

# Helminths

Helminths is a general term for a parasitic worm, are large macroparasites; adults can generally be seen with the naked eye. Many are intestinal worms that are soil-transmitted and infect the gastrointestinal tract. Other parasitic worms such as schistosomes reside in blood vessels.

**Helminths: Metazoa** → **Phylum: Platyhelminths (Class. A. Trematoda, B. Cestoda)**

→ **Phylum: Aschelminths (Class. Nematodes)**

## Phylum: Platyhelminthes

### A- Class: Trematoda (Flukes)

## General characteristic of trematodes

- 1- Trematodes are dorsoventrally flattened and leaflike in shape, except for the blood flukes or Schistosomes which is cylindrical.
- 2- Their bodies are covered with tegument, which is usually armed with scalelike spines. They have two suckers: one oral and one ventral except Heterophyes which has third genital sucker.
- 3- Trematodes are hermaphroditic, having both male and female reproductive organs in the same individual, except for the blood flukes, the sexes are separate.
- 4- All require one or more intermediate host (s) for completion of their life cycles, the adult worm develops in secondary intermediate host except schistosomes which do require only one intermediate host.
- 5- The eggs are in general oval equipped with covering at the top called the operculum, through which the larval worm comes out to find its appropriate snail host.
- 6- Transmission of trematodes can occur through the consumption of water and food that is contaminated with trematodes in the larval stages of their life cycle.

## **Hepatic Flukes**

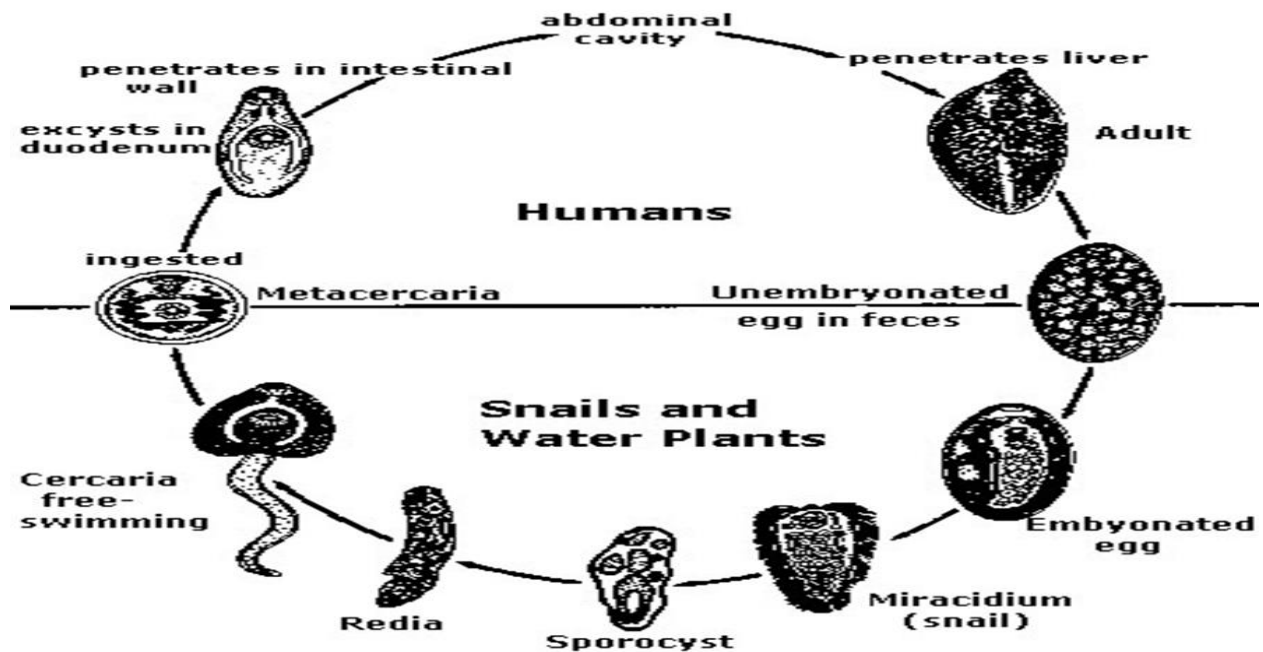
### ***Fasciola Hepatica***

*Fasciola hepatica*, also known as the common liver fluke or sheep liver fluke, causative agents of fasciolosis, is a parasitic trematode of the class Trematoda, phylum Platyhelminthes. It infects the livers of various mammals, including humans ( gall bladder and bile ducts) as a definitive host, the intermediate host of *Fasciola hepatica* is snail (Lymnaea sp. or Fossaria) where asexual reproduction occurs. Transmission of *Fasciola hepatica* by sheep and cattle to humans the world over. Sporadic or endemic *F. hepatica* infections in humans have been reported from about 50 countries (WHO, 1999).

