

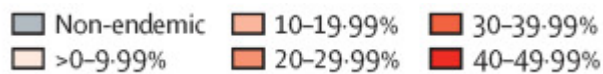
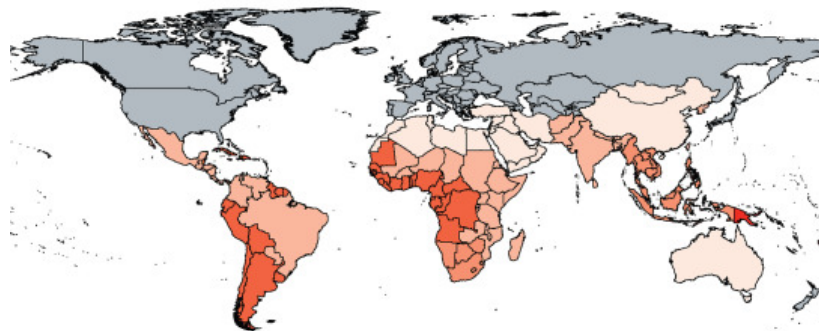
# **Bible class - Worm infections**

## **Benjamin Misselwitz**

### **04.12.2019**

*”Generalising about the Nematoda is extremely hazardous. The often cryptic diversity is such that it will frustrate the best of intentions.”*

W.C. Clark



*Strongyloides stercoralis*

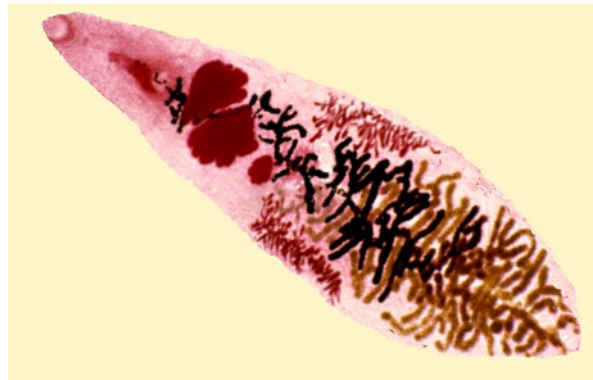
- > 1'500'000'000 humans infected
- Largest pathogens (1mm – 10m)
- Low (untreated) mortality of 1:20'000  
Tbc: 1:10, Malaria: 1:100
- Humans developed tolerance

# Helminths Worms

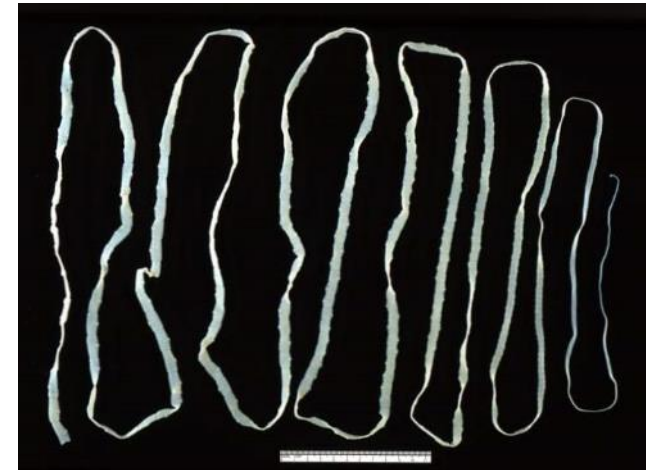
**Nematodes**  
Roundworms



**Trematodes**  
Flatworms



**Cestodes**  
Tapeworms



# Helminths – classification

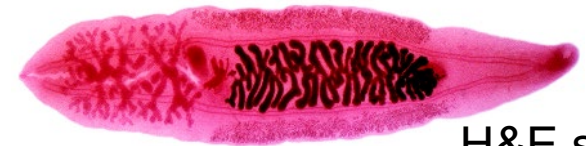
## → **Nematodes** (roundworm)

- **Ascariasis** (large roundworm)  
*Ascaris lumbricoides* (=Spulwurm)
- **Enterobiasis**, Oxyuriasis (Pinworm infection, Madenwurm)  
*Enterobius vermicularis*
- **Strongyloidiasis** (threadworm, Zwergfadenwurm)  
*Strongyloides stercoralis*
- **Whipworm infection** (Trichuriasis, Peitschenwurm)  
*Trichuris trichiura*
- **Hookworm infektion** (Hakenwurm)  
*Necator americanus*, *Ancylostoma duodenale*

# Helminths – classification

## → **Trematodes** (flatworm)

- **Fasciolosis**  
*Fasciola hepatica*  
Liver fluke, grosser Leberegel
- **Clonorchiasis**  
*Clonorchis sinensis*  
Chinese liver fluke
- **Schistosomiasis** (Pärchenegel)  
the only trematode with males + females  
*Schistosoma mansoni*  
*Schistosoma haematobium*...



