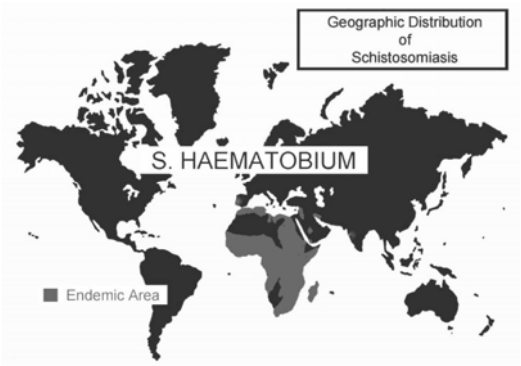
Helminths:

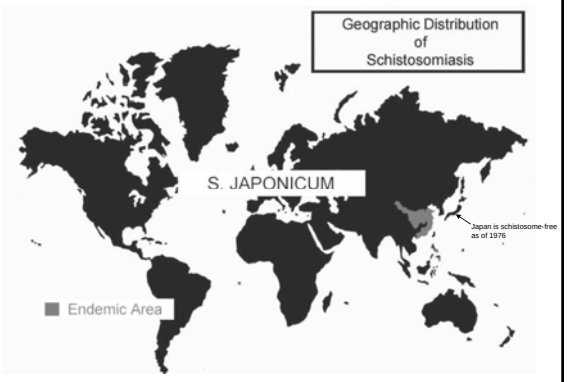
Trematoda - non-segmented flat worms

The schistosomes:

Schistosoma mansoni
Schistosoma haematobium
Schistosoma japonicum
Schistosoma mekongi



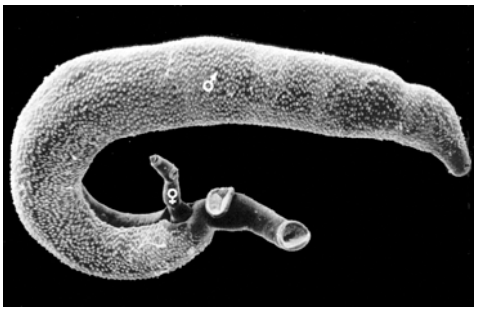
Aquatic freshwater snails are the intermediate hosts for all schistosome species



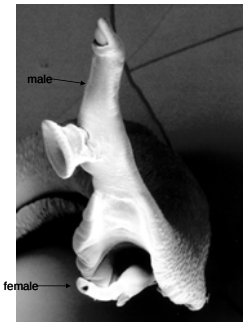
Schistosoma mansoni

Schistosoma japonicum

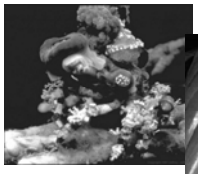
Adult male and female *Schistosoma mansoni*



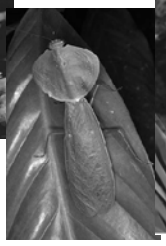
Locked in life's embrace



One Effective Evolutionary Strategy for Survival:
Camouflage



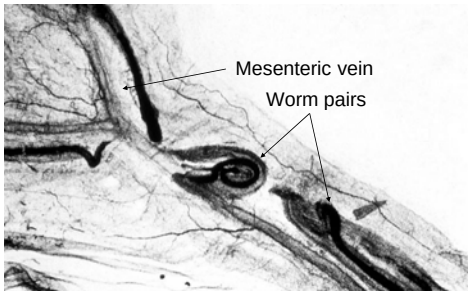
Decorated Crab



Praying Mantis

Sargasso Sea Horse

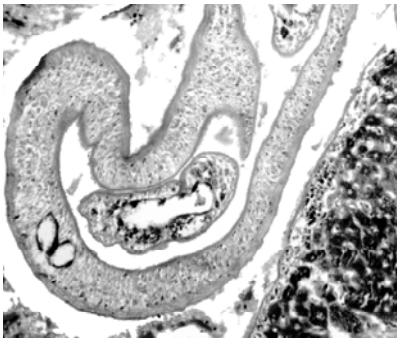
Schistosoma mansoni in situ



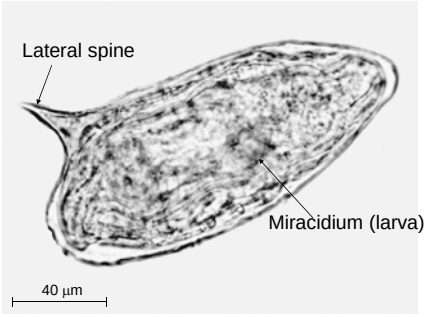
avoiding immune attack by employing a unique set of molecular
mechanisms. One scheme involves incorporating host serum proteins onto the tegumental surface as camouflage, mimicking
the strategy of the decorated crab. The other employs a mimic
surface molecule similar to beta -2-microglobulin, a

