Medical Laboratory Techniques Department

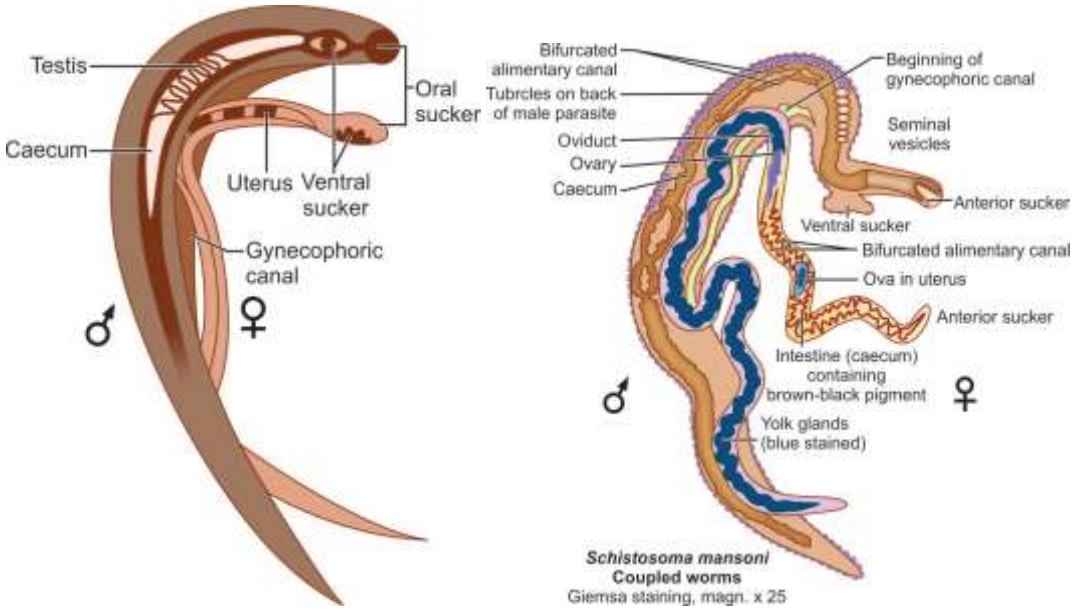
Lecture 13 : Trematodes (Blood Flukes)(part1)

Dr.Fatima H.Abbas
FatimaHashim@mustaqbal-college.edu.iq

Trematodes (Blood Flukes)

Schistosomes

- 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 milion 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 the **gynecophoric canal**, in which the female is held. It appears as though the body of the male is split longitudinally to produce this canal; hence the name schistosome (Greek*schisto*: *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.

Schistosoma haematobium

Habitat

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

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.

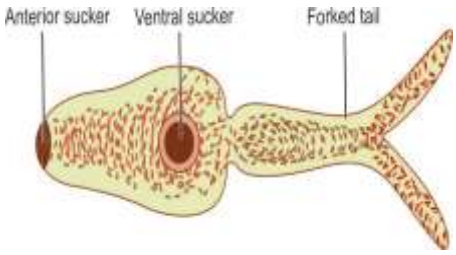
Egg

The eggs are ovoid, about 150 µm by 50 µm, nonoperculated, with a brownish yellow transparent shell carrying a **terminal spine** at one pole شوكة طرفية في قطب واحد ; the terminal spine being characteristic of the species.

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.



Egg of *S. haematobium* Schematic diagram to show cercaria larva of *Schistosoma* spp.

- From the venules, the eggs make their way through the vesical wall by the piercing الحاده action of the spine, assisted by the mounting pressure الضغط المتصاعد within the venues 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.
- 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 تثير local tissue reactions. They may be found, for instance in **rectal biopsies**, but are seldom نادرا passed live in feces.

