

Lecture 4. TREMATODES (FLUKES)

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Phylum PLATHELMINTES

- They are multicellular bilaterally symmetrical organisms
- They have three germ layers; ectoderm, endoderm and mesoderm that are not separated by a cavity.
- Flat worms are acoelomate animals with parenchyma inside

Classification

- **Phylum PLATHELMINTES** is divided into three classes:
- Class *Turbellaria* – are free-living
- Class *Trematoda*
- Class *Cestoidea* - both live as parasites

Class Trematoda

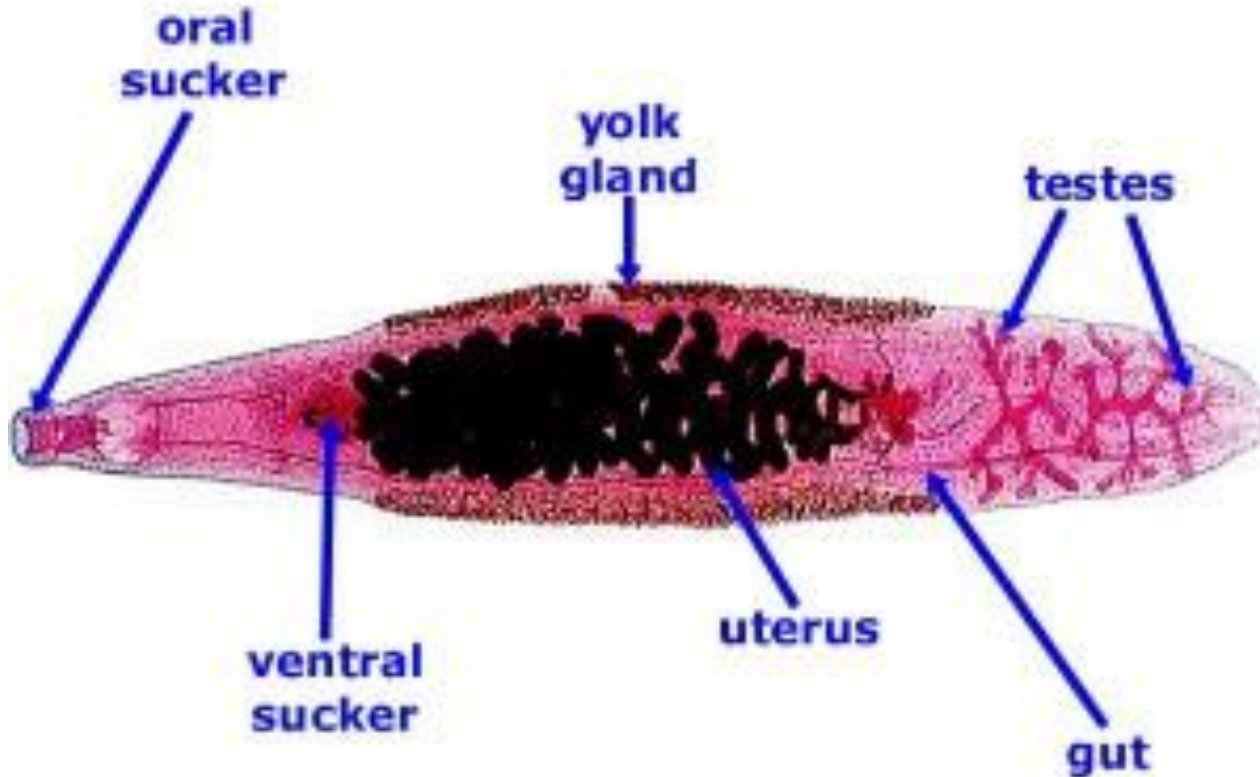
- Trematoda includes the flukes which are shaped like a live
- Flukes have a thick cuticle and two suckers
- Cuticle is special non-living cover-layer secreted by the epidermis.



