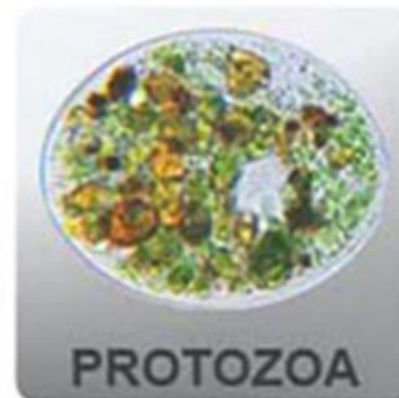


Parasite II



Parasites

```
graph TD; Parasites --> Protozoa; Parasites --> arthropods; Parasites --> Helminthes; Protozoa --> Intestinal; Protozoa --> Urogenital; Protozoa --> Blood_tissue[Blood and tissue]; Helminthes --> Cestodes; Helminthes --> Trematodes; Helminthes --> Nematodes;
```

Protozoa

arthropods

Helminthes

Intestinal

Urogenital

Blood and
tissue

Cestodes

Trematodes

Nematodes

Helminths (Worms)


General Characteristics:

- Eukaryotic, multicellular parasites, in the kingdom Animalia.
- They are worm-like organisms that live and feed off living hosts, receiving nourishment and protection while disrupting their hosts' nutrient absorption, causing weakness and disease
- They can infect human (always endoparasites), animals and plants.
- Their sizes ranging from barely visible roundworms (0.3 mm) to huge tapeworms 25 meters long.

Helminths (Worms)

- **Sources for human infection** are contaminated food, soil, and water or infected animals
- **Routes of infection** are by oral intake or penetration of unbroken skin

Helminthes are classified into three categories:

1. Nematodes (roundworms)
 2. Trematodes (flukes)
 3. Cestodes (tapeworms)
- 
- Flatworms

Helminthes

Nematodes
(round worms)

Ascaris lumbricoides
(Roundworm)



Cystods
(tape worms)

Taenia saginata



Trematodes
(fluks)

Bilharzia
(Schistosomiasis)



Helminths Life Cycle

- **Consist of 3 stages:** egg, larva, and adult
- Adult nematodes are either male or female, where cestodes and trematodes are hermaphroditic (adult worms contain both male & female reproductive organs)

Diagnosis of helminths infection by:

- a. Observing the worms in specimen
- b. Observing larva or eggs under the microscope

Nematodes (Roundworms)

- Elongate, cylindrical, non-segmented parasite
- Tapered at both ends
- Variable in size (5mm – 100cm)
- Sexes are separate (male is smaller than female)
- The vast majority are free- living soil and freshwater worms, but around 200 are parasitic, including 50 species that affect humans.

Nematodes divided into:

- Intestinal nematodes, e.g. *Ascaris lumbricoides*
- Tissue nematodes

Nematodes



Ascaris lumbricoides

- *Ascaris lumbricoides* is the largest nematode parasitizing the human intestine
- **Caused disease:** Ascariasis

Geographical distribution:

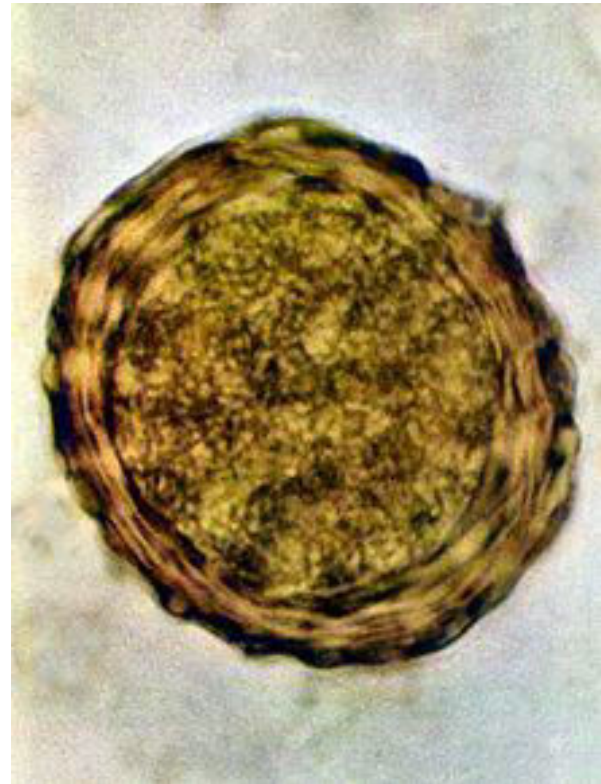
World wide (1/3 the world population is infected with this worm) but more common in tropical and subtropical countries.

