



Week 8: Hydra





WELCOME

to the wonderful world of

ANIMALS

Domain Eukarya

(the only domain we will focus on for the rest of the semester!)

Lineage Opisthokonta (animals & fungi)

(the only lineage we will focus on for the rest of the semester!)

Phylum: **Porifera**

Phylum **Cnidaria**

Phylum **Platyhelminthes**



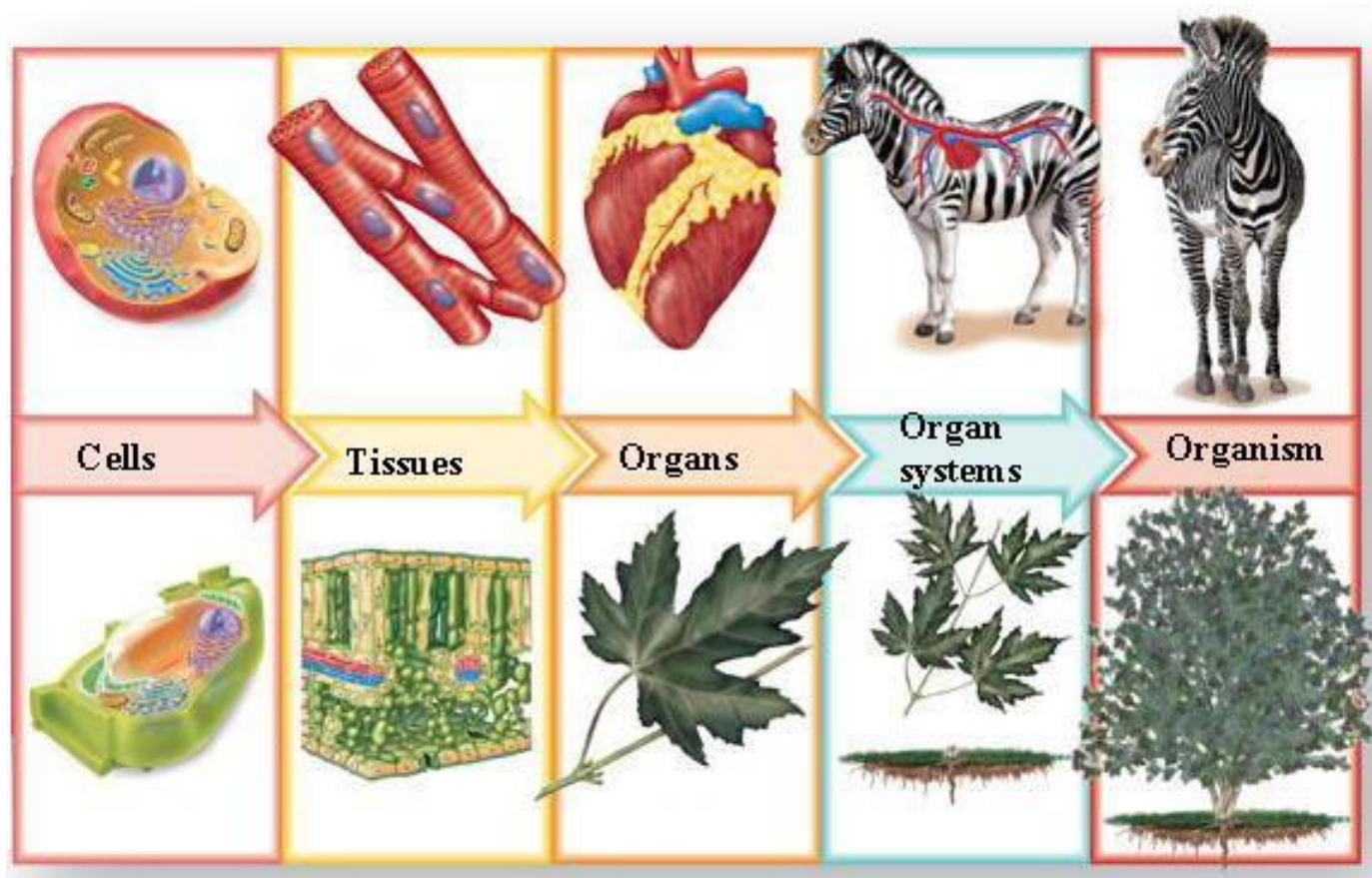
Today we will go over these three phyla, and the classes that reside within.

Goals for this week:

- ☐ List the physiological systems of a flatworm and what can be seen in their histology
- ☐ Recognize the three phyla of animals and a few of their subgroups – naming their parts and understanding their life cycles
- ☐ Draw a phylogenetic tree complete with primitive and derived traits
- ☐ Go over the levels of organization of cells and differentiate between the phyla with that information

Levels of Organization

Animal bodies are composed of multiple cells of several types, each type performing a specific function

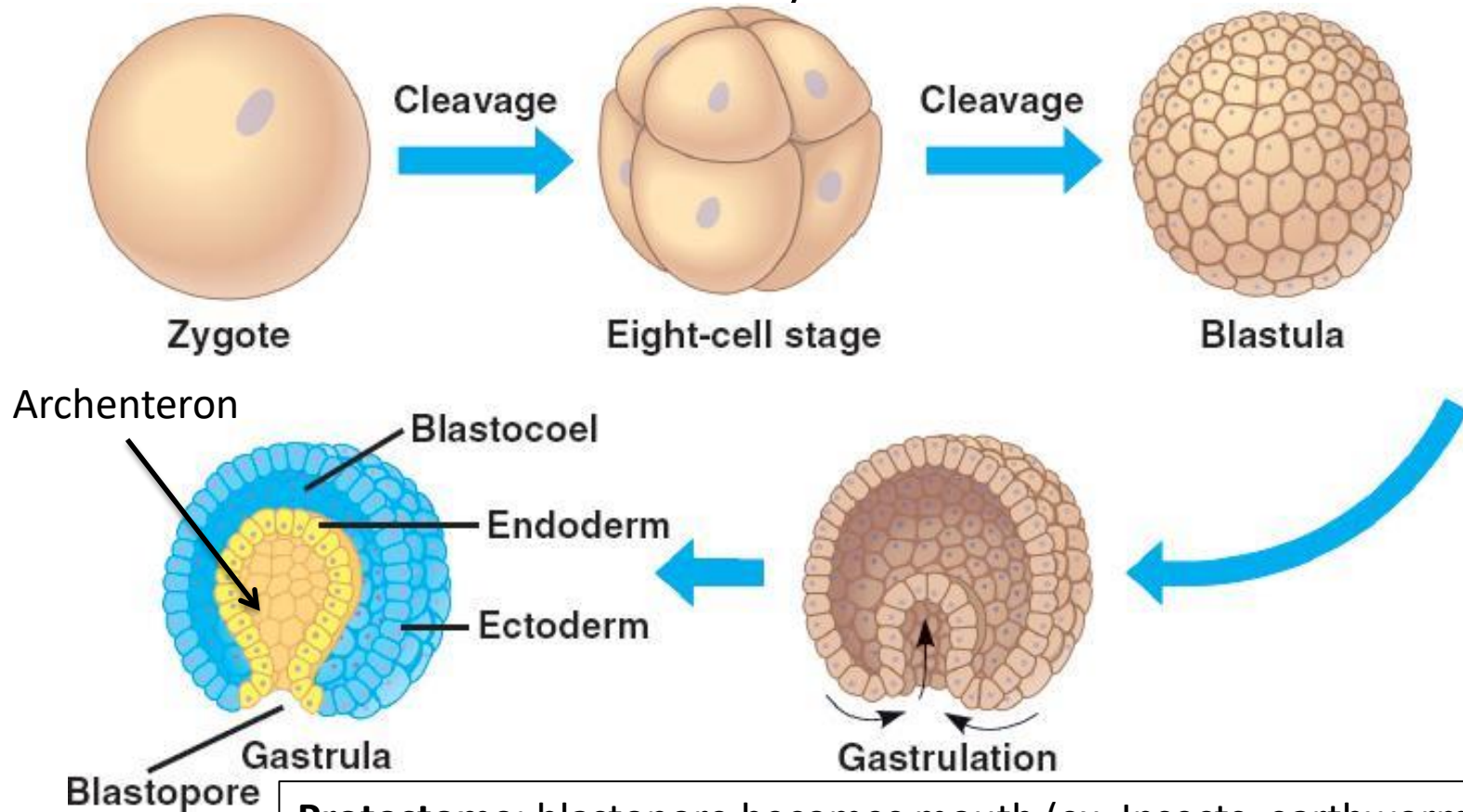


To understand these levels of organization, we need to understand animal development.

Terms to Define: blastula, gastrula, ectoderm, endoderm, mesoderm, blastopore, archenteron, protostome, dueterostome

Germ Layers

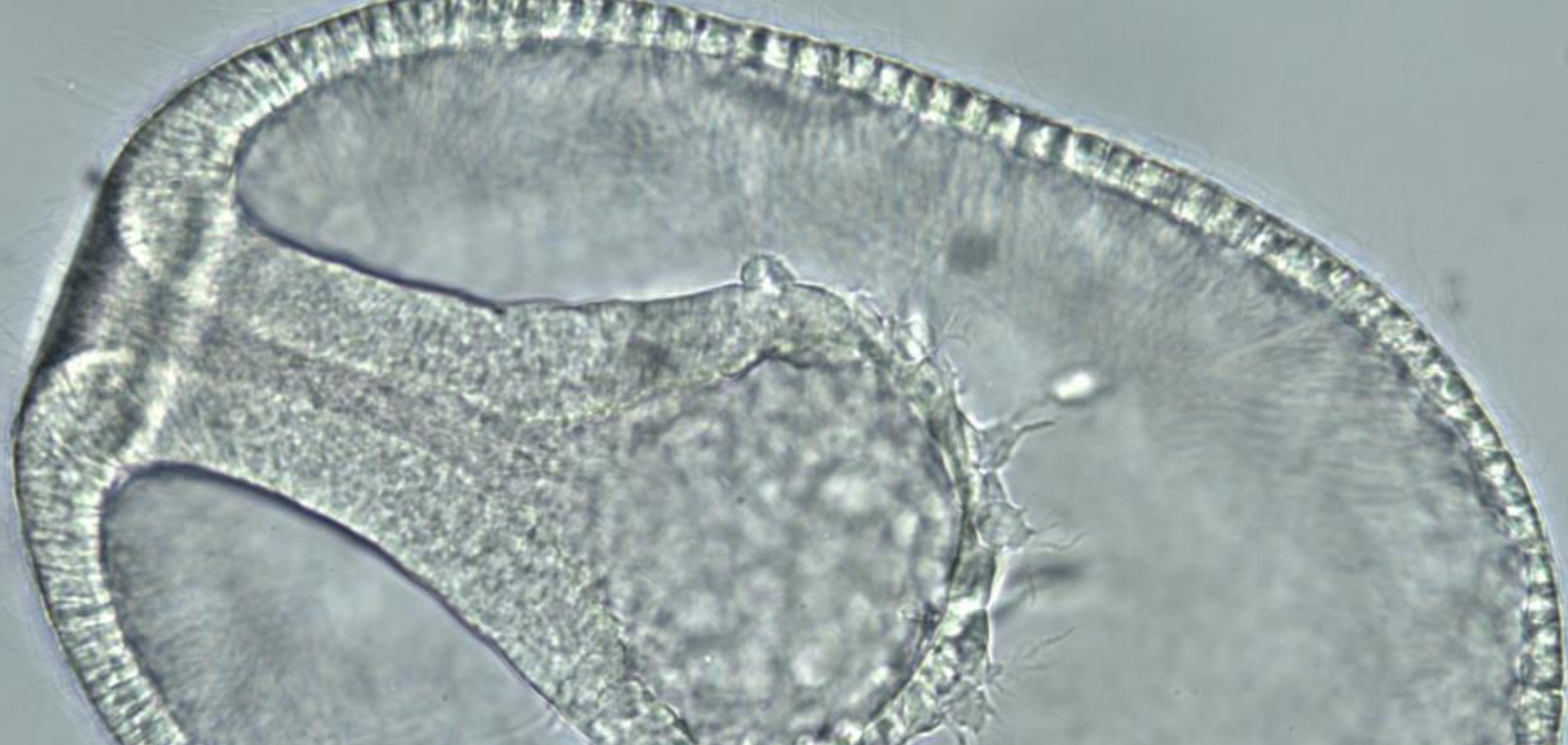
Germ layers are the primary layers of cells that form during embryo development → all adult structures come from these initial layers!



Protostome: blastopore becomes mouth (ex. Insects, earthworms)

Dueterostome: blastopore becomes anus (ex. Humans, sea stars)

The archenteron (cavity) develops into the adult digestive tract, and the blastopore either the mouth or anus



“It is not birth, marriage, or death, but gastrulation which is truly the most important time in your life.”

