Mollusks

Soft-bodied Invertebrates

Phylum Mollusca

- Very diverse - more species of molluscs than any other group in the ocean.
- Phylum includes:
  - Bivalves (2 shells); ex. Clam
  - Gastropods (1 shell, coiled); ex. Snail
  - Cephalopods (large head, tentacles); ex. Octopus



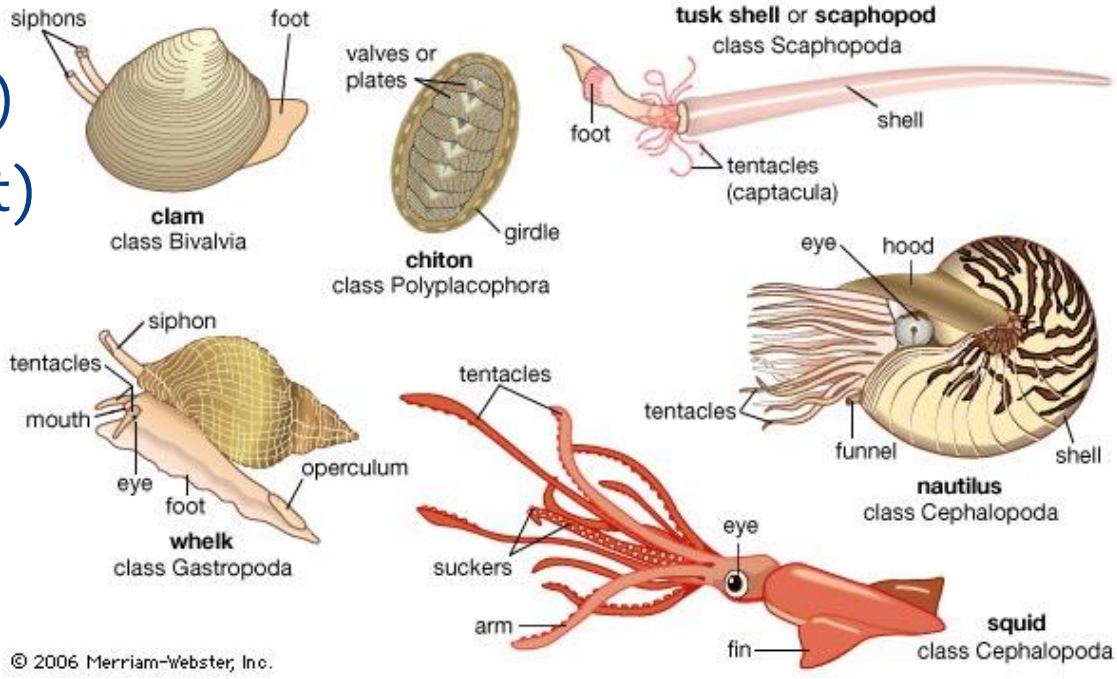
Phylum Mollusca

K P C O F G S

- Class **Bivalvia** (clams, mussels)
- Class **Gastropoda** (snails)
- Class **Cephalopoda** (octopus, squids)

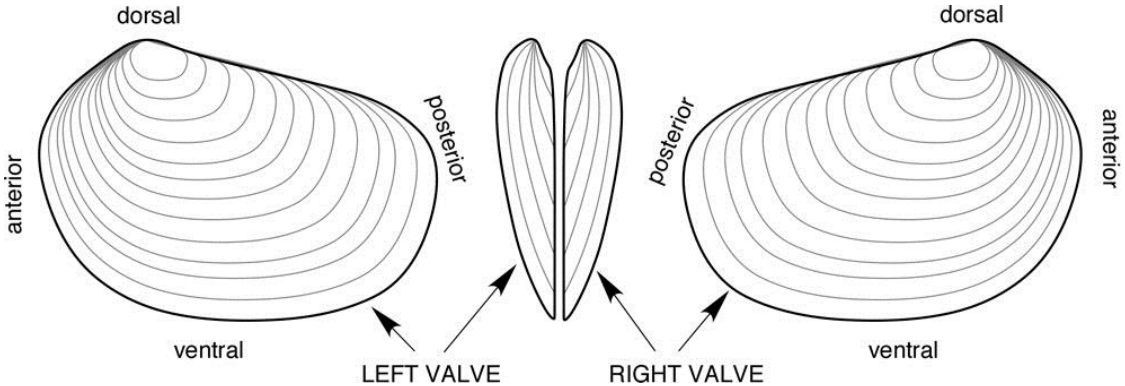
Phylum Mollusca

- **Soft-bodies**
- Calcium carbonate **shell**
- **Mantle** (thin layer of tissue that covers the body)
  - Mantle secretes the shell
  - **Bilateral** symmetry (most)
  - Muscular **foot** (movement)
  - **Head** with sensory organs
  - Paired **gills** (O_2 exchange)
  - **Radula** (tool used to feed, scrapes surfaces)



Bivalvia
clams, mussels, oysters, scallops

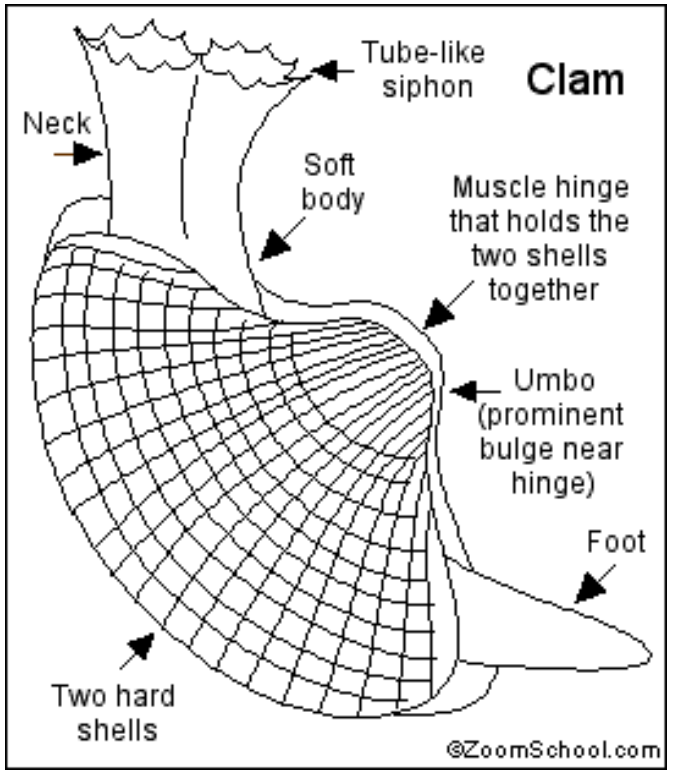
- Approx. 10,000 species
- Bodies are **bilaterally** symmetrical, laterally compressed
- Have head, foot, coiled visceral mass (internal organ)
- Mantle: membrane that lines the inside of the shell; contains glands that release calcium carbonate.
- Clams live buried in sand; intertidal and subtidal zones.



