The Trematodes

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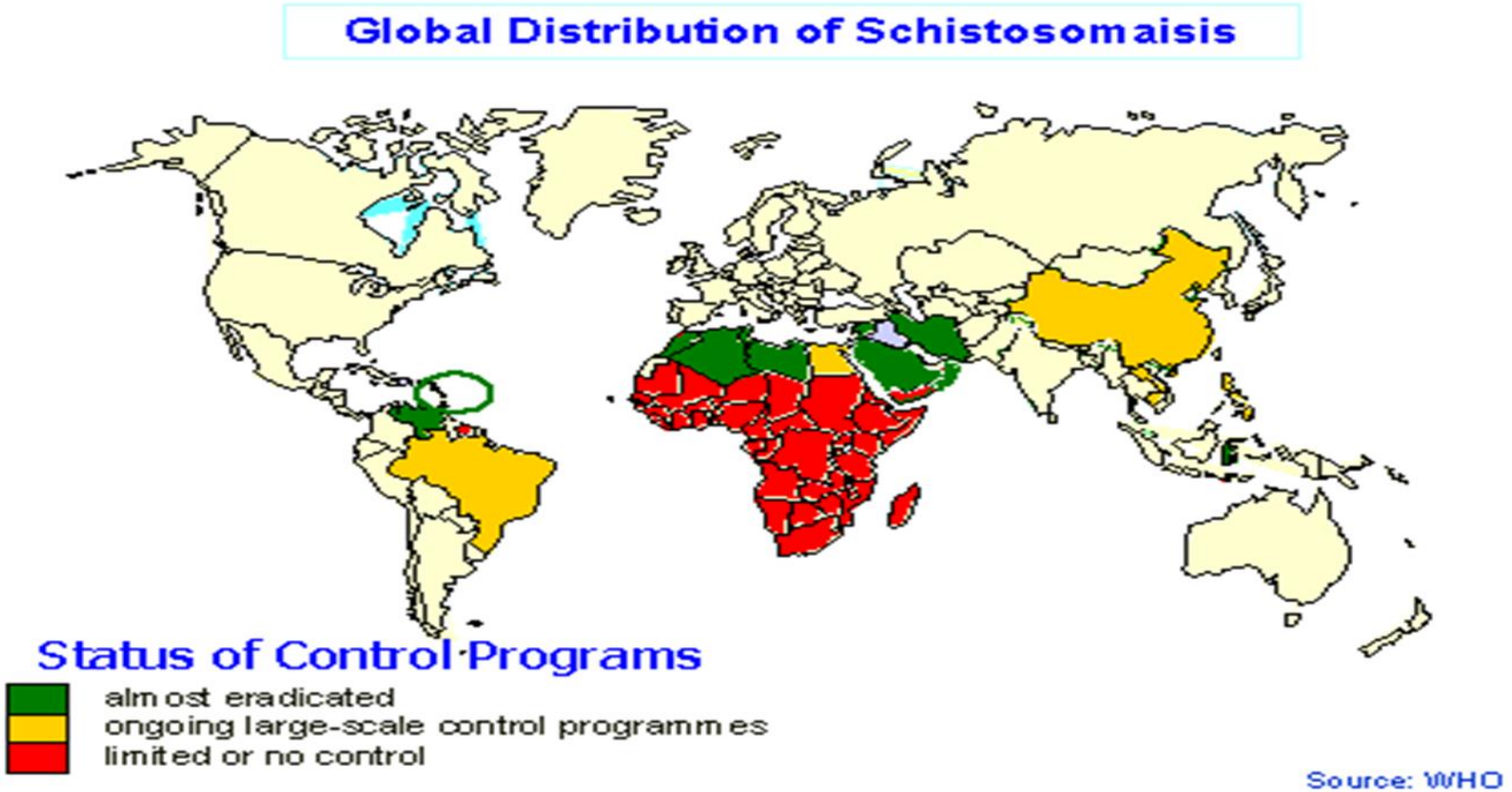
PROTOZOA	HELMINTHS
Unicellular Single cell for all functions	Multicellular Specialized cells
1:Aoebae: move by pseudopodia. 2:Flagellates: move by flagella. 3:Ciliates: move by cilia 4:Apicomplexa(Sporozoa) tissue parasites	Round worms (Nematodes): - elongated, cylindrical, unsegmented. Flat worms : - **Trematodes:** leaf-like, unsegmented. - Cestodes: tape-like, segmented.

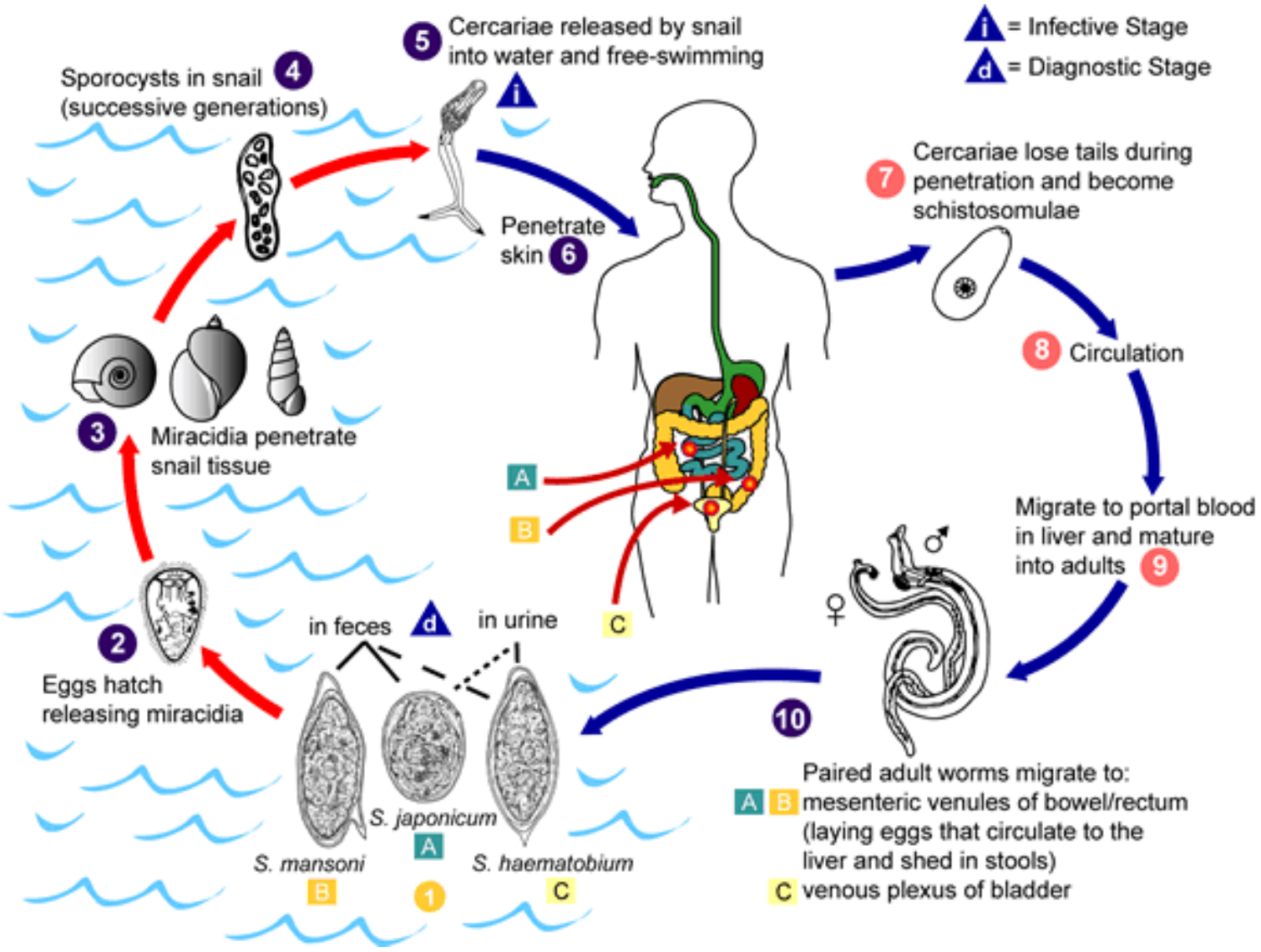
Blood Flukes
Schistosoma spp



Schistosoma

A genus of trematodes, ***Schistosoma***, commonly known as **blood-flukes**, are parasitic flatworms responsible for a highly significant group of infections in humans termed schistosomiasis. Schistosomiasis is considered by the World Health Organization as the second most socioeconomically devastating parasitic disease, (after malaria), with hundreds of millions infected worldwide.