- Lewis Wolpert, developmental biologist

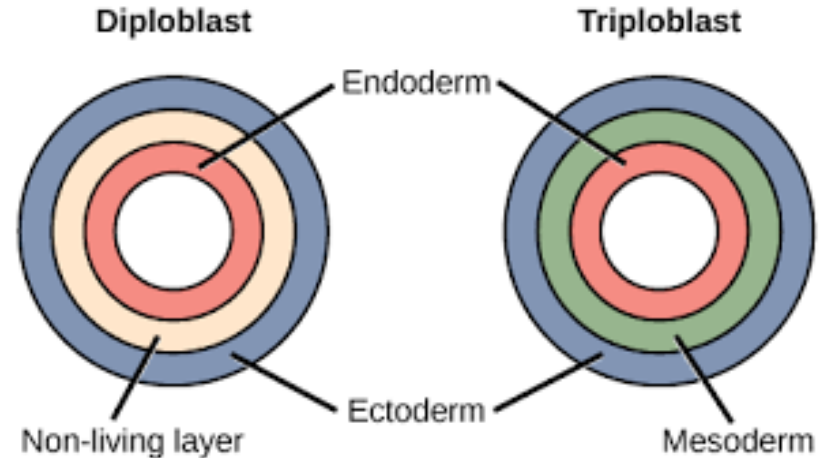
Diploblastic and Triploblastic

- **Diploblastic**

- Adult structures derive from only two germ layers: endoderm and ectoderm
 - sponges and cnidarians

- **Triploblastic**

- Adult structures derive from all three germ layers: endoderm, mesoderm and ectoderm
 - flatworms



Levels of Organization Across Phyla

- **Phylum Porifera**

- Sponges are the least complex animals
- Cellular level of organization, no tissues

- **Phylum Cnidaria**

- Tissue level of organization, no organs

- **Phylum Platyhelminthes**

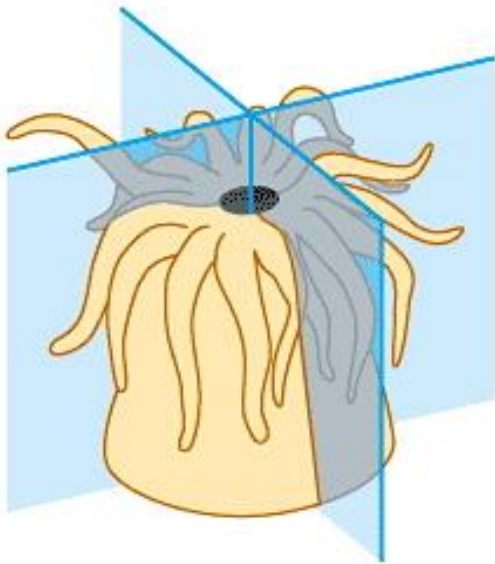
- Organ level of organization, no organ systems

Nature of Digestive Tract

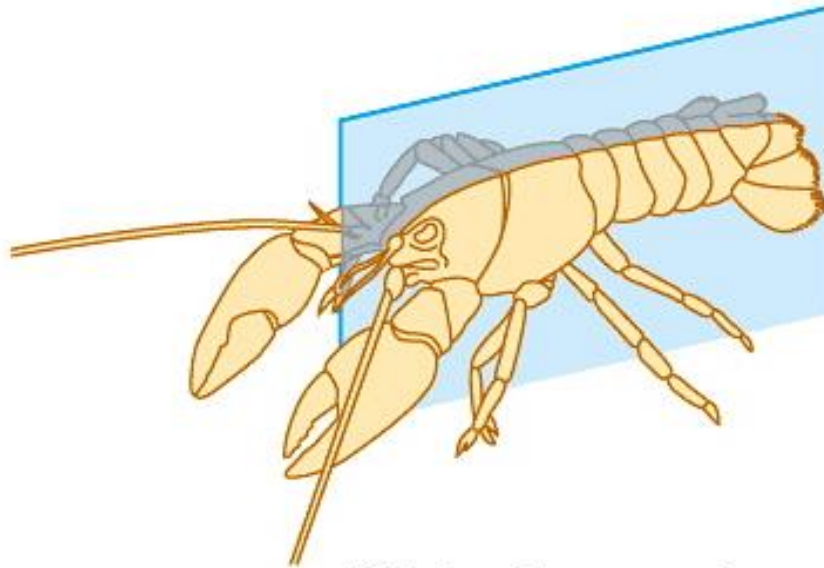
- Sponges have no digestive tract
 - Each cell is responsible for obtaining its food
- Cnidarians and flatworms have simple digestive tracts
 - Saclike pouch with a single opening that functions as both a mouth and an anus
- Other animals: gut is a tube that works like a conveyer belt

Symmetry

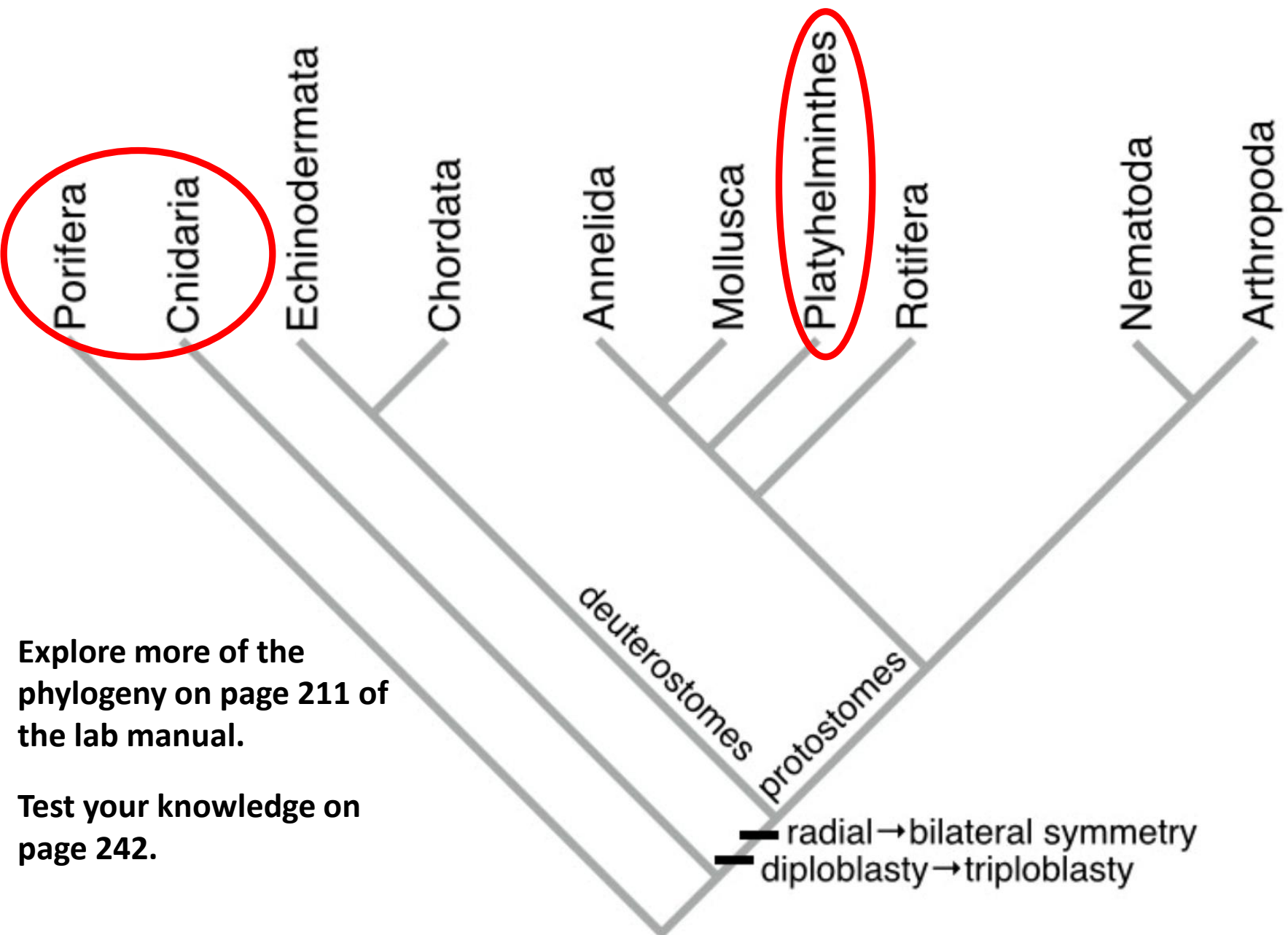
- **Radial symmetry** (Cnidaria)
- **Bilateral symmetry** (Platyhelminthes)
- **Asymmetry** (Porifera)



Radial symmetry



Bilateral symmetry



Explore more of the phylogeny on page 211 of the lab manual.

Test your knowledge on page 242.

— radial → bilateral symmetry
— diploblasty → triploblasty

Characteristics

Phylum Porifera

- **Sessile**, aquatic organisms that form large colonies
- Skeleton of most sponges consists of crystalline **spicules** composed of calcium carbonate or silica
- Some sponges are supported by a network of fibrous protein called **spongin**
- All sponges have specialized cells called **choanocytes**, each with a flagellum and a collar
 - Flagellum move water through the sponge and collar gathers food



Siliceous spicules
(Hexactinellida)



Siliceous spicules
(Demospongiae)



Spongin



Calcareous



Sponge Filter Feeding

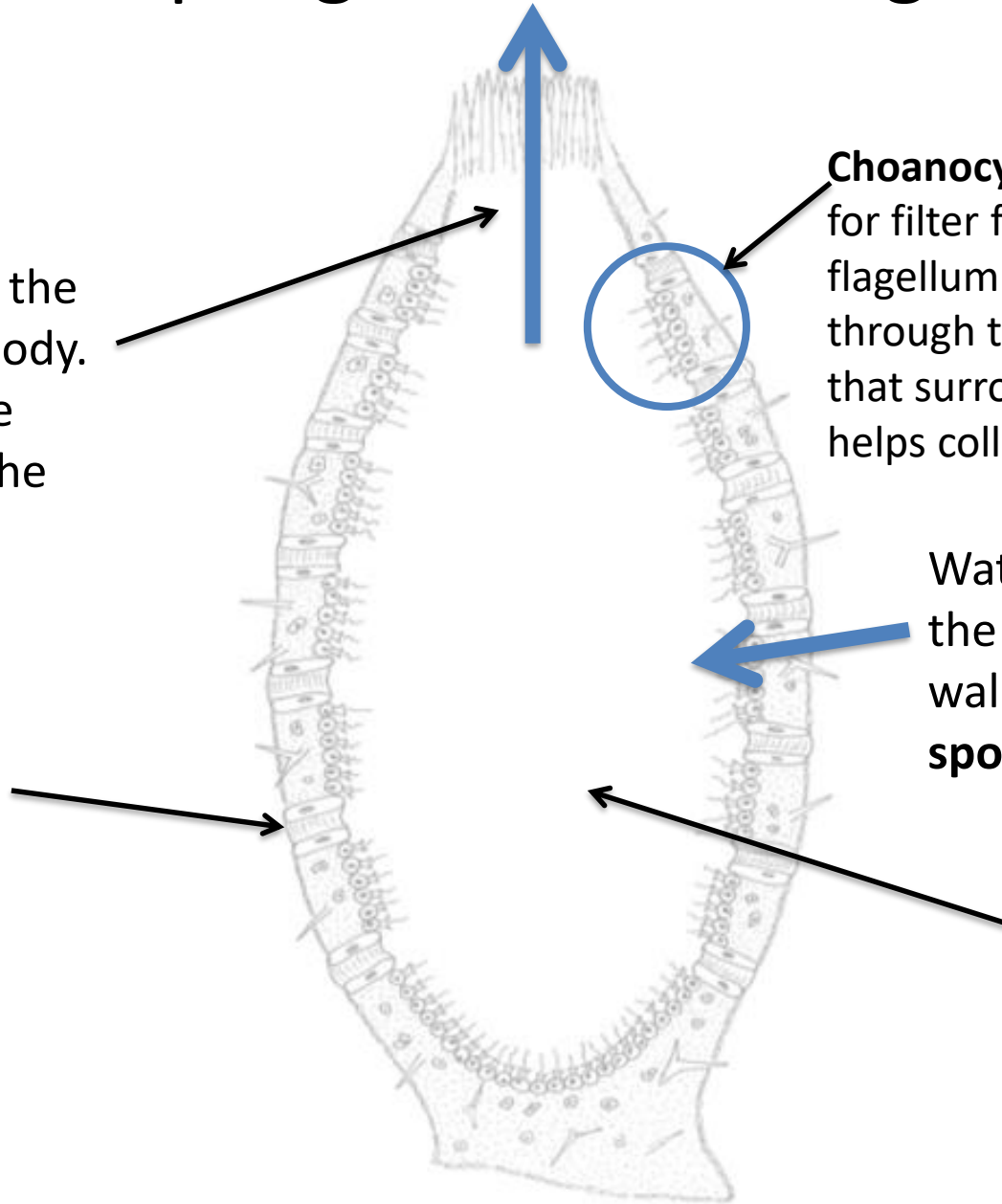
Osculum: where the water exits the body. It is the one large opening where the waste goes.