The most significant Trematodes are:

- **Liver flukes: *Fasciola hepatica*, *Clonorchis sinensis* and *Opisthorchis felinus***
- **Lung fluke: *Paragonimus westermani***
- **Blood flukes: *Schistosoma mansoni*, *S. japonicum* and *S. hematobium*;**

The liver flukes are hermaphroditic

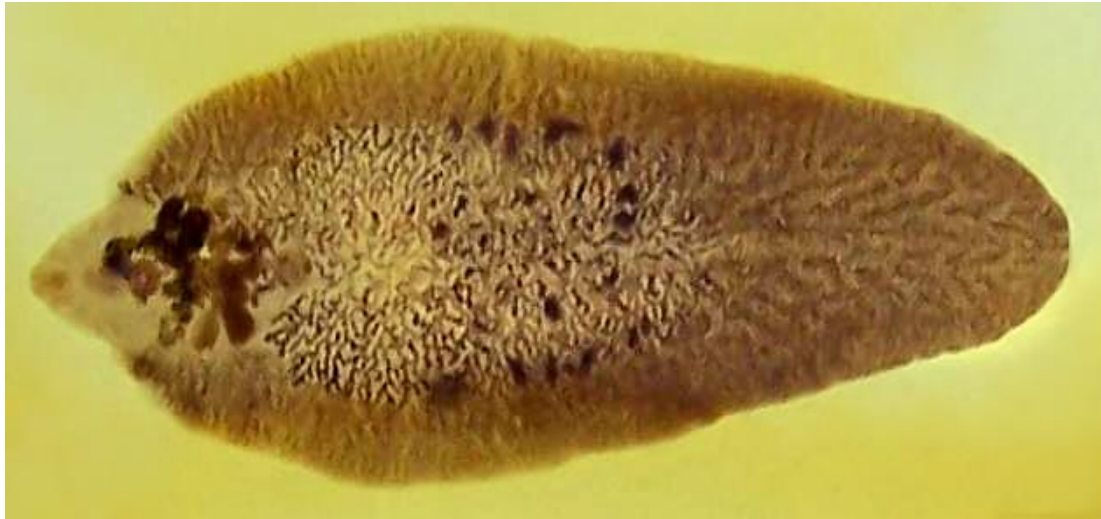


Clonorchis sinensis



Opisthorchis felineus

Morphology of *Fasciola hepatica*

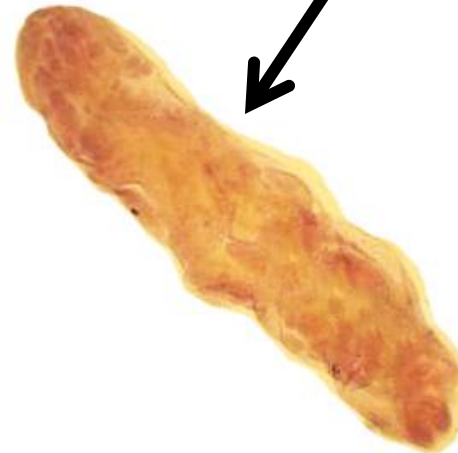


***Fasciola hepatica* – adult form**



The egg

Larva forms

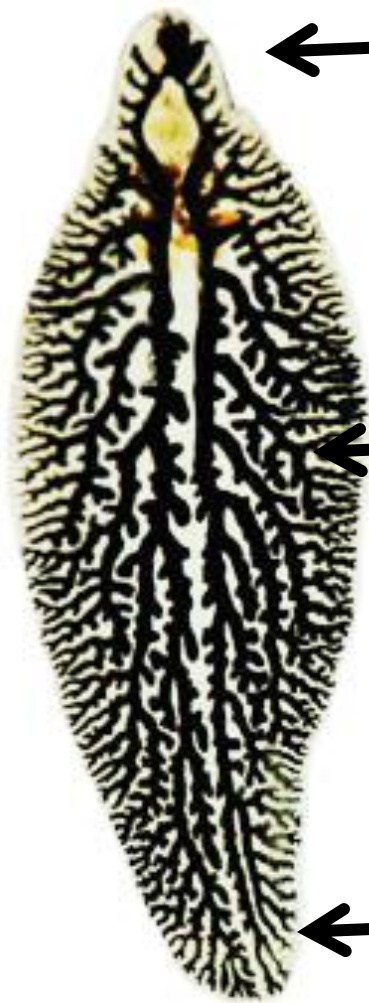


Rediae



Cercaria

Fasciola hepatica
Digestive system



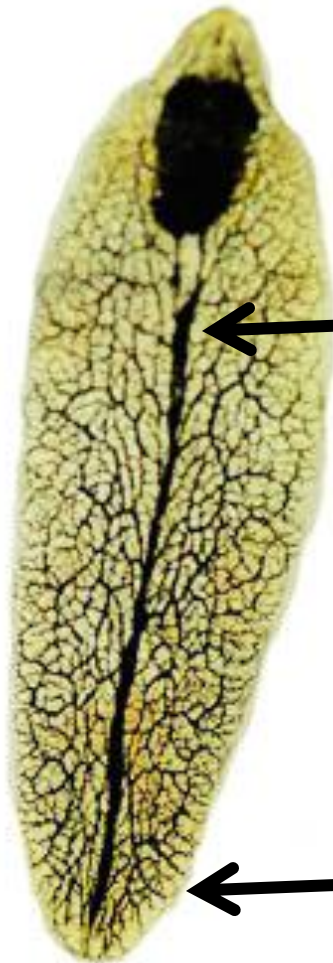
← **Oral sucker with mouth**

