

Biosc 41 Announcements 10/8

- ❖ Quick review of protists, phyla Porifera and Cnidaria
- ❖ Quiz: protists, phyla Porifera and Cnidaria
- ❖ Today's lecture: phylum Mollusca!
- ❖ Today's lab: phylum Platyhelminthes (exercise 37)
- ❖ Next quiz Wed 10/15- phyla Platyhelminthes, Rotifera, Mollusca

Quick Protist Review...

- ❖ Are protists monophyletic, paraphyletic, or polyphyletic?
- ❖ What are protozoa?
- ❖ How do protists get energy?
- ❖ How do protists reproduce?
- ❖ Why are protists so diverse?
- ❖ What are a few examples of protists?
- ❖ Are protists ever pathogens?

Quick Phylum Porifera Review...

- ❖ Invertebrates in general...
 - How abundant are they, compared to vertebrates?
 - What type of protist is thought to be the ancestor to all metazoans (animals)?
 - What is the main difference between the Metazoa and Eumetazoa?
 - What is the phylum of basal Metazoans that has only one species?
- ❖ What type of symmetry do sponges have?
- ❖ What cells generate the water current so important for sponge feeding and reproduction?
- ❖ What are the skeletal fiber structures in sponges called?

Quick Phylum Cnidaria Review...

- ❖ What is the most distinguishing feature of this phylum?
- ❖ What type of symmetry do Cnidarians have?
- ❖ What are the two possible body forms for Cnidarians?
- ❖ Name three of the classes of Cnidarians we've talked about
- ❖ What are the stinging cells called? The stinging organelles within these cells?
- ❖ What type of nervous system do Cnidarians have?
- ❖ Which Cnidarian body form undergoes sexual reproduction, and which undergoes asexual reproduction?
- ❖ What protist is involved in symbiosis with some corals?
- ❖ What feature(s) distinguish phyla Cnidaria and Ctenophora?

Quiz 4

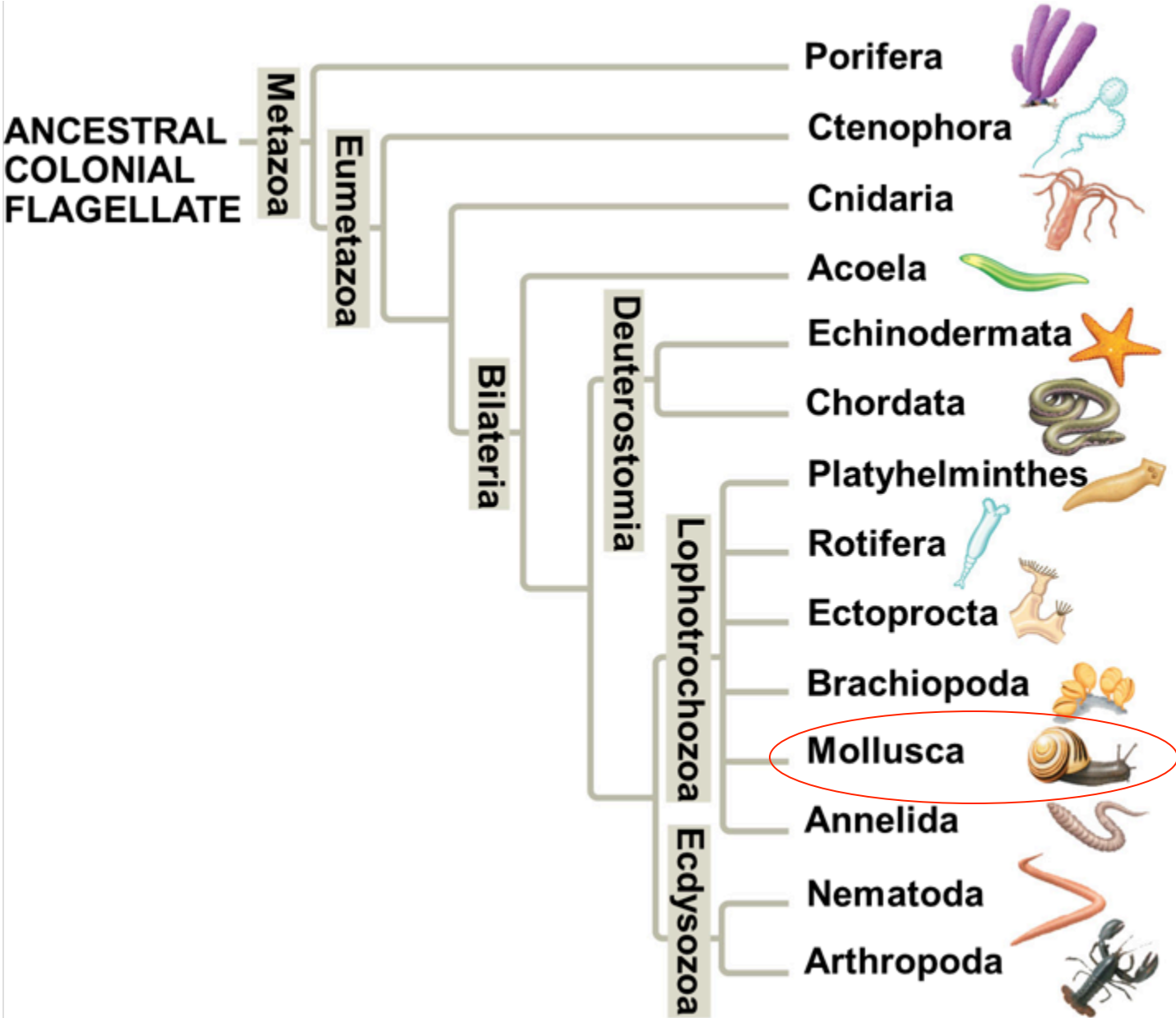
1. Are protists monophyletic, paraphyletic, or polyphyletic?
2. List three examples of protists
3. Describe two functions of choanocytes in sponges
4. In Cnidarians, the _____ body form undergoes sexual reproduction, while the _____ body form undergoes asexual reproduction
5. Describe two features that distinguish phyla Cnidaria and Ctenophora

An Introduction to the Invertebrates (part 3): Phylum Mollusca

Reference: Chapter 33



More Relationships...



Molluscs - Overview

- ❖ Mollusca - “the soft things” (Aristotle)
- ❖ Phylum Mollusca includes snails and slugs, oysters and clams, and octopuses and squids
- ❖ Molluscs have adapted to a very wide variety of habitats
 - Most are marine and can be found in all ocean habitats
 - Many species of gastropod are freshwater and terrestrial
- ❖ Molluscs have evolved an array of highly diverse body plans



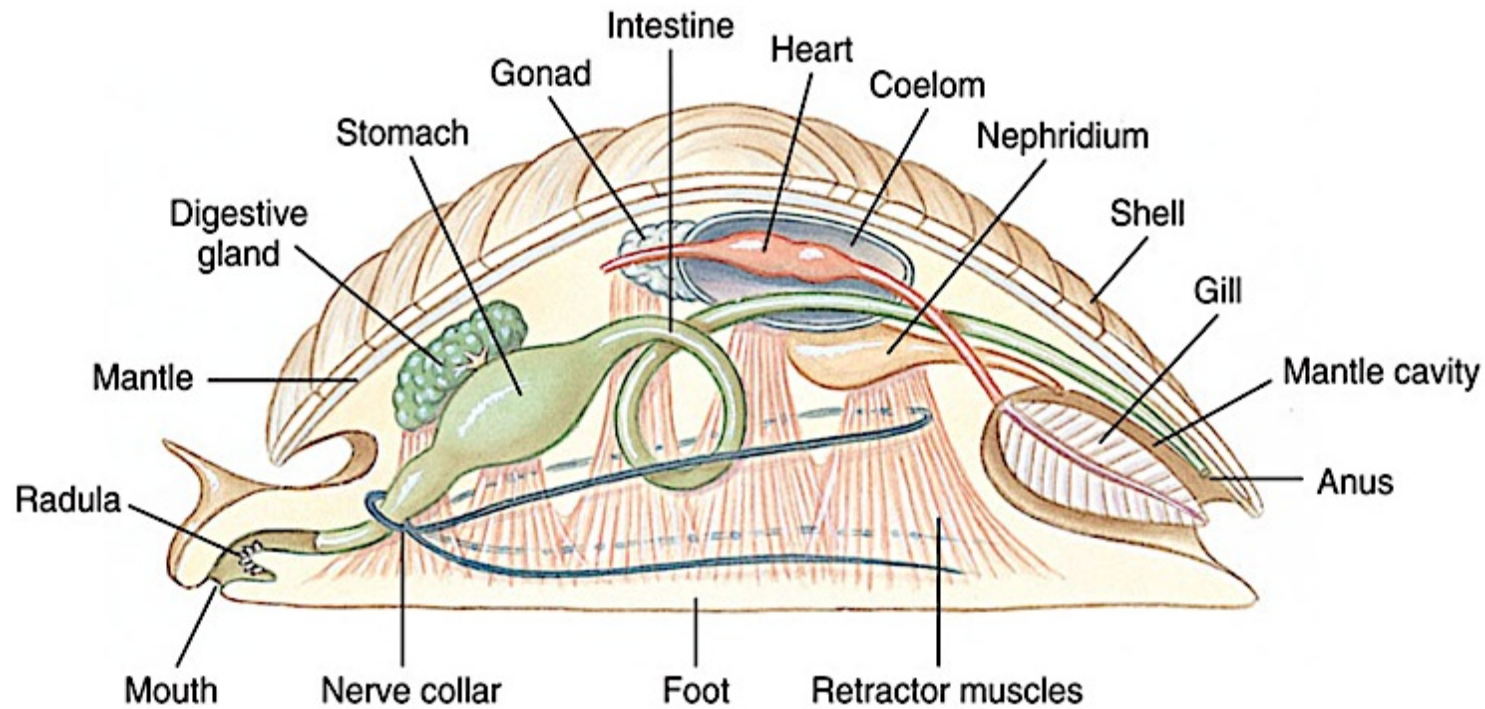
Mollusc Overview



- ❖ Video, molluscs (~15 min): <http://shapeoflife.org/video/phyla/molluscs-survival-game>

Mollusc Morphology - Basic Body Plan

- ❖ Triploblastic, bilaterian, eucoelomate, lophotrochozoan protostomes
- ❖ All molluscs have a similar body plan with **three main parts**:
 1. **Mantle**
 2. **Muscular foot**
 3. **Visceral mass**



