http://www.MetaPathogen.com:

Schistosoma, blood fluke

Schistosoma species are causative agents of a tropical disease **schistosomiasis** or **bilharzia**. Millions of people are infected worldwide by three main species: *S. mansoni*, *S. japonicum*, and *S. haematobium*

Of the ~2700 genera of **Digenean** parasites, the 13 that comprise the *Schistosomatidae* are different in the following ways:

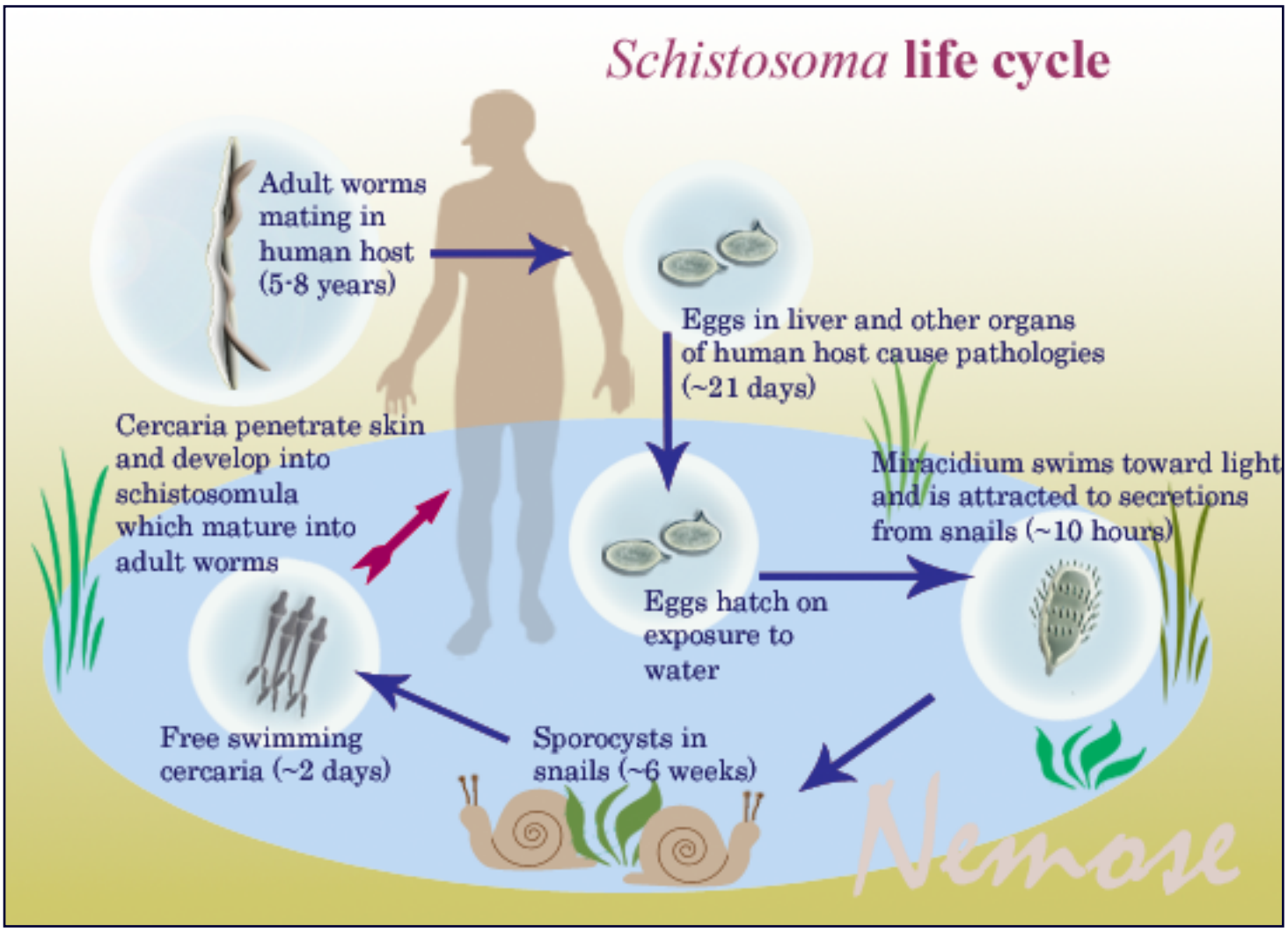
- they have two rather than three hosts
- they are **dioecious** (having female and male reproductive organs in separate individuals)
- they infect their hosts by directly penetrating the body surface, rather than being eaten
- they are **intravascular** parasites (live inside blood vessels)

No routine laboratory techniques were developed so far for culturing schistosomes through their complete life cycle *in vitro* as well as for expressing transgenes for targeted gene silencing and other purposes. Also, there are no schistosome cell lines. Therefore, analysis of schistosome-host interactions are very challenging and is confined mostly to traditional parasitological techniques.

