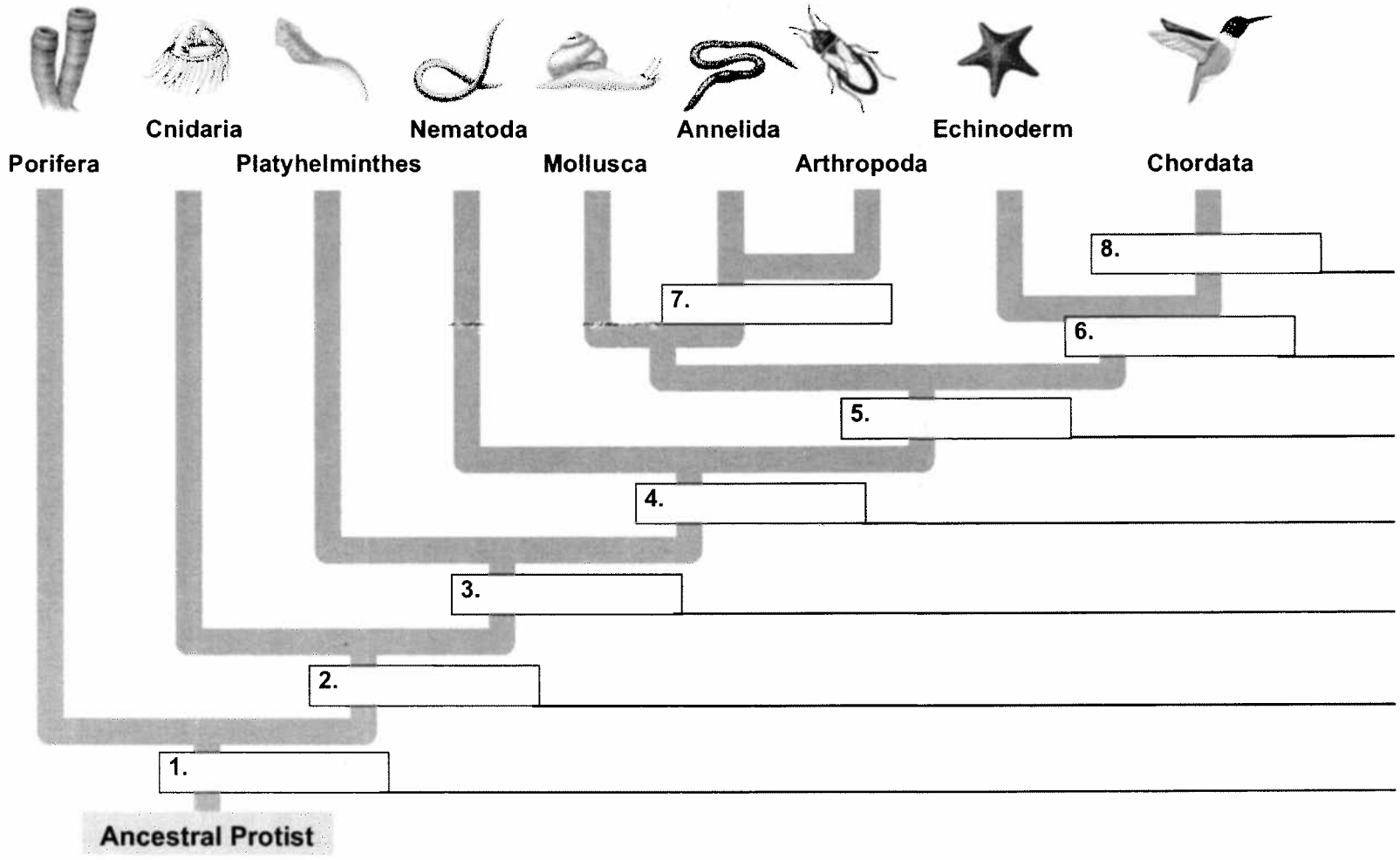
Name _____

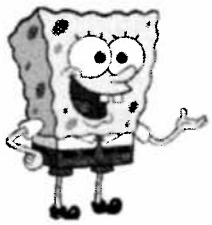
EUKARYOTES: ANIMALS

Complete the diagram below: (1) label the key advance at each evolutionary branch point, and (2) explain the significance of each evolutionary advance.



