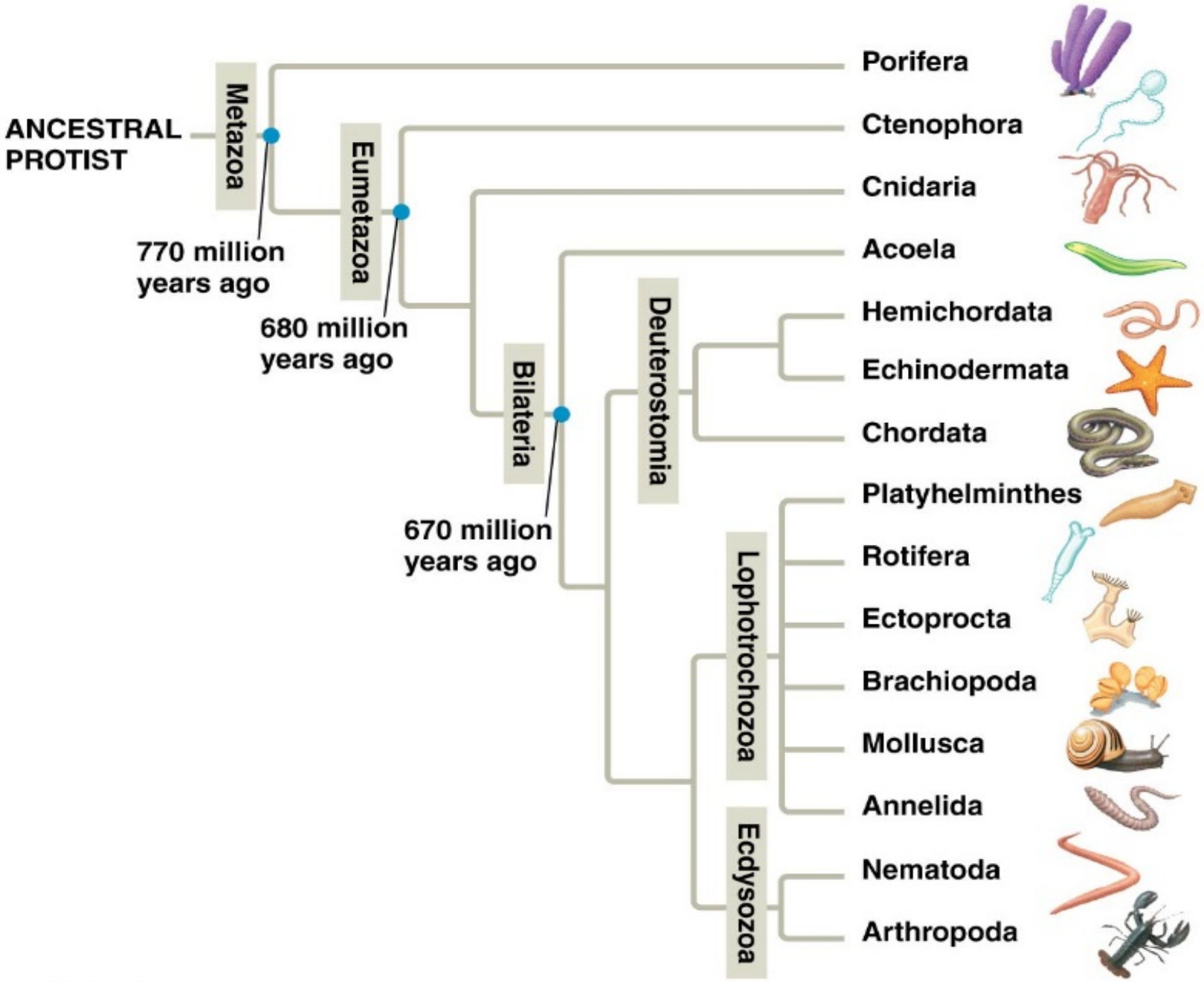
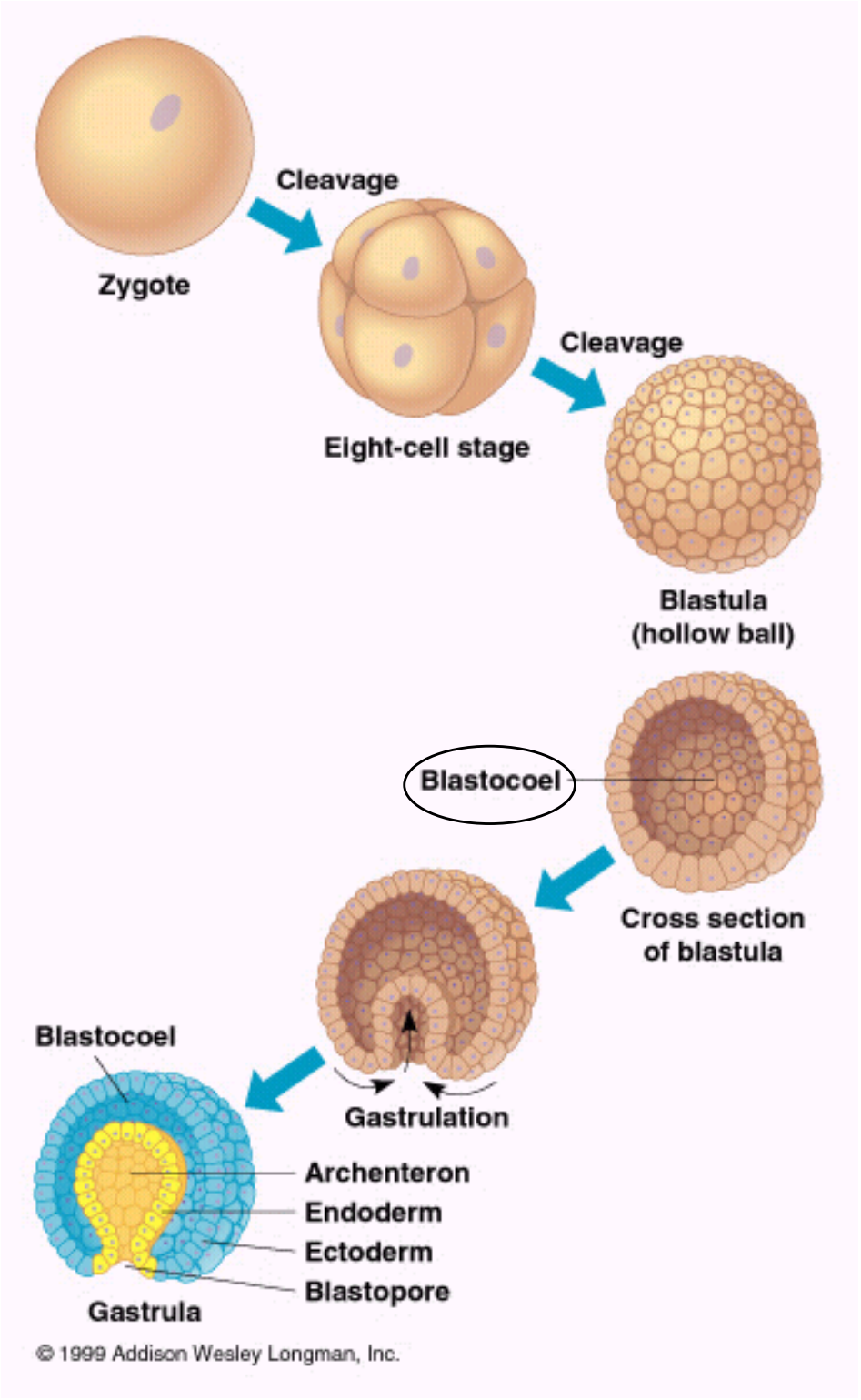
Cladogram of animals



What is an Animal?

- Multicellular,
- **Heterotrophic**, eukaryotic organism
- Cells lack cell wall, held together by structural proteins (collagen)
- Contain nervous and muscle tissue
- Most reproduce sexually with a dominant diploid stage



Development

- Zygote (cleavage)
- Morula
- **Blastula**
- Gastrula
  - Blastopore
  - Archenteron
  - Two layers of tissue (endoderm & ectoderm)

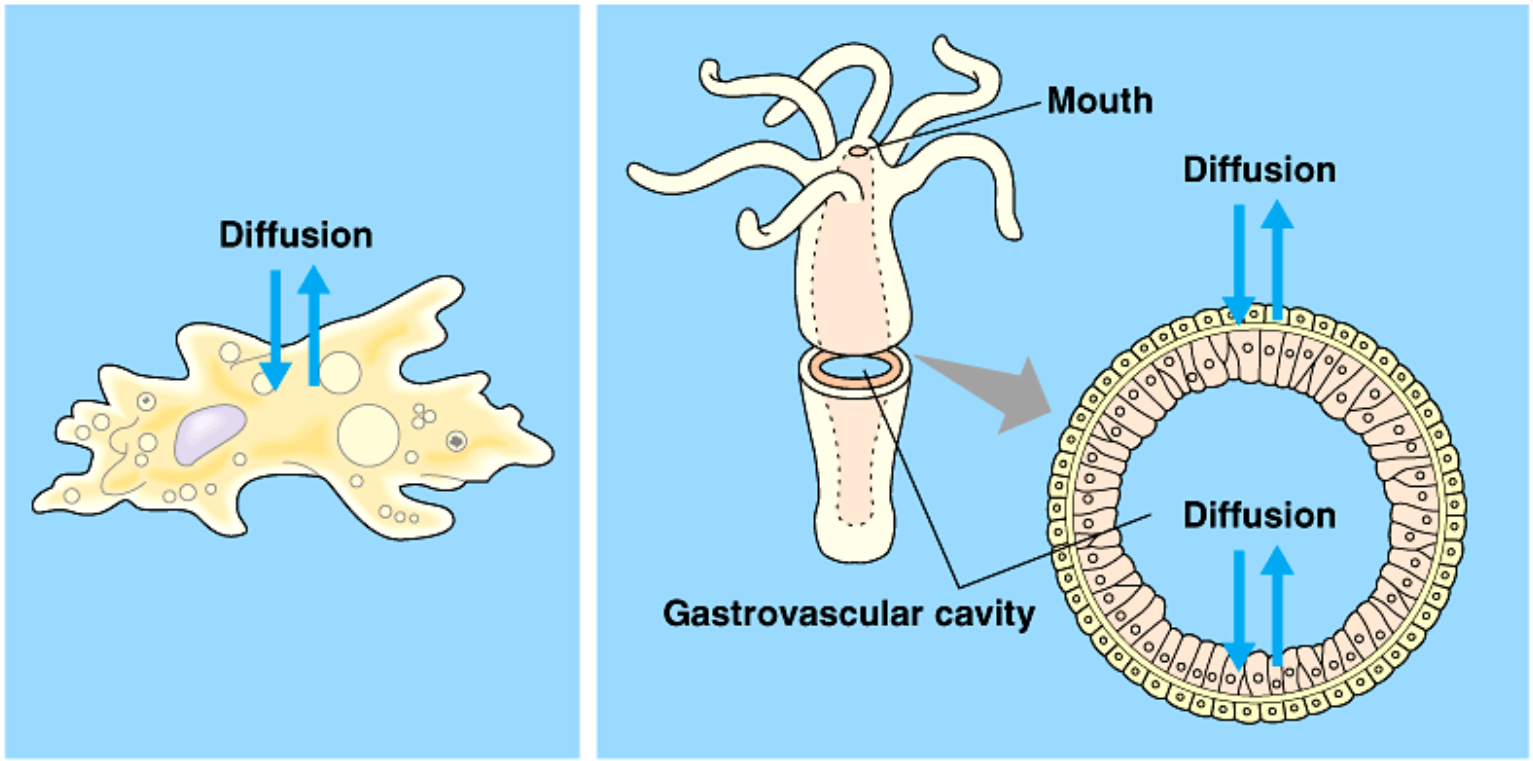
Animal Phylogeny Overview

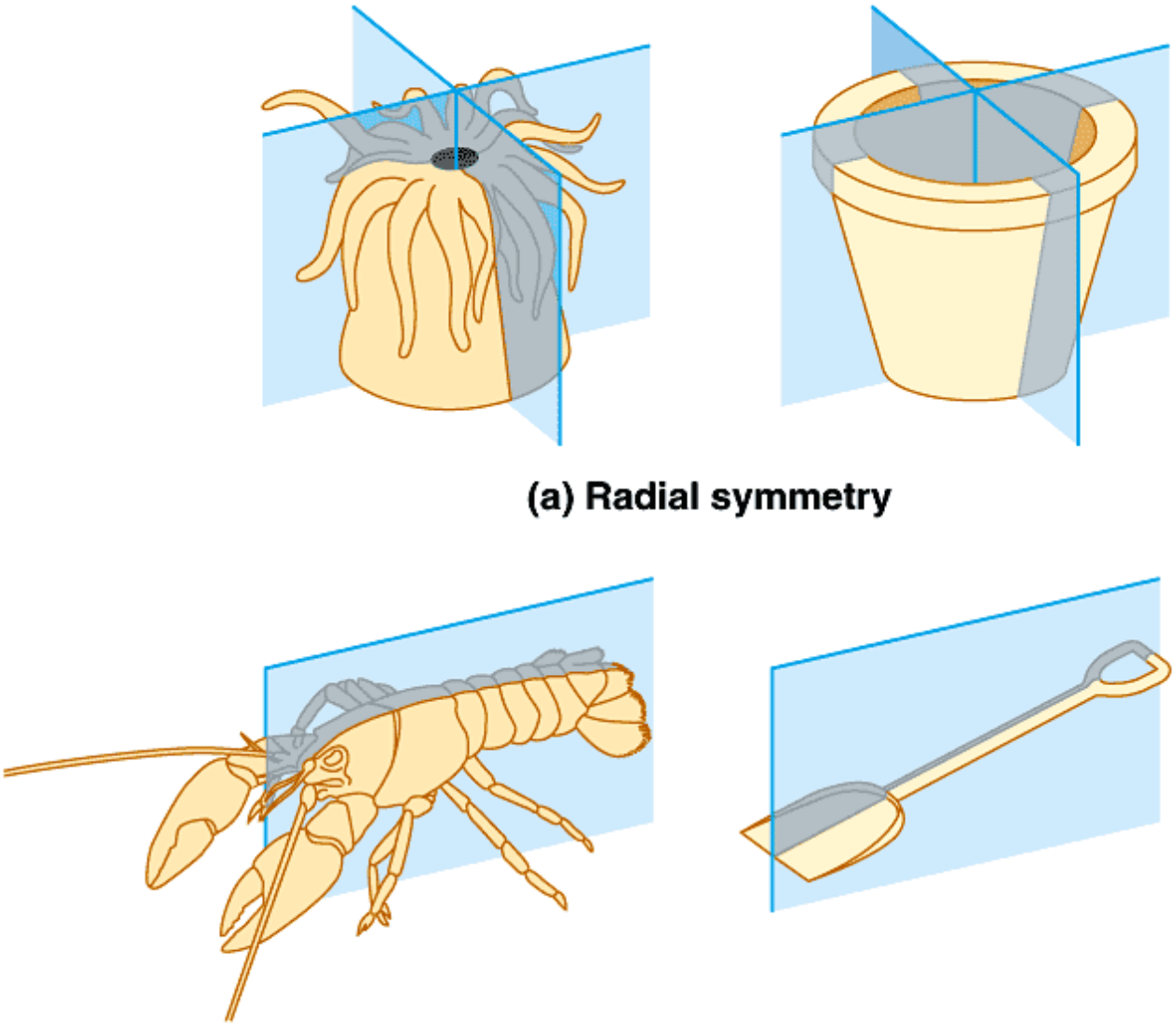
- Organization Level
- Body Symmetry
- Body Cavities
- Development
- Segmentation

Organization Level

Group of cells working to perform a function that are separated by membranous layers