Bivalvia

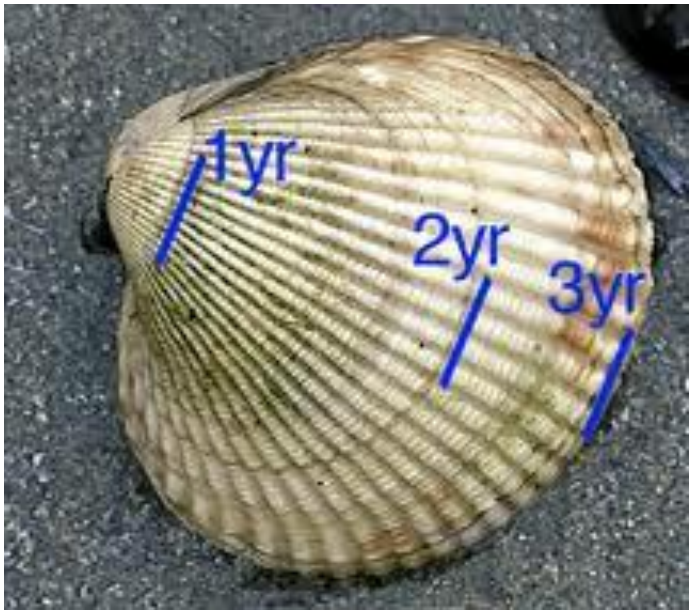
clams, mussels, oysters, scallops

- Body is enclosed within a shell
  - 2 shells (valves)
  - Valves hinged at one end.
  - **Umbo** is hump at dorsal (top) side of shells, near hinge
    - Umbo is the oldest part of the shell
    - Growth of shell is from umbo – growth lines/rings show on shell.
  - No head, no radula
  - Gills: exchange oxygen and filter food particles from water.
  - Adductor muscles keep shells closed.



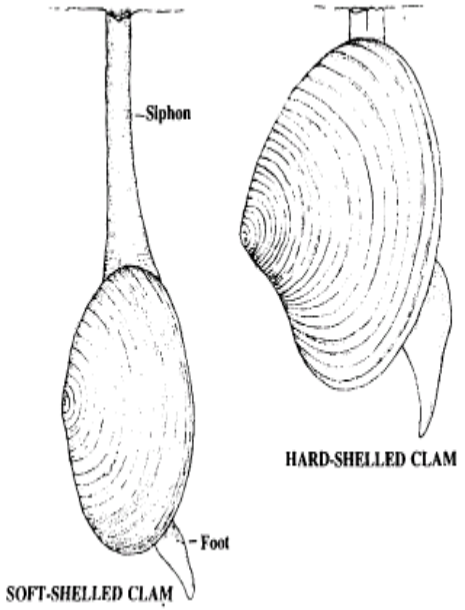
World's Oldest Animal: a clam!

http://www.nbcnews.com/video/nightly-news/53547313#53547313



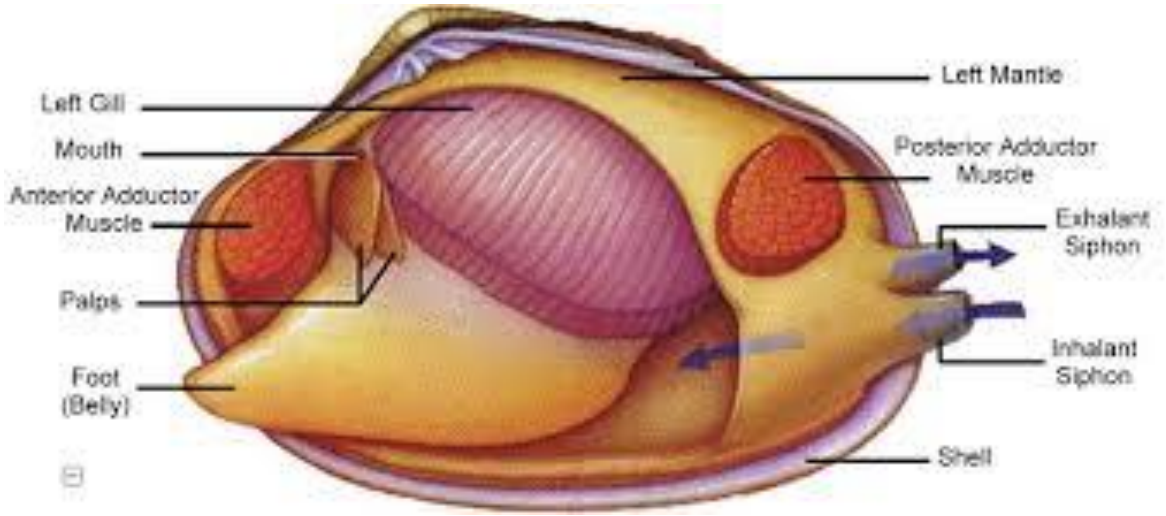
Bilvalve Feeding

- Shells are shut tight; only a small gap between them.
- Siphon tube sticks out from gap to feed and breathe.
  - **Incurrent** (IN) and **outcurrent** (OUT) openings
  - Water moves IN (**food particles and O_2**)
  - Water moves OUT (**waste from digestion and CO_2**)
- Bivalves are filter feeders: water comes in through the siphon and washes over gills – food particles get stuck on gills and mantle and are then moved toward the mouth.



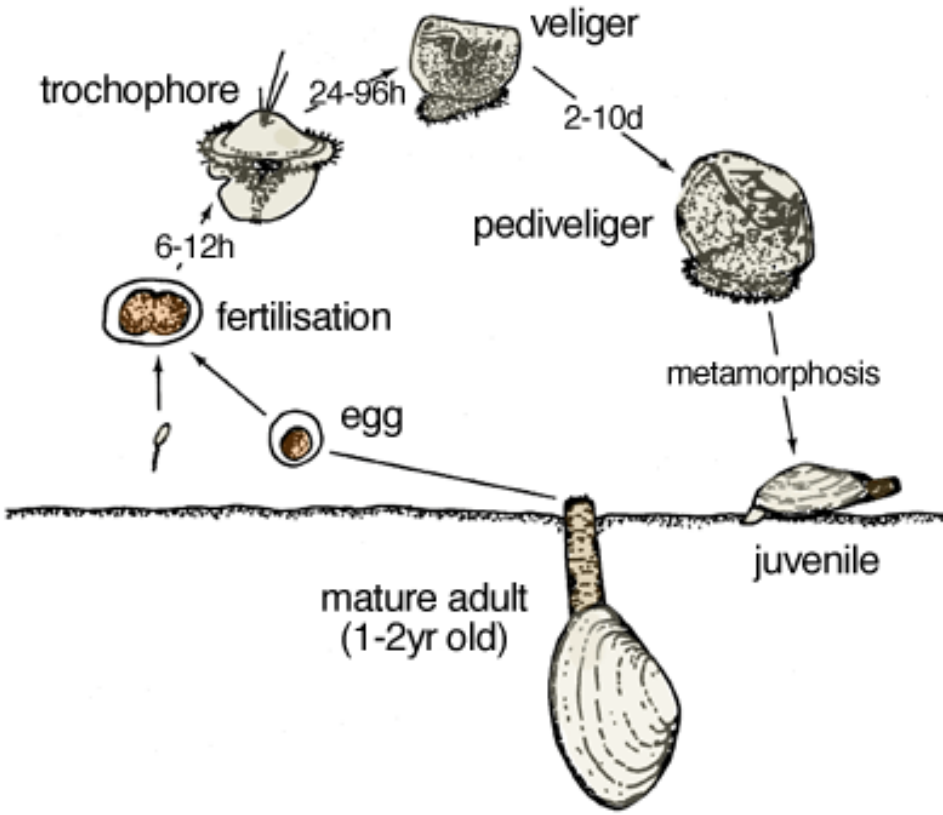
Bilvalve Breathing

- Breathe using gills: water flows over gills - O_2 comes in, CO_2 goes out
- Open circulatory system transports oxygen through a colorless blood.