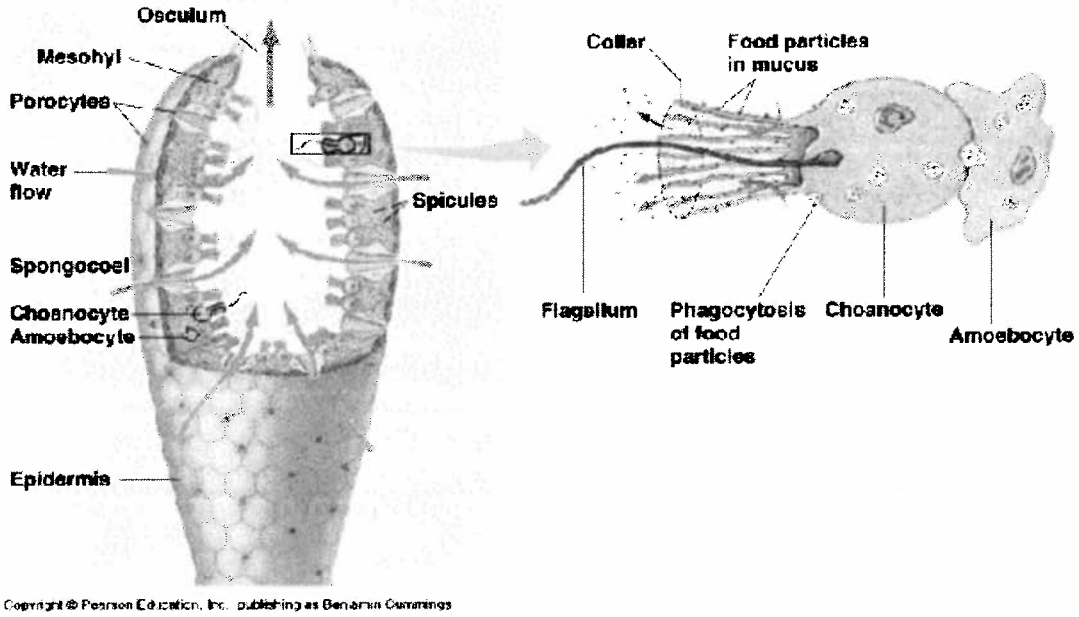
Kingdom: Animalia

Phylum: **PORIFERA**



- By far the most primitive animal alive
- Multicellular, but no true tissues (and certainly no organs)
- Cells are quite independent - if you break up the sponge into individual cells and give the mush several hours, the cells will re-form themselves into a sponge!
- Sponges are sessile (non-moving)...the ancient Greeks thought they were plants.
- No nerves, no muscles, but individual cells can move and react, though.

