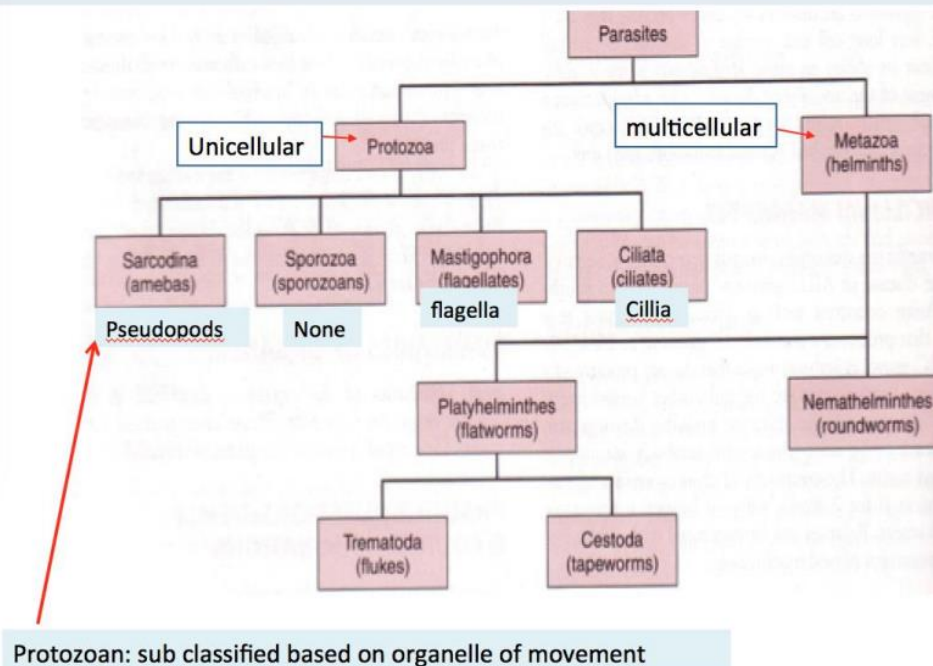




Trematodes Lec.1

Classification of Parasites



The helminthes are **multicellular** parasites (metazoa) **bilaterally symmetrical** animals having three germ layers

- The term *helminth* (Greek *helmins*-worm) originally referred to intestinal worms, but now comprises many other worms, including tissue parasites as well as many free-living species.

Helminths, which occur as parasite in humans, belong to two phyla

1. **Phylum *Platyhelminthes* (flatworms):** It includes two classes:
 - i. **Class: Trematoda** (flukes or digeneans)
 - ii. **Class: Cestoda** (tapeworms)
2. **Phylum *Nemathelminthes*:** It includes class nematoda



**Table: features of different classes of helminthes**

	Trematodes	Cestodes	Nematodes
shape	Leaf-like unsegmented	Tape-like, segmented	Elongated, cylindrical, unsegmented
Head end	Suckers present; but no hooks	Suckers present; some have attached hooks	Hooks and sucker absent. Well-developed buccal capsule with teeth or cutting plates seen in some species
Alimentary canal	Present but incomplete, no anus	Absent	Complete with anus
Body cavity	Absent	Absent	Present
sex	Not separate: Hermaphrodite except Schistosoma	Not separate: Hermaphrodite (monoecious)	Separate (diecious)
Life cycle	Requires three host except schistosomes (two host)	Requires two host except Hymenolepis (one host) and Diphyllbothrium (three host)	Requires one host except filarial worms (two host) and Dracunculus (two host)

Trematoda or trematodes or Digenea.

Commonly known as the flukes, they belong to

Phylum Platyhelminthes (flatworms)

Class Trematoda.

Classification of trematodes

The Classification of trematodes of medical importance is based on their habitat, the trematodes may be placed into two categories, those that reside in the intestine, bile duct, or lung (organ-dwelling) and those that reside in the blood vessels around the intestine and bladder (blood-dwelling).