Morphology

Adult (in small intestine)

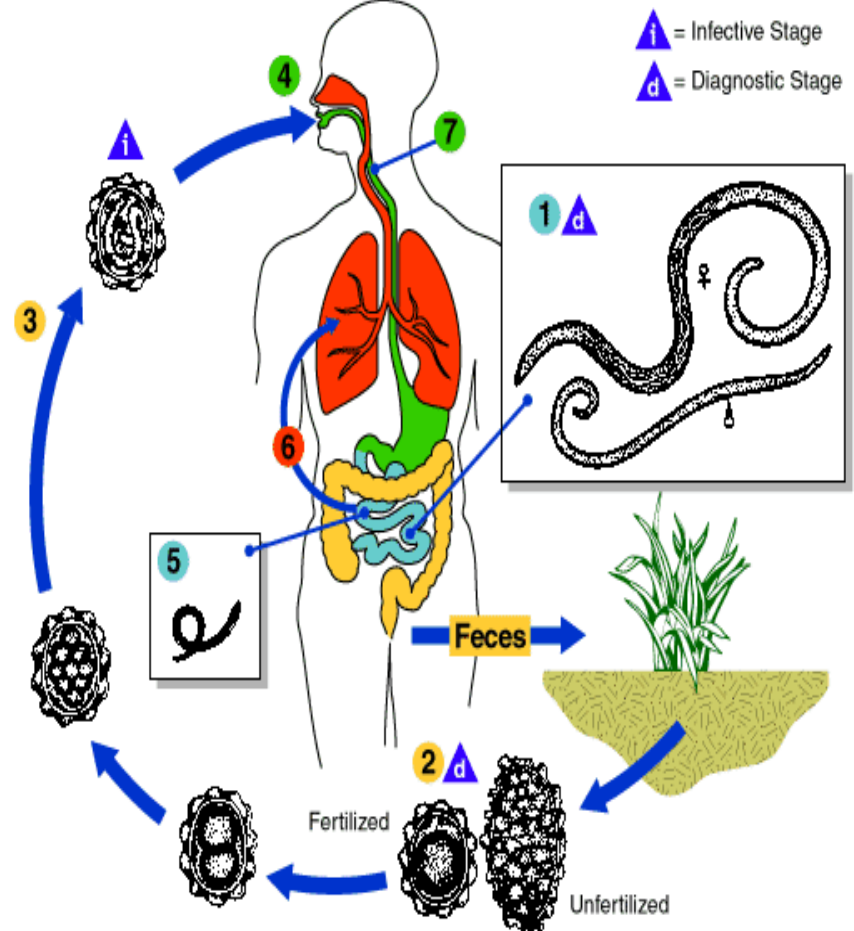


Egg (infective stage)



Ascaris Life Cycle

- Fertilized egg ingested, hatches in duodenum>> larvae penetrate intestine wall and enter blood vessels. From there, it is carried to the liver then to the lung
- In three weeks, the larvae migrate up the respiratory tree to the epiglottis to be coughed up, swallowed, and thus returned to the small intestine, where they mature to adult male and female worms (2 months from egg to mature adult)
- Each female produce 200,000 eggs per day
- Adult worms can live 1 to 2 years.



Ascariasis

Clinical symptoms:

➤ Lung phase

It causes hemorrhage, inflammation, bacterial infection.