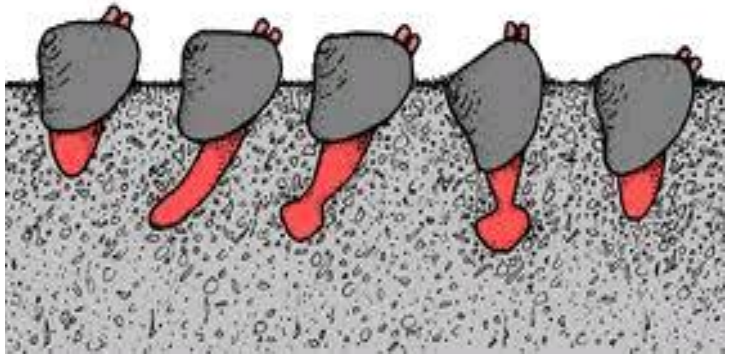
Bilvalve Reproduction

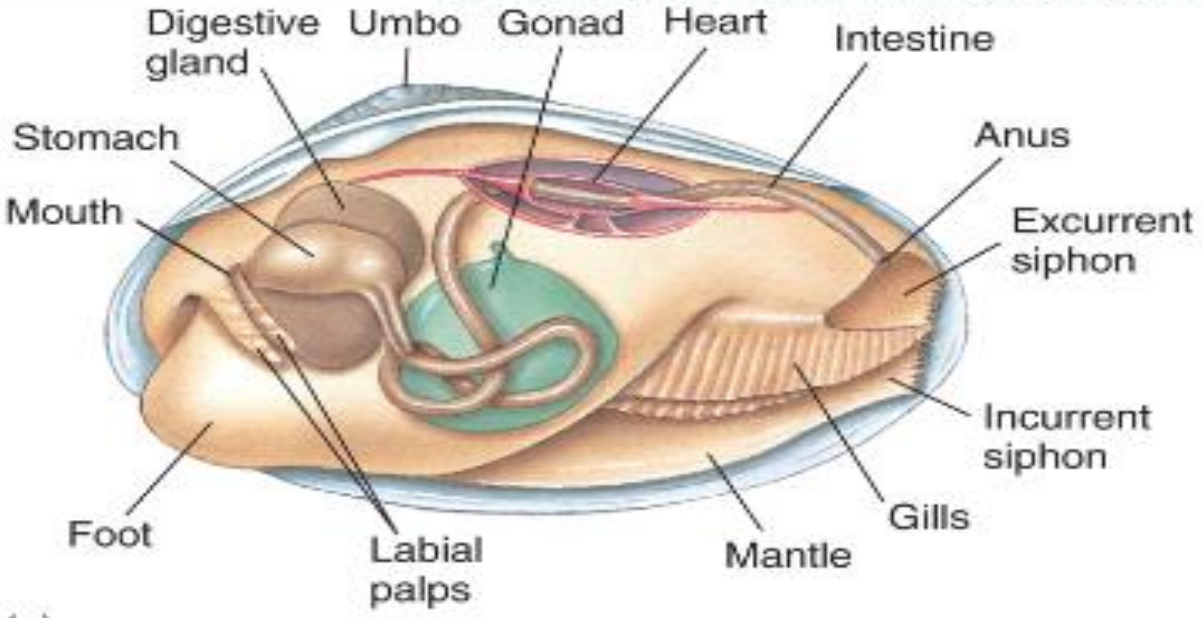
- Reproduction is **external**: eggs and sperm are released into the water.
- **Temporary zooplankton**: larvae are planktonic.
  - When shells are formed, they sink to the bottom and develop into adults.



Bivalve Diversity

- Not all bivalves burrow in sand
  - **Mussels**: use byssal threads (protein fibers) to attach themselves to rocks, other surfaces.
  - **Oysters**: cement themselves to shells of other oysters.
  - **Scallops:** some species swim by clapping their shells together (one very strong adductor muscle)





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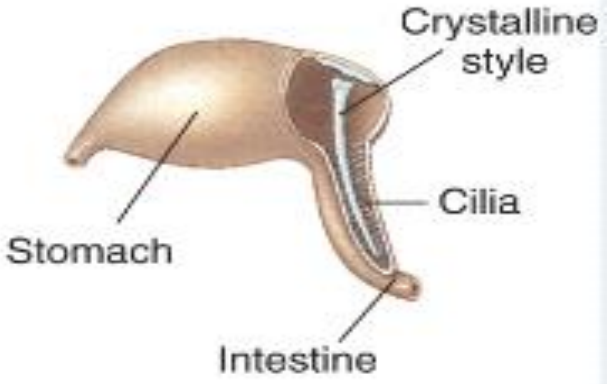

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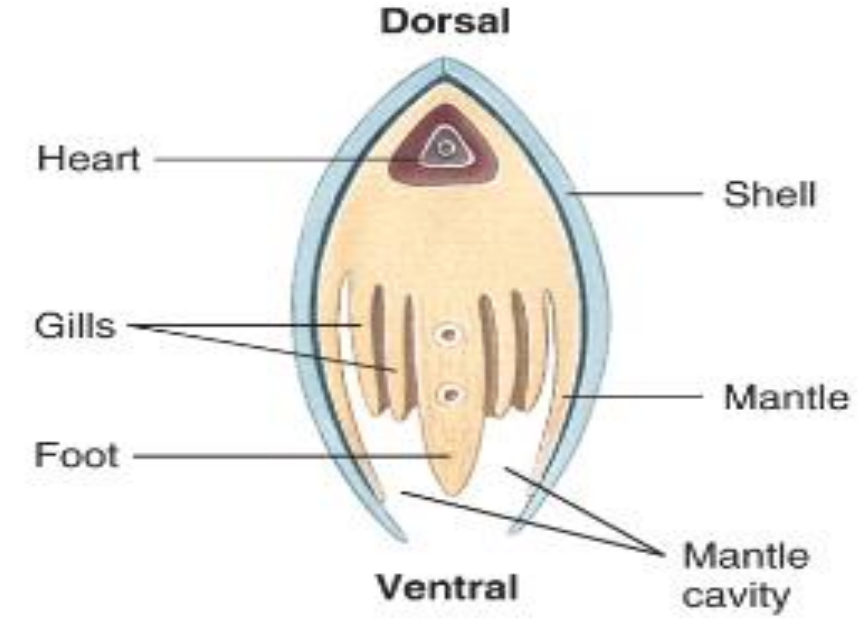

