Protostomes

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Learning goals

- Describe the supergroups and clades of the protostomes and distinguish their characteristics
- Describe distinguishing features of flatworms, Rotifers, Mollusca, Annelids, Lophophorates, Nematoda, Arthropods
- Describe the traits of the four major classes of Mollusca and two major classes of Annelids

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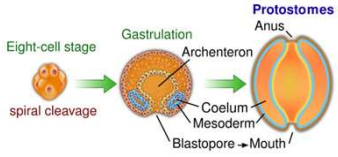
Clades of Protostomes

- **Spiralians**
  - Grow by gradual addition to the body mass
  - Spiral cleavage
  - Include two main groups:
    - **Lophotrochozoa**
    - **Platyzoa**
- **Ecdysozoans**: Animals that molt



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Platyzoans (Spiralia)

Phylum Platyhelminthes

- Flattened, ciliated, soft-bodied animals
- Bodies are solid aside from an incomplete digestive cavity (**acoelomate**)
- Carnivores and/or scavengers

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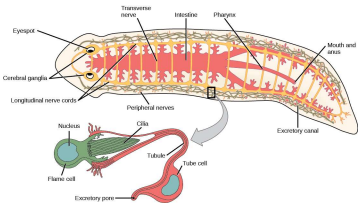
Platyzoan systems 1

- **Digestion**
  - Single opening to cavity (mouth at mid body)
  - Ingest food and tear via muscle contractions
  - Cells lining gut endocytosis food
- **Circulatory / gas exchange**
  - No true system
  - Gas diffuses between cells and surroundings
- **Excretion / osmoregulation**
  - Network of fine tubules
  - Lined with flagellated flame cells



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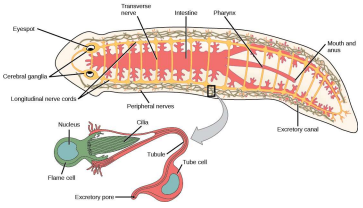
Platyzoan systems 2

- **Simple nervous system**
  - Anterior cerebral ganglion and nerve cords
  - Eyespot can distinguish light from dark
- **Reproduction**
  - Complex
  - Most are hermaphroditic
  - Sexual reproduction between 2 individuals
  - Also have capacity for asexual regeneration



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Class Turbellaria

- Free-living
- Scavenge and prey on small animals
- e.g. *Planaria*

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Class Trematoda: the flukes

- *Schistosoma* (Trematoda)
- Afflict 5% of world's population
- About 800,000 people die each year
- Fertilized egg must break through the wall of the blood vessels in intestine or the urinary bladder to get out

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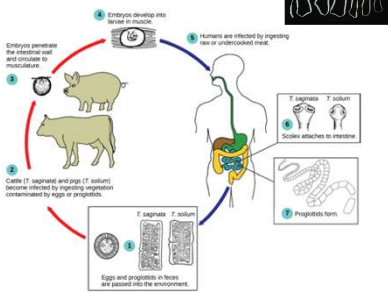
Class Cestoda: the tapeworms

- Body divided into three zones
  - **Scolex**: attachment structure
  - **Neck**
  - **Strobila**: series of repetitive sections (proglottids)



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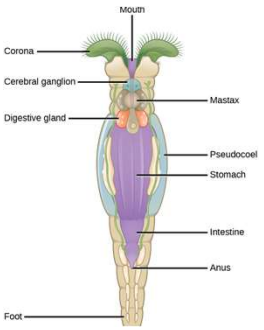

Phylum Rotifera

- **Pseudocoelomates**
- **Corona**: ring of cilia at the anterior end; used for locomotion and food acquisition

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Understanding check

What is spiral cleavage?

What does it mean to be an acoelomate

What does it mean to be a pseudocoelomate

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Clade Lophotrochozoa

- **Trochophore**
  - A free-living larva
  - Mollusca, Annelida
- **Lophophore**
  - A horseshoe-shaped crown of ciliated tentacles surrounds the mouth used in filter-feeding
  - Sessile
  - Bryozoa and Brachiopoda.