Symptoms:

Bloody sputum, cough , wheezing, and fever.

➤ Intestinal phase

Symptoms: Related to number of worms;

- Small numbers: asymptomatic.
- Large numbers: Passing of worm in stool, vomit, nausea, malabsorption and abdominal pain.

Complications:

If untreated, can cause intestinal obstruction (blockage) and malnutrition.

- Deaths from Ascariasis range from 8000 to 100,000 annually worldwide

Cestodes (tapeworms)

- Long, ribbon-like, segmented worms.
- Primarily intestinal parasites.
- Can reach 15 m in length.



Species infect humans:

- *Taenia saginata* (the beef tapeworm)
- *T. solium* (the swine tape- worm)
- *Diphyllobothrium latum* (the fish tapeworm)

Name of the disease: Teniasis.

Taenia saginata (beef tapeworm)

Morphology:

➤ **Adult** is divided into three parts:

1. Head: round and small. It has four suction disks
2. Neck: small, slender, about an inch long
3. Number of segments.

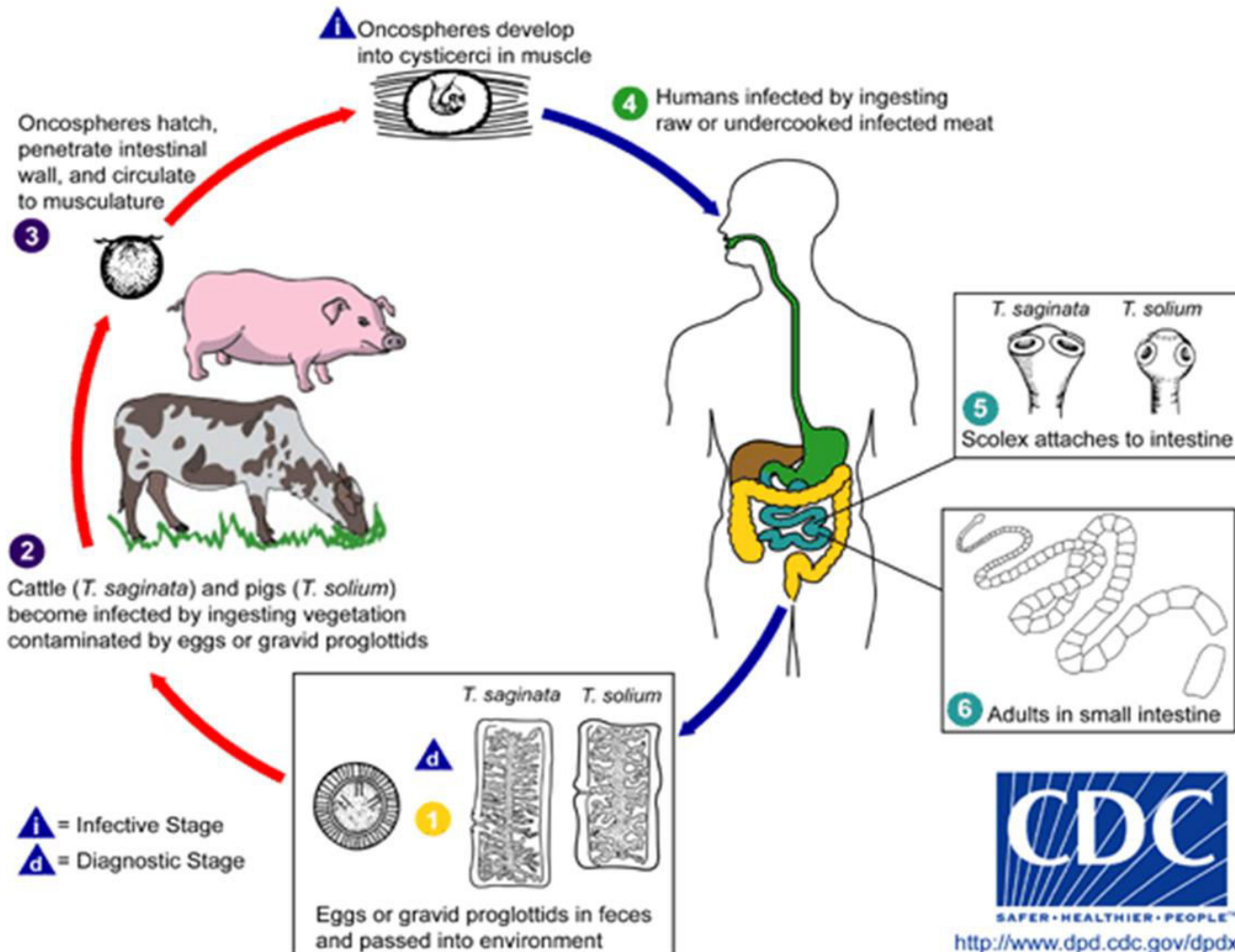
- Adult tapeworms can grow up to 25 meters in the lumen of the intestine, but are usually closer to 5 meters in length



