



**Medical Analysis
Department**

Trematoda (Blood Fluke)

Medical Parasitology II (MA302)

Summer School

Lecture 4

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Trematoda

They are leaf-shaped unsegmented, flat and broad helminths (hence the name fluke, from the Anglo-Saxon word *floe* meaning flatfish). The name trematode comes from their having large prominent suckers with a hole in the middle (Greek *trema*: hole, *eidos*: appearance)

***Schistosoma* sp.**

Classification Based on Habitat

Based on habitat, trematodes can be classified as (Table):

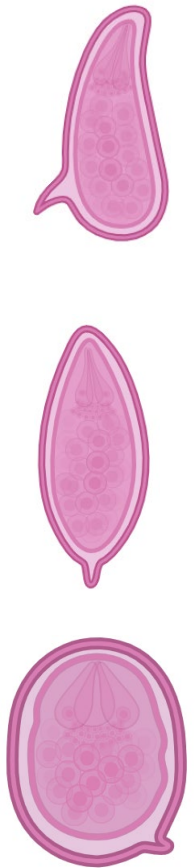
- Blood flukes
- Liver flukes
- Intestinal flukes
- Lung flukes.

Schistosoma sp.

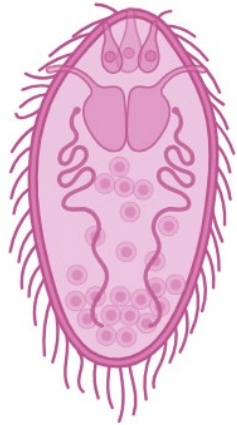
- Blood flukes, cylindrical in shape (not flat like other flukes).
- Dioecious (male and female are separate).
- Eggs with characteristic spines (species-specific).
- Life cycle involves snails (intermediate host) and humans (definitive host).
- Infection by skin penetration of cercariae in water.
- Adults live in blood vessels (mesenteric veins or bladder plexus).
- Cause schistosomiasis due to tissue reaction to eggs.

Schistosoma sp stages

Egg



Miracidia



Cercariae



Adult



Schistosoma Haematobium

Case study

A 14-year-old boy presented with painless blood in the urine and painful urination after frequently swimming in freshwater canals. Urine microscopy revealed terminal-spined eggs of *Schistosoma haematobium*. He was treated with praziquantel and advised to avoid swimming in contaminated freshwater, leading to complete recovery.

Epidemiology

This vesical blood fluke, formerly known as *bilharzia haematobium*, has been endemic in the Nile valley in Egypt

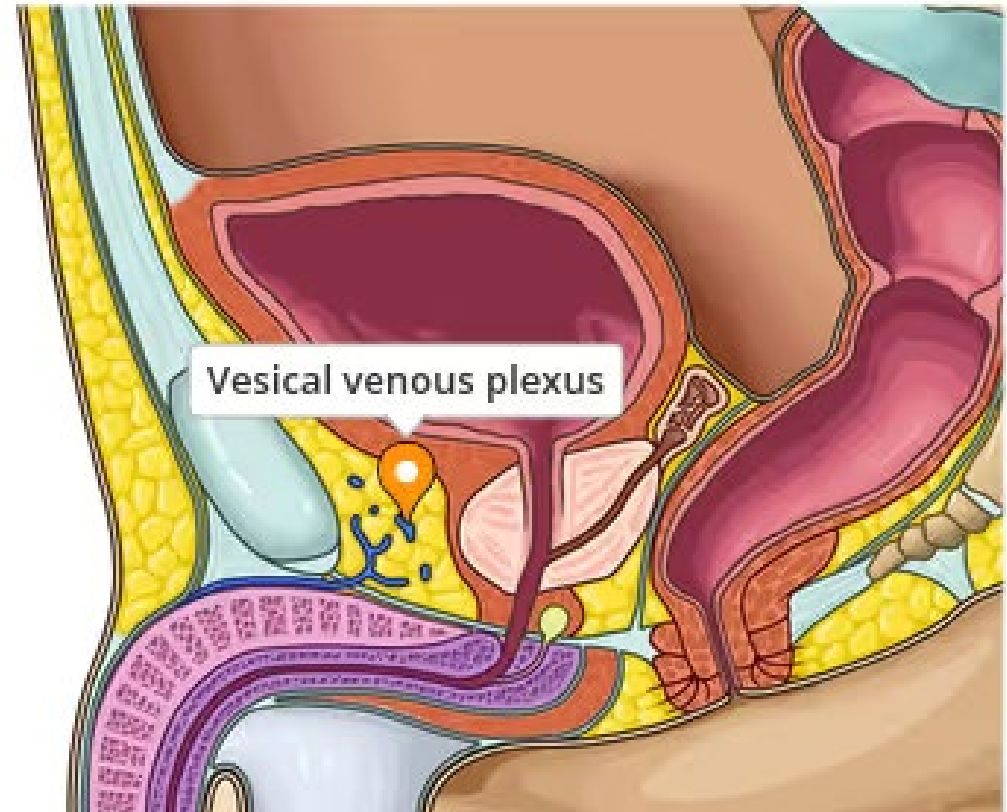
Although maximally entrenched in the Nile valley, *S. haematobium* is also endemic in most parts of Africa and in West Asia.

About 200 million persons are at a risk of infection and 90 million are infected by *S. haematobium* globally.