← **Two branches of intestine have many lateral branches**

← **Intestine is blind ended.
Anus is absent**

digestive system

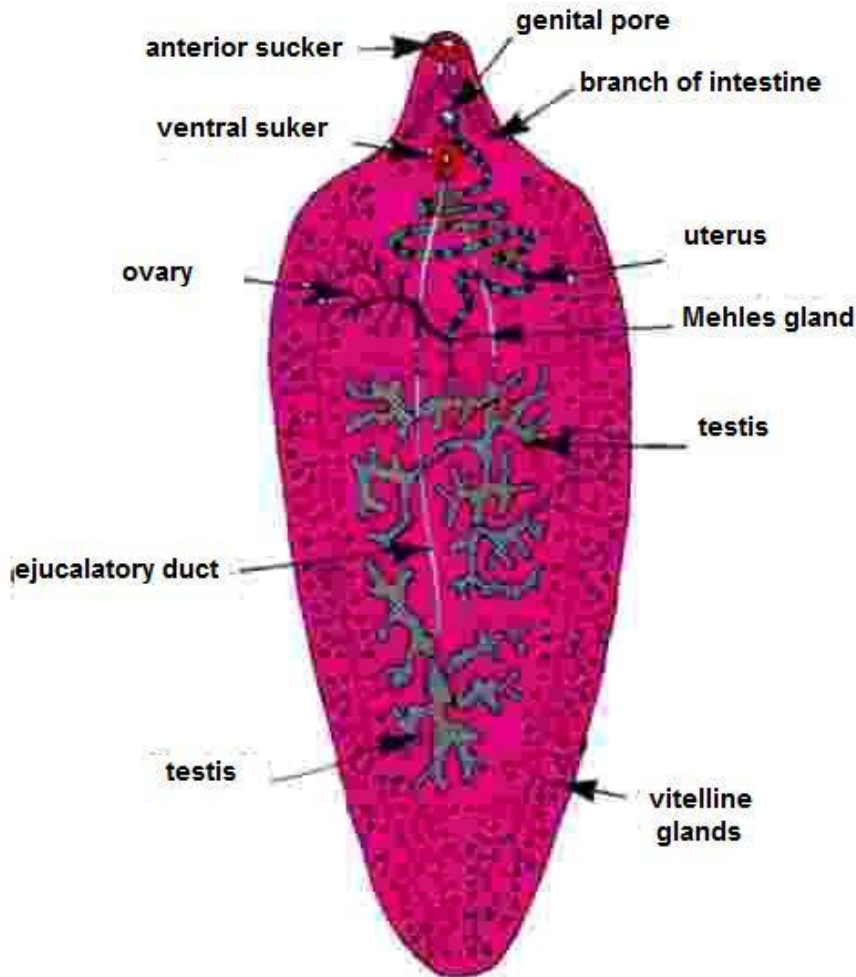
excretory system



**the central excretory channel
with many lateral branches**

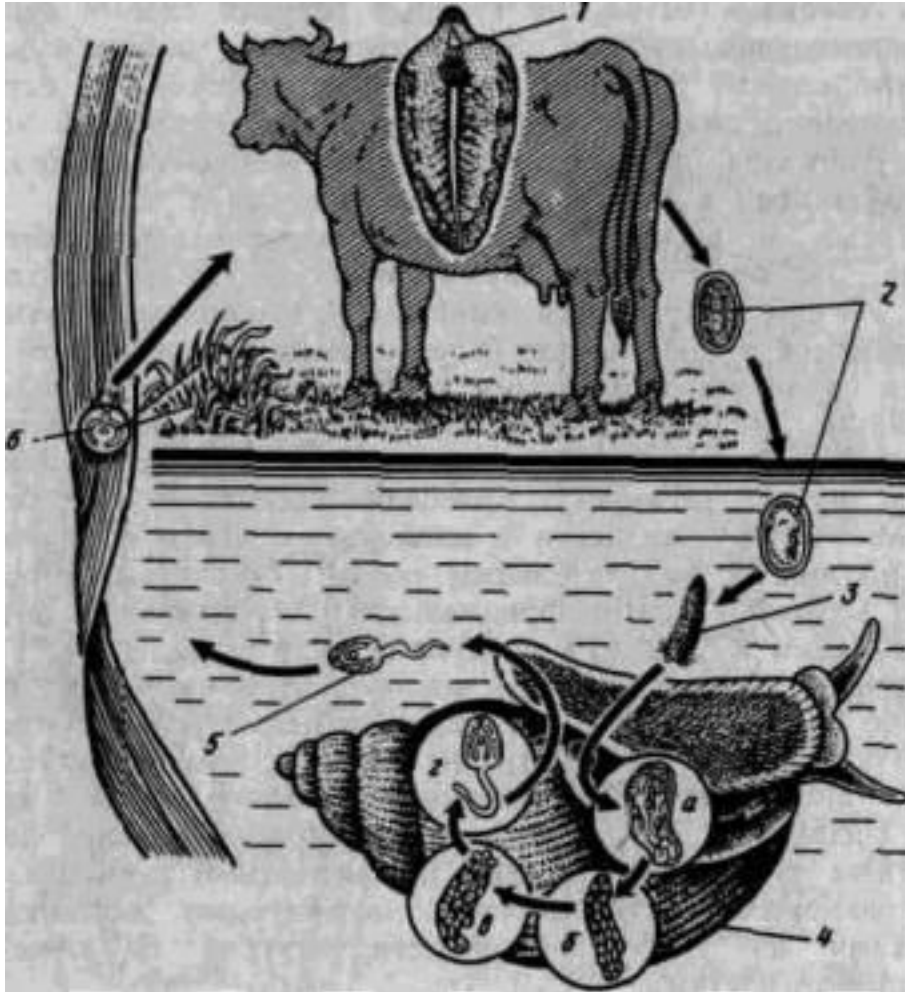
**excretory pore is at the posterior
end**

The reproductive system of *Fasciola hepatica*



- Testis and ovary are very strong branched.
- Ejaculatory duct ended with genital pore which is placed at the anterior end of the body.
- The single ovary is placed near the ventral sucker.
- Uterus is like a coiled tube filled with eggs.
- Ovary, uterus and Mehles glands all pass in ootype in the middle part of the body.
- Vitelline glands are very strong branched and are placed at the both sides of the body

Life cycle of *Fasciola hepatica*



1. The definitive hosts are man, pigs, cattle, sheep, cows, goats;

eggs are passed in the stool into fresh water (2);

miracidia (3) penetrate intermediate host - snail *Galba truncatula*

the miracidium develops into *sporocyst, rediae and cercariae (4)*;

the *cercaria (5)* are encyst as adolescaria (6) on water and plants

***Fasciola hepatica* causes fasciolosis**

- **Symptoms:**
- ***The toxic secretions cause hepatitis***
- ***Irritation of bile duct resulting in bile obstruction***
- ***Adult worms may invade the liver and cause necrotic foci***
- **Diagnosis**
- ***Detection the eggs in stool***