Adult flatworms parasitize **blood capillaries** of either the **mesenteries(** *Schistosoma mansoni*)or **plexus of the bladder (***Schistosoma haematobium)*, depending on the infecting species


i = Infective Stage
d = Diagnostic Stage
1 Eggs hatch releasing miracidia
2 Miracidia penetrate snail tissue
3 Sporocysts in snail (successive generations)
4 Cercariae released by snail into water and free-swimming
5 Penetrate skin
6 Cercariae lose tails during penetration and become schistosomulae
7 Circulation
8 Migrate to portal blood in liver and mature into adults
9 Paired adult worms migrate to:
A B mesenteric venules of bowel/rectum (laying eggs that circulate to the liver and shed in stools)
C venous plexus of bladder
10 in feces
in urine
S. japonicum
S. mansoni
S. haematobium
A
B
C

Schistosoma spp

CERCARIA IS THE INFECTIVE STAGE.

Cercaria emerge from snail in the water and penetrate the skin of the human.

The **cercaria** is transformed into **a schisosomula** inside the host tissues.

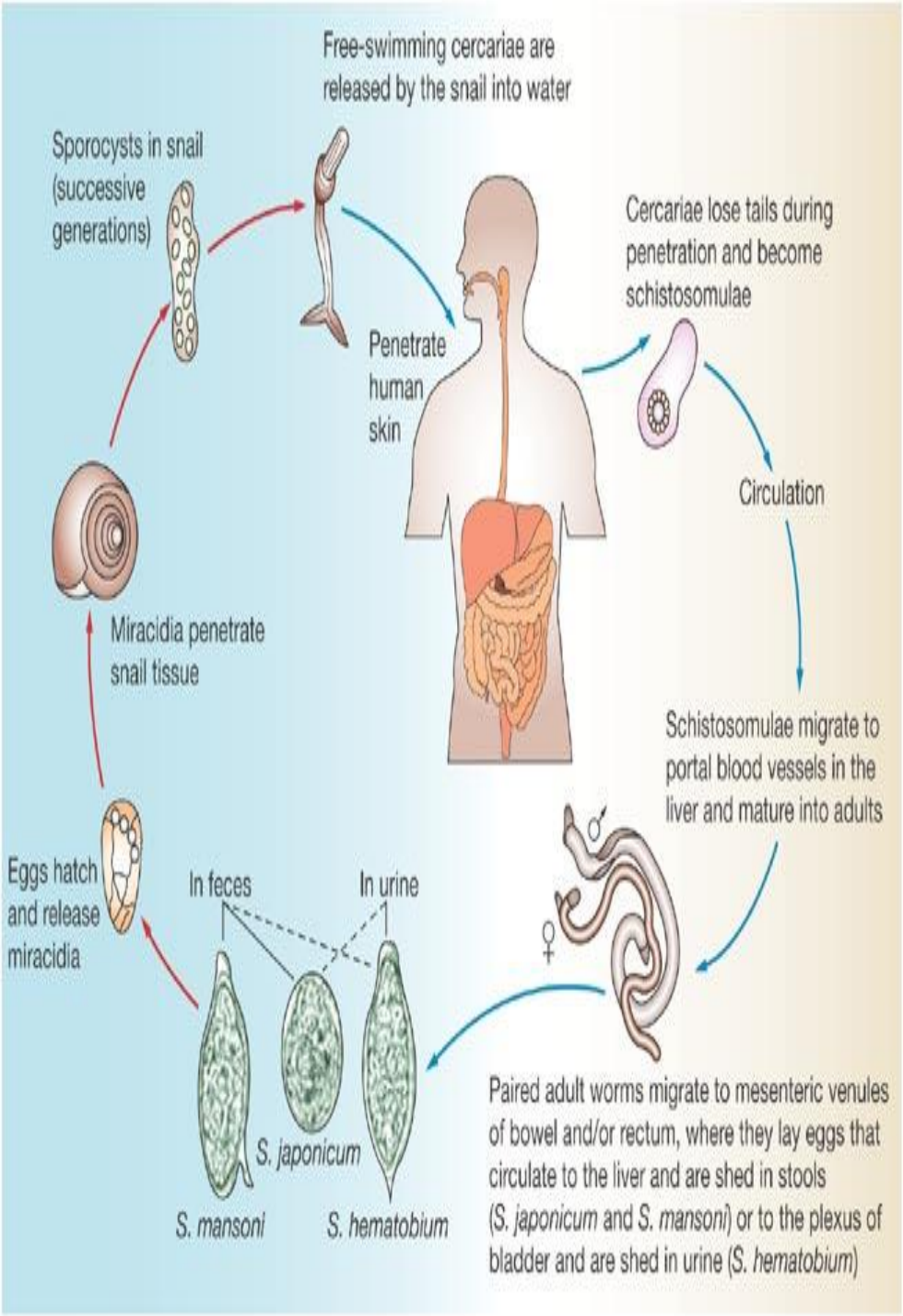
The **schistosula** first enters the systemic circulation and then finds its way into **the portal circulation** (S.mansoni &Sjaponicum) worms mature in the **mesenteric veins of the portal circulation** ,S.haematobium worms generally remain in the systemic circulation and mature in the blood vessels of the **vesical plexus**.

THE EGG IS THE DIAGNOSTIC STAGE

.The eggs of S.mansoni &S.japonicum are passed **mainly in stool** and S.haematobium passed **mainly in the urine**.

PATHOLOGY:

The EGG is the main cause of pathology in schistosomiasis . Many eggs become stranded in the tissues or are carried by the blood stream to other organs mainly the LIVER. The host reaction to the eggs may vary from small granulomas to extensive fibrosis .The extent of damage is generally related to the number of eggs present in the tissues.



PATHOLOGY:

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After the eggs of the human-infected with S.mansoni & S.japonicum are passed in the feces into the water 0r the eggs are passed during micturition from host infected with S.haematobium .

the miracidium hatches out of the egg and searches for a suitable freshwater snail to act as an intermediate host . In the snail the miracidium develops to cercaria. From a single miracidium result a few thousand cercaria, every one of which is capable of infecting a human

Cercaria emerge from snail in the water and penetrate the skin of the human .The cercaria is transformed into a schisosomula inside the host tissue.

