## OTHER TREMATODOSES

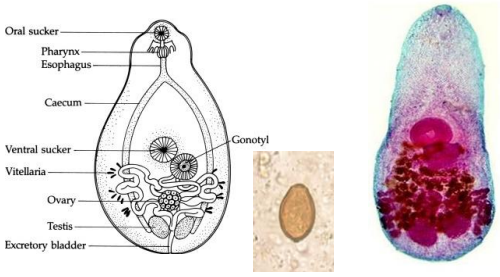
(Orders: **OPISTHORCHIIDA** and **STRIGEIDIDA**) of human and veterinary importance (genus ***Schistosoma, Paragonimus, Opistorchis, Metagonimus,Alaria*** etc.)

*prof. MVDr. Alica Kočišová, PhD.*

## Class: DIGENEA

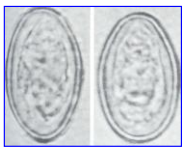
| Order | Family | Genus |
|---|---|---|
| OPISTHORCHIIDA | Heterophyidae | *Heterophyes, Metagonimus, Apophallus* |
| | Opistorchiidae | *Opisthorchis* (syn. *Clonorchis*), *Metorchis* |
| STRIGEIDIDA | Schistosomatidae | *Schistosoma, Bilharziella, Trichobilharzia, Orientobilharzia, Ornithobilharzia, Heterobilharzia, Austrobilharzia* |
| | Strigeidae | *Apatemon, Cotylurus, Parastrigea, Strigea* |
| | Diplostomidae | *Diplostomum, Alaria* |

## HETEROPHYIDAE: *Heterophyes heterophyes*

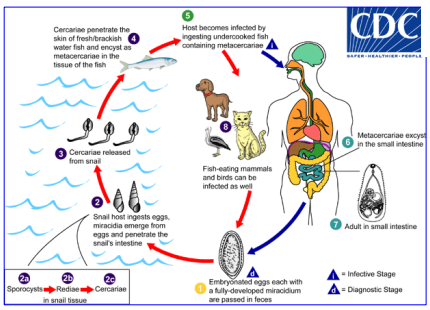



Adults *H. heterophyes;* small int. of the cat

Eggs containing miracidia

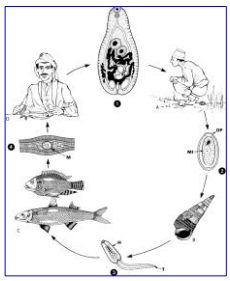


## Life cycle




**EPIDEMIOLOGY**

- People at high risk for **infection** are those who live by bay waters including **fishermen**.
- Infection is acquired by eating **raw fish**, a common food in areas of heavy **endemicity**.
- It is possible that inhabitants of these areas eat more low-salted or improperly cooked fish and that their fish are obtained from **polluted water**.
- It is common practice for people to **defecate** on the lake shores and river banks or from their boats while fishing.



## Clinical Presentation

- **diarrhea** and **colicky abdominal pain**.
- Migration of the eggs to the heart, resulting in **potentially fatal myocardial** and **valvular damage**.

## PATHOLOGY

- mild inflammatory reaction .
- In heavy infections - intestinal pain and mucosa diarrhea.
- The heart can be affected with tissue reaction in the valves and myocardium that cause heart failure.
- Eggs can also get into the brain or spinal cord and cause neurological disorders and sometimes fatalities.

**DIAGNOSIS**
- Eggs

**THERAPY**
Praziquantel

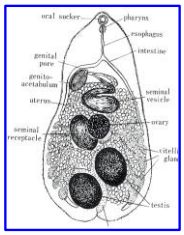
## HETEROPHYIDAE: *Metagonimus yokogawai*

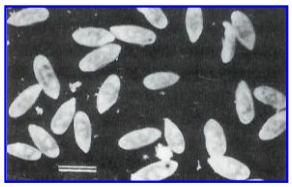
**Location**: small intestine
**Size**: 1 – 1.5 mm