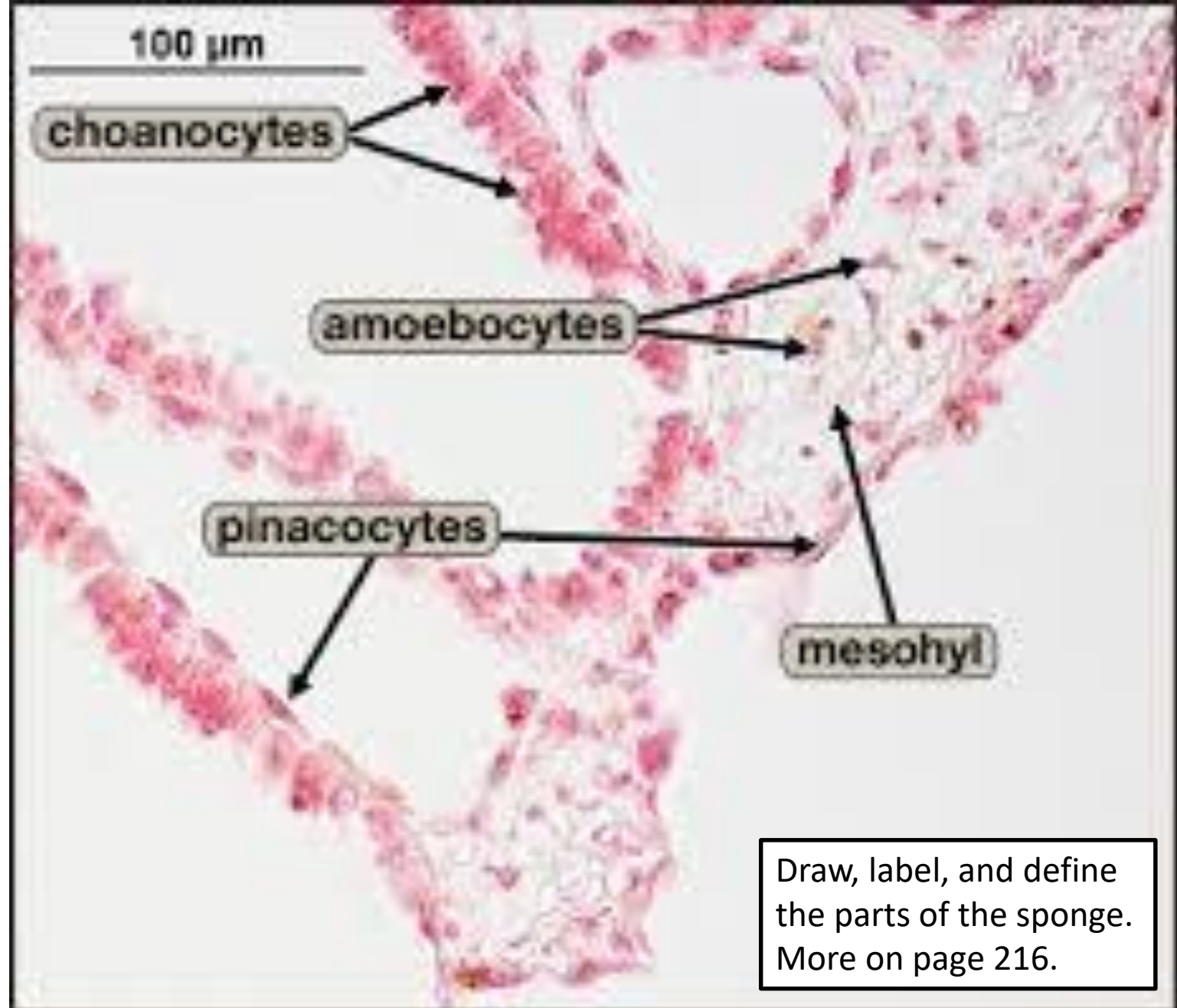
Ostia: the pores that reside in the body wall.

Choanocytes: specialized cells for filter feeding. Their flagellum helps move water through the body and the collar that surrounds the flagellum helps collect food.

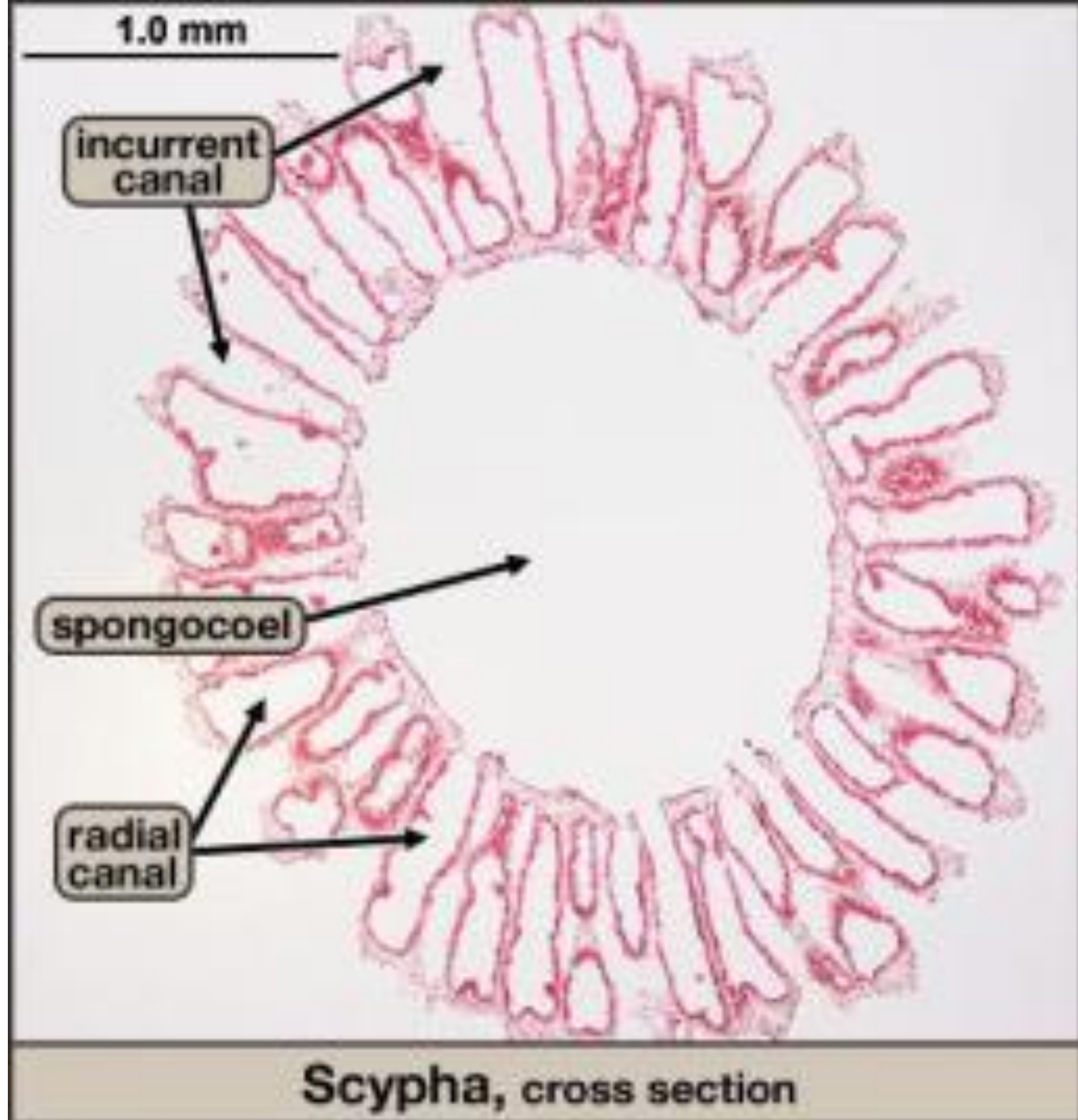
Water enters through the **ostia** of the body wall and enters the **spongocoel**.

Spongocoel: the large cavity at the center of the sponge.



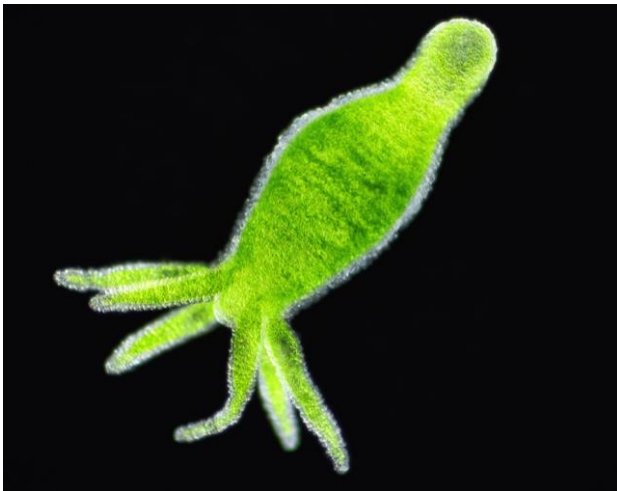


Scypha, longitudinal section



Phylum Cnidaria

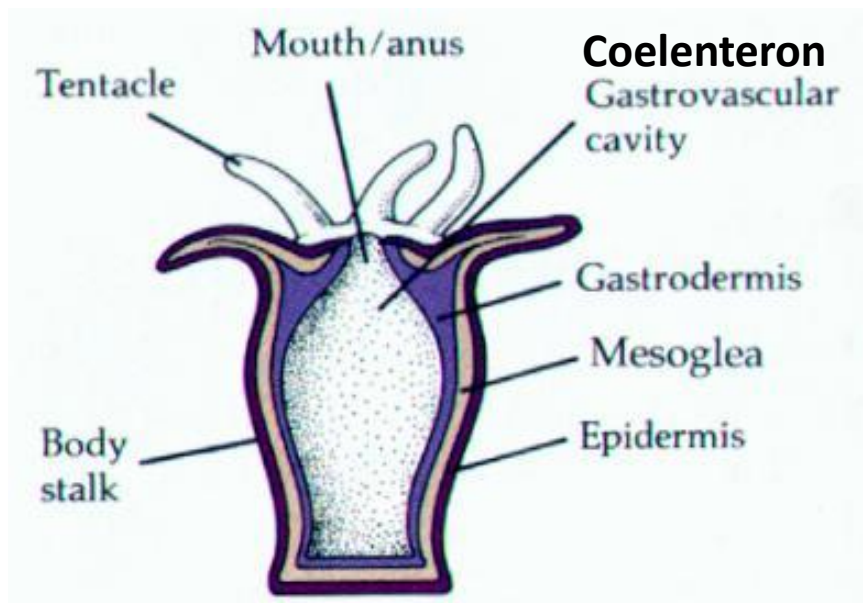
- Includes about 10,000 species (all aquatic)
- Phylum is divided into 3 classes:
 - Class **Hydrozoa** (*Hydra* and relatives)
 - Class **Scyphozoa** (sea jellies)
 - Class **Anthozoa** (anemones and corals)



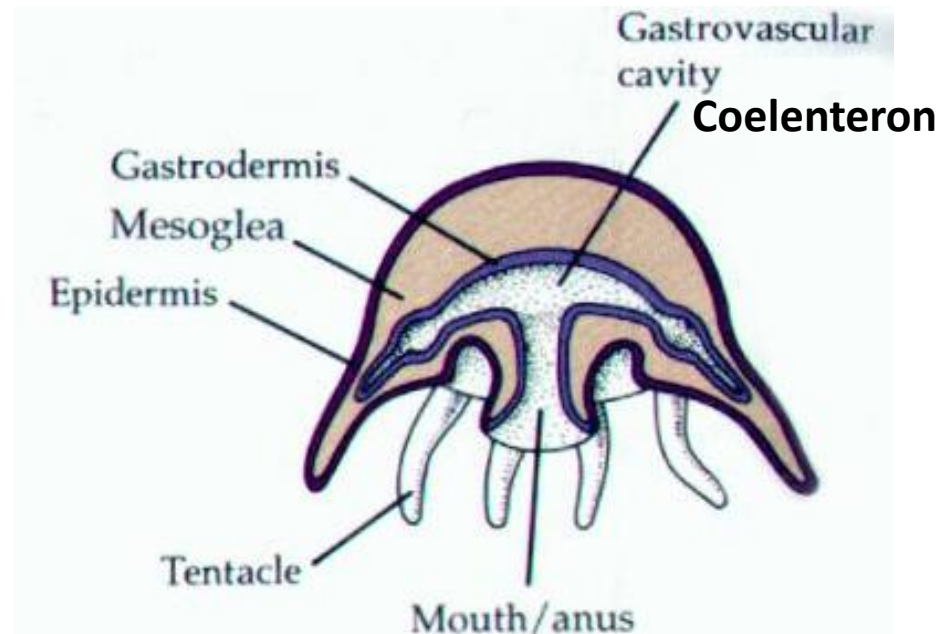
Cnidarian Body Plan

- Composed of two cell layers, an outer epidermis (derived from ectoderm) and an inner **gastrodermis** (derived from endoderm), between these layers is the **mesoglea** (Gastrovascular cavity = *coelenteron*)
- Mesoglea hydrostatic skeleton that muscles can work against. Rigid and flexible.
- There isn't a brain, but instead a nerve net!