➤ **Egg** present in feces



Taenia saginata Life Cycle



1. Cattle ingesting vegetation contaminated with eggs >> intestine>> eggs (oncospheres) hatch
2. Oncospheres penetrate the intestinal wall, and migrate to the muscles, where they develop into larva (cysticerci) which can survive for several years in the animal.
3. Humans become infected by ingesting raw or undercooked infected meat. In the human intestine, the cysticercus develops over 2 months into an adult tapeworm, which can survive for years in human's small intestine.

Taenia saginata

Transmission:

- Acquired in humans through the ingestion of raw or poorly cooked meat of infected cows.
- These cows have been infected via the ingestion of human feces containing the eggs of the parasite

Taenia saginata

Habitat:

- Adult>> in small intestine of man (definitive host)
- Egg>> in feces
- larva stage>> in muscle of thigh, shoulder, neck and heart of cattle (intermediate host)

Clinical symptoms:

- High infection: diarrhea and constipation
- Vomiting
- Loss of appetite
- Anemia

Trematodes (flake)

- Small (about 1 cm) flat , leaf-like worms.
- Infest various organs of the human host (e.g. intestinal veins, urinary bladder, liver, or lung)
- All parasitic trematodes use freshwater snails as an **intermediate host**.



Schistosoma spp.

Name of the disease:

- Schistosomiasis (Bilharzia)
- It is a disease of the venous system, adult Schistosomes take up residence in various abdominal veins, therefore they are called (Blood Flukes)
- This disease very common among children

Types of Schistosomiasis:

- Intestinal Schistosomiasis
- Urinary tract Schistosomiasis

Transmission:

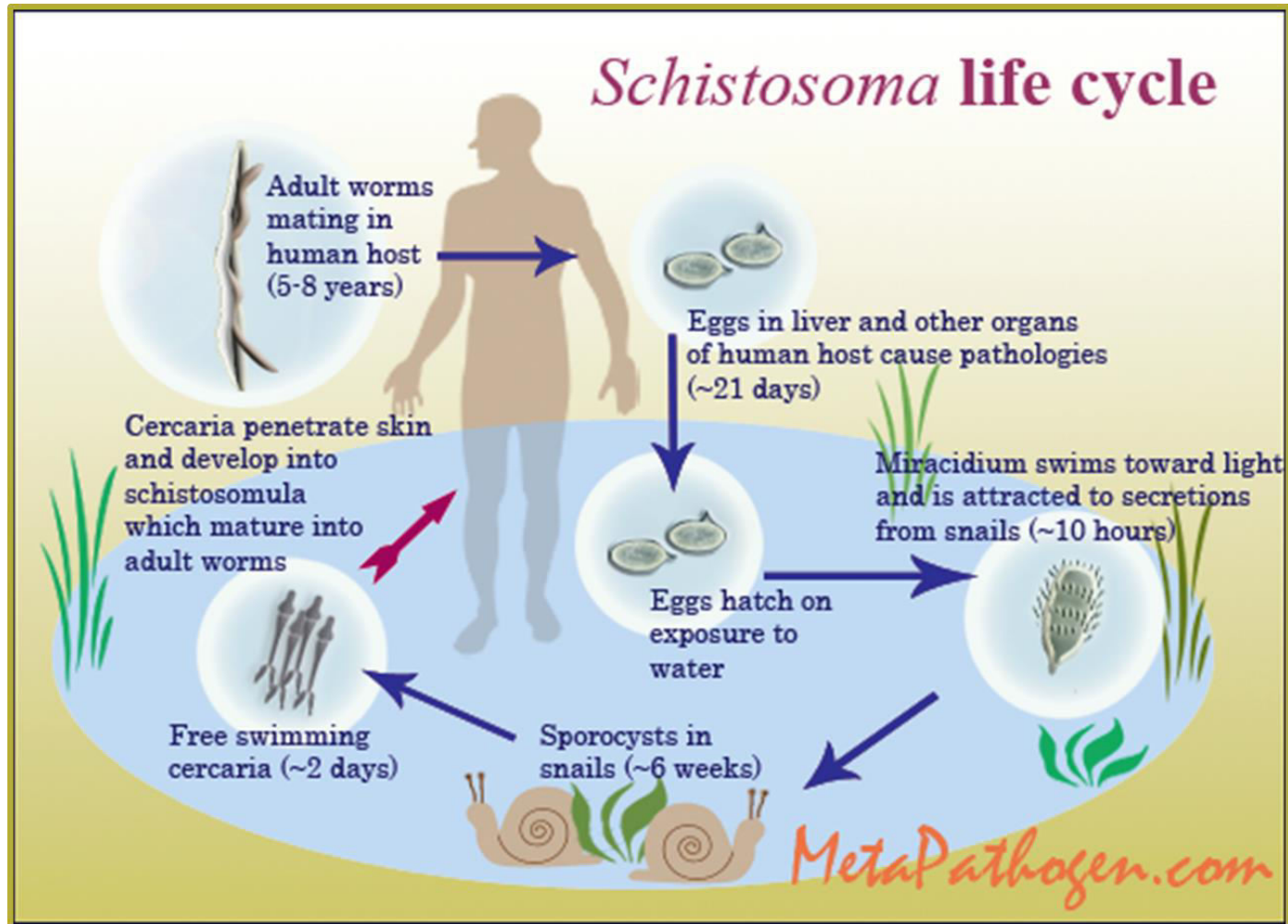
- By direct skin penetration, when people come in contact with contaminated water.

(Fresh water becomes contaminated by *Schistosoma* eggs when infected people urinate or defecate in the water. The eggs hatch and the parasites grow and develop inside snails)

- *Schistosoma* is NOT acquired by ingestion of contaminated food, it directly penetrates the skin of swimmers in contaminated rivers and lakes



Schistosoma spp. Life Cycle



1. Infected humans release eggs into the water (by defecating or urinating into the water)
2. The egg hatches in the water and gives larva (miracidium)>> which swims to a snail and live inside it.
3. In snail, the miracidium multiplies and transforms into larva called (cercaria)>> Cercariae are given off into the water
4. Cercaria penetrate human skin (who swim in the water) pass into small blood and lymphatic vessels then to the liver
5. Cercaria>> mature to Schistosomes>> mature to adult worms

Schistosomiasis (Bilharzia)

Clinical symptoms:

- Most people have no symptoms when they are first infected. After few days, rash or itchy skin due to hypersensitivity reaction to the parasite.
- within 1-2 months, other symptoms may develop including: fever, cough , urticaria, splenomegaly, diarrhea and abdominal pain.

Chronic Schistosomiasis:

- Without treatment, schistosomiasis can persist for years.

Symptoms:

- Intestinal: GI bleeding, diarrhea, pain, and enlarged liver.
- Urinary Tract: Hematuria (blood in urine) and dysuria (painful urination).