### **Life cycle**

- 1- Infection in the Sheep host is initiated by swallowing the metacercaria (encysted larva) together with contaminated watercress or other littoral plants.
- 2- The metacercaria excysts within the lumen of the small intestine.
- 3- The immature fluke burrows through the wall of the small intestine, enters the peritoneal cavity, and penetrates the liver, where it then begins to feed upon the parenchymal cells. *Fasciola hepatica* grows slowly, achieving sexual maturity after 2 months in the liver. Eggs are produced by each worm after another month of development.
- 4- Golden-brown, large eggs, easy to see under low power, and measure 130-150 x 60-90 micrometers, eggs that are shed by the bile duct-intestinal tract route. Each egg has an operculum at one end. After 4 to 15 days in water at approximately 22°C the completely developed miracidium escapes when the operculum opens.

- 5- The ciliated miracidium swims about seeking its appropriate snail in the genera *Lymnaea*, serve as intermediate host.
- 5- The miracidium continues to the sporocyst, then the redia stage. Each new stage signals an increase in the number of individual immature flukes.
- 6- Each redia gives rise to many cercariae, which then penetrate out of the snail and into the water.
- 7- The cercariae encyst upon watercress and other littoral plants.
- 8- The encysted cercariae, now termed metacercaria, are resistant to mild changes in temperature and some chemicals. The metacercaria is the infective stage of the infection.



**Clinical manifestation :**

- Incubation period of 4-6 weeks, diarrhea and digestive disturbance, vomiting and steatorrhea.
- stool mixed with bile, leukocytosis and eosinophilia(acute phase) up 80% anemia and necrotic foci of liver (liver rot), loss of hair.

**Diagnosis:**

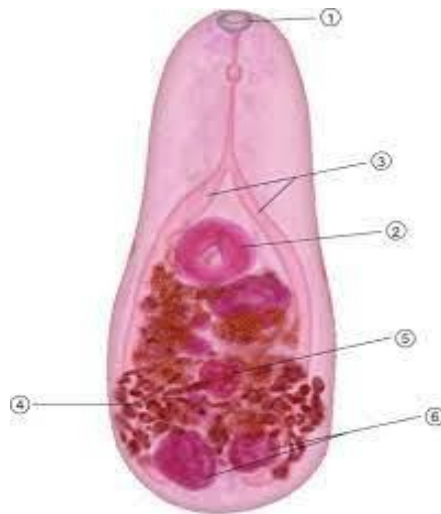
- 1- Rise in liver specific serum enzymes.
- 2- Complete blood count for anemia & eosinophilia.
- 3- Detection of operculated eggs in stool after at least two to three months.
- 4- Serological enzyme-linked immunosorbent assay (ELISA) tests and (CT) scan.