Polyp (Hybroid) – sessile phase

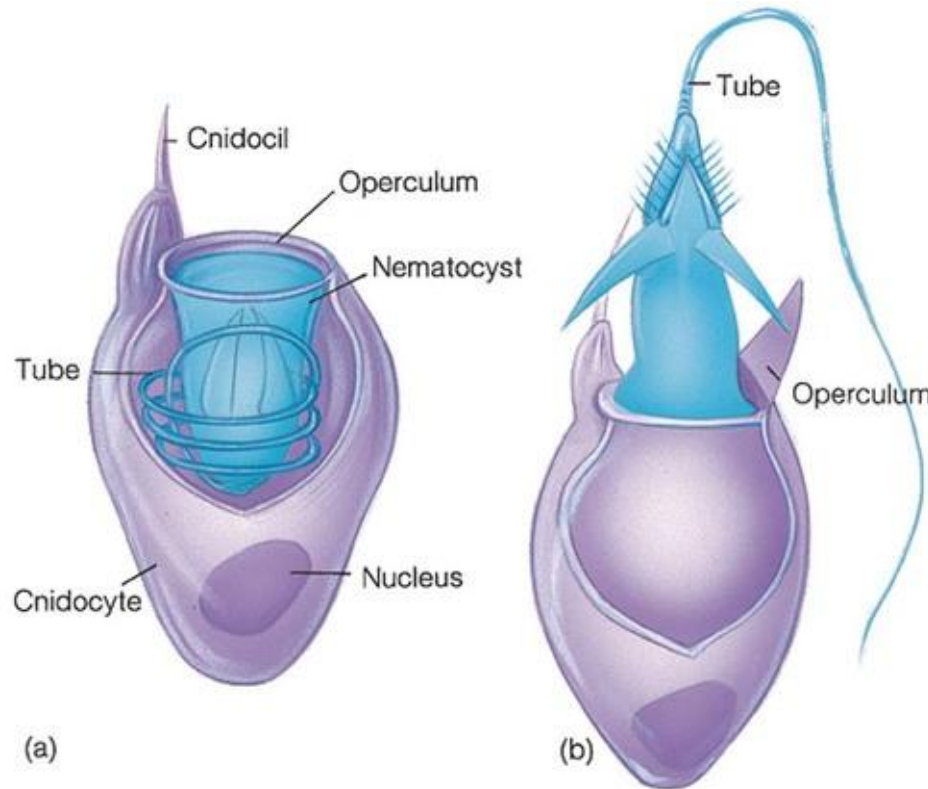


Medusa – swimming phase



Stinging Cells

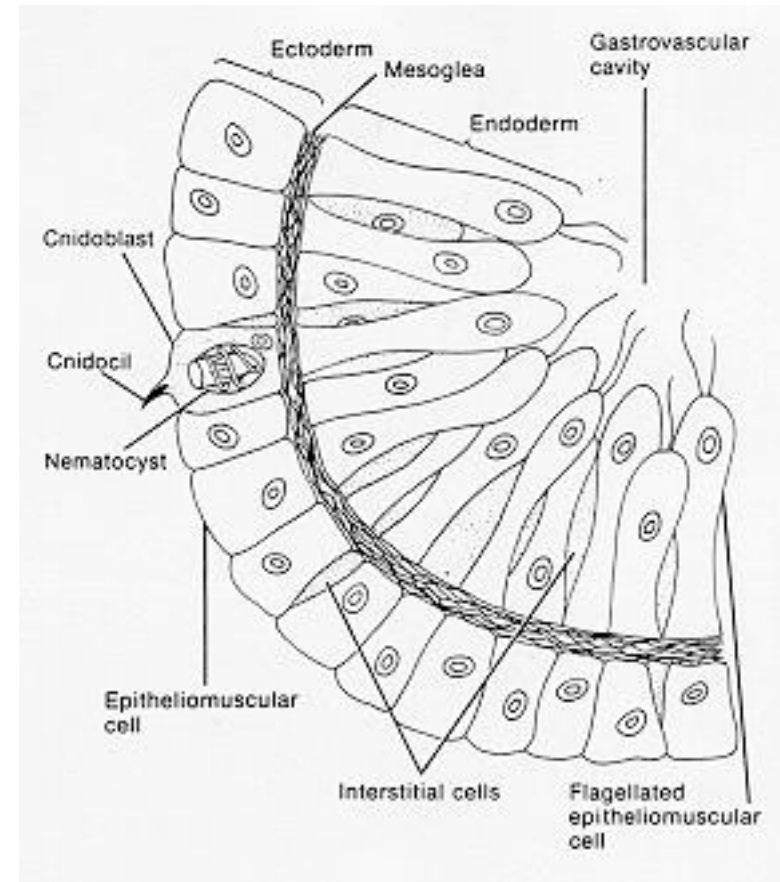
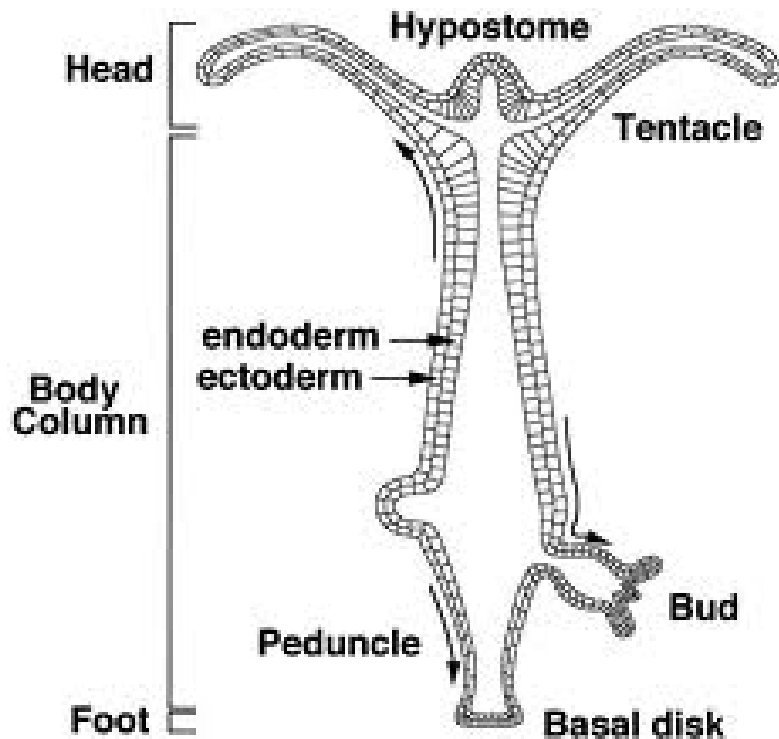
- Cnidarians have stinging cells called **cnidocytes**
- Used to capture prey and in defense
- Each cnidocyte encloses a fluid-filled **nematocyst**, bears a trigger-like **cnidocil**



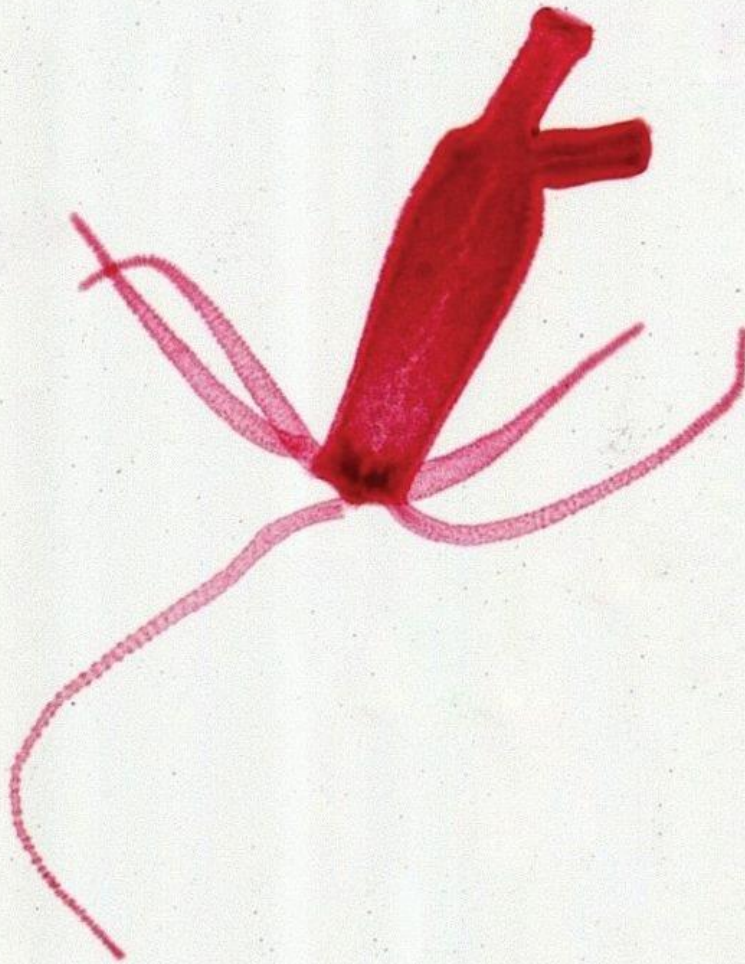
(a) Before explosion, (b) after explosion

Class Hydrozoa

- Ex: *Hydra*, *Obelia*, siphonophores
- Solitary or colonial (siphonophores), most marine, some freshwater
- Hydras attach to underwater plants or stones
- Feed on zooplankton, worms, snails, and tadpoles
- May move by locomotion, or use currents to float



Hydra budding (whole mount)



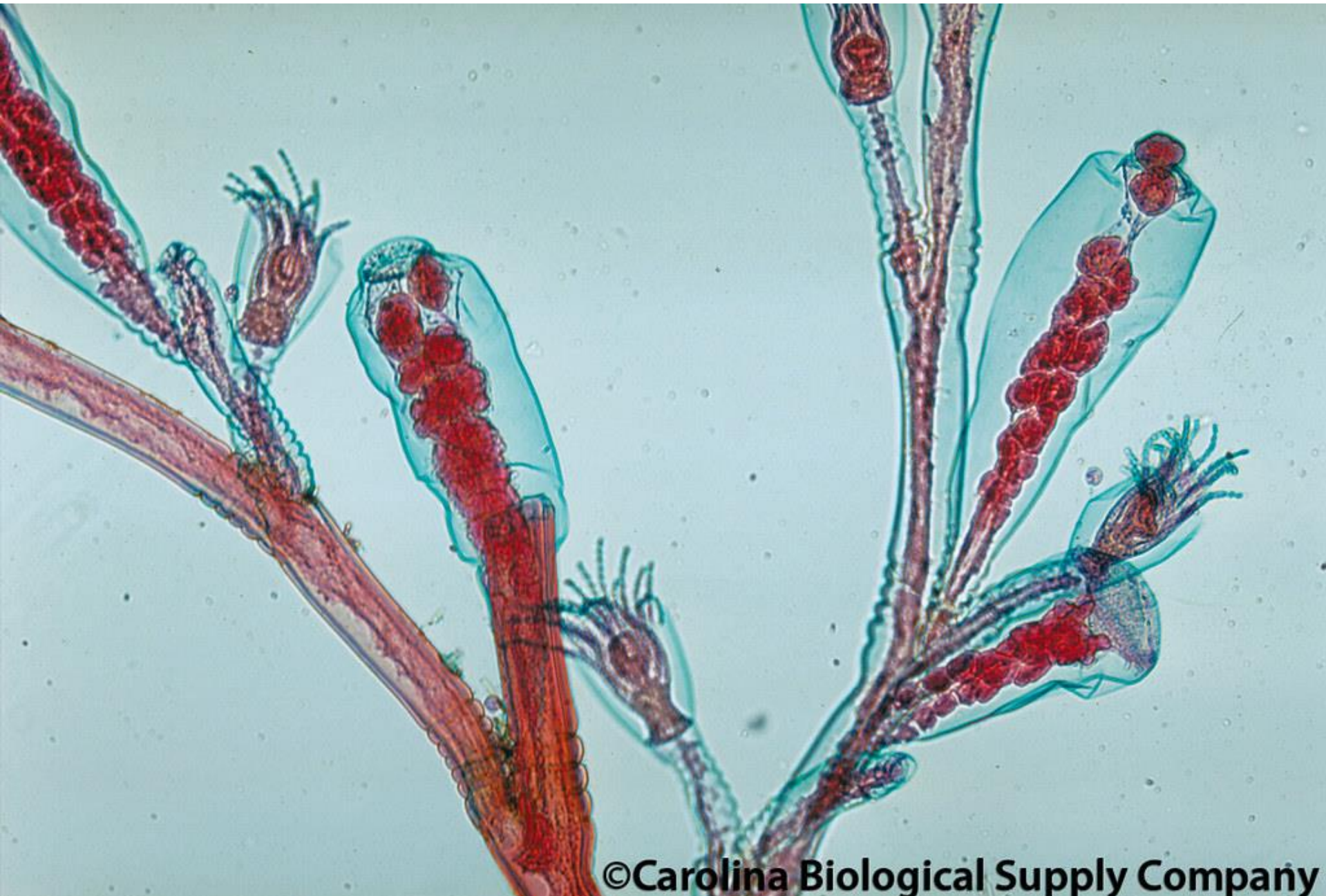
How *Hydra* looks budding
when alive

I'm the bud!