**Hosts**: dogs, cats, humans, rats, pigs

**2 IH** : 1IH – water snail *Semiliscospira*

2 IH sweet fish,



Adults of *Metagonimus yokogawai*

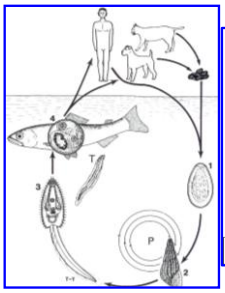
Arrow: genital pore

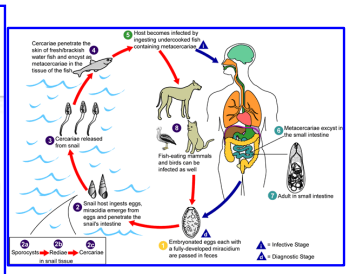
- First intermediate hosts (IH) are snails;
- Second IH are cyprinid fish, which contain the infectious metacerariae;

- The **incubation** period is 1–2 weeks like the **prepatent** period.

SEM of an adult worm showing the scaly surface and the laterally from the midline situated small ventral sucker (the sexual opening is close by).

## *Metagonimus* spp. – life cycle






## Pathology and clinical signs

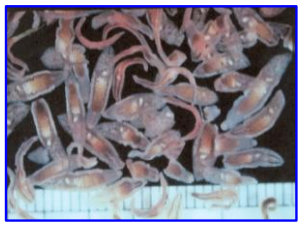
- Flukes invade the intervillous space of the small intestine
- **Mechanical and toxic effects** cause catarrh in the surrounding region
- Abdominal pain, diarrhea
- Zoonotic character
- Lieberkühn's invasion crypt, erosion Ec, deformation intestinal villi, edema, vascular dilation, inflammatory infiltration, digestive disorders, bluetongue, diarrhea, Eggs - lymph, veins heart metastases, CNS

### Diagnosis
By microscopical determination of eggs in the faeces.

### Therapy
- Praziquantel

## OPISTORCHIIDAE

- **Location**: bile ducts, liver
- **Size**: 7 – 12 mm
- **FH**: fish eating mammals, human
- **2 IH**: **1 IH** - water snail
  **2 IH** - wide variety of fish



## OPISTHORCHIIDA: Opistorchiidae: *Opisthorchis* (syn. *Clonorchis*)

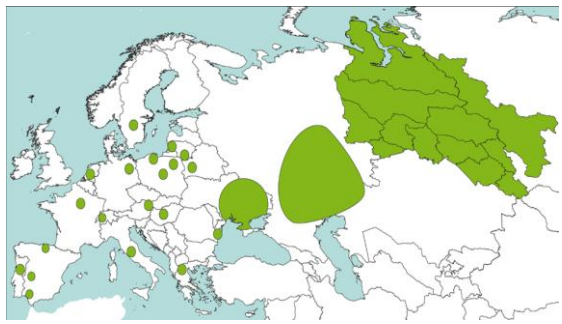
- Opistorchiosis (klonorchiosis)

- ***Opistorchis felineus*** (*Opistorchis tenuicollis*)
- ***Opistorchis viverrini***
- ***Clonorchis sinensis***
- ***Metorchis albidus***

Hosts: **dog, cat, man, birds**

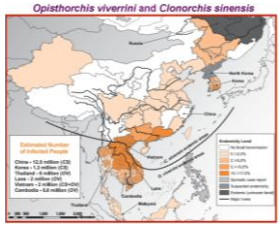
***Clonorchis sinensis*** ***Opisthorchis viverrini*** ***Opistorchis felineus***

***Opisthorchis felineus***



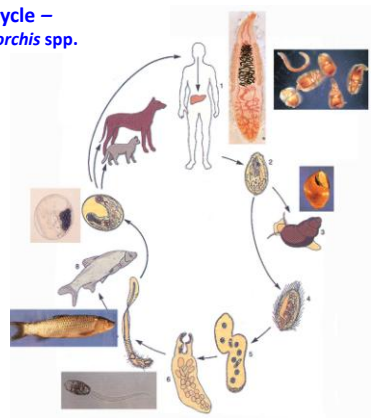
Pozio, E and Morales, MAGomez (**2014**). Clonorchiasis and Opisthorchiasis. Helminth Infections and their Impact on Global Public Health. (Bruschi, F, ed.)., Springer-Verlag Wienpp. 123–152.