- *Schistosoma mansoni*
  - **General information**
  - **Life cycle**
- *Schistosoma japonicum*
  - **General information**
  - **Life cycle**
- *Schistosoma haematobium* (not yet represented here)

---

cellular organisms - Eukaryota - Fungi/Metazoa group - Metazoa - Eumetazoa - Bilateria - Acoelomata - Platyhelminthes - Trematoda - Digenea - Strigeidida - Schistosomatoidea - Schistosomatidae - Schistosoma



Schistosoma mansoni

General information

- *Schistosoma mansoni* is **digenic** trematode ("digenic" means that its lifecycle includes two hosts - definitive and intermediate) of the

superfamily *Schistosomatoidea*.

- Intermediate host of *S. mansoni* are snails of the genus *Biomphalaria* (*Planorbidae* family).
- *S. mansoni* occurs in Africa, Madagascar, parts of South America (such as Venezuela and Brazil), Puerto Rico and the West Indies.
- *S. mansoni* is found in rodents and primates but primary target of the infection are humans.

Life cycle of *Schistosoma mansoni*

- egg

  female discharges up to 300 eggs per day singly (not in batches as *Schistosoma japonicum*); into mesenteric venule of definitive host (human); the eggs eventually obstruct blood flow in the venule causing a partial necrosis in the intestinal wall; hence, the eggs are dropped of into the lumen of the intestine, and passed to feces; eggs measure ~140 X 60 µm in diameter (bigger than eggs of *Schistosoma japonicum*)

- miracidium

  a free-swimming larva; once the egg is released into environment, miracidium hatches immediately and starts swimming; if it happened to swim into a snail of species *Biomphalaria* sp., it enters the snail and starts its first life as a parasite

- sporocyst

  a sac-like secondary larval stage; miracidium transforms into a primary (mother) sporocyst; germ cells within the primary sporocyst begin dividing to produce secondary (daughter) sporocysts, which migrate to the snail hepatopancreas; once at the hepatopancreas, germ cells within the secondary sporocyst begin to divide again, this time producing thousands of new parasites, known as cercariae, which are the larvae capable of infecting mammals

- cercarium

  an infectious form of *Schistosoma* which infects their hosts by direct skin penetration; cercariae emerge daily from the snail host; they are highly motile, alternating between vigorous upward movement and sinking; cercarium attaches to the human skin and secretes proteolytic enzymes helping it to enter into cuteneous capillary vessel; upon the penetration the cercarium sheds its tail and transforms into schistosomulum

- schistosomulum

  a tailless cercarium; after penetration and spending a few days in the skin, schistosomula migrate to the lungs (in 3-4 days), and after passing through the pulmonary capillaries, enter the systemic circulation and, eventually, are carried to the mesenteric vein of the host; there they mature into adult schistosomes in a month; female schistosomes do not maturate without a mature male and females schistosomes from single sex infections are underdeveloped and exhibit immature reproductive system; male schistosome holds female between its gynecophoral canal; at this time, the infection of the final host is complete and sexual reproduction of the parasite begins

- adult

  adult males are approximately 1 cm long and 0.11 cm wide; adult females are approximately 1.4 cm long and 0.016 cm wide; the adults can live for years; male and female are always hugged together; up to half the eggs released by the worm pairs become trapped in the mesenteric veins, or will be washed back into the liver, where they will become lodged; trapped eggs mature normally, secreting antigens that elicit a vigorous immune response

Schistosoma japonicum

General information

- *Schistosoma japonicum* is **digenic** trematode ("digenic" means that its lifecycle includes two hosts - definitive and intermediate) of the superfamily *Schistosomatoidea*.
- Intermediate host of *S. japonicum* are snails of the genus *Onchomelania hupensis* spp.
- *S. japonicum* occurs in Southeast Asia and western Pacific countries (including China, the Philipines and Indonesia).
- Apart from humans *S. japonicum* infect a wide range of animals including cattle, dogs, pigs, and rodents.

