SCHISTOSOMA HAEMATOBIUM

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Schistosomes are dioecious, (sexes are separate) trematodes, which lead to Schistosomiasis (bilharziasis). Schistosomiasis is a water-borne disease constituting an important public health problem and affecting millions of persons in Africa, Asia, and Latin America. It is estimated that over 100 million people are infected with ***S. haematobium, S. mansoni*** and ***S. Japonicum*** each. Two other species of Schistosoma parasitizing humans are ***S. mekongi*** and ***S. intercalatum*****.** The male worm is broader than the female and its lateral borders are rolled ventrally into a cylindrical shape, producing a long groove or trough called gynecophoric canal, in which the female is held. It appears as though the body of the male is split longitudinally toproduce this canal; hence the name schistosome (GreekSchisto: split and soma: body).

Schistosomes were formerly called **Bilharzia** after **Theodor Bilharz** who in 1851, first observed the worm in the mesenteric veins of an Egyptian in Cairo. All schistosomes live in venous plexuses in the body of the definitive host, the location varying with the species.

SYSTEMATIC POSITION

Phylum: Platyhelminthes
Class : Trematoda
Subclass: Digenea
Order: Prosostomata
Suborder: Strigeata
Superfamily: Schistosomatoidea
Genus: Schistosoma
Species : *haematobium, S. mansoni, S. japonicum, S. intercalatum*

GEOGRAPHICAL DISTRIBUTION

Various parts of Africa and Middle East.

Habit and Habitat

Adult worm live in copula, in the pelvic venous plexus – vesical, prostatic and uterine plexuses of veins.

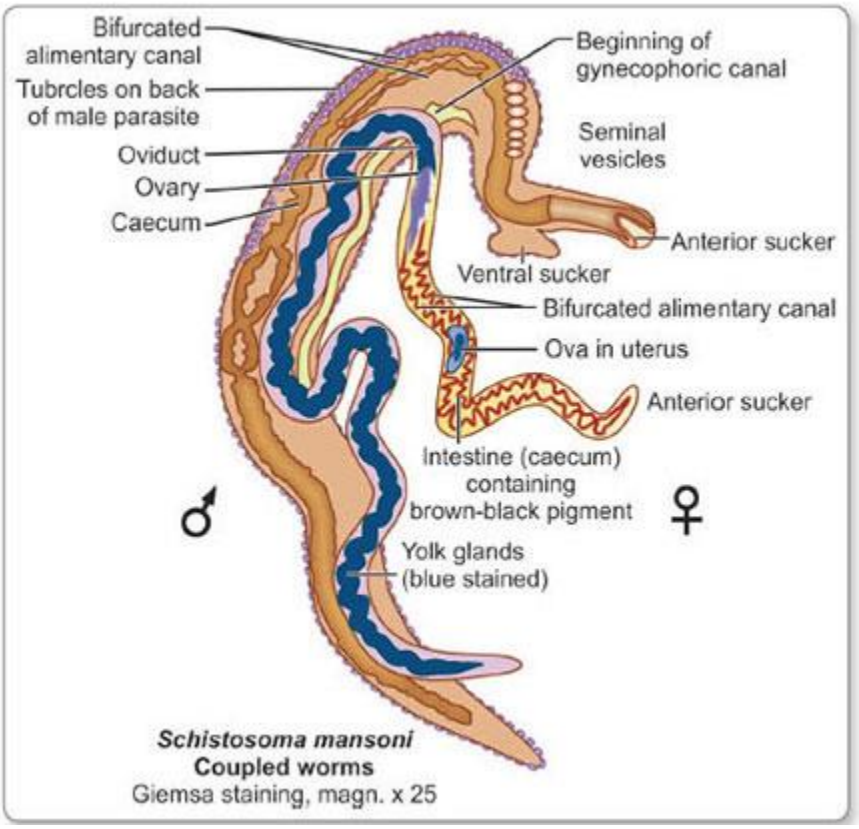
Differentiating features of *S. haematoboum, S. mansoni* and *S. japonicum*