A. Blood (Blood fluke)

1. *Schistosoma haematobium* (In the vesical and pelvic venous plexuses)
2. *Schistosoma mansoni* (In the inferior mesenteric vein)
3. *Schistosoma japonicum* (In the superior mesenteric vein)

B. Biliary tract (Liver fluke)

1. *Clonorchis sinensis*
2. *Opisthorchis viverrini*
3. *Fasciola hepatica*



C. Intestine (Intestinal fluke)

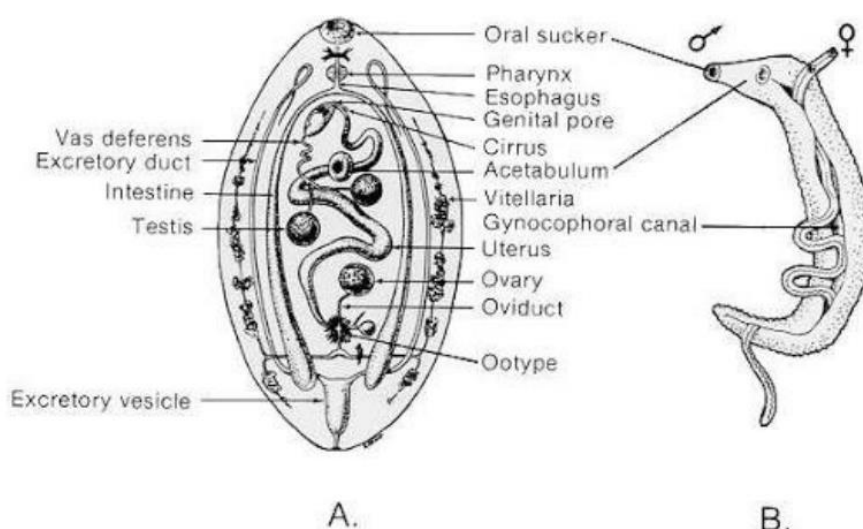
1. *Fasciolopsis buski*
2. *Heterophyes heterophyes*
3. *Metagonimus yokogawai*

D. Respiratory tract (Lung fluke)

1. *Paragonimus westermani*

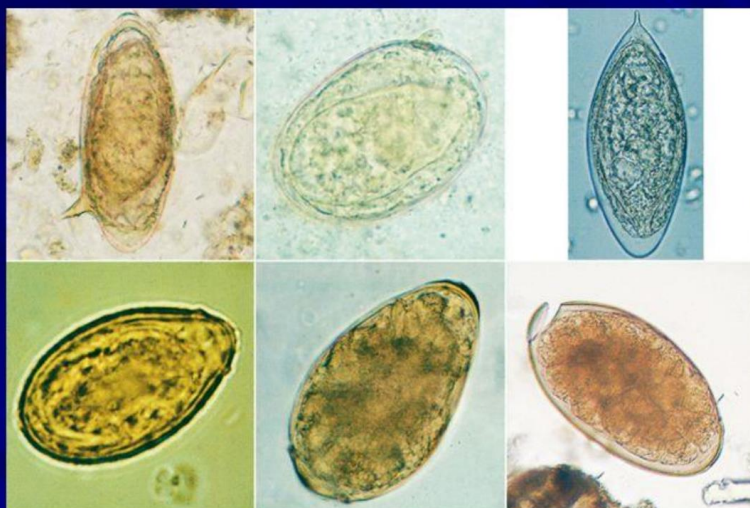
General characters:

1. Trematodes are unsegmented helminths, flat, broad and leaf shaped. They have large prominent suckers. The unique feature of flukes is the presence of two muscular cup-shaped suckers (hence called *distomata*) the **oral sucker** surrounding the mouth at the anterior end and the **ventral sucker** or *acetabulum* in the middle, ventrally