Habitat

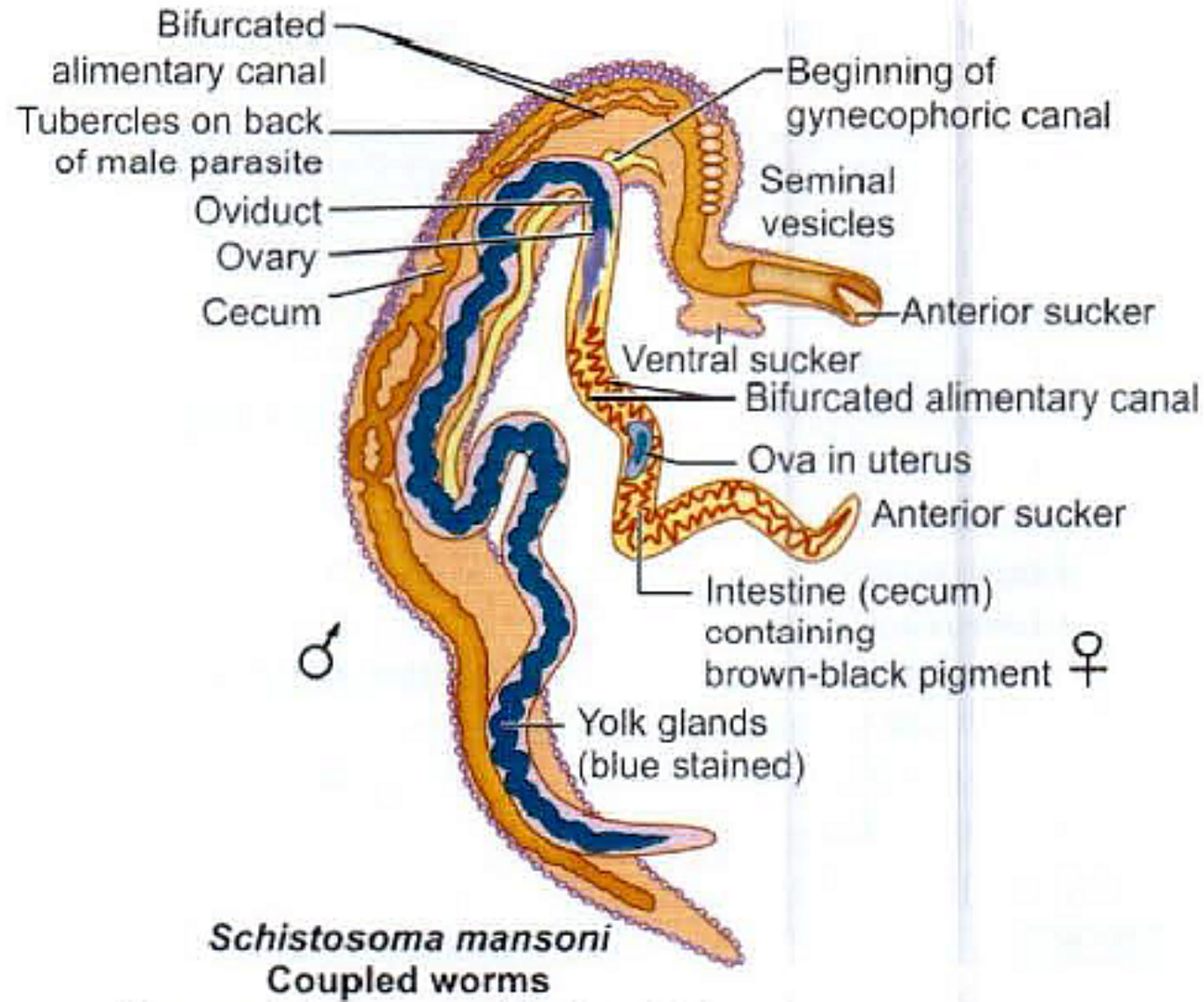
The adult worms live in the vesical and pelvic plexuses of veins.



Morphology

Adult worm

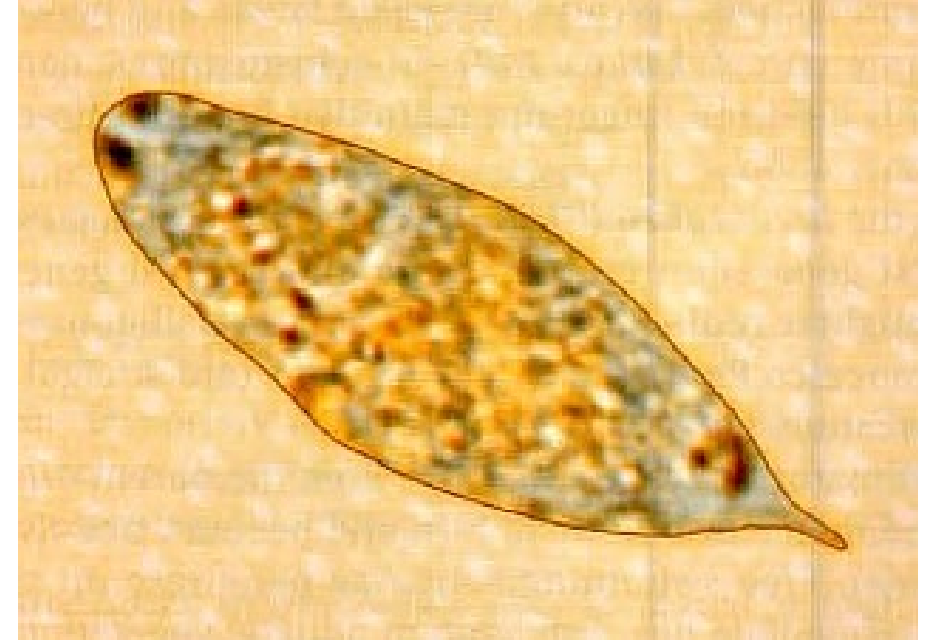
- The male is 15 mm long by 0.9 mm thick and covered by a thick tuberculate tegument.
- It has two muscular suckers: (1) the oral sucker being small and (2) the ventral sucker is large and prominent. Beginning immediately behind the ventral sucker and extending to the caudal end is the gynecophoric canal, in which the female worm is held (Fig. 3).
- the adult female is long and slender (20 mm by 0.25 mm).
- the gravid worm contains 20-30 eggs in its uterus at one time and may pass up to 300 eggs a day.



Morphology

Egg:

The eggs are elongated, brownish yellow (about $150\text{ }\mu\text{m}$ by $50\text{ }\mu\text{m}$) and nonoperculated. the eggs have characteristic terminal spine at one pole.



