

PLATYHELMINTHES & HELMINTHES LECTURE-6

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Learning objectives

By the end of lecture students should be able to recall phylum Platyhelminthes and Helminthes their sub classes

(cestodes and trematodes),(nematodes).

- Life cycles, pathogenesis, clinical findings,
- Laboratory diagnosis, treatment and prevention of their respective organisms
- Should be able to diagnose their clinical casses.

Platyhelminthes & Helminthes

- **Platyhelminthes:**
- Cestodes
- Trematodes
- **Helminthes:**
- Nematodes

Platyhelminthes (platy--flat; helminth--worm)

Divided into two classes:

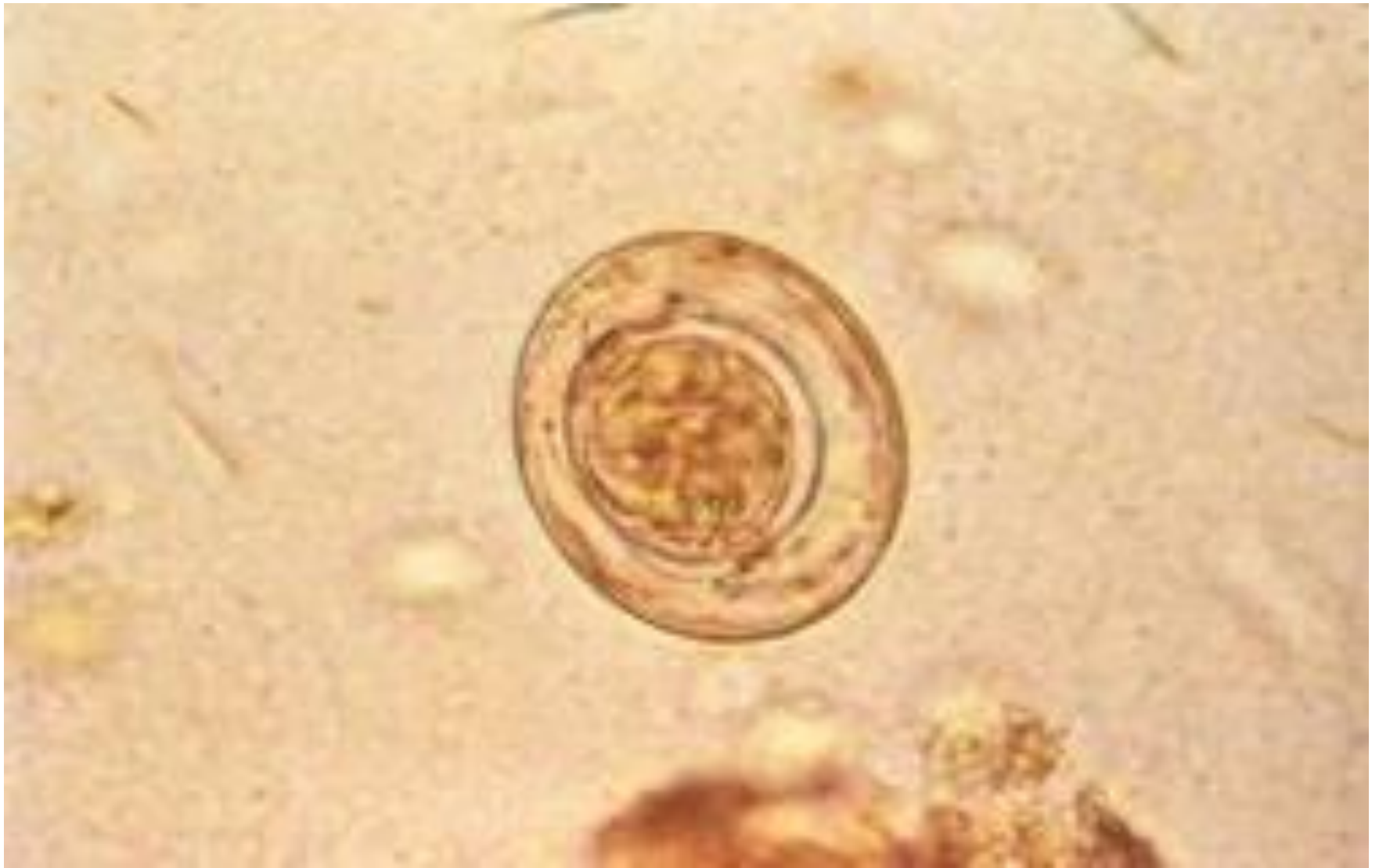
- **Cestodes (tapeworms).**
- **Trematodes (flukes).**