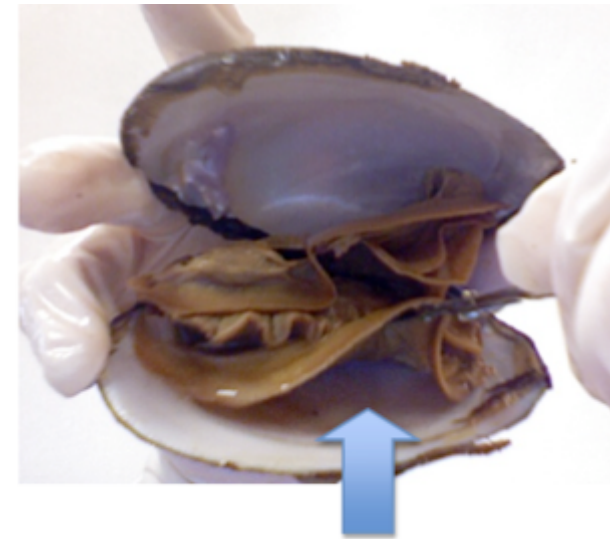
Mollusc Morphology - Mantle

- ❖ Mantle
 - Muscular layer of tissue which forms the major covering of the body
 - In some groups portions have evolved into siphons
 - Epithelial cells secrete the shell in shelled molluscs



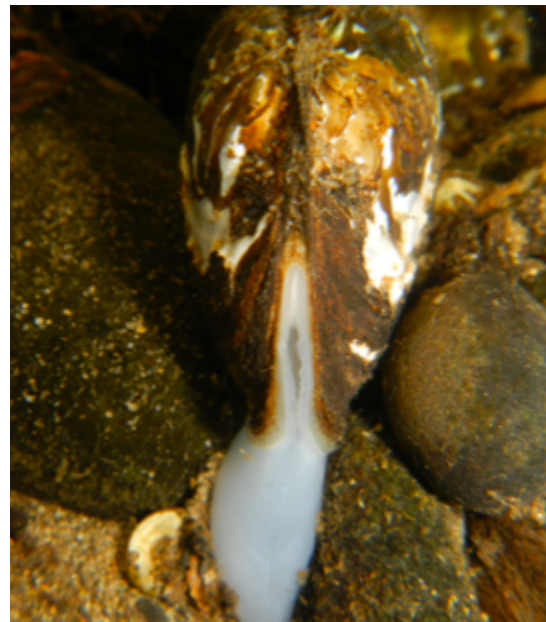
Mollusc Morphology - Mantle Cavity

- ❖ Mantle Cavity
 - Internal cavity generated by folds in the mantle
 - NOT the coelom (which is much reduced)
 - Encloses respiratory organs in most
 - Lined with epidermal cells and exposed to external environment



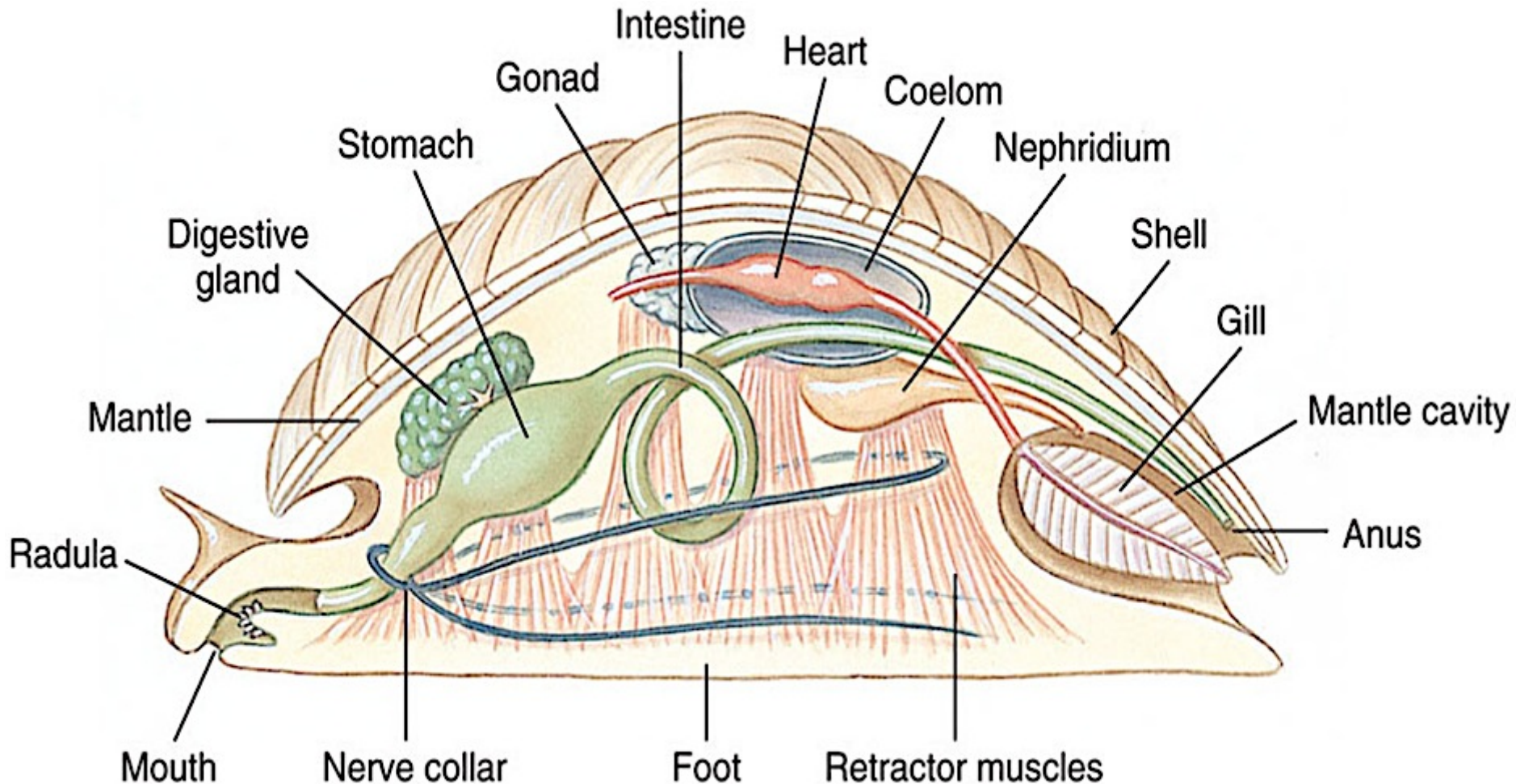
Mollusc Morphology - Muscular Foot

- ❖ “Base” of the mollusc body
- ❖ Contains statocysts
 - Sensory cells that assist with balance
 - May function as “ears” for some
- ❖ Adapted in various ways
 - Locomotion in gastropods
 - Tentacles in cephalopods
 - Burrowing in bivalves



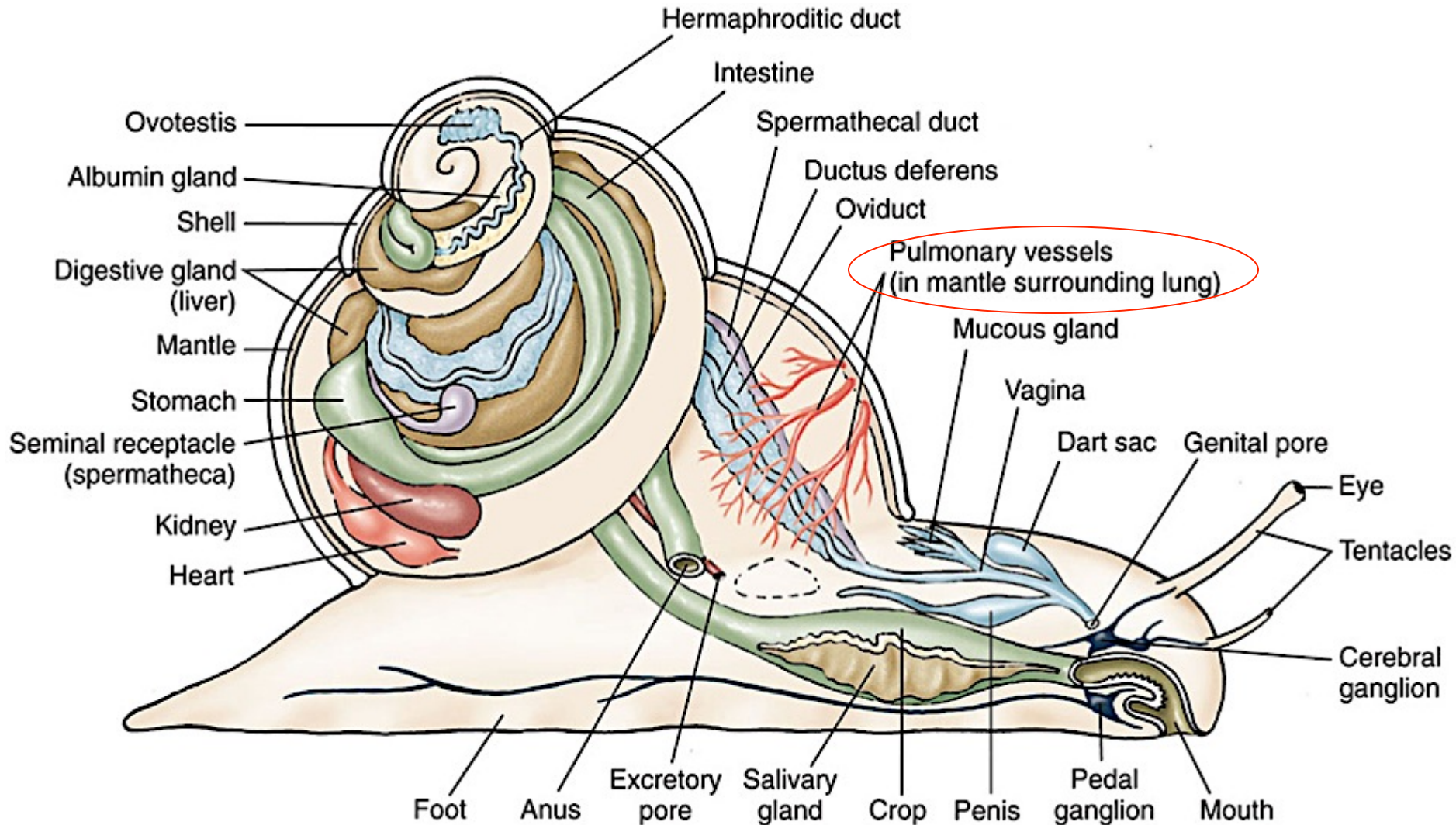
Mollusc Morphology - Visceral Mass

- ❖ Internal organs, arranged in various ways within the body
- ❖ Coelom is reduced to open space surrounding heart and gonads