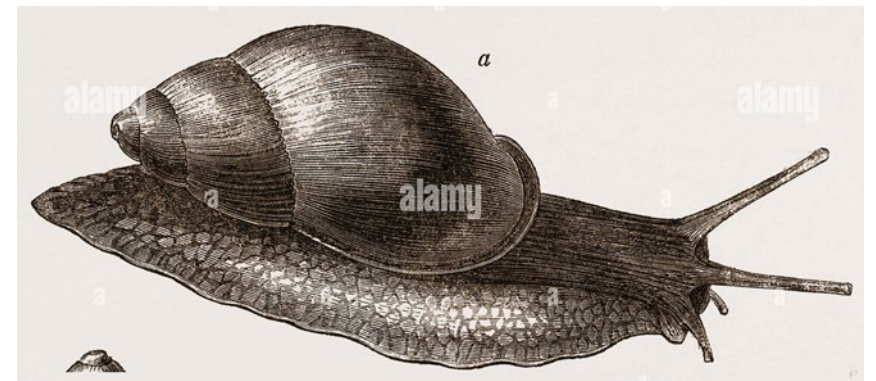
Life cycle

S. haematobium passes its life cycle in two hosts:

1. Definitive host: Humans are the only natural definitive hosts. o animal reservoir is known.

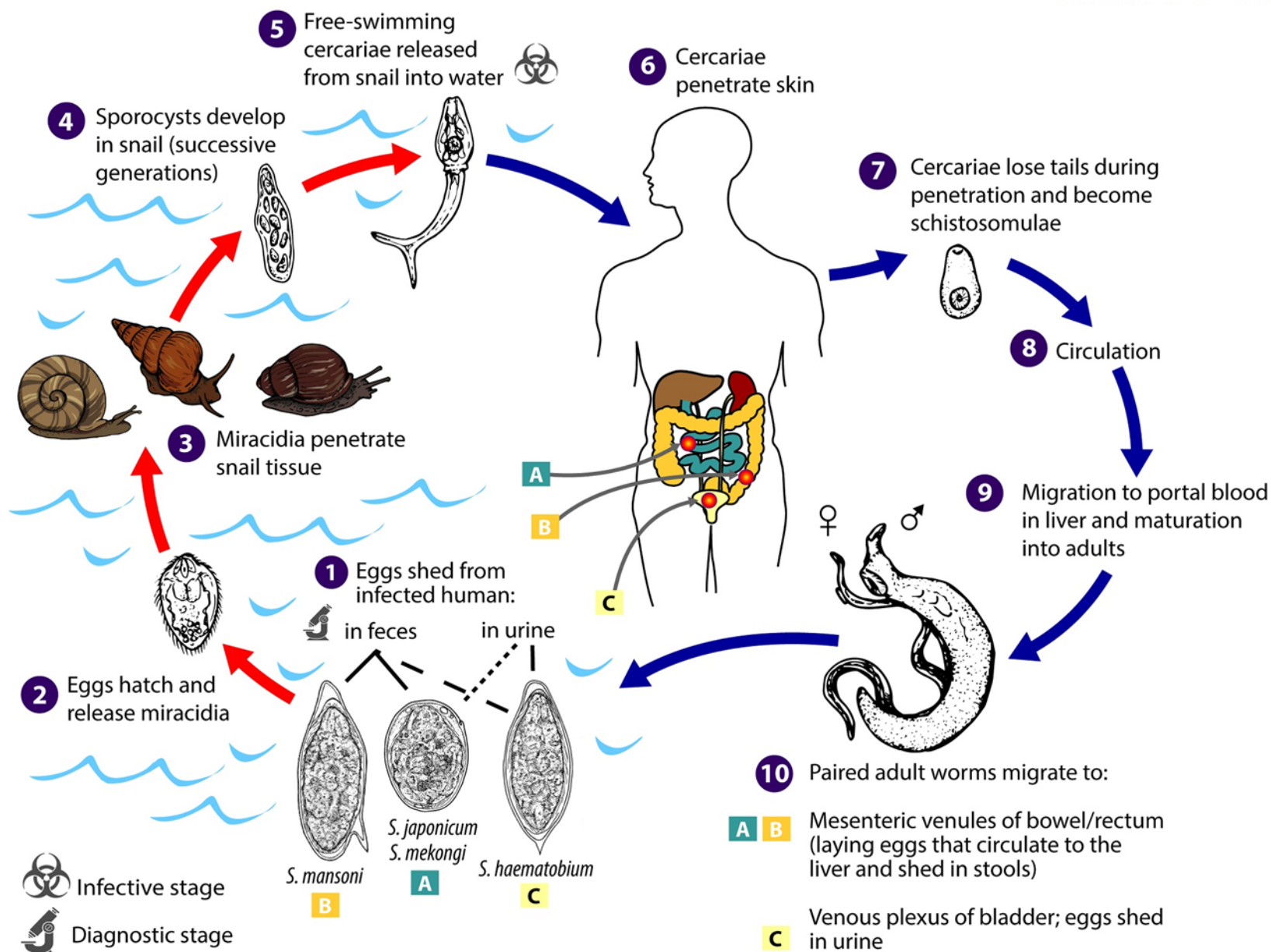


2. Intermediate host: Freshwater snails (snail of the genus *Bulinus*).



Life Cycle

- Eggs with terminal spine are passed in urine.
- In freshwater, eggs hatch → release miracidia.
- Miracidia infect *Bulinus* snails (intermediate host).
- Develop into sporocysts → cercariae.
- Cercariae leave snail and swim freely.
- Infect humans by penetrating skin in contaminated water.
- Transform into schistosomula → migrate via blood to venous plexus of the bladder.
- Mature into adult worms (male & female) in bladder veins → produce eggs, continuing the cycle.



Sign and Symptoms

Acute Schistosomiasis:

- Skin penetration causes itching and rash (swimmer's itch), more severe with nonhuman species.
- Schistosomule migration may lead to allergic or toxic reactions, cough, and mild fever.

Sign and Symptoms

Chronic Schistosomiasis:

- Eggs in bladder cause painless hematuria, dysuria, and proteinuria, especially in children.
- Bladder mucosa becomes inflamed, ulcerated, thickened with granulomas (sandy patches), fibrosis, and calcification.
- Complications include hydronephrosis, hydroureter, bladder carcinoma, chronic cystitis, and stone formation.
- Other organs that may be affected include lungs, CNS, skin, and genital organs.

Laboratory diagnosis

1. Urine microscopy:

The eggs with characteristic terminal spines can be demonstrated by microscopic examination

2. Histopathology:

Schistosome infection may also be diagnosed by demonstrating its eggs in bladder mucosa! biopsy and rectal biopsy

3. Serology:

Detection of antigen or antibody by ELISA

4. Ultrasonography (USG):

is also useful in diagnosing *S. haematobium* infection. USG may show hydroureter and hydronephrosis

Treatment

Treatment

- **Praziquantel** (40-60 mg per kg in divided doses in a single day) is the drug of choice.
- **Metriphonate** is the alternative drug of choice in schistosomiasis due to *S. haematobium* (7.5 mg/kg weekly for 3 weeks).



Schistosoma Mansoni

Case study

A 28-year-old farmer complained of abdominal pain, bloody diarrhea, and fatigue after repeated exposure to irrigation canals. Stool examination revealed lateral-spined eggs of **Schistosoma mansoni**. He received praziquantel therapy and was educated on avoiding contaminated freshwater exposure, resulting in complete recovery.