Life Cycle

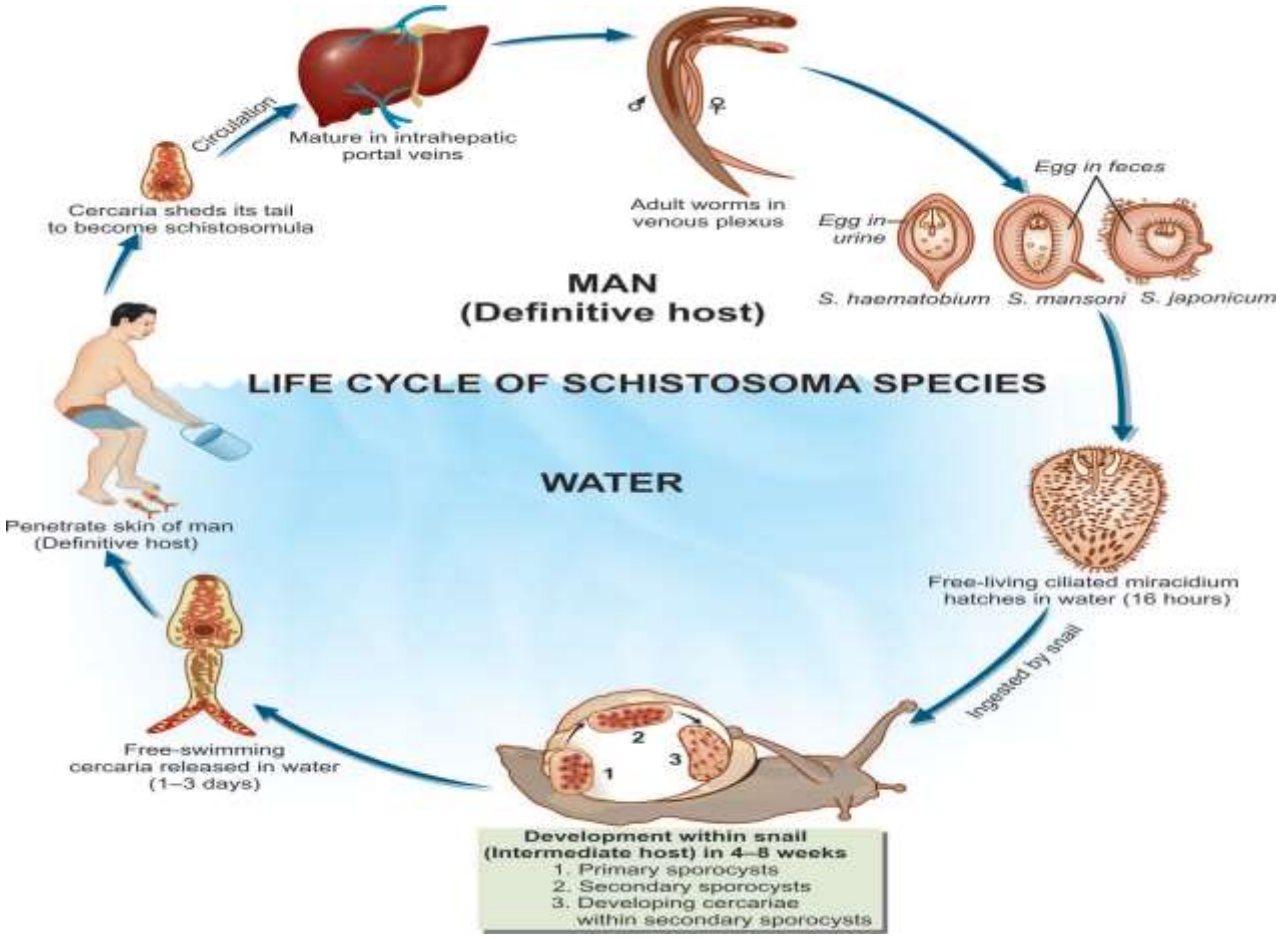
S. heamatobium passes its life cycle in 2 hosts.

Definitive host: Humans are the only natural definitive hosts. No animal reservoir is known.

Intermediate host: Fresh water snails.

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, 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*.



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 وضع البيضه وبثقها
- Tissue proliferation and repair.

- **The clinical features during the incubation period** may be **local cercarial dermatitis** or general **anaphylactic الأعراض التأقية العامة** or **toxic** symptoms.
- Cercarial dermatitis consists of transient عابره- وقتية itching and petechial حبرية lesions at the site of bentry of the cercariae (**swimmer's itch حكة السباحين**).
- 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 توعك, and urticarial الشرى.
- This is accompanied يرافقهاby leucocytosis, eosinophilia, enlarged رقيقtender liver, and a palpable واضح spleen. This condition is more common in infection with *S. japonicum* (**Katayama fever**).***Clinical features during oviposition** include **painless terminal 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.
- **Clinical features during tissue proliferation and Repair In the chronic stage,** there is generalized hyperplasia تضخمand fibrosis تليف of the vesical mucosa with a granular appearance مظهر حبيبي (**sandy patch**) رقعة رملية.
- At the sites of deposition of the eggs, dense infiltration تسرب with lymphocytes, plasma cells, and eosinophils leads to **pseudoabscesses**.
- Initially, the trigone is involved, but ultimately the entire mucosa becomes inflamed, thickened, and ulcerated.
- Secondary bacterial infection leads to **chronic cystitis**.
- **Calculi** form in the bladder due to deposition of oxalate and uric acid crystals around the eggs and blood clots.
- There may be **obstructive hyperplasia** of the ureters and urethra (**hydroureter**).
- **Chronic schistosomiasis** has been associated with squamous cell **carcinoma سرطان of the bladder**. Such malignancy is detected in a younger age group as compared to transitional cell carcinoma of the bladder. In fact, *S. haematobium* is now classified as
  a human carcinogen.
- Significant disease may occur in other organs during **Schistosomiasis**.
- Lungs and central nervous system (spinal cord), skin, and genital organs may be involved.
- Ectopic lesions in the spinal cord produce a transverse myelitis-like synodome.
- Schistosomiasis favors urinary carriage of typhoid bacilli.

Laboratory Diagnosis

- ✓ **Urine Microscopy**

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

- Eggs are more abundant in the blood and pus passed by patients at the end of micturition.
- Nucleopore filtration method provides quantitative data on the intensity of infection, which is of value in assessing the degree of tissue damage and in monitoring the effect of chemotherapy.
- Eggs can also be seen in the seminal fluid in males.

- ✓ **Histopathology**
- ✓ Schistosome infection may also be diagnosed by demonstrating its eggs in **bladder**
- ✓ **mucosal biopsy**.
- ✓ **Detection of Antigen**

Another diagnostic method is by detection of specific schistosome antigens in serum or urine. Two glycoprotein antigens associated with the gut of adult schistosomes: circulating anodic antigen (CAA) and circulating cathodic antigens (CCA) can be demonstrated by ELISA using monoclonal antibodies. The test is very sensitive and specific, but is available only in specialized laboratories

- ✓ **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), bentonite flocculation test, indirect haemagglutination (IHA), immunofluorescence, and gel diffusion tests.