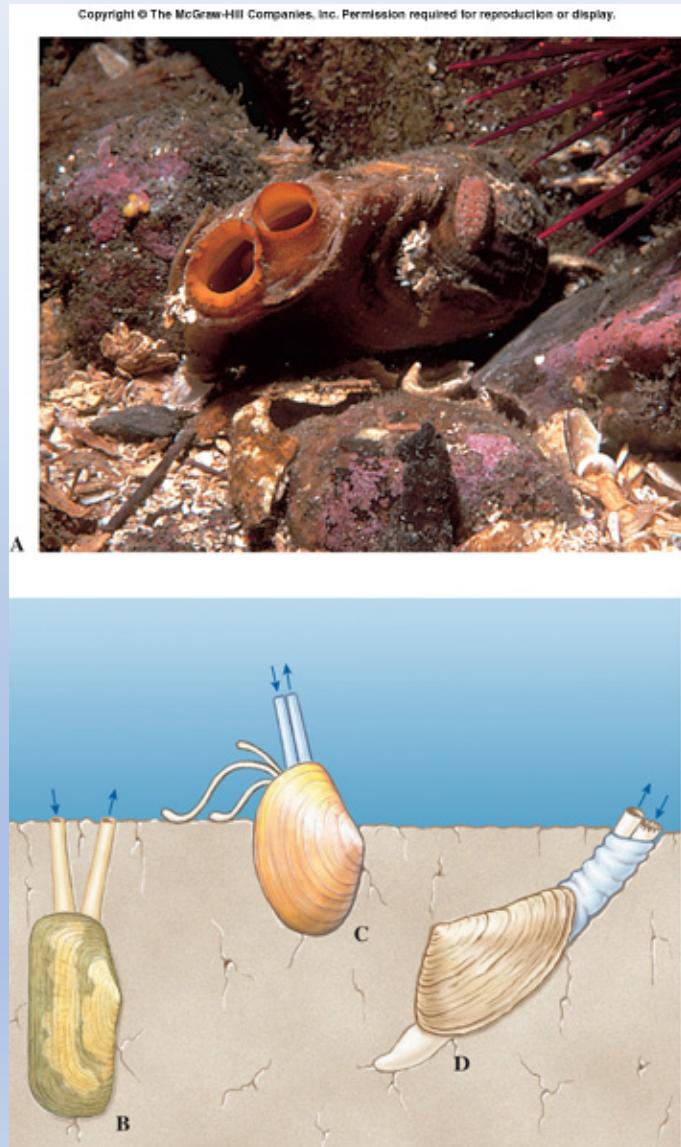
- Laterally (right-left) compressed shell
- Shells are held together by a hinge ligament
- Umbo is the oldest part of the shell
- Growth occurs in concentric rings around it.



