

Semester-1

ZOO CC101: Non-Chordates I: Protists to Pseudocoelomates : Unit 3

Schistosoma haematobium

Life Cycle and Pathogenicity

Dr.Sister M.Stuti A.C

Department of Zoology

Patna Women's College

Patna University

OBJECTIVES

- The students will learn :
- Geographical distribution, habitat & morphology of *Schistosoma haematobium*
- Life cycle of *Schistosoma haematobium*
- Pathogenicity, treatment and prophylaxis

INTRODUCTION

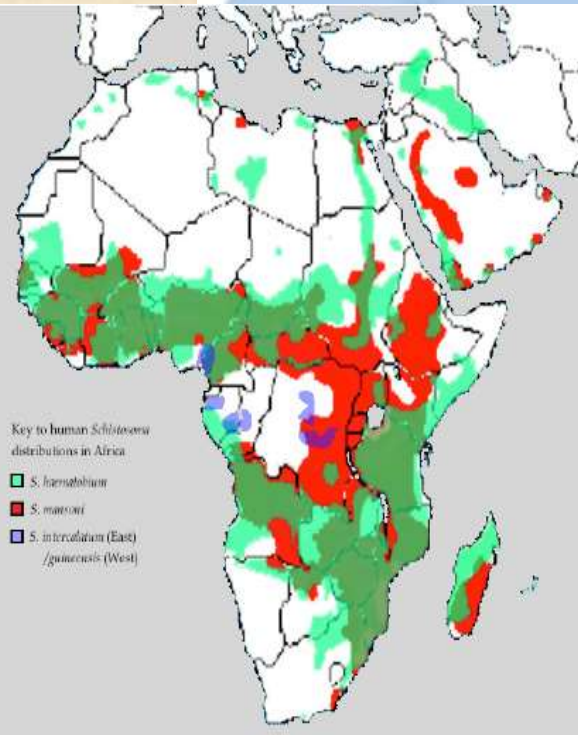
- *Schistosoma haematobium* is commonly known as the vesical blood fluke
- *Schistosoma* are parasitic blood dwelling fluke worms
- *Schistosoma* causes a disease called **Schistosomiasis**
- The genus *Schistosoma* contains different species that are of major pathological importance to man, *Schistosoma haematobium* (*S. haematobium*) *S. mansoni*, *S. japonicum* *S. mekongi*, *S. intercalatum* etc.
- Habitat is urogenital veins (**vesical plexus**), hepatic portal system & mesenteric vessels of human beings

SYSTEMATIC POSITION

- Phylum: Platyhelminthes
- Class: Trematoda
- Order: Digenea
- Genus: ***Schistosoma***
- Species: ***haematobium***

GEOGRAPHICAL DISTRIBUTION:

Various parts of Africa and Middle East.
Gadgil and Shah (1952) reported a few cases for India
(Ratnagiri in Maharashtra State)



Key to human *Schistosoma* distributions in Africa

- *S. haematobium*
- *S. mansoni*
- *S. intercalatum* (East) / *guineensis* (West)

Key:
Schistosomiasis-endemic areas

■ Hepatic-intestinal	■ Low risk for urinary
■ Both hepatic-intestinal and urinary	■ Low risk for hepatic-intestinal
■ Not endemic	■ Low risk for both hepatic-intestinal and urinary

GEOGRAPHICAL DISTRIBUTION

- Human Schistosomiasis is endemic in large areas of (sub) tropics
- It has been estimated that over 700 million people in 74 countries are exposed to the risk of Schistosomal infection, and almost 200 million were estimated to be infected in 2003 (Ferwirch, 2006) of which 85% in sub Saharan Africa.