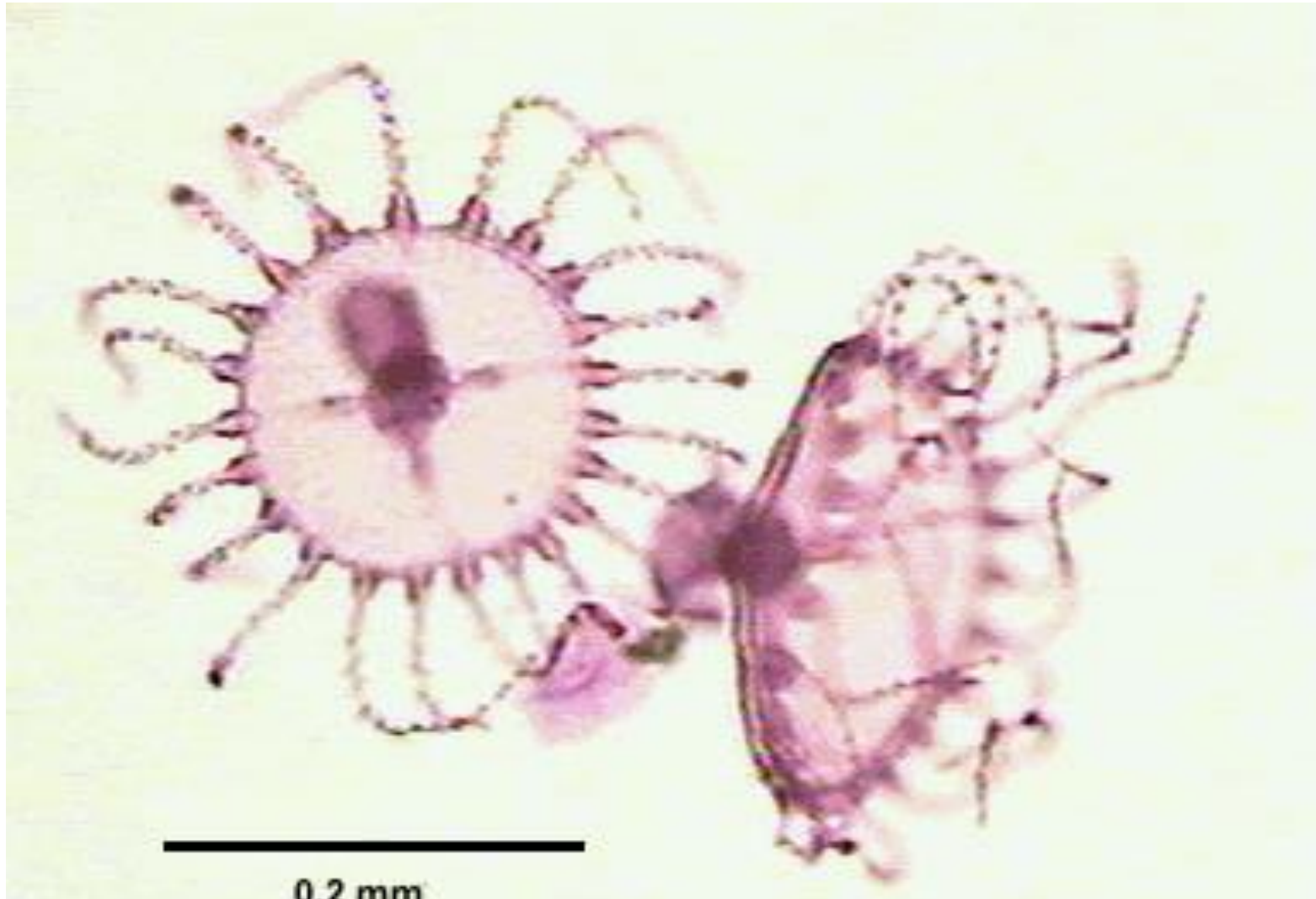


Labeling exercise of *Hydra* is on page 222
of the lab manual.

Obelia hydroid (polyps)



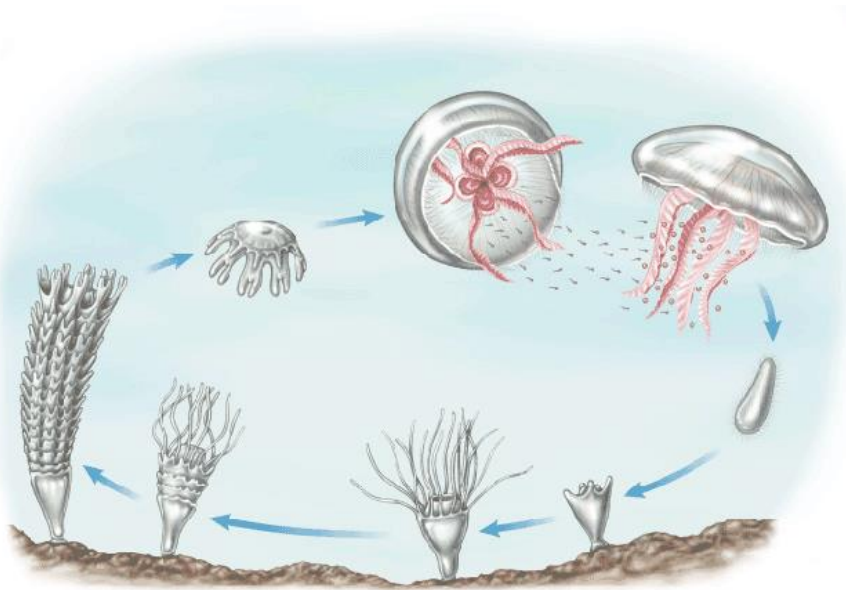
Obelia medusa



Life cycle of *Obelia* is on page 223 of the lab manual.

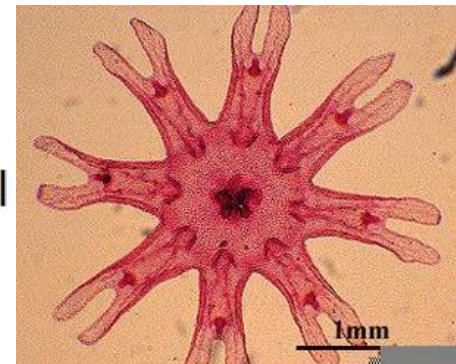
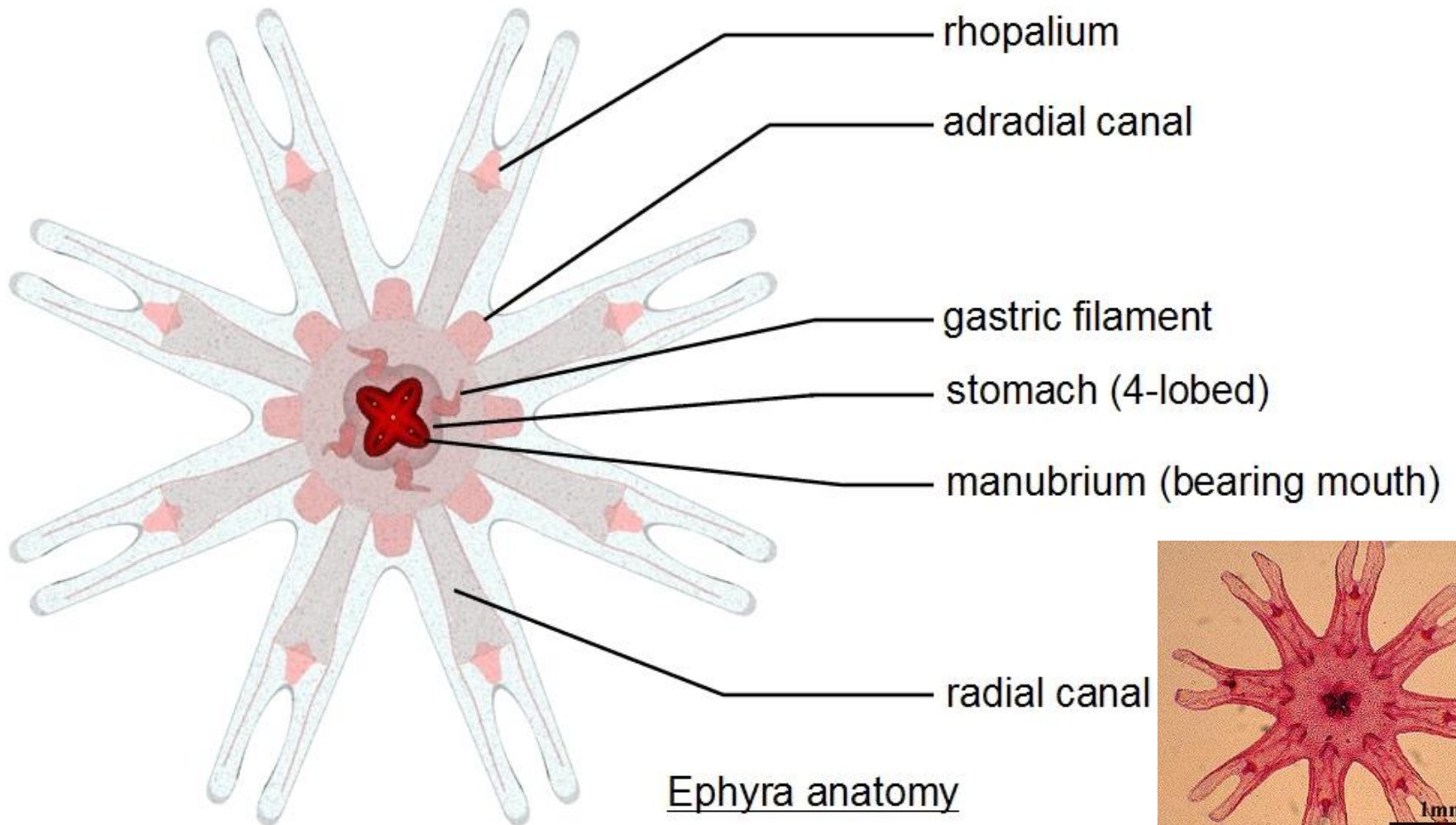
Class Scyphozoa

- Includes most large jellyfish, all are marine
- Dominant life form is the medusa
- ***Aurelia*** – moon jelly
- **Ephyrae** – stack of baby medusa that are released as the mature