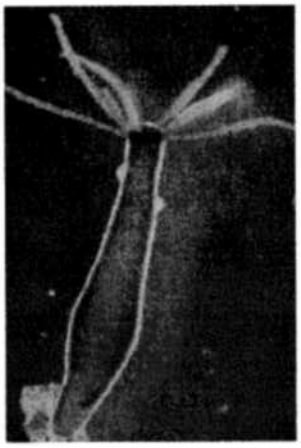
Sponge Anatomy



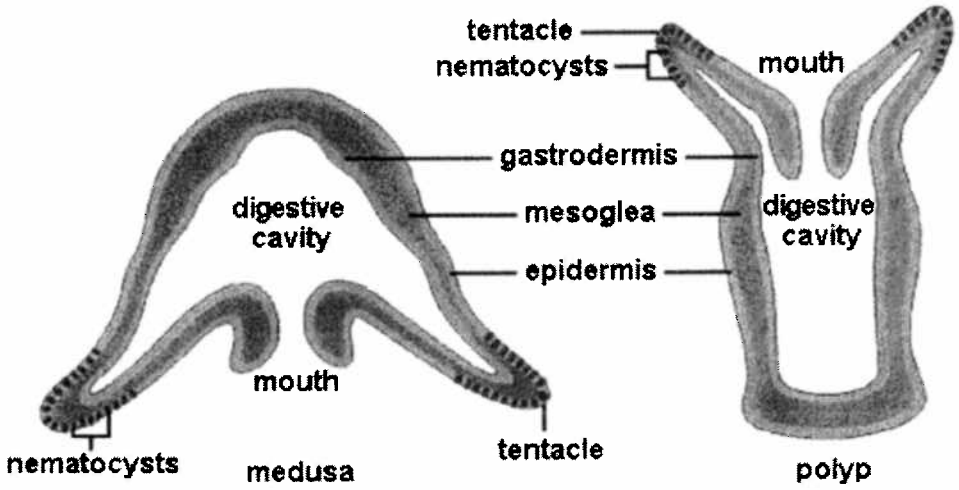
- A sponge's purpose in life is to move water through itself. Water moves in through the ostia (small holes) and out through the osculum (big hole). Nutrient molecules in the water are picked up by choanocyte cells and digested by amoebocyte cells.
- Sponges are hermaphrodites - they make both eggs and sperm, and they can self-fertilize.
- Evolutionary dead-end . . . as far as we can tell, no species alive today are descended from sponges.

Kingdom: Animalia
Phylum:

Cnidaria



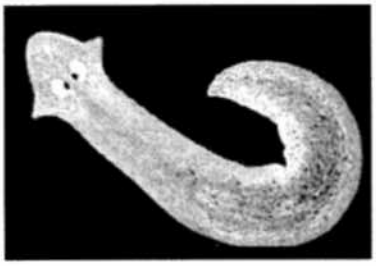
- Animals with true tissues
- Includes jellyfish, sea anemones, and corals
- Animals with **radial symmetry** (as opposed to bilateral symmetry)
- REALLY simple body plan – basically a bag made of two cell layers – a digestive sac surrounded by tentacles, with a middle "glue" called Mesoglea.



Carnivorous – stinging cells with "harpoons" called nematocysts on the tentacles inject poison into prey, and the tentacles push the paralyzed prey into the digestive cavity.

The digestive sac has one opening that serves as **both the mouth and the anus**. Anything that can't be digested the organism spits back out.

Very simple nervous system called a nerve net – no centralized brain .