	Schistosoma haematobium	*Schistosoma mansoni*	*Schistosoma japonicum*
Habitat	Veins of the vesical and pelvic plexuses, less commonly in portal vein and its mesenteric branches	Inferior mesenteric vein and its branches	Superior mesenteric vein and its branches
Morphology			
Size: *Male* *Female*	1.5 cm × 1 mm 2 cm × 0.22 mm	1 cm × 1 mm 1.4 cm × 0.25 mm	1.2–2 cm × 0.5 mm 2.6 cm × 0.3 mm
Integument	Finely tuberculated	Grossly tuberculated	Non-tubercular
Number of testes	4–5 in groups	8–9 in a zigzag row	6–7 in a single file
Ovary	In the posterior one-third of the body	In the anterior half of the body	In the middle of the body
Uterus	Contains 20-30 eggs	1–3 eggs	50 or more eggs
Egg	Elongated with terminal spine	Elongated with lateral spine	Round with small lateral knob
Cephalic glands in Cercariae	2 pairs oxyphilic and 3 pairs basophilic	2 pairs oxyphilic and 4 pairs basophilic	5 pairs oxyphilic, no basophilic
Distribution	Africa, Near East, Middle East, India	Africa and south America	China, Japan, far east (oriental)
Definitive host	Man	Man	Man (mainly) domestic animals & rodents (which act as reservoir of infection
Intermediate host	Snail of Genus *Bulinus*	Snail of Genus *Biomphalaria*	Amphibian snail of Genus *Oncomelania*

Morphology

Adult worm

- The male is 10–15 mm long by 1 mm thick and covered by a finely tuberculated cuticle.
- It has 2 muscular suckers, the oral sucker being small and the ventral sucker 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.
- The adult female is long and slender, 20 mm by 0.25 mm with the cuticular tubercles confined to the two ends.
- The gravid worm contains 20–30 eggs in its uterus at one time and may pass up to 300 eggs a day.

Eggs

- The eggs are ovoid, about 150 µm by 50 µm, non-operculated, with a brownish yellow transparent shell carrying a terminal spine at one pole.
- The terminal spine being characteristic of the species.