2. Trematodes are hermaphrodites except for schistosomes.
3. Their eggs are operculated except for schistosome eggs.

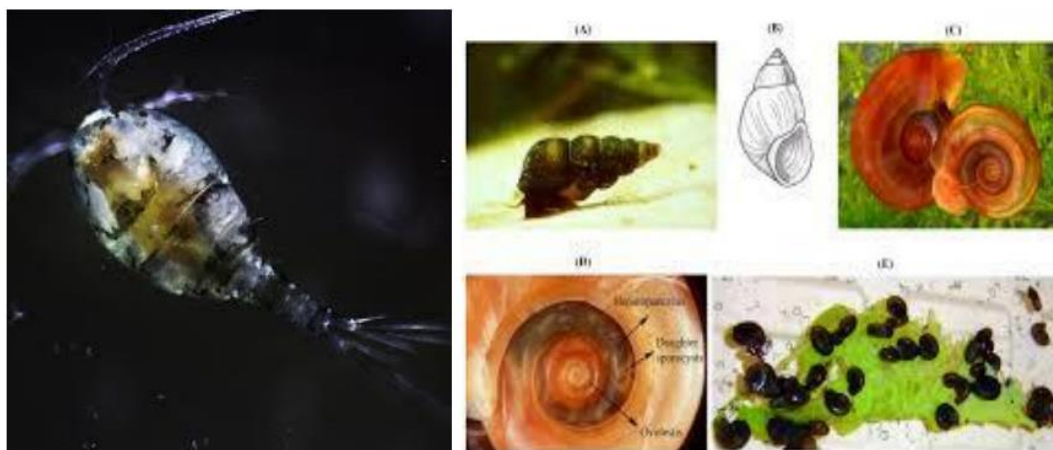
Eggs of trematodes



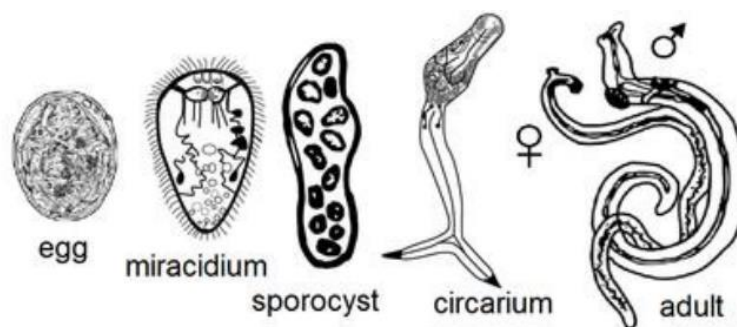
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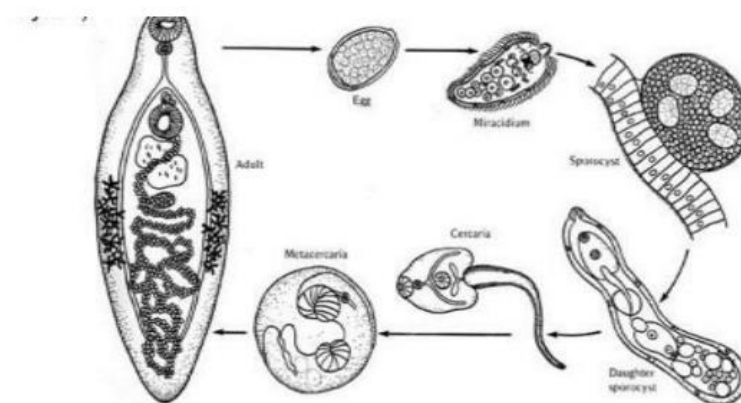
4. Snails are the only intermediate host for schistosomes and are the first intermediate host for other trematodes.



5. The miracidium is the 1st stage larva is ingested by the snail within the egg or release and penetrates the snail. The cercaria is the 2nd stage larva that develop in the redia (cylindrical larva) then attached to aquatic plants or aquatic organisms and develops into metacercaria.



6. Metacercaria (tailless encrusted larva) is the infective stage for trematodes except for schistosomes whereby cercariae is the infective stage.



7. The outer surface of the fluke is called the **tegument**. This is composed of scleroprotein. The tegument is the host-parasite interface, and metabolically active body covering performing all the vital activities such as protection, absorption and secretion



Blood flukes (schistosomes)

There are three main species of blood flukes that are primarily associated with disease in humans (known as **schistosomiasis**, **bilharziasis**, or snail fever), all belonging to the genus *Schistosoma*.