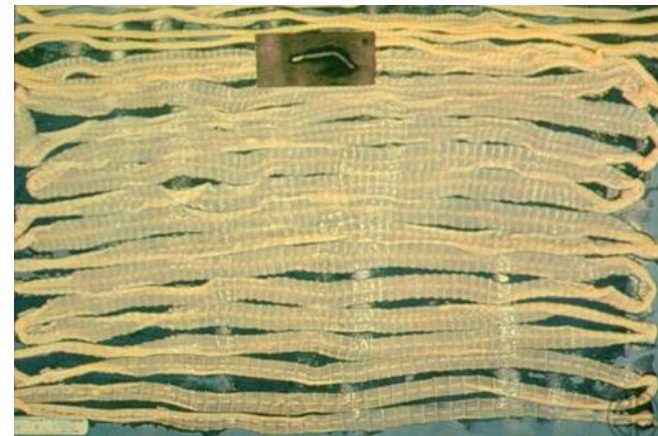
H&E stain



# Helminths – classification

## → **Cestodes** (tapeworm)

- **Taeniasis, cysticercosis**  
*Taenia sanguinata, T. solium*
- **Diphyllobothriasis**  
*Diphyllobothrium latum*  
Fish tapeworm
- **Echinococcosis**  
**Cystic/ unilocular echinococcosis**  
*Echinococcus granulosus*
- **Alveolar/ multilocular echinococcosis**  
*Echinococcus multilocularis*

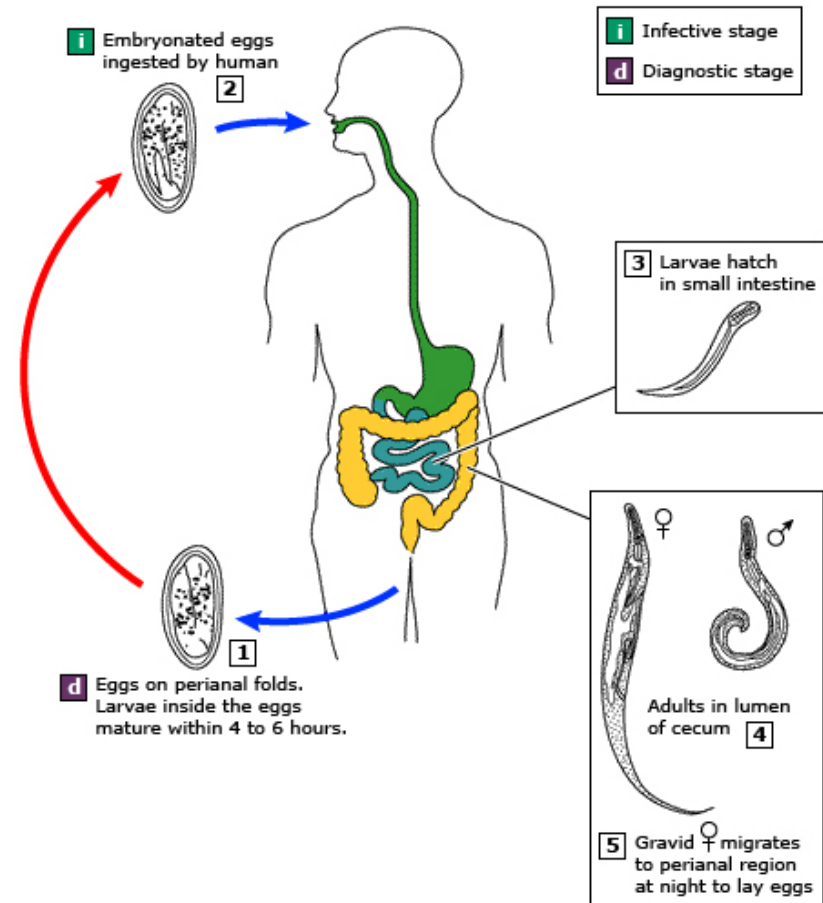


# Enterobius vermicularis – Pinworm, Madenwurm

- Worldwide distribution Most common worm in Western countries
- Age-group: 5-10 years
- Simple life cycle:

## Symptoms

- Pruritus ani
- Gynecological infection
- Abdominal pain, nausea, vomiting
- Appendicitis
- Nasal mucosa infection



# Enterobius vermicularis – Pinworm, Madenwurm

- **Diagnosis???**



**Pinworm paddle test**



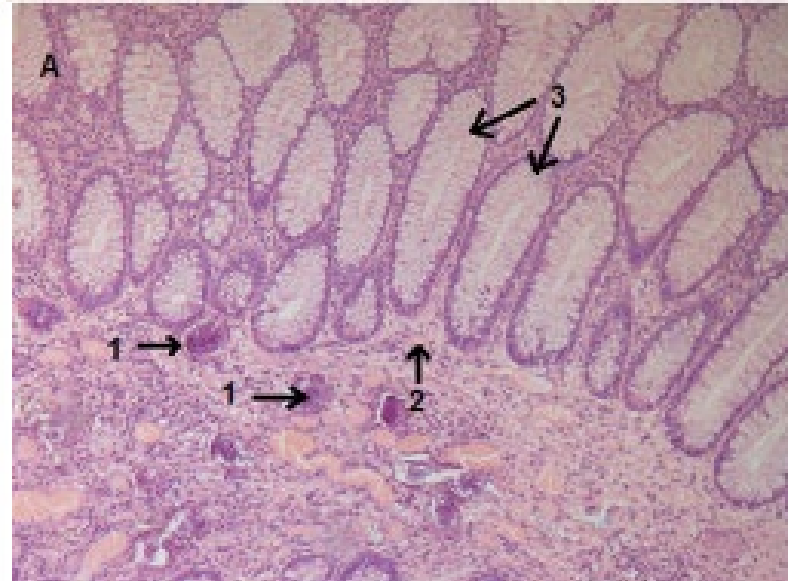
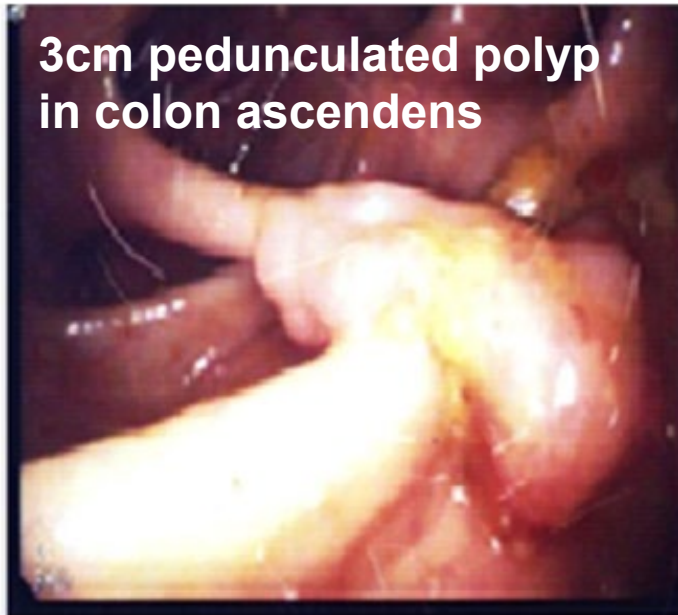
## **Treatment:**

- Mebendazol (100mg)
- Albendazol (400mg)
- Pyrantel pamoate (11mg/kg, max 1g)
- → treat family, repeat treatment after 2 weeks
- → clip fingernails, wash hands, change linings



# The special case...

- 20-year old Ethiopian women in Lebanon
- 3 years diffuse colicky abdominal pain, bloating
- Exacerbated by food, relieved by defecation
- Discharge of mucus, 1 episode of bloody stool



Praziquantel → 2d: abdominal improved → 6 weeks: free of symptoms

# Schistosomiasis

