

### Phylum Platyhelminthes

#### I. Characteristics

- A. Representatives are microscopically small or up to 7 meters in length; believed to have a cnidarian-like ancestor; free living and parasitic forms.
  1. Parasitic forms (flukes and tapeworms) show specialization:
    - a. suckers or hooks for holding on to the host
    - b. bodies are resistant to the host's digestive enzymes: cuticle
    - c. complicated life cycles utilizing one or more intermediate hosts followed by a definitive host
    - d. produce large numbers of eggs
    - e. loss of unneeded structures: sense organs; digestive system in certain members
- B. Dorsoventrally flattened bodies (commonly called flatworms) to be distinguished from the nematoda roundworms; parasitic forms from both groups are called helminths (helminthology).
- C. No true segmentation.
- D. Bilateral symmetry with cephalization
- E. Acoelomate: no body cavity.
- F. 3 germ layers (tissue-triploblastic): Ectoderm, Endoderm, Mesoderm (mesenchyme)
- G. Epidermis soft and ciliated; or covered by cuticle (thin, noncellular external covering for protection) with external suckers or hooks or both for host attachment.
- H. Well-developed digestive, muscular, nervous, excretory and reproductive systems (as compared to coelenterates) due to well developed organs: muscular pharynx, eyespots, simple brain, complex reproductive organs, protonephridia
  1. Digestive (if present):
    - a. Incomplete: mouth but no anus and usually much branched; absent in tapeworms (parasitic); "sac" body plan: gastrovascular cavity.
  2. Muscle: contracting muscle fibers that produces changes in body shape and assist locomotion; sheath-like layers arranged in circular, longitudinal, and oblique layers.
    - a. Spaces between fibers and internal organs filled by soft mass of cells (parenchyma: acts as a hydrostatic skelton)
  3. Nerve: contains pair of anterior "ganglia" (primitive brain) or a nerve ring and one to three pair of lengthwise nerve cords with transverse connectives (ladder-like); statocysts for equilibrium, tactile cells and chemoreceptors.
  4. Excretory: contains protonephridia ending in specialized collecting cells called flame cells with long waving cilia located between body cells; pinocytosis into the flame bulb which then leads into a highly branched system of tubules.
    - a. Waste materials and excess water pass into flame cells and are driven by cilia into excretory ducts leading to excretory pores on exterior surface.
  5. Reproductive:
    - a. Sexes usually monoecious (containing gonads, testis and ovary with a duct system).
    - b. Internal fertilization.
    - c. Microscopic eggs.
    - d. Development either direct or with one or more larval stages.
    - e. Asexual in some forms.
- I. No skeletal, circulatory, or respiratory systems.
  1. Fluid in parenchyma around internal organs serves to distribute products of digestion and to carry oxygen; gases diffuse across the moist epidermis of the body exterior; acts as a hydrostatic skeleton.

#### II. Representative classes:

- A. Turbellaria (free-living flatworms, planarians, Dugesia).
  1. Common to cool, clear, slow streams or ponds of freshwater; avoid light by clinging to under surfaces of stones or logs in the water, marine species as well.
  2. Two dark eyespots found dorsally on anterior end (ocelli).
  3. Entire ventral surface covered by cilia for locomotion (glides over a slime track).
  4. Midventrally the mouth opening is in an extensible muscular pharynx.
  5. Great powers of regeneration (asexual); mostly hermaphroditic; cross-fertilize into a common genital pore.
  6. Protonephridia with flame cells
- B. Trematoda (flukes, which are external and internal parasites).
  1. Characteristic thick cuticle (protection) with no cilia; hooks and suckers.

2. Mouth is usually surrounded by a sucker; all are parasitic (majority are endo-parasites); often have two suckers (attachment and feeding).
  3. One or more hosts in life cycle; usually utilize vertebrate (adult stage) as the definitive host; may involve one or two invertebrate host(s) for the parasite's larval stages (intermediate hosts).
  4. Flukes that infect humans are commonly named for the organ they invade.
    - a. Liver flukes (Clonorchis or Opisthorchis):
      - 1) Common to regions in the Orient; eggs from definitive host pass out the excreta -----> into water -----> goes through a number of stages via intermediate hosts (snail, fish, encysts on vegetation)----> eaten raw by definitive host (human, cat, dog, pig); the most important human fluke.
      - 2) Once ingested, the larval stage moves to the favorite body region (bile ducts, gallbladder, and pancreatic ducts) resulting in cirrhosis, jaundice, and even death as they become adults.
    - b. Blood flukes (Schistosoma).
      - 1) Fork-tailed larvae are free swimming in fresh water where they can burrow through the human skin and enter the circulatory system and migrate throughout the body to certain favorite regions depending on the fluke type.
        - a) Eggs are shed via human feces and urine.
        - b) Aquatic snails are the frequent intermediate host.
        - c) The inch-long adults may live for years in the human host causing schistosomiasis; remain permanently attached together in the intestinal veins of humans
        - d) Differs from most flukes in being dioecious.
        - e) Accumulation of vast quantities of eggs within the body causes schistosomiasis (dysentery, anemia, weakness, reduced resistance to infections); still one of the major infectious diseases of the world (200 million infected): Africa, S. America, W. Indies, Middle & Far East.
  5. Avian (birds) shistome in northern U.S. Lakes; enters skin of swimmer ("Swimmers itch"); dead end in its life cycle.
- C. Cestoda (tapeworms: intestinal parasites of vertebrates).
1. Long, flat and ribbon-like (flatness enhances diffusion so that there is no need for respiratory, circulatory, or digestive systems).
  2. Require at least two hosts; often one of the intermediate hosts is an invertebrate.
  3. Cuticle covered body consisting of a series of joined sections (proglottids)
    - a. Body may have several to 1,000 proglottids
    - b. Proglottids form by budding (asexual).
    - c. When it is mature, it contains excretory organs, complete set of male and female reproductive organs (capable of producing thousands of eggs), muscles and nerve cord.
    - d. Proglottids of posterior end are mature; they may detach, pass out the feces to the ground.
    - e. Secondary or intermediate hosts such as cattle or pigs swallow these zygotes; larvae hatches and is carried by the blood to eventually enter skeletal muscle
    - f. Can form a hard-walled cyst that allows for infected meat, if poorly cooked or eaten raw the cyst is transferred to the primary or definitive host (human) where the adult is a parasite of the vertebrate's digestive tract; human's digestive juices break down the cyst wall to release larva.
    - g. Cyst develops into new tapeworm attached to intestinal wall.
    - h. note significance of highly developed reproductive system; monoecious.
  4. Anterior end has a small knob-like structure called a scolex consisting of four suckers and a cirlet of hooks.
  5. Representative human tapeworms:
    - a. Beef tapeworm (Taenia saginata): humans contract by eating rare or raw meat of infected cattle resulting in diarrhea, vomiting, epigastric pain, weight loss, and increased appetite; adult can expel proglottids for many years.
      - 1) "Bladder worm"; encysted larvae in cow's skeletal muscle (intermediate host)
      - 2) Most common human tapeworm with the adult achieving a length up to seven meters.
    - b. Pork Tapeworm (Taenia solium): humans contract by ingesting rare pork or contamination by human feces or ova; symptoms depend on their location: eye, brain, muscles, visceral organs, and most frequently in subcutaneous tissue.
      - 1) Juveniles may encyst in the CNS resulting in great damage.
    - c. Fish Tapeworm: eating raw or poorly cooked fish