# 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

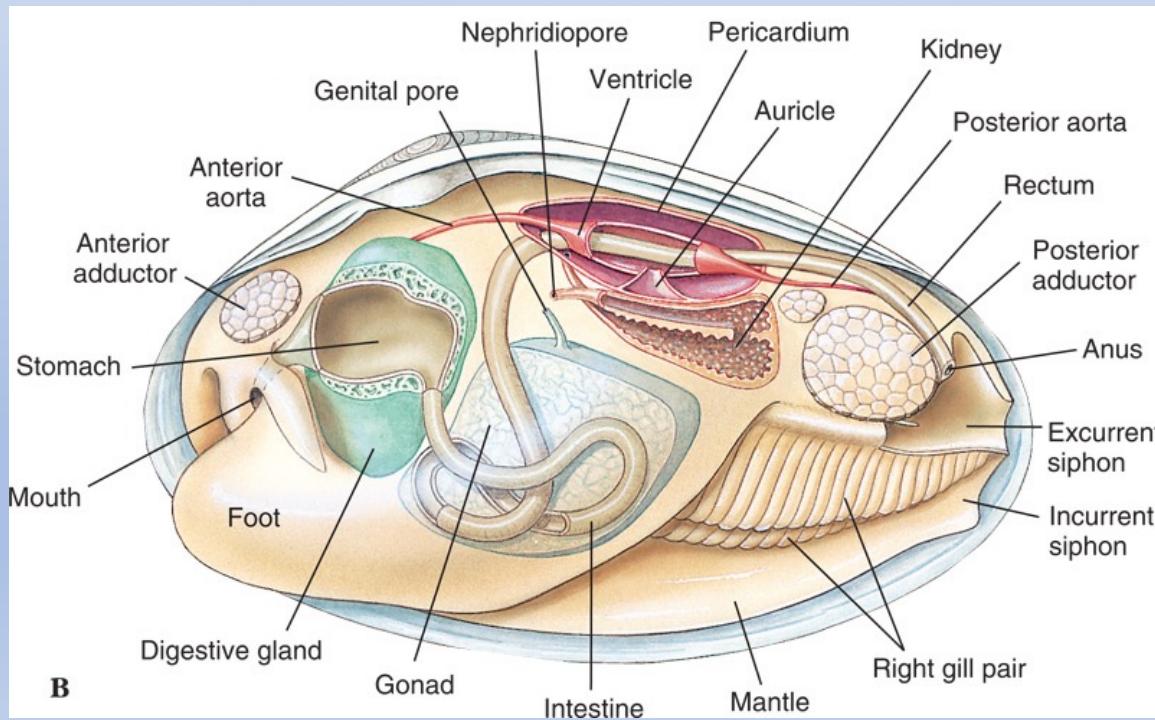
- Bivalves move around by extending the muscular foot between the shells.
- Scallops and file shells swim by clapping their shells together to create jet propulsion.



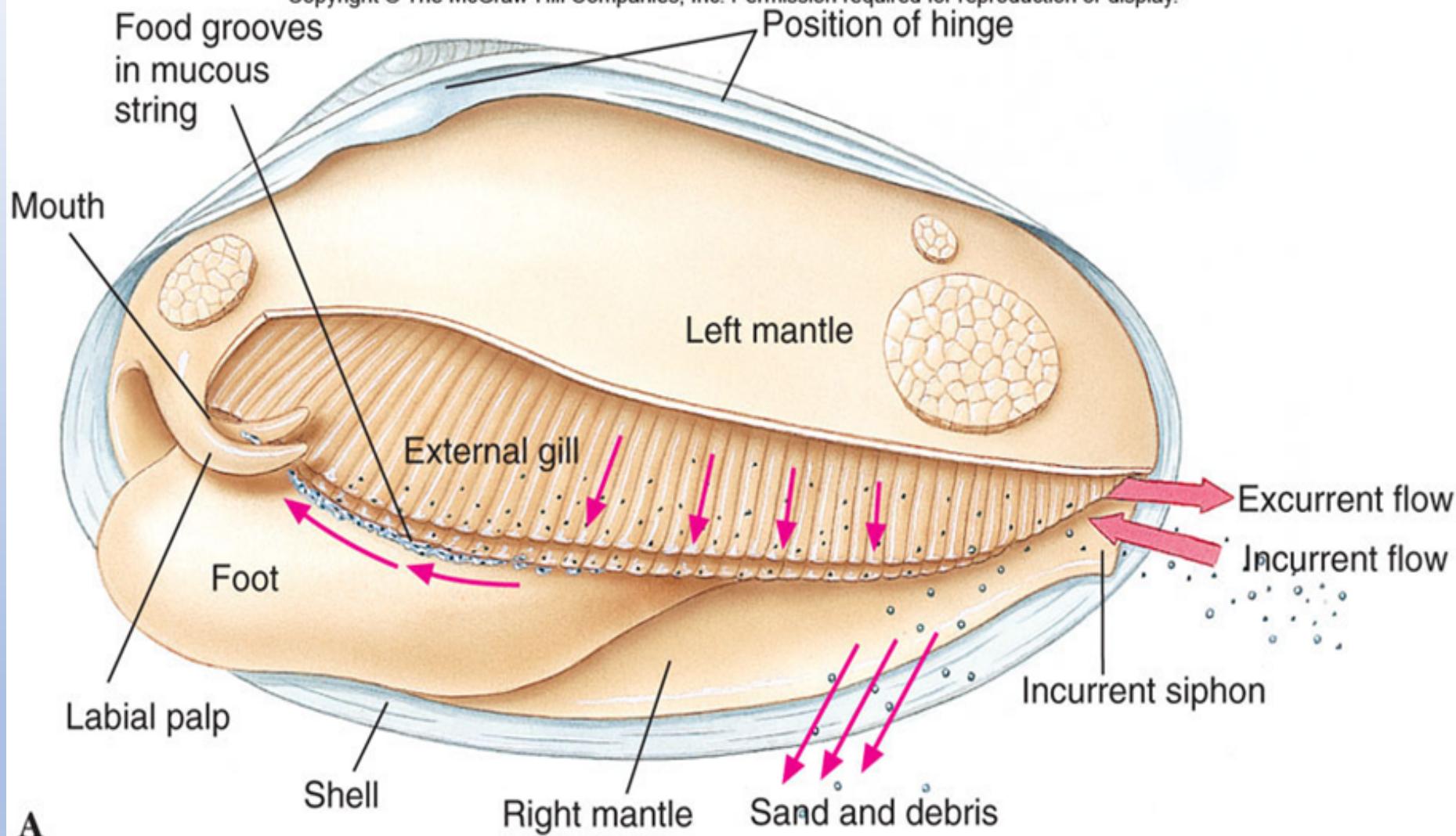
[http://www.youtube.com/watch?v=vmi\\_I8QW5eo](http://www.youtube.com/watch?v=vmi_I8QW5eo)