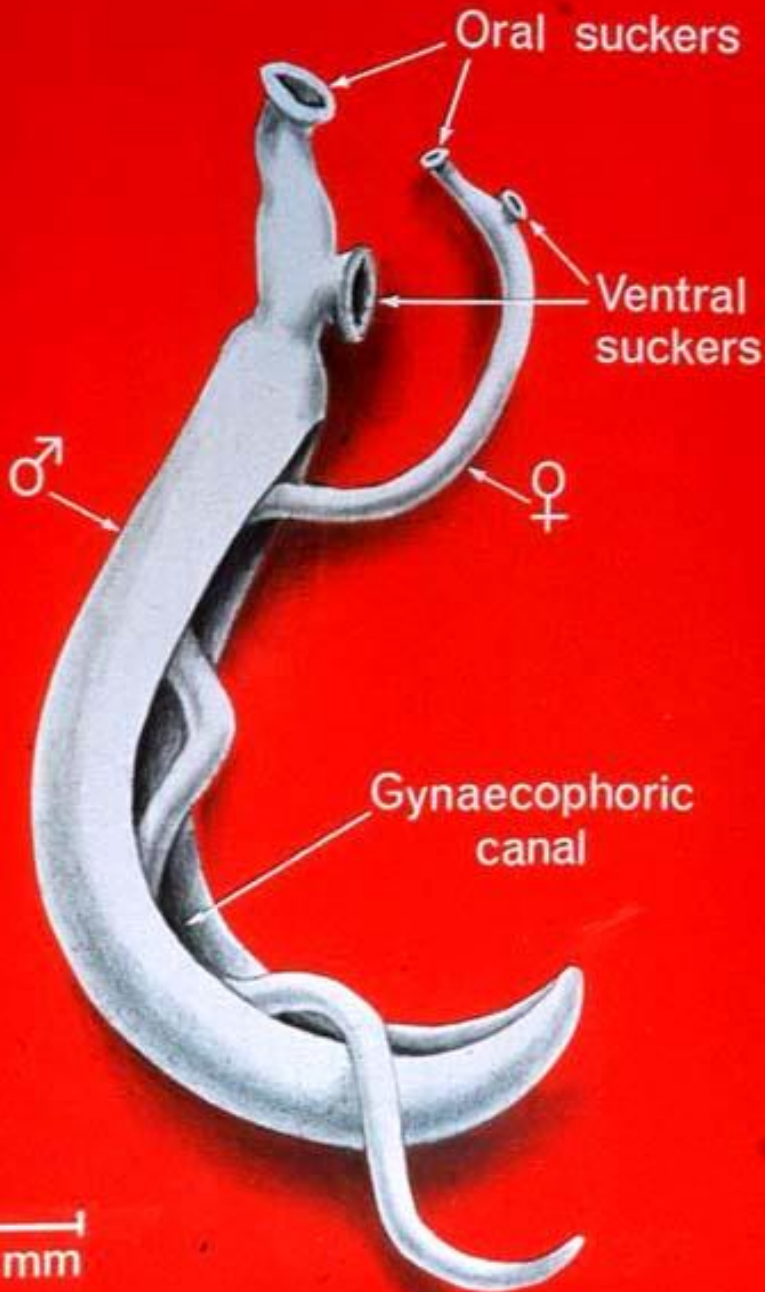
Schistosomiasis (Bilharziasis)

- Geographic distributions:
- *Sch. hematobium* is prevalent in Africa, *Sch. mansoni* is found in Africa and America
- *Sch. japonicum* is common in the Far East
- Epidemiology وبائية المرض

Approximately 250 million people are infected with schistosomes and 600 million are at risk.

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**



The eggs are very characteristic and confirm diagnosis.