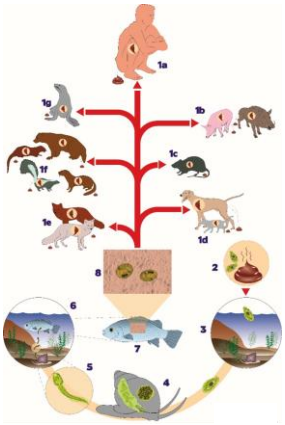
***Opisthorchis viverrini* and *Clonorchis sinensis***



***Clonorchis sinensis* a *Opistorchis viverrin***

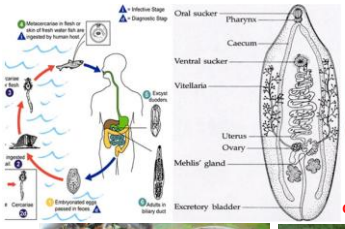
**Life cycle – *Opistorchis* spp.**

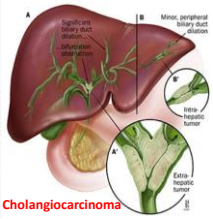





- Reservoir hosts of ***Clonorchis sinensis*** and ***Opisthorchis viverrini*: 1a, 1b, 1c, 1d,;**
- Reservoir hosts of ***Opisthorchis felineus*: 1d, 1e, 1f and 1g;**

Pozio, E, Armignacco, O, Ferri, F and Morales, M A Gomez (**2013**). Opisthorchis felineus, an emerging infection in Italy and its implication for the European Union. Acta Trop. 126, pp. 54–62.

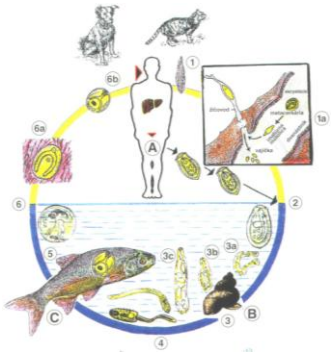


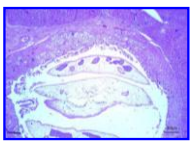




# Clonorchiosis

***Clonorchis sinensis***

- **Helmintozoonosis**



**Adult flukes in liver**

## Dogs, cats:

- bile ducts;

- juvenile stages - liver parenchyma migration = **HEPATITIS**
- adult fluke - **CHOLANGITIS, PERICHOLANGITIS**
- pancreas damage

- slimming
- icterus
- ascites
- liver - painful, enlarged

- latent flow;
- clinical manifestations - in moderate infection

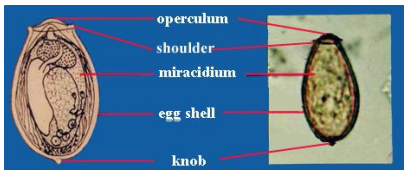
## Epidemiology, prevention

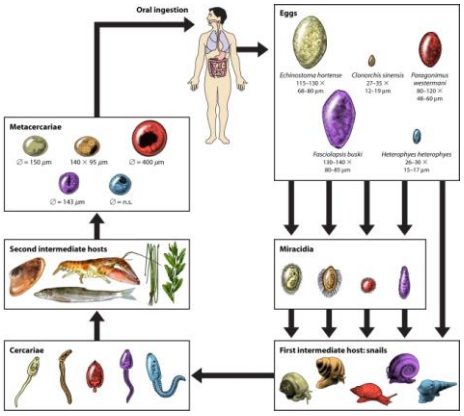
Sushi - preparation

Gastronomic customs; consumption of uncooked fish meat; protection of water resources (liquidation of freshwater snails).

## OPISTORCHIOSIS

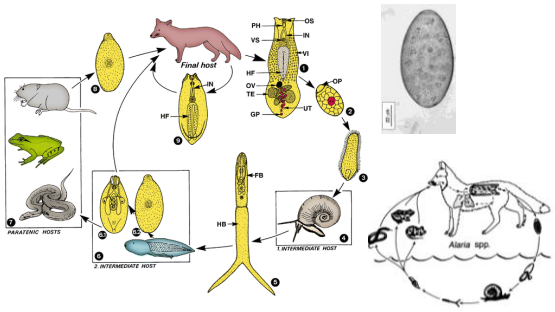
- *Opistorchis felineus* and *Opistorchis viverrini*
- Helmintozoonosis