These three species are

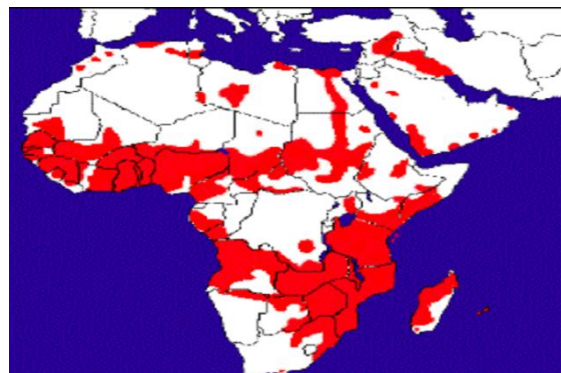
1. *Schistosoma haematobium*
2. *Schistosoma japonicum* (Oriental blood fluke)
3. *Schistosoma mansoni*.

The blood flukes differ in morphology and life cycle characteristics from the other trematodes. They are similar, however, by requiring a freshwater snail as the intermediate host. Schistosomiasis is devastating tropical disease ,being a major source of morbidity and mortality for developing countries in Africa, South America, the Caribbean, the Middle East, and Asia.

Schistosoma haematobium

Distribution

Schistosoma haematobium has been known to occur primarily in the Old World. Almost all of Africa and portions of the Middle East, including Iran, Iraq, and Saudi Arabia are considered endemic regions.



Habitat

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

Intermediate host: snail genus *Bulinus*

Infective stage : bifurcated tail cercaria





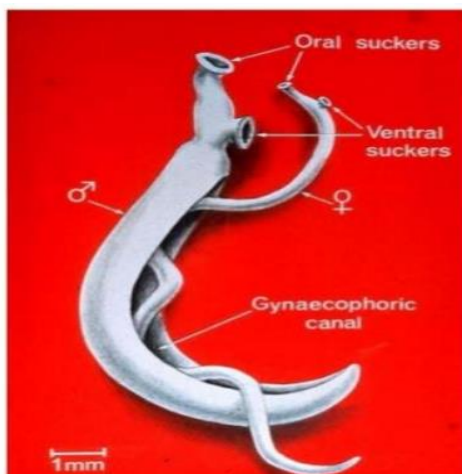
Morphology

The adult male worm is 10–15 mm long by 1 mm thick and is covered by a finely tuberculated cuticle.

It has 2 muscular suckers: a small oral sucker and a large prominent ventral sucker. Immediately behind the ventral sucker and extending to the caudal end is the gynecophoric canal, where the female worm is found.

The adult female is 20 mm by 0.25 mm with the cuticular tubercles confined to the 2 ends.

The gravid female worm contains 20–30 eggs in its uterus at one time and may pass up to 300 eggs a day.



Morphology

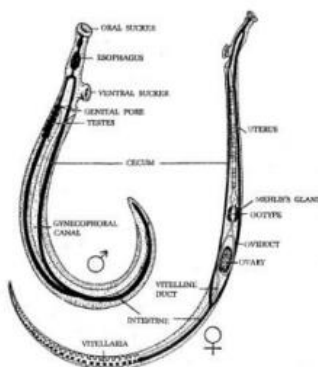
- Adult worms are 10 to 20 mm long
- Schistosomes have separate sexes
- the male has a canal in which the slender female worm resides

Morphology of Adult Schistosoma

Schistosoma is _____

Male worms are shorter and stouter than females.