Possibl

Cross section of a pair of adult schistosomes in situ in a mesenteric venule

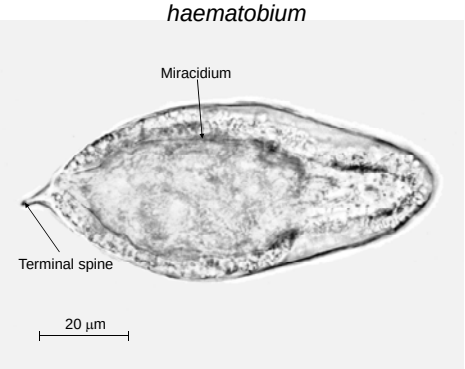


Embryonated egg of *Schistosoma mansoni**

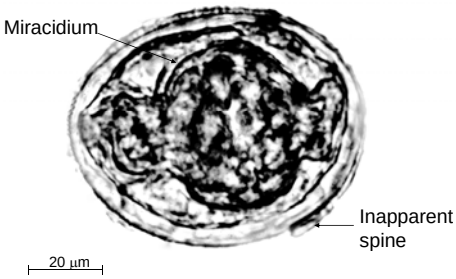


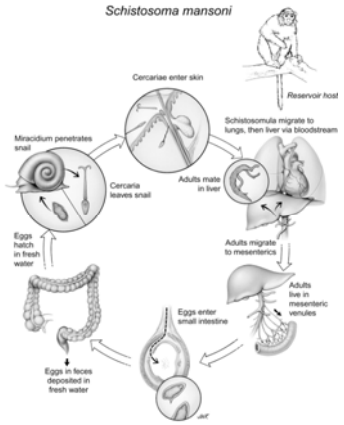
* The adult female requires tumor necrosis factor for maximum egg production

Embryonated egg of *Schistosoma haematobium*

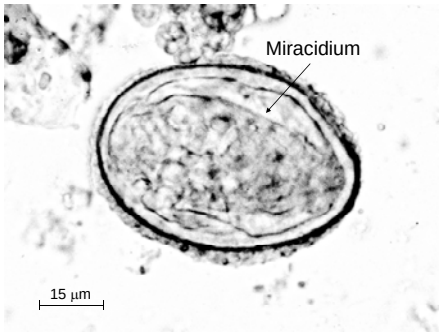


Embryonated egg of *Schistosoma japonicum*



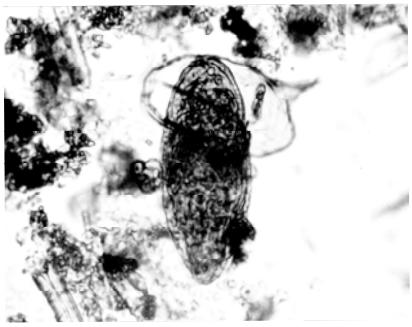


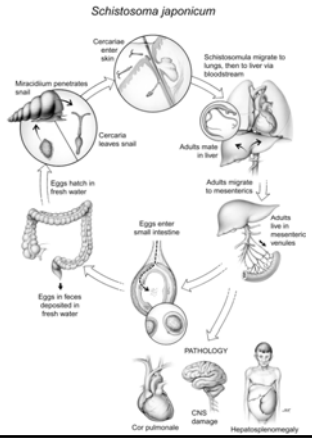
Embryonated egg of *Schistosoma mekongi*



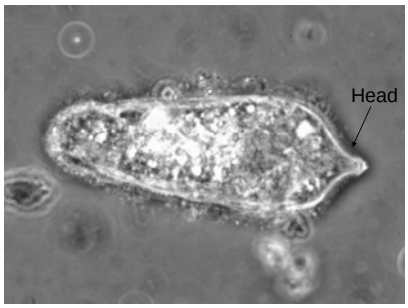
Biomphilaria glabrata, a common intermediate snail host for *Schistosoma mansoni*