**Therapy:** Triclabendazole 10 mg/kg body weight in single dose or 2 time daily.

## Intestinal flukes

### *Heterophyes heterophyes*

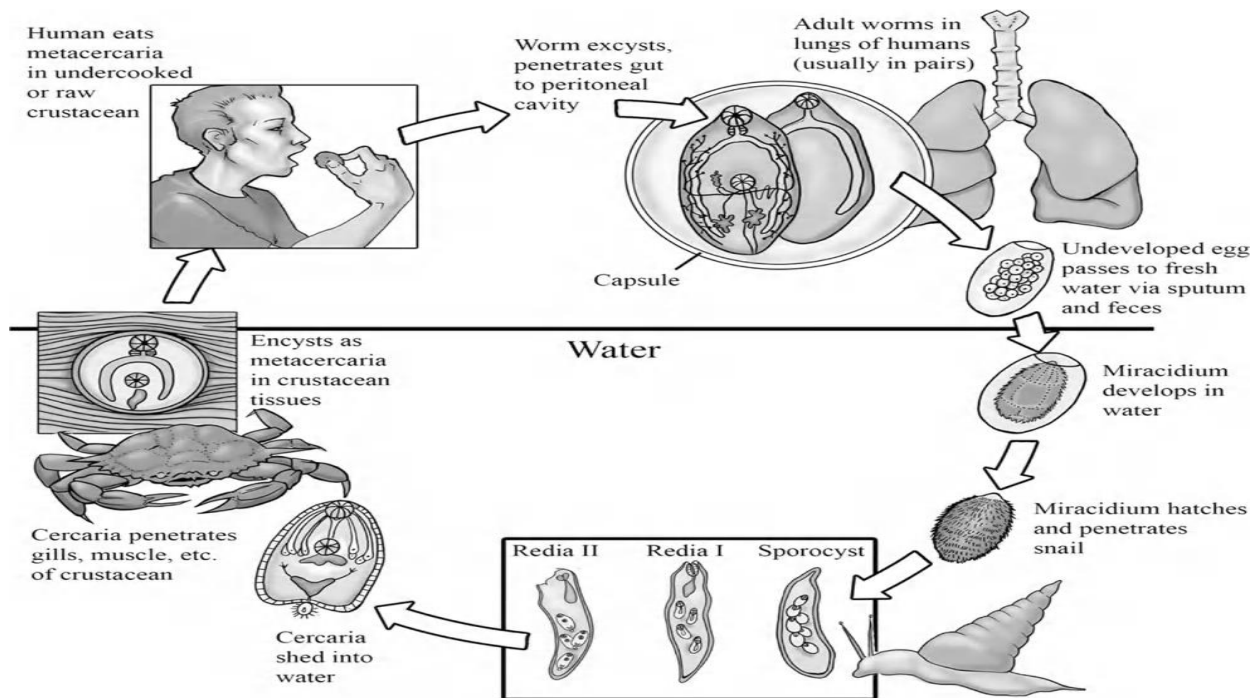
Human infection by *H. heterophyes* occurs in Asia, Egypt, and Hawaii. The adult stages appear pear shaped and measure 2×0.4 mm and thus are rather small. They occur in the small intestine of humans, dogs, cats and other animals in case they eat infected fish meat. *H. heterophyes* (oral sucker: small. ventral sucker: large and genital sucker).



## Lung flukes

### *Paragonimus westermani*

The Oriental lung fluke is one of several digeneans of the same genus that infect the human respiratory tract. Early symptoms include a cough producing blood-tinged sputum and pulmonary pain. A low-grade fever usually accompanies these symptoms.



### ***Schistosoma* spp.**

#### Causative agents of schistosomiasis or bilharziasis

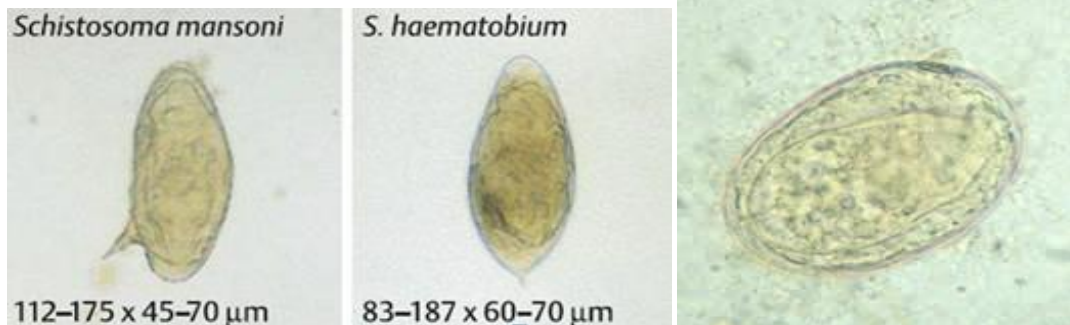
Schistosomiasis is also known as bilharziosis after the German physician Theodor Bilharz, who discovered *Schistosoma hematobium* in human blood vessels in 1851. One of the most frequent tropical diseases with about 200 million infected persons. The occurrence of schistosomiasis depends on the presence of suitable intermediate hosts (freshwater snails).

Human infections result from contact with standing or slow-moving bodies of water (freshwater) when *Schistosoma* cercariae enter the skin.