Cestodes:

- Four medically important cestodes (tapeworms):

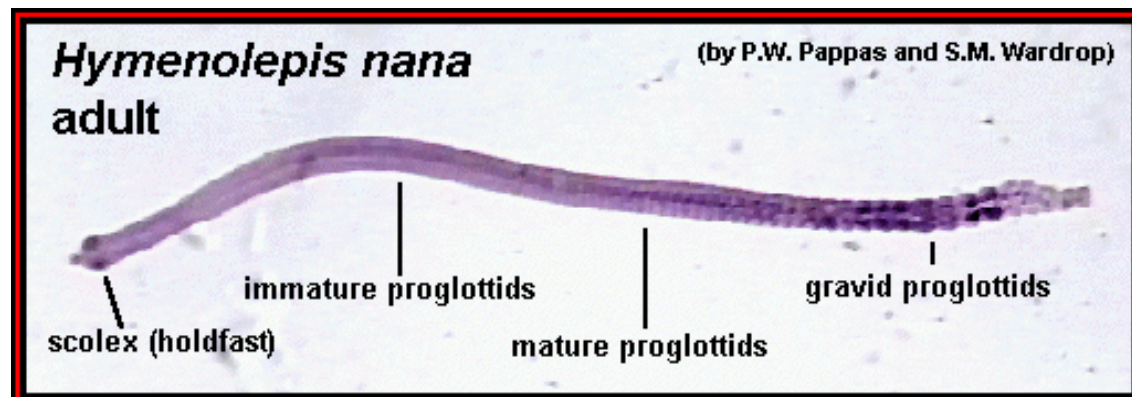
1. *Taenia solium*.
- *Taenia saginata*.
2. *Diphyllobothrium latum*.
3. *Echinococcus granulosus*.
4. *Hymenolepis nana*.

4. *Hymenolepis nana* (dwarf tapeworm)



Habitat

- Adult worm lives in distal portion of ileum of man.
- **Definitive host:** Humans.
- **Intermediate host:** **None.**
- Leads to **autoinfection.**
- Adult worm: 3 to 5 cm long.



