

## **Prof.Dr.Hashim R.Tarish**

### Trematoda (Flukes)

**Trematoda** is a class of flatworms known as **flukes**. They are obligate internal parasites with a complex life cycle requiring at least two hosts. The intermediate host, in which asexual reproduction occurs, is usually a snail. The definitive host, where the flukes sexually reproduce, is a vertebrate.

### Trematodes of medical importance

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Flukes that cause disease in humans are often classified based on the organ system they infect. For example:

1-**Blood flukes** inhabit the blood in some stages of their life cycle. Blood flukes that cause disease in humans include *Trichobilharzia regenti*, which causes swimmer's itch, and seven species of genus *Schistosoma* which cause schistosomiasis: *S.haematobium*, *S. japonicum*, *S. mansoni*, As a definitive host, humans are infected when the cercariae (the larval forms of trematodes) penetrate the skin. Any contact with water

containing these cercariae can potentially result in infection. Adult blood flukes can live for years in human or animal [reservoir hosts](#).

*S. haematobium* and *S. japonicum* are of particular importance, as these are [carcinogenic parasites](#). *S. haematobium*, which infects the [urinary bladder](#), is among the most important causes of [bladder cancer](#) in humans. *S. japonicum* is associated with the development of [liver cancer](#).

2- [Liver flukes](#) are commonly found within [bile ducts](#), liver, and [gallbladder](#) in certain mammalian and avian species as *Fasciola gigantica*, *Fasciola hepatica*,

3- [Lung flukes](#): there are ten species of lung flukes that infect humans, causing [paragonimiasis](#).<sup>[10]</sup> Of these, the most common cause of human paragonimiasis is *Paragonimus westermani*, the oriental lung fluke. Lung flukes require three different hosts in order to complete their life cycle. The first intermediate host is a snail, the second intermediate host is a crab or crayfish, and the definitive host for lung flukes is an animal or human host.

4-Intestinal flukes inhabit the **epithelium** of the **small intestine**. These include *Fasciolopsis buski* (which causes **fasciolopsiasis**).



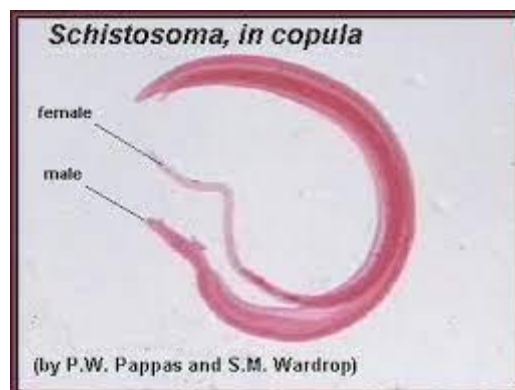
### **schistosomes**

Three major species of schistosomes infect humans: *Schistosoma mansoni*, *S japonica*, and *S haematobium*. The adult male and female schistosomes reside in human mesenteric or vesical venules. Fertilized female worms produce large numbers of egg, which pass out of the blood vessels, through the tissues, and into the

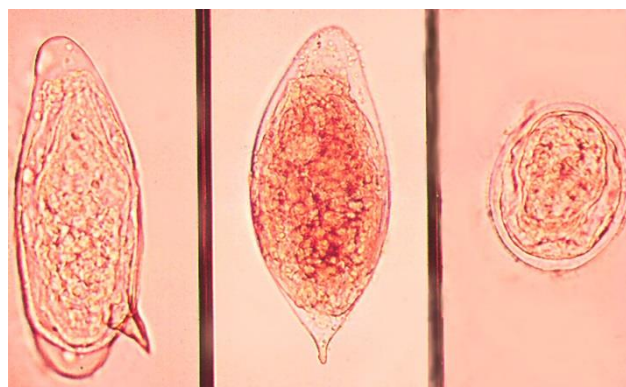
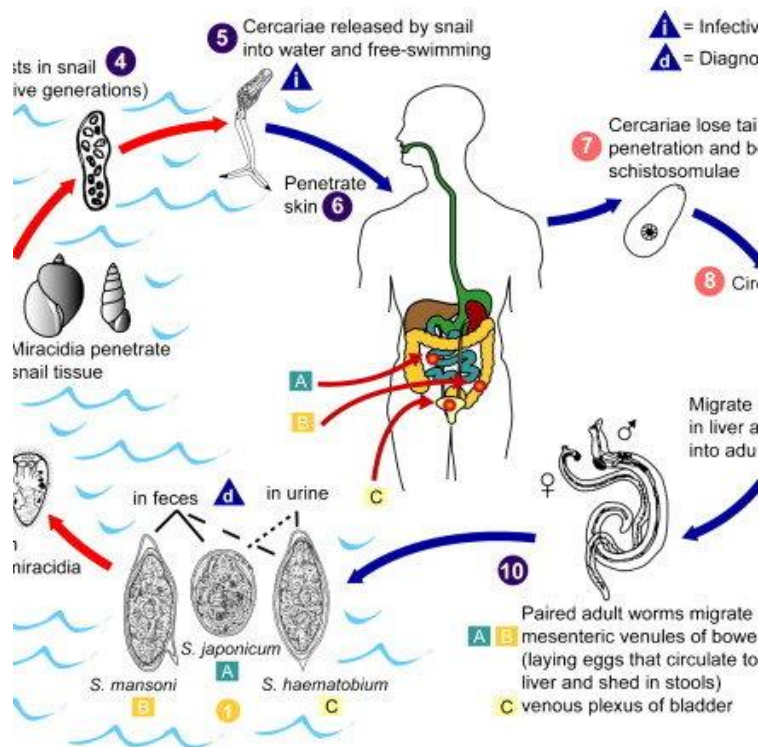
lumen of the gut (*S mansoni* and *S japonicum*) or urinary bladder (*S haematobium*), from which they are shed into the environment, where they may infect a snail intermediate host. After a period of asexual multiplication in the snail, the cercariae pass out into water from which they directly penetrate into human skin. The young schistosomes migrate from the skin to the lungs and then to the hepatoportal system, where they mature, mate and pass down into the mesenteric or vesical venules .