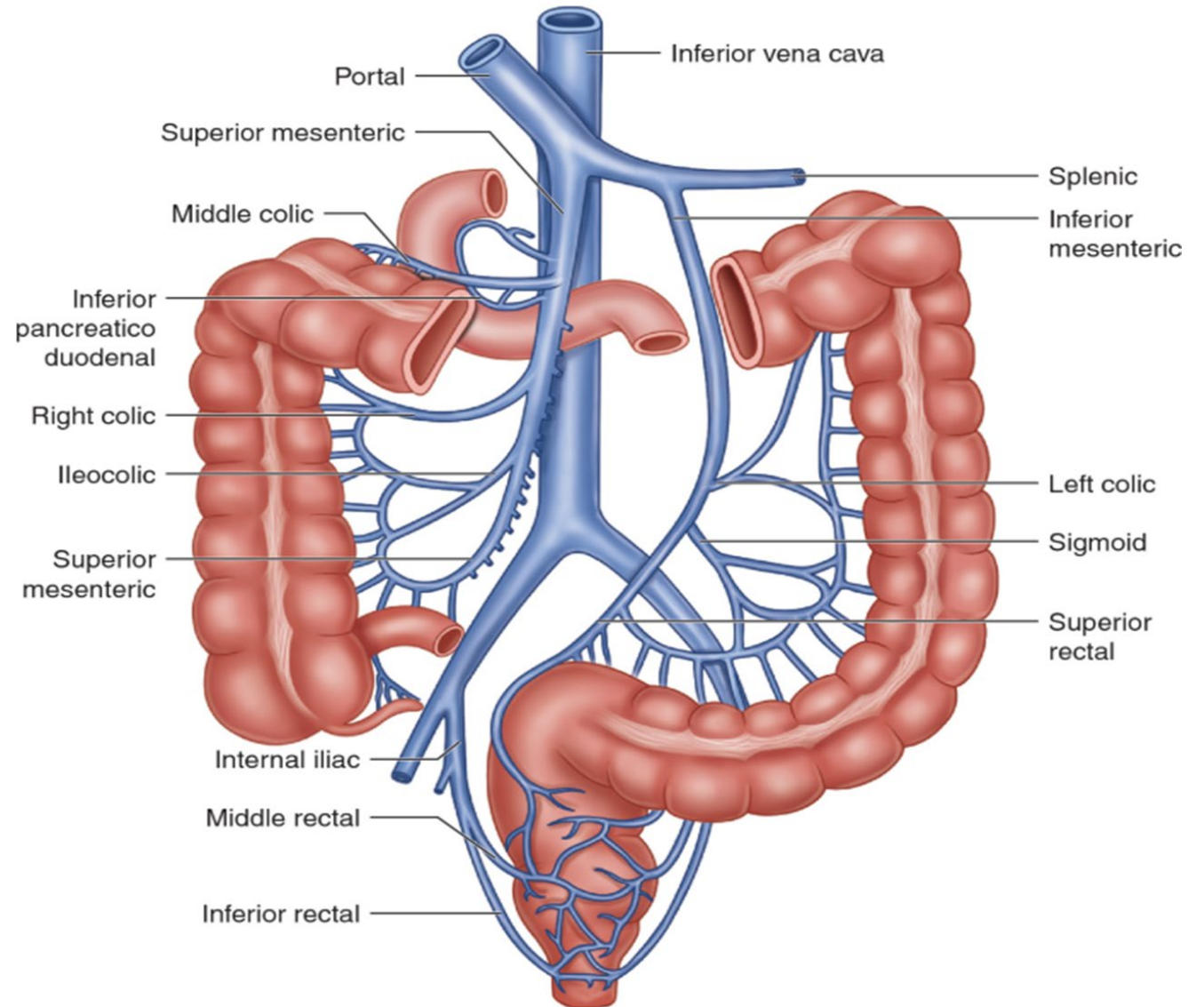
Epidemiology

It is widely distributed in Africa, South America and the Caribbean islands.



Habitat

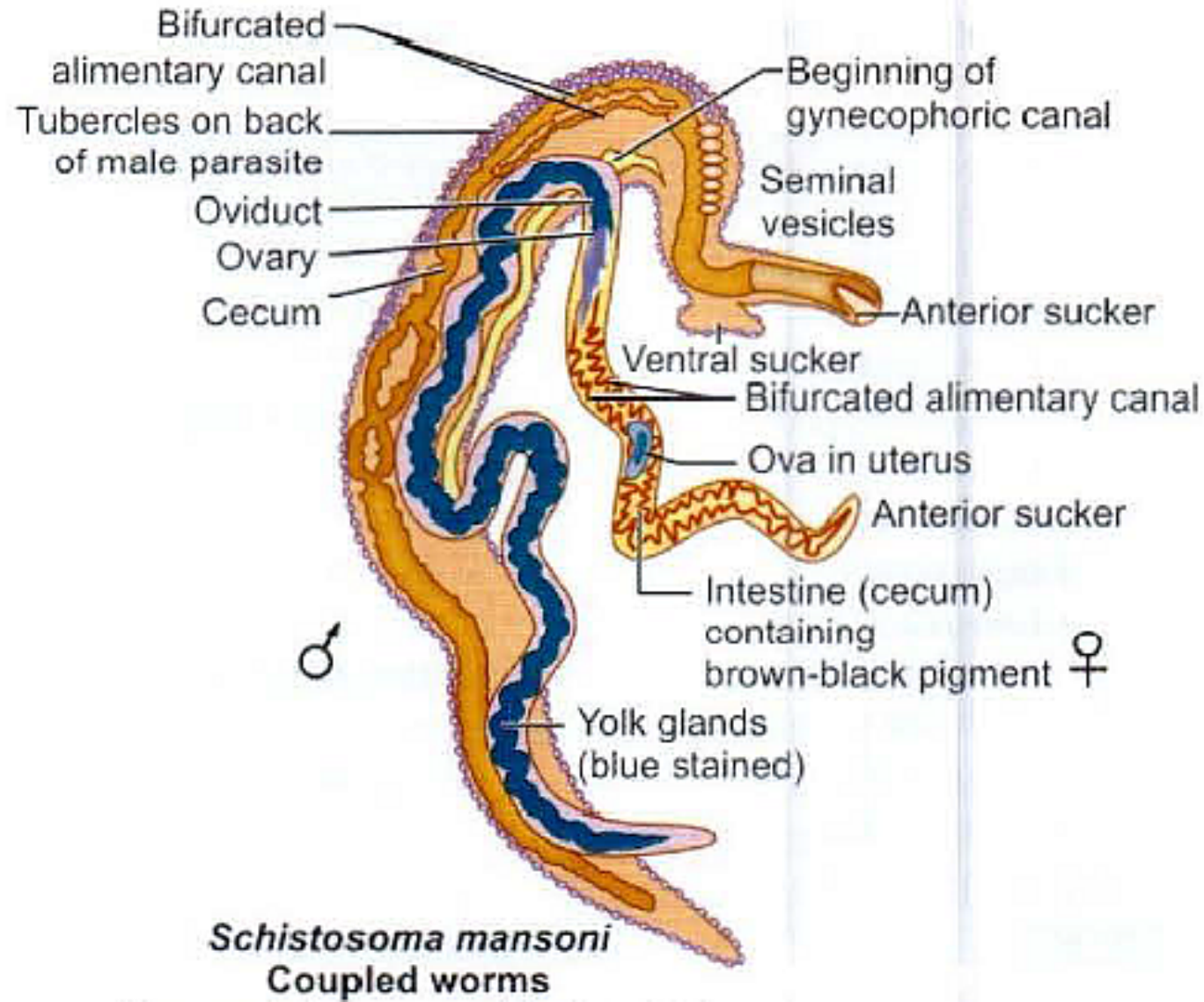
Adult worm lives in the inferior mesenteric vein.