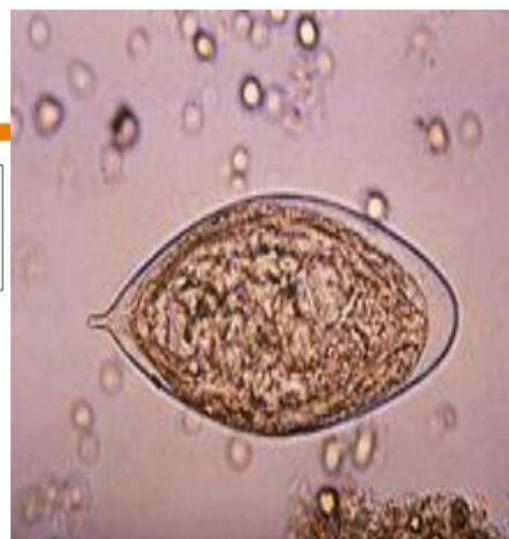
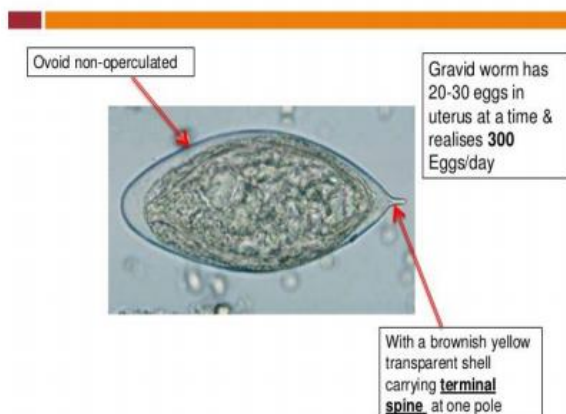
- males have
 - ventral longitudinal groove in which the female resides
 - several testes are located behind the acetabulum



The eggs

Are **elongated**, about 150 μm by 50 μm , **non-operculated**, with a **terminal spine** contain miracidium (embryonated) .

EGG





Mechanism of egg expulsion:

The eggs are laid usually in the small venules of the **vesical and pelvic plexuses**, though sometimes they are laid in the mesenteric portal system, pulmonary arterioles and other ectopic sites.

The eggs are laid one behind the other with the spine pointing posteriorly. From the venules, the eggs make their way through the vesical wall by the piercing action of the spine, assisted by the mounting pressure within the venules and a lytic substance released by the eggs. The eggs pass into the lumen of the **urinary bladder** together with some extravasated blood.

- they are discharged in the urine, particularly towards the end of micturition.
- For some unknown reasons, the eggs are passed in *urine* more during *midday* than at any other time of the day.
- The eggs laid in *ectopic sites* generally die and evoke local tissue reactions. They may be found, for instance in *rectal biopsies*, but are seldom passed live in feces.

Life cycle

S. haematobium passes its life cycle in two hosts:

1. **Definitive host:** Humans are the only natural definitive hosts. No animal reservoir is known.
2. **Intermediate host:** Freshwater snails (snail of the genus ***Bulinus***).

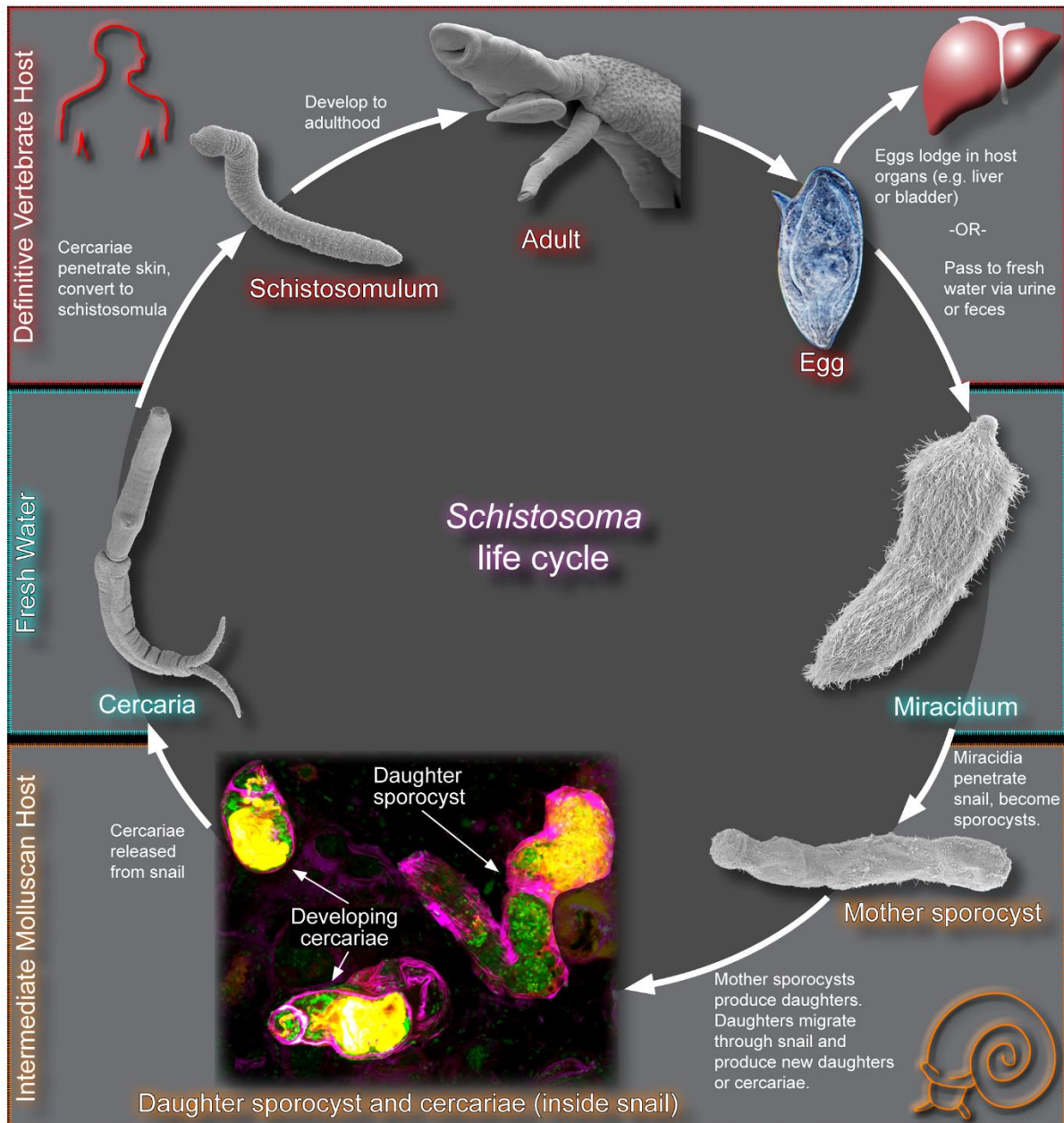
Infective form: Cercaria larva.

- The eggs that are passed in urine are embryonated and hatch in water under suitable conditions to release the free-living *ciliated miracidia*.
- Miracidia swim about in water and on encountering a suitable intermediate host (snail *Bulinus* species).

Development in snail: Inside the snail, the miracidia lose their cilia and in about 4-8 weeks, successively pass through the stages of the first and second generation sporocysts

- Large numbers of *cercariae* are produced by asexual reproduction within the second generation sporocyst. The cercaria has an elongated ovoid body and **forked tail** (bifurcated tail)
- The cercariae escape from the snail into water.
- Swarms of cercariae swim about in water for 1 -3 days. Persons become infected by contact with water containing cercariae during bathing.

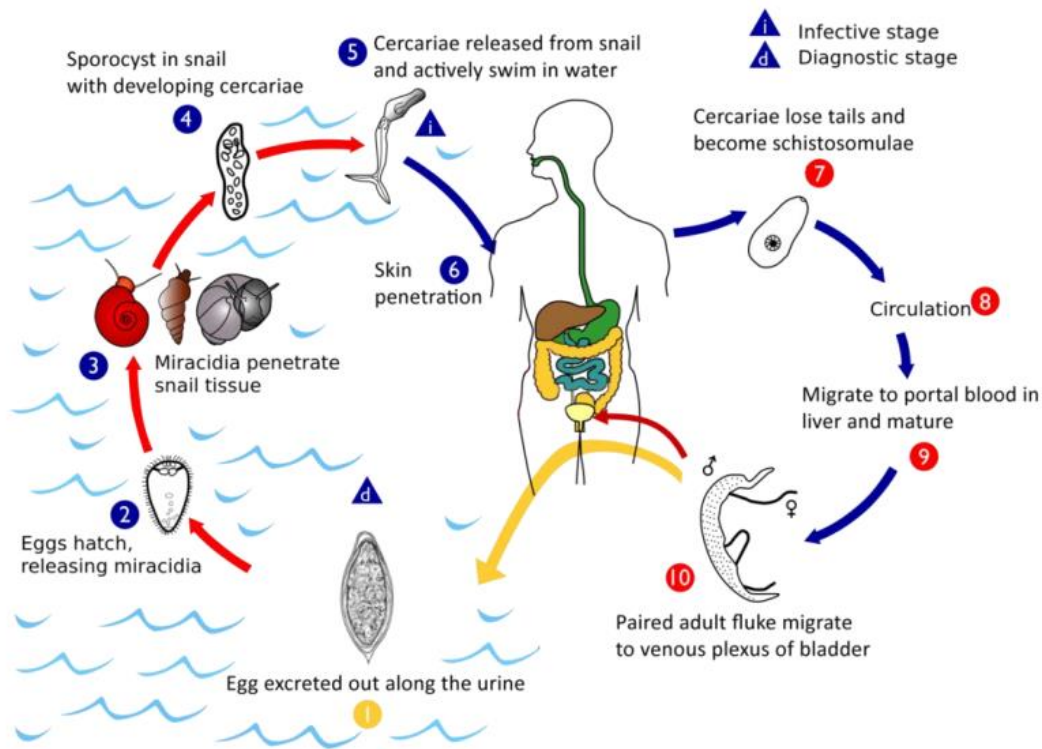
Suckers and **lytic substances** secreted by cercariae helps them to penetrate intact skin.



Development in man: After penetrating the skin, the cercariae lose their tails and become schistosomulae which travel via peripheral venules to systemic circulation.

- They then start a long migration, through the vena cava till it reaches the liver.
- In the intrahepatic portal veins, the schistosomulae grow and become sexually differentiated adolescents about 20 days after skin penetration.
- They then start migrating against the bloodstream into the inferior mesenteric veins, ultimately reaching the *vesical* and *pelvic venous plexuses*, where they mature, mate and begin laying eggs. Eggs start appearing in urine usually 10-12 weeks after cercarial penetration.

The adult worms may live for 20- 30 years.



Clinical stages and Pathology

✓ **Asymptomatic.** It is believed that most chronic *Schistosoma* infections contracted in known endemic areas remain asymptomatic.

✓ **Schistosomiasis, Bilharziasis.** Schistosomiasis can be divided into three phases:

(1) **The Prepatent stage** migratory phase lasting from penetration to maturity which will be in the form of **Cercarial dermatitis** patient will be presents with transient itching and petechial lesions at the site of entry of the cercariae , more often seen in visitors to endemic areas than among locals who may be immune due to repeated exposure. It last for 1 week and it is called (swimmer's itch)

(2) **The acute phase** which occurs when the schistosomes begin producing eggs, Clinical features during oviposition include painless terminal haematuria. Haematuria is initially microscopic, but become gross in heavy infection. Patients develop frequency of micturition with burning sensation. Cystoscopy shows hyperplasia and inflammation of bladder mucosa. In endemic regions, haematuria is so widespread that it is thought a natural sign of puberty for boys, and is confused with menses in girls.

Katayama fever (more common with *S. japonicum* and *S. mansoni* than *S. haematobium*) is a systemic hypersensitivity reaction to the schistosomulae migrating through tissue and deposition of ova in the host tissue. It is presented with rapid onset of fever, nausea, myalgia, malaise, fatigue, cough, diarrhea, and eosinophilia occur 1 to 2 months after exposure. Although rare in chronically exposed persons, it is common in people new to endemic areas, such as tourists and travelers.



(3) **The chronic phase** which occurs mainly in endemic areas many of the eggs die and become calcified eventually producing fibrosis of vesical mucosa and formation of egg granulomas (**sandy patches**), which may lead to urinary tract blocking leading to obstructive uropathy (hydroureter and hydronephrosis), which can be further complicated by bacterial infection and kidney failure. In the most severe condition, chronic bladder ulcers and bladder carcinoma develop.