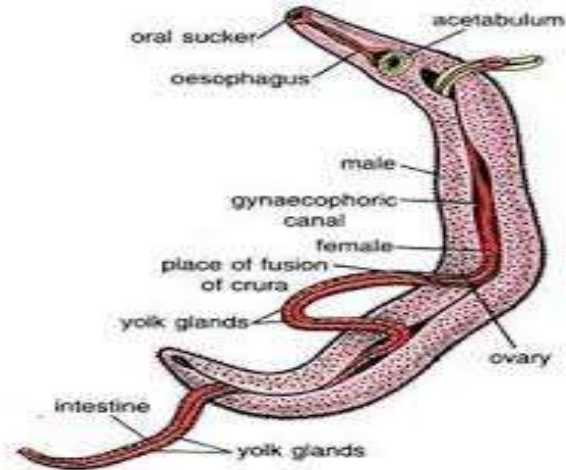
GEOGRAPHICAL DISTRIBUTION

- Natural streams, ponds and Lakes are typical sources of infections, but over the past few decades, man-made reservoirs and irrigation system, have contributed to the spread of **Schistosomiasis**.
- Prevalence of infection generally show a peak at the ages of 5-15 years and a decrease in adults



MORPHOLOGY

- *Schistosomes* are not hermaphroditic, but have separate sexes.
- The adult worms are 1-2 cm long with a cylindrical body that features two terminal suckers, a complex tegument, a blind digestive tract and reproductive organs
- Schistosomes are long-lived worms, having a life span of 20-30 years.
- Body is cylindrical, elongated and greyish or pinkish in colour.



Schistosoma haematobium
Male & female

- Both male and female worms are provided with oral and ventral suckers. Ventral suckers is large and powerful in male.
- Female is lodged in ventral **gynecophoric canal** of the male. It is formed by the infolding of the ventral body wall.

MORPHOLOGY



- Alimentary canal is simple and consists of mouth, oesophagus and forked (bifid) intestine pharynx is absent. Genital aperture lies immediately below the ventral sucker.
- Sexes are separate and sexual dimorphism is well marked.
- Male shorter and has cylindrical and flattened body. It measures 8-16 mm in length.
- The male reproductive system consists of 4 to 5 testes, vas efferentia, a short vas deference and seminal vesicle.
- Female is longer and has more slender delicate cylindrical body with smooth surface.

MORPHOLOGY

- **Male**

Size: 1-1.5 cm by 1 mm

Cuticula: finely tuberculated

testes: 4-5, in groups

- **Female**

Size: 2 cm by 0.025mm

- **Ovary:** Behind the middle of the body

- **Uterus:** contains 20-30 eggs

- **Egg:** 150 by 50 micron



Male



Female

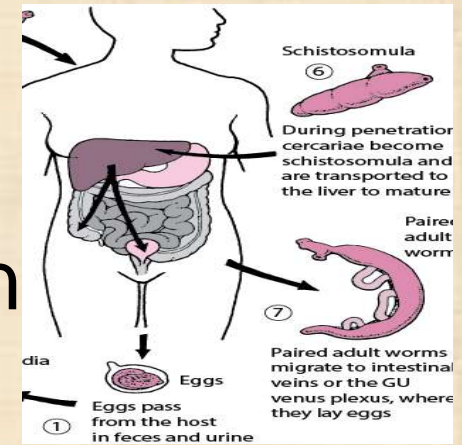


Egg

LIFE CYCLE

- *S. haematobium* passes its life cycle in two hosts

- **Definite host-Man**-Worms living in vesical and prostatic venous plexus



- **Intermediate host-Fresh water snail**
(*Bulinus truncate*)