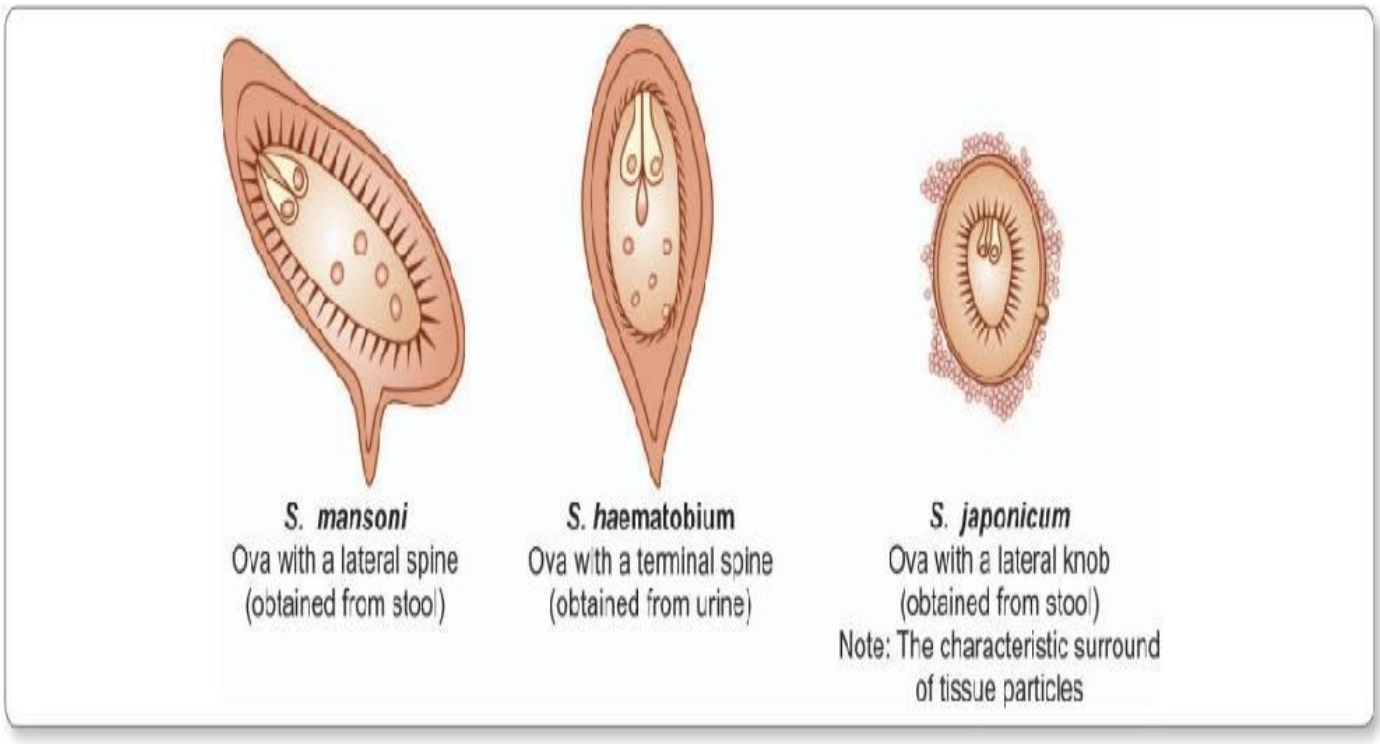


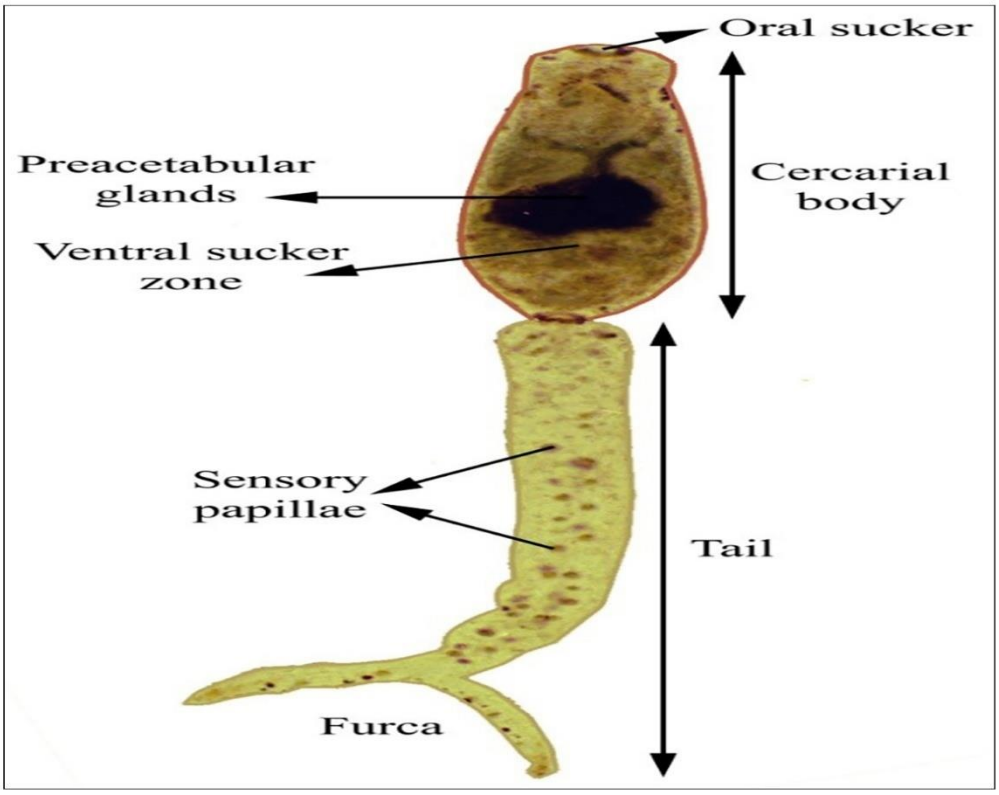
Fig. 13.7: Schematic diagram to show distinguishing features of eggs of *S. mansoni*, *S. haematobium*, and *S. japonicum*