Morphology

Adult worm

- *S. mansoni* resembles *S. haematobium* in morphology and life cycle, except:
- The adult worms are smaller and their integuments studded with prominent coarse tubercles.
- The prepatent period (the interval between cercarial penetration and the beginning of egg laying) is 4-5 weeks.



Morphology

Egg:

The egg has a characteristic lateral spine, more near to the rounded posterior end. The eggs are nonoperculated and yellowish brown.



Life cycle

Definitive host: Humans are the only natural definitive hosts, though in endemic areas monkeys and baboons have also been found infected.

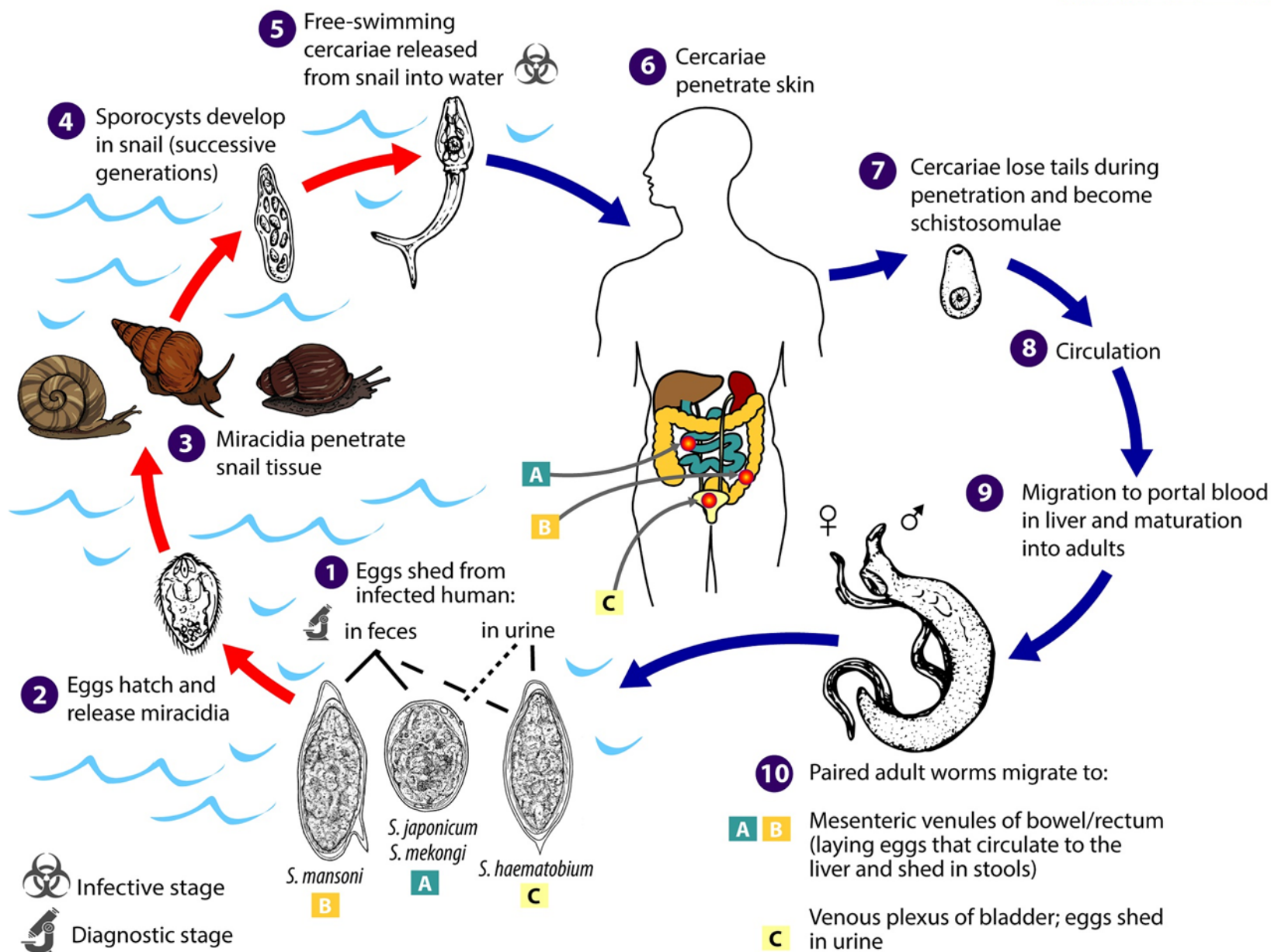


Intermediate host: freshwater snails of the genus *Biomphalaria*.



Life Cycle

- Eggs with lateral spine are passed in feces.
- In freshwater, eggs hatch releasing miracidia.
- Miracidia infect Biomphalaria snails (intermediate host). Develop into sporocysts → cercariae.
- Cercariae leave the snail and swim freely.
- Infection occurs when cercariae penetrate human skin in contaminated water.
- They transform into schistosomula, migrate via circulation to mesenteric veins of large intestine.
- Mature into adult worms, produce eggs, and cycle repeats.



Sign and Symptoms

Cercarial dermatitis:

Following skin penetration by cercariae: A pruritic rash called as cercarial dermatitis or swimmers itch may develop locally. It is a self-limiting disease.