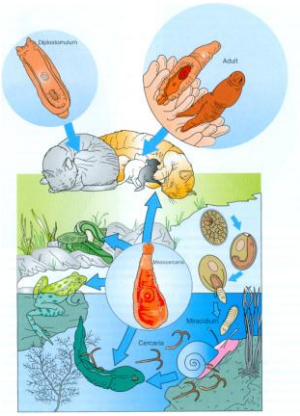



## STRIGEIDIDA: Diplostomidae: *Alaria*

- *Alaria alata, Alaria canis*

*Alaria marcianae*

## Family: Schistosomatidae

➢ The surgeons in Napoleon's army reported hematuria (bloody urine) during the invasion of Egypt in 1799 (***Schistosoma haematobium***).

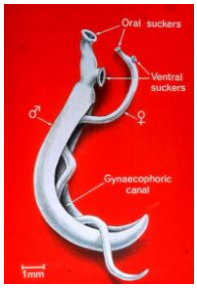
➢ 50 years later, German parasitologist Theodor Bilharz, would name it ***Distomum haematobium***.

## STRIGEIDIDA: Diplostomidae: *Schistosoma* blood flukes

Worldwide, 200 million are infected and another 600 million are at risk of being infected;
Endemic in 74 developing countries with more than 80% of infected people living in sub-Saharan Africa

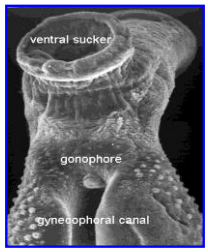
a) **gonochorist**
b) parasitize in **blood vessels** - portal; mesenteric, vesicular venules of man;
***S. haematobium***
***S. intercalatum***
***S. mansoni***
***S. japonicum***
***S. mekongi***
***S. bovis***
***S. matthei***

c) The female lies in a **canalis gynecophorus** male
d) Furcocercariae invade the host **actively-percutaneously** (the tail of the cercaria is bifurcated)
e) the eggs do not have an operculum but a **thorn**



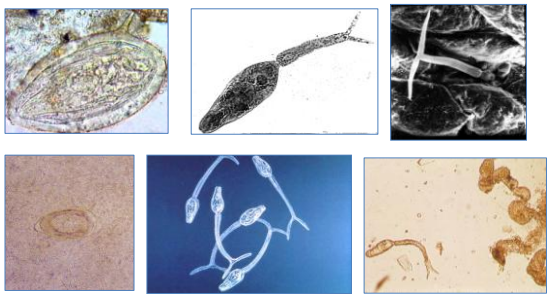


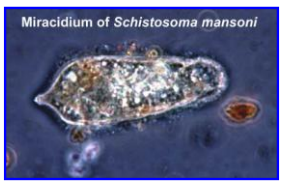
*Schistosoma japonicum* adults; Female is held by gynecophoral canal of male.



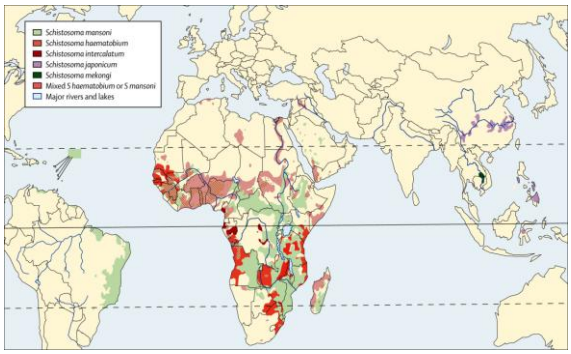

*Schistosoma mansoni* adult male Ventral sucker is prominent. Gonophore is the male reproductive organ. It passes sperm to the female. Caudal to it gynocophoral canal is visible.