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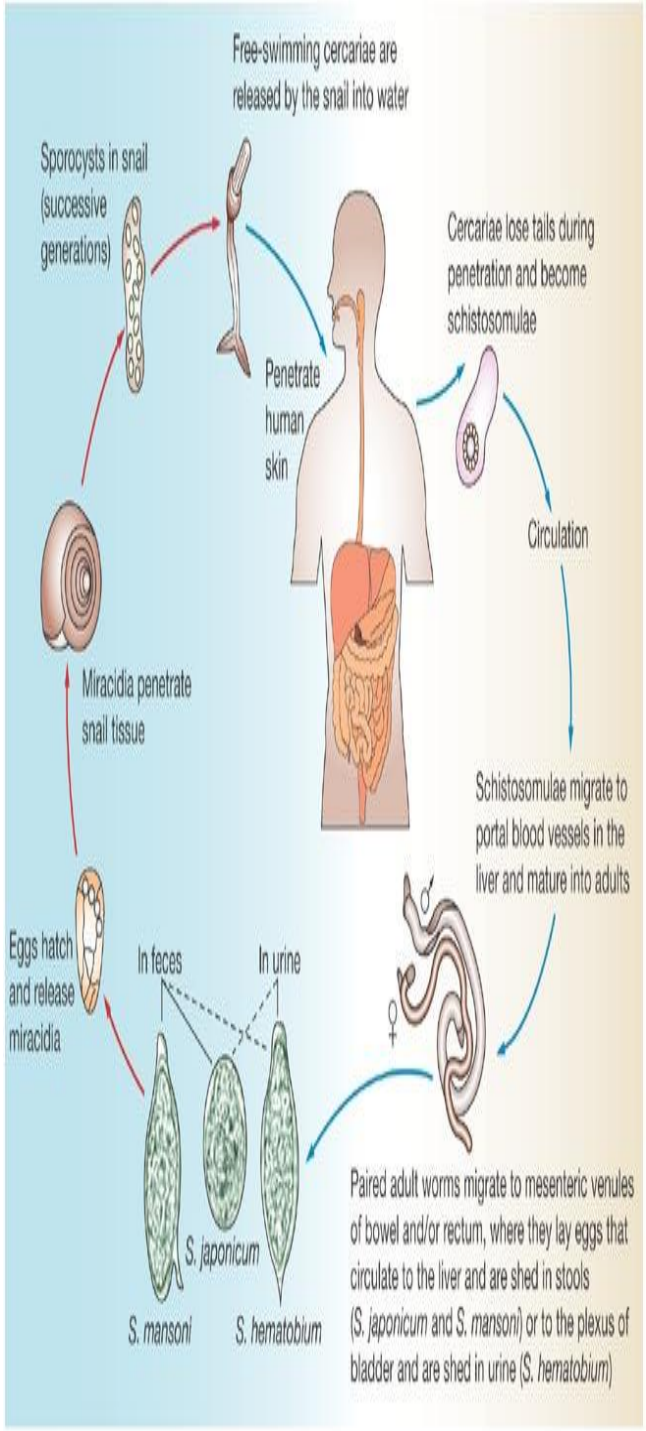
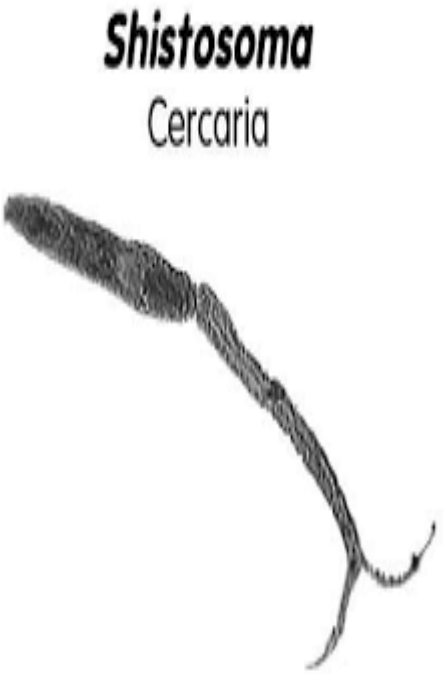


The cercaria emerge from the snail during daylight and they actively seeking out their final host. When they recognize human skin and become schistosomula,

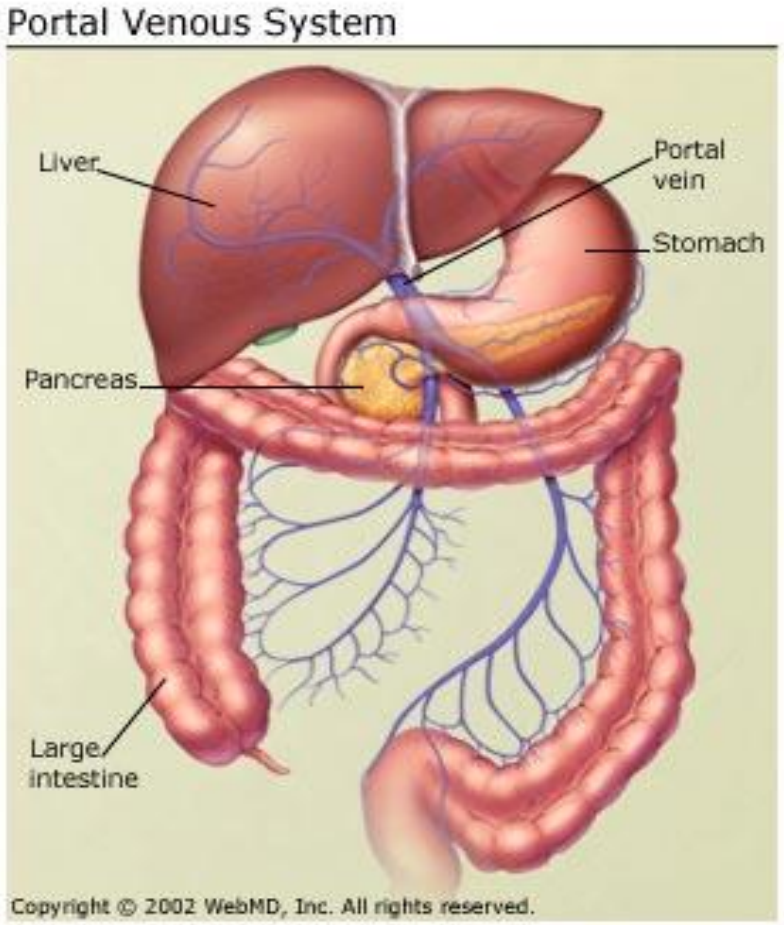
Each schistosomule spends a few days in the skin and then enters the circulation starting at the dermal lymphatic and venles, they feed on blood.
The schistosomule migrates to the lung and then moves via circulation through the left side of the heart then it develops into a sexually mature adult and the pair migrate to the mesenteric veins (S.mansoni &S.japonicum) or to urinary bladder veins (S.haematobium).

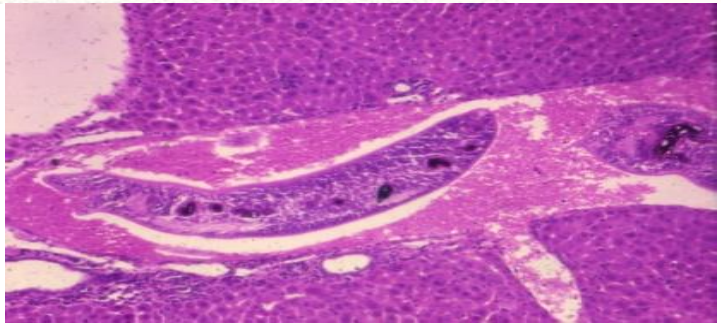
The female fluke lays as many as 30 eggs per day which migrate to the lumen of the urinary bladder and ureters (S.haematobium)

Each female lays 300 eggs a day the eggs move into the lumen of the host's intestines and are released into the environment with the feces (S.mansoni & S.japonicum)



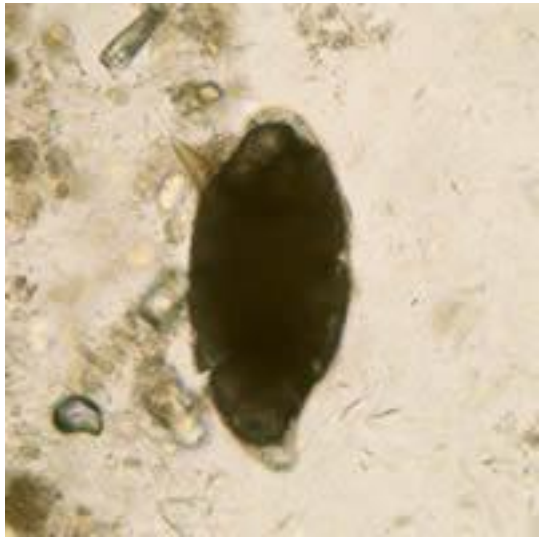
Schistosome dermatitis, or "swimmers itch" occurs when skin is penetrated by a free-swimming, fork-tailed **infective cercaria**. The dermatitis often develops 24 hours after exposure and last for 2 to 3 days and then spontaneously disappears.