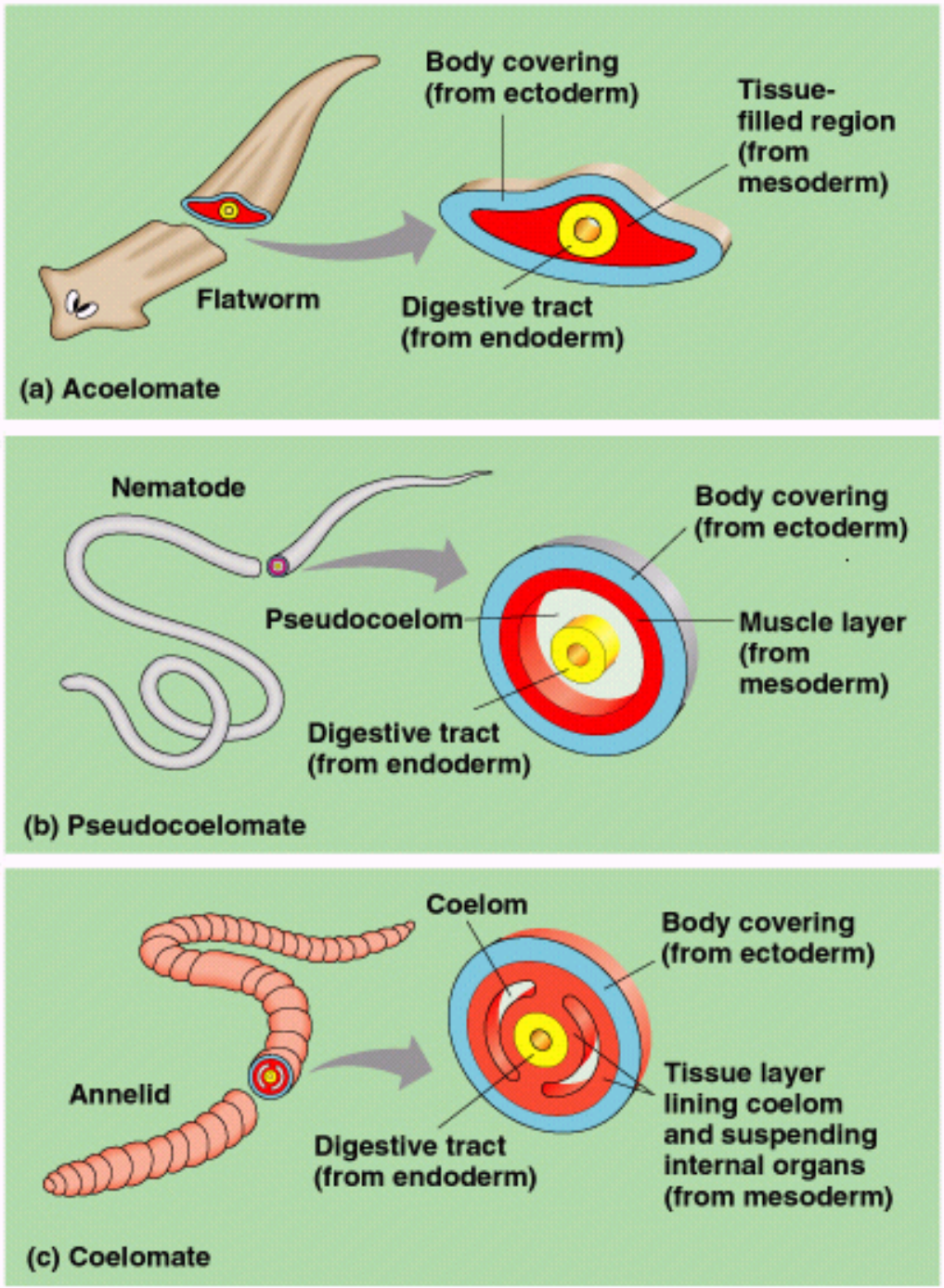
- Cellular Level vs. Tissue Level
  - Cellular Level: Porifera (sponges)
  - Tissue Level: all others





Body Symmetry

- Radial vs. Bilateral
  - Radial Symmetry: Cnidaria & Ctenophora
  - Bilateral Symmetry: all others

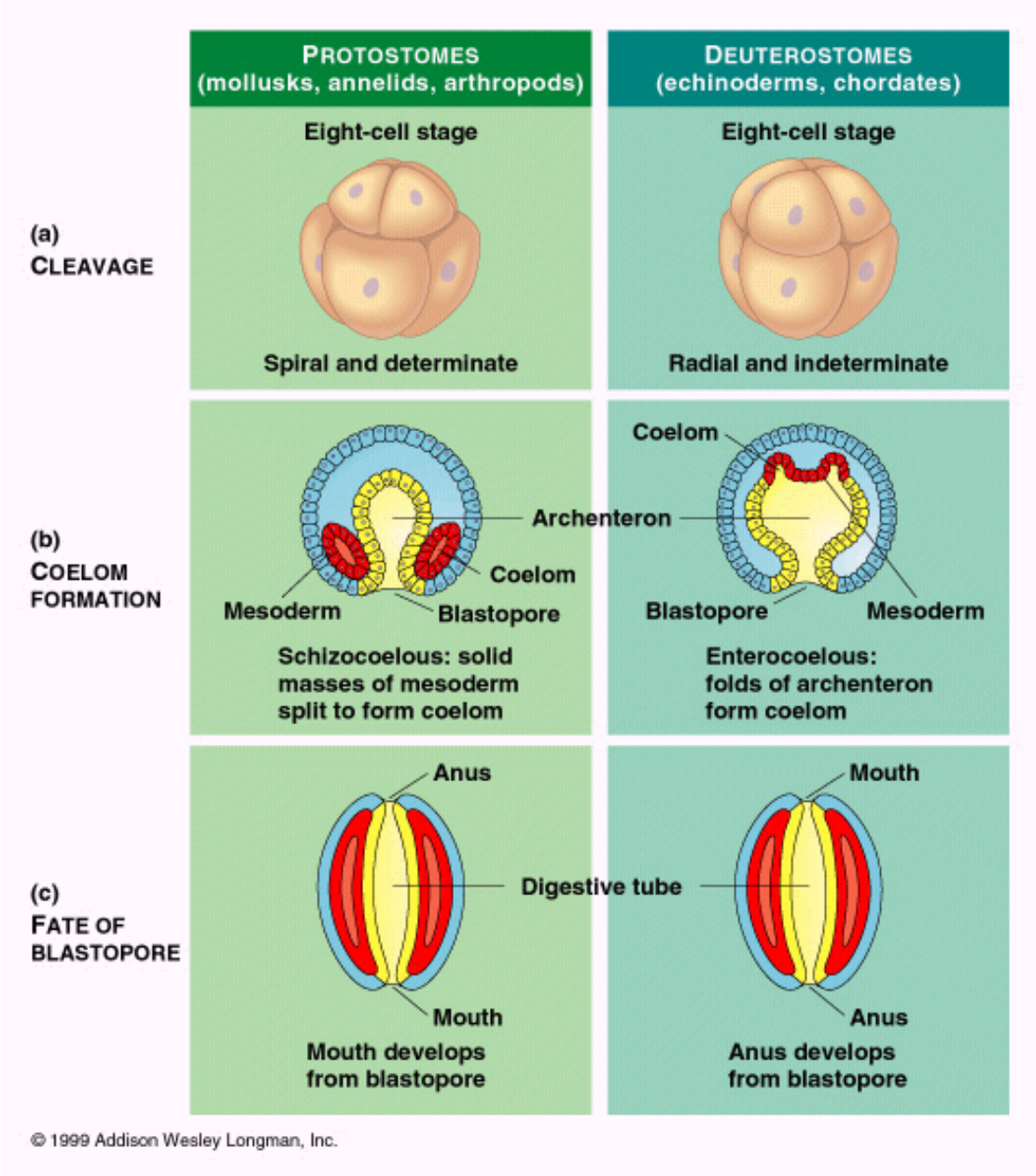


Body Cavities

- **Acoelomates**: Platyhelminthes (flatworms)
- **Pseudocoelomates**: Nematoda (roundworms)
- **Coelomates**: all others

Development

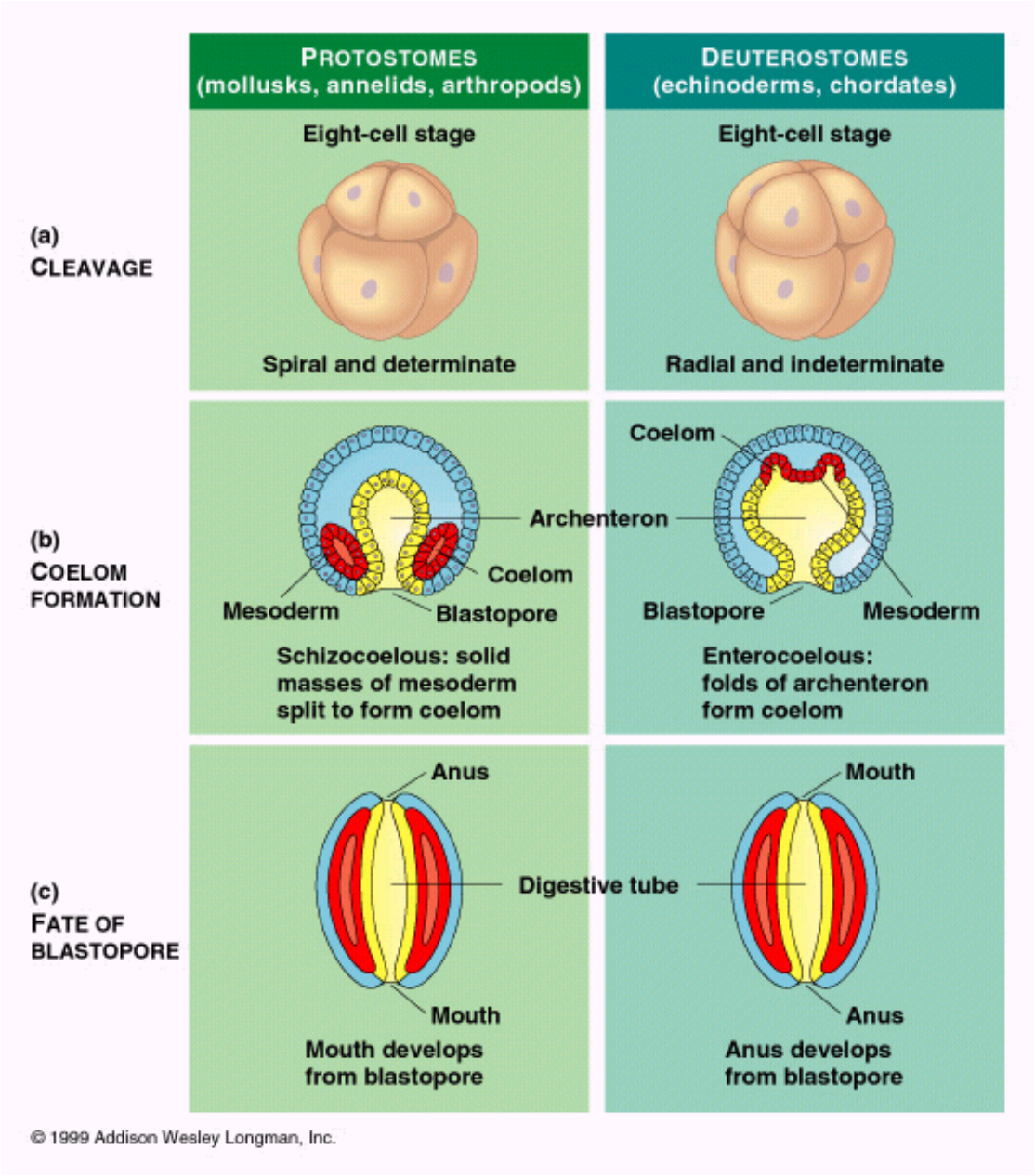
- **Protostomes**
  vs.
  Deuterostomes



Protostomes vs. Deuterostomes

- Cleavage
  - Spiral and Determinate
- Coelom Formation
  - Schizocoelous
- Fate of Blastopore
  - Mouth

- Cleavage
  - Radial and Indeterminate
- Coelom Formation
  - Enterocoelous
- Fate of Blastopore
  - Anus

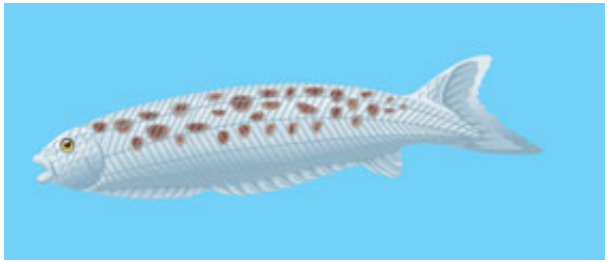


Development

- Protostomes vs. Deuterostomes
  - Protostomes:
    - Mollusca (clams, snails)
    - Annelida (segmented worms)
    - Arthropoda (Crustaceans, insects)
  - Deuterostomes
    - **Echinodermata** _____ (Seastars)
    - Chordata (vertebrates)

Segmentation

- Mollusca (soft - unsegmented)
- Annelida (soft – segmented)
- Arthropoda (hard – segmented)
- Chordata (segmented)