# 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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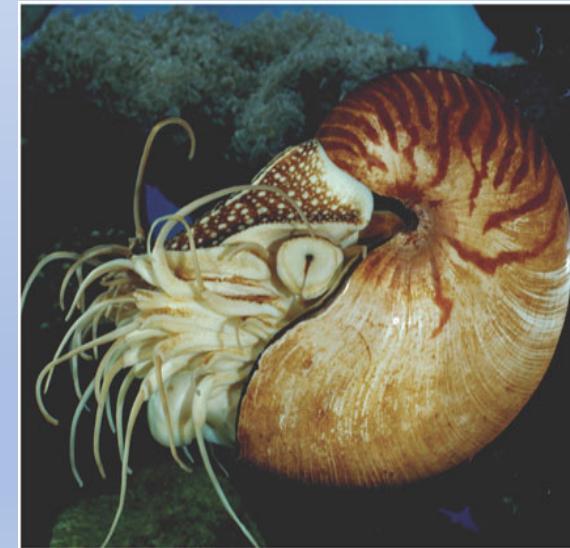
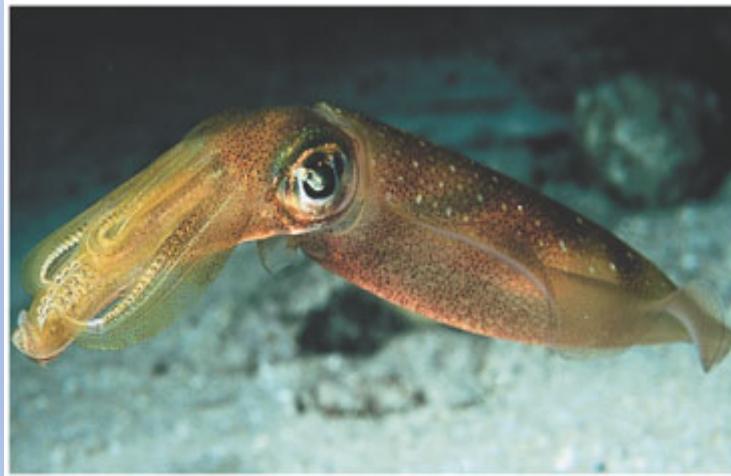
# Class Bivalvia