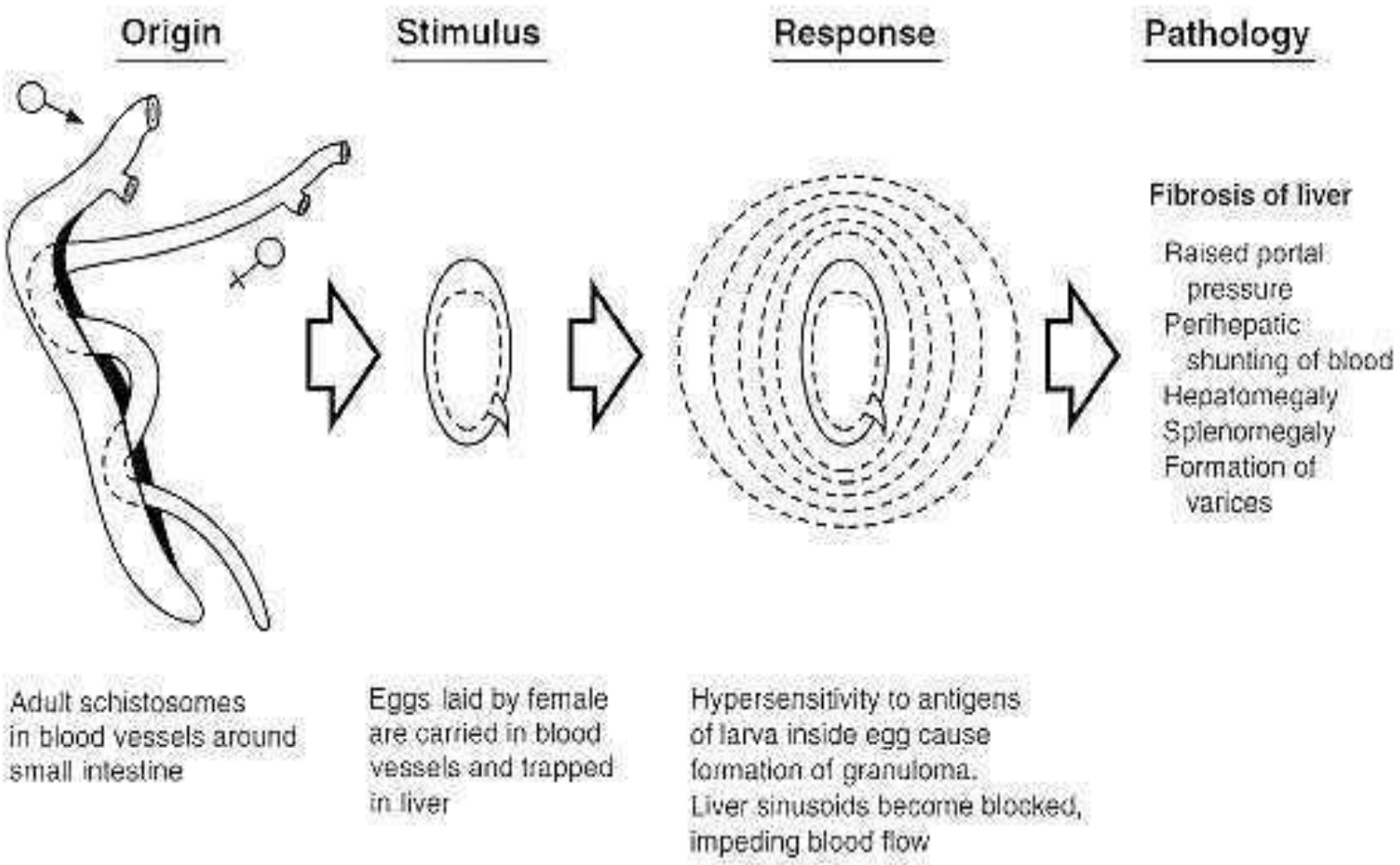


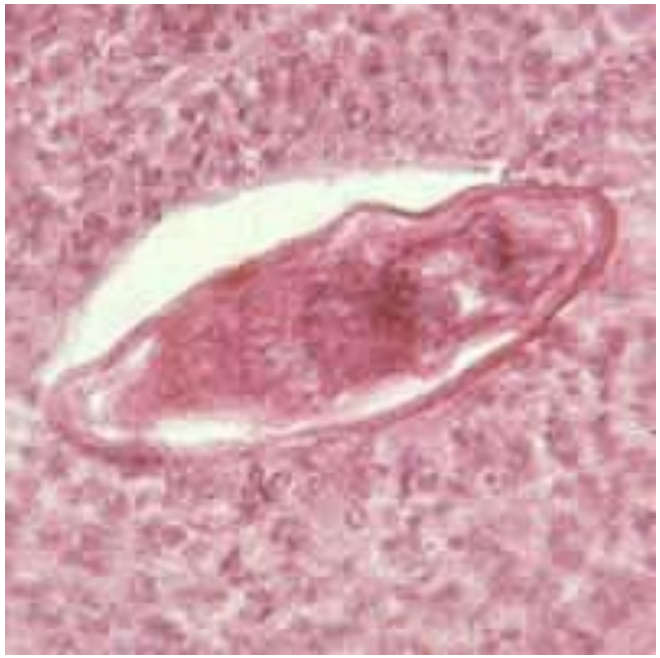
Developing schistosome in liver:

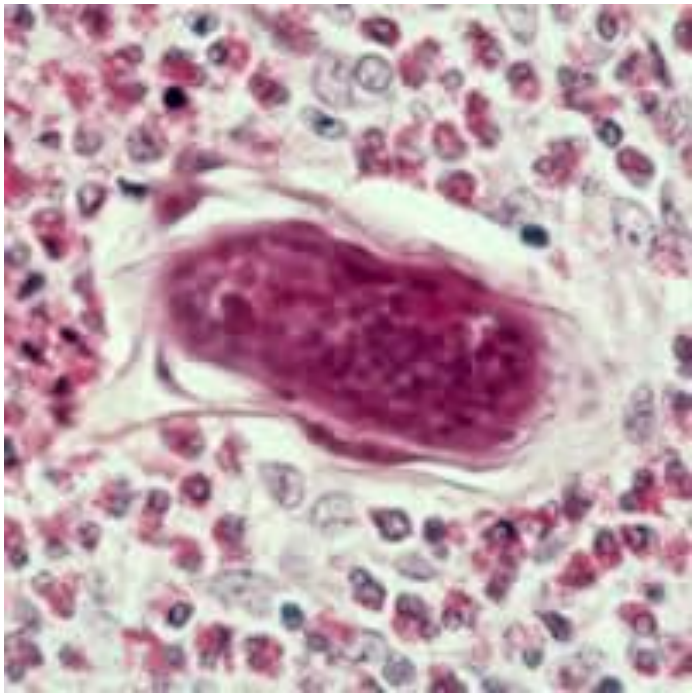
S. mansoni &S. japonicum located mainly in **mesenteric vein** and its branches, the worm discharges **EGGS** ,the eggs travel in 2 directions : 1- some eggs find their way into the lumen of the bowel and appear in the faeces,2- other flow with blood stream in the portal circulation and enter **the LIVER**. Most of these eggs are trapped in the liver and give rise to pathology , again some of these eggs find their way through the liver tissue and enter the systemic circulation to another organ as brain ,fibrosis of the liver caused from eggs settled in the liver may produce portal hypertension ,which may lead to hepatomegally ,splenomegally esophageal varices,haemorroids and ascites.



Eggs of *Schistosoma mansoni with lateral spine*


Origin
Stimulus
Response
Pathology
Fibrosis of liver
Raised portal pressure
Perihepatic shunting of blood
Hepatomegaly
Splenomegaly
Formation of varices
Adult schistosomes in blood vessels around small intestine
Eggs laid by female are carried in blood vessels and trapped in liver
Hypersensitivity to antigens of larva inside egg cause formation of granuloma.
Liver sinusoids become blocked, impeding blood flow





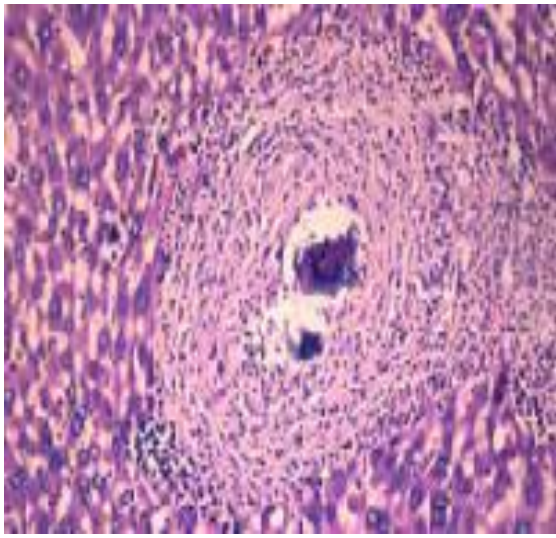
Eggs of *Schistosoma mansoni*
in the liver and cellular reaction.

Hepatomegally and slenomegally wih ascites.

HEPATOSPLENOMEGALLY IN CHRONIC SCHISTOMAIASES.