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Phylum Mollusca

- Extremely diverse
- Marine, freshwater, terrestrial
- Some have a shell, some do not
- Important food source
- Snails, slugs, clams, octopuses and others

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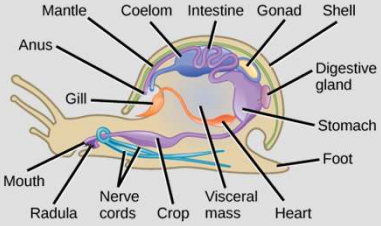
Mollusca body plan



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Class Polyplacophora (Chitons)

- Marine mollusks that have oval bodies
- 8 overlapping dorsal calcareous plates
- Body is not segmented under the plates
- Most chitons are grazing herbivores

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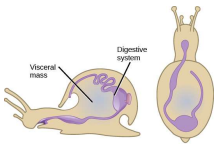
Class Gastropoda

- Limpets, snails, slugs
- Primarily marine, some freshwater, some are the only terrestrial mollusks
- Most have a single shell, some have lost it
- Heads typically have pairs of tentacles with eyes

- • **Torsion**
  - Unique among animals
  - Mantle cavity and anus are moved from the posterior to the front



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Class Bivalvia

- Clams, scallops, mussels, oysters Most marine, some freshwater
- No radula or distinct head
- Have two shells (**valves**) hinged together; **adductor muscles** counter hinge ligament
- Water enters through **inhalant siphon** and exits through **exhalant siphon**

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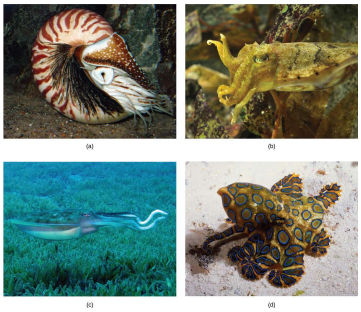
Class Cephalopoda

- Strictly marine species
- Predators
- Only mollusk **with closed circulatory system**
- Foot has evolved into a series of **arms** equipped with suction cups
- **Beak-like** jaws
- Largest relative brain sizes among invertebrates
- Highly developed nervous system
- Chambered nautilus has external shell
  - Other cephalopods lack external shell
- Squid and cuttlefish have internal shells
- Jet propulsion using **siphon**
- **Ink** can be ejected from siphon
- **Chromatophores** allow for changing skin color for camouflage or communication



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Mollusca characteristics (for you reference)

- Body, usually covered by a dorsal shell composed mainly of **calcium carbonate**.
- A broad, flat, muscular **foot**, located ventrally, which is used for locomotion.
- The body organs (**viscera**) are concentrated as **a visceral mass** located above the foot.
- The dorsal body wall forms a pair of folds called the **mantle**. The mantle is a thin sheet of tissue that generally overhangs the visceral mass, forming a mantle cavity. The mantle may contain glands that secrete a shell. The mantle cavity contains **gills** or a **lung**.
- A rasp-like structure called a **radula**, which is a belt of teeth in the mouth region. (The radula is not present in clams or their relatives, which are filter feeders.)
- A **coelom**, generally reduced to small compartments around certain organs, including the heart and excretory organs (**metanephridia**). The main body cavity is typically a **hemocoel**, a space containing blood (see the following discussion of open circulatory systems). The hemocoel is not a coelom.

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Phylum Annelida

- Segmented worms
  - Repeated units
  - Allows for specialization
- Well-developed cerebral ganglion
- Sensory organs in ring-like segments
- Ventral nerve cord

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Class Errantia (Polychaetes)

- Clamworms, scaleworms, lugworms, sea mice, tubeworms
- Paired **parapodia** on most segments
- Used in locomotion or gas exchange
- **Chaetae** on parapodia
- Most gonochoric
- External fertilization
- Trochophore larva

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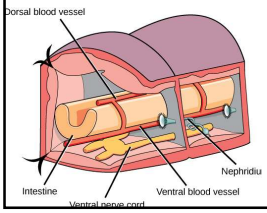

Class Clitellata: earthworms

- Head not well differentiated
- **No parapodia**
- **Few chaetae**
- **Hermaphroditic** but cross-fertilize
- **Clitellum**: thick band on body
  - Clitellum secretes mucus cocoon

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Class Clitellata: leeches

- Mostly in freshwater
- **Flattened dorsoventrally**
- Hermaphroditic and cross-fertilization
- Coleom reduced, not divided into segments
- **Suckers** at both ends of body
- No chaetae

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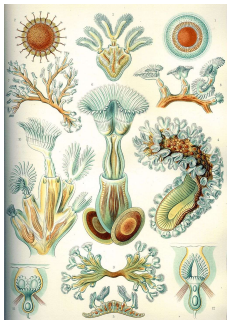
Phylum Bryozoa

- Small
- Live in colonies
- Anus opens near their mouth
- Asexual reproduction occurs frequently by budding



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Phylum Brachipoda

- Lamp shells
- Two calcified shells
- Dorsal and ventral (not lateral as in bivalves)
- Lophophore lies on the body, between the shells

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Understanding check

What is a trochophore and which groups exhibit this feature?

What is a lophophore and which groups exhibit this feature?

How would you distinguish a bivalve from a brachiopod?

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