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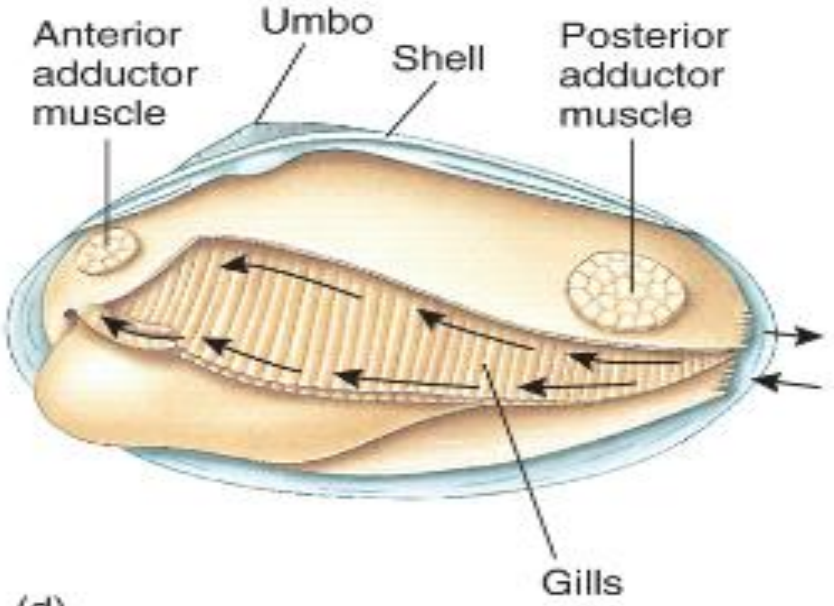
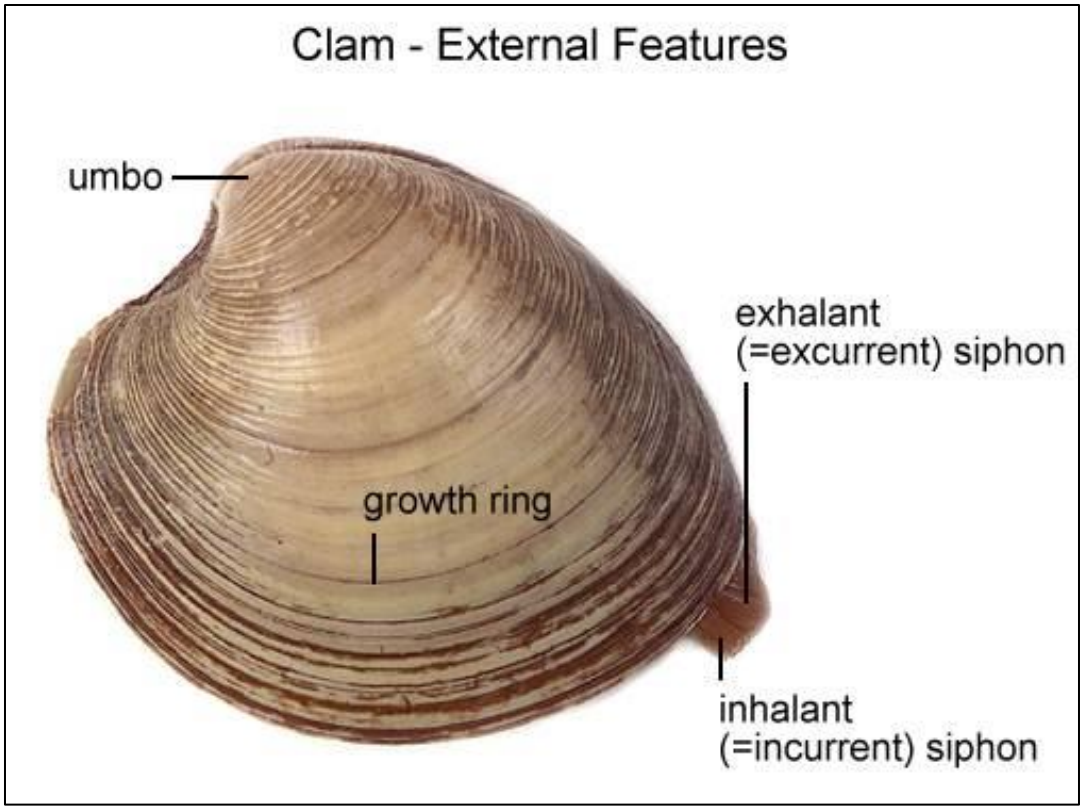
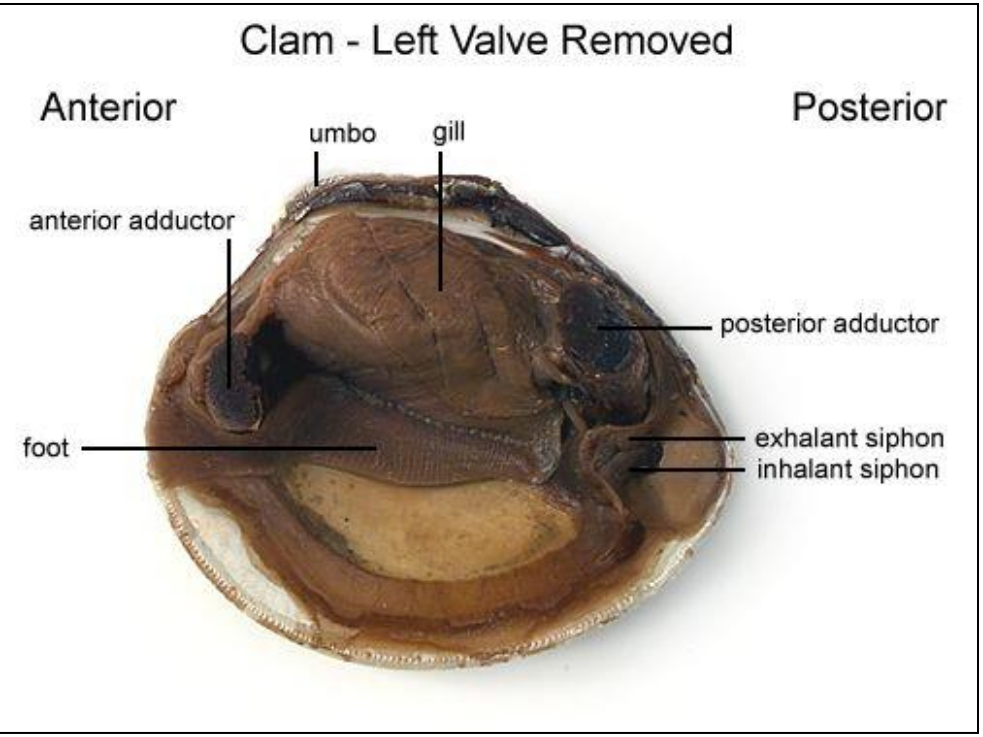