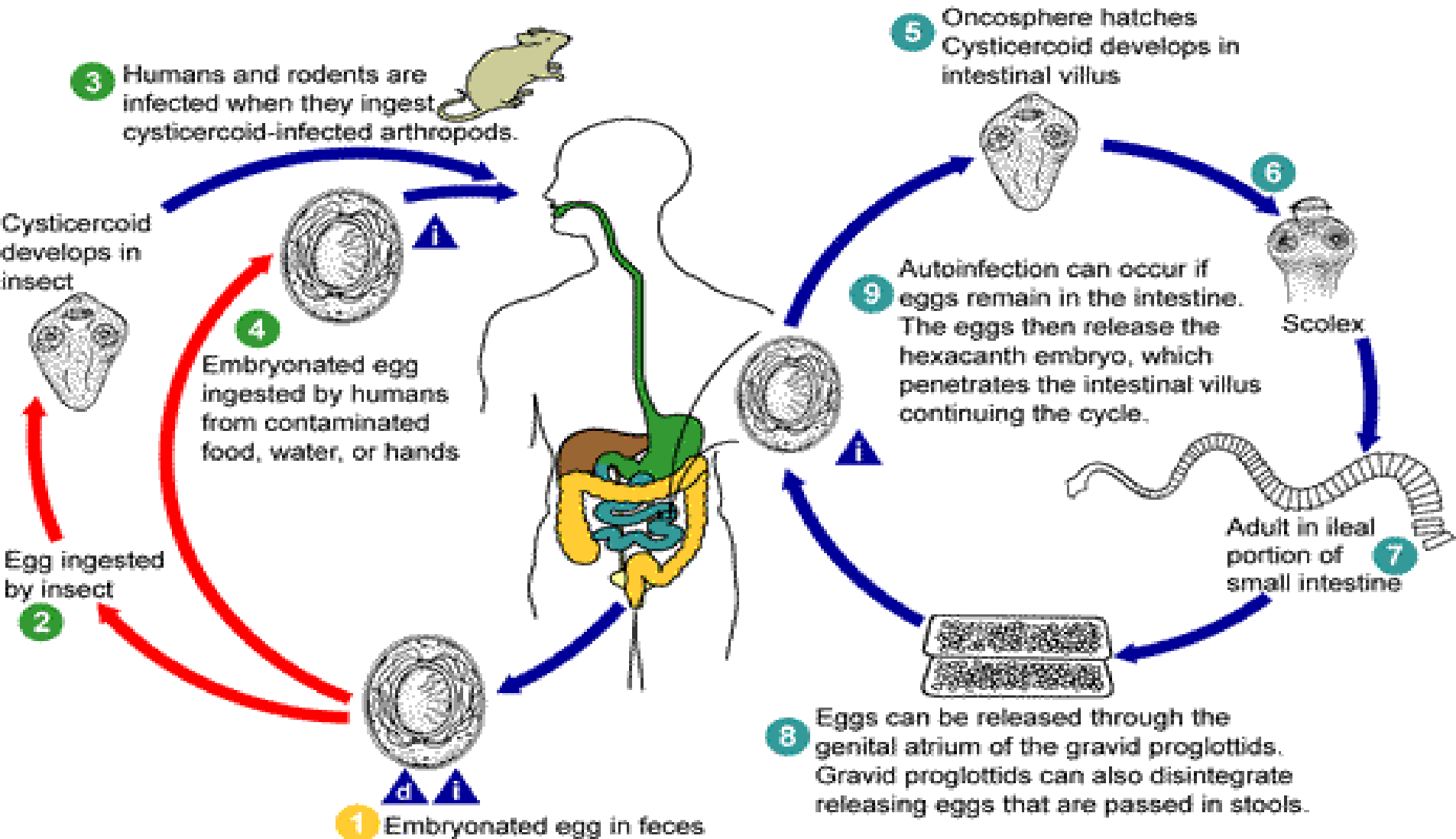
Geographical Distribution

- **Most frequently** found tapeworm in United States.
- Most prevalent in south-eastern states, usually in children.

- Organism found worldwide.
- Commonly in tropics.

Life Cycle

i = Infective Stage
d = Diagnostic Stage



Life Cycle

- Eggs **directly infectious** for humans, i.e. ingested eggs develop into adult worms (without intermediate host).
- Eggs hatch & differentiate into cysticercoid larvae and then into adult worms within duodenum.
- Gravid proglottids detach, disintegrate & release fertilized eggs.
- Eggs either pass in stool or re-infect small intestine (**autoinfection**).