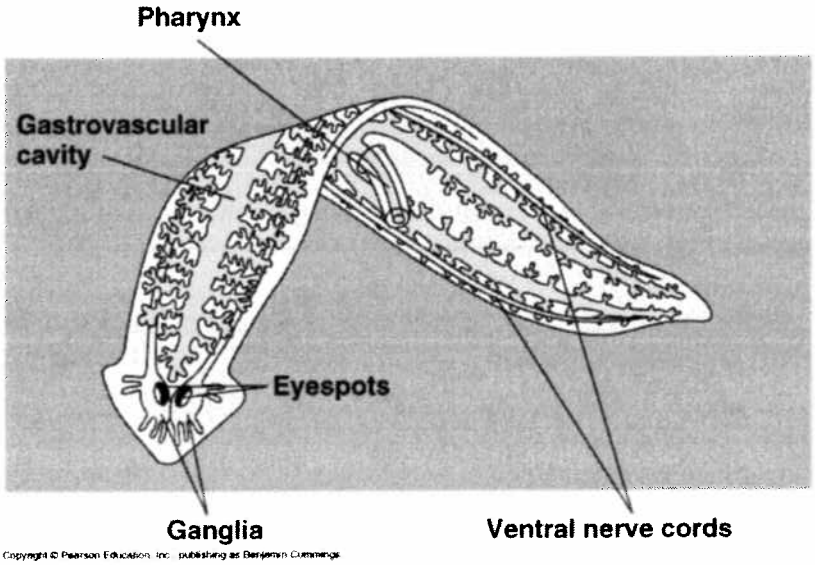
Kingdom: Animalia

Phylum: **Platyhelminthes**

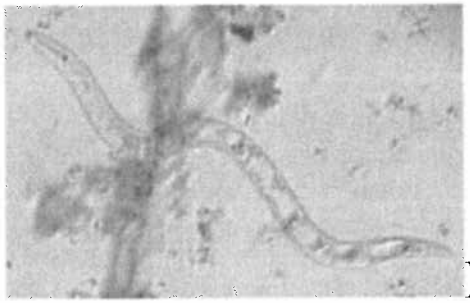
"flat worms"

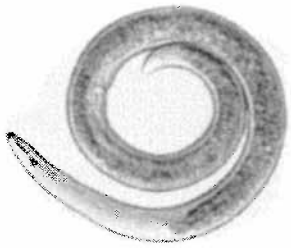
- Bilateral symmetry instead of radial symmetry
- First to have mesoderm as an embryonic tissue – remember that mesoderm forms the muscles and inner organs, so more complicated insides than the cnidarians.
- Still have a gastroventricular cavity – only one opening for both mouth and anus.
- Circulatory systems are unnecessary when you're flat! Being flat means that all of your cells are close enough to some surface to get their oxygen and release wastes by diffusion.
- Always found in watery environments – they have no way to prevent water loss, although some have osmoregulation mechanisms – allows them to move into freshwater.

- Tapeworms
- Flukes
- Planaria (→)
- Trematodes



- Starting to see more of an organized, cephalized nervous system.
- GREAT at regeneration.

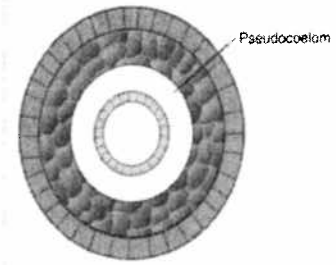


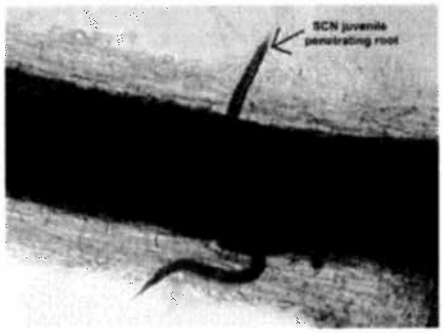


Kingdom: Animalia

Phylum: *Nematoda*

- Slender, worm-like animals 2.5mm long, but can be up to 5cm.
- Bodies have ridges, bristles, spikes or other distinctive structures
- Nematodes number about 28,000 species, and 16,000 are parasitic.
- Unlike Cnidarians and Platyhelminthes, Nematodes have a **digestive system** - with a mouth **and** an anus - more like a tube with openings at both ends.
- Live from the poles to the tropics, fresh water and marine.
- Nematodes are pseudocoelomates. The coelom (pronounced *SEE-luhm*) is the empty space between your inner body wall and your outer intestinal wall. Very simple animals don't have any such space at all (acoelomates), and complex animals like us (coelomates) not only have a space, but it's lined on all sides with mesodermal tissue.