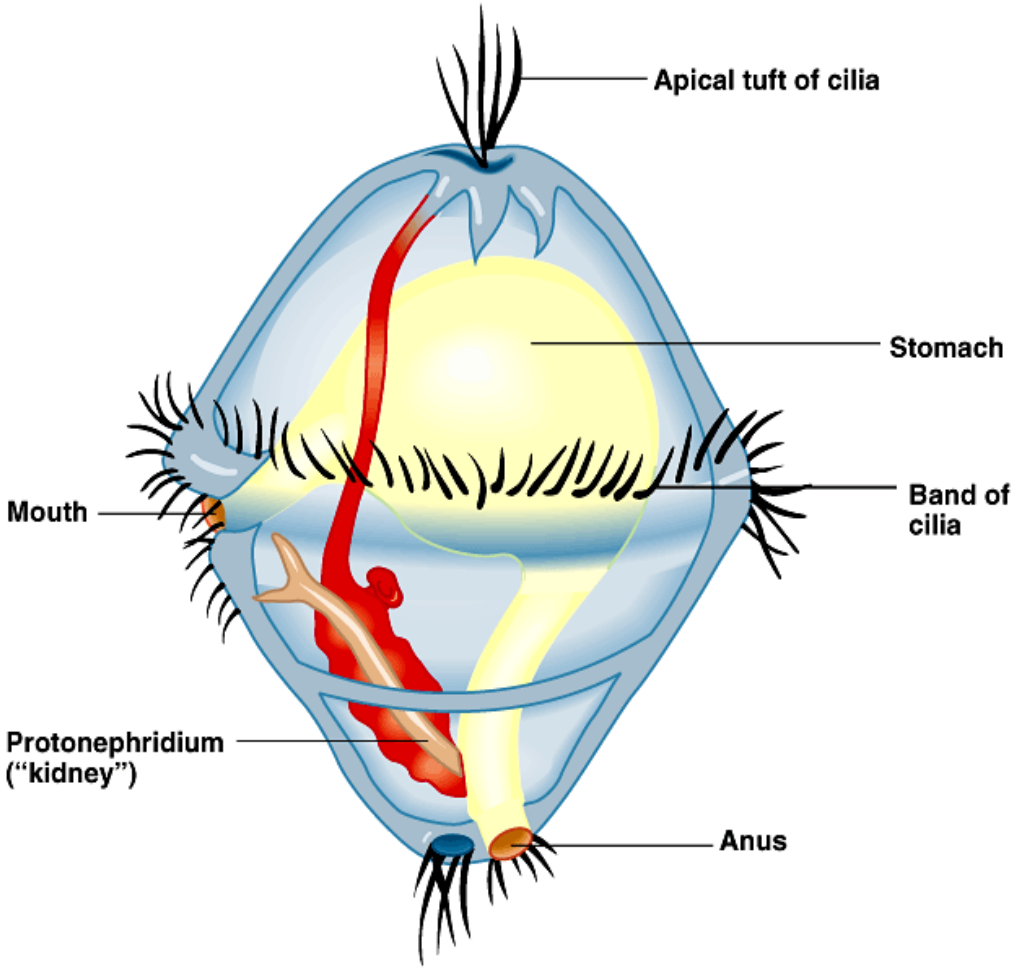
Tissues

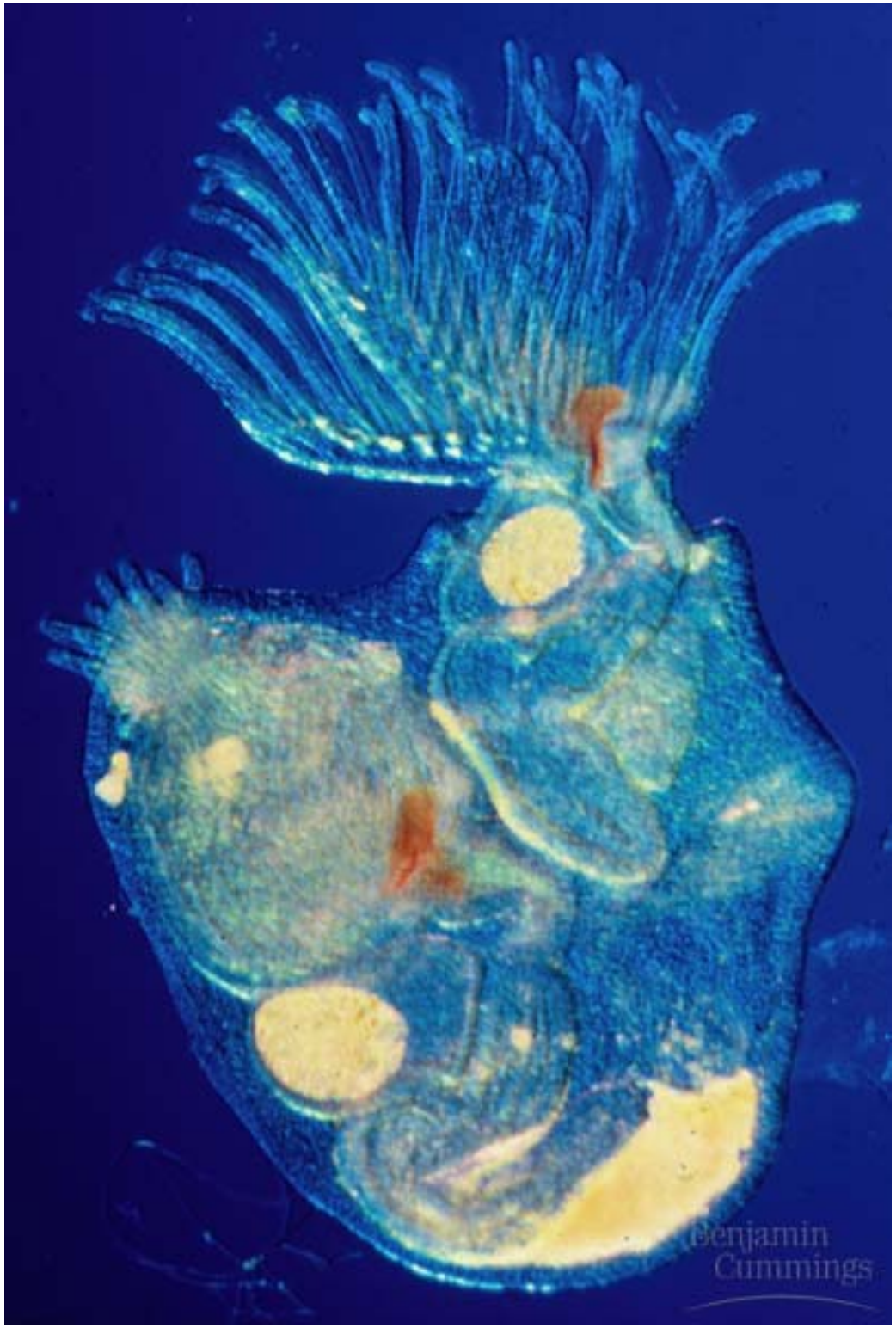
Groups of cells with a common structure and function separated by a membrane

Tissues

- **Epithelial Tissue**
  - tightly packed cells used for lining
  - (stratified Squamous, Simple Columnar)
- **Connective Tissue**
  - cells scattered through an extracellular matrix (Bone, Blood, Cartilage)
- **Nervous Tissue**
  - transmits signals (neurons)
- **Muscle Tissue**
  - fibers for contraction (smooth, skeletal, cardiac)

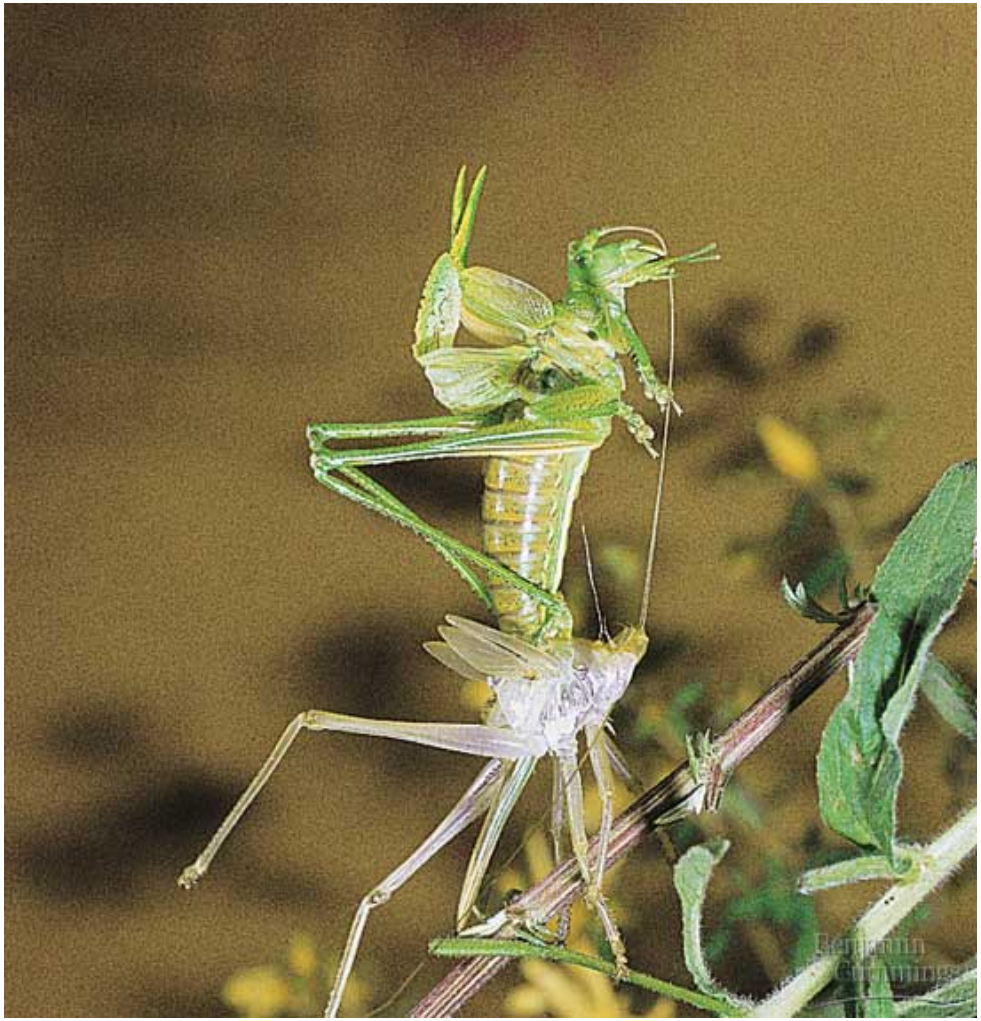
Trochophore Larva





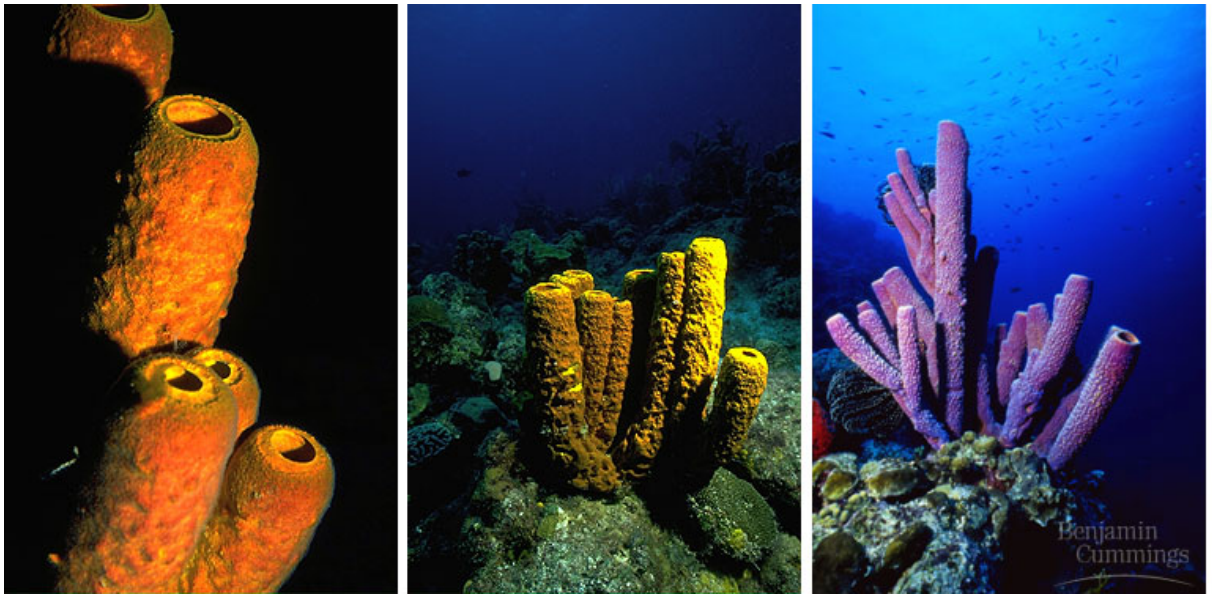
Lophophorate

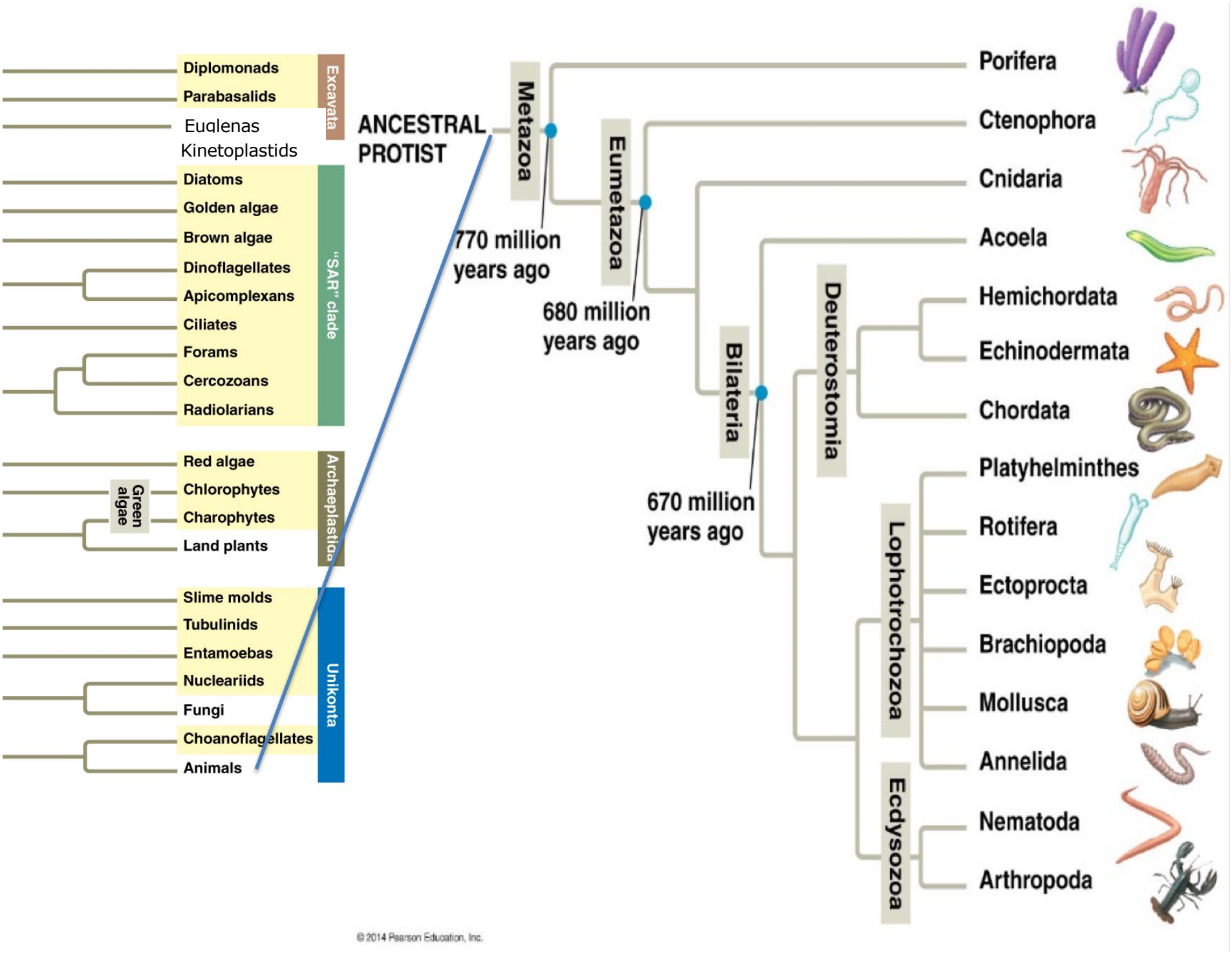
Ecdysis



Porifera

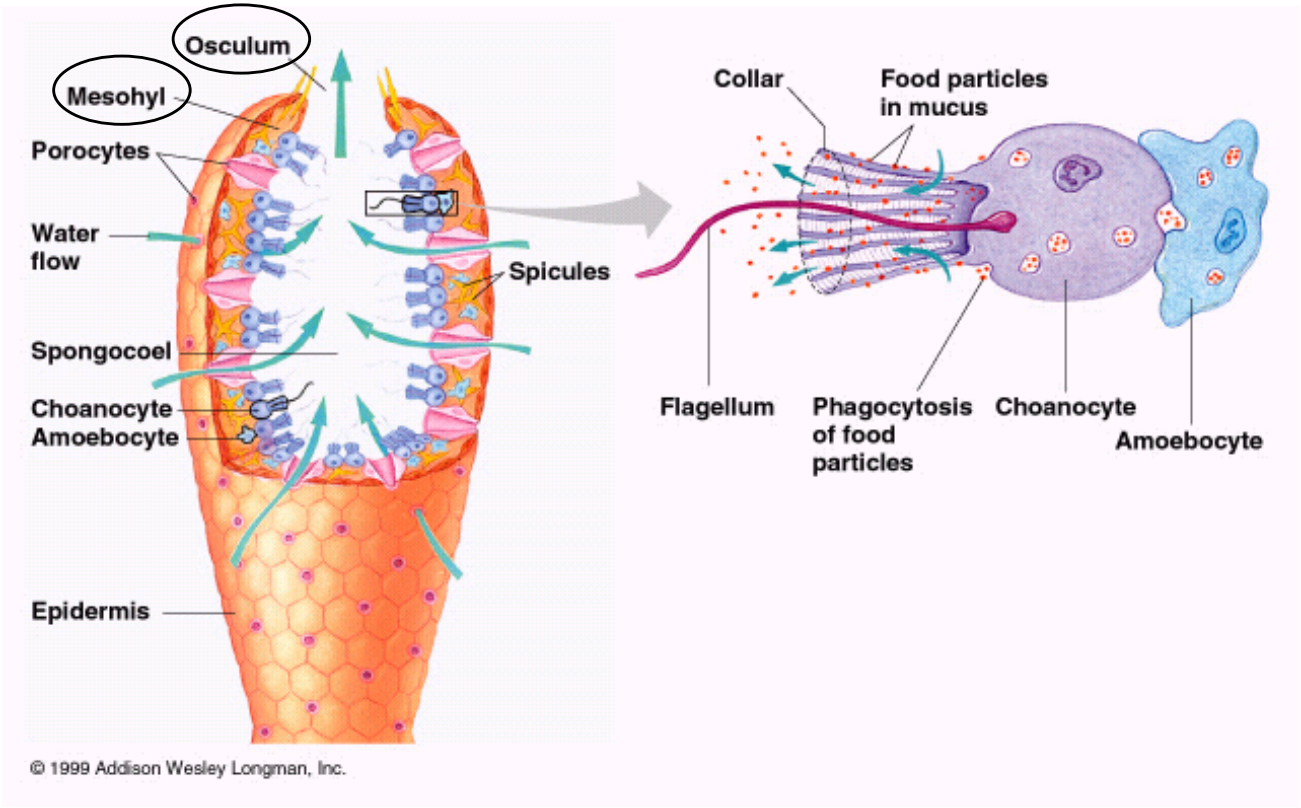
- Cellular level of organization
- Mostly marine
  - 9000 species (only 100 are freshwater)
- Asymmetrical and Sessile
- Hermaphrodites
- Often live in groups – called a “sleeze”