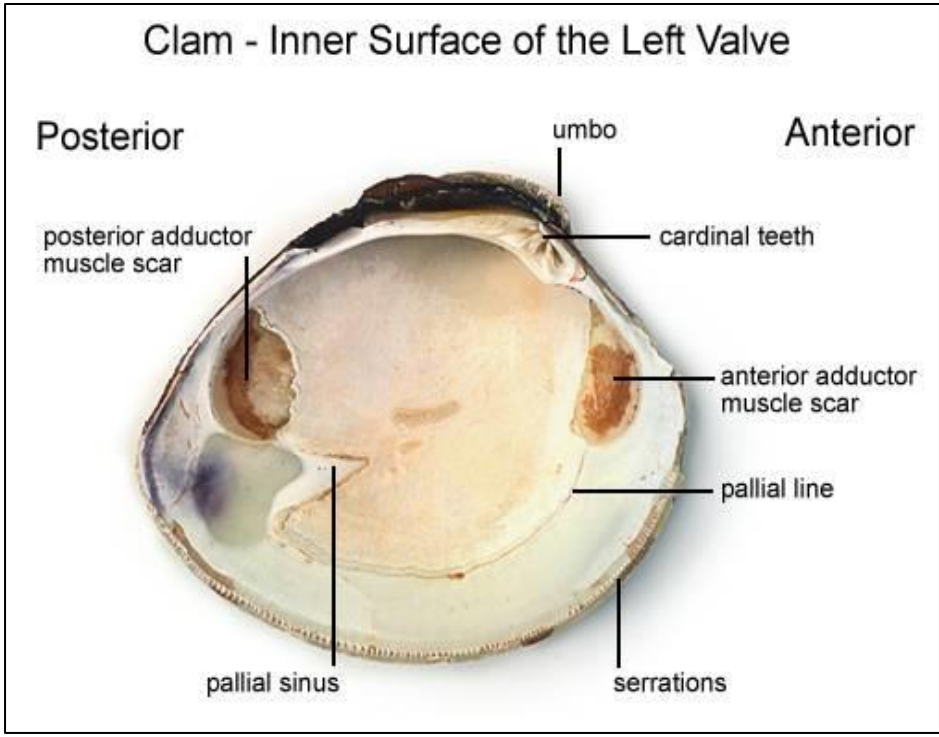
(d)

Clam – external features



Clam – internal features





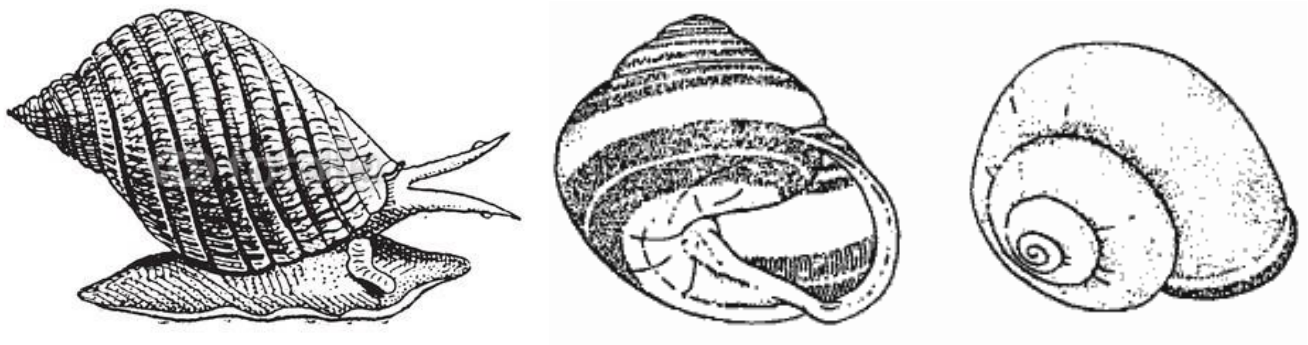
Phylum Mollusca

K P C O F G S

- Class **Bivalvia** (clams, mussels)
- Class **Gastropoda** (snails)
- Class **Cephalopoda** (octopus, squids)

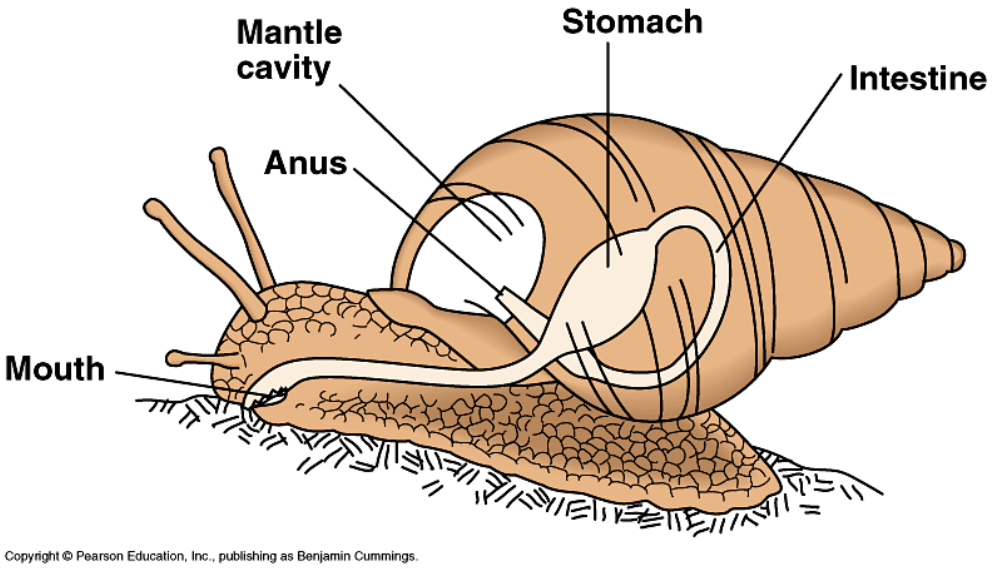
Gastropods:
snails and slugs

- Two-thirds of all mollusks are gastropods.
  - 80,000-100,000 species (mostly marine)
- Univalves: one shell – it is usually spiral or coiled.
- Gastropoda means "stomach-foot".



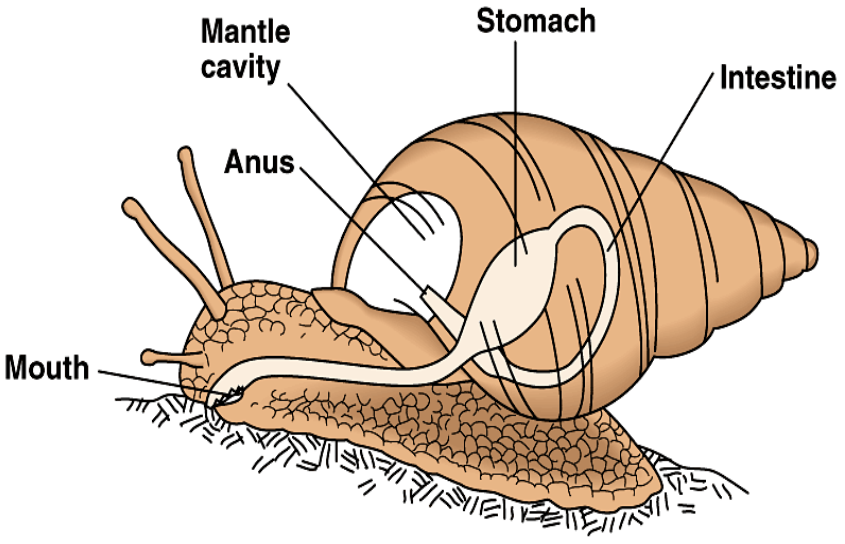
Gastropod Feeding

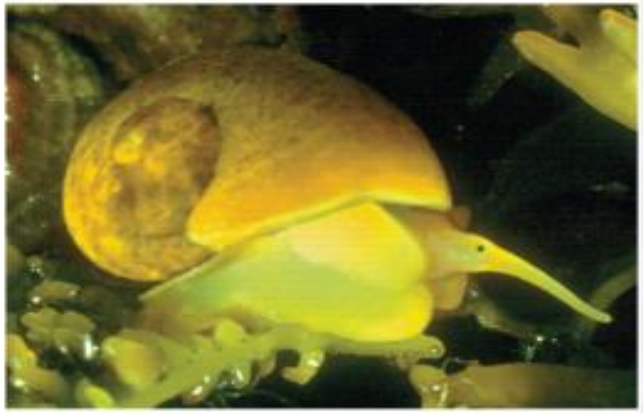
- Large muscular **foot** is used to move on surfaces.
- **Radula** is used to scrape food from rocks.
- Food is taken in through the **mouth** and moves down a one-way digestive tract; waste is sent out through the **anus**.