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. heamatobium*** passes its life cycle in 2 hosts.
- **Definitive host:** Humans are the only natural definitive hosts. No animal reservoir is known.
- **Intermediate host:** Fresh water snails (*Bulinus truncatus*).
- **Infective form:** Cercaria larva (Fork tail cercaria)



- 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, penetrate into its tissues and reach its liver.
- The intermediate hosts are snails of Bulinus species in Africa.
- In India, the intermediate host is the limpet, Ferrisia tenuis.

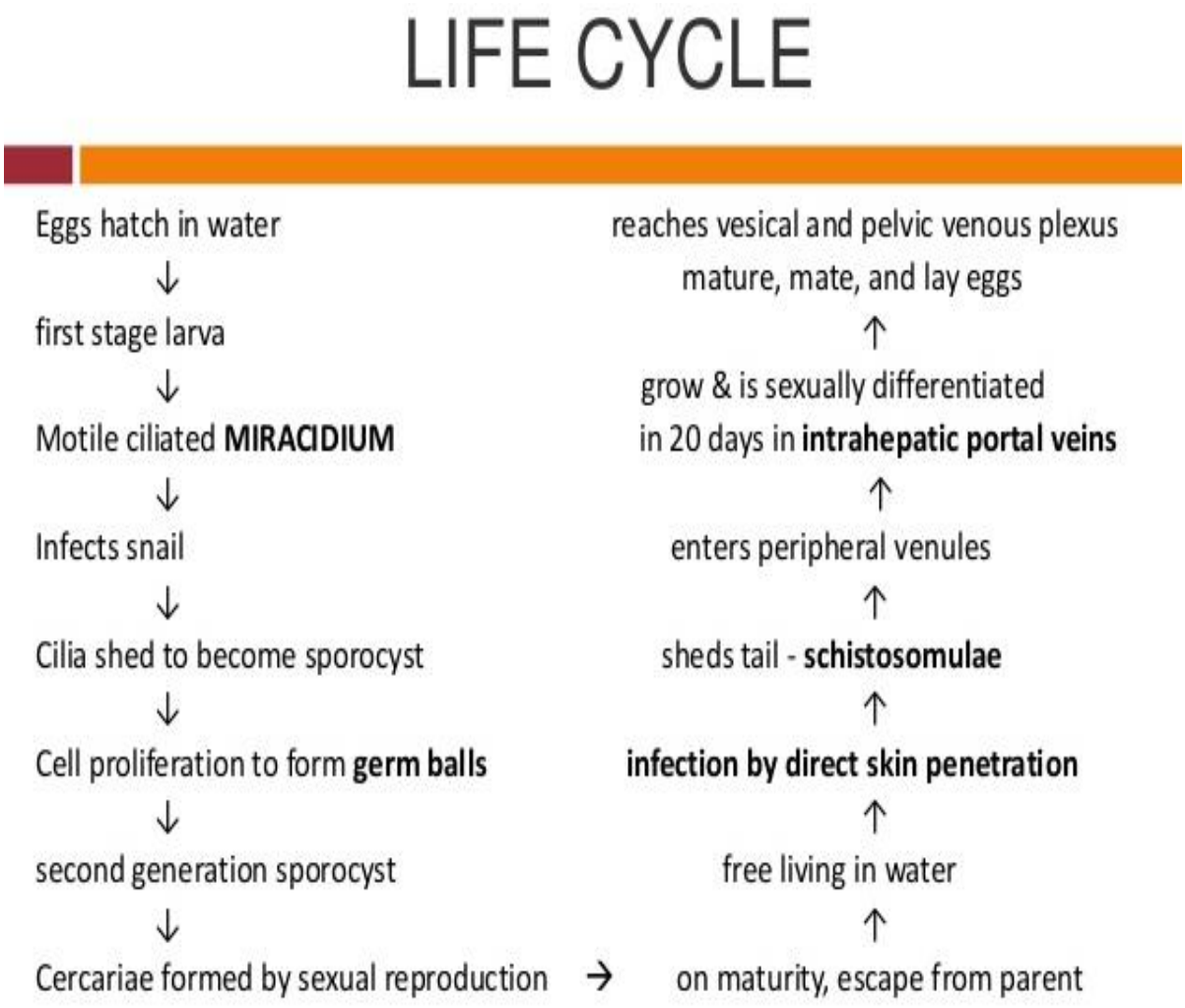
Development in snail

- 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 number of cercariae are produced by asexual reproduction within the second generation sporocyst.
- The cercaria has an elongated ovoid body and forked tail (furcocercous cercaria).
- The cercariae escape from the snail. Swarms of cercariae swim about in water for 1–3 days.

- If during that period they come into contact with personsbathing or wading in the water, they penetrate through their unbroken skin.
- Skin penetration is facilitated by lytic substances secreted by penetration glands present in the cercaria.

Development in Man

On entering the skin, the cercariae shed their tails and become schistosomulae which enter the peripheral venules. They then start a long migration, through the vena cava into the right side of the heart, the pulmonary circulation, the left side of the heart, and the systemic circulation, ultimately reaching 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 blood stream 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.