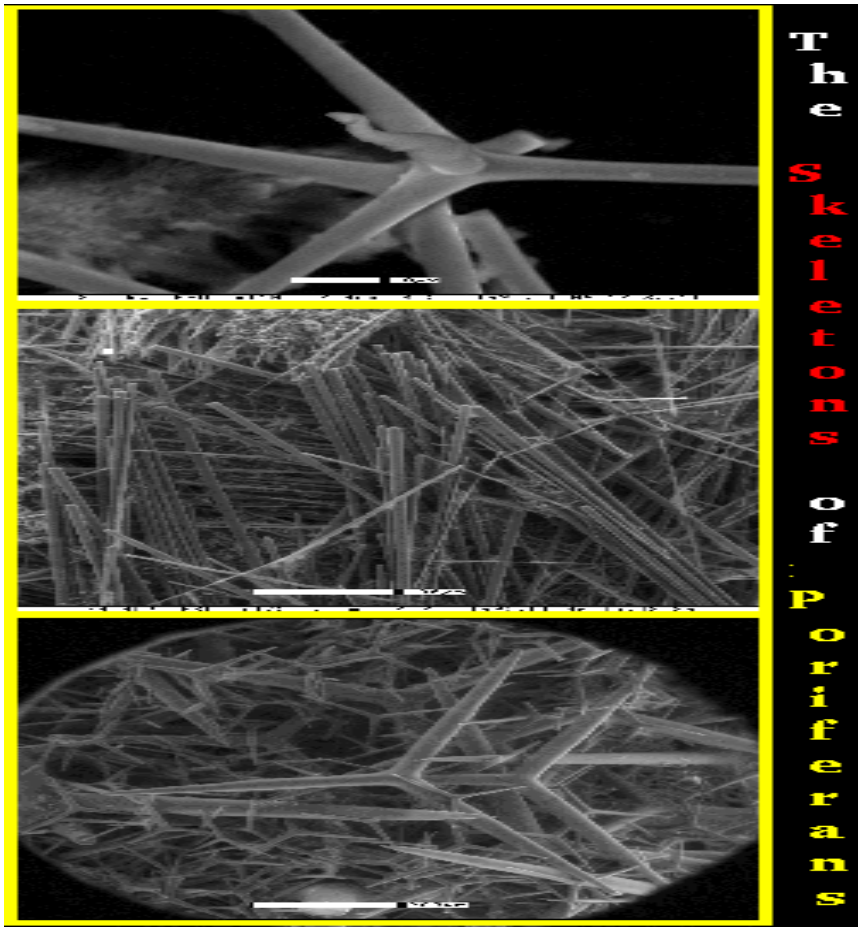


Porifera

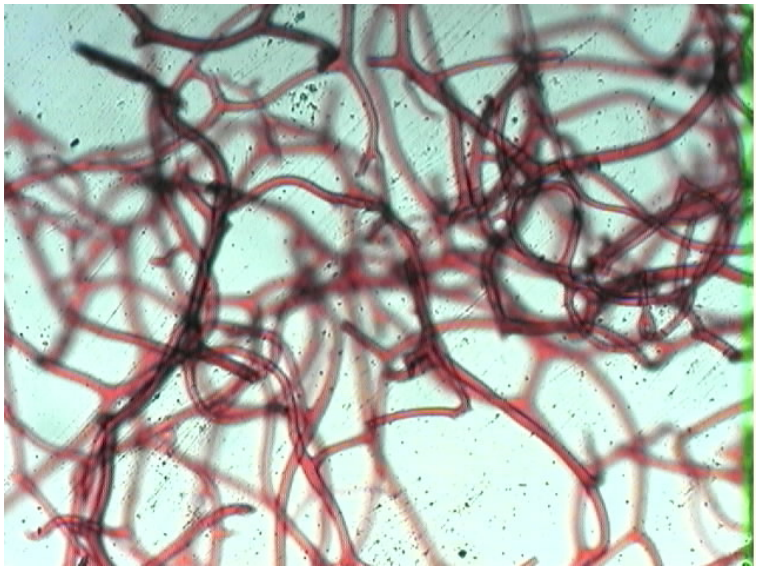
- Cellular Level of Organization
  - **Choanocyte**: flagellated cells
  - **Amoebocyte**: pseudopodia



Porifera

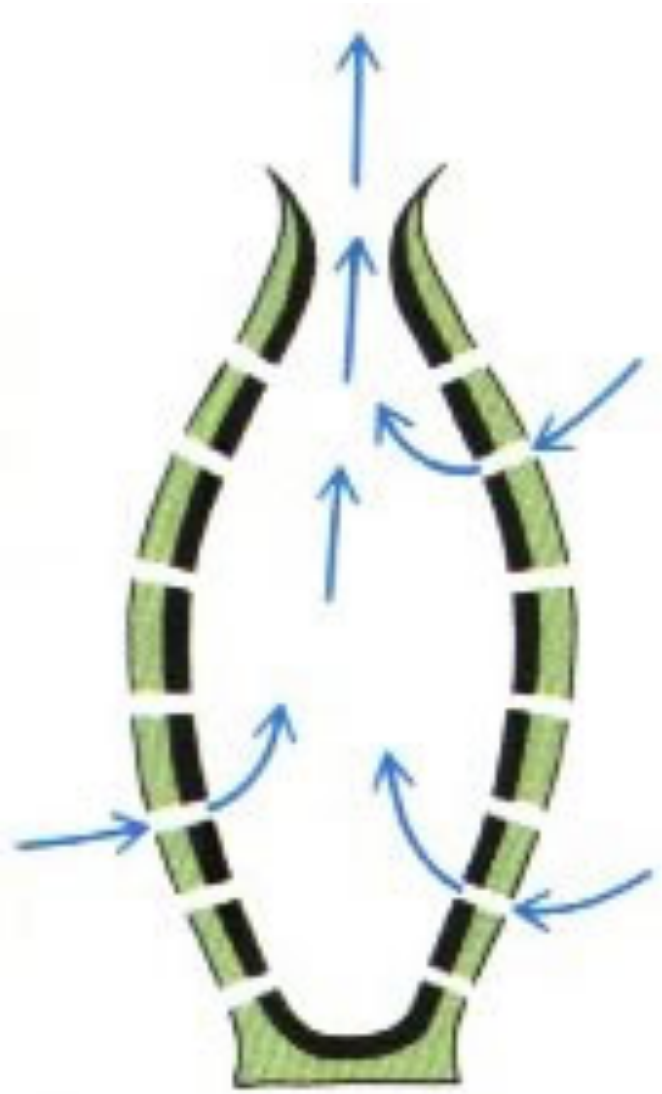


- Skeleton
  - spicules (calcium carbonate or silica)
  - spongin (protein)



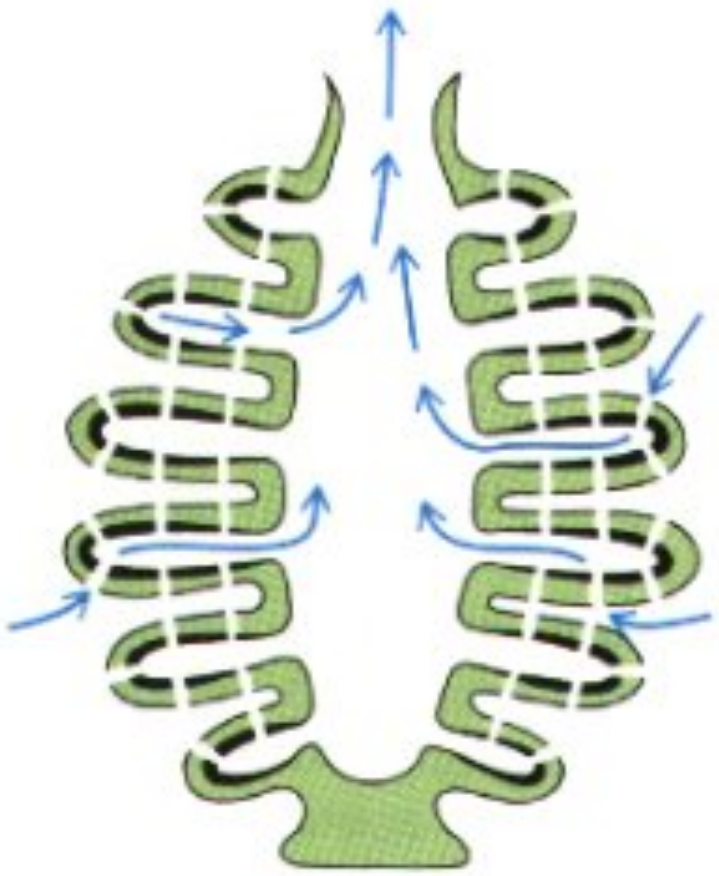
Porifera

- Water Movement
  - **Asconoid**
    (flagellated spongocoel)
    - ostia - spongocoel-osculum



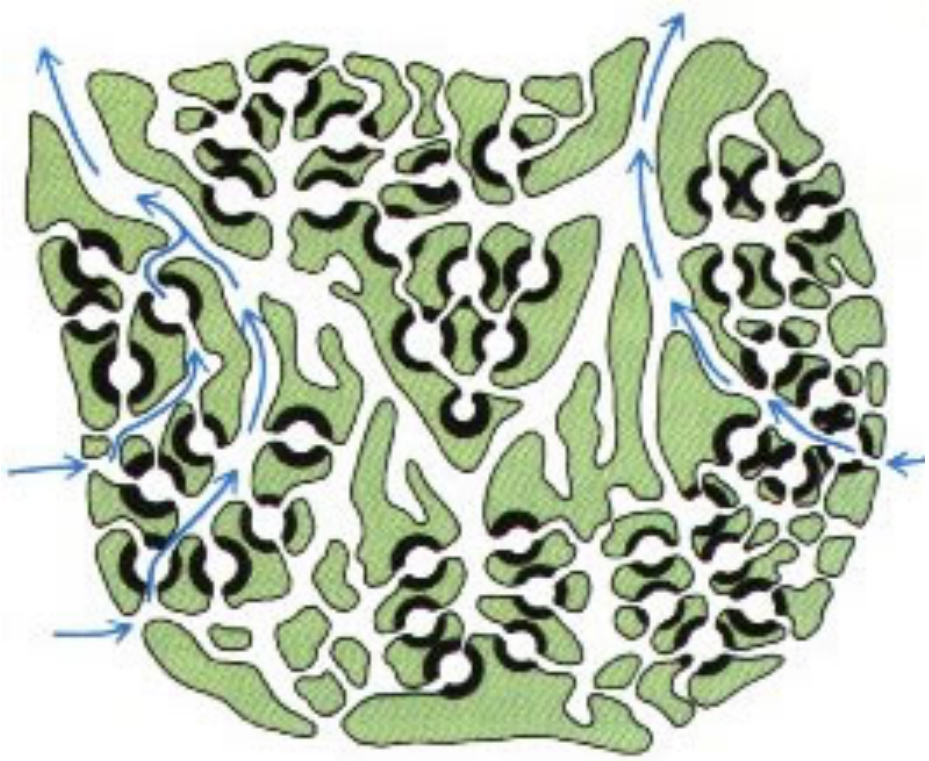
Porifera

- Water Movement
  - **Sycnoid** (flagellated radial canals)
    - ostia - incurrent canal - prosopyle - radial canal - apopyle - spongocoel - osculum



Porifera

- Water Movement
  - **Leuconoid** (flagellated chambers)
    - ostia - incurrent canal - flagellated chamber - excurrent canal - osculum

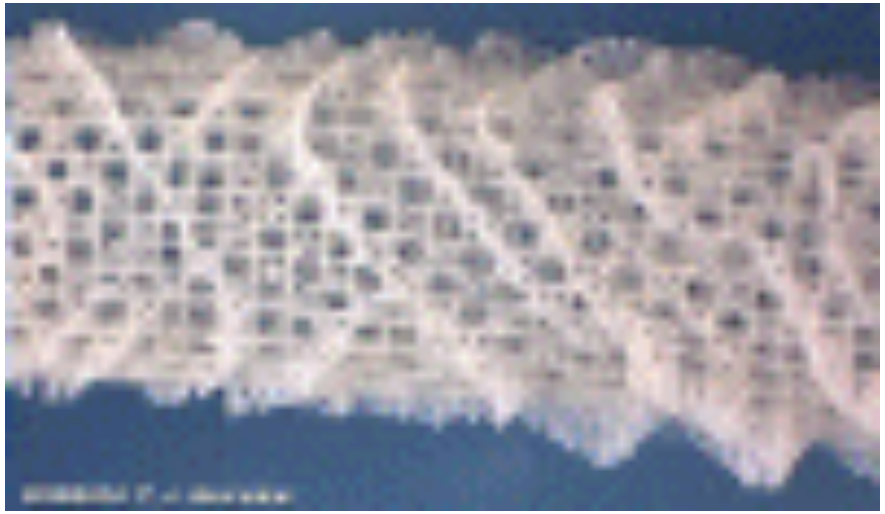


Classification

- Class: Calcarea
  - Calcium **Spicules**
  - asconoid, syconoid, leuconoid

Classification

- Class: Hexactinellidae
  - silica spicules
  - syconoid, leuconoid



Classification

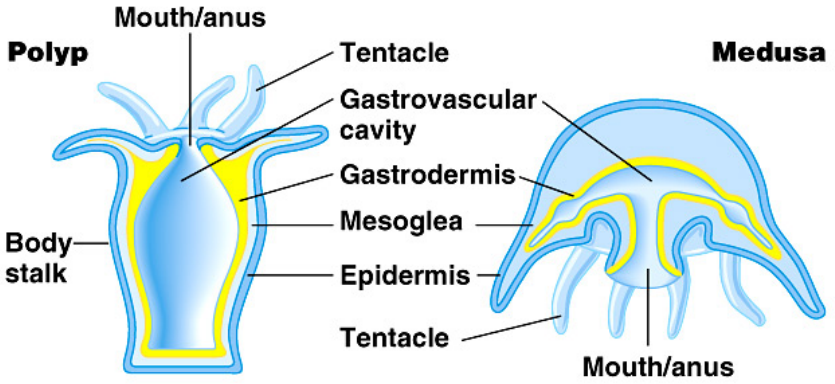
- Class: Demospongiae
  - silica spicules and/or **Spongin**
  - leuconoid

