Microbiology

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Medical Parasitology Classification

- **Definitions:**
  - Medical Helminthology: Deals with parasitic worms
  - Medical Protozoology: Deals with unicellular parasites

- **Phylum**
  - Helminths (Parasitic Worms)
    1. Phylum Platyhelminthes (Flatworms)
       - ✓ Includes:
         - Class**:** *Trematoda* (Flukes)
         - Class**:** *Cestoidea* (Tapeworms)
    2. Phylum Nemathelminthes (Roundworms)
       - ✓ Includes:
         - Class**:** *Nematoda* (e.g., Ascaris lumbricoides, pinworms, etc.)

  - Protozoa (Unicellular Parasites)
    1. Class**:** *Rhizopoda* (Move by pseudopodia)
    2. Class**:** *Ciliata* (Move by cilia)
    3. Class**:** *Zoomastigophora* (Move by flagella)
    4. Class**:** *Sporozoa* (Move by gliding movement)

- **Nematode (Roundworm) Infections**
  - ***Ascaris lumbricoides (Human Roundworm)***
    - ✓ Infection: Eggs are resistant to environmental conditions.
    - ✓ Eggs: 75x40 µm, brownish with a thick mamillated shell.
    - ✓ Development: Eggs take 2-3 weeks to become infective.
    - ✓ Size:
      - Adult female: 20–35 cm
      - Adult male: 15–30 cm
    - ✓ Transmission: Humans can also be infected by pig roundworm (Ascaris suum), which is indistinguishable from A. lumbricoides.
    - ✓ Pathology:
      - High numbers cause bowel obstruction, and migration leads to complications like bowel perforation, peritonitis, vomiting, and abdominal pain.
      - Larvae migration through lungs induces inflammatory response (pneumonitis) and bronchial spasm.

  - ***Enterobius vermicularis (Pinworm)***
    - ✓ Size: Female pinworms ~10 mm, male pinworms ~3 mm.
    - ✓ Infection: Common in children, more frequent in temperate than tropical climates.
    - ✓ Eggs: Football-shaped, 50–60 µm, visible larvae inside.
    - ✓ Diagnosis: Scotch Tape technique to collect eggs from perianal area.
    - ✓ Symptoms: Perianal pruritus, especially at night (due to hypersensitivity reaction to eggs laid by female worms).

- ***Trichuris trichiura (Whipworm)***
  - ✓ Size: Female whipworms ~30–50 mm, male whipworms smaller.
  - ✓ Shape: Anterior end slender; posterior end thicker (whip-like appearance).
  - ✓ Eggs: 50 µm with distinct polar plugs.
  - ✓ Transmission: Eggs become infective after about 3 weeks of incubation in moist, shady soil.
  - ✓ Habitat: Colon, where worms mate and release eggs that pass out with feces.

- ***Ancylostoma duodenale and Necator americanus (Hookworms)***
  - ✓ Size: Female hookworms ~10 mm, males slightly smaller.
  - ✓ Eggs: Oval, 60x40 µm, hatch into rhabditiform larvae, which transform into infective filariform larvae.
  - ✓ Transmission: Larvae penetrate skin or mucous membranes, typically through barefoot contact with contaminated soil.
  - ✓ Pathology:
    - Larvae cause skin irritation ("ground itch").
    - In the intestine, adult worms attach to intestinal villi and feed on blood, leading to anemia.
    - Symptoms: Abdominal discomfort, diarrhea.

- ***Strongyloides stercoralis (Threadworm)***
  - ✓ Size: Adult females ~2 mm long.
  - ✓ Reproduction: Parthenogenic (females reproduce without males).
  - ✓ Eggs: Laid within the intestine, hatch into larvae that are passed into feces.
  - ✓ Transmission: Some larvae develop into free-living male and female worms in the soil.
  - ✓ Pathology: Can cause chronic intestinal and tissue infections, and developmental adaptation to sustain population.