### Eggs and furcocercariae





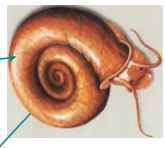

**Miracidia of *Schistosoma mansoni* penetrating the foot of its intermediate snail host**




## Transmission

➢ Pollution of fresh water with excreta containing Schistosome eggs

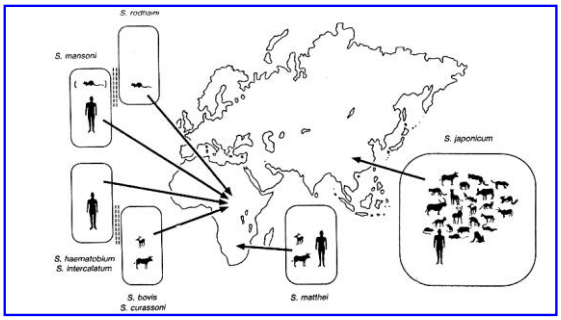
➢ Presence of the snail host



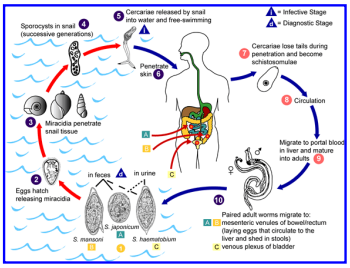
Snail from genus *Biomphalaria*

➢ Human contact with water infested with cercaria

## Hostit specificity



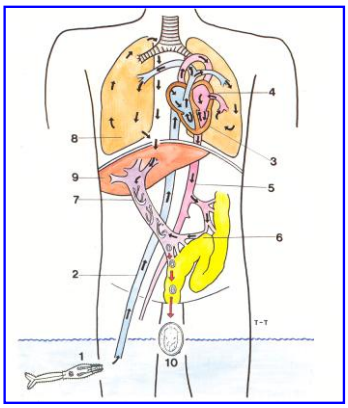

## Life Cycle (External environment and snail host)




*Biomphalaria* spp.

*Oncomelania* spp.

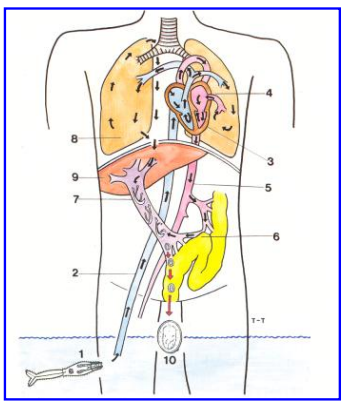
## Life Cycle




## Life Cycle

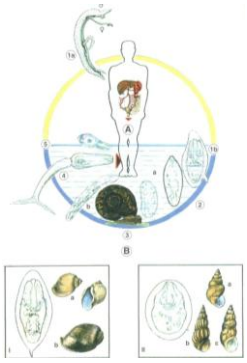
➢**Only those schistosomules** that enter the mesenteric arteries, traverse the intestinal capillary bed, and **reach the liver by the hepatic portal** system continue to grow;

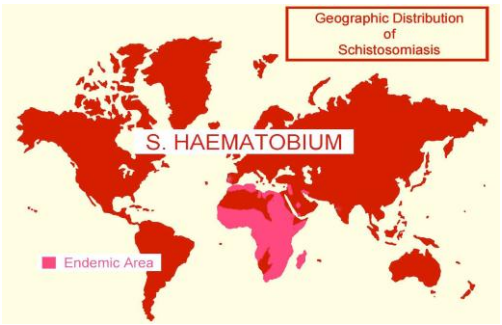
➢ About **3 weeks** post penetration the worms reach the **hepatic portal** veins (*S. mansoni*);
➢ veins of the **small intestine** (*S. japonicum*);
➢ the **urinary bladder** (*S. haematobium*) where they reach sexual maturity and mate.

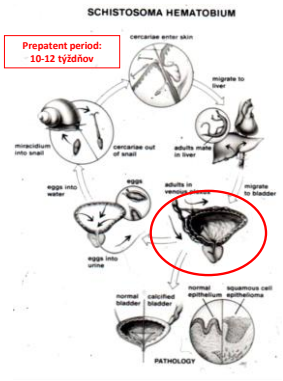



## SCHISTOSOMOSIS OF URINARY SYSTEM

- ***Schistosoma haematobium*** **– bladder vessels**
- **HELMINTOZOONOSIS**
- endemic in 74 developing countries;
- more than 80% of infected people live in Africa;
- 600 million people are at risk of being infected;
- 200 million are infected;






- **Inkubation**: 6-8 weeks;
- **IH**: snails
- **Diagnosis:** urine examination and egg microscopic examination;
- **Therapy**: praziquantel;
- **Prevention**: avoid contact with contaminated water;