Radial Symmetry

- Includes the phylum: Cnidaria
  - (hydras, jellies, sea anemones, and coral)
- Includes the phylum: Ctenophora
  - (comb jellies)
- Tissue-system level of organization
- **Diploblastic**
  - Endoderm
  - Ectoderm

Body Forms

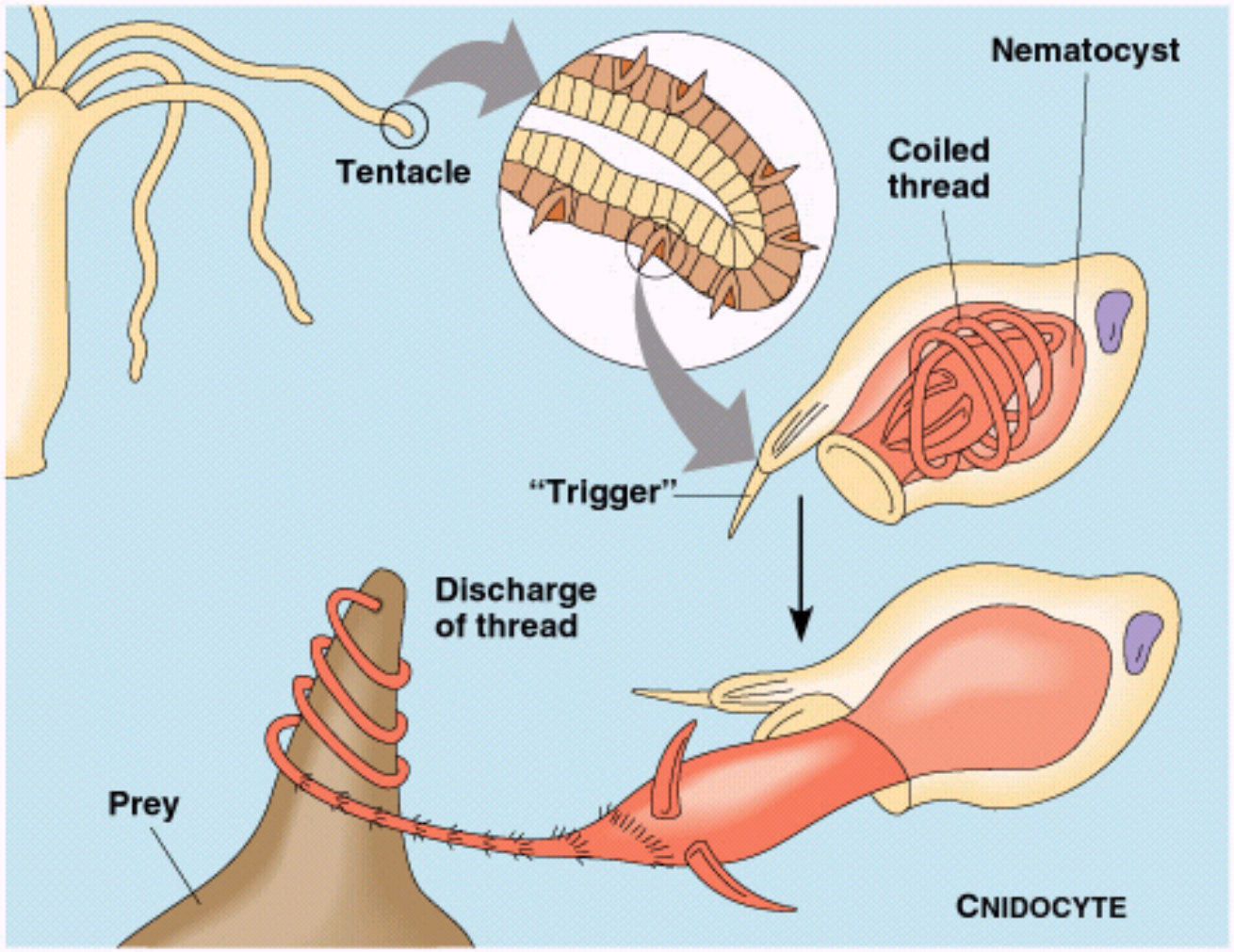
- Cnidaria contain two body forms with a gastrovascular cavity (__Polyp__ and __Medusa__)



(a) Sea anemone: a polyp

(b) Jelly: a medusa

Cnidocytes

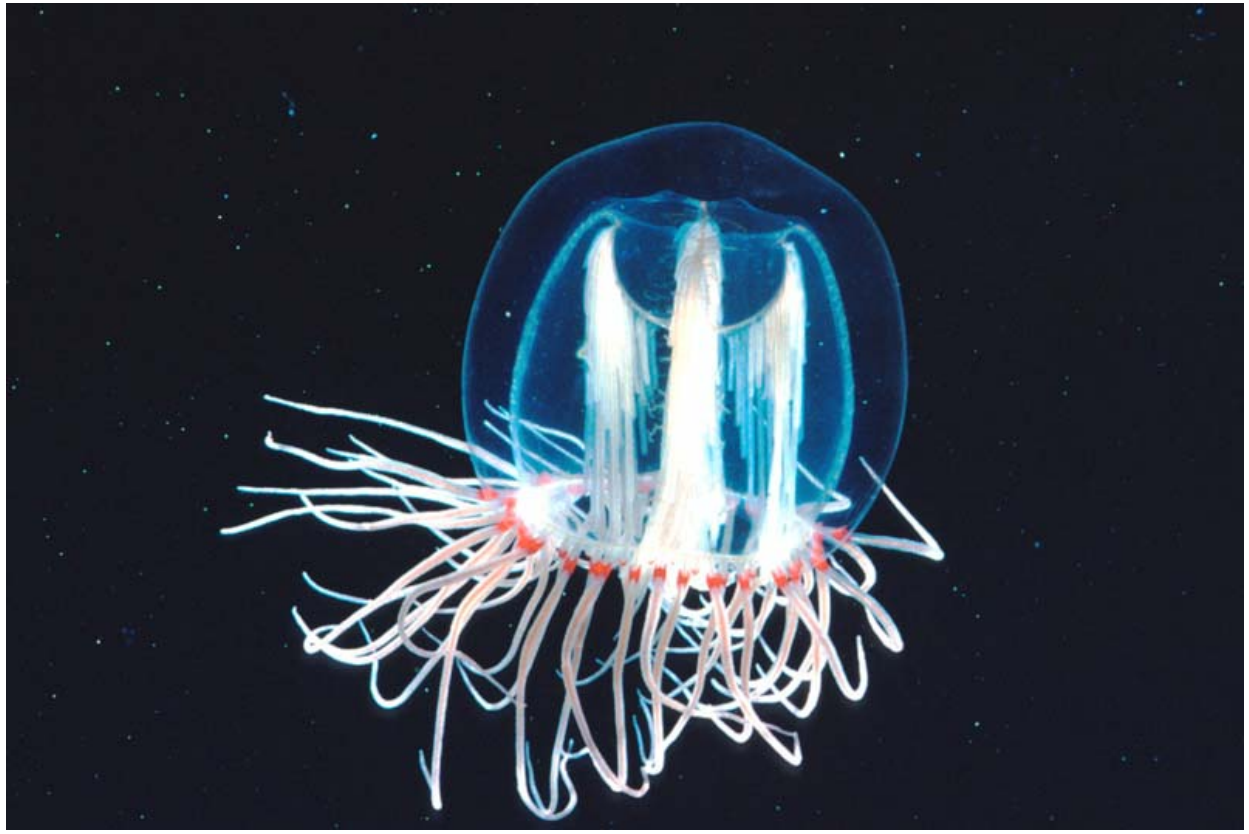


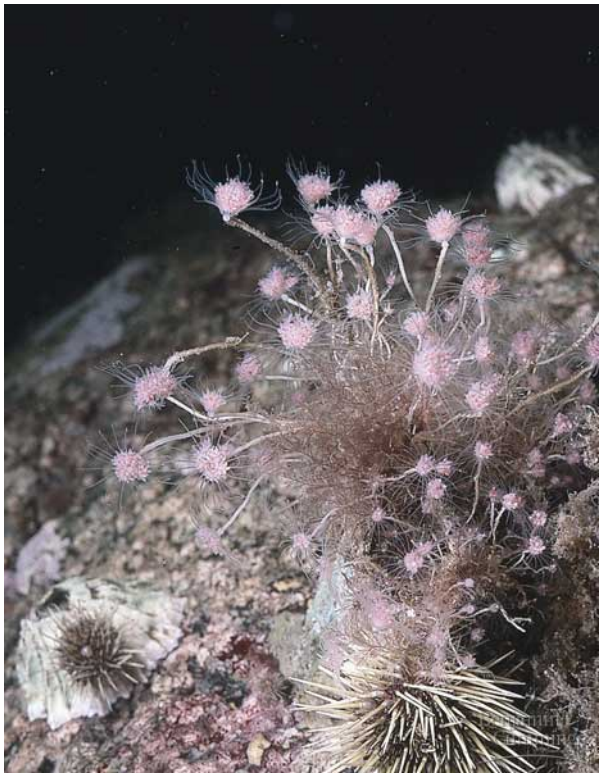
- **Nematocyst**
  - thread with barbs
- **Cnidocil**
  - trigger

Classification

- Class: **Hydrozoa**
  - (Portuguese man-of-war, Hydra, Obelia)
- Class: **Scyphozoa**
  - (Jellies)
- Class: **Anthozoa**
  - (Sea Anemones, Corals, Sea fans, Sea pansies)
- Class: **Cubozoa**

Hydrozoa





Class: Hydrozoa

- Most are marine
- Most species contain both a polyp and medusa stage
- Polyp stage often colonial
- Reproduction
  - asexual: budding
  - sexual: zygotes and larvae (planula)

Portion of a colony of polyps

Feeding polyp

Reproductive polyp

Medusa bud

❷

❶ ASEXUAL REPRODUCTION (BUDDING)

❸

Gonad

Medusa

SEXUAL REPRODUCTION

MEIOSIS

❹

Egg (*n*)

Sperm (*n*)

FERTILIZATION

Zygote (*2n*)

❺

Developing polyp

❻

Mature polyp

Planula larva

KEY TO LABELS

Haploid (*n*)

Diploid (*2n*)

Class: Scyphozoa

Class: Scyphozoa

Class: Scyphozoa

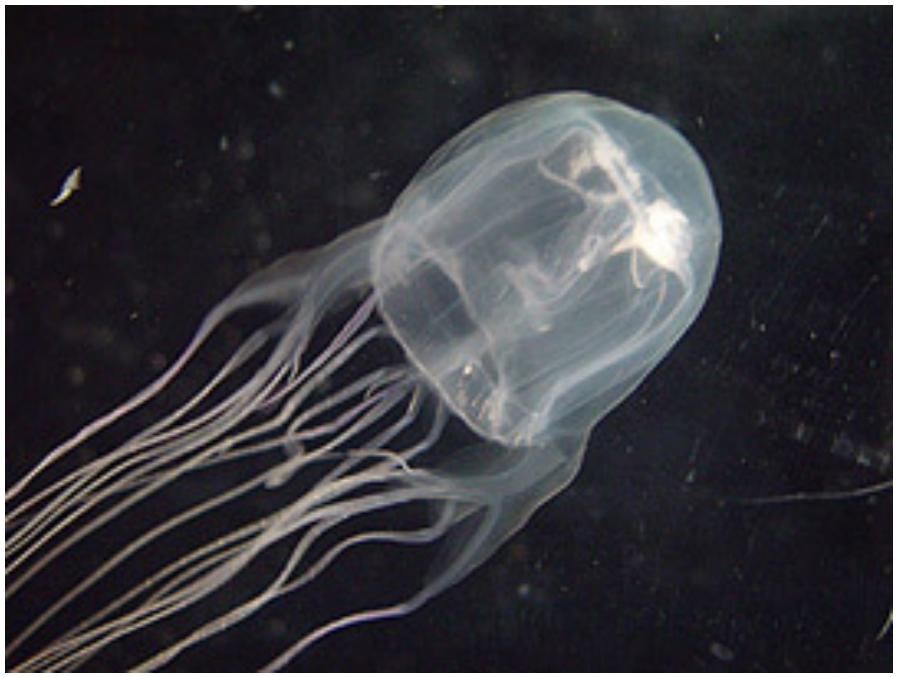
- All are marine
- Polyp stage reduced or absent
- Medusa stage is free living
- Common name: sea jellies

Class: Anthozoa

- All are marine
- Polyp stage dominant
- No medusa stage

Class: **Cubozoa**

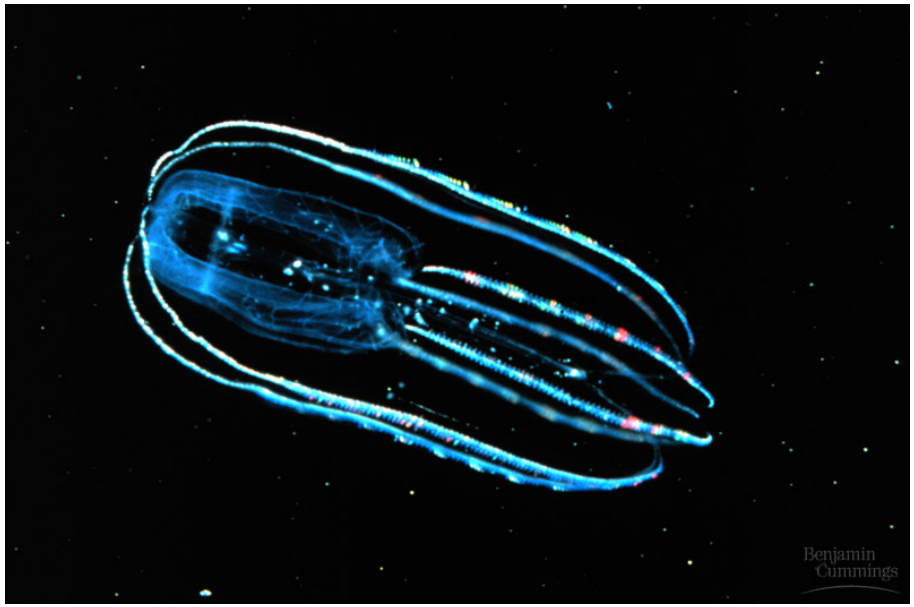
- Box Jellies
- Complex eyes embedded in medusa stage
- Sea Wasp – venom can kill 60 people



Class: Anthozoa

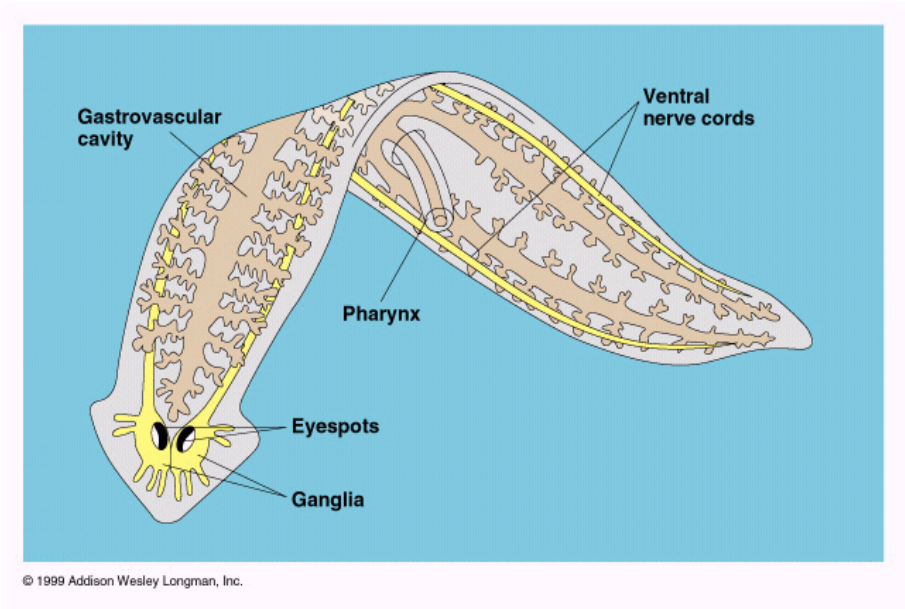
Phylum: Ctenophora

- Comb Jellies
- Contain comb plates with cilia
  - largest animal to move with cilia
- Tentacles with **Colloblasts** (adhesive cells)