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



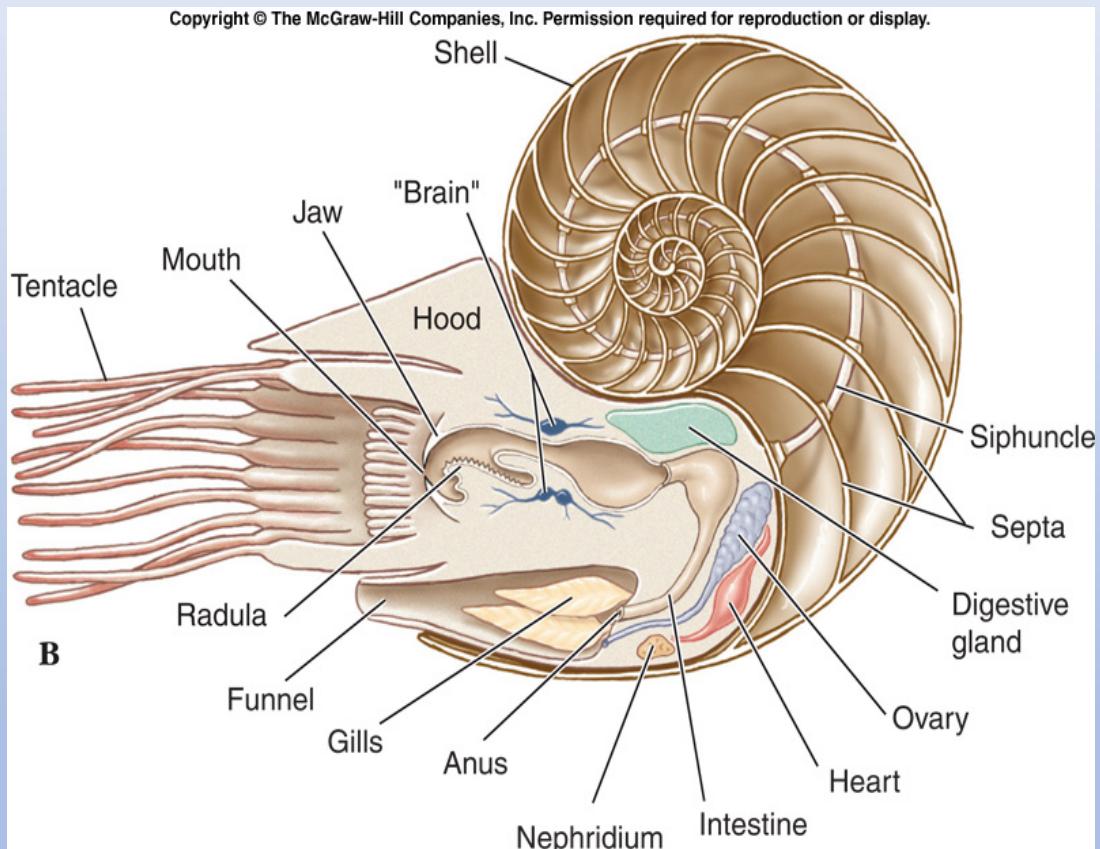
# Class Cephalopoda

- *Kaphale* = head   *Podos* = foot
- Cephalopods include octopuses, squid, nautiluses 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