- ***Trichinella spiralis (Trichinosis)***
  - ✓ Transmission: Acquired by eating raw or improperly cooked pork infected with the larval stage.
  - ✓ Infection: Larvae molt into adult worms in the small intestine, release larvae which circulate in the blood and encyst in muscle tissue.
  - ✓ Pathology:
    - Early symptoms: Diarrhea, abdominal pain, nausea.
    - Later symptoms: Muscle pain and weakness from encysted larvae.

- ***Tissue Nematodes (Filariasis)***
  - ✓ Family Filariidae:
    - Thread-like worms that infect the lymphatic system or connective tissue.
    - Require intermediate hosts (e.g., mosquitoes, flies).
  - ✓ Examples:
    - *Wuchereria bancrofti* (Mosquito)
    - *Brugia malayi* (Mosquito)
    - *Loa loa* (Eye worm – transmitted by Chrysops flies)
    - *Onchocerca volvulus* (River blindness – transmitted by black flies)

- ***Lymphatic Filariasis (Elephantiasis)***
  - ✓ Transmission: Microfilariae (larval form) are carried by mosquitoes.
  - ✓ Pathology:
    - Lymphatic obstruction causes fluid to accumulate in tissues, leading to massive swelling (lymphedema), especially in limbs.
    - Severe cases can cause thickening of skin and tissues resembling an elephant’s leg.

➢ *Platyhelminthes (Flatworms)*

1. *Cestoda (Tapeworms)*

- ✓ Characteristics: Hermaphroditic, lack digestive tract, complex life cycles.
- ✓ Acquisition: Infection through ingestion of undercooked meat (containing cysts).
- ✓ Examples:
  - Taenia saginata (Beef tapeworm)
  - Taenia solium (Pork tapeworm)
  - Echinococcus granulosus (Hydatid cyst)
  - Diphyllobothrium latum (Broad fish tapeworm)

2. *Taenia saginata (Beef Tapeworm)*

- ✓ Size: Grows 4-8 m in length, 6-7 mm in width, with about 1000 segments.
- ✓ Transmission: Acquired by ingesting undercooked beef.
- ✓ Symptoms: Minimal, often asymptomatic.

3. *Taenia solium (Pork Tapeworm)*

- ✓ Size: Similar to T. saginata but slightly shorter and with a modified scolex.
- ✓ Cysticercosis: Involves the presence of larval cysts in human tissues (especially muscles and brain), leading to potential neurological issues such as epilepsy.

4. *Echinococcus granulosus (Hydatid Cyst)*

- ✓ Size: Adult tapeworm about 5 mm.
- ✓ Transmission: Eggs ingested from dogs or other canids.
- ✓ Pathology: Cysts develop in the liver and lungs, leading to hydatid disease.

5. *Diphyllobothrium latum (Broad Fish Tapeworm)*

- ✓ Size: Can exceed 10 m in length.
- ✓ Transmission: Acquired from improperly cooked or raw fish.
- ✓ Symptoms: Growth of tapeworm in the intestine, releasing millions of eggs daily.

6. Trematodes (Flukes)

- ✓ Life Cycle: All trematodes undergo a complex asexual phase with larvae in snails (intermediate hosts).
- ✓ Eggs: Operculated, pass into freshwater where they hatch into miracidia, which then infect snails and later become cercariae (infective stage).
- ✓ Common Trematodes:
  - *Clonorchis sinensis* (Chinese liver fluke)
  - *Fasciola hepatica* (Sheep liver fluke)
  - *Paragonimus westermani* (Lung fluke)
  - *Schistosoma species* (Blood flukes)

➢ *Schistosomiasis*

- ✓ Species:
  - *S. mansoni*: Inferior mesenteric veins of the large intestine.
  - *S. japonicum*: Inferior and superior mesenteric veins of the small intestine.
  - *S. haematobium*: Veins of the urinary bladder.
- ✓ Pathology:
  - Eggs lead to granulomatous reaction, causing liver fibrosis, portal hypertension, hepatosplenomegaly, and esophageal varices.
  - *S. haematobium*: Urinary tract involvement causing urethral pain, hematuria, dysuria, and bladder obstruction.

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