Phylum: Platyhelminthes

- Flatworms
- Acoelomates
- Gastrovascular Cavities
- Organ-system level of organization
- Triploblastic



Classification

- Class: Turbellaria
  - (Planarians)
- Class: Monogenea
  - (Monogenes - one host)
- Class: Trematoda
  - (Flukes)
- Class: Cestoidea
  - (Tapeworms)

Class: Turbellaria

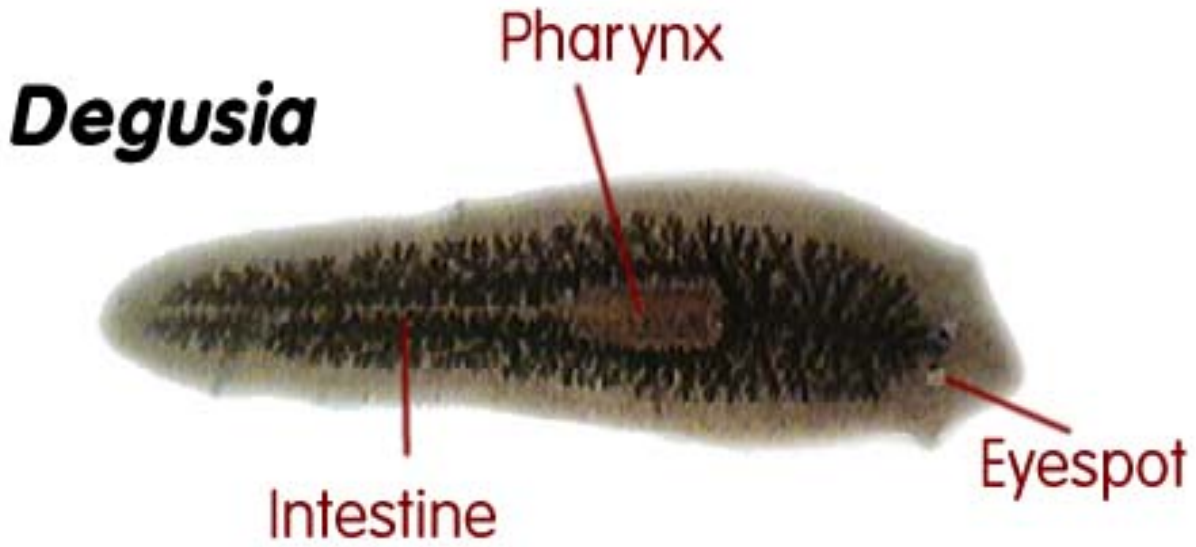
- Free-living and mostly marine
- Cephalization
- Gastrovascular cavity
- Regeneration

Class: Turbellaria

Class: Turbellaria

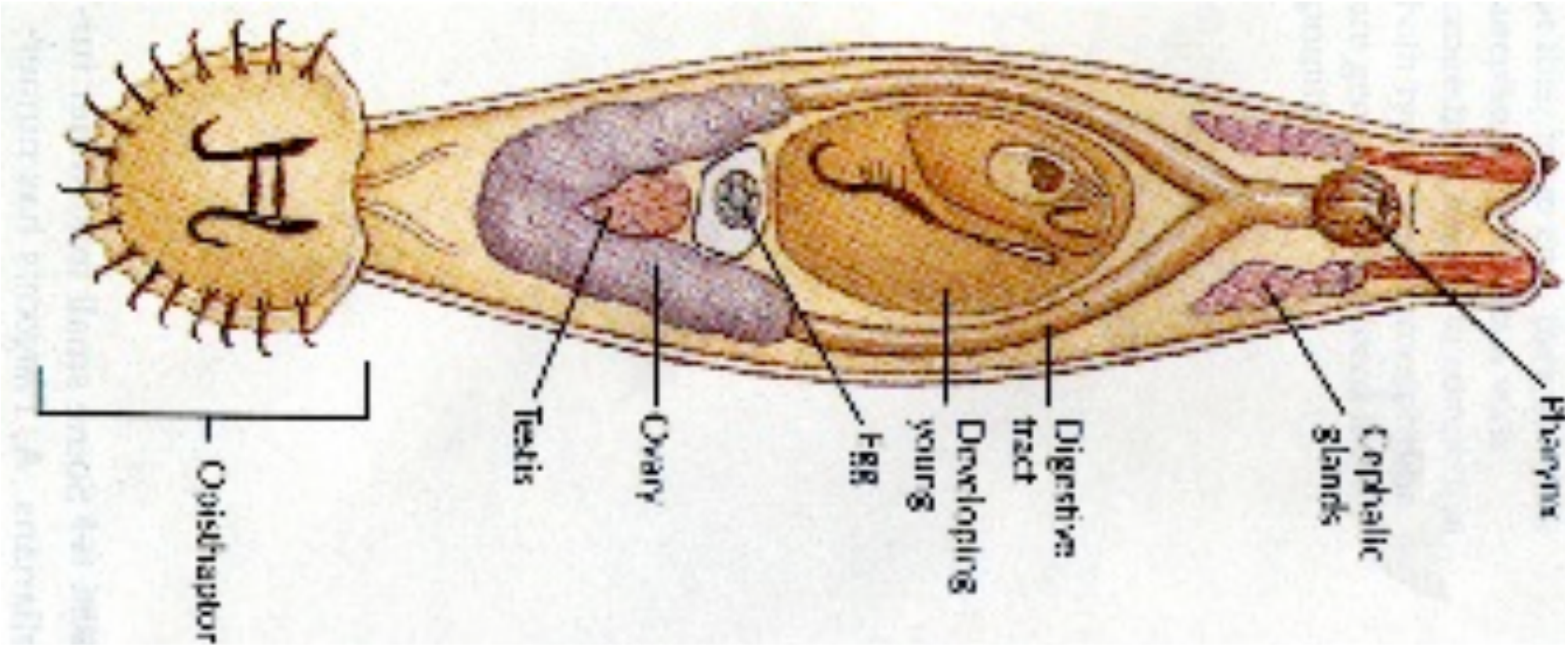
Class Turbellaria

- Free living
- Protrusible proboscis



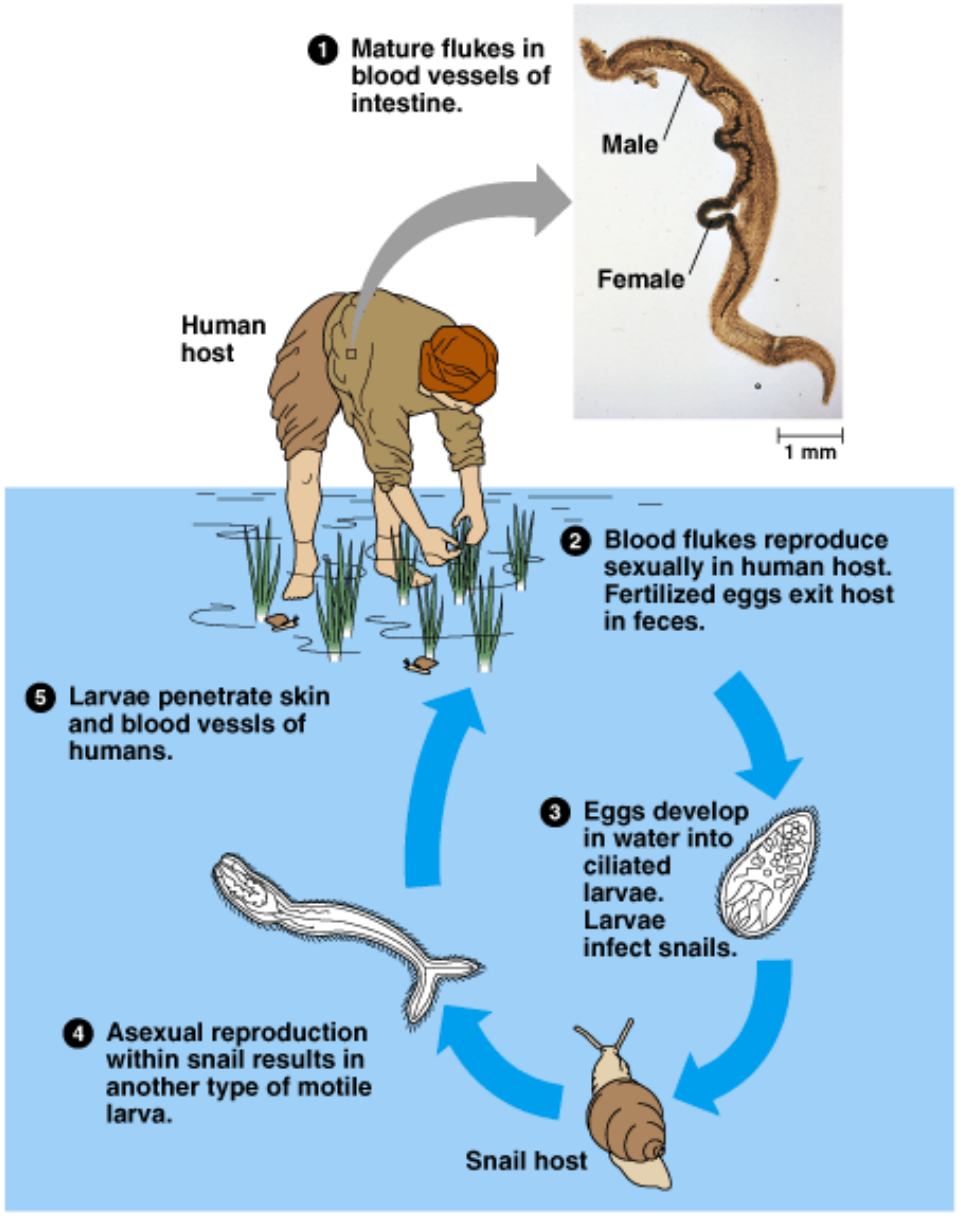
Class: Monogenea

- Parasitic (One host)
- Fish parasites

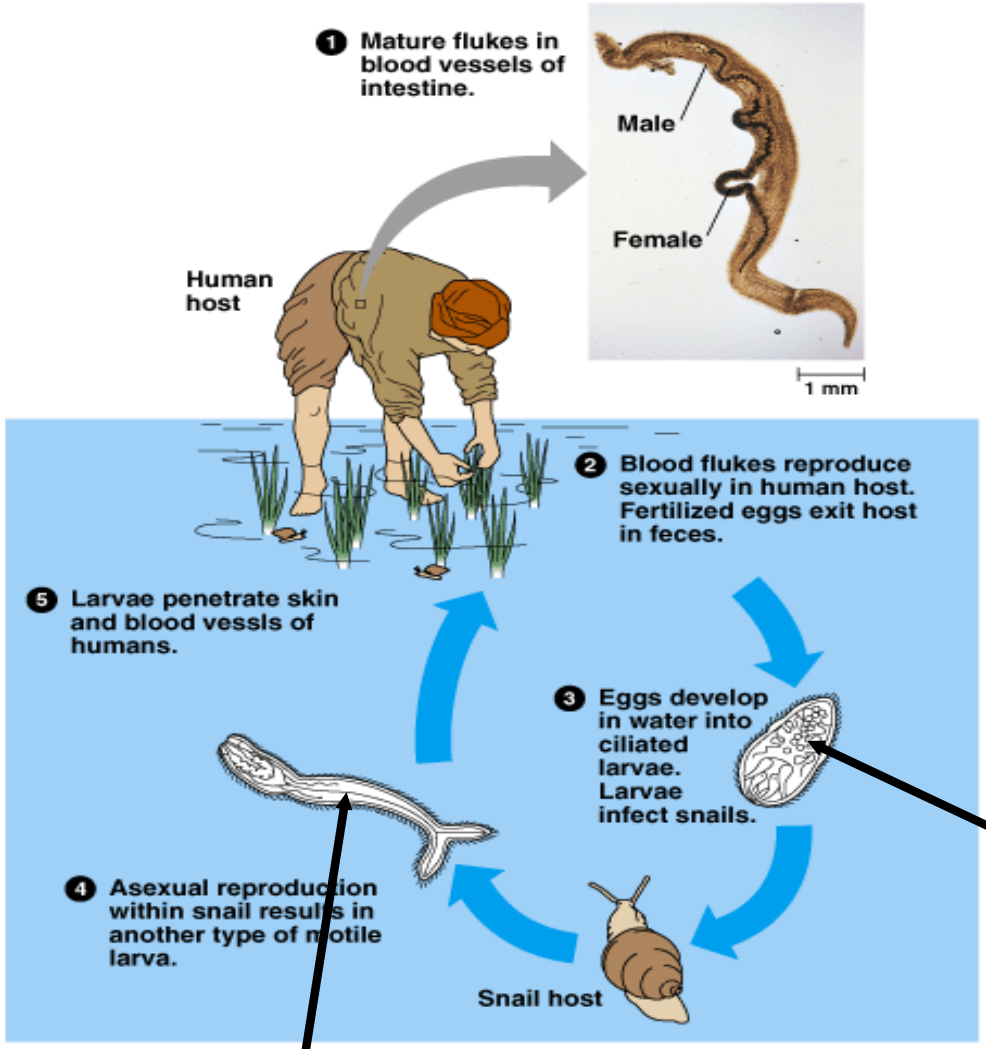


Class: Trematoda

- Endoparasitic flukes
- Two hosts
- Female fits into groove on males body



Schistosoma



Enters through skin and moves to intestine (Blood Fluke)