Mollusc Morphology - Respiration

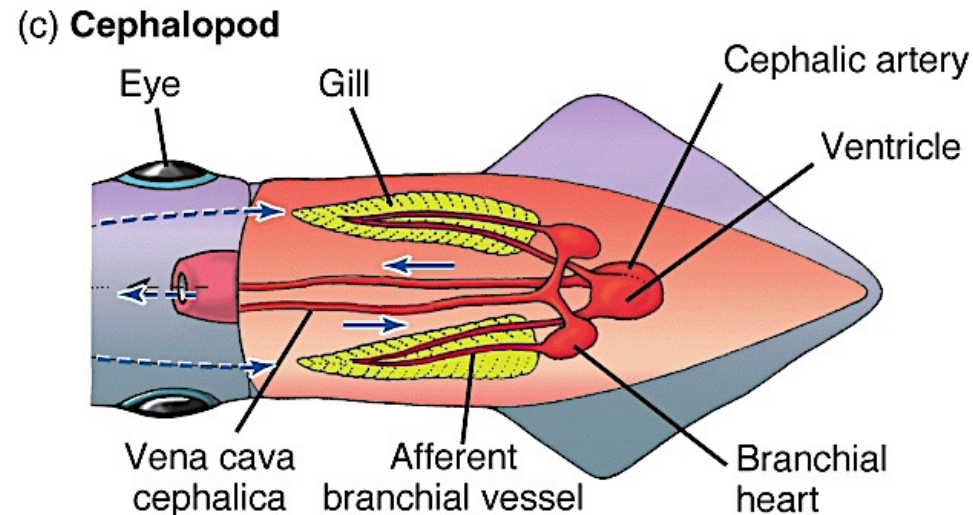
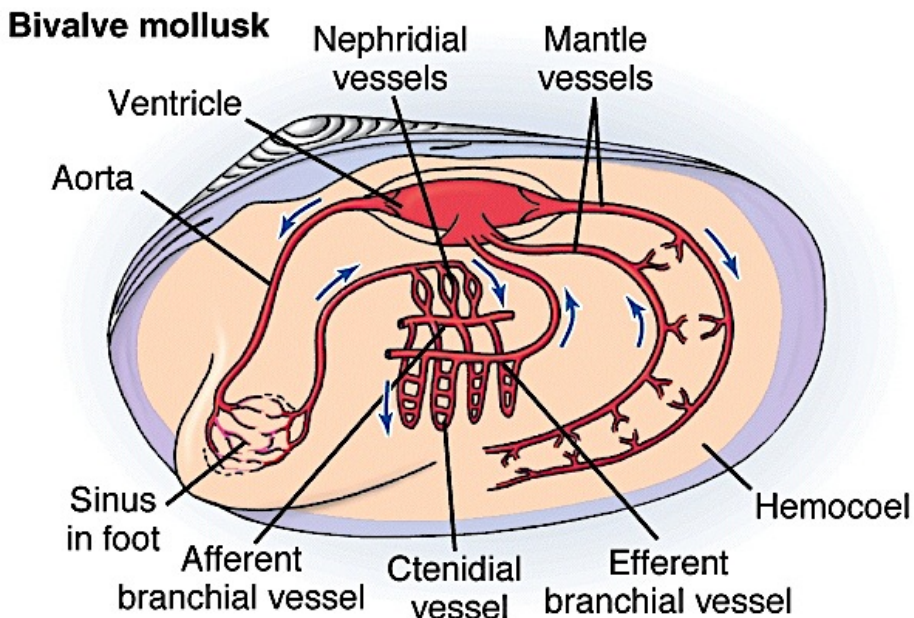
- ❖ Aquatic species have gills enclosed within the mantle cavity
- ❖ Terrestrial snails and slugs have a modified lung



Mollusc Morphology - Circulation

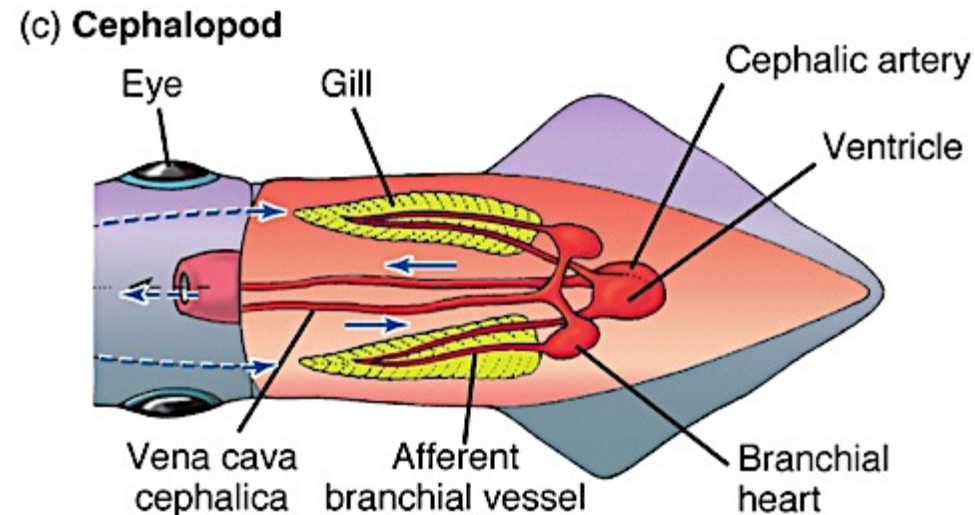
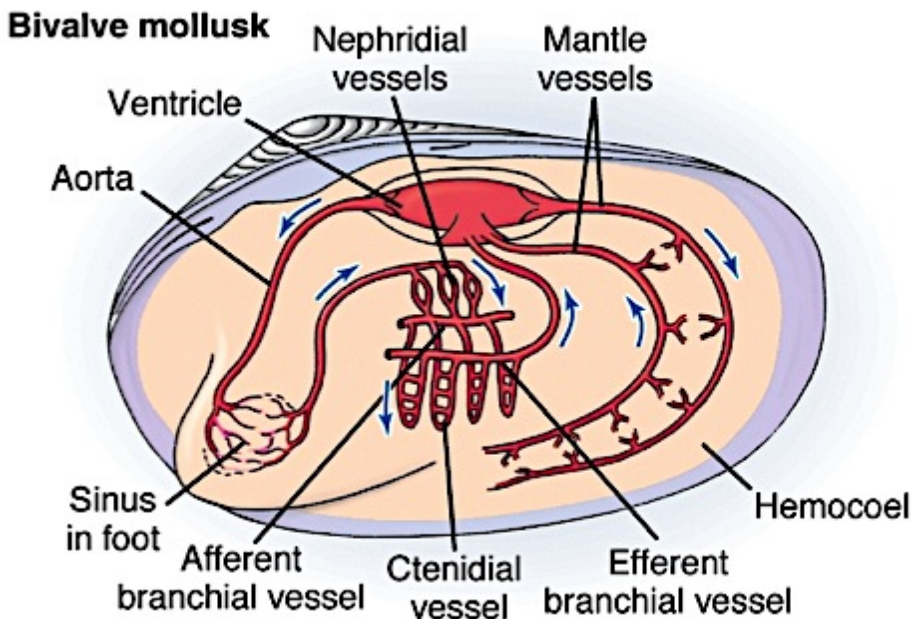
❖ Circulatory system

- Open (except in cephalopods)
 - Open circulatory system is one in which blood is released directly into organs and body cavities (hemocoel)
 - No clear distinction between blood and interstitial fluid - Blood is known as hemolymph
- Hemolymph contains **hemocyanin** to transport oxygen; appears blue when exposed to air



Mollusc Morphology - Circulation

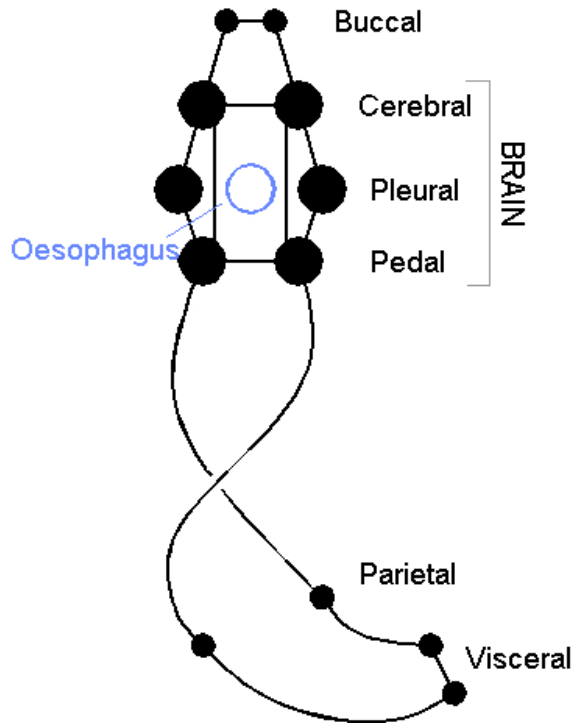
- ❖ Circulatory system includes beating heart
 - When relaxed, oxygenated hemolymph flows into the heart
 - Hemolymph is pushed out of the heart through the veins during contractions



Mollusc Morphology - Nervous System

❖ Nervous System

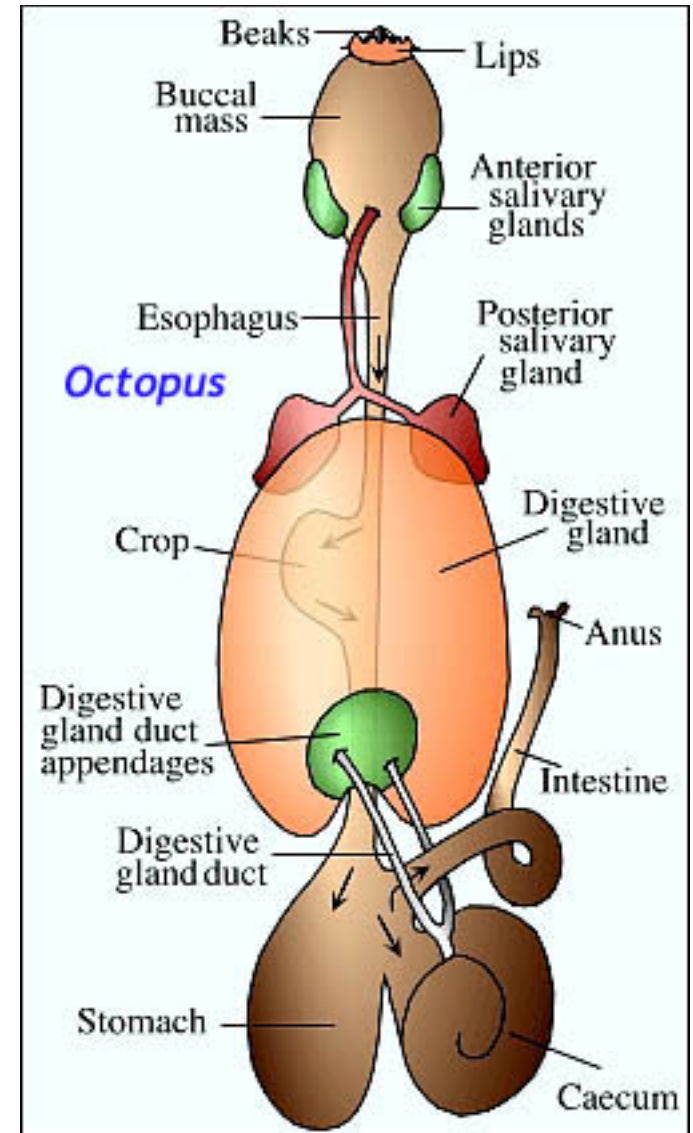
- Two nerve cords and a brain (more or less)
- Some groups have well-developed eyes