- ***S. mansoni*** eggs in feces have a spine on the side

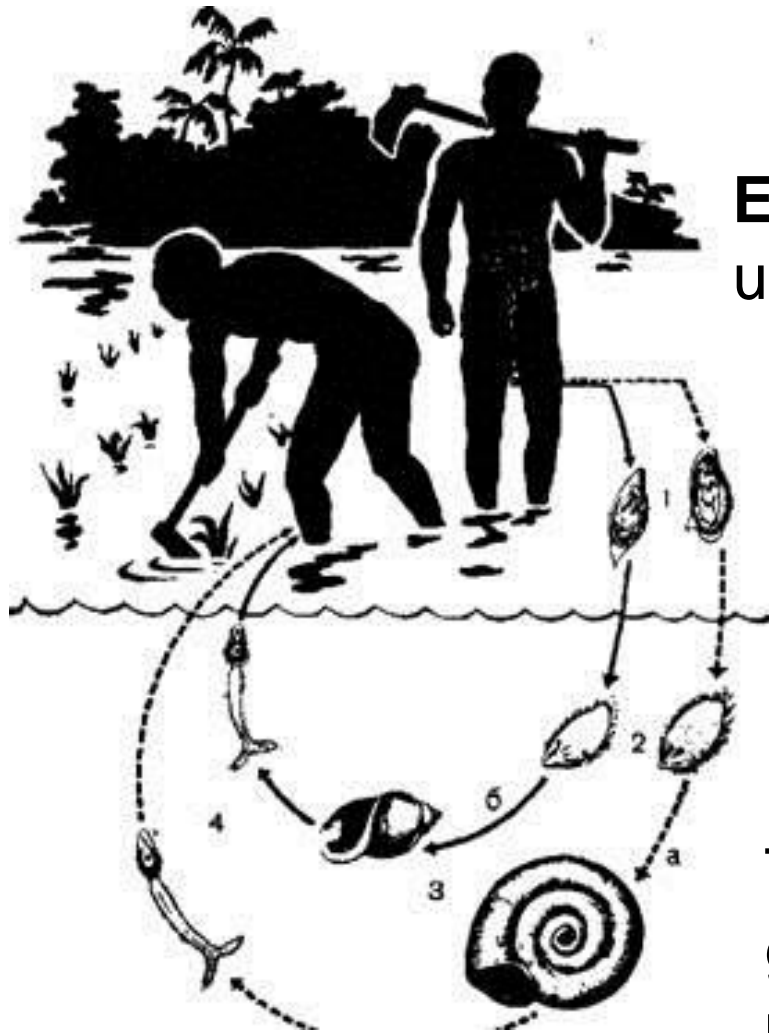


- ***S. hematobium*** eggs in urine have an apical spine



- ***S. japonicum*** eggs are more round with a vague spine on the side.

Life cycle of *Schistosoma sp.*



Eggs are eliminated with feces or urine (1)

the eggs hatch and release **miracidia (2)**, which penetrate specific **snail intermediate hosts (3)**

The stages in the snail include 2 generations of **sporocysts** and the production of **cercariae (4)**

Cercaria penetrates the skin

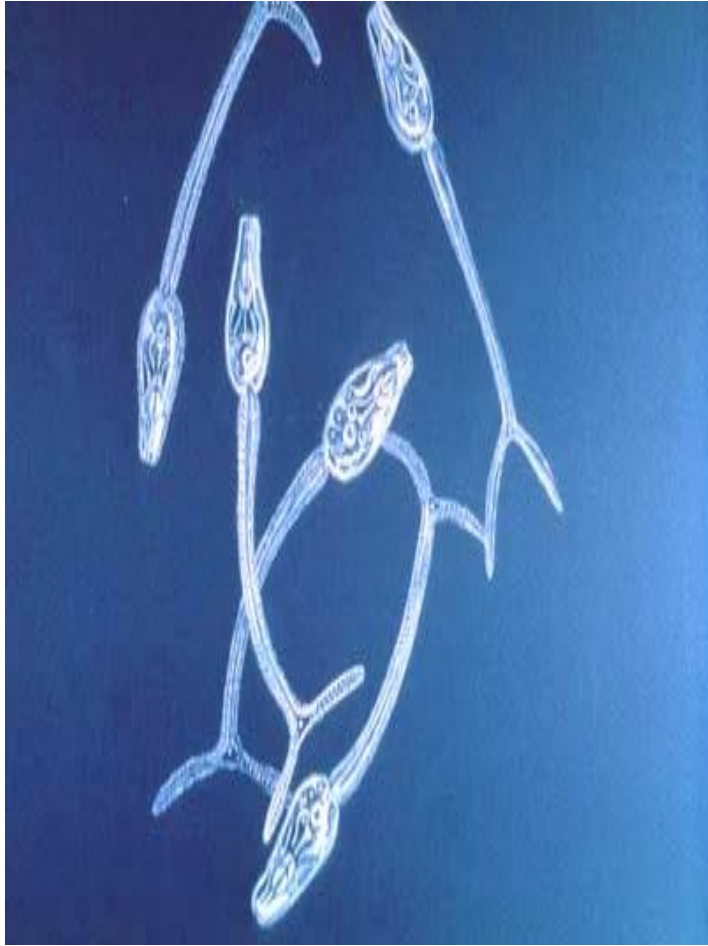
Intermediate Hosts are freshwater snails