Sign and Symptoms

Katayama Fever (Acute Schistosomiasis):

- Occurs 4–8 weeks after infection when egg laying begins.
- Due to immune complex reaction from high worm load.
- Symptoms: fever, rash, joint pain, hepatosplenomegaly, lymphadenopathy, eosinophilia.

Intestinal Schistosomiasis (Chronic):

- Egg deposition in intestine causes abdominal pain and bloody diarrhea.
- Leads to microabscesses, granulomas, fibrosis, mainly in colon and rectum.
- Eggs carried to liver cause hepatosplenomegaly, periportal fibrosis, and portal hypertension.
- Complications: gastrointestinal bleeding.

Laboratory diagnosis

1. Stool microscopy:

Eggs with lateral spines may be demonstrated microscopically in stools.

2. Rectal biopsy:

Proctoscopic biopsy of rectal mucosa may reveal eggs when examined as fresh squash preparation between two slides.

3. Serology:

Detection of antigen or antibody by ELISA

4. Imaging:

Ultrasonography is useful to detect hepatosplenomegaly and periportal fibrosis.

Treatment

- **Praziquantel** (single oral dose 40 mg/kg) is the drug of choice.
- **Oxamniquine** (single oral dose 15 mg/ kg) is also effective. It damages the tegument of male worm and thereby, makes the worm more susceptible to the action of the immune



Schistosoma Japonicum

Case study

A 40-year-old rice farmer presented with chronic abdominal pain, diarrhea, and hepatosplenomegaly after years of working in flooded rice fields. Stool examination demonstrated small lateral-knobbed eggs of **Schistosoma japonicum**. He was treated with praziquantel and advised to reduce contact with contaminated freshwater, leading to clinical improvement.