S. haematobium :

the worm is located in the vesical venous plexus surrounding the urinary bladder .Many ***eggs*** *are trapped in the wall of the bladder where they may give rise to calcification and granuloma formation .Constriction of the orifice of the ureter may produce kidney damage , hydronephrosis and cancer of the bladder.*



Pathology of Schistosomiasis

- ***Schistosoma haematobium***
- Causes urinary schistosomiasis

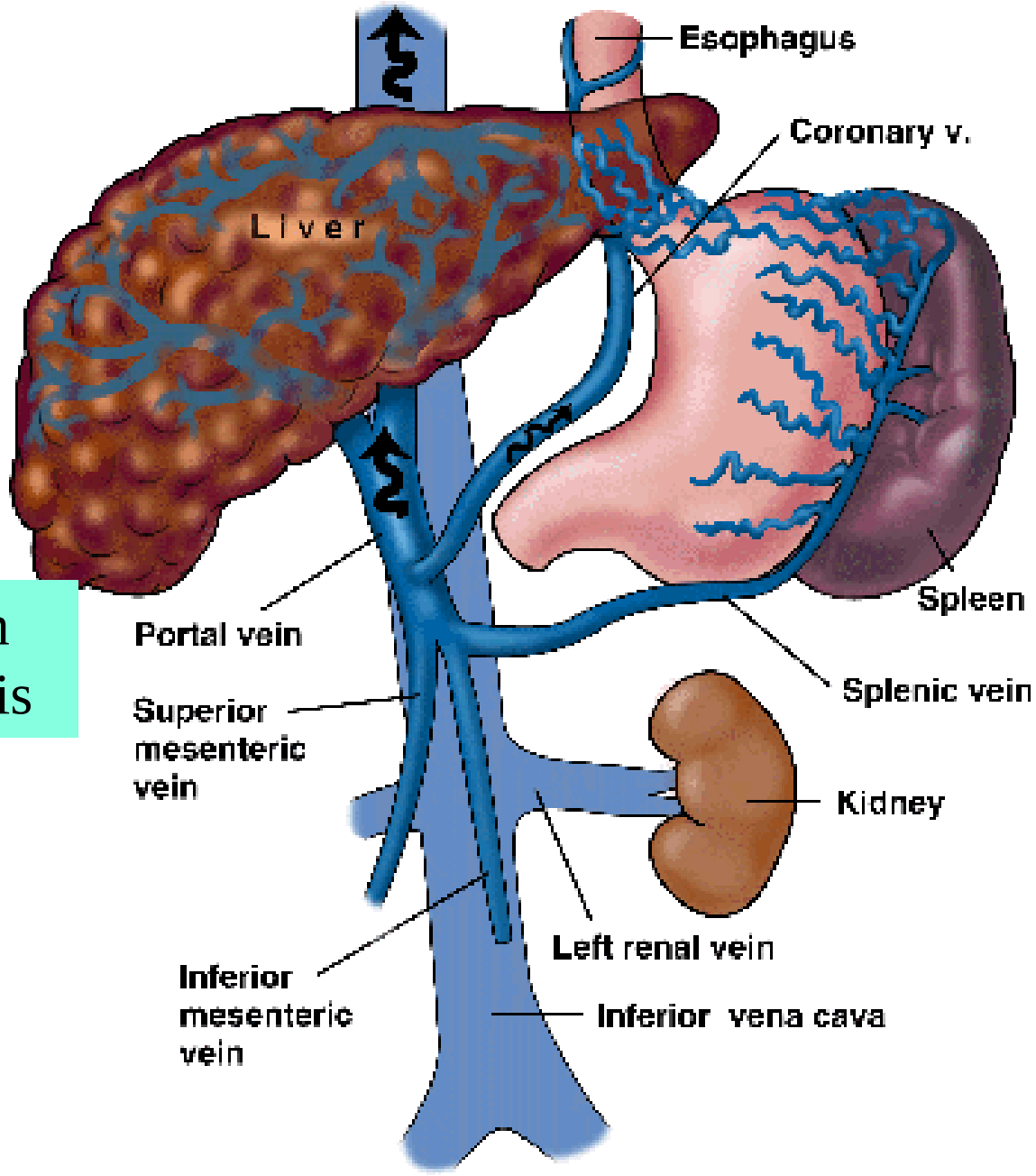
1. PREPATENT PERIOD 10-12 wks
2. EGG DEPOSITION AND EXTRUSION:
   1. painless haematuria
   2. Inflammation of bladder and burning micturition
   3. CNS involvement (rare)
3. TISSUE PROLIFERATION AND REPAIR:
   - Fibrosis , papillomata in the bladder and lower ureter leading to obstructive uropathy.
   - Periportal fibrosis
   - Lung and CNS involvement

- ***Schistosoma mansoni***

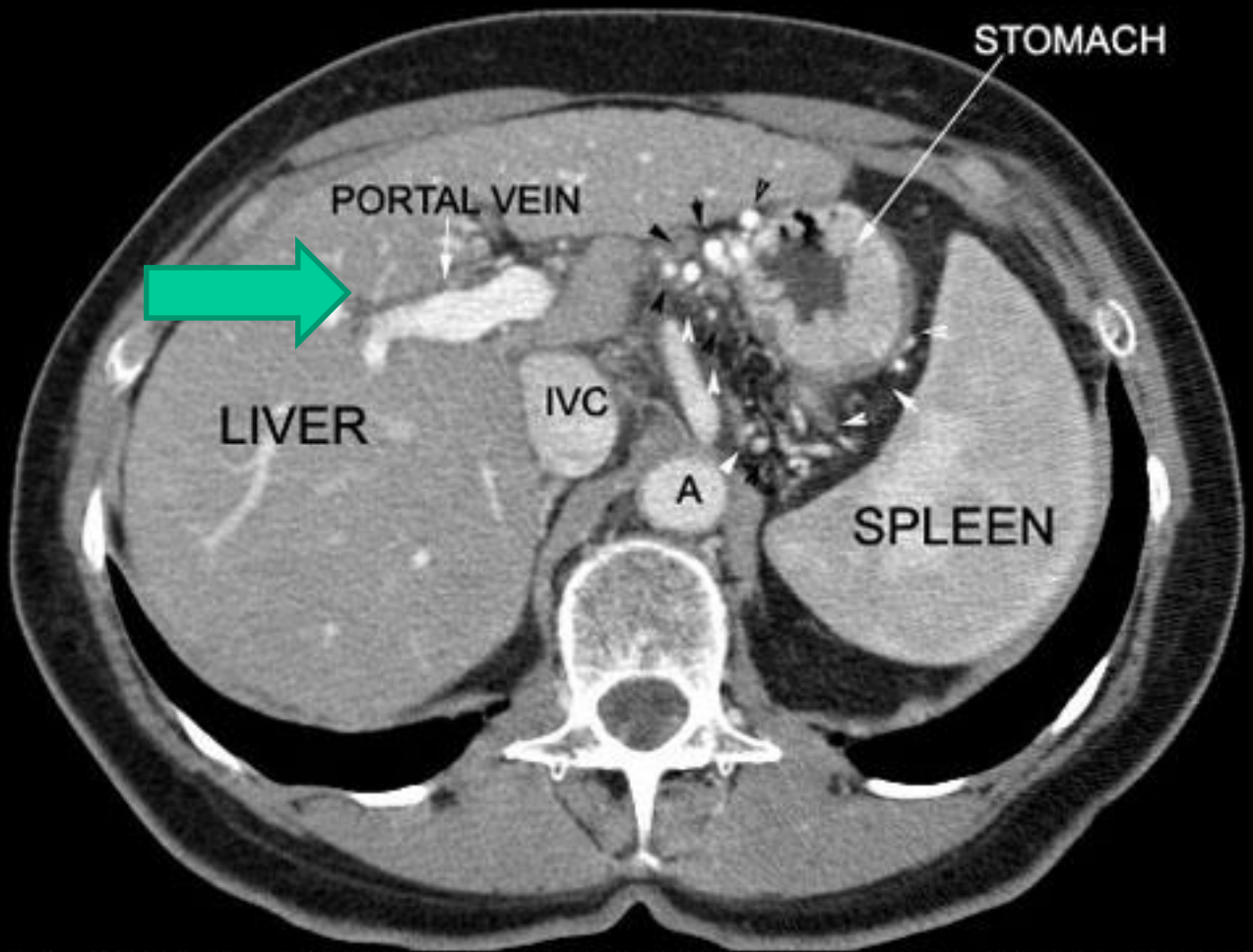
Causes intestinal schistosomiasis

1. PREPATENT PERIOD 5-7 wks
2. EGG DEPOSITION AND EXTRUSION:
   1. dysentery (blood and mucus in stools),
   2. hepatomegaly splenomegaly
   3. CNS involvement (rare)
3. TISSUE PROLIFERATION AND REPAIR:Fibrosis ,
   - Papillomata in intestine,
     - Pperiportal fibrosis,hematemesis
   - Lung and CNS involvement.