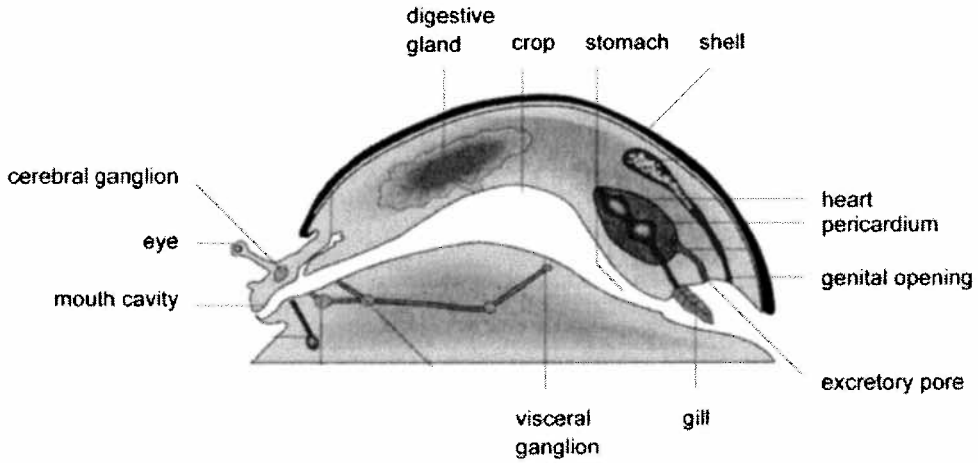


Kingdom: Animalia

Phylum: **Mollusca**

- Three main body parts: a large foot, a visceral mass (internal organs), and a mantle (a thin fold of tissue that drapes over the internal organs, and in most mollusks secretes the hard shell).
- Well-developed body systems.
  - **Open circulatory system** – no blood vessels! The heart just sloshes **hemolymph** around the internal organs.
  - **Respiratory system** – gills.
  - **Nervous system** – starting to see clumps of nerves (called ganglions) in important places, like in the head, and around the digestive tract

INTERNAL ANATOMY OF A MOLLUSK

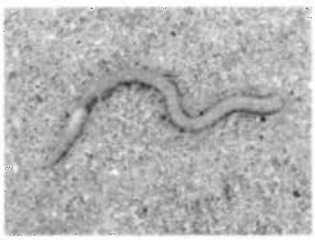


- **Gastropods**: Snails and slugs! Mostly herbivores, but some are predators. They use their sharp rasping organ (called a **radula**) to scrape holes in other mollusk's shells, or to bore into animal tissue.
- **Bivalves:** Oysters, mussels, clams, scallops. Can open and close their shell at will with their powerful adductor muscles. When shell is open, they are suspension feeders. They can use their foot to drag themselves along, but generally they just stay put.
- **Cephalopods**: Octopi and squids. Built for speed! Vicious carnivores, with beak-like jaws, sticky tentacles, some of which contain poison. VERY well developed nervous system and sense organs, particularly the eyes.