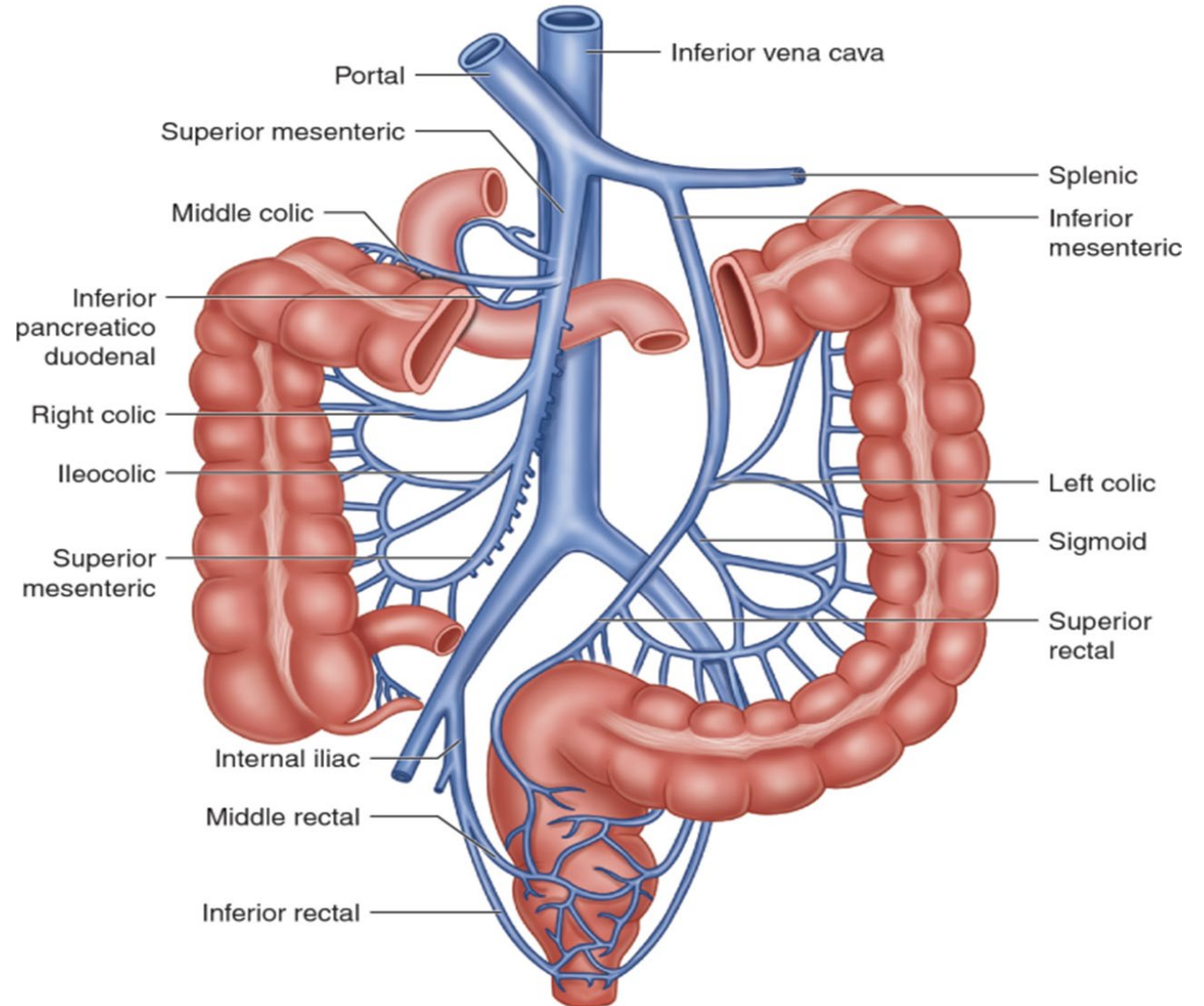
Epidemiology

S. japonicum is found in the Far East, Japan, China, Taiwan, Philippines and Sulawesi.



Habitat

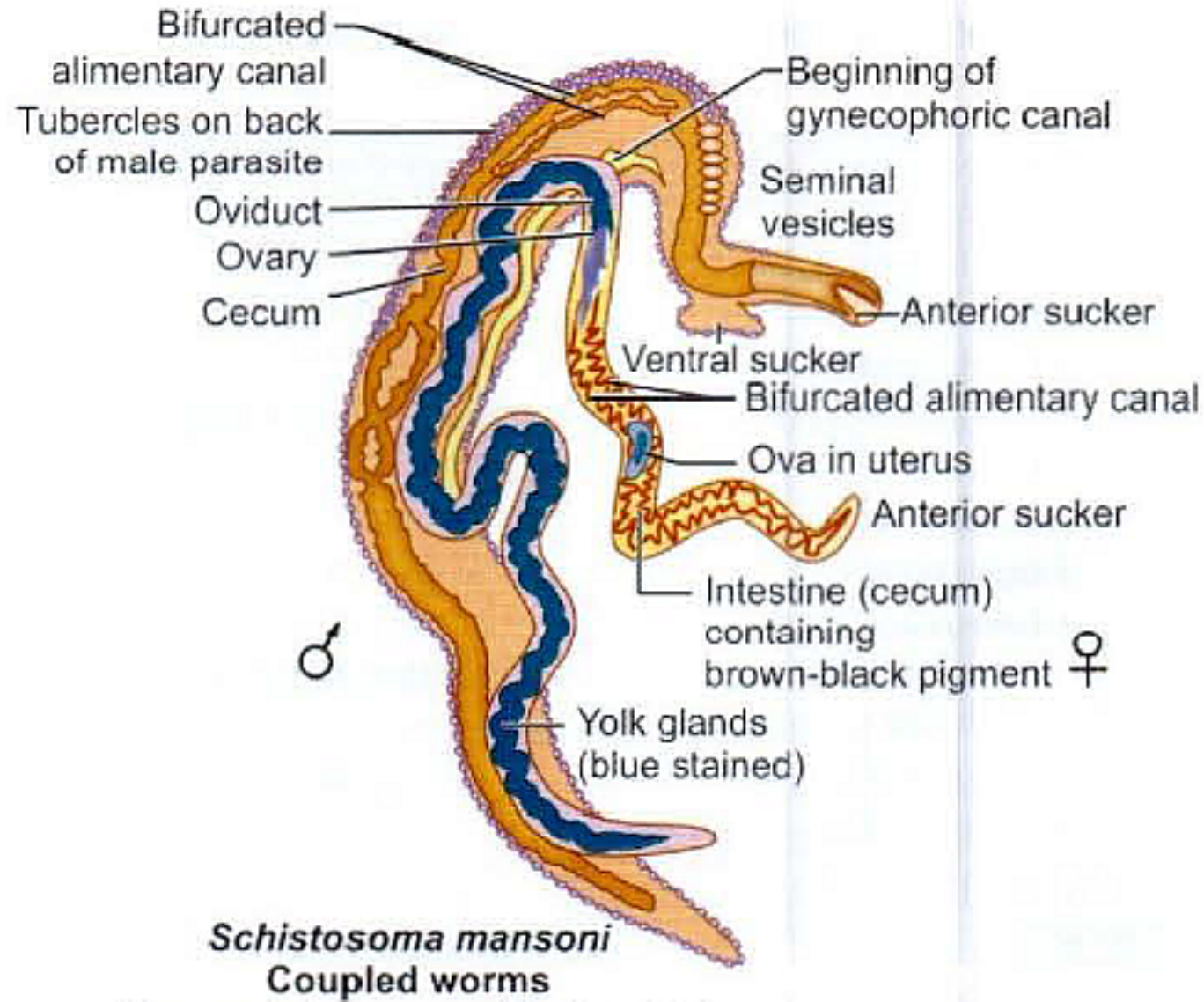
The adult worms are seen typically in the venules of the superior mesenteric vein draining the ileocecal region.

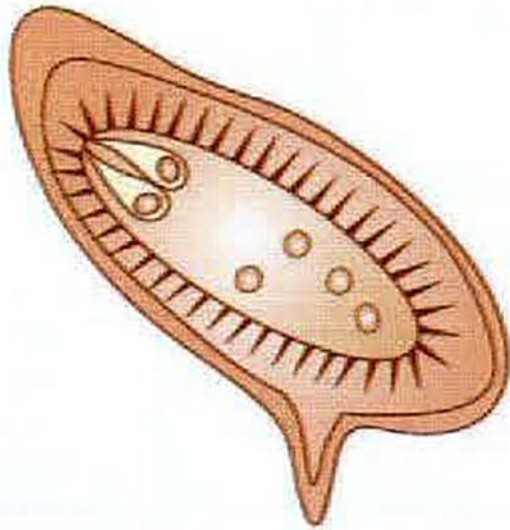


Morphology

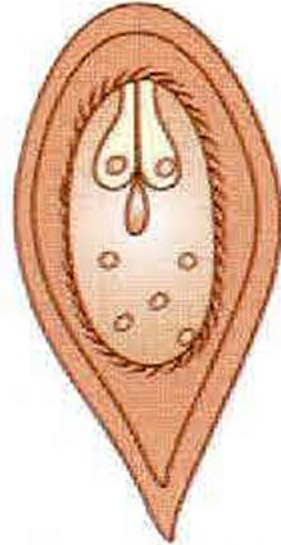
Adult worm

- Morphologically, they are similar to the schistosomes described earlier
- The prepatent period is 4-5 weeks.

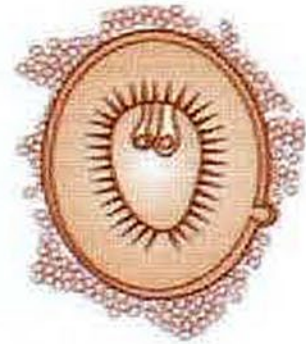




S. mansoni
Ova with a lateral spine
(obtained from stool)



S. haematobium
Ova with a terminal spine
(obtained from urine)

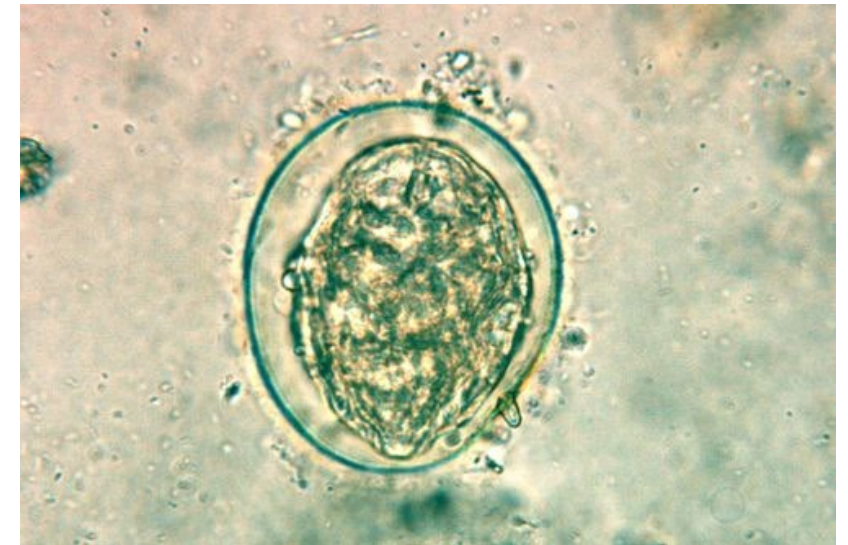


S. japonicum
Ova with a lateral knob
(obtained from stool)
Note: The characteristic surround
of tissue particles

Morphology

Egg:

The eggs are smaller and more spherical than those of *Schistosoma haematobium* and *Schistosoma mansoni*. The egg has no spine, but shows a lateral small rudimentary knob



Life cycle

Definitive host: Man is the definitive host but in endemic

areas, natural infection occurs widely in several domestic

animals and rodents, which act as reservoirs of infection.