*Schistosoma haematobium* causes **urinary schistosomiasis**; *S. mansoni* and *S. japonicum*, are the causative agents of **intestinal schistosomiasis** and other forms of the disease. Schistosomiasis occurs endemically in 74 tropical and subtropical countries of Africa, South America, and Asia

<b>Schistosoma species and length (mm)</b>	<b>Main location of adult stages</b>	<b>Eggs: characteristics, dimensions, and excretion</b>	<b>Intermediate hosts (snails), Animal reservoir hosts</b>
<i>S. haematobium</i> M: 10–15×1 F: 20–26×0.3	Venous of urinary (bladder, etc.)	Ovoid, with terminal spine, 83–187×60–70µm E: urine, <u>rarely stool</u>	I: Bulinus species R: Monkeys, hamsters
<i>S. mansoni</i> M: 6–12×1 F: 7–16×0.3	Mesenteric veins Venous of intestine	Ovoid, with lateral spine, 112–175 ×45–70µm E: stool	I: Biomphalaria species. R: Rats, mice, monkeys

<i>S. japonicum</i> M: 12–20×0.5 F: 12–28×0.3	Mesenteric veins Venis of intestine	Elliptical, spine tiny or lacking 70–100 ×50–65µm E: stool	I: Oncomelania species. R: Cattle, Mice, dogs, cat
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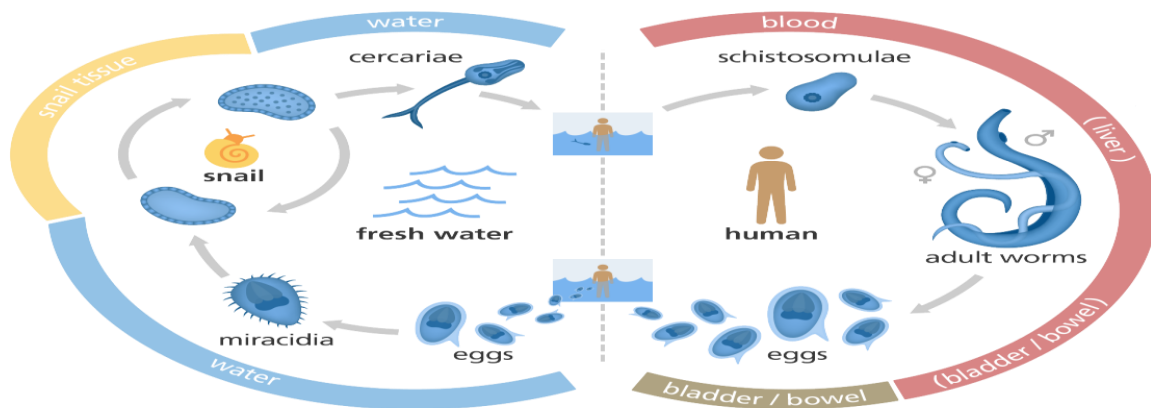
Couple of the species *Schistosoma mansoni*.

The male transports the female inside the  
so-called canalis gynaecophorous.

### **Life cycle**

- 1-The adult parasites live in the **lumen of veins**. Sexually mature *Schistosoma* females lay about 100–3500 eggs a day, depending on the species, each containing an immature miracidium (= ciliate larva)
- 2- The eggs are deposited into freshwater, the miracidia hatch from the eggshell and begin their search for a suitable intermediate host.

- 3- Miracidia enter suitable freshwater snails serve as intermediate hosts in which the reproduce asexually, producing sporocysts, and finally numerous cercariae,
- 4- The cercariae swim freely about or cling to the surface of the water. Upon contact with a human host, enzyme secretion and dynamic movements enable them to enter the skin within a few minutes. During the infection process, the cercaria loses its tail, sheds the surface and transforms into the schistosomulum.



## Clinical features

1-The 1<sup>st</sup> sign is itching and rash (cercarial dermatitis) at penetration site.

**Katayama fever** is a systemic hypersensitivity reaction to the schistosomula migrating through tissue.

2-Acute intestinal schistosomiasis (*S. mansoni*, *S. japonicum*) is characterized by fever, headache, hepatosplenomegaly and eosinophilia.

3-Acute urinary schistosomiasis (*S. haematobium*) is accompanied by fibrosis of bladder.



4-Manifestations of chronic schistosomiasis include formation of bladder and urinary stones [**hematuria** may progress to cancer]. Fevers occur accompanied by abdominal pain, swellings of the liver and spleen and dysfunction of the intestine (Katayama syndrome).

5- Incubation period: Depending on the amount of worms inside a human body, symptoms of disease are noted about 4–8 weeks after an infection. Patency: Up to 25 years.

### **Diagnosis**

1-If no eggs appear, demonstration in rectal biopsy (for all species), or in biopsy of bladder. 2- X-ray of urinary tract or intestine. 3 - Serological test.

**Treatment:** The drug of choice (according to WHO) is praziquantel (40 mg/kg Bodyweight) given as single dose.