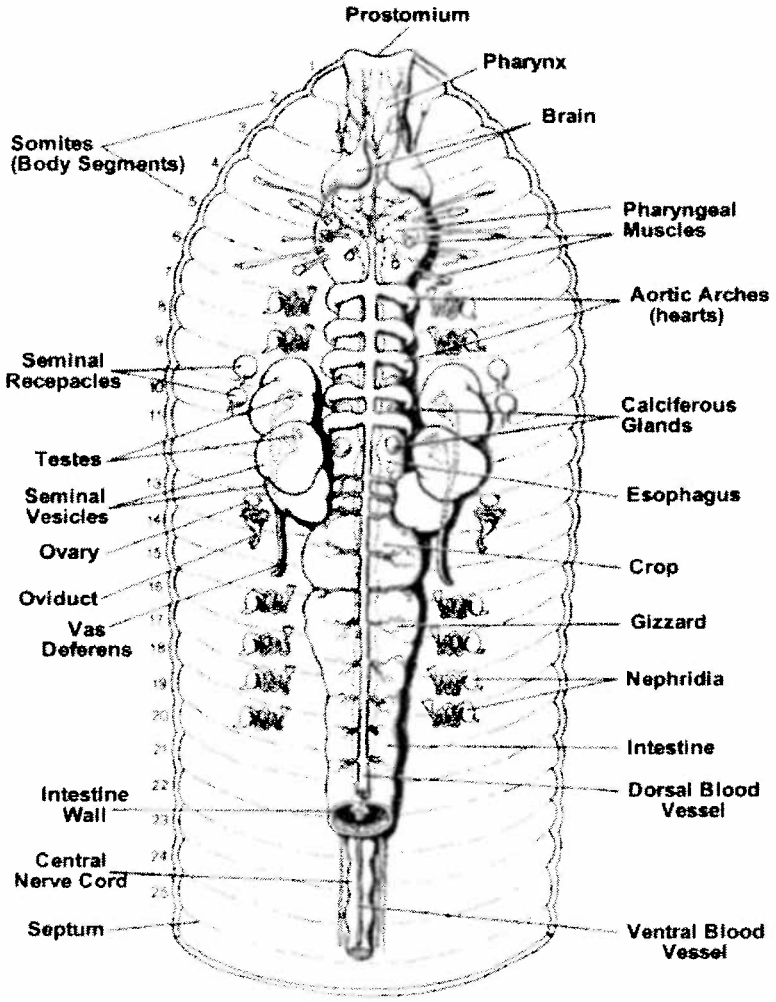
Octopi are really quite smart and have been known to predict World Cup Soccer winners!

Phylum: Annelida

"LITTLE RINGS"



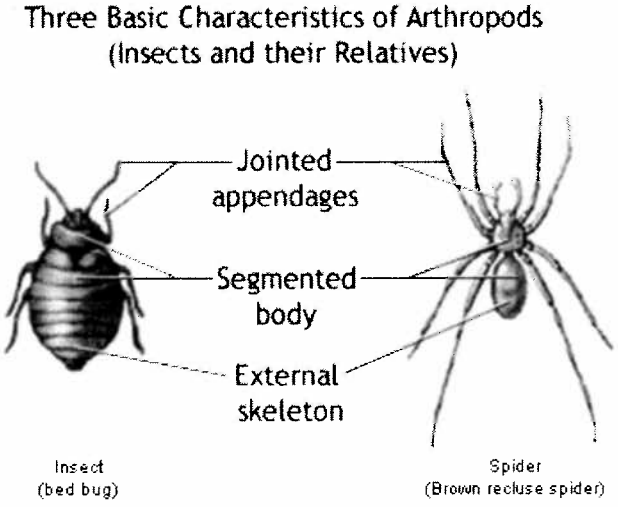
- Annelids – segmented worms – earthworms, leeches
- Bodies are literally broken up into segments, partitioned by thin pieces of tissue called septa. Each segment has a piece of the circulatory, nervous, excretory, and digestive systems running through it.
- **Segmentation** is a useful development – each segment is pretty independent of the rest since each one has a piece of the four important systems in it. If you lose a few segments, you're probably still OK.

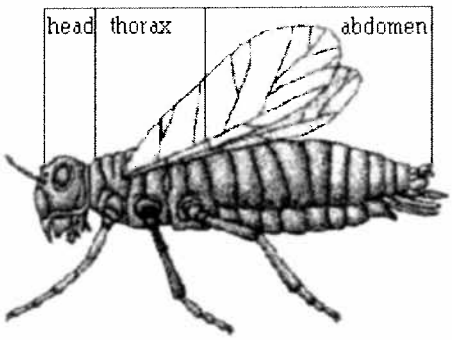


- We finally have a **closed circulatory system** –more efficient, no longer have oxygenated and deoxygenated blood sloshing together.
- True coelomates (internal body cavity lined **on both sides** with mesodermal tissue). The coelom is filled with air and fluid, so it provides a nice, cushioned space for all those important internal organs.
- Most annelids are hermaphrodites.
- Annelids have what's known as a **hydrostatic skeleton**. Imagine squeezing a long water balloon – that's how they move!