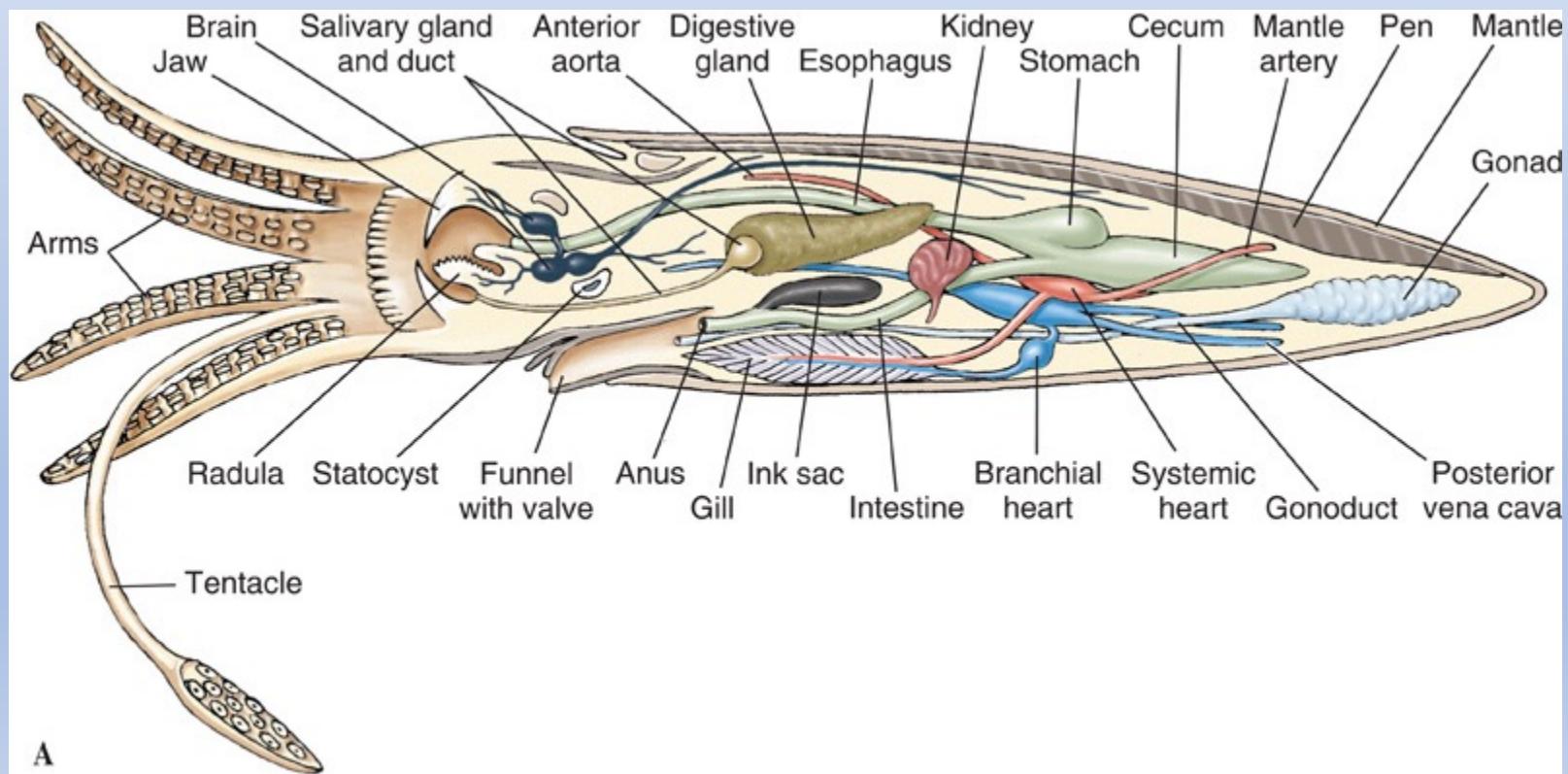
- **Cuttlefish** have a small curved shell, completely enclosed by the mantle and are masters of camouflage.

Did you see that?