- ***Bulinus*** (for *S. haematobium*)
- ***Biomphalaria*** (for *S. mansoni*)
- ***Oncomelania*** (for *S. japonicum*)

Definitive host for *Schistosoma sp.*

- **Man**
- **Dogs, cats, rodents, pigs, hourse and goats, serve as reservoirs for S. Japonicum**

The infective cercariae

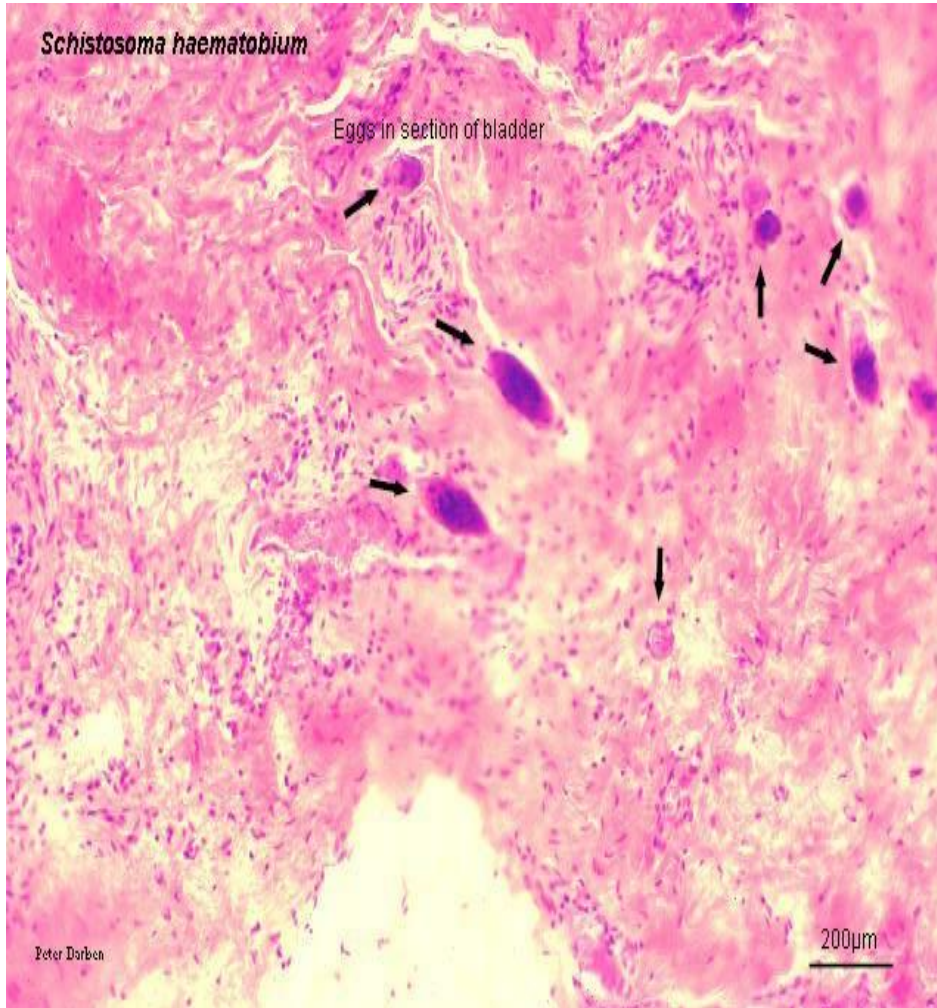


- Man is infected by cercaria in fresh water by skin penetration
- The cercaria travel through the venous circulation to the heart, lungs and portal circulation
- They mature and reach:
- the mesenteric veins (*S. japonicum* and *S. mansoni*)
- the bladder vessels (*S. hematobium*) where they live and ovulate for the duration of the host's life.