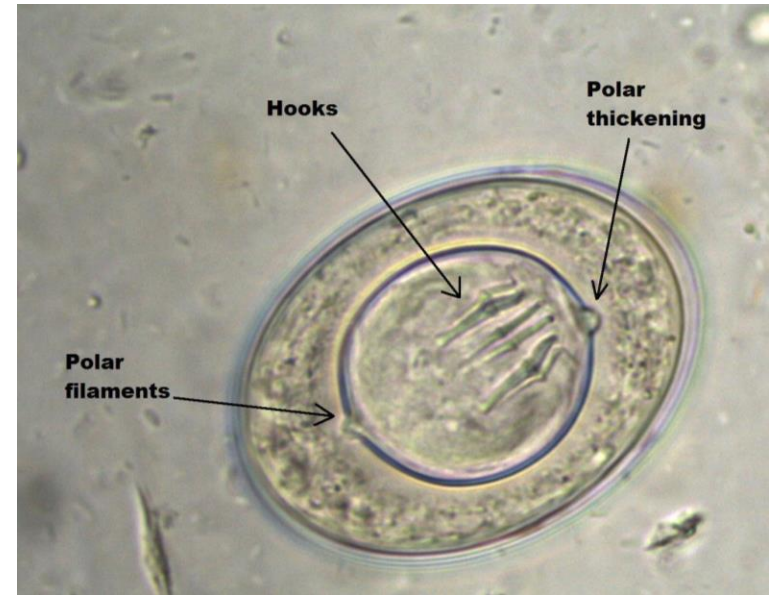
Pathogenicity & Clinical findings

- First infection occurs through food contaminated with eggs of *H.nana*, liberated in feces of infected man or rodent.
- Afterwards auto-infection increase the number of parasites.
- Infection causes little damage.
- Most patients asymptomatic.
- Abdominal pain and diarrhoea with heavy infection.

Diagnosis

□ Stool Examination: Eggs in stools.

Colorless, oval to round
30-45um in size
8 to 10 polar filaments
Six-hooked larva



□ ELISA: 80% sensitivity.

Treatment & Prevention

- Praziquantel.
- Niclosamide.

- **Prevention:**
- Good personal hygiene.
- Avoidance of fecal contamination of food & water.

Trematodes



Classification of Trematodes

- **Blood Trematodes/flukes:** *Schistosoma* species:
 - a. In vesical venous plexus: *S. haematobium*
 - b. In rectal & portal venous plexus: *S. mansoni* & *S. japonicum*.
- **Intestinal Trematodes/ flukes:** *Fasciola hepatica*
- **Hepatic Trematodes/ flukes:** *Fasciola hepatica*, *Clonorchis sinensis*.
- **Lung Trematodes/ flukes:** *Paragonimus westermani*.

Habitat & Transmission

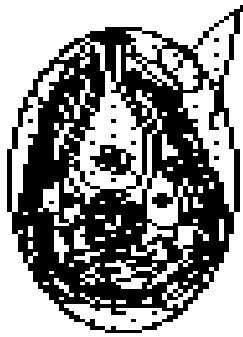
- **Definitive host:** Sexual cycle in humans.
- **Intermediate host:** Asexual reproduction in freshwater snails.
- **Transmission to humans:**
 1. Penetration of skin by free-swimming cercariae of schistosomes.
or
 2. Ingestion of cysts in under-cooked (raw) fish or crabs.

Geographical Distribution

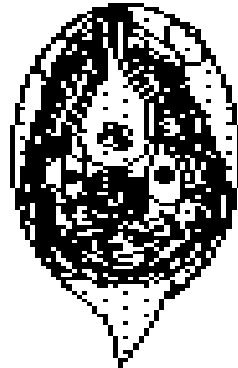
- Not endemic in United States.
- Immigrants from tropical areas like Southeast Asia frequently infected.
- Depends on presence of specific freshwater snails (**intermediate hosts**).
- *S. mansoni* found in Africa & Latin America.
- *S. haematobium* found in Africa & Middle East.
- *S. japonicum* found in Asia.
- More than 150 million people in tropical areas of Africa, Asia & Latin America affected.