Mollusc Morphology - Digestive System

❖ Digestive System

- Radula (surrounded by beak in some)
- Complete gut
- Well-developed digestive gland in most

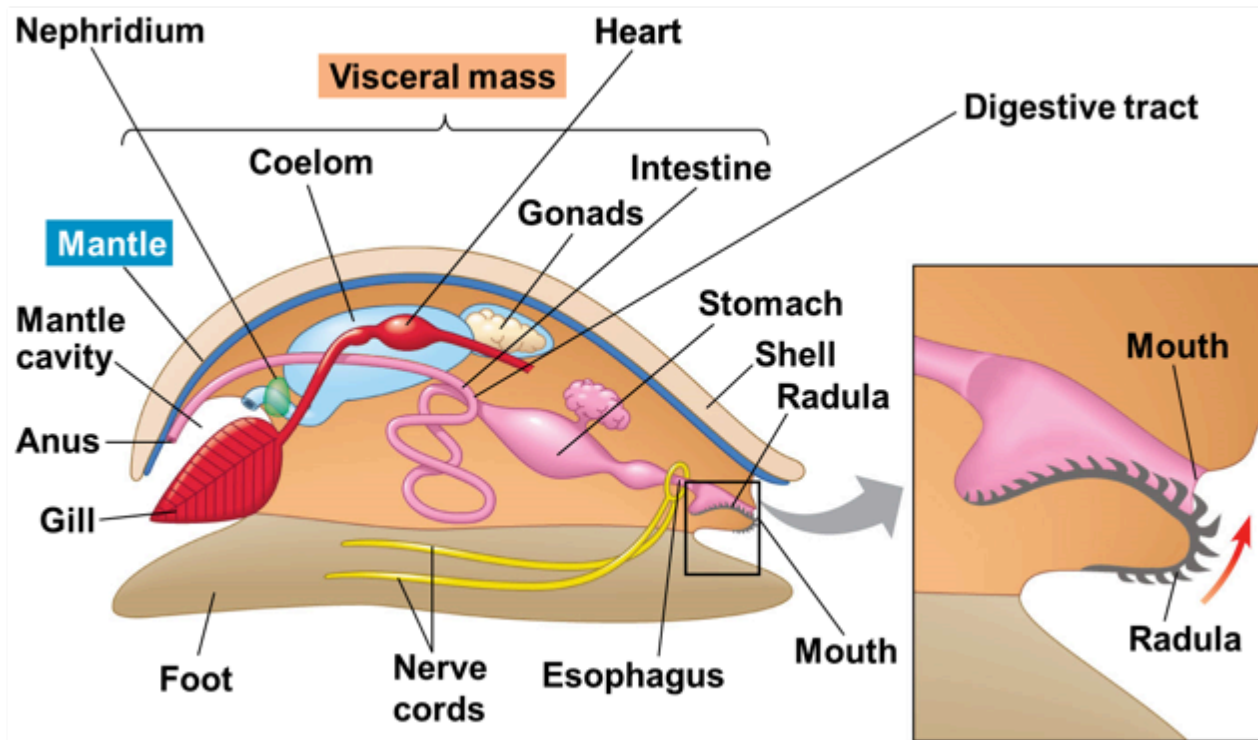




Video- What the vampire squid really eats (~5 min)
<https://www.youtube.com/watch?v=X8oWnbcLI40>

Mollusc Morphology - Digestion

- ❖ Digestive System consists of a complete gut
 - Mouth, stomach, intestine, anus
 - Various mucous and digestive glands
 - Some groups have pouches (cecum)
 - Much of the lining of the gut is ciliated



❖ Radula

- Stiff, serrated structure
- Adapted for scraping or grabbing
- Used to inject venom in some groups

Mollusc Morphology - Excretion

- ❖ **Excretory system - heart and nephridia (“little kidneys”)**
 - The heart filters waste from hemolymph and releases it into coelom as urine
 - The nephridia reclaim usable material from the urine, inject more wastes into it, and eject it into the mantle cavity for excretion into the environment
 - Example of mollusc “multi-tasking” - using organ systems for more than one purpose

Mollusc Morphology - Support

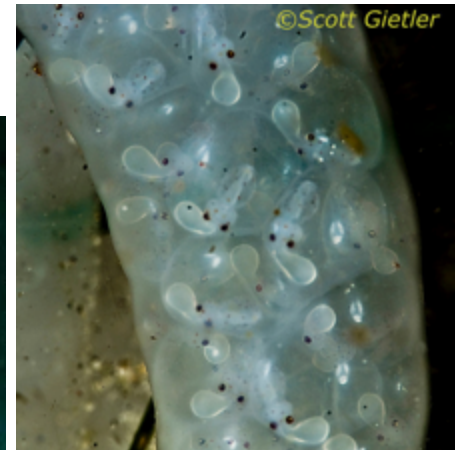
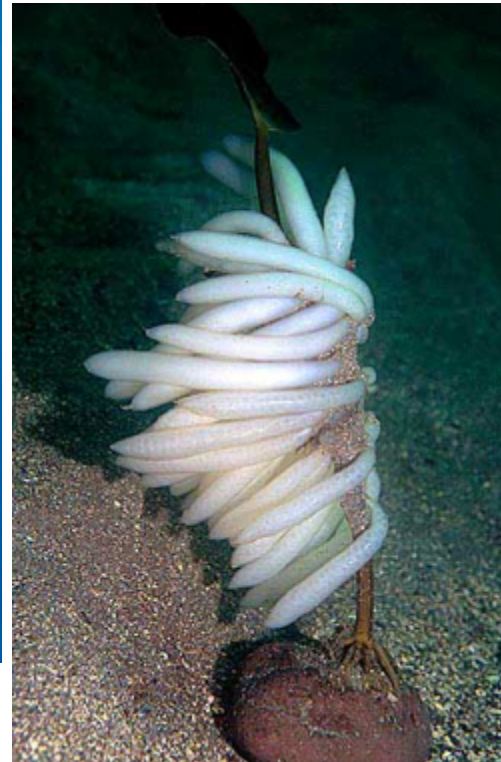
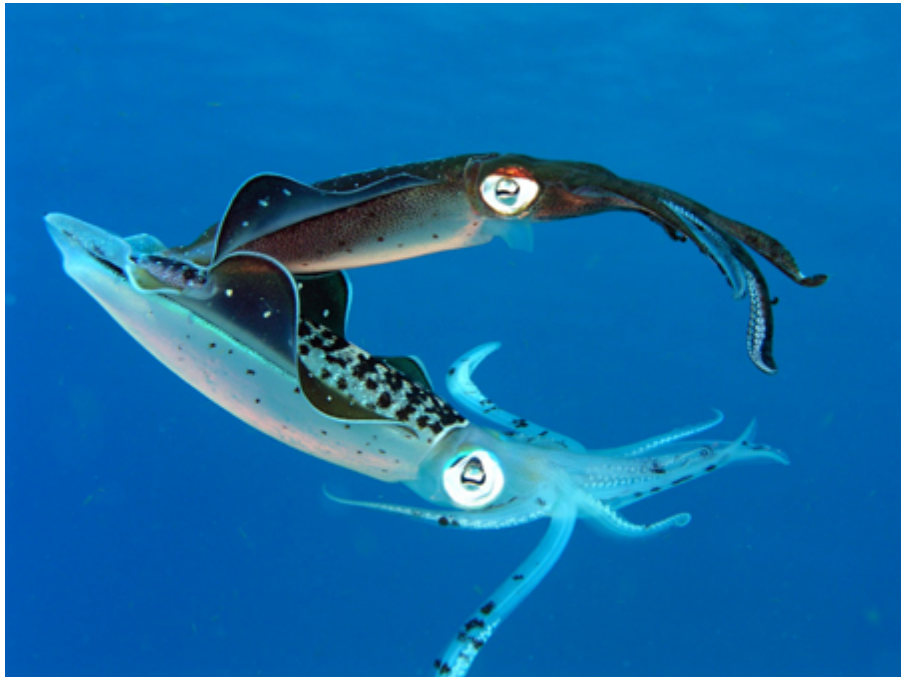
- ❖ Hemocoel(s) can function as **hydrostatic skeleton**
 - Can be filled with water or gas and exert pressure that provides structure and support to the body
- ❖ Shells
 - Calcium carbonate with protein
 - Secreted by the mantle
 - Sometime internal (cuttlefish)



Mollusc Morphology -Reproduction

❖ Reproduction

- Some groups maintain separate genders (cephalopods); some are hermaphroditic (gastropods)
- Fertilization internal or external, depending on group