Gastropod Feeding

- Nutrients are transported using an open circulatory system:
  - **Heart** pumps blood through tissue when it contracts.
- **Kidneys**: **filter** and send out waste from cells.
- **Operculum**: trapdoor over shell's opening.
  - When not feeding or moving, snails close up into their shells.





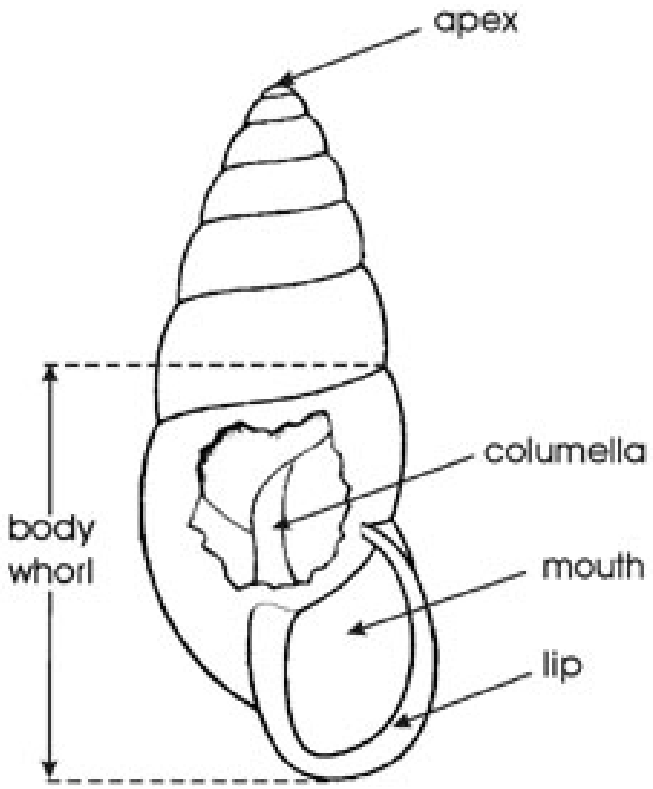
Littorina obtusata,
North Atlantic Ocean

Gastropod Reproduction

- Some species have **separate sexes.**
- Some species are **hermaphrodites** (both male & female)
- **Internal** fertilization: egg is fertilized INSIDE the organism.
- **External** development: fertilized eggs can be deposited into the water OR eggs may develop in an egg case.
- Many snail larvae are **planktonic.**

Shell Morphology

- APEX: first part of shell formed; oldest.
- WHORL: one complete coil of the shell.
- BODY WHORL: last part of shell formed; youngest.
- MOUTH: opening of shell.
- LIP: thickened edge of mouth.
- SPIRE: all visible whorls, not including body whorl.

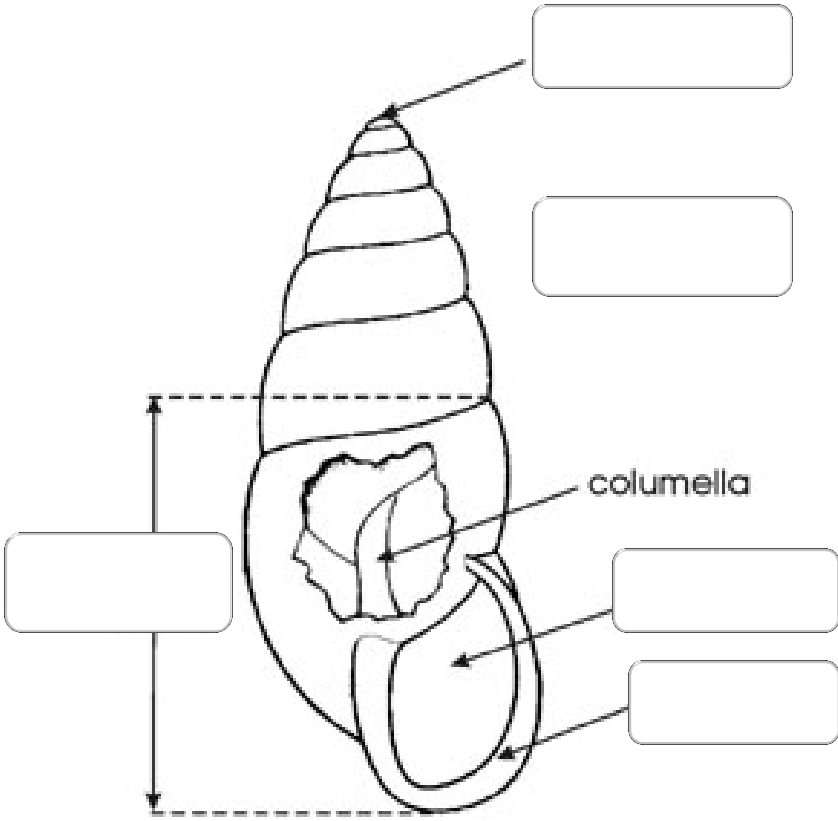


Gastropod Anatomy

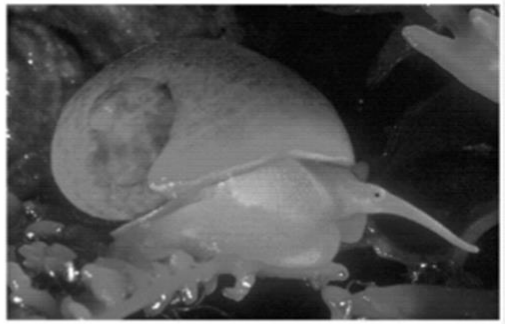
STRUCTURE	FUNCTION
Shell	Protection
Muscular foot	Movement
Anterior antennae (eyes)	Vision
Posterior antennae	Sensitivity
Siphon	Water intake
Gills	Breathing/gas exchange
Radula	Feeding/ingestion
Mouth, stomach, intestines, anus	One-way digestion
Kidney	Filtration & Excretion
Heart	Nutrient transport

Gastropod Morphology

- APEX: _____
  _____.
- WHORL: _____
  _____.
- BODY WHORL: _____
  _____.
- MOUTH: _____.
- LIP: _____.
- SPIRE: _____
  _____.