Skin penetration by furocercaria(72 h)

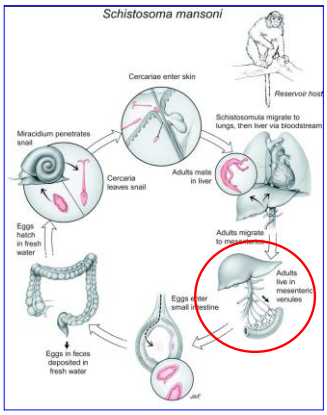
Migration (6 days) - right heart - pulmonary circulation - left heart - body circulation - portal vessels (adolescence 4 weeks)

Fully calcified bladder in chronic form of schistosomosis.

## INTESTINE SCHISTOSOMOSIS

***Schistosoma mansoni, S. mekongi*** – mesenteric vessels - ***vena mesenterica caudalis***;

Ecological conditions for Schistosoma mansoni infection - Lake Victoria, Kenya.




**Pathology and clinical symptoms:**

**Stage 1:** dermatitis

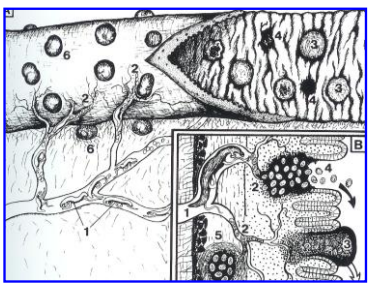
**Stage 2:** binds to the secretion of eggs

**3. Intestinal form:**

**4. Hepatosplenic form:**

Hepato-splenomegalia in *Schistosoma mansoni* infection caused by blockage of sinusoidal capillaries in the liver.

Hepato-splenomegalia and ascites caused by hypertension in *Schistosoma mansoni* infection. Characteristic "spider veins" on the surface of the abdomen



The eggs in the capillaries perforate the wall, accumulate in the perivascular tissues, pass into the lumen of the intestine and excretions into the external environment;


**Diagnosis:** ovoscopic finding, clinical picture, rectal biopsy, serology, post mortem – autopsy

**Therapy**: praziquantel, nitridazol, leucanthon

# LIVER SCHISTOSOMOSIS - JAPONICUM

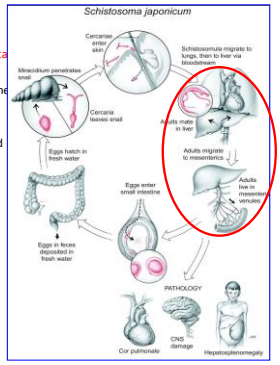
➢ ***Schistosoma japonicum***

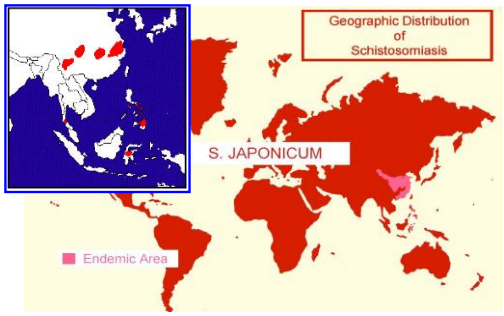
➢ **Location:** plexus vena mesenterica cranialis, porta system veins;

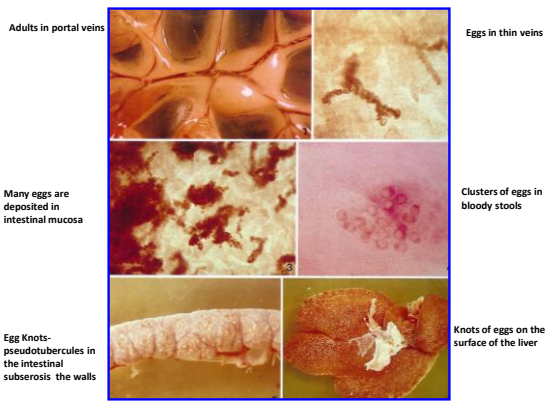
➢ **Acute stage** - fever, diarrhea, finding of eggs in the stool, abdominal pain, gradual enlargement of the liver;

➢ **Chronic stage** - liver fibrosis, the liver shrinks and hardens, the edge is granulated; **enlarged spleen; ascites, dilation of abdominal veins, GIT bleeding, thrombocytopenia**;