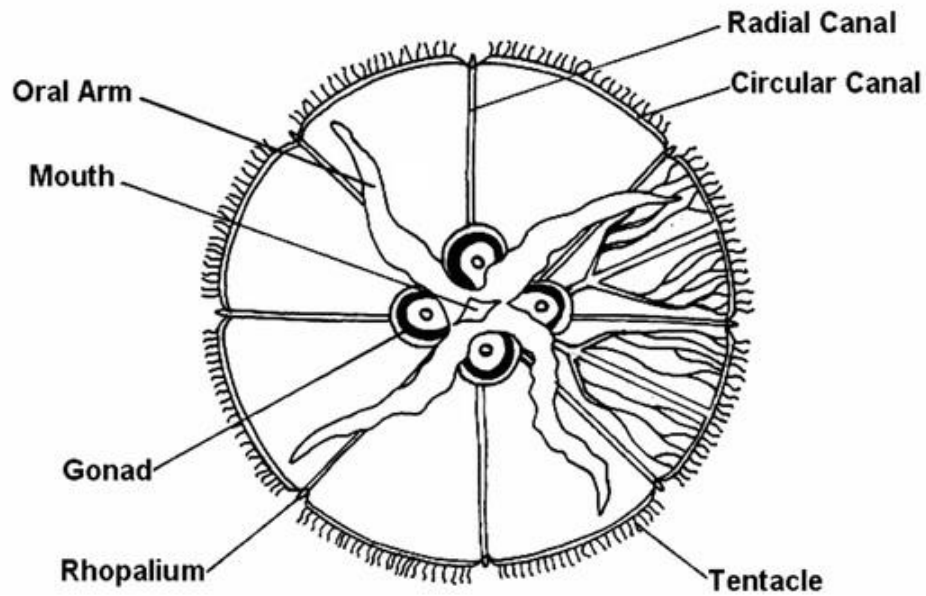
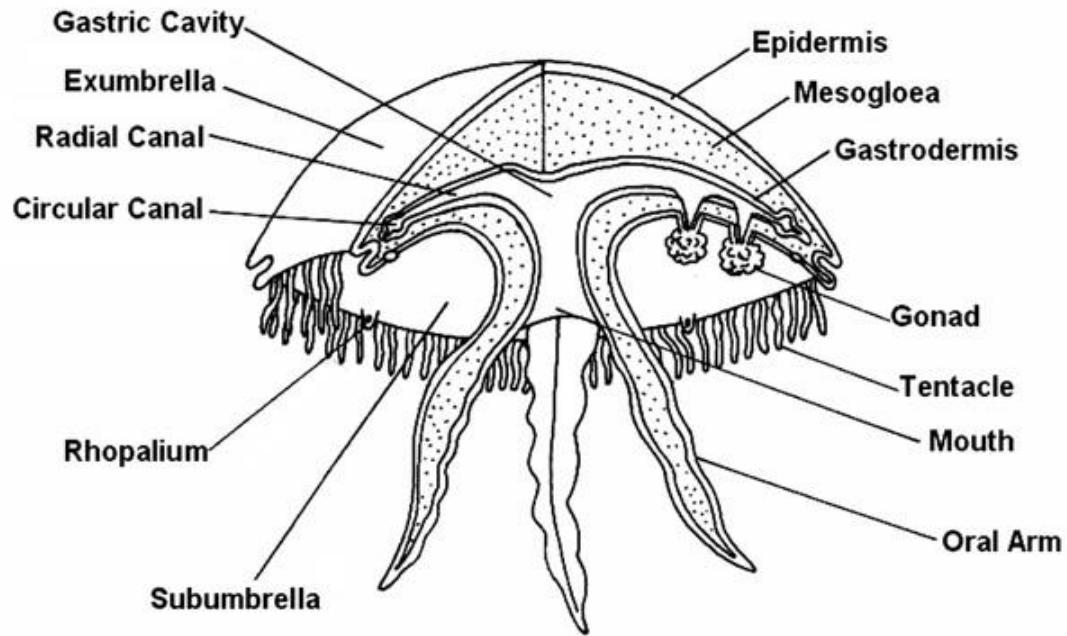


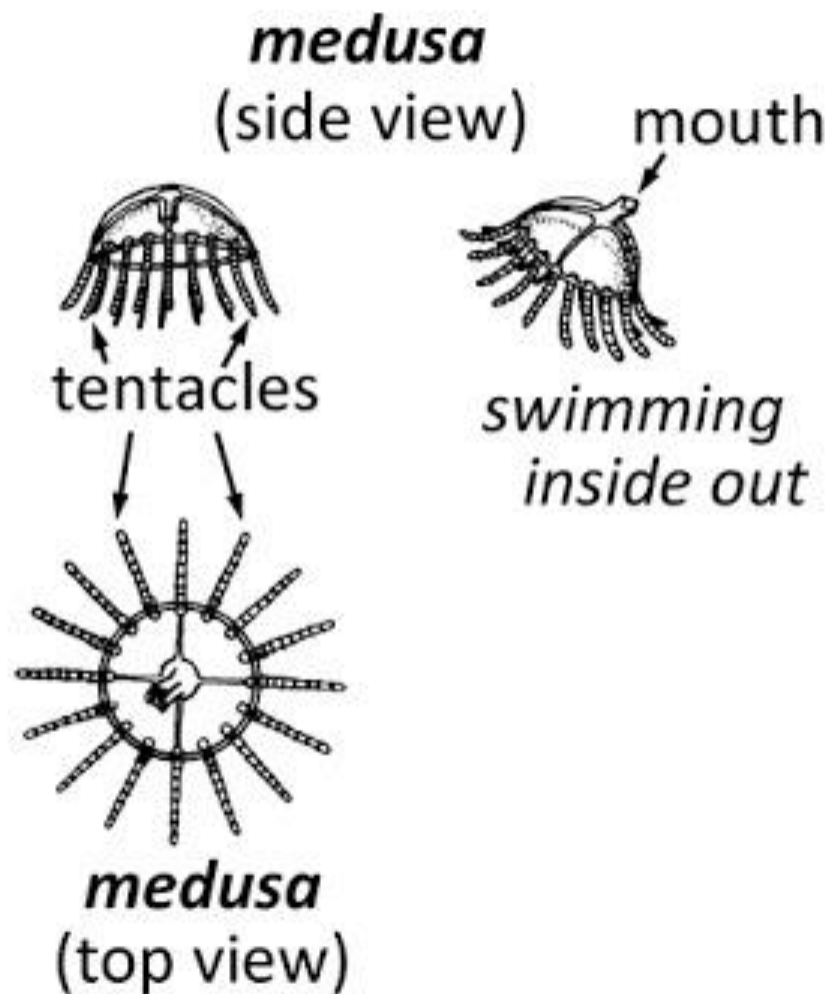
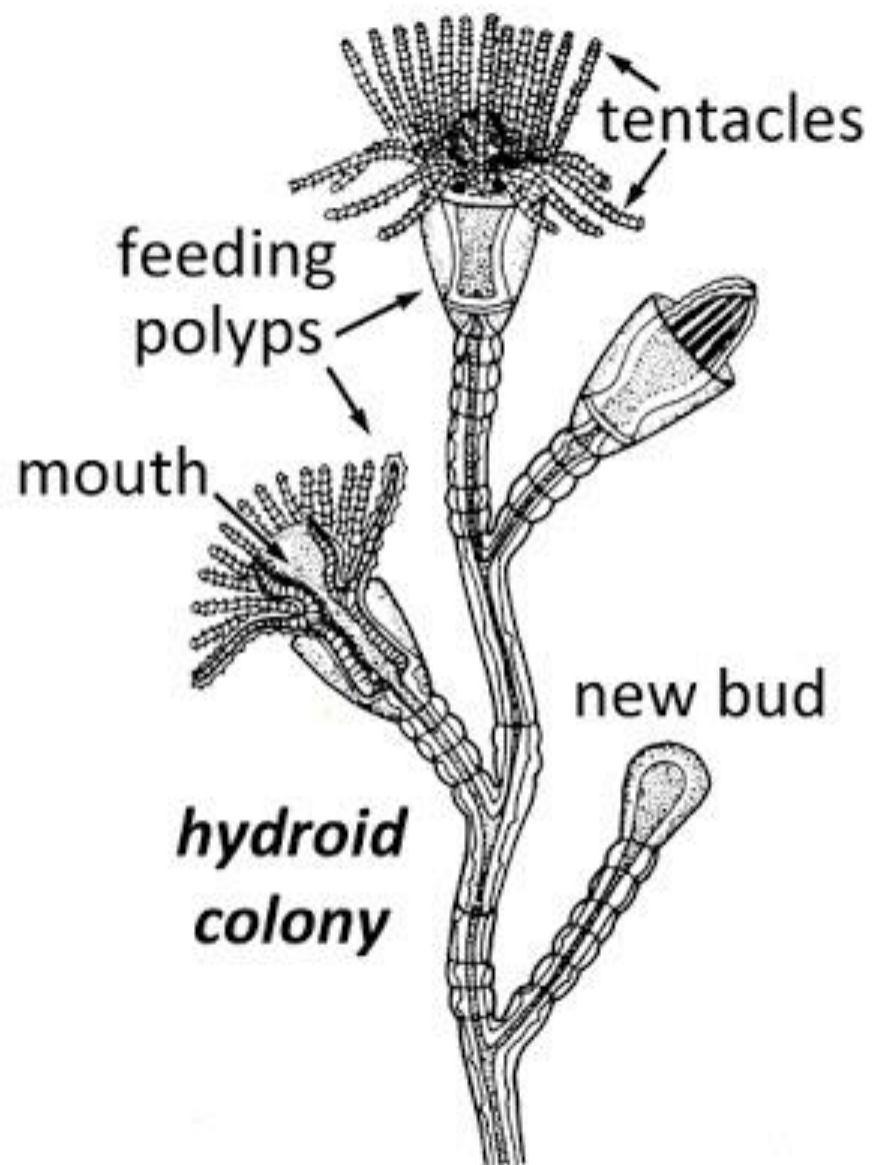
Ephyrae

Aurelia ephyra – note anatomy



Phylum: Cnidaria
***Aurelia* (Moon Jellyfish)**





Class Anthozoa

- Most advanced cnidarians
- Anemones and corals

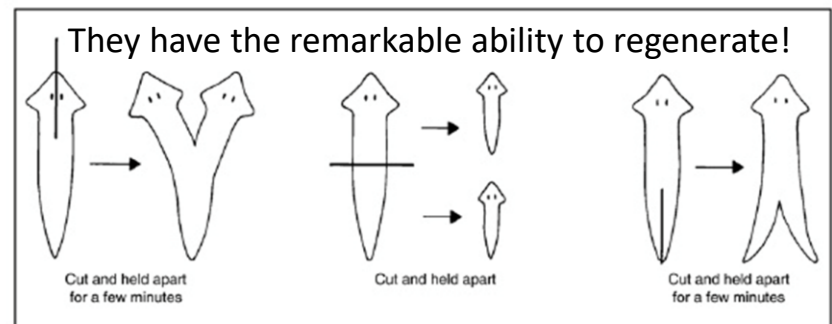


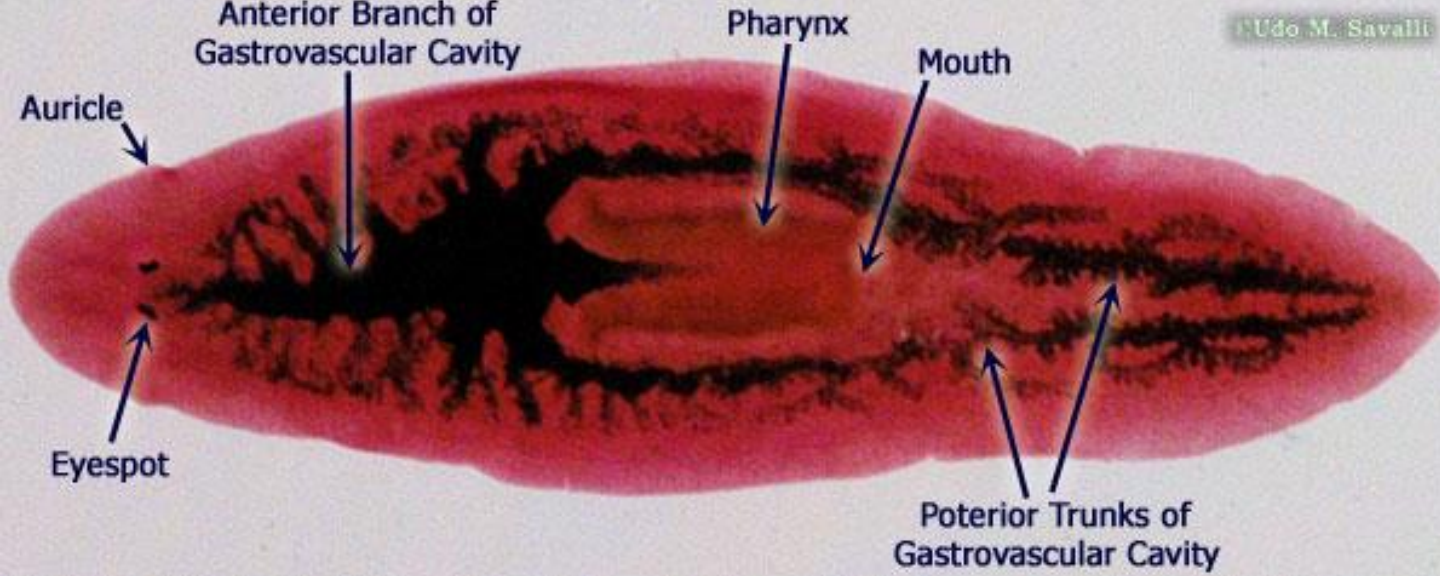
Phylum Platyhelminthes

- Bilaterally symmetrical, triploblastic flatworms with **cephalization** and true organs
- Phylum is divided into 4 classes
 - **Class ‘Turbellaria’** (free-living flatworms)
 - Class Monogenea (ectoparasitic flukes)
 - **Class Trematoda** (endoparasitic flukes)
 - **Class Cestoda** (tapeworms)