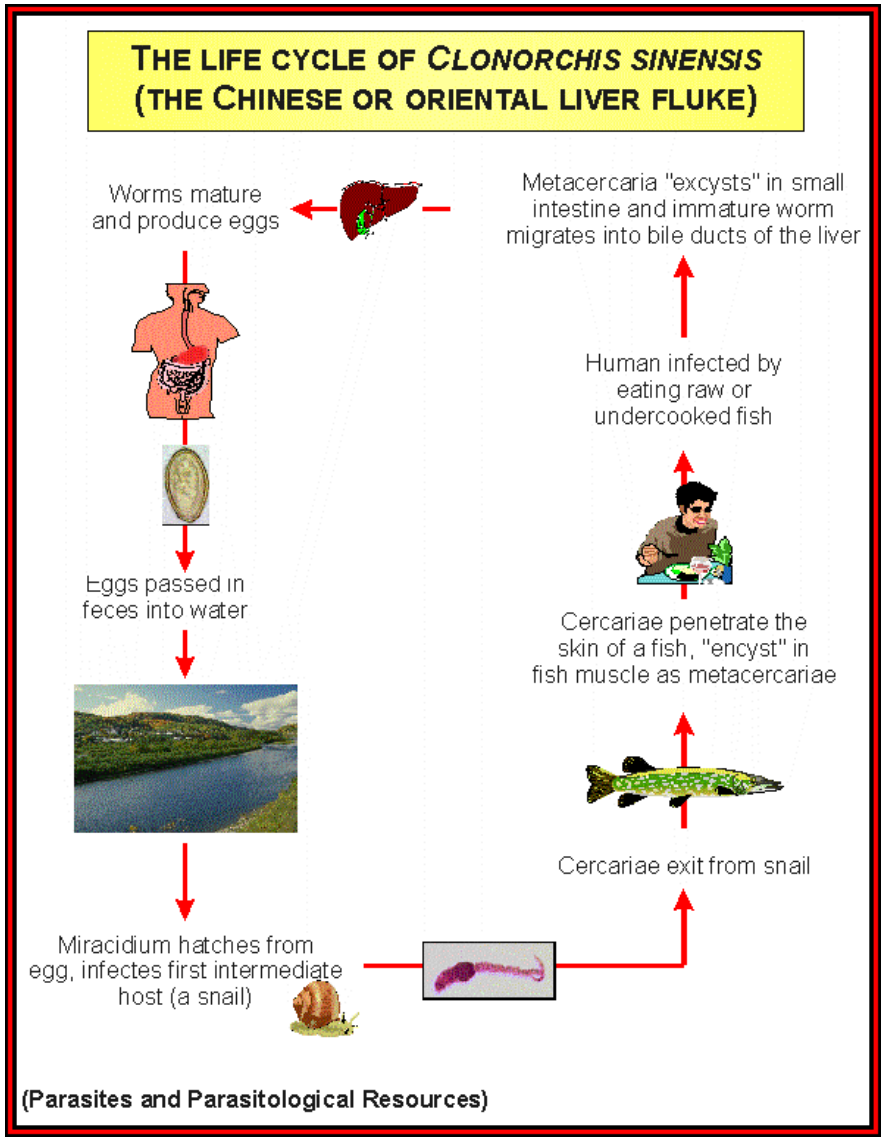
- invert host - snail (Africa, South America, West India)
- symptoms: pain, anemia, dysentery

Miracidia Larva

Cercariae Larva

Clonorchis

- enters by eating raw fish and moves to bile ducts (Liver Fluke)
  - invert host - snail (China, Asia, Japan)
  - symptoms: cirrhosis of the liver, death

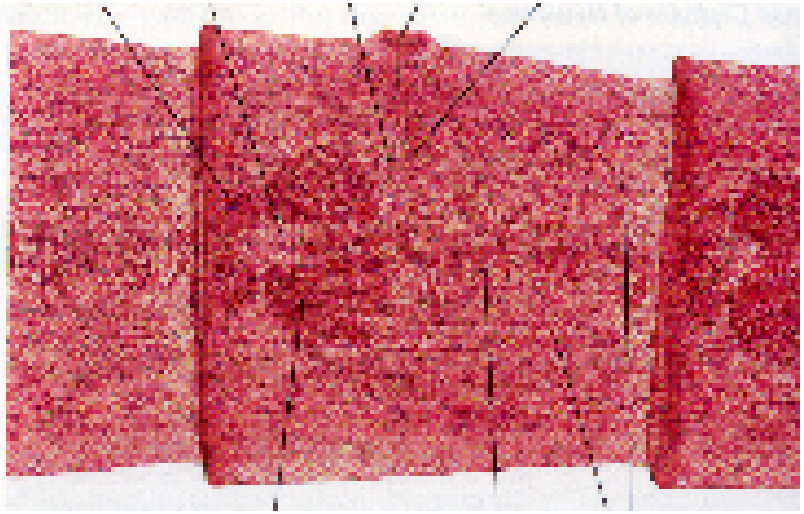


Class: Trematoda

- Swimmer's dermatitis: larvae enters skin
  - larvae in skin, can't complete life cycle in humans

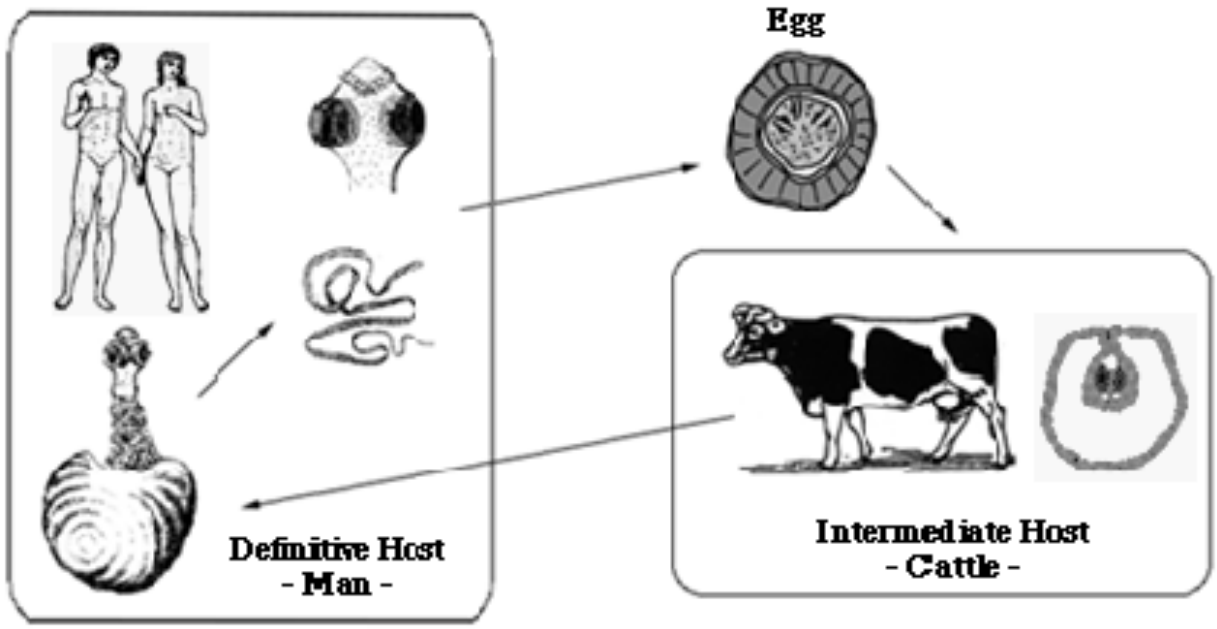
Class: Cestoidea

- Endoparasitic tapeworms
- Body parts
  - **Proglottids**
  - scolex with hooks and suckers



Taenia saginata

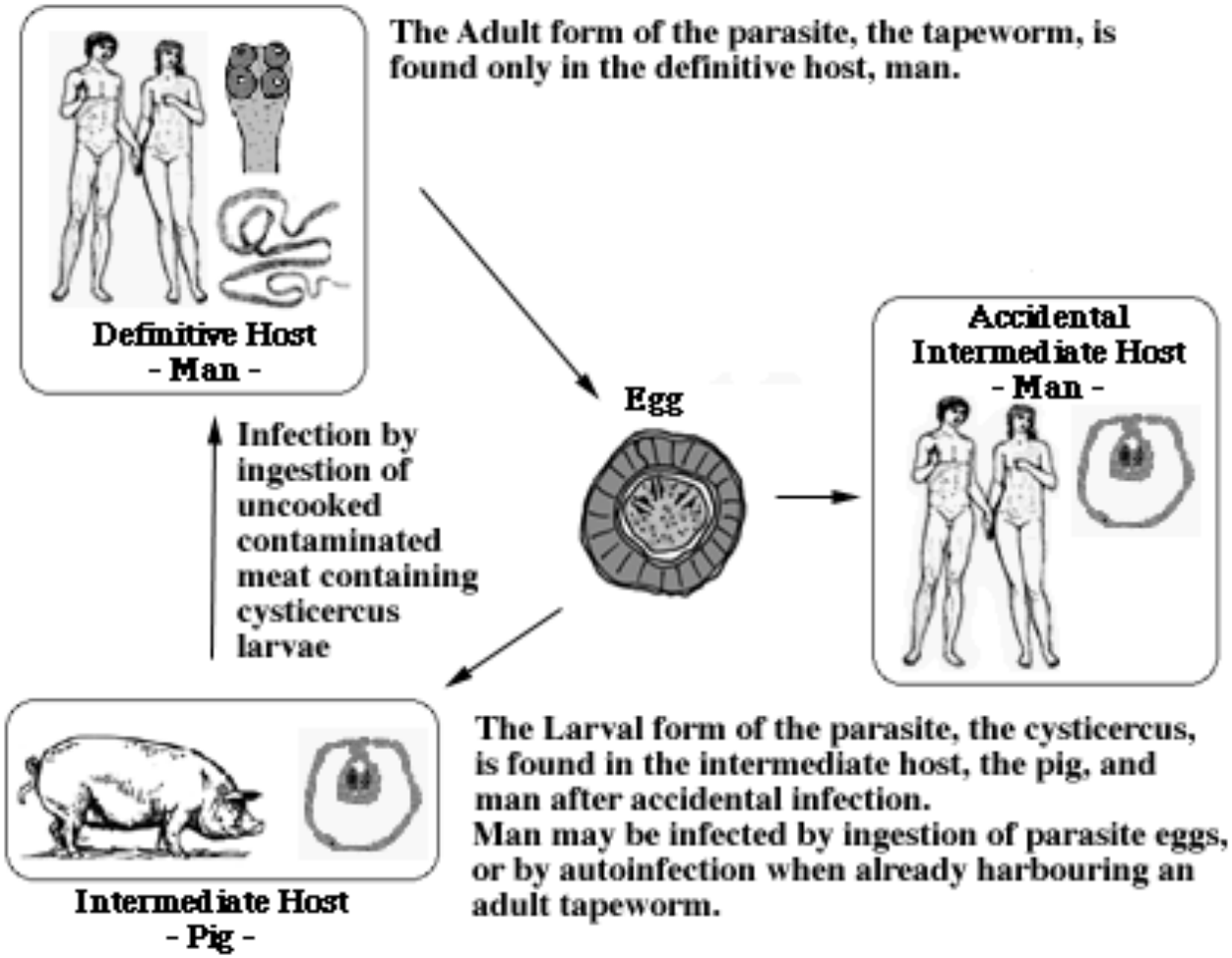
- Beef tapeworms (adult) undercooked beef



Infection by ingestion of undercooked contaminated meat containing the cysticercus larvae.

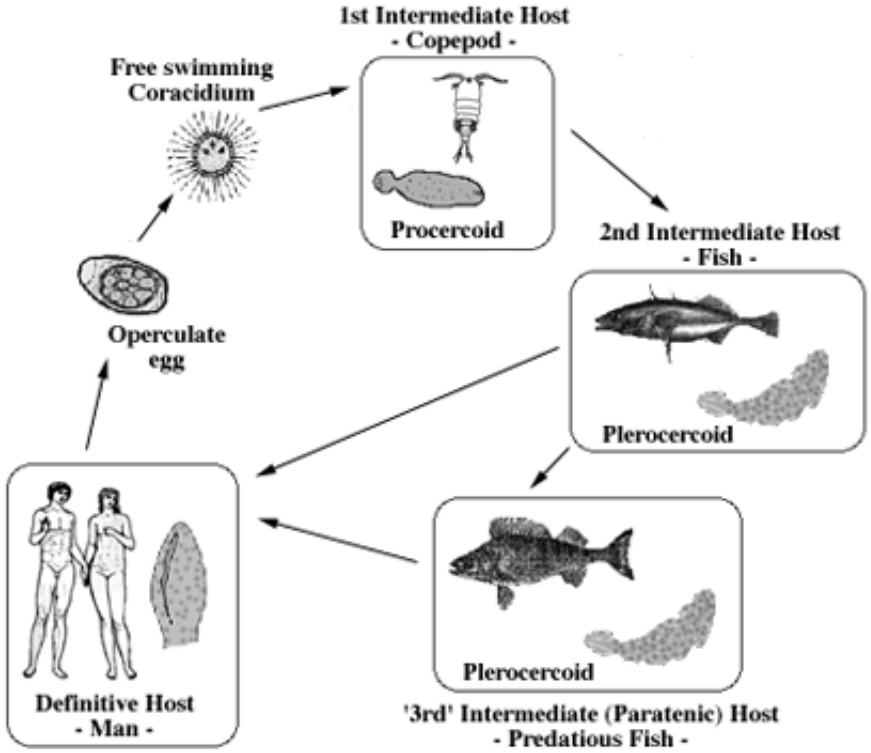
Taenia solium

- Pork tapeworms (adult) undercooked pork



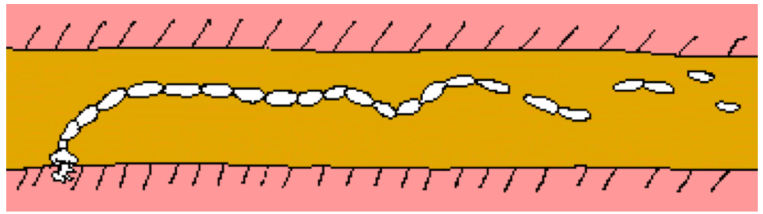
Diphyllobothrium latum

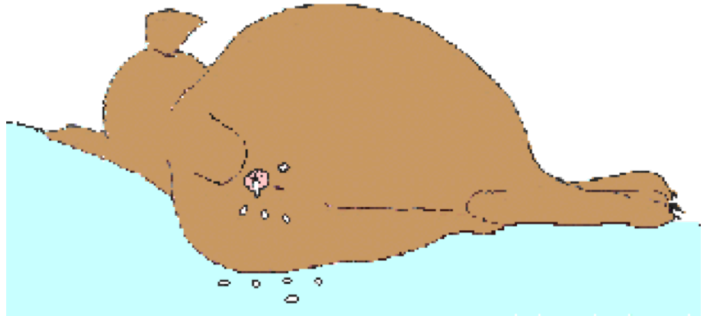
- Fish tapeworm (adult)
  - undercooked fish



Dipylidium caninum

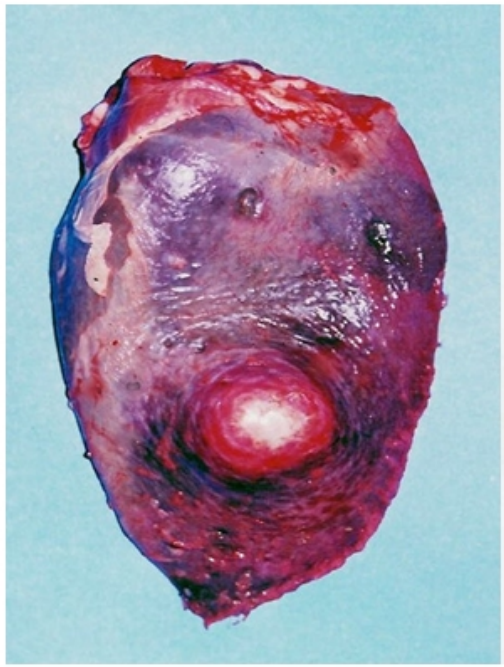
- Dog tapeworm (adult)
  - undercooked dog