Schistosoma (blood flukes) causes schistosomiasis

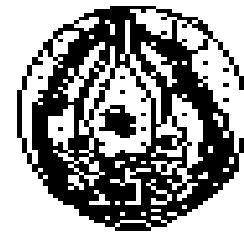
- *Schistosoma mansoni* & *Schistosoma japonicum*: Adults live in mesenteric veins. (Gastrointestinal tract).
- *Schistosoma haematobium*: lives in veins draining urinary bladder. (Urinary tract).
- **Three species distinguished by appearance of eggs in microscope:**
- *S. mansoni* eggs: Prominent lateral spine.
- *S. japonicum* eggs: No spine.
- *S. haematobium* eggs: Terminal spine.



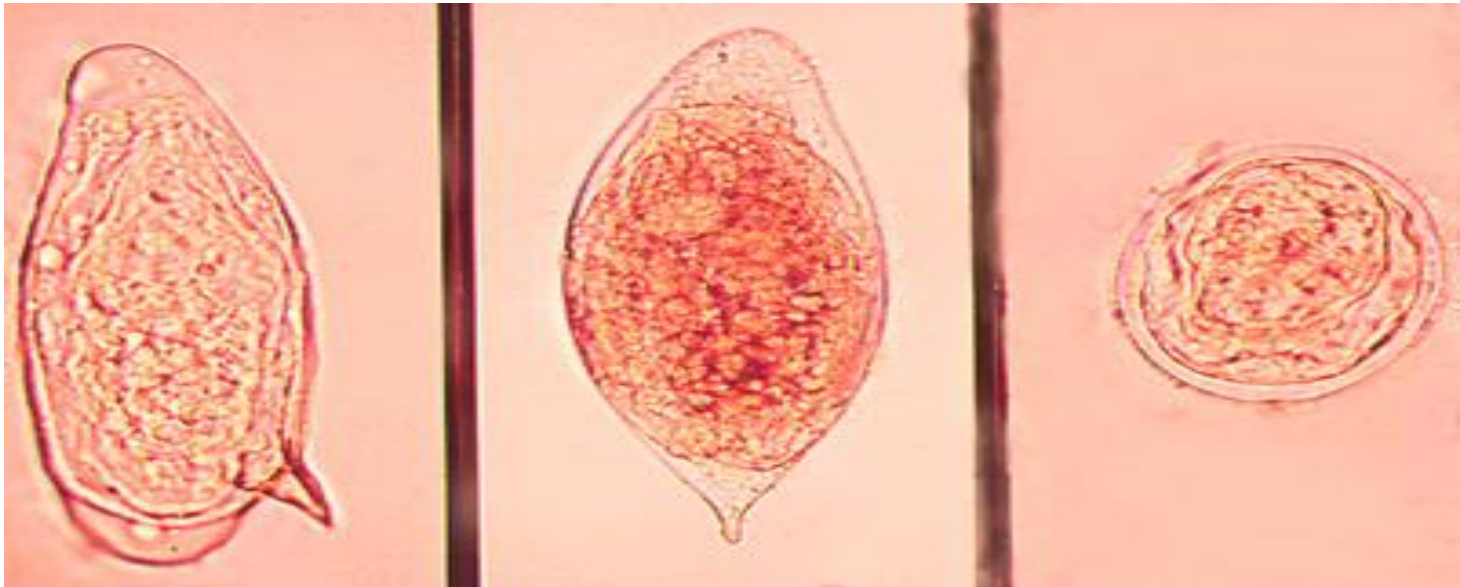
S. mansoni



S. haematobium



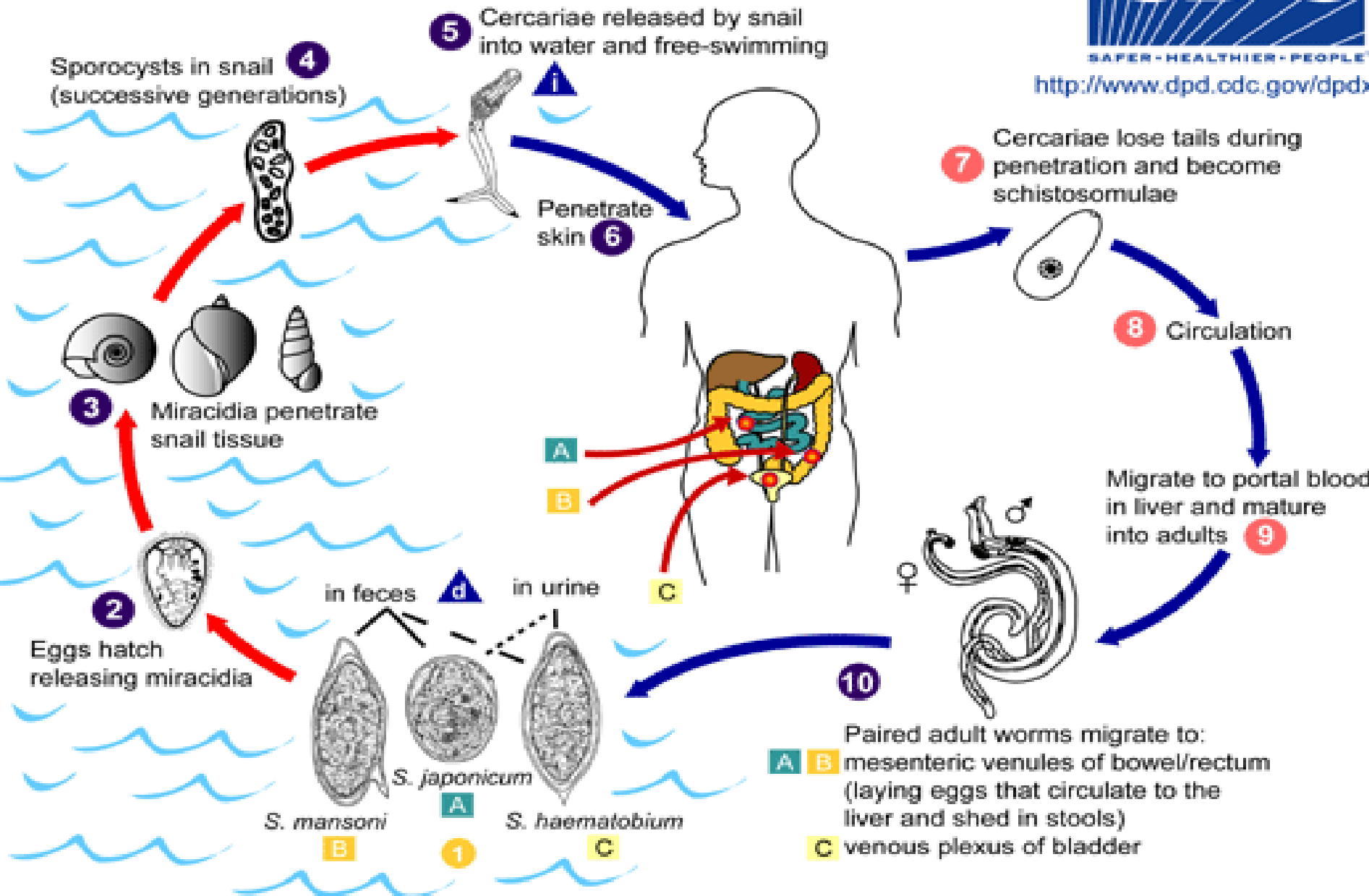
S. japonicum



Life cycle

- Humans infected when free-swimming, fork-tailed **cercariae** penetrate skin.
 - Differentiate to larvae (schistosomula), enter blood & carried via veins into arterial circulation.
- ↓
- Enter superior mesenteric artery pass into portal circulation & reach liver, (mature into adult flukes).
- ↓
- *S. mansoni* and *S. japonicum* adults migrate against portal flow to reside in mesenteric venules.
 - *S. haematobium* adults reach bladder veins through venous plexus between rectum & bladder.
- ↓
- Female lays fertilized eggs, which penetrate vascular endothelium & enter gut or bladder lumen.
 - Eggs excreted in stools or urine & must enter fresh water to hatch.
- ↓
- Once hatched, ciliated larvae (miracidia) penetrate **snails** (intermediate hosts) & undergo further development & multiplication to produce many cercariae.
 - Cercariae leave snails, enter fresh water, and complete cycle by penetrating human skin.