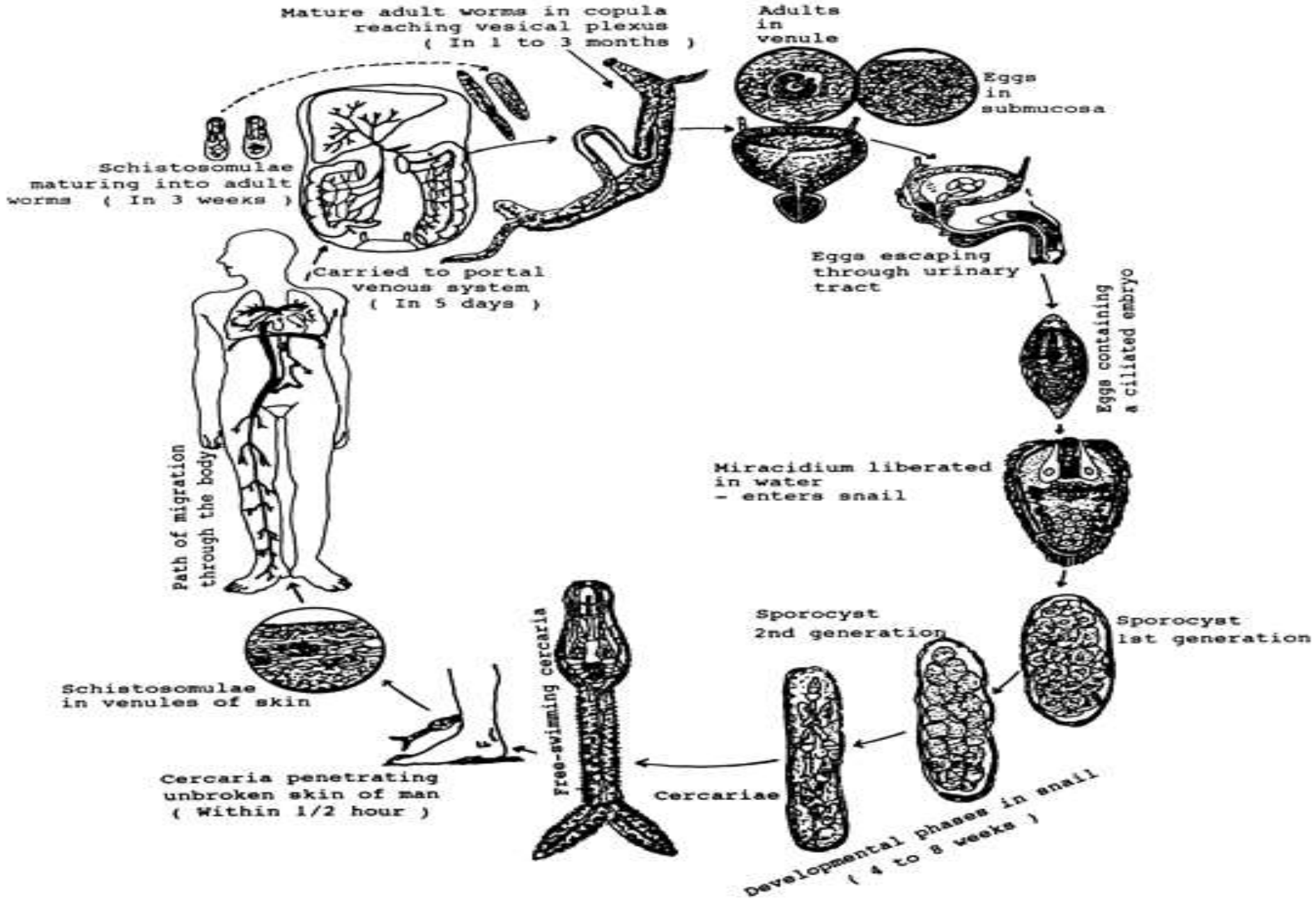
BULINUS TRUNCATUS(*S. haematobium*)