➢ **Therapy: praziquantel, niridazol, oxamnichin, metrifonate;**




**Clinical symptoms**

Splenomeghaly

ascites

**Ecological setting for acquisition of *Schistosoma japonicum*: fish farming in China**

➢ **Ecological setting for the acquisition of *Schistosoma mansoni* : a river in Puerto Rico.**

➢ **Note ascites in small child heavily infected with *S. mansoni* .**

- **Ecological Setting for the acquisition of *Schistosoma mansoni* and *Schistosoma haematobium*: irrigation devices in Egypt**

## Clinical symptoms

- Schistosomosis is an **immunologic disease**.
- Symptoms are rarely seen except in heavily infected individuals.
- Following skin penetration, the symptoms of human schistosomiasis appear in 4 phases:

- **1. corresponds to the penetration of cercariae**
- **2. migration phase**
- **3. acute phase**
- **4. chronic phase**

- 1. Skin penetration – cutaneous allergy; petechiae with edema and pruritus, urticaria ( vesicular), 36 hours to 10 days.
- 2. The migration phase **(from penetration to egg production)** There are often no symptoms, by toxic reactions and pulmonary congestion accompanied by fever;
- This phase may last 4-10 weeks, during which the worms migrate from the lungs to the liver where they reach sexual maturity and mate
- **Migration** of the schistosomula: chills, fever, sweating, cough, diarrhea, leukocytosis

- **3. The acute phase** Symptoms such as blood stools (***S. mansoni*** and ***S. japonicum***) and hematuria (***S. hematobium***) are caused by passage of eggs through the intestinal and urinary bladder walls;
- (***Katayama's fever***) may occur weeks after the initial infection, especially by ***S. mansoni*** and ***S. japonicum***.
- fever, chills, headache, anorexia, urticaria, and diffuse megaly, lymphadenopathy and diffuse vasculitis lesions
  - 2-3 weeks after the infection and usually lasts 1-2 months (typhoid fever)

Egyptian boy with hepatosplenomegaly, ascites fluid build-up and superficial collateral circulation

(NAMRU-3 clinical ward in Cairo)

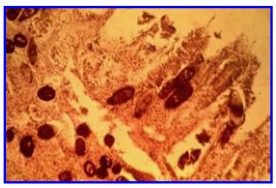
## The 2 faces of schistosomosis

**'Intestinal' asymptomatic schistosomiasis at the Egyptian village level**

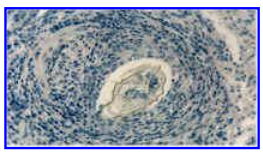
**4. Chronic disease** - most important
- Fatigue, bowel and bladder symptoms, hepatic dysfunction; Usually there is mild, chronic **bloody diarrhea**, with mild **abdominal pain** and **lethargy;**

Schistosomiasis showing typical distension of the abdomen.

**Symptomatology**



Intestinal schistosomiasis: eggs in the wall of the gut



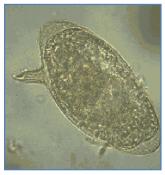
*Schistosoma* egg in the liver: granuloma formation

## Clinical signs

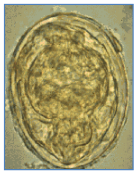
Occasionally central nervous system lesions occur:

- cerebral granulomatous disease may be caused by ectopic *S. japonicum* eggs in the brain,
- and granulomatous lesions around ectopic eggs in the spinal cord from *S. mansoni* and *S. haematobium* infections may result in a transverse myelitis with flaccid paraplegia.