i = Infective Stage
d = Diagnostic Stage



Pathogenesis

- Eggs in liver induce **granulomas, fibrosis, hepatomegaly, & portal hypertension.**
- Granulomas formed in response to antigens secreted by eggs.
- Hepatocytes undamaged, liver function tests normal. Portal hypertension leads to **splenomegaly.**
- *S. mansoni* eggs damage wall of distal colon (inferior mesenteric venules).
- *S. japonicum* eggs damage walls of both small and large intestines (superior & inferior mesenteric venules).
- Damage due to digestion of tissue by proteolytic enzymes produced by egg & to host inflammatory response that forms granulomas in venules.
- Eggs of *S. haematobium* in wall of bladder induce granulomas & fibrosis, leading to **carcinoma of the bladder.**

Clinical findings

- Most patients asymptomatic.
- **Chronic infections:** symptomatic.
- **Acute stage:** Shortly begins after cercarial penetration: itching & dermatitis followed 2 to 3 weeks later by fever, chills, diarrhea, lymphadenopathy, & hepatosplenomegaly.
- Eosinophilia: Response to migrating larvae.
- **Chronic stage:** Significant morbidity & mortality.
- ***S. mansoni* or *S. japonicum* infection:** Gastrointestinal hemorrhage, hepatomegaly, massive splenomegaly & ruptured esophageal varices.
- ***S. haematobium*:** Hematuria, superimposed bacterial urinary tract infections.

- **Swimmer's itch:** Pruritic papules. Immunologic reaction to presence of cercariae in skin. Appear within minutes to hours after exposure (immediate/ IgE-mediated hypersensitivity).

Laboratory Diagnosis

- **Stool & Urine examination:** Ova in feces or urine.
- Large lateral spine of *S. mansoni*.
- No spine of *S. japonicum*.
- Large terminal spine of *S. haematobium*.
- **Serologic tests:** Not useful.
- Moderate Eosinophilia.

TREMATODES

Scale:
0 24 48 μm



Schistosoma japonicum



Schistosoma mansoni



*Schistosoma haematobium*¹

Treatment & Prevention

- Praziquantel.
- **Prevention:** Proper disposal of human waste & eradication of snail host when possible.
- Swimming in areas of endemic infection should be avoided.

MCQ # 1

- A retired Air Force colonel has had abdominal pain for 2 years; he makes yearly freshwater fishing trips to Puerto Rico and often wades with bare feet into streams. Which of the following should be in your differential diagnosis?
 - a. Trichinosis
 - b. Schistosomiasis
 - c. Toxoplasmosis
 - d. Visceral larva migrans
 - e. Giardiasis

MCQ # 2

- 397. Which of the following organisms penetrates skin, is endemic in Asia, and has a small lateral spine on its eggs?
 - a. Paragonimus
 - b. Clonorchis
 - c. *S. mansoni*
 - d. *S. japonicum*
 - e. *S. haematobium*

MCQ # 3

- Which of the following organisms penetrates skin, is endemic in Africa and the Middle East, has large terminal spines on its eggs, and is found in urine samples?
 - a. Paragonimus
 - b. Clonorchis
 - c. *S. mansoni*
 - d. *S. japonicum*
 - e. *S. haematobium*

SEQ # 1

- A 19-year-old man complained of several episodes of blood in his urine. He has no dysuria or urethral discharge. He is not sexually active. He is a college student but was born and raised in Egypt. Physical examination revealed no penile lesions. Urinalysis shows many red cells, no white cells and several large eggs with terminal spines.
- a) Name the causative agent of the disease.
- b) Name the other two species of this organism and the differences in their ova.
- c) Name two cestodes, nematodes and trematodes.