Phylum: **Arthropoda** (means "jointed feet")

- By FAR the most successful phylum on this planet. 2/3 known species are arthropods.
- Also segmented, but segments highly specialized for various purposes.
- Very strong **exoskeleton** providing the major adaptation that allowed some arthropods to move onto land. Exoskeletons have downsides. Since the exoskeleton is made up of chitin (a carbohydrate), and not living cells like our skeleton, it doesn't grow with the animal. Arthropods must molt (shed their skin) every now and then which is energetically expensive.
- **Breathing**: Aquatic species tend to have long feathery gills, with lots of surface area for O_2/CO_2 exchange. Terrestrial species have an extensive branching system of air tubes that stem from lots of tiny holes in the exoskeleton.
- Arthropods are back to an **open circulatory system**.
- Specialized appendages: Pincers, jointed walking legs, copulatory appendages, palps to move food into the mouth, antennae, & spinnerets.

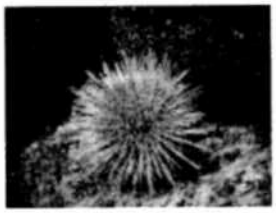




Kingdom: Animalia

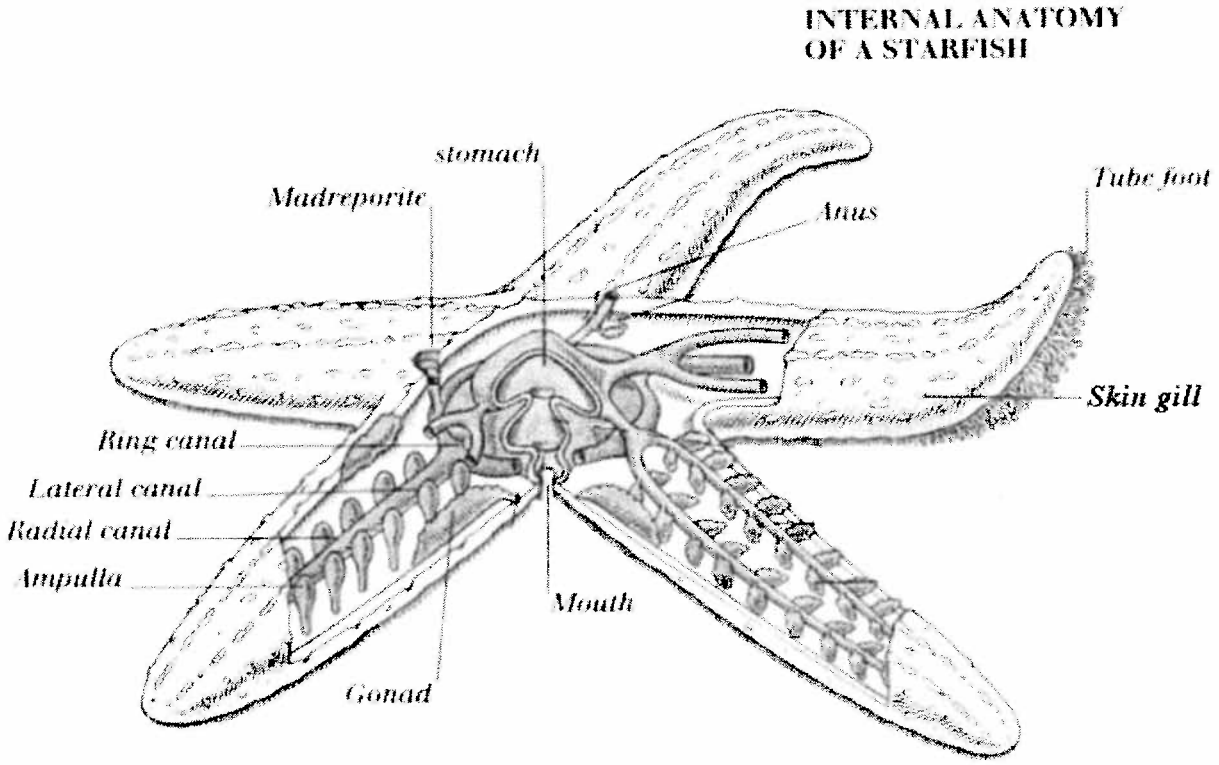
Phylum: **Echinodermata**

("spiny skin")