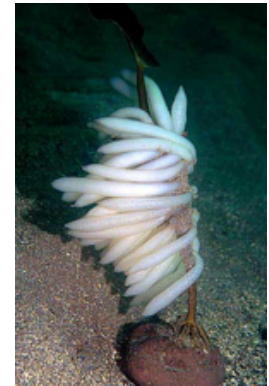
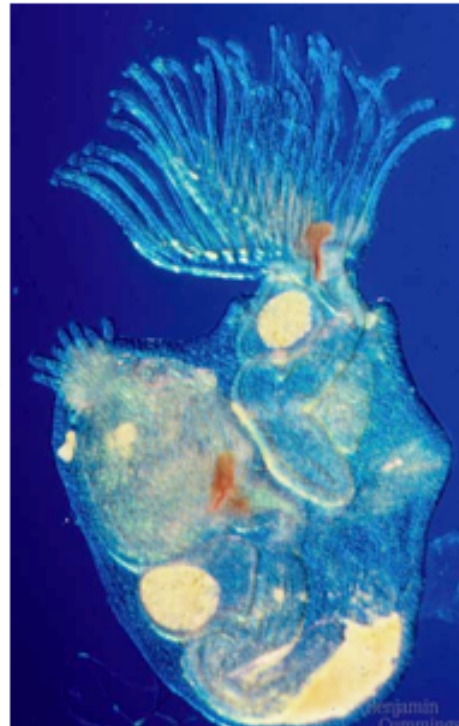
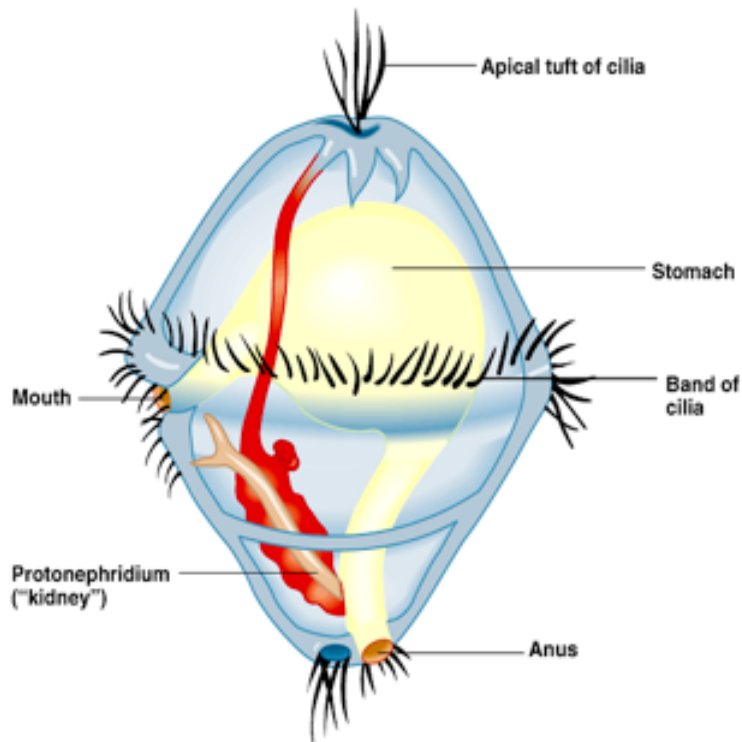


❖ Octo-mom video (~3 min):

<https://www.youtube.com/watch?v=lFCQltYMLQk>

Mollusc reproduction

- ❖ Most molluscs have separate sexes with gonads located in the visceral mass, but many gastropods are hermaphrodites
- ❖ All groups lay eggs
- ❖ The life cycle of many molluscs includes a ciliated larval stage called a **trochophore** (this is why they are classified as lophotrochozoa!)



Mollusc Taxonomy

- ❖ Four major classes of molluscs are
 - Polyplacophora (chitons)
 - Gastropoda (snails, nudibranchs and slugs)
 - Bivalvia (clams, oysters, and other bivalves)
 - Cephalopoda (squids, octopuses, cuttlefish, and chambered nautilus)



Polyplacophora - Chitons

- ❖ Chitons are oval-shaped marine animals encased in an armor of eight dorsal plates
- ❖ They use their foot like a suction cup to grip rock, and their radula to scrape algae off the rock surface

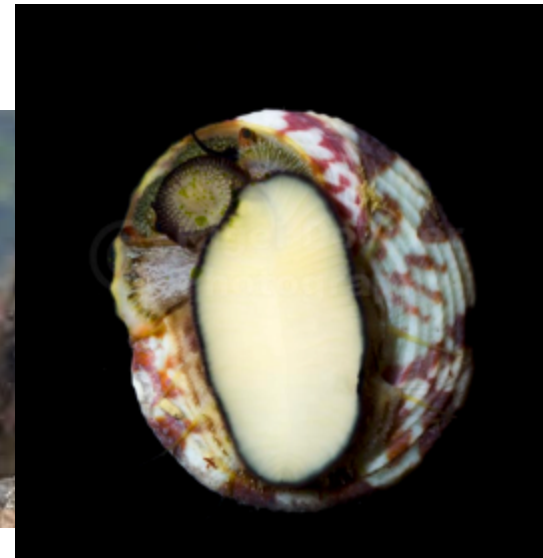


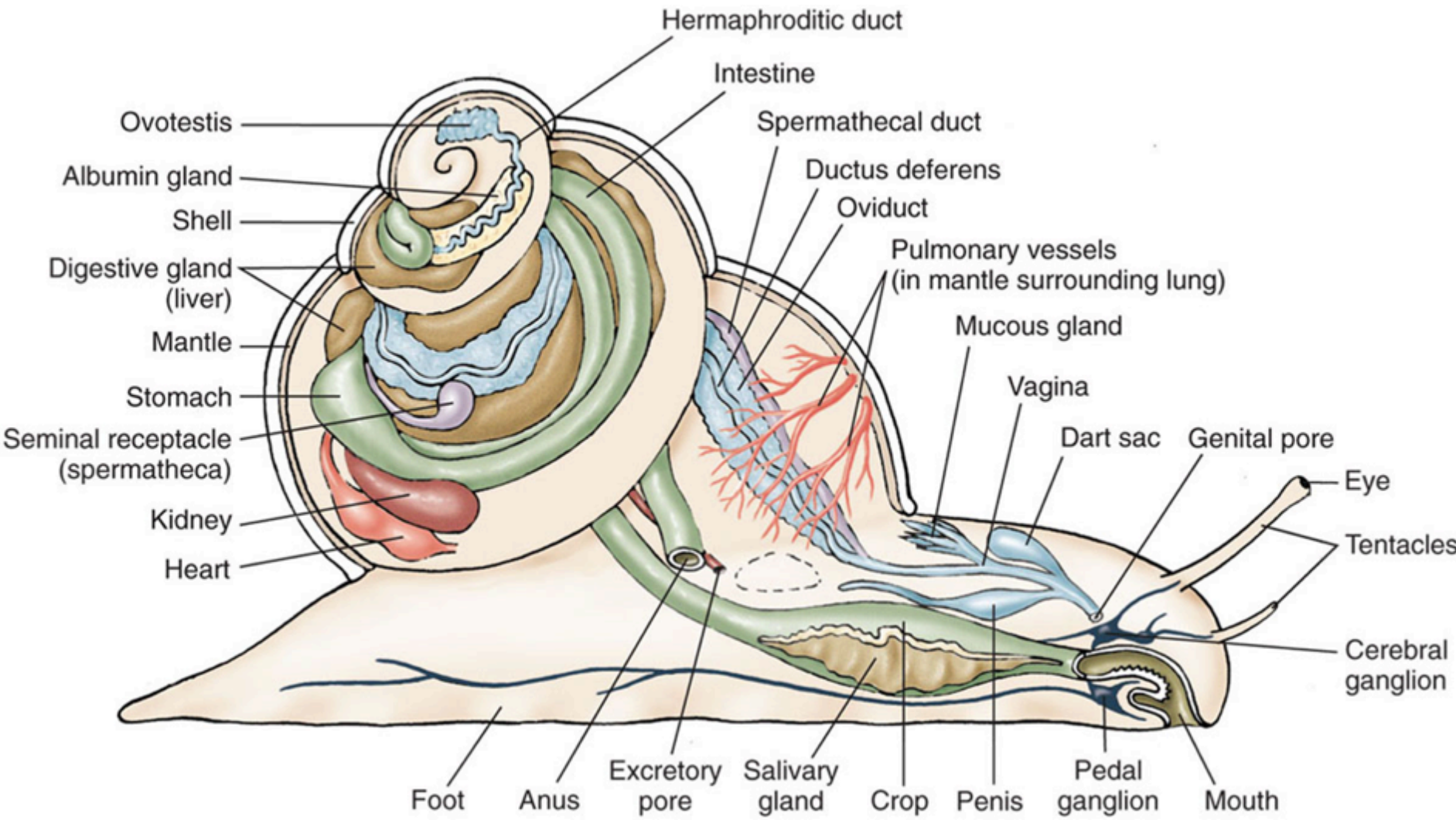
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Gastropoda - “stomach foot”