Miracidium of *Schistosoma mansoni* caught in the act of hatching





Miracidium of *Schistosoma mansoni*



Oncomelania nosophora, a common snail intermediate host for *Schistosoma japonicum* in China

SEM of a cercaria of *Schistosoma mansoni,* the infective stage for humans

Photo: D. Scharf

Pathogenesis:

1. Miracidium inside egg in small intestine releases proteases, dissolves tissues, induces bleeding and diarrhea.

2. Eggs (50% of those produced) wash back into liver, lodge in pre-sinusoidal capillaries, eventually block flow of blood.

3. Blockage of portal circulation results in portal hypertension.

4. Portal hypertension leads to induction of embryonic circulatory paths, eggs then by-pass liver. Toxic brain syndrome may ensue.

5. Adults avoid immune detection by:
   a. camouflage strategy, incorporating host serum proteins on tegumental surface.
   b. synthesizing β-2 microglobulin-like molecule on tegumental surface.

Clinical Disease:

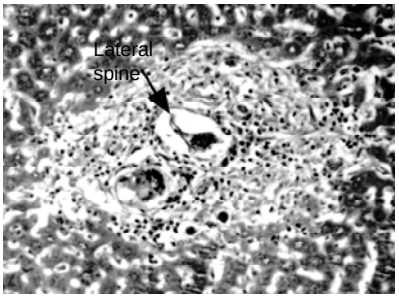
Acute Phase

1. "Katayama Fever"
2. Paralysis
3. CNS involvement

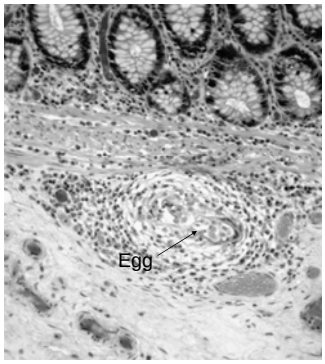
Chronic Phase

1. GI bleeding and diarrhea
2. Portal hypertension due to blockage of pre-sinusoidal capillaries
3. Esophageal varices
4. Ascites
5. Rupture of varices, bleeding, death
6. *Cor pulmonale*, right side heart failure, death
7. Toxic brain syndrome

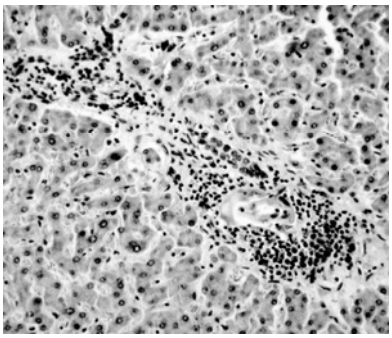
Granuloma in liver surrounding eggs of *Schistosoma mansoni*



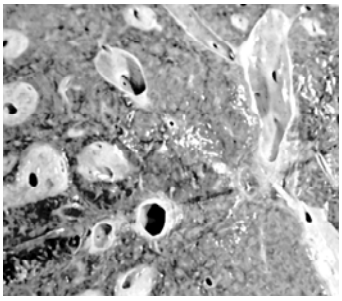
Schistosome egg in tissue of the small intestine. Note intense granuloma



Granuloma surrounding an egg of *Schistosoma mansoni* in liver tissue



Pipe stem fibrosis in liver due to heavy infection with *Schistosoma mansoni.* Note normal liver tissue next to fibrotic vessels



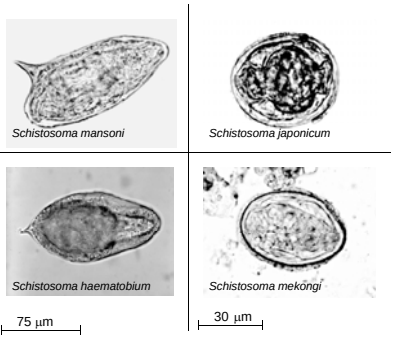
Diagnosis:

1. Microscopic examination of feces, urine, rectal "snip" for eggs.

2. Capture ELISA for detecting circulating antigens (experimental).

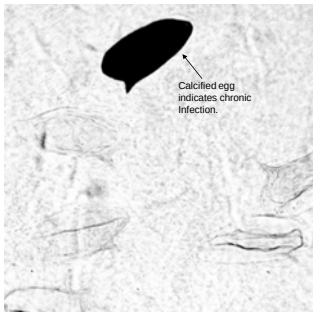
3. Serological tests (e.g., ELISA): indirect measure of exposure, not active disease.