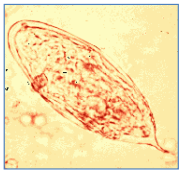
## Diagnosis



*S. mansoni*

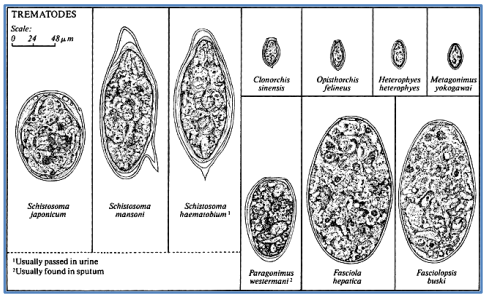


*S. japonicum*



*S. haematobium*

## Diferential diagnosis of trematoda eggs




## Treatment

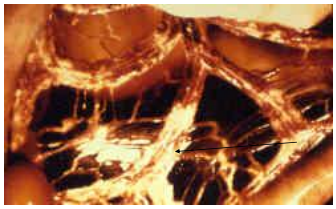
- There are a number of chemotherapeutic agents on the market, many of which have toxic side effects
- praziquantel: effective in a single dose against all species
  oxamniquine: effective in a single dose, but only against *S. mansoni*
- **According to WHO, the key to future schistosomosis control lies in a 4-basic steps:**
- **1. population-based chemotherapy, with repeated drug administration to infected individuals**
- **2. use of molluscicides**
- **3. introduction of biological controls, such as carnivorous, snails and fish**
- **4. education of the population**

## *Heterobilharzia americana*

*(canine schistosomosis)*

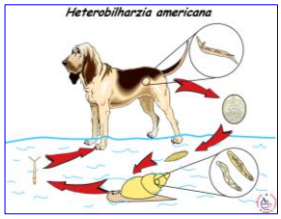
- Cause of canine schistosomiasis in dogs of North America
- Especially prevalent in the Gulf Coast States
- Life cycle and morphology is typical of the Family Schistosomatidae

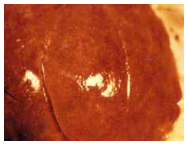
## *H. americana*



***H. americana* in mesenteric veins**

## *H. americana* Life Cycle



IH - aquatic snail *Lymnaea cubensis*,

## Diagnosis of *H. americana*

- finding the distinctive eggs in feces is the only practical diagnosis method
- sedimentation is an acceptable method and the method of choice
- Treatment with : FBZ at 40 mg/kg (for 10 days ), Praziquantel

## Schistosome dermatitis

**Freshwater species**

*Trichobilharzia* spp.
*Gigantobilharzia* spp.
*Ornitobilharzia* spp.

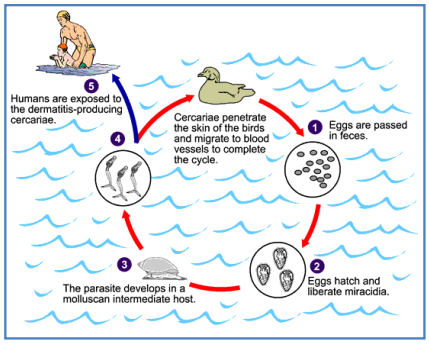
**ducks,geese**

**Sea species**

*Austrobilharzia* spp.
*Microbilharzia* spp.

**seagull, pelicane**

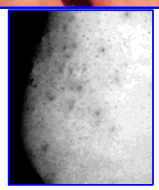
## Schistosome dermatitis

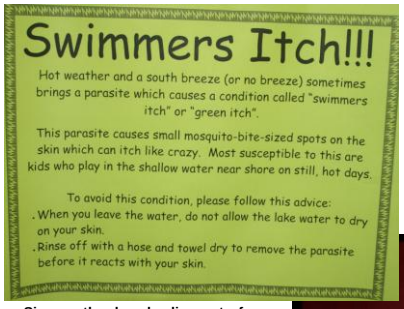



Place where people suffer from swimmer`s itch

Hanuama Bay in Hawaii

## Cercarial dermatitis



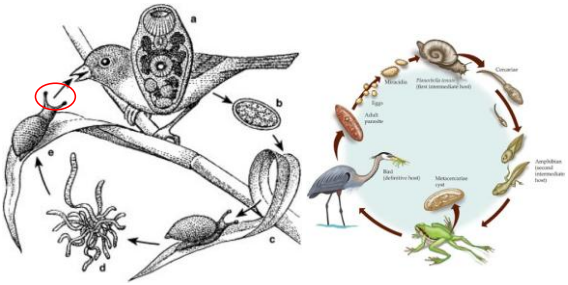



**Sign on the door leading out of a resort to Lake Bemidji, in Minnesota (the advice can't hurt, but may not help either**

**Cercarial Dermatitis**

## *Leucochloridium paradoxum*

- location - intestine





*Succinea* - Europe and Nord America