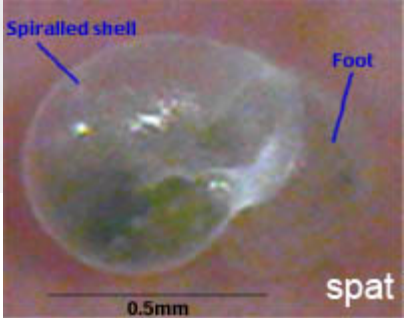
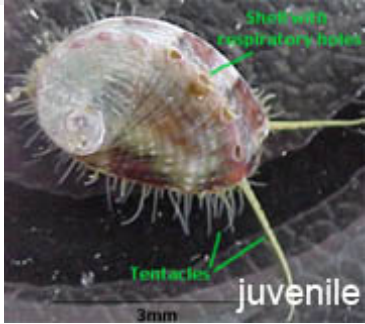
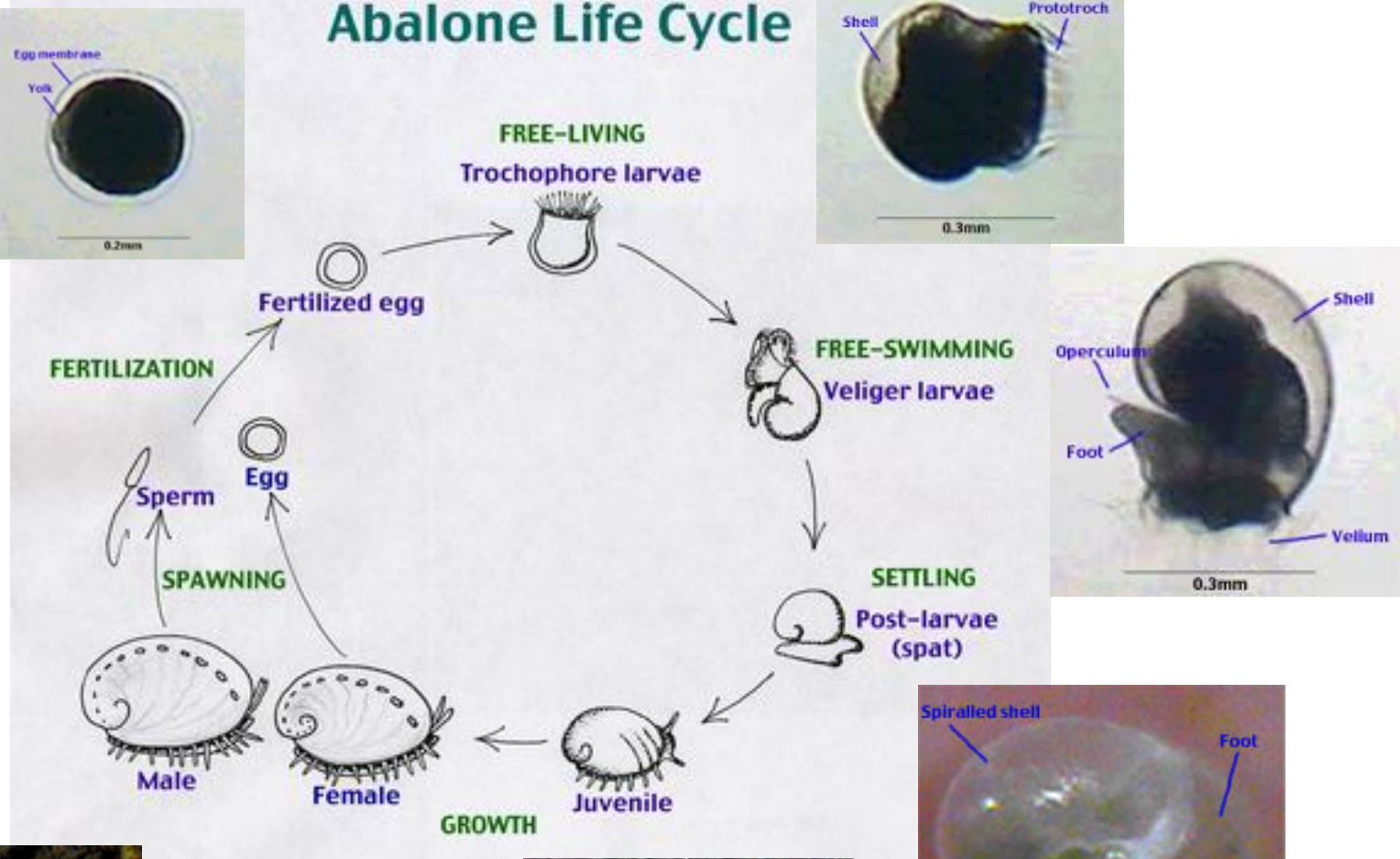
- ❖ About three-quarters of all living species of molluscs are gastropods - only insects have more
- ❖ Most gastropods are marine, but many are freshwater and terrestrial species
- ❖ Most gastropods have a single, spiraled shell
- ❖ Slugs lack a shell or have a reduced shell



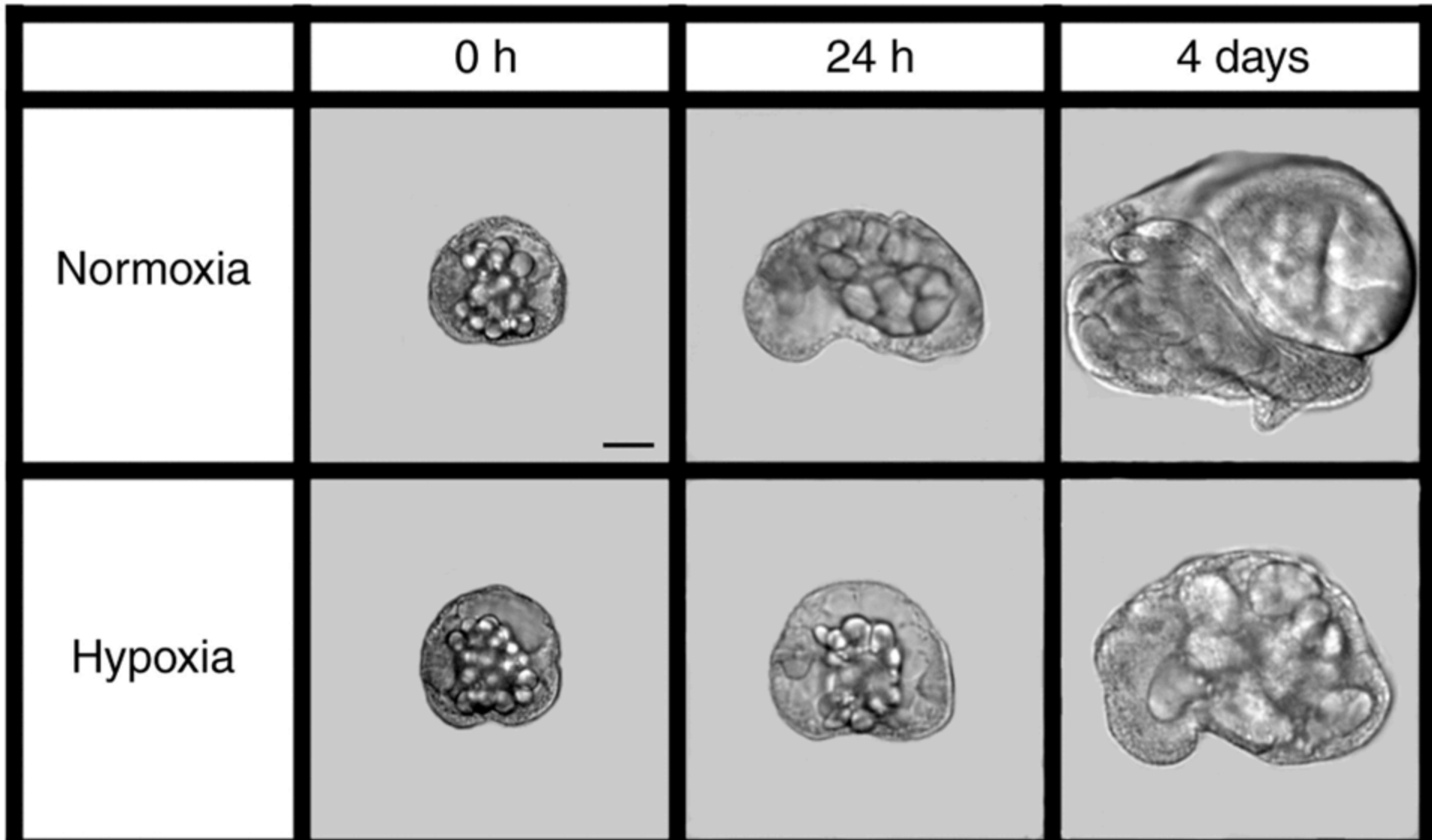


Gastropod Development

Abalone Life Cycle



Snails need oxygen to develop properly!



Gastropod Development - Torsion

❖ Torsion

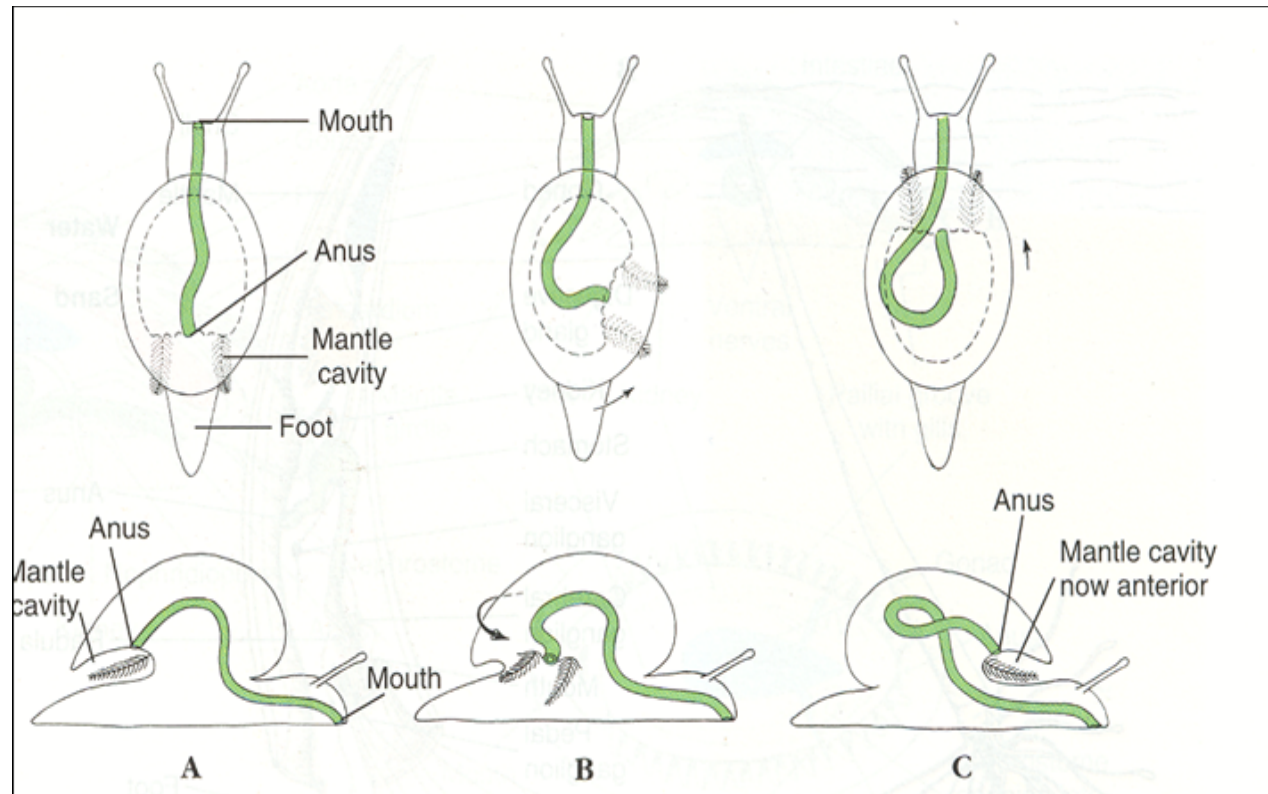
- Occurs during development (veliger stage)
- Visceral mass rotates 180 degrees relative to head
- causes the animal's anus and mantle to end up above its head

❖ Pro's

- Protection
- Balance

❖ Con's

- Animal dispels wastes on its head



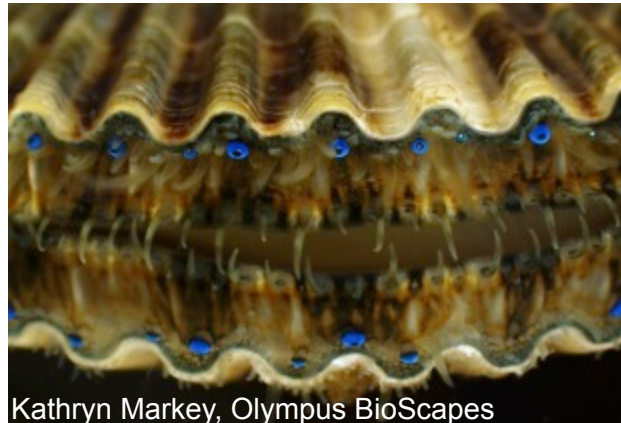
Gastropoda - Nudibranchs

- ❖ Special case - secondary **detorsion**
 - Restores “normal” gut morphology
- ❖ Some species are strong swimmers