Portal hypertension in chronic schistosomiasis



PORTAL HYPERTENSION



THE PORTAL VEIN IS ENLARGED. ARROWHEADS POINT TO THE PERI GASTRIC VARICES.

Diagnosis of Schistosomiasis

- ***Schistosoma haematobium***
- ***Parasitological:***
  - **Examination of urine**
- ***Immunological***
  - ***Serological tests***
- ***Indirect:***
  - ***Radiological***
  - ***Cystoscopy***

- ***Schistosoma mansoni***
- ***Parasitological***
  - **Examination of stools**
- ***Immunological***
  - ***Serological tests***
- ***Indirect:***
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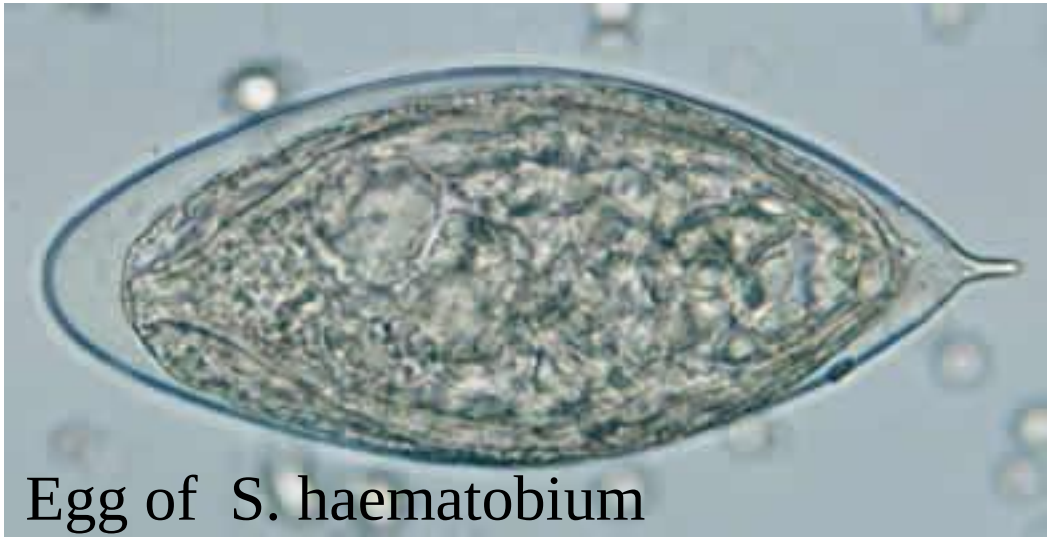
  - ***endoscopy***