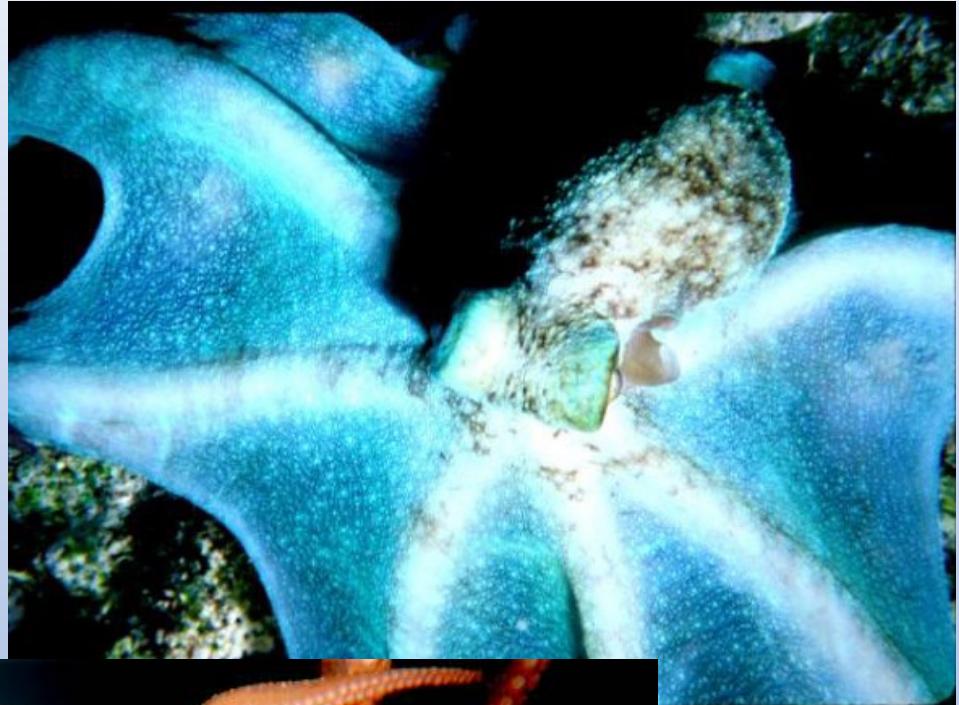
# Class Cephalopoda - Shells

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



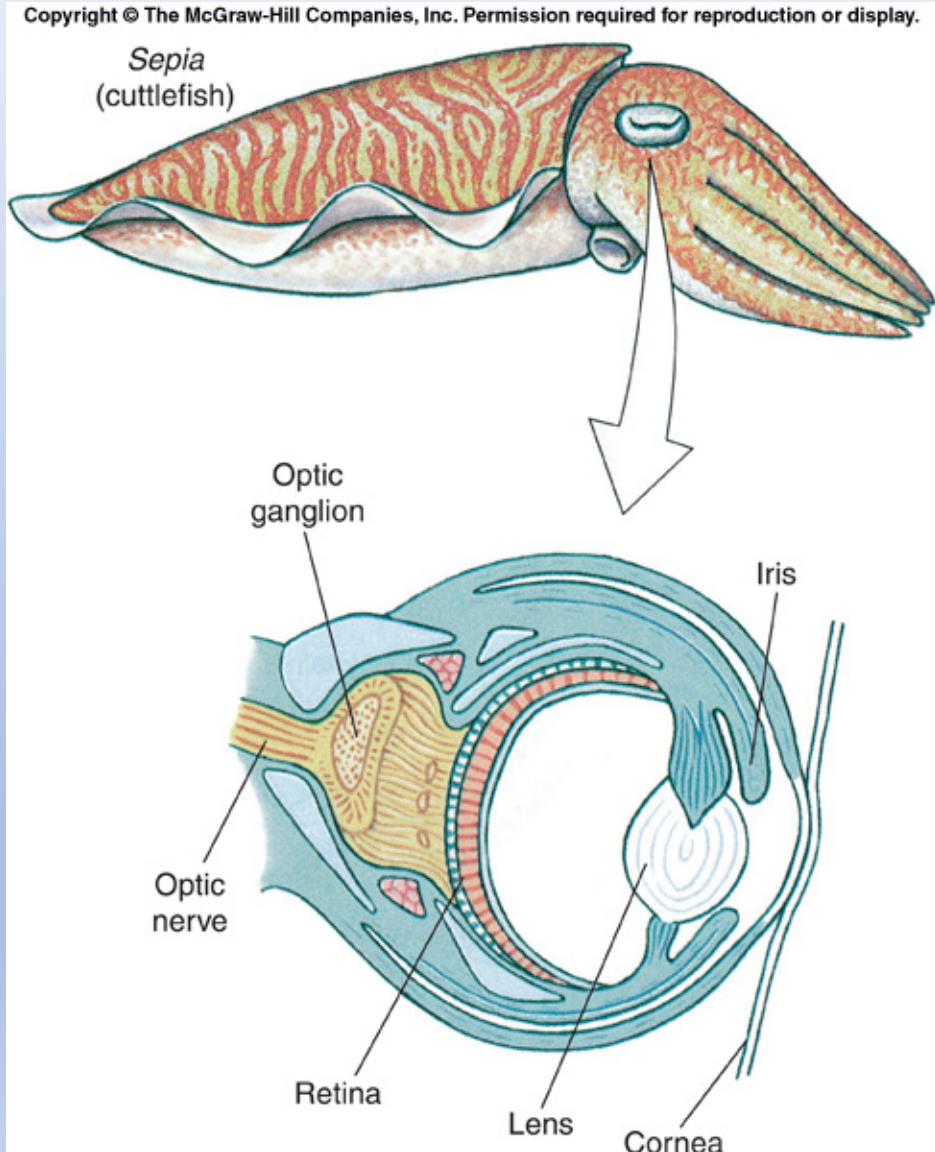
# Class Cephalopoda - Locomotion

- 