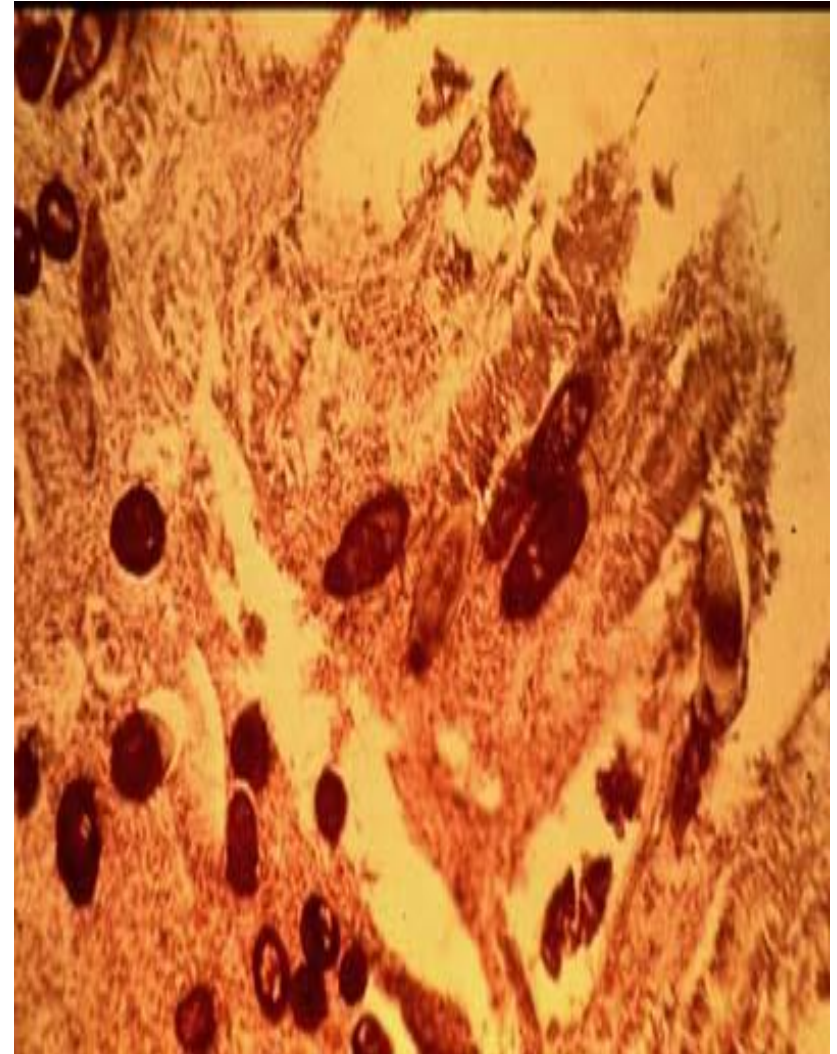
Sites for localization

- ***S. japonicum*** is found in the superior mesenteric veins of the small intestine
- ***S. mansoni*** occurs in the superior mesenteric veins of the large intestine
- ***S. haematobium*** occurs in the venous plexus of bladder, it can also be found in the rectal venules

Schistosoma haematobium
eggs in section of bladder



Schistosoma mansoni eggs
in the wall of the gut



Pathology of schistosomiasis

- *S. mansoni* and *S. japonicum* includes:
 - Katayama fever, periportal fibrosis **تليف حول** **الاعية البابية**, portal hypertension, and egg granulomas in brain or spinal cord.
- *S. haematobium* includes: hematuria, **دم فى البول** calcification, squamous cell carcinoma, and occasional egg granulomas in brain or spinal cord.

- **Hepatosplenomegaly, تضخم الكبد والطحال**
- **ascites, استسقاء**
- **muscle atrophy,**
- **anaemia,**
- **diarrhea**
- **haemorrhage from the gastrointestinal tract**

Treatment and control

- **Contaminated water should be avoided**
- **Sanitary disposal of sewage** التخلص الصحى من مياه المجارى
Prevent the contamination of water by feces and urine
- **Destruction of snails**
- **Treatment the patients**
- **No vaccine is available**
- **Praziquantel is effective against all species**