LIFE CYCLE Contd

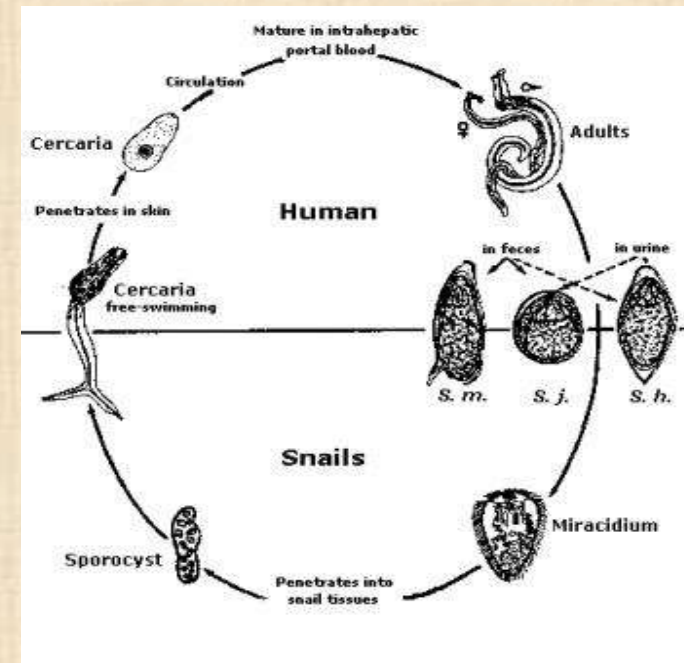
- Embryonated eggs pass with urine of definitive host and gain access to water
- Eggs produced do not reach the vesical lumen and are carried away with the bloodstream and or trapped in the tissues, these eggs provoke a granulomatous inflammatory response, which is the main cause of pathology in the human.
- Ciliated larvae (miracidia) hatch out of the eggs move freely in water in search of their intermediate host
- The miracidium on entering its proper larval host, penetrates into the soft tissues of the snail and reaches the liver.
- Miracidium is transformed into a tubular sporocyst
- Sporocysts multiplies and forms second generation of sporocysts they give rise to final larval forms, the fork -tailed *Cercaria* which are infective to man.



LIFE CYCLE



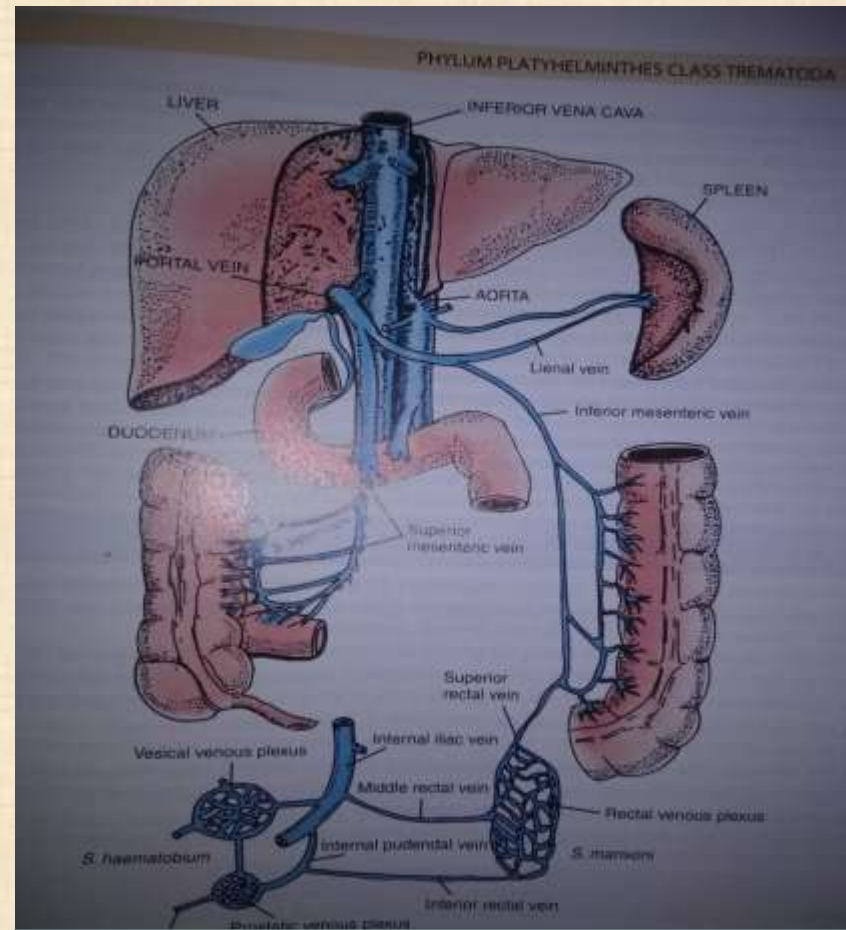
- The Cercaria escapes from the snail into water
- Infection results when human beings bathing or wading in the water are infected
- They attach to skin and penetrate the human unbroken skin
- The cercaria lose their tail now known as (**schistosomulae**) and gain access to a peripheral venule