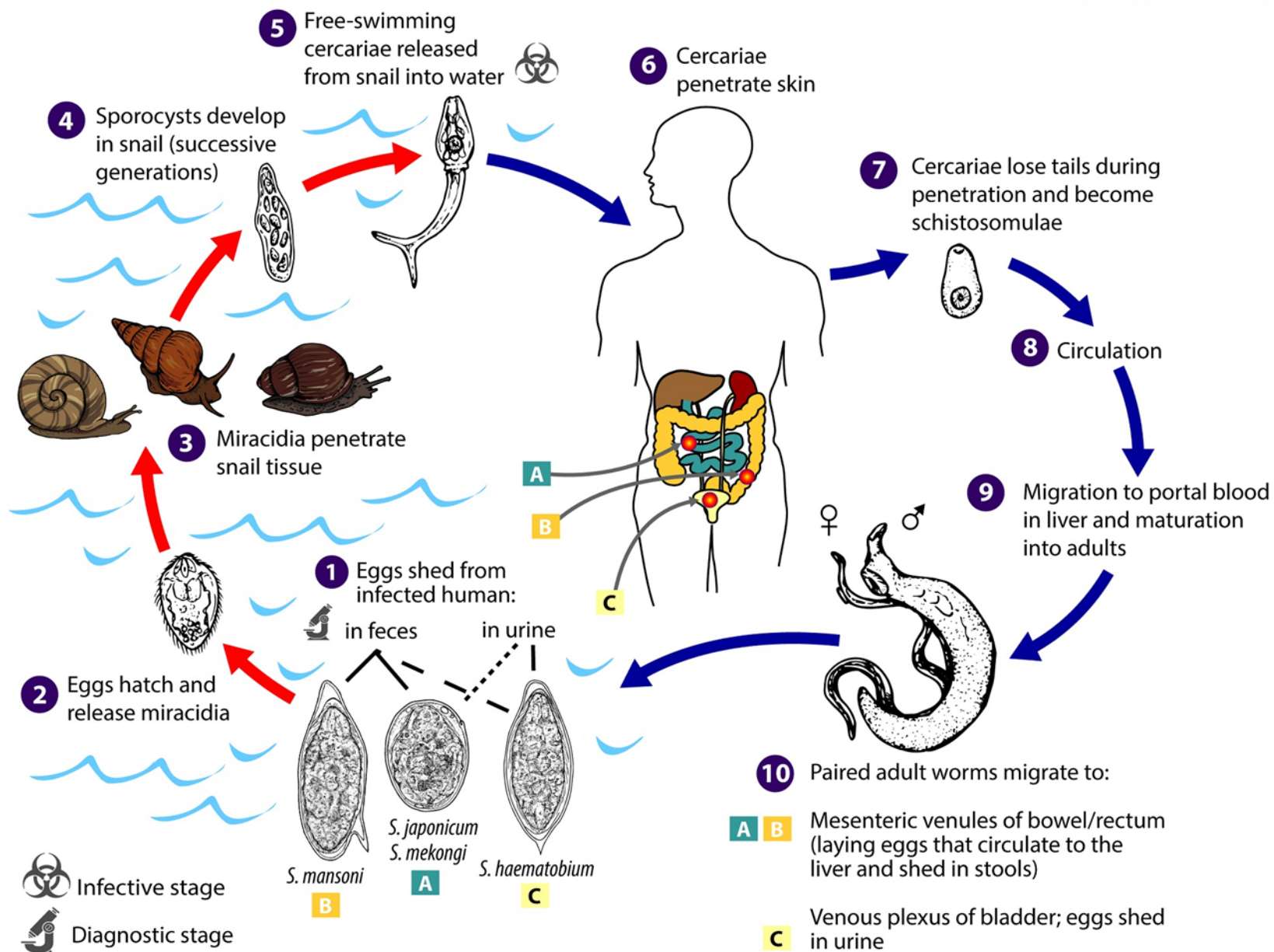
Intermediate host: Amphibian snails of the genus

Oncomelania.



Life Cycle

- Eggs with small lateral knob are passed in feces.
- In freshwater, eggs hatch releasing miracidia.
- Miracidia infect *Oncomelania* snails (intermediate host). Develop into sporocysts → cercariae.
- Cercariae leave the snail and swim freely.
- Humans get infected when cercariae penetrate the skin in contaminated water.
- They become schistosomula, migrate via circulation to mesenteric veins of small intestine.
- Mature into adult worms, produce eggs, and the cycle continues.



Sign and Symptoms

Causes Oriental schistosomiasis (Katayama disease). More severe than *S. mansoni* due to higher egg production. Acute phase: Katayama fever (similar to *S. mansoni*).

Chronic phase: intestinal hyperplasia, hepatosplenomegaly, periportal fibrosis (clay pipe-stem), portal hypertension → esophageal varices, GI bleeding. Intestinal symptoms: abdominal pain, bloody diarrhea, anemia.

Complications: CNS involvement (epileptic seizures, spinal lesions) and lung disease (cor pulmonale) in some cases.

Laboratory diagnosis

1. Stool microscopy:

Eggs with lateral Knob may be demonstrated microscopically in stools.

2. Rectal biopsy:

Proctoscopic biopsy of rectal mucosa may reveal eggs when examined as fresh squash preparation between two slides.

3. Serology:

Detection of antigen or antibody by ELISA

4. Imaging:

Ultrasonography is useful to detect hepatosplenomegaly and periportal fibrosis.

Treatment

S. japonicum infection is more resistant to treatment than other schistosomiasis. A prolonged course of intravenous tartar emetic gives good results. Praziquantel is the drug of choice.



References

- Paniker, C. K. J. & Ghosh, S. 2021. *Paniker's textbook of medical parasitology*, New Delhi, Jaypee Brothers Medical Publishers.