Life cycle of *Schistosoma japonicum*

- egg

  female discharges 500-3,5500 eggs per day into mesenteric venule of definitive host (human); the eggs eventually obstruct blood flow in the venule causing a partial necrosis in the intestinal wall; hence, the eggs are dropped of into the lumen of the intestine, and passed to feces; eggs measure ~80 X 60 µm in diameter, are oval to round in shape with subterminal spine

- miracidium

  a free-swimming larva; once the egg is released into environment, miracidium hatches immediately and starts swimming; if it happened to swim into a snail of species *Oncomelania*, it enters the snail and starts its first life as a parasite

- sporocyst

  a sac-like secondary larval stage; miracidium transforms into a primary (mother) sporocyst; germ cells within the primary sporocyst begin dividing to produce secondary (daughter) sporocysts, which

migrate to the snail hepatopancreas; once at the hepatopancreas, germ cells within the secondary sporocyst begin to divide again, this time producing thousands of new parasites, known as cercariae, which are the larvae capable of infecting mammals

- cercarium

an infectious form of *Schistosoma* which infects their hosts by direct skin penetration; cercariae emerge daily from the snail host; they are highly motile, alternating between vigorous upward movement and sinking; cercarium attaches to the human skin and secretes proteolytic enzymes helping it to enter into cuteneous capillary vessel; upon the penetration the cercarium sheds its tail and transforms into schistosomulum

- schistosomulum

a tailless cercarium; after penetration schistosomula migrate to the lungs (in 3-4 days), and after passing through the pulmonary capillaries, enter the systemic circulation and, eventually, are carried to the mesenteric vein of the host; there they mature into adult schistosomes in a month; male schistosome holds female between its gynecophoral canal; at this time, the infection of the final host is complete and sexual reproduction of the parasite begins

- adult

the adult worms can live for years; male and female are always hugged together; up to half the eggs released by the worm pairs become trapped in the mesenteric veins, or will be washed back into the liver, where they will become lodged; trapped eggs mature normally, secreting antigens that elicit a vigorous immune response; schistosomiasis is a chronic desease characterized by abdominal pain, fever, anemia, hepatosplenomegaly; acute schistosomiasis (Katayama fever) may occur weeks after initial infection

Pathologies

- Acute pathology
  - **Cercarial dermatitis**, skin rash that can be accomanied by lesions and can persist for days, occurs upon massive penetration of skin by cercariae.
  - **Katayama fever** is a systemic hypersensitivity reaction against the migrating schistosomulae. The disease (fever, fatigue, myalgia, etc.) starts suddenly in a few weeks or even months after a primary infection. Most patients recover spontaneously after 2-10 weeks. This type of illness is not common in individuals who live in areas that are endemic for schistosomiasis. It occurs instead in those people who have no previous history of exposure.
- Chronic pathology
  - Urinary schistosomiasis (*S. haematobium*)
  - Intestinal schistosomiasis
  - Hepatic schistosomiasis and hepatosplenic schistosomiasis (*S. mansoni*, *S. japonicum*)
  - Ectopic ("displaced") schistosomiasis
    - Genital schistosomiasis (*S. mansoni*, *S. haematobium*)
    - Pulmonary schistosomiasis (*S. mansoni*)
    - Neuroschistosomiasis (*S. japonicum*, *S. haematobium*)

References

PubMed articles

- Gryseels B. et al. Human schistosomiasis. *Lancet. 2006 Sep 23;368(9541):1106-18.* **PMID: 16997665**
- Pearce EJ, MacDonald AS. The immunobiology of schistosomiasis. *Nat Rev Immunol. 2002 Jul* **PMID: 12094224**

Websites

- **Wikipedia: *Schistosoma mansoni*.**
- **Animal Diversity Web: *Schistosoma mansoni*.**
- **eMedicine: Schistosomiasis, Bladder**
- ***Schistosoma japonicum*.**
- **Wikipedia: *Schistosoma japonicum*.**
- **eMedicine: Schistosomiasis, Bladder**

Last updated 03/15/09
nemose@live.com