- Echinoderms have an **internal skeleton**, although it's not living like ours. A series of calcified (hardened calcium) plates extend throughout the animal's body, giving it some physical stability.

- Water-vascular system - a network of water-filled canals that leads to little extensions called tube-feet. Water enters the system through the madreporite and travels through the canals into the ampulla attached to each tube foot. When the ampullae contract, water is forced into the tube feet, giving them an immense amount of suction.

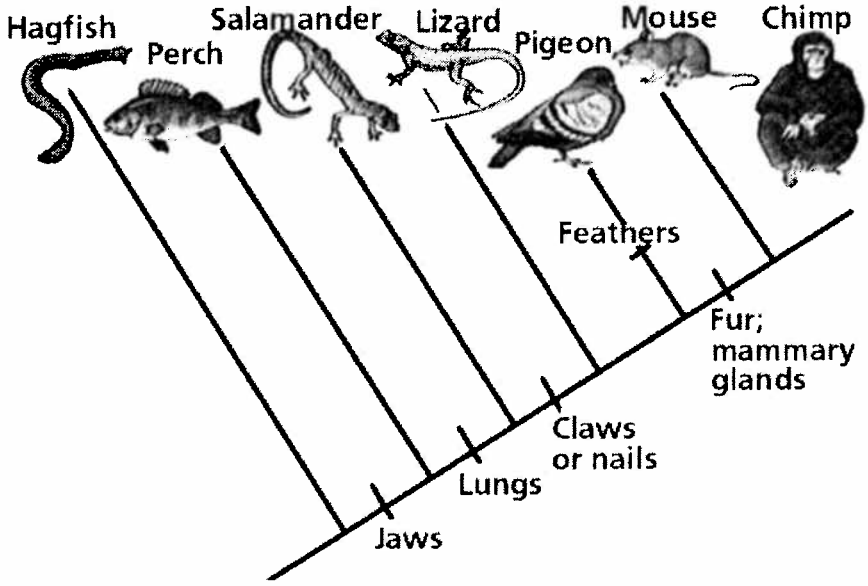


- **Radial symmetry** - each arm contains gonads (reproductive organs), water-vascular canals, and nerves.
- Some starfish are actually able to push their stomachs out of their mouths and secrete digestive enzymes.
- Echinoderm larvae are bilaterally symmetrical, explaining their position as direct ancestors to vertebrates .

Kingdom: Animalia

Phylum: Chordata

- Every chordate, from humans down to sea squirts, have the following characteristics <u>at some point</u> during their life span:
    - **Pharyngeal slits** – openings in the throat area that allow water to pass through for O_2/CO_2 movement. We did actually have these while we were in the womb.
    - **A dorsal, hollow nerve cord** – our spinal cord is dorsal (on our back), and filled with fluid in its hollow spaces.
    - **A ventral heart** – our heart is closer to our front than our back
    - **A tail** – believe it or not, you had a tail for a short period in the womb.
    - **A dorsal supporting rod (notochord)** – this is replaced by the vertebral column in most chordates.



- We chordates have some of the most sophisticated evolutionary equipment found on Earth, including . . .
    - a closed circulatory system with a multi-chambered heart
    - bilateral symmetry with lots of cephalization (and sophisticated sense organs)
    - an internal skeleton that grows with us
    - an extraordinary immune system
    - a digestive tract with lots of specialized portions (but the mouth still develops second . . .)