LIFE CYCLE

Route through which adult Schistosomes migrate to their sites of location

- From peripheral venule they are carried through the right heart into the pulmonary capillaries
- They are carried through the left heart into the systemic circulation
- The majority are shunted in the abdominal aorta and gain the access mesenteric artery pass through the capillary bed in the intestinal and enter portal circulation (taking 5 days to reach the liver).

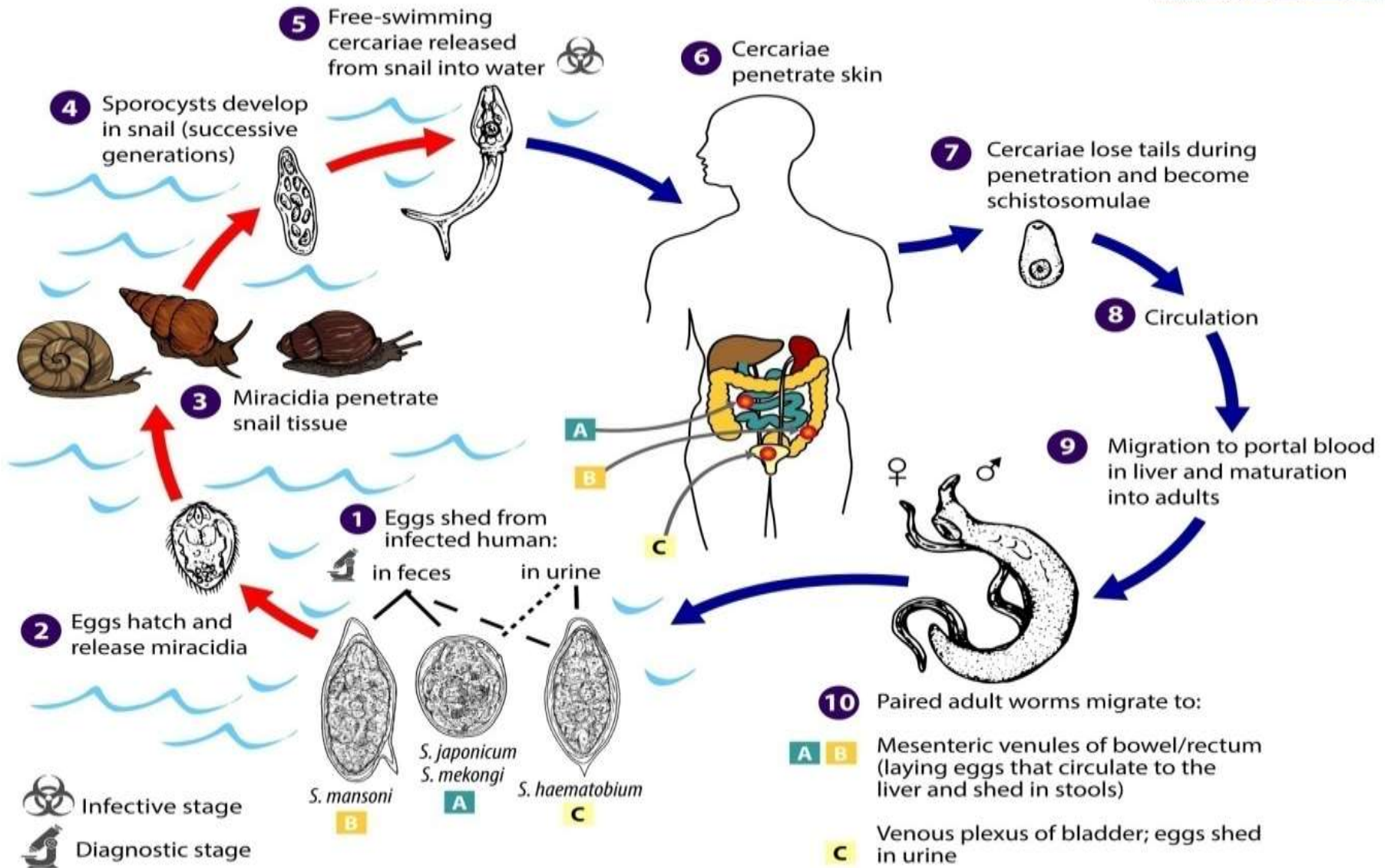


Portal venous system and its connections

LIFE CYCLE Contd...