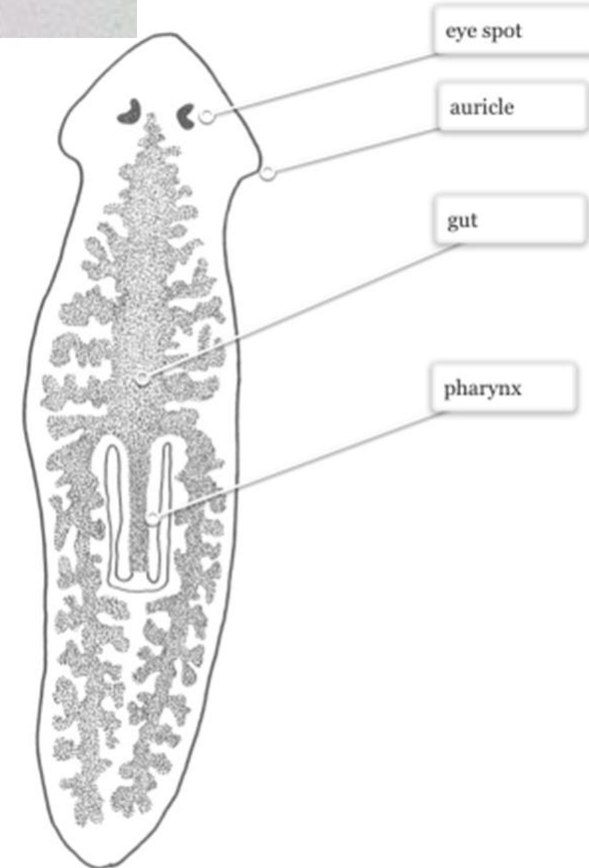
Class 'Tubellaria'

- Mostly marine, some freshwater (they have been found in local waterways in the San Fernando Valley), some in tropical rainforests
- Example: *Dugesia* ('planarians')
 - Gut has only a single opening
 - Feed on dead animal matter and animals caught in their slime
 - **Acoelomate** body arrangement – region between body wall and gut is filled with tissues and organs of mesodermal origin
 - Eliminate metabolic wastes and regulate water balance via flame cells
 - Simultaneous hermaphrodites (cosexual)



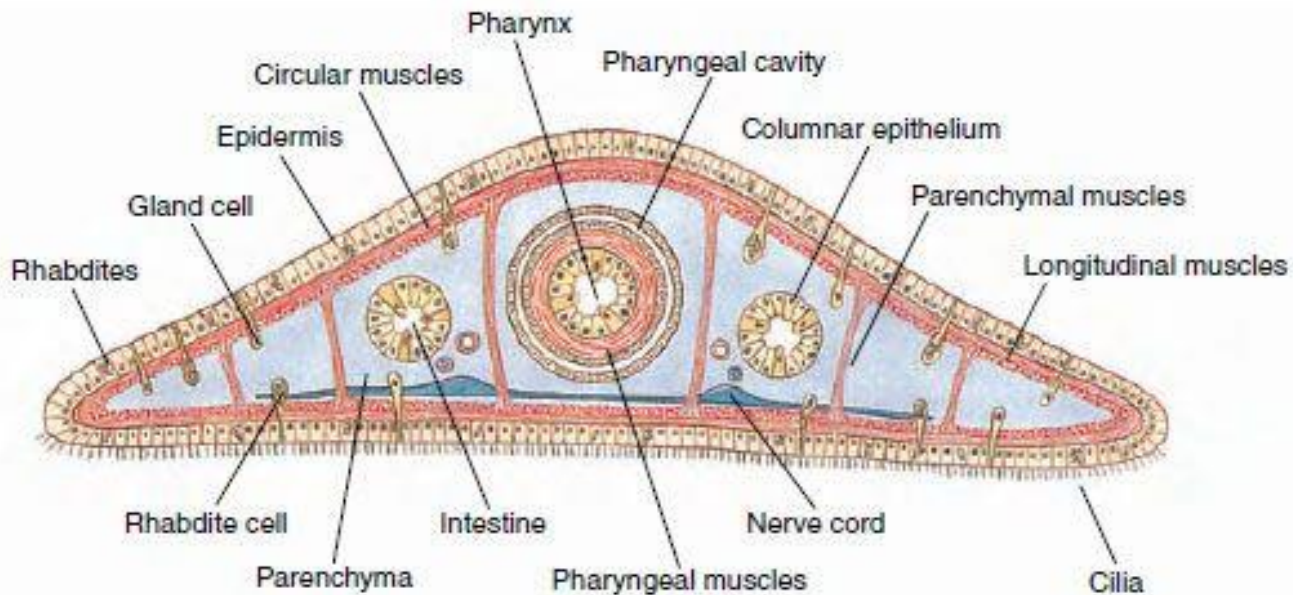
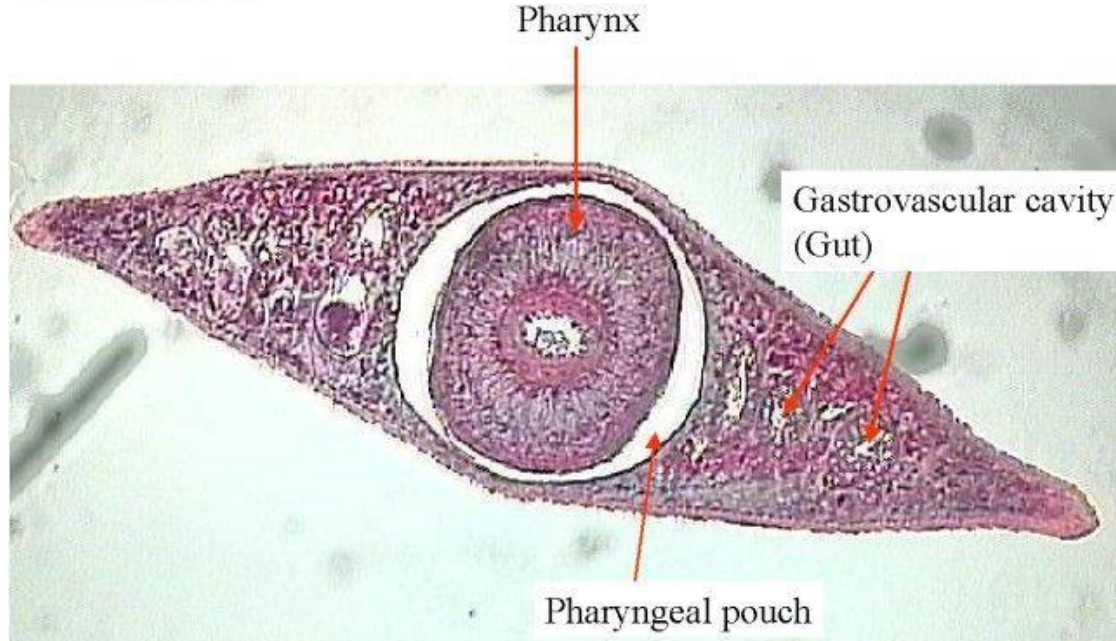


Planaria Whole Mount



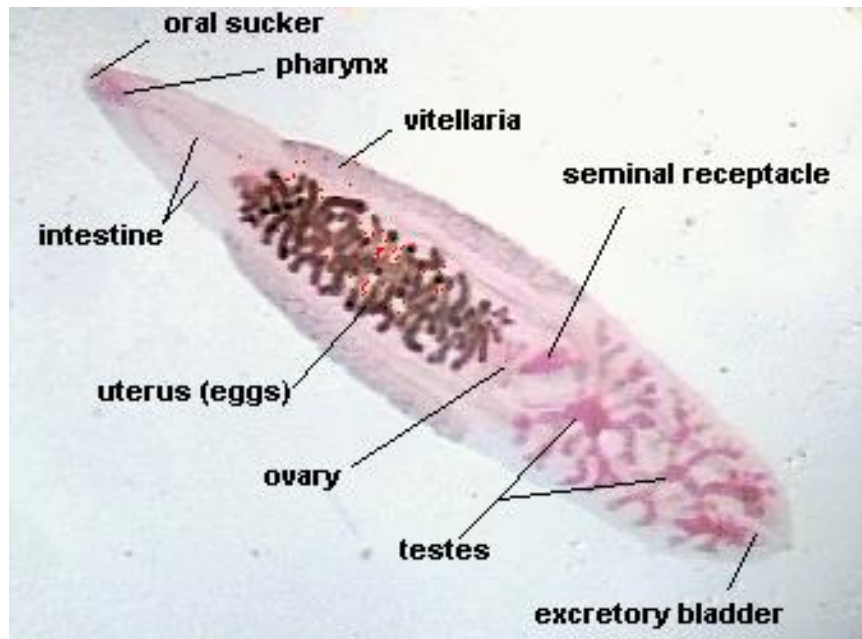
Cross Section of Planaria

Planarian c.s. X 40



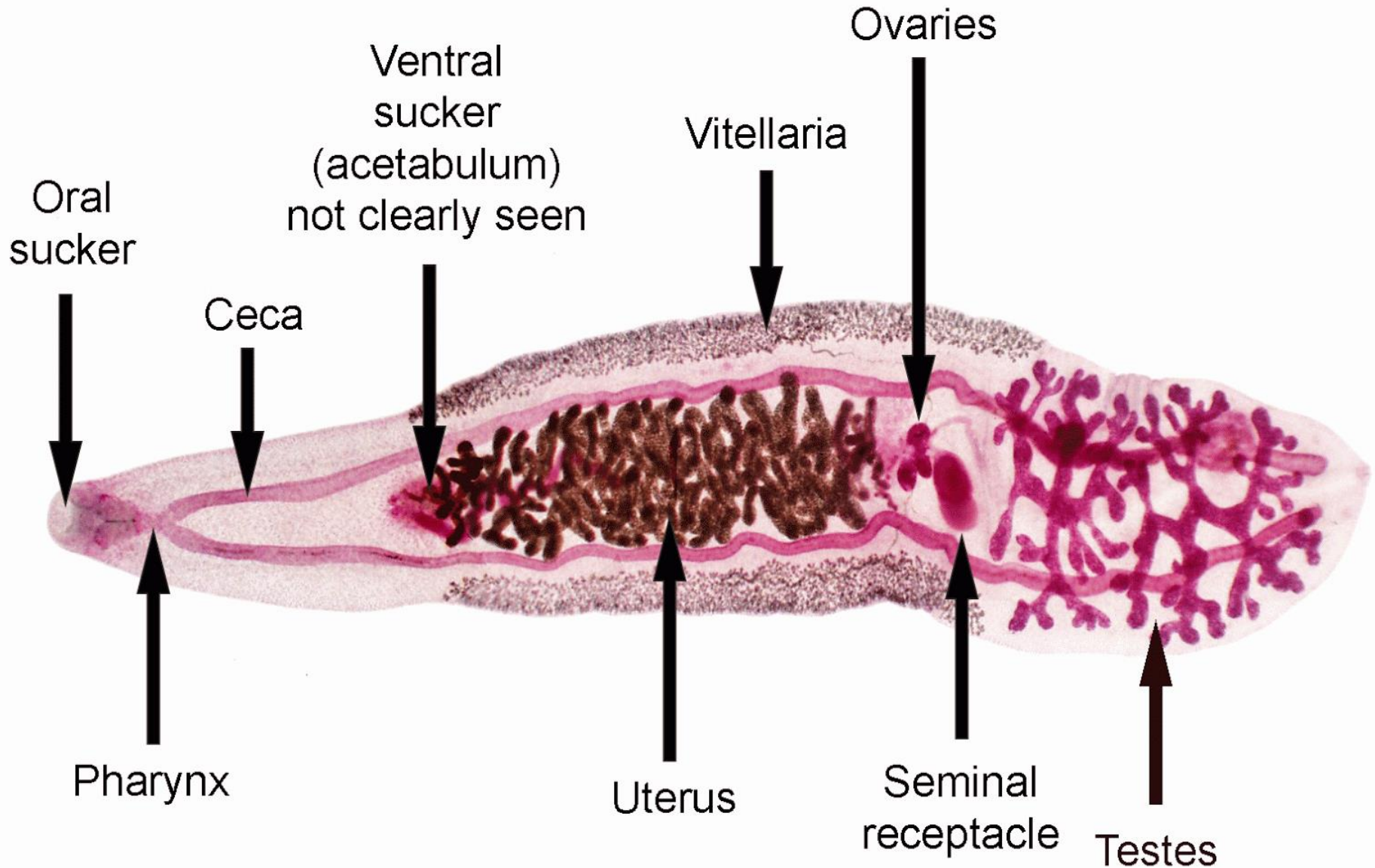
Class Trematoda - flukes

- All are parasites called flukes
- Important human parasites
 - *Clonorchis sinensis*: Human liver fluke
 - *Schistosoma*: Blood flukes



Clonorchis sinensis

For prompts and videos, go to pages 232-233.