Gastropod Anatomy



Littorina obtusata,
North Atlantic Ocean

Gastropod Anatomy

STRUCTURE	FUNCTION

Molluscs

http://shapeoflife.org/video/molluscs-survival-game

http://shapeoflife.org/video/geerat-vermeij-evolutionary-biologist-reading-shell%E2%80%99s-story

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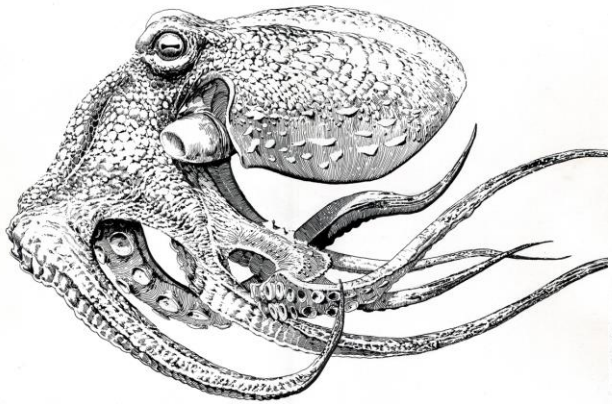
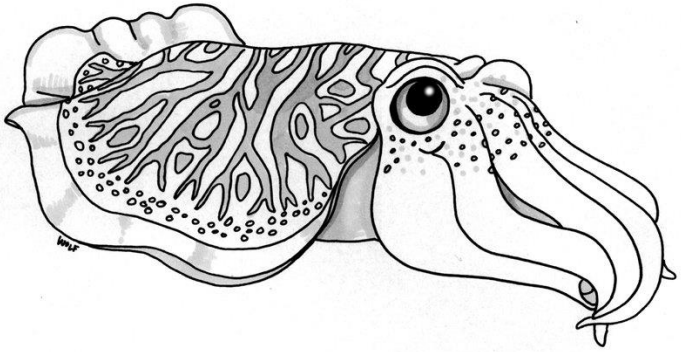
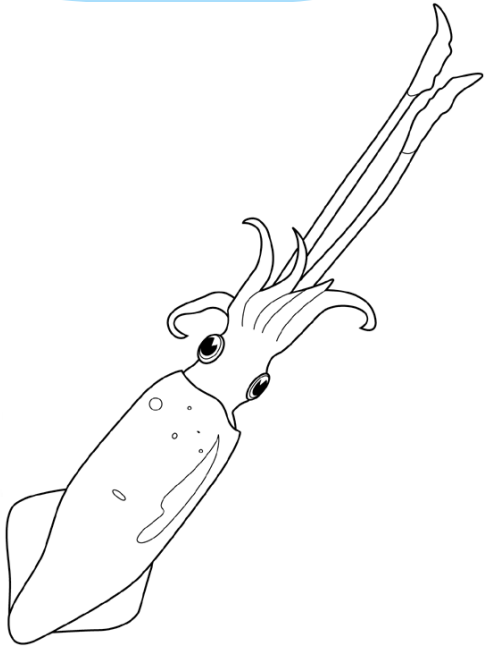
Cephalopoda:
squid, octopus, cuttlefish

- 800 marine species
- Prominent head and tentacles
- Cephalopoda means "head-foot".





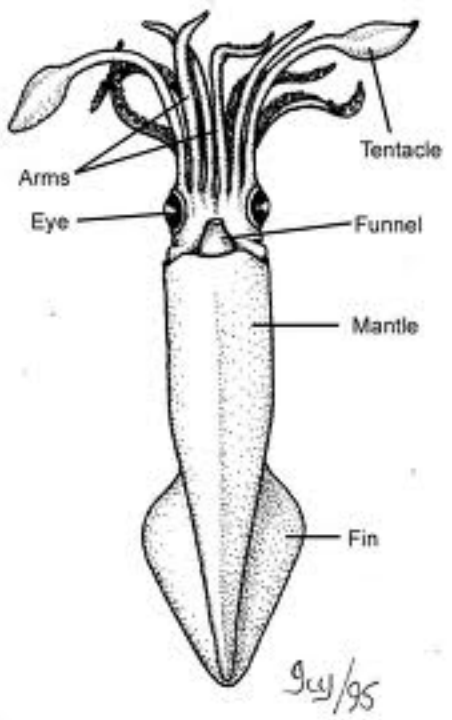


Cephalopoda: squid, octopus, cuttlefish

- **Swimming** mollusks: swim by **jet propulsion**
  - Streamlined body shape
  - No external shell (shell is either lost or very reduced)
  - Draw water into mantle and then contract mantle to send water out of the water jet/siphon – **propels** through water.
  - **Can direct** themselves by changing the direction of the water jet (coordinated by a highly developed nervous system).
  - https://www.youtube.com/watch?v=eT8sNJp9yOw

Cephalopoda:
squid, octopus, cuttlefish

- **"Foot" of Cephalopods is modified into arms & tentacles**
  - Tentacles: capture prey (fish, crabs)
    - Animal is killed with their beak.
    - Octopus also paralyzes with venom
- Complex nervous system.
- One-way digestive tract (mouth → anus)
- **Closed** circulatory system transports nutrients.



Cephalopoda: squid, octopus, cuttlefish

- **Squid:** long, thin internal shell (“**pen**”)
  - Fastest cephalopod; swims in **large schools** (gives protection)
  - 8 arms, 2 tentacles
- **Octopus:** no remaining shell (some may have vestigial remnants)
  - Solitary, efficient hunters (use beak, also venom in some sp.)
  - 8 arms
- **Cuttlefish:** internal shell(cuttlebone)
  - 8 arms, 2 tentacles
  - **solitary** organism
- **Nautilus:** large external shell
  - **solitary** organisms.
  - 60-90 short tentacles