Bivalvia

- ❖ Bivalves are marine and include many species of clams, oysters, mussels, and scallops
- ❖ They have a shell divided into two halves drawn together by adductor muscles
- ❖ The mantle cavity of a bivalve contains gills that are used for feeding as well as gas exchange
- ❖ **Incurrent/excurrent siphons** move water across the gills
- ❖ The foot is adapted for burrowing in sediment
- ❖ Some bivalves have eyes and sensory tentacles along the edge of their mantle



Kathryn Markey, Olympus BioScapes



Bivalve reproduction/development

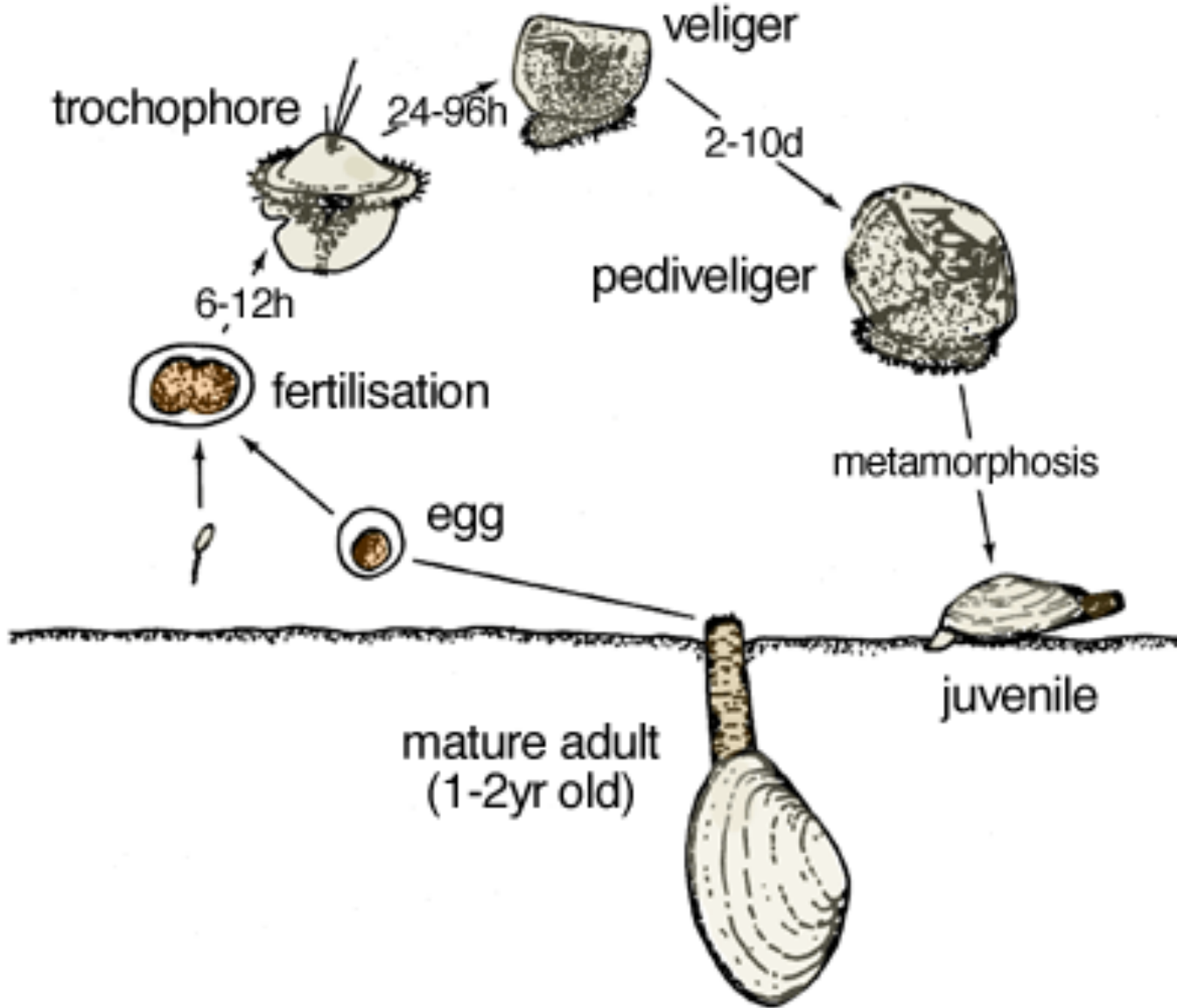
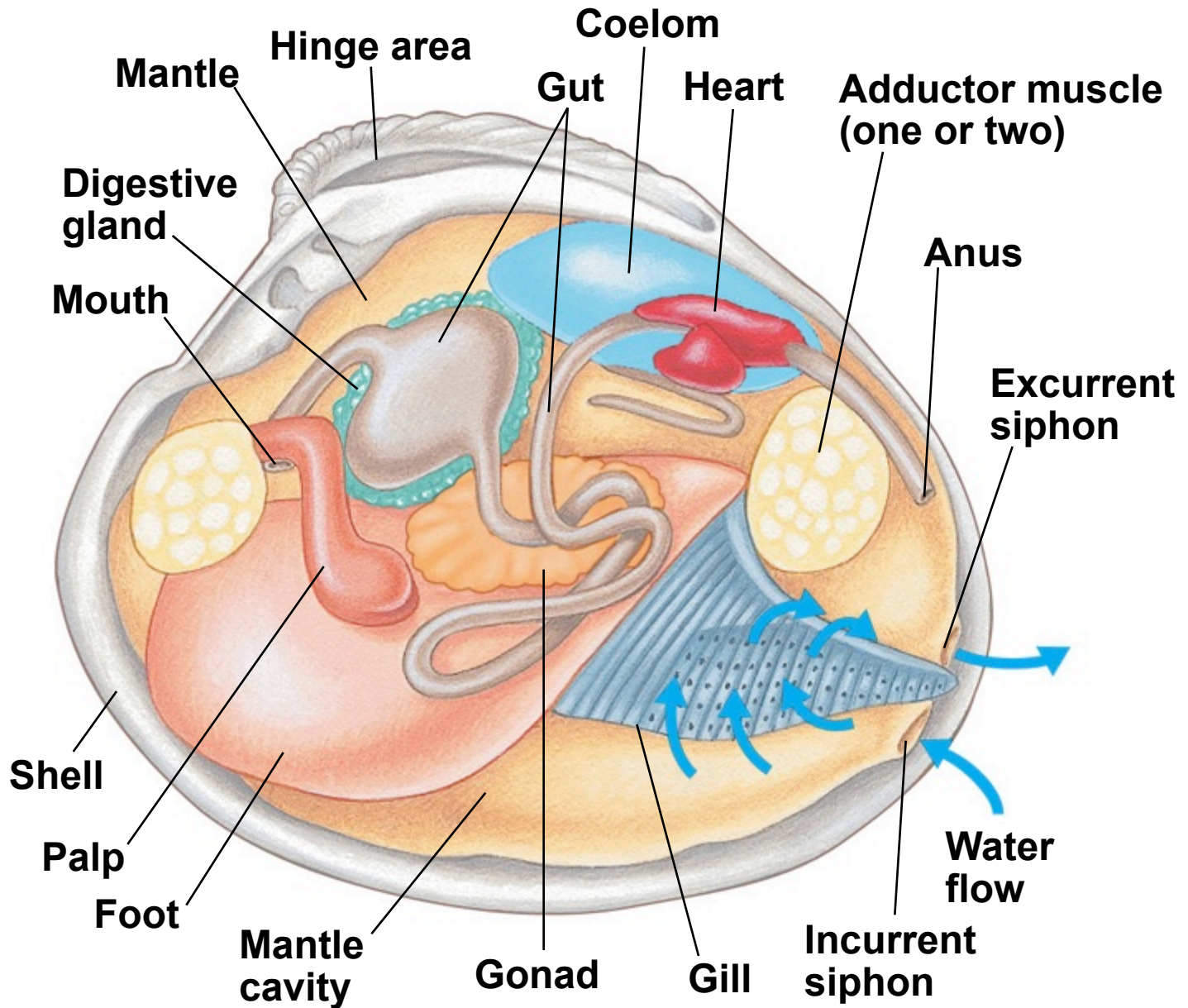


Figure 33.20



Cephalopoda - “head foot”

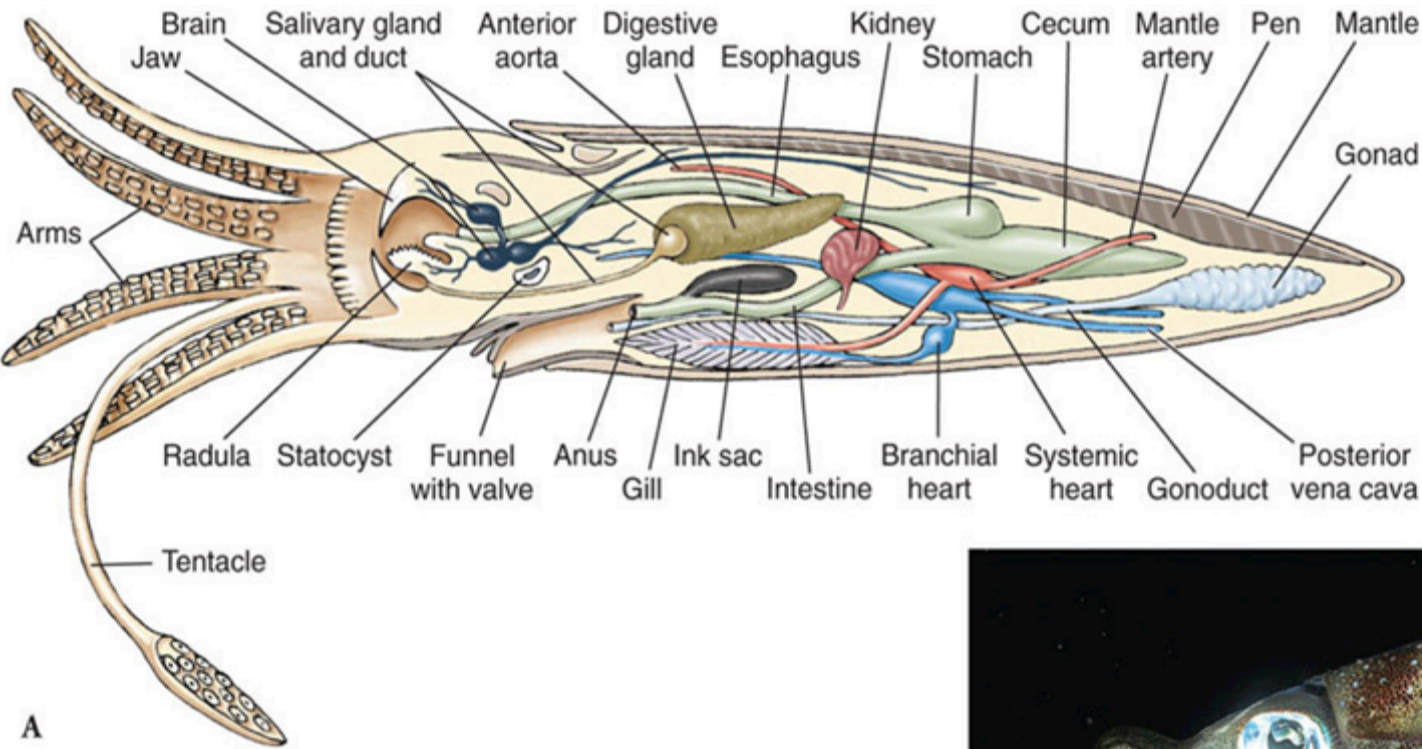
- ❖ Cephalopods have a body plan greatly modified from the basic mollusc body plan
 - The muscular foot has been modified into tentacles
 - The mouth is equipped with a hinged, chitin beak
 - Some groups have greatly reduced radula
 - Most cephalopods use a **siphon** for locomotion, a specialized structure that pumps water through the body and propels the animal backwards through the water