Human schistosomiasis is a parasitic disease caused by blood-worms that infect multiple organs, including the liver, intestine, bladder, and urethra.

Morphology and life cycle of *Schistosoma*



Asexual reproduction occurs in freshwater snails. In the snail, this begins with the development of miracidia into a sporocyst. Sporocysts multiply and grow into cercariae. In the mammalian hosts, parasites grow to become mature, mate, and produce eggs



The schistosome life cycle occurs in 2 hosts: snails and mammals. Either asexual or sexual reproduction occurs, depending on the type of host . Asexual reproduction occurs in freshwater snails. In the snail, this begins with the development of miracidia into a sporocyst. Sporocysts multiply and grow into cercariae. In the mammalian hosts, parasites grow to become mature, mate, and produce eggs. Mammalian hosts include humans, mice, and dogs.

### Snail hosts

Mammal hosts release worm eggs into the external environment through feces or urine. In fresh water, these eggs form miracidia, which hatch and infect snails. *S. haematobium* infects snails of the genus *Bulinus*. *S. japonicum* infects snails of the genus *Oncomelania*. *S. mansoni* infects snails of the genus *Biomphalaria*.

After infiltration, the miracidium removes the ciliated plates, develops into a mother sporocyst, and then produces daughter sporocysts. Daughter sporocysts produce either cercaria (cercariogenous sporocysts) or

more daughter sporocysts (sporocystogenous sporocysts). Daughter sporocysts can also experience a re-differentiation into new daughter sporocysts. Snails can shed hundreds of cercariae daily; about 200 for *S. haematobium*, 15 to 160 for *S. japonicum*, and 250 to 600 for *S. mansoni*.

### Mammalian hosts

Cercariae enter human skin and shed their forked tail, forming schistosomula. The schistosomula migrate throughout the body's tissues through blood circulation. Schistosomula grow into schistosomes and adult worms.

Adult worms in humans exist in various locations specific to each species. *S. haematobium* exists in the **bladder and ureters**, but it can also exist in the rectal venules. *S. japonicum* exists more frequently in **the small intestine**. *S. mansoni* worms can exist in either **large or small intestine and they are able to transfer between those sites**. Water containing cercariae can cause human schistosomiasis.

Clinical manifestations of schistosomiasis consist of acute (Katayama syndrome) and chronic manifestations. The incubation period of Katayama syndrome is about 14

to 84 days. Katayama syndrome's symptoms may include fever, headache, myalgia, rash, and respiratory symptoms. For *S. haematobium*, clinical manifestations of the chronic disease can cause **dysuria and hematuria**. It can also lead to injury of the genital tract and susceptibility to other infections. Chronic infections can cause **bladder cancer**. Clinical manifestations of the chronic disease are blood in the stool, constipation, and diarrhea. These clinical manifestations occur in patients with *S. japonicum* and *S. mansoni* schistosomiasis. Chronic inflammation also occurs in patients with *S. japonicum* and *S. mansoni* schistosomiasis. It can cause bowel wall ulceration, fibrosis, hyperplasia, polyposis, and portal hypertension.

## Diagnosis

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Examination of excrement is a key method used to diagnose suspected schistosomiasis infections . For examination purposes, several diagnostic techniques are available: the Kato-Katz, miracidium hatching test (MHT), formol-ether concentration technique (FECT), circulating cathodic antigen (CCA), point of care test (POCT), and polymerase chain reaction (PCR)-based technique. Alemu et al<sup>3</sup> showed that the FECT is time-consuming and requires several materials. Moreover, the sensitivity and specificity of the FECT are almost similar to the Kato-Katz technique. The Kato-Katz technique is



fast, easy to perform, and requires minimal training. This technique has an 87.5% sensitivity rate and 100% specificity rate. For research purposes, Kato-Katz and FECT could be used.<sup>3</sup> Traditional methods cannot detect schistosomiasis in low-intensity levels.