An Introduction to the Invertebrates, Part Two
Platyhelminthes & Rotifers

Reference: Chapter 33.3, 33.4
More Relationships
The Bilaterians

- Bilaterian animals have bilateral symmetry and triploblastic development (3 primary germ layers)
- Most (but not all) have a coelom and a digestive tract with two openings
- The clade Bilateria contains Acoelomorpha, Deuterostomia, Lophotrochozoa, and Ecdysozoa
Phylum Acoelomorpha (Acoela in Fig. 32.11)

- “Basal Bilaterians”
  - Bilateral symmetry
  - Acoelomate
- Resemble flatworms (Phylum Platyhelminthes)
  - Simple nervous system and a saclike gut
- Molecular evidence suggested Acoelomorphs diverged early from other bilaterians
Superphylum Lophotrochozoa

- The superphylum Lophotrochozoa was identified by molecular data
- Some develop a lophophore for feeding, others pass through a trophophore larval stage, and a few have neither feature
- Lophotrochozoa includes the flatworms, rotifers, ectoprocts, brachiopods, molluscs, and annelids
Phylum Platyhelminthes - the Flatworms

- Members of phylum Platyhelminthes live in marine, freshwater, and damp terrestrial habitats
- Characteristics - they are FLAT!
  - Bilateral symmetry, triploblastic development, acoelomate
  - Flattened dorsoventrally
  - Gastrovascular cavity has one opening, the mouth
  - Gas exchange takes place by diffusion across the surface (being flat makes this efficient!)
- Protonephridia
  - Regulate osmotic balance
Flatworms are divided into two “lineages” (Superclasses)

- **Catenulida**, or “chain worms,” reproduce asexually by budding
- **Rhabditophora** are more diverse and include both free-living and parasitic species
  - Groups (Classes)
    - **Turbellaria**
      - Paraphyletic - now about 11 orders
    - **Neodermata** (all parasitic)
      - **Cestoda** (tapeworms)
      - **Trematoda** (flukes)
      - **Monogenea** (not discussed here)
Free-Living Rhabditophorans

- Also known as Turbellarians
- The best-known are planarians (Genera *Planaria, Dugesia*)
  - Marine or fresh water habitat
  - Prey on smaller animals (& sometimes pretty big ones!)
- Characteristics
  - Light-sensitive eyespots and centralized nerve nets (more complex and centralized than cnidarian nerve nets)
  - Mouth adapted for attaching, and absorbing nutrients from prey
    - Sac-like gut but no anus
  - No vascular or respiratory system - respiration takes place across the epidermis
  - Hermaphrodites and can reproduce sexually, or asexually through fission
Planarian

- Pharynx
- Gastrovascular cavity
- Gastrovascular cavity
- Mouth
- Eyespots
- Ganglia
- Ventral nerve cords
Reproduction in the Turbellaria

- Many species are true hermaphrodites...
  - ...but it’s complicated
- Individuals carry both male and female sex organs
  - But self-fertilization is not common and individuals mate with one another
  - There is a “choice” as to who plays which role
    - Determined by “penis fencing”...
      [https://www.youtube.com/watch?v=wn3xlulRhlY](https://www.youtube.com/watch?v=wn3xlulRhlY)
    - Winner injects sperm into the loser, who produces fertilized eggs
Parasitic Rhabditophorans - Trematoda and Cestoda

- Parasites derive their nutrition from other animals
- Two important groups of parasitic rhabditophorans are Classes Trematoda and Cestoda
- Most have complex life cycles
  - More than one host
    - Definitive host
      - Harbors sexually reproducing stage of the parasite
    - Intermediate host
      - Harbors nonreproductive or asexually reproducing stage of the parasite
Trematoda – “flukes”

- Parasitize a wide range of hosts
  - Most have complex life cycles with alternating sexual and asexual stages, with different hosts for each stage
- Trematodes that parasitize humans spend part of their lives in invertebrate hosts
  - They produce surface proteins that mimic their host and release molecules that manipulate the host’s immune system
Trematodes

- Flukes
  - Flat, leaf-shaped bodies
- Many are parasites
  - *Clonorchis sinensis*: Chinese liver fluke
  - *Shistosoma*: “blood” flukes
Trematode Life Cycle

- Schistoma mansoni ("blood fluke")
Trematode: *Clonorchis* (liver fluke)

1. Hermaphroditic adult fluke releases eggs into human lung
2. Eggs reach water after being excreted in feces
3. Miracidium develops in egg and hatches from egg
4. Free-swimming miracidium enters snail
5. Inside snail, miracidium develops into redia, which reproduces asexually to produce rediae; several cercaria develop within redia
6. Cercaria leaves snail and enters crayfish
7. In crayfish, cercaria encysts to produce metacercaria
8. Infected crayfish is eaten by human, and metacercaria develops into adult fluke

*Metacercaria* (0.25–0.5 mm)

*Cercaria* (0.5 mm long)

*Asexual reproduction*

*Intermediate host*

*Adult fluke (7.5–12 mm long)*

*Sexual reproduction*
Cestoda - Tapeworms

- Parasites of vertebrates and lack a digestive system
- Tapeworms absorb nutrients from the host’s intestine
- The scolex contains suckers and hooks for attaching to the host
- Proglottids are units that contain sex organs and form a ribbon behind the scolex
- Fertilized eggs, produced by sexual reproduction, leave the host’s body in feces
Common tapeworms

- Humans can be definitive or intermediate host
- *Taenia saginata*
  - Beef tapeworm
    - Humans are the definitive host
  - Cattle are the intermediate host
- *Echinococcus granulosis*
  - Dog tapeworm
    - Humans are intermediate host
Humans as Intermediate Host

1. Adult tapeworm releases eggs, which are excreted by definitive host.
2. Intermediate host ingests eggs.
3. Eggs hatch, and larvae migrate to liver or lungs.
4. Larvae develop into hydatid cysts.
5. Definitive host eats intermediate host, ingesting cysts.
6. Scoleces from cyst attach to intestine and grow into adults.

(a) Adult tapeworm
(b) Life cycle
Phylum Rotifera

- Tiny animals that inhabit fresh water, the ocean, and damp soil
- Smaller than many protists but truly multicellular
- Have specialized organ systems
  - **Alimentary canal**, a digestive tube with a separate mouth and anus that lies within a fluid-filled pseudocoelom
  - Reproduce by **parthenogenesis**, in which females produce offspring from unfertilized eggs
Rotifer video (~2 min)
https://www.youtube.com/watch?v=ac-NesPB97I
Review of Relationships

- Porifera
- Ctenophora
- Cnidaria
- Acoela
- Echinodermata
- Chordata
- Platyhelminthes
- Rotifera
- Lophotrochozoa
- Ecdysozoa
- Deuterostomia
- Bilateria
- Eumetazoa
- Metazoa
- Ancestral Colonial Flagellate

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