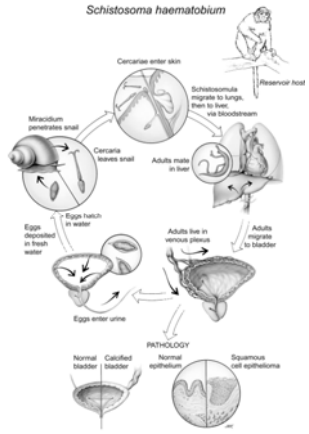
Summary of Schistosome Egg Morphology



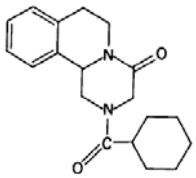
Schistosoma haematobium

Biopsy of rectal tissue revealing eggs of *Schistosoma mansoni*



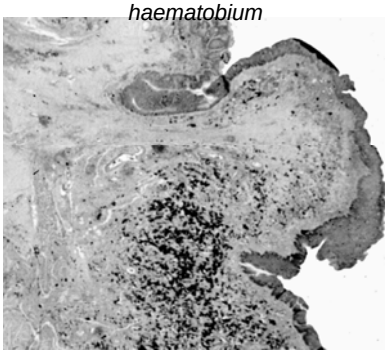


Drug of Choice:
Praziquantel

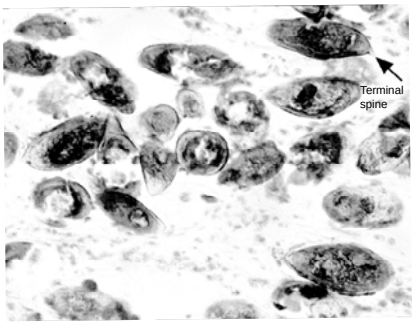


Mode of Action:
Interferes with Ca^{2+} ion channels, leads to disrupted tegument. This drug is more effective if the patient has already developed antibodies against tegumental antigens.

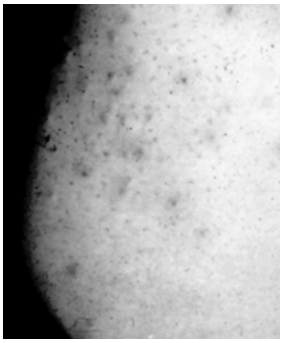
Histological section of bladder with pseudopolyp due to chronic infection with *Schistosoma haematobium*



Schistosoma haematobium eggs in bladder wall



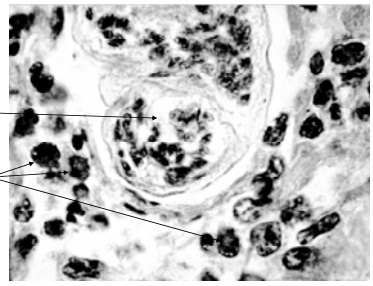
"Swimmer's Itch"



Pathogenesis:

Eggs lodge in bladder wall, induce cellular changes associated with granuloma formation.

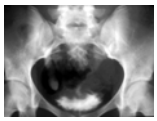
Cercaria of *Schistosoma mansoni* in skin surrounded by eosinophils



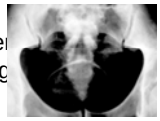
Th2 protective mechanism:
Eosinophils and specific IgE antibodies combine to kill the parasi

Clinical Disease:

1. Squamous cell epithelioma



2. Calcification of dome of bladder due to accumulation of dead eg



3. Hydronephrosis

Medical Ecology:

Transmission is encouraged by:

1. Dam building, irrigation projects (e.g., 3 Gorges Dam, China).

2. Reservoir hosts (primates, oxen).

3. Indiscriminate dispersal of feces and urine into environ

Prevention and Control:

1. Sanitary disposal of feces

Prevention and Control (cont'd)

2. Public health education.

3. Snail control.

4. Community-based drug programs (praziquantel).

5. Vaccine development for reservoir hosts (e.g., water buffalo).

One picture is…….