Cephalopoda: ADAPTATIONS

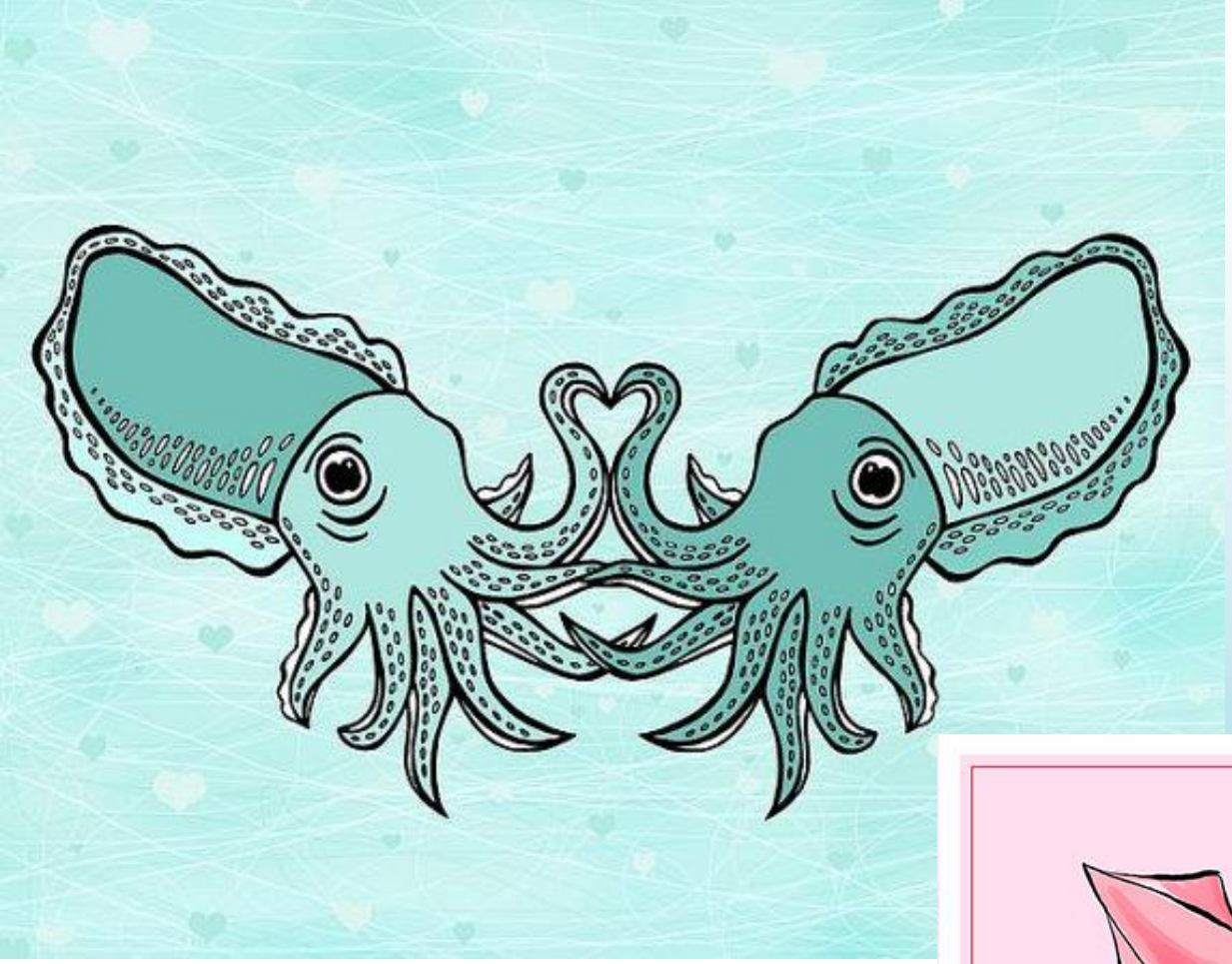
- **Camoufla**

Cephalopoda: Chambered Nautilus

- Has a coiled external shell.
- Shell has multiple compartments, some filled with gas to help with buoyancy.
- Lives in deep, tropical waters.
- Feeds during the night in shallower waters.

Cnidarian Project

- You will be assigned 2 types of Cephalopods.
- Go online and research the basic characteristics and life history of two chosen species.
- Create a Valentine for each Cnidarian (you must choose a *specific species*).
  - *Make it cheesy and creative.*
  - *Follow the rubric!*
- ***This assignment will be worth a DOUBLE CW GRADE!***




I'M A SUCKER FOR YOU!


INKIN' OF YOU, VALENTINE
OCEANTEALSEA.TUMBLR.COM

https://www.youtube.com/watch?v=QMFqV4SJLWg

Cephalopoda: Cuttlefish

- Shell is internal – helps support the soft body.
- Lives on the bottom of the ocean, preys on invertebrates in the sand.
- Ten tentacles, 2 are very long.

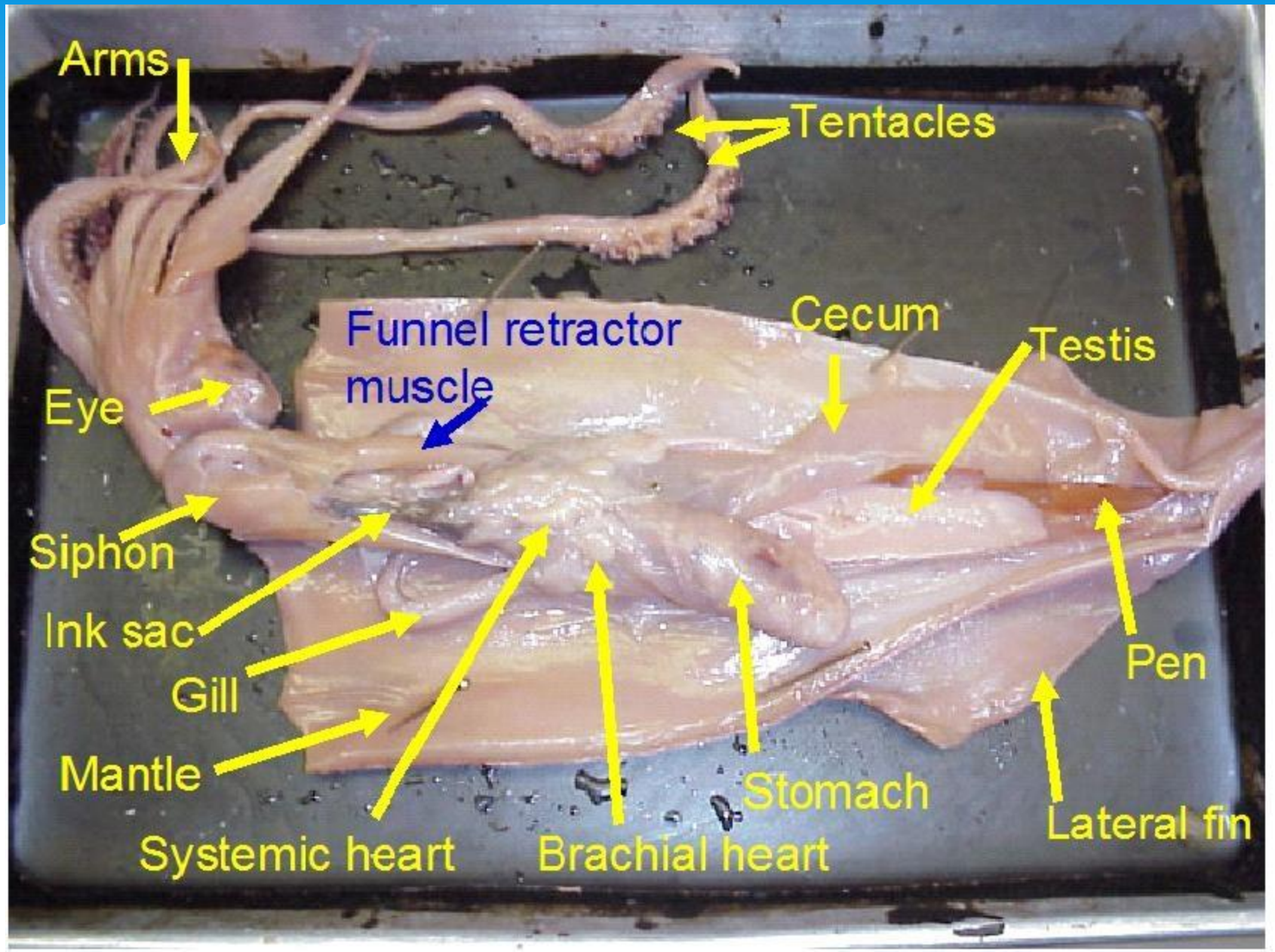
Cephalopoda: Reproduction

- Breed in shallow water.
- Separate sexes: internal fertilization; external development.
- Male uses tentacle to deliver sperm to female (places it in mantle cavity).
  - Fertilized eggs are placed on rocks or algae: squid die after mating; octopus female cares for the eggs.

http://video.pbs.org/video/1778564635/

Squid Dissection

https://www.youtube.com/watch?v=OueQ9kU36i0


Arms
Tentacles
Funnel retractor muscle
Cecum
Testis
Eye
Siphon
Ink sac
Gill
Mantle
Pen
Stomach
Lateral fin
Systemic heart
Brachial heart