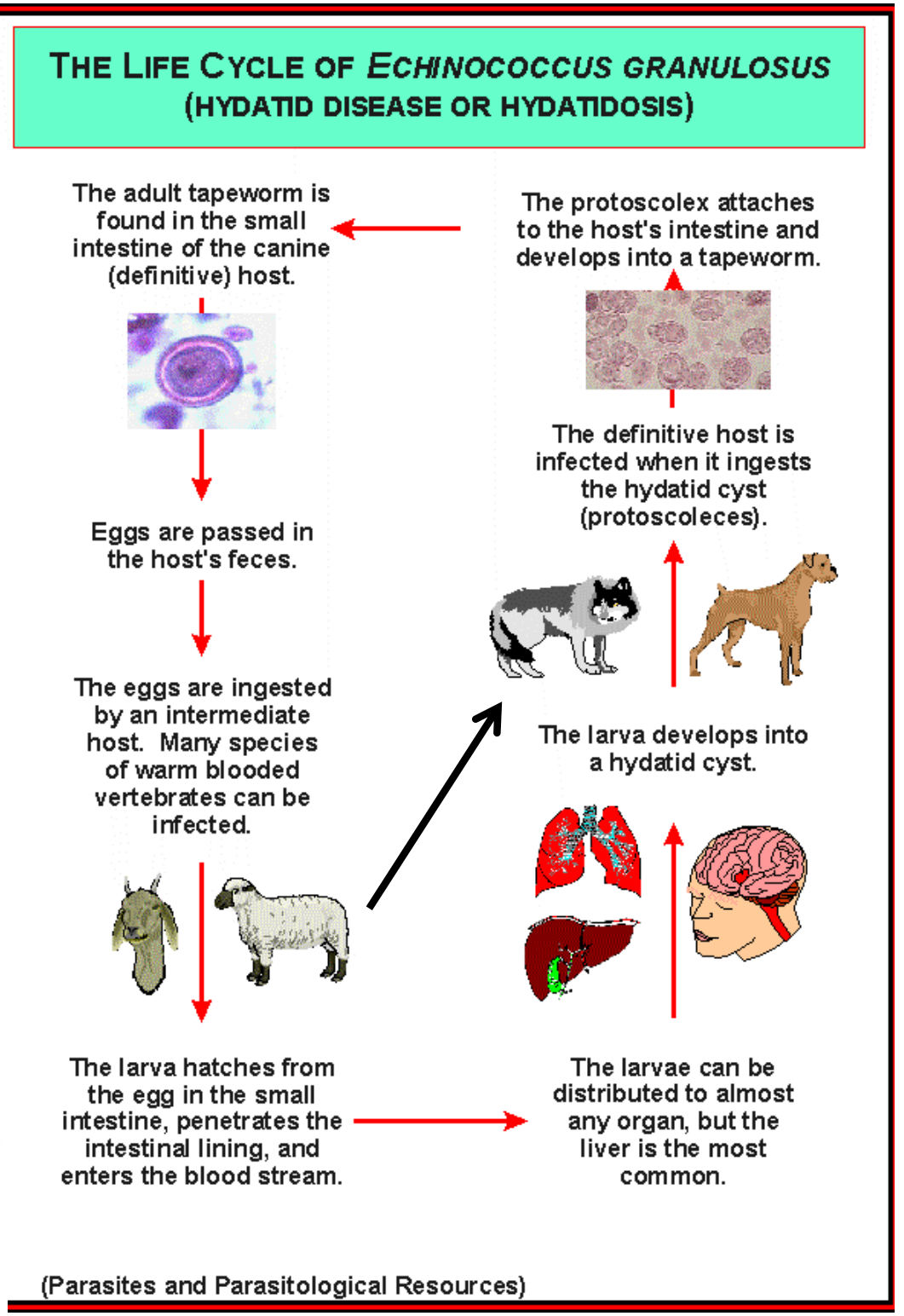




Echinococcus

- Unilocular hydatid (cyst)
  - association with dogs and ruminants





Pseudocoelomates

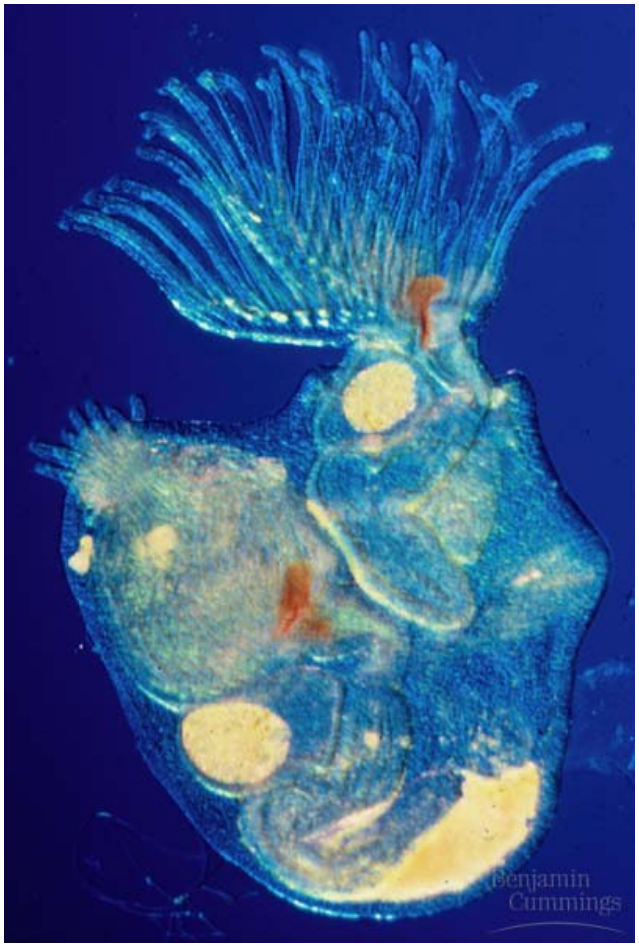
- Includes the Phyla: Rotifera & Nematoda
- False Cavity
  - store nutrients
  - movement
  - hydrostatic skeleton
  - space for organ development

Phylum: Rotifera

- Mostly freshwater
- Ring of cilia around mouth
- Jaws with complete alimentary canal
- **Parthenogenesis**

Lophophorate Phyla

- P. Ectoprocta (Bryozoans) - colonial and moss-like
- P. Phoronids - marine tube worms
- P. Brachiopods - lamp shells

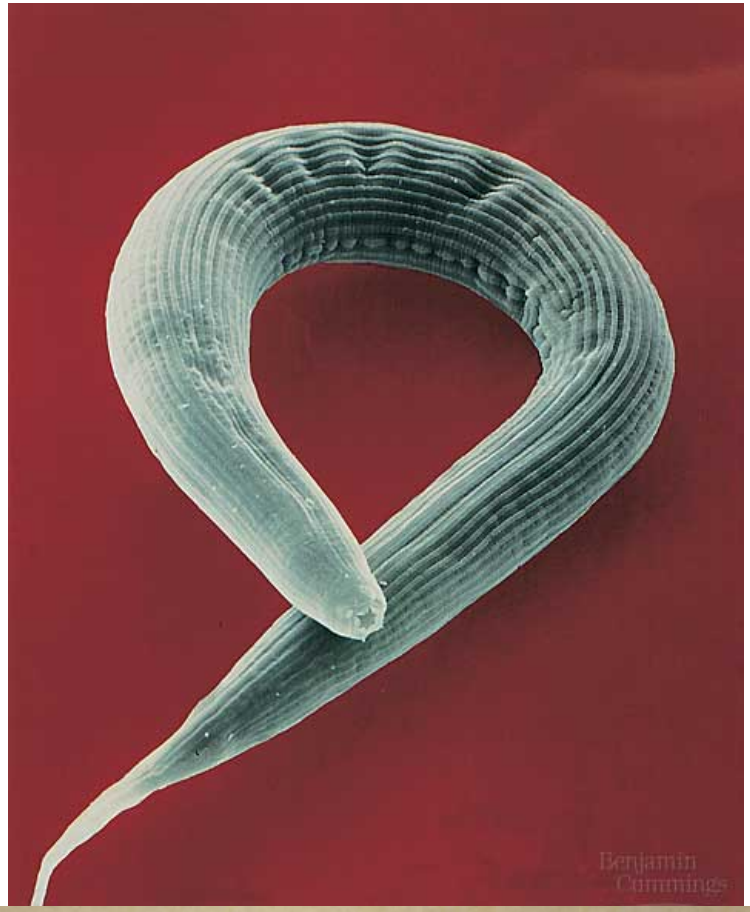


Phylum: Nemertea

- Proboscis Worms (ribbon)
  - closed circulatory system
  - complete digestive tract
  - proboscis

Phylum: Nematoda

- Unsegmented, round with tapered ends
- Complete alimentary canal
- decomposers, agricultural pests, parasites

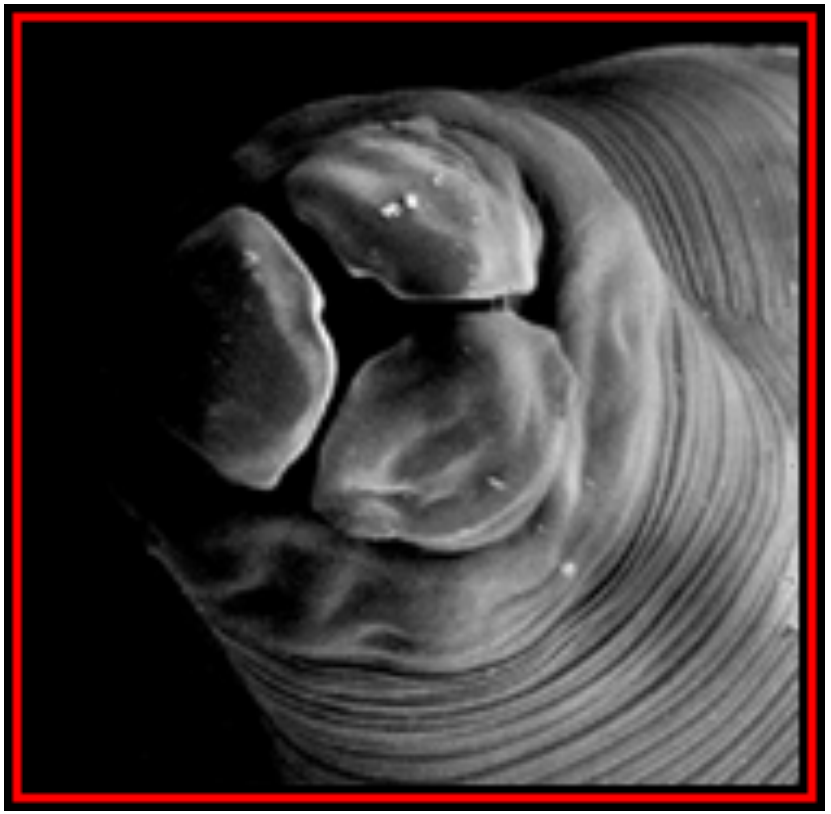


Ancylostoma

- Hookworm (burrows into skin and moves to intestine)

Enterobius

- Pinworm (pick up eggs from anus or dust with eggs)

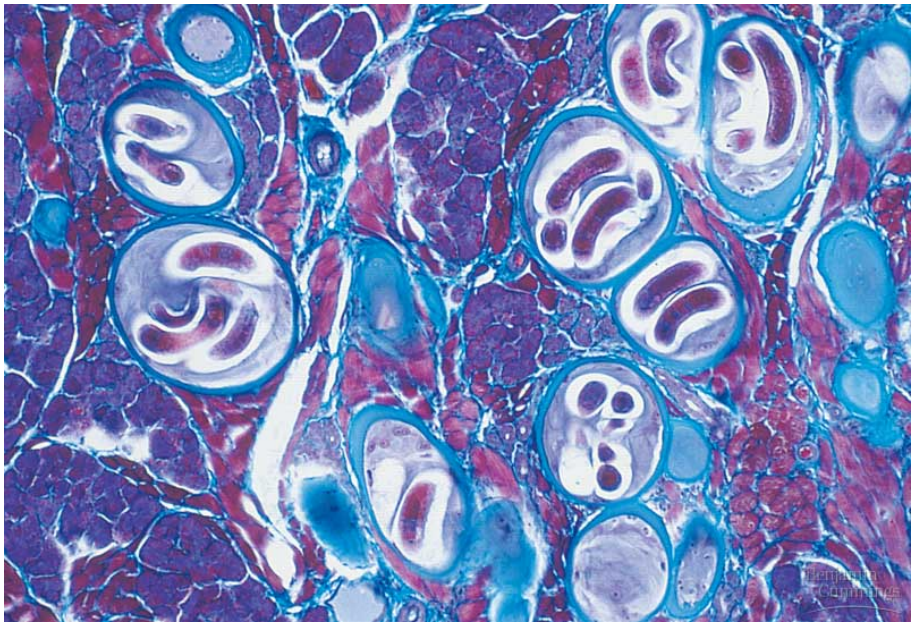


Ascaris

- Human roundworm (pick up eggs in food)

Trichinella

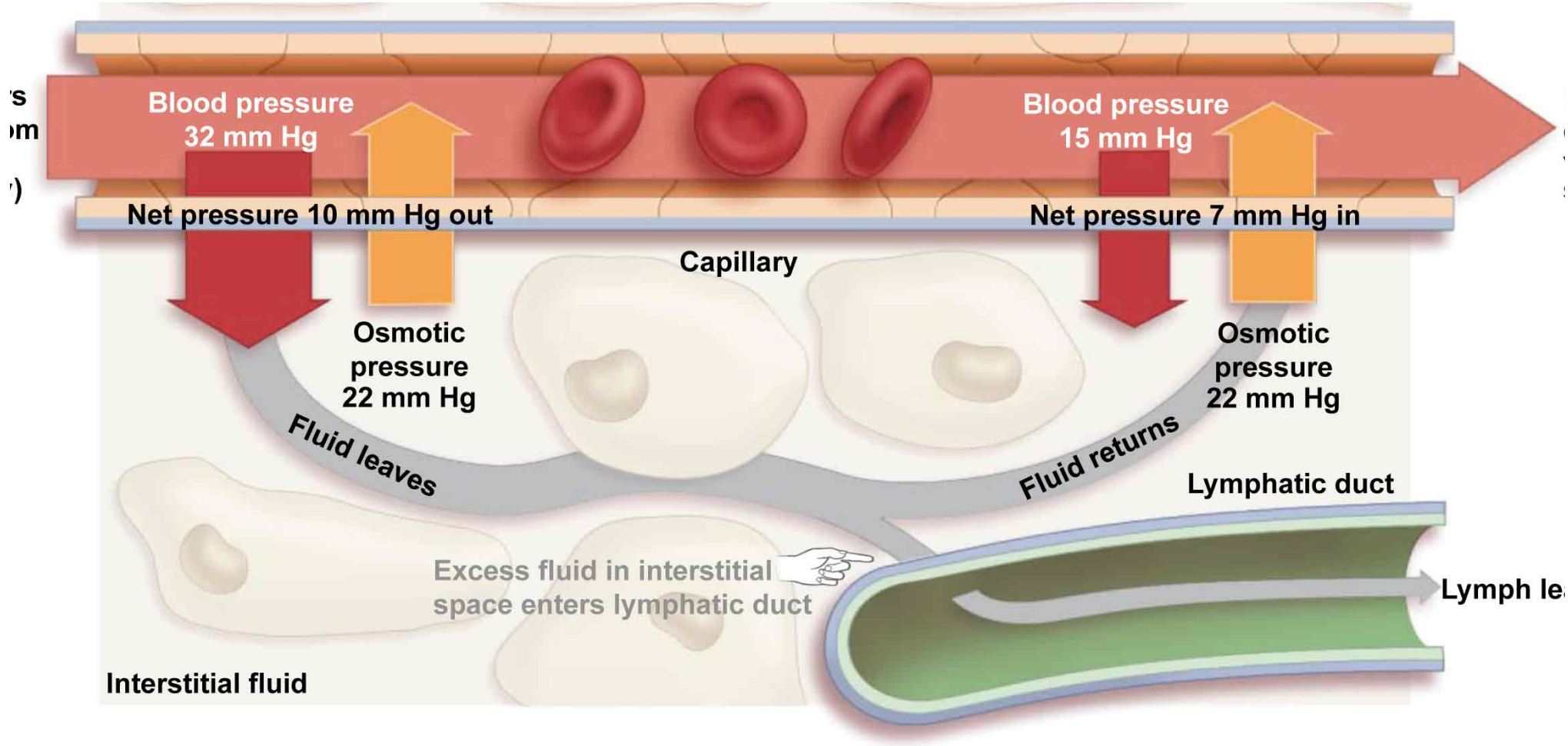
- Trichina worm (pick up from infected muscle in pork)



Wuchereria

- blocks lymph channels
- pick up from mosquitoes

Lymphatic System



Wuchereria

- Causes elephantiasis

Dracunuclus

- Guinea Worm