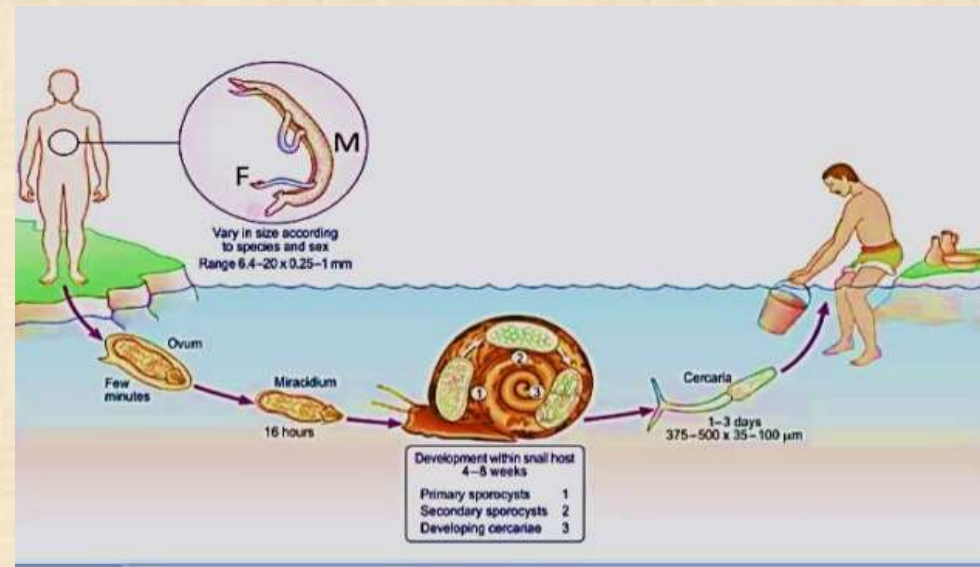
- The larvae grows into adults.
- After becoming sexually differentiated they move out of liver into the inferior mesentric vein,rectal venous plexus, pelvic veins and eventually enter the vesical plexus of veins
- The sexually mature worms copulate(the female are enclosed in the male) and the fertilized females lay eggs which are voided with the urine
- The cycle is repeated.