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**



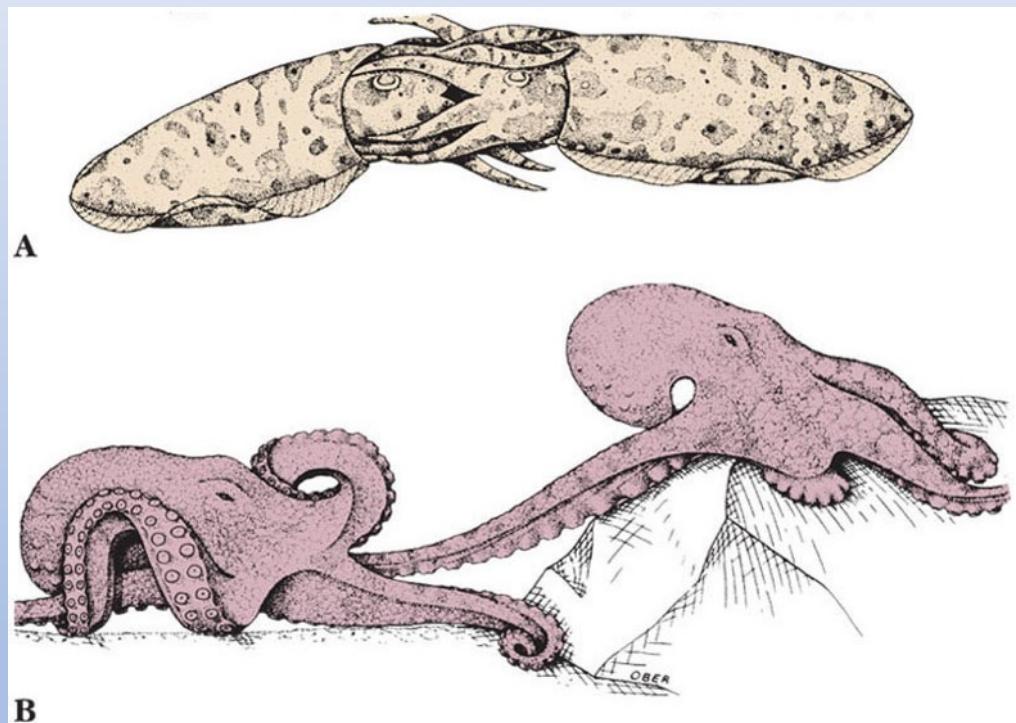
# Protection

- 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.



# 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