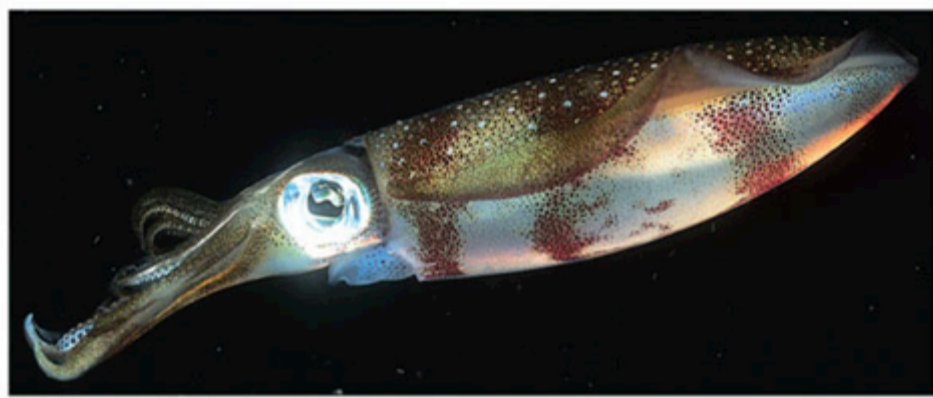
Cephalopoda - “head foot”

- ❖ Cephalopods have a closed circulatory system, well-developed sense organs, and a complex brain
- ❖ Nautilus retains a shell
- ❖ Cuttlefish retain an internal shell
- ❖ Most cephalopods have distinct sexes





A



B

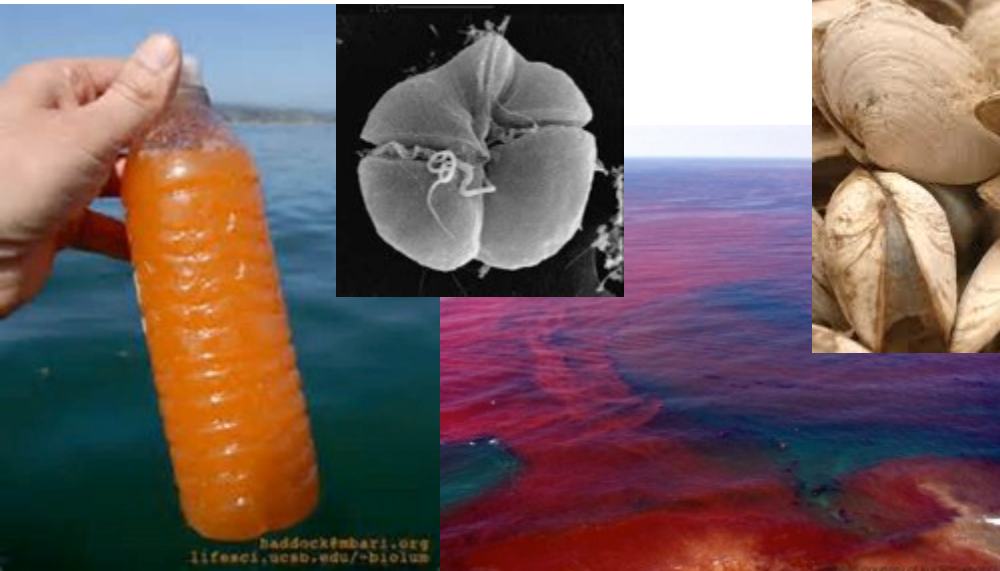
B: © Dave Fleetham/Tom Stack & Associates



Video: true facts about the octopus (~ 6 min):
<https://www.youtube.com/watch?v=st8-EY71K84>

Molluscs behaving badly - PSP

- ❖ Seasonal influx of nutrients cause phytoplankton populations to soar
 - Pigmented algae can cause the water to turn color - red tides, yellow tides, etc.
- ❖ Dinoflagellates and other algae can produce powerful neurotoxins - saxitoxin is the most common
- ❖ Suspension feeding molluscs concentrate toxins in their tissues
- ❖ When ingested, can result in PSP - paralytic shellfish poisoning
 - Severe illness
 - Can be fatal



Molluscs behaving badly - Humboldt Squid

- ❖ Eastern Pacific - South America → Alaska
 - Most common in southern portion of range
 - Generally passive and curious, but can be extremely aggressive if disturbed while feeding
 - Tentacles have “teeth” on suckers that cause serious lacerations

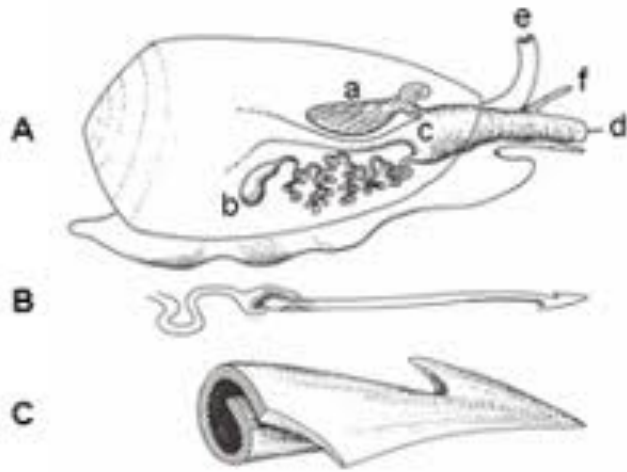


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Molluscs behaving badly - Cone Snails

❖ Extremely venomous



Love amongst the molluscs

- ❖ Molluscs have some of the most bizarre courtship and mating rituals known
- ❖ Love darts
- ❖ Color patterns in cuttlefish
- ❖ Parental Care



Video: love darts (~ 2 min):
<https://www.youtube.com/watch?v=VTV23B5gBsQ>

Protecting Freshwater and Terrestrial Molluscs

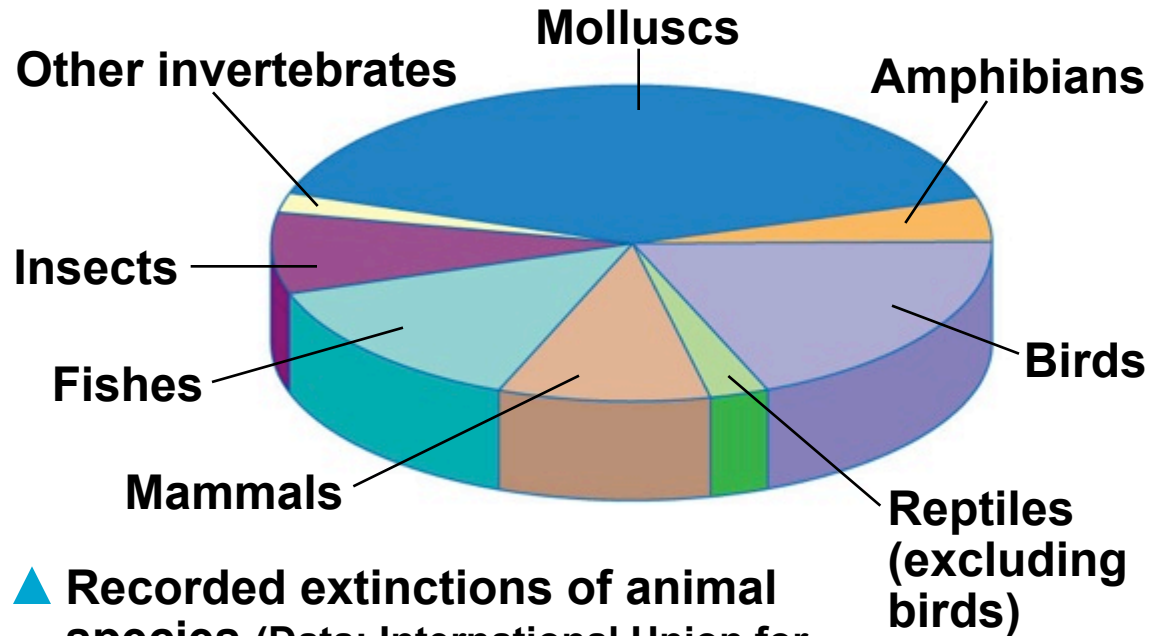
- ❖ Molluscs are the animal group with the largest number of recent extinctions
- ❖ The most threatened groups are
 - Freshwater bivalves, including pearl mussels
 - Terrestrial gastropods, including Pacific island land snails
- ❖ These molluscs are threatened by habitat loss, pollution, and non-native species
- ❖ Other species are threatened by climate change
 - Ocean acidification and warming - Humboldt Squid



Figure 33.22



▲ An endangered Pacific island land snail, *Partula suturalis*



▲ Recorded extinctions of animal species (Data: International Union for Conservation of Nature, 2008)



◀ Workers on a mound of pearl mussels killed to make buttons (ca. 1919)

Summary of Relationships