LIFE CYCLE



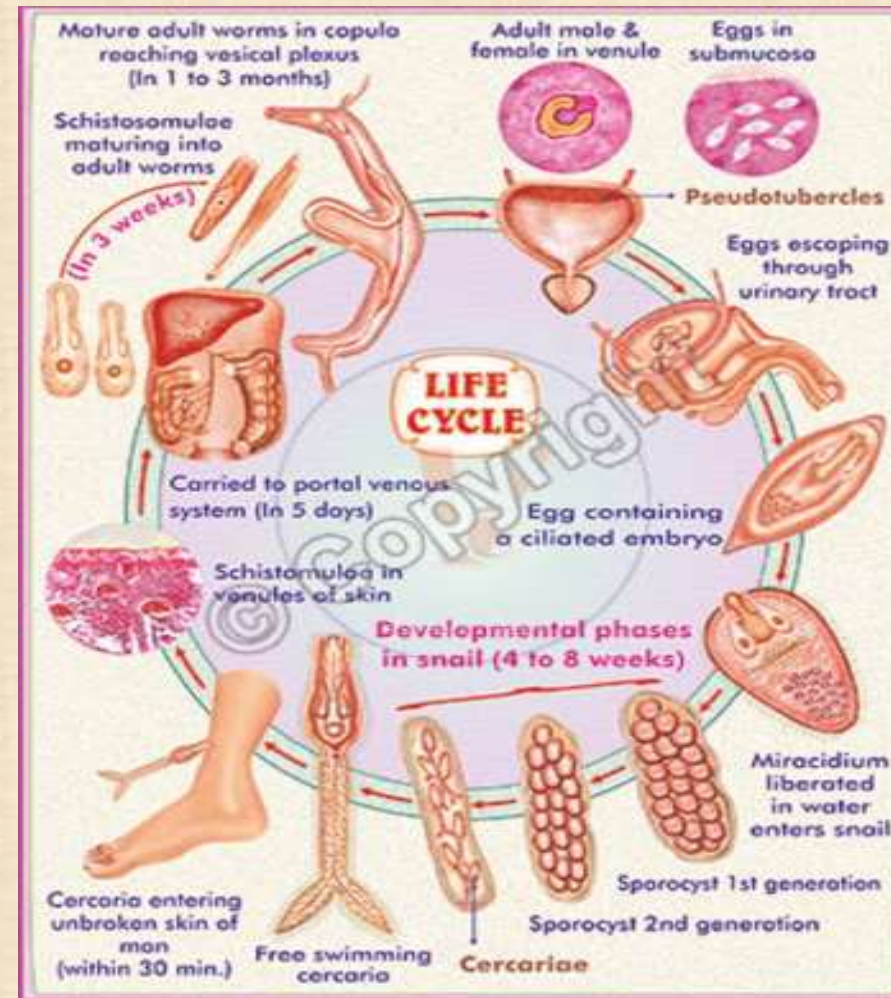
INFECTION

- Schistosoma infections follow direct contact with freshwater harbouring *Cercariae*
- Three major ways of infection
 - i) Contamination of fresh water with excreta containing *Schistosoma* eggs
 - ii) The presence of the snail intermediate host
 - iii) Human contact with water-infested with *Cercariae*



PATHOGENECITY

- Bathing in infected pool
- Cercariae stick to the surface of the skin of bather
- ***Infecting Agent***
Cercariae.
- ***Portal of entry***-Skin
- ***Site of location***-Vesical plexus of veins.(Urinary bladder)



PATHOGENESIS

- The terminal – spined eggs of *S.haematobium* may erode blood vessels and cause haemorrhages
- Schistosoma eggs, deposited in the tissues, act like foreign protein and have an irritative effect leading to round cell infiltration and connective tissue hyperplasia.

CLINICAL FEATURES

- Disease caused is referred to as **schistosomiasis haematobia** (urinary schistosomiasis or bilharziasis)

Disease passes through 3 phases

- At the site of entrance by Cercariae **local reaction(dermatitis)**
- Toxic metabolites liberated during growth of schistosomulae **fever, fatigue, weight loss, urticaria, enlarged tender liver and palpable spleen.**
- **Haematuria**(terminal)



DIAGNOSIS

Based on the demonstration of eggs of
S.haematobium

- A microscopical examination of urine. Sophisticated techniques give quantitative estimation of egg excretion
- Examination of stool: Concentration methods may detect the eggs

TREATMENT

- The drug having specific actions on the schistosomes are **Praziquantel** (40mg/kg/day in two divided doses for 1 day)
- **Metrifonate** (single dose of 7.5mg to 10mg/kg body weight, weekly for 3 weeks)
- **Praziquantel** is more effective drug than **Metrifonate**

PROPHYLAXIS

The preventive measures are-

- Eradication of the disease in man
- Prevention of pollution of water with human excreta
- Destruction of the snail vector in endemic areas
- Avoidance of swimming, bathing, wading or washing in infected water.



REFERENCE

- Ruppert EE, Fox RS and Barnes RD (2004). Invertebrate Zoology ;7/e, Cengage Learning, 255-256
- Cheng TC. General Parasitology (2006) 2/e Academic Press
- Chatterjee KD (2009). Parasitology; 13 e, CBS Publishers and distributors, 175-181

THANK YOU