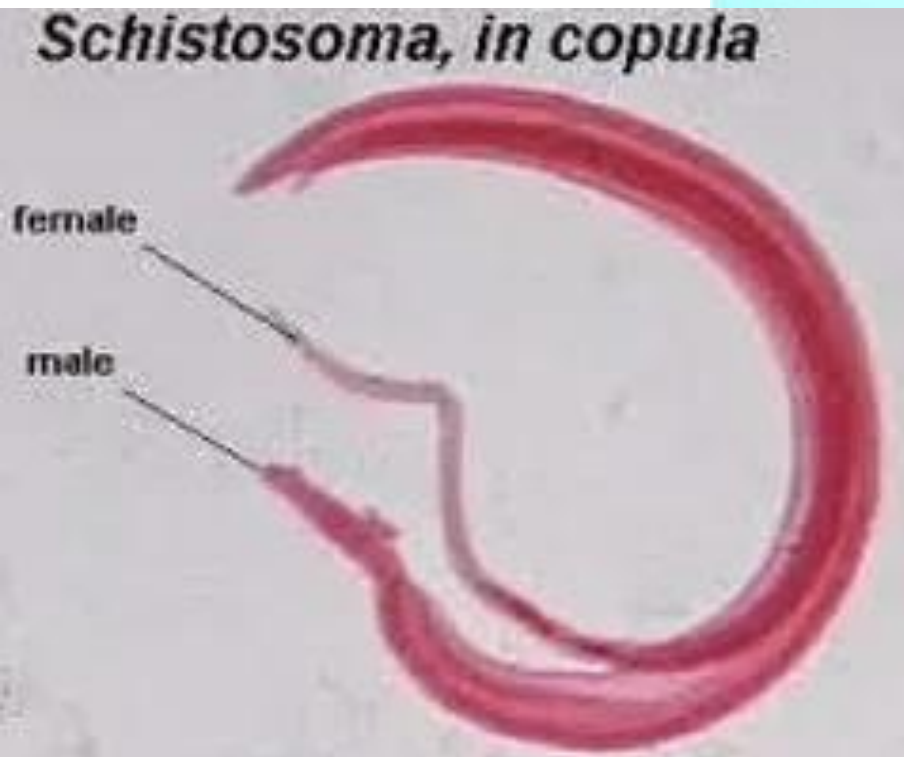


Cercariae Fluke



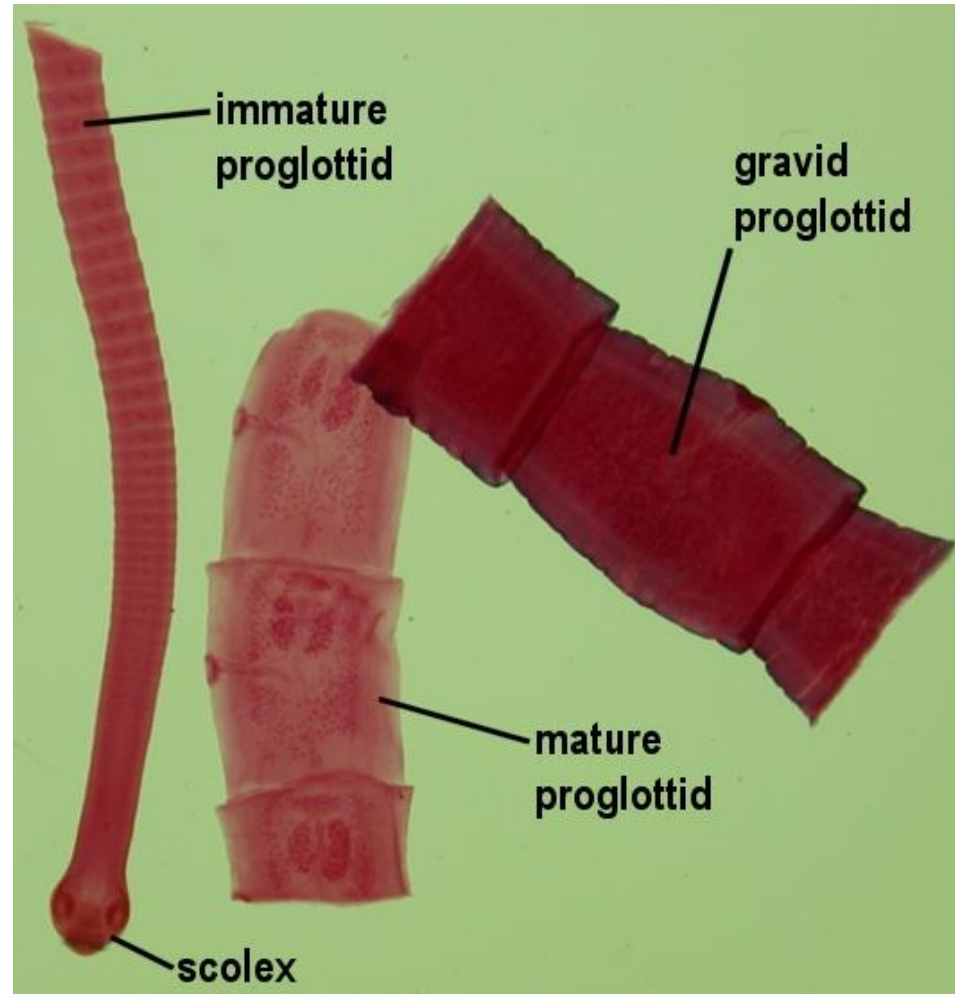
For prompts and videos, go to pages 232-233.

Compare the male and female blood fluke worms and how they fit together.

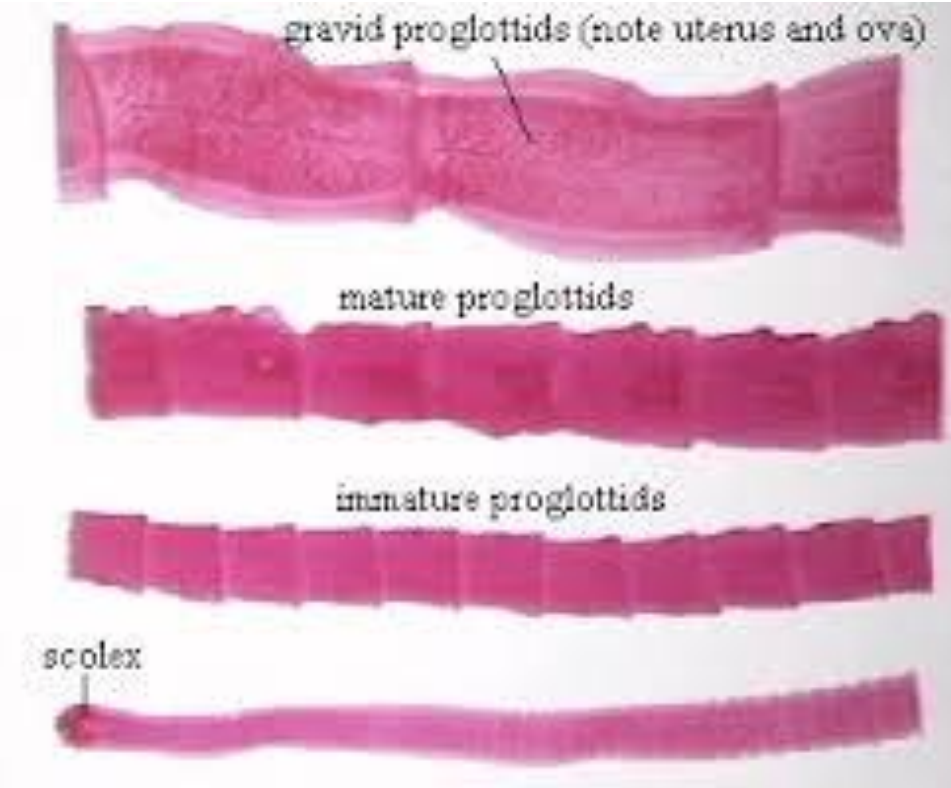
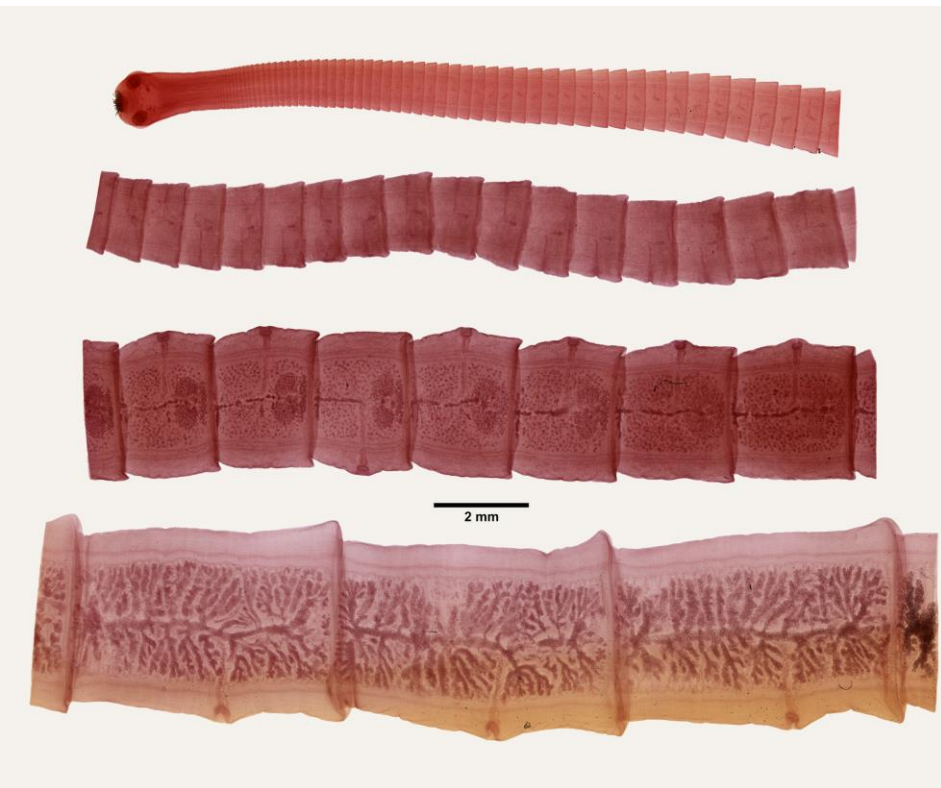


Class Cestoda - Tapeworms

- Tapeworms - ribbon-like flatworms
- Parasitize vertebrates, usually the intestines, require multiple hosts
- Head has a **scolex** with suckers and hooks for anchoring
- Body sections called **proglottids** bud off in a chain



Taenia pisiformis



Prompts on page 235

Checklist

☐ Phylum Porifera

- ☐ Dry sponges and glass sponge
- ☐ *Scypha* (prepared slide)

☐ Phylum Cnidaria

☐ Scyphozoa

- ☐ *Aurelia ephyra* (prepared slide)

☐ Anthozoa

☐ Hydrozoa

- ☐ *Hydra* (live organism)
- ☐ *Hydra* budding wm (prepared slide)
- ☐ *Obelia* hybroid (prepared slide)
- ☐ *Obelia* medusa (prepared slide)

☐ Phylum Platyhelminthes

☐ *Clonorchis sinensis*

☐ *Taenia pisiformis*

☐ *T. pisiformis* mature proglottids

☐ Cercariae fluke

☐ *Schistosoma* male wm

☐ *Schistosoma* female wm

☐ Analyzing Coral Growth Lab Report

☐ Discussion

☐ The quiz!