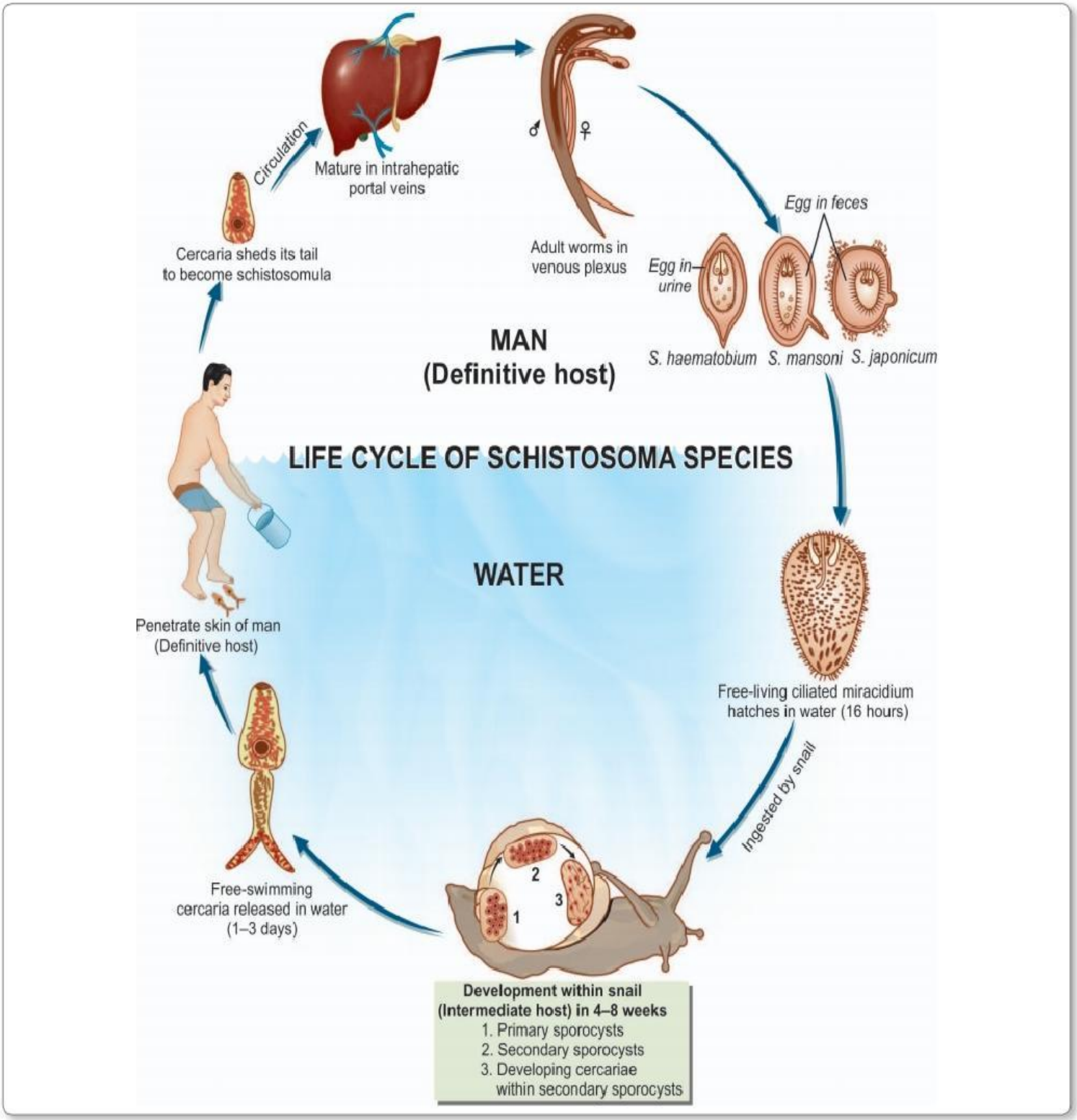
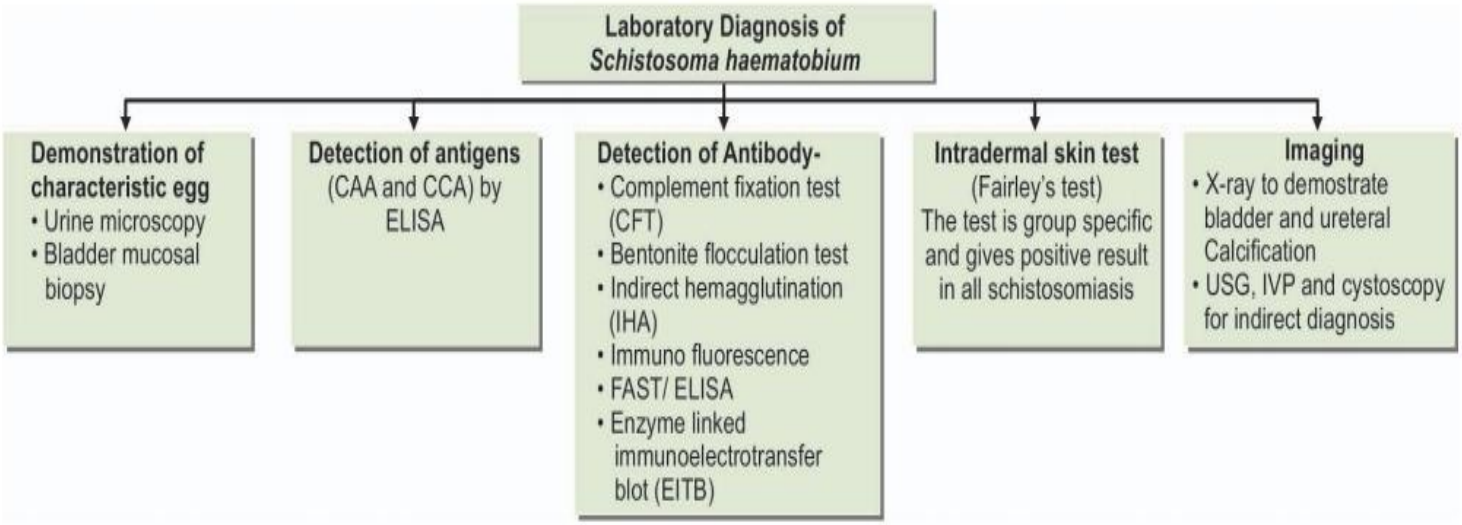


Fig. 13.6: Life cycle of *Schistosoma* spp.