Egg of S. haematobium

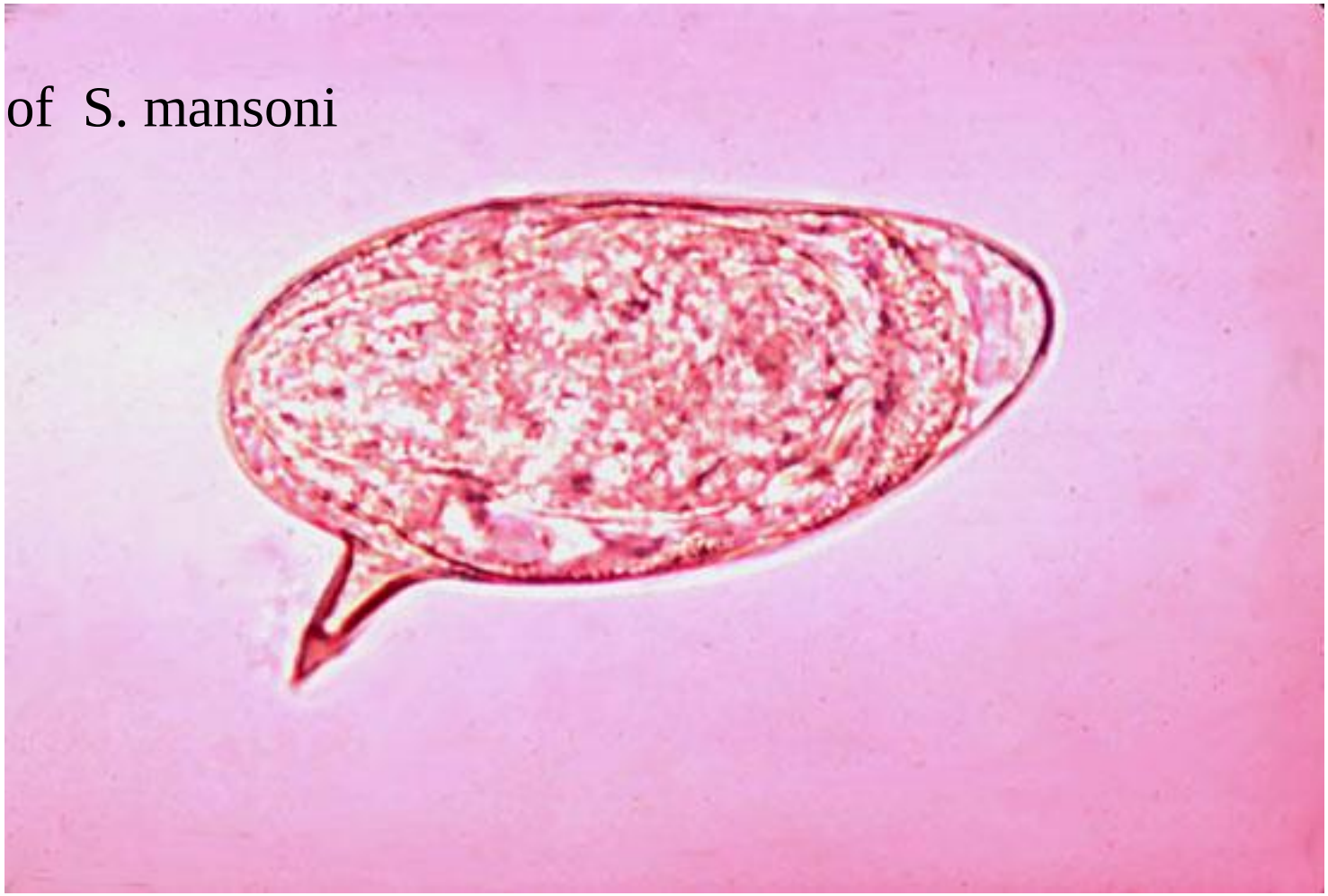
Egg of

S. japonicum



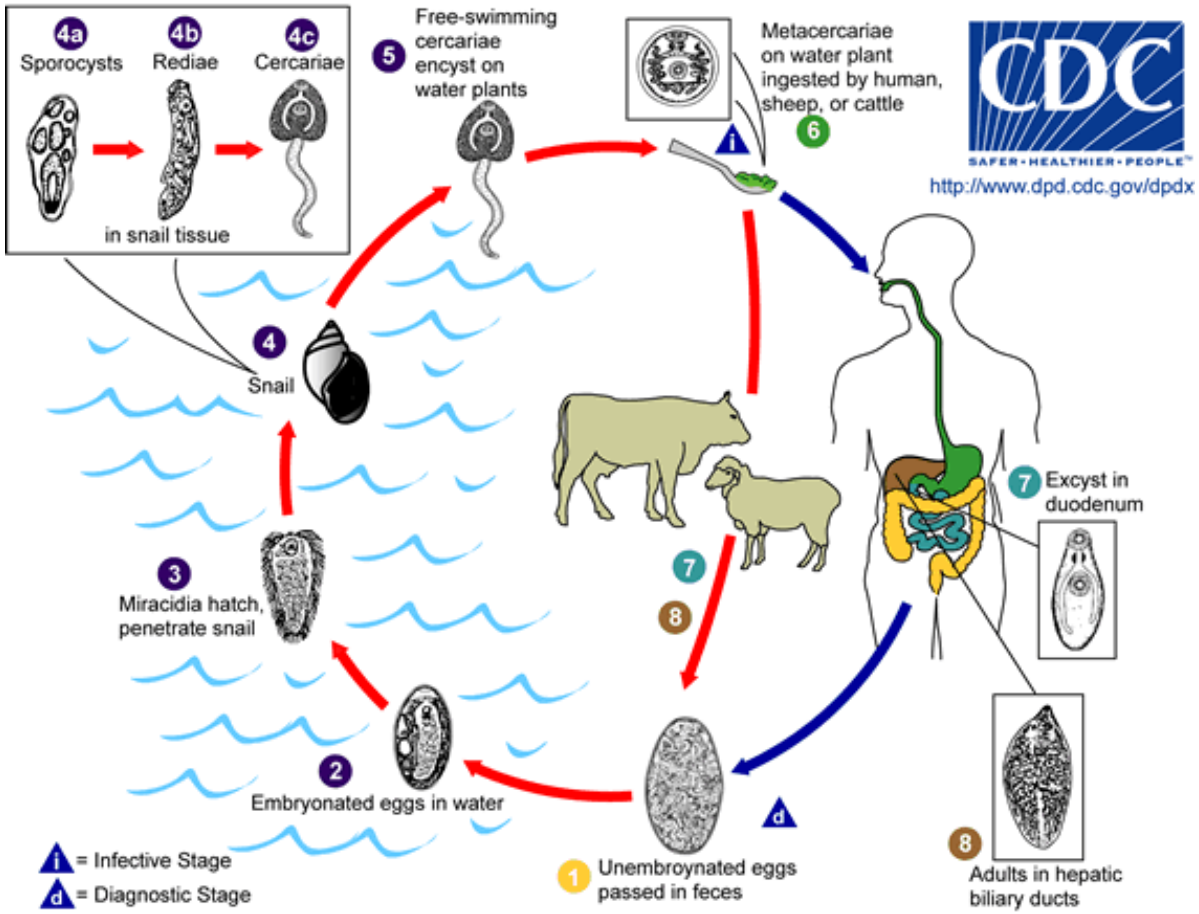
Egg of S. haematobium

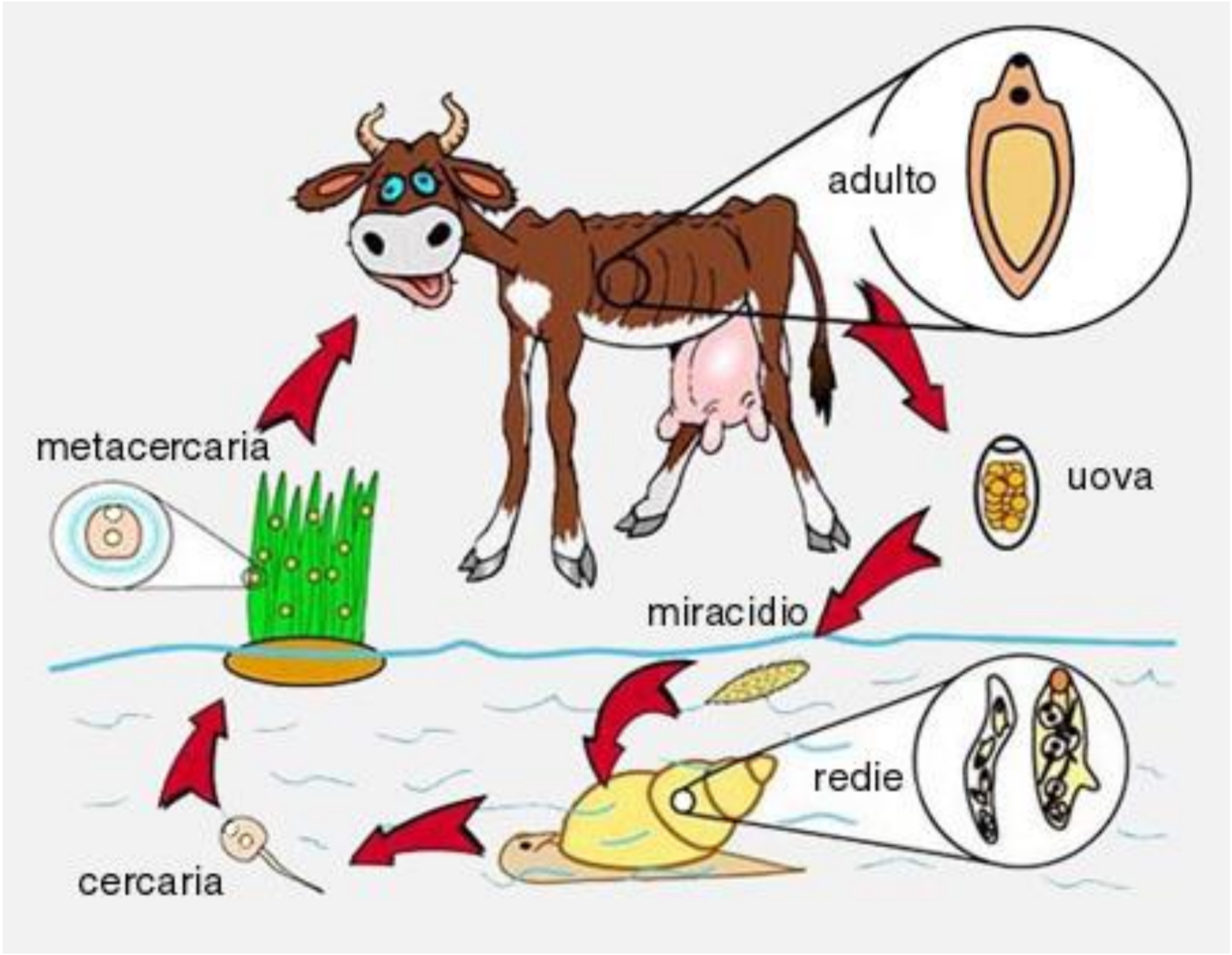
Egg of S. mansoni

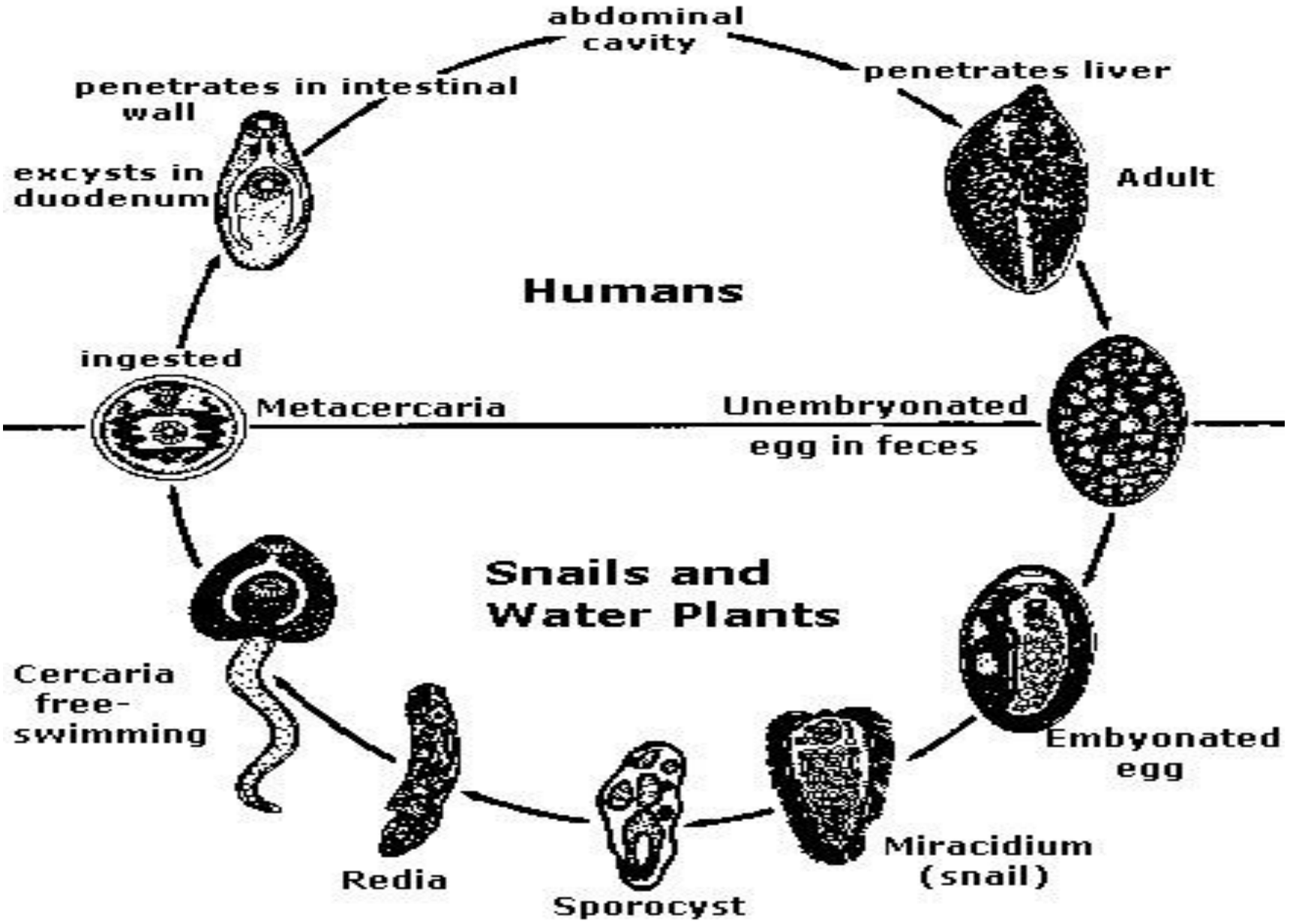


Drug of choice for schistosomiasis is
Praziquantel

Life-cycle of *Fasciola hepatica*




adulto
metacercaria
uova
miracidio
redie
cercaria


abdominal cavity
penetrates liver
penetrates in intestinal wall
excysts in duodenum
Adult
Humans
ingested
Metacercaria
Unembryonated egg in feces
Snails and Water Plants
Cercaria free-swimming
Embyonated egg
Redia
Sporocyst
Miracidium (snail)

Snail intermediate host of :
Fasciola hepatica

Watercress , one means of transmission of fascioliasis

Fasciola hepatica

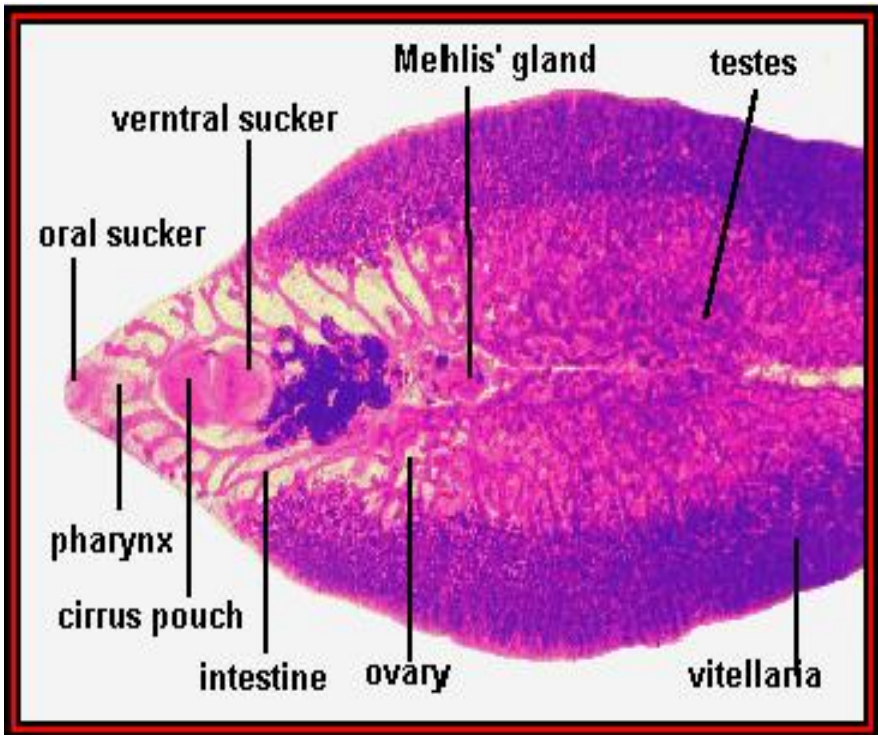
Fasciola hepatica

Egg of *Fasciola hepatica*

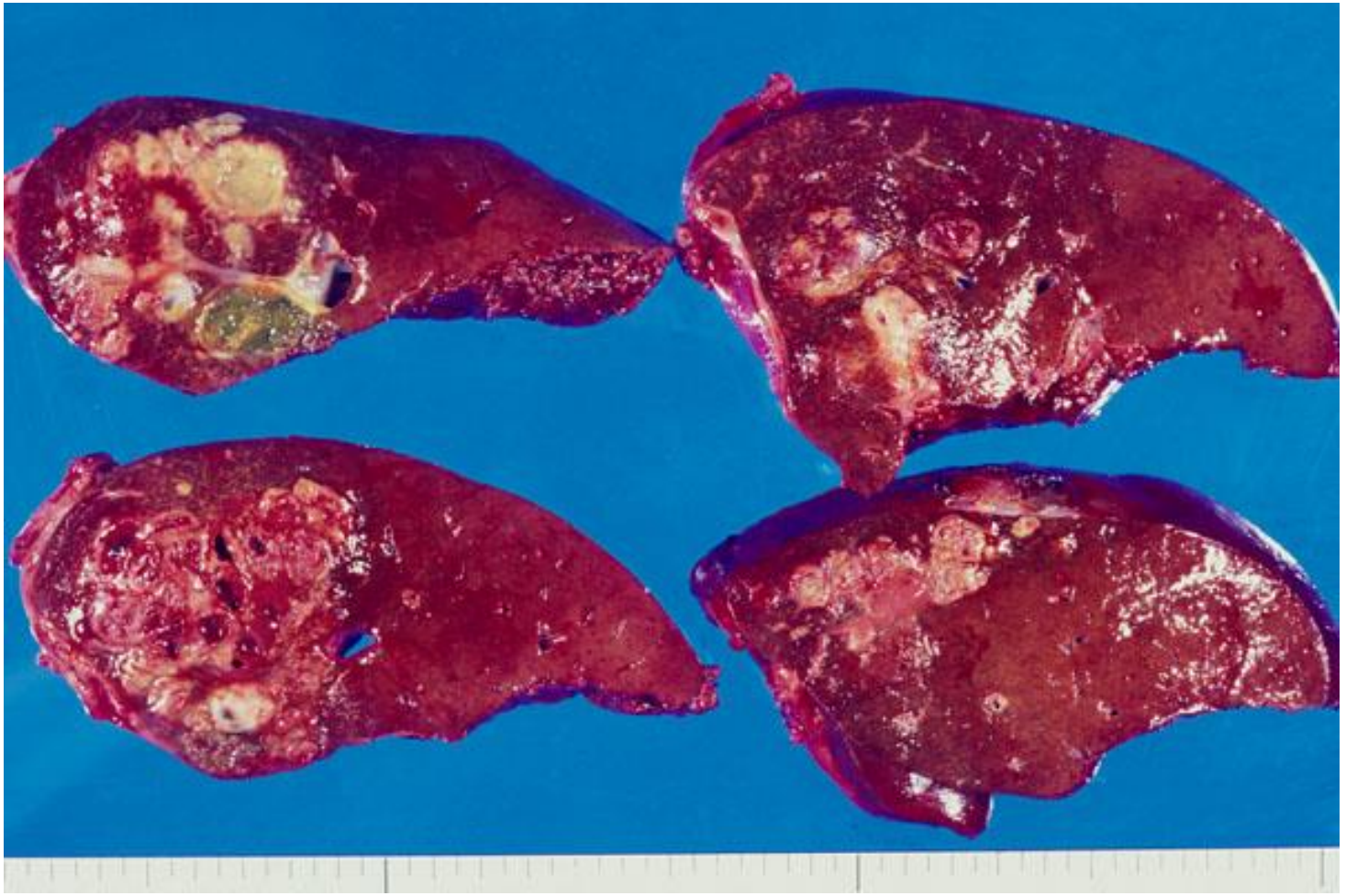
Fasciola hepatica

- Pathology and clinical picture :
  - **True infection :** occur when man accidentally ingests water plant (watercress) contaminated with **METACERCARIA** , the adult worm can causes mainly biliary colic with **biliary obstruction, jaundice,** generalised abdominal pain ,cholisistietis and cholithiasis.
  - **False infection is when eggs are eaten in infected animal liver and passed in stools.**
- Diagnosis: eggs in stools or duodenal aspirate.
- Treatment: Triclabendazole.

Fasciola hepatica adult



Fasciola hepatica in bile duct



Sheep liver infected with *Fasciola hepatica*

***Fasciola hepatica*: spurious infection (false infection) will not lead to liver infection only we can detect eggs in stool**

TREATMENT

Triclabendazole is the drug of choice to treat fascioliasis and is on the WHO list of essential medicines.

The correct dosage is calculated based on the person's weight (10 mg/kg) and the tablets are given at one time.