PATHOGENICITY AND CLINICAL FEATURES

- Clinical illness caused by schistosomes can be classified depending on the stages in the evolution of the infection, as follows:
- Skin penetration and incubation period.
- Egg deposition and extrusion.
- Tissue proliferation and repair.
- The clinical features during the incubation period may be local cercarial dermatitis or general anaphylactic or toxic symptoms.
- Cercarial dermatitis consists of transient itching and petechial lesions at the site of entry of the cercariae (swimmer's itch).
- This is seen more often in visitors to endemic areas than in locals who may be immune due to repeated contacts.
- It is particularly severe when infection occurs with cercariae of nonhuman schistosomes.
- Anaphylactic or toxic symptoms include fever, headache, malaise, and urticaria.
- This is accompanied by leucocytosis, eosinophilia, enlarged tender liver, and a palpable spleen.
- This condition is more common in infection with *S. japonicum* (Katayama fever).
- Clinical features during oviposition include painless terminal hematuria (endemic hematuria).
- Hematuria is initially microscopic, but becomes gross, if infection is heavy.
- Most patients develop frequency of micturition and burning.
- Cystoscopy shows hyperplasia and inflammation of bladder mucosa, with minute papular or vesicular lesions.

LABORATORY DIAGNOSIS



- Specific diagnosis of schistosomiasis can be made by detection of the characteristic ova in the:
    - Stool ***(S. mansoni*** and ***S. japonicum***) or urine ***(S. haematobium***) under microscopic examination.
    - Biopsy material obtained through the protoscope(S. ***mansoni*** and***S. japonicum***) and cystoscope***(S.*** haematobium) and examined microscopically after compression or sectioning.

Urine microscopy

- The eggs with characteristic terminal spines can be demonstrated by microscopic examination of centrifugedeposits of urine or by filtration of a known volume of urine through nucleopore filters.

Detection of antigen

- Another diagnostic method is by detection of specific schistosome antigens in serum or urine by ELISA using monoclonal antibodies
- The test is very sensitive and specific.

Detection of antibody

- Several serological tests have been described for detection of specific antibody, but are not very useful as they cannot differentiate between present and past infection.
- These include complement fixation test (CFT), indirect haemagglutination (IHA), immunofluorescence, and gel diffusion tests.

Intradermal Skin Test (Fairley's test)

- Skin tests are group-specific and give positive results in all schistosomiasis.
- The intradermal allergic test uses antigen from infected snails, cercariae, eggs, and adult schistosomes from experimentally-infected laboratory animals.

Imaging

- X-ray of the abdomen may show bladder and ureteral calcification.
- Ultrasonography (USG) is also useful in diagnosing ***S. haematobium*** infection. USG may show hydroureter and hydronephrosis.
- Intravenous pyelogram (IVP) and cystoscopy are also useful in indirect diagnosis of the disease.

TREATMENT

- Praziquantel is the drug of choice (40mg/kg for 1 day).
- Metriphonate is the alternative drug of choice in Schistosomiasis due to ***S. haematobium***. (7.5 mg/kg. weekly for 3.

PROPHYLAXIS

Preventive measures include the following:

- Prevention of pollution of water with human excreta.
- Avoidance of swimming, bathingwading or washing in infected water.
- Effective treatment of infected persons to lessen the likelihood of water pollution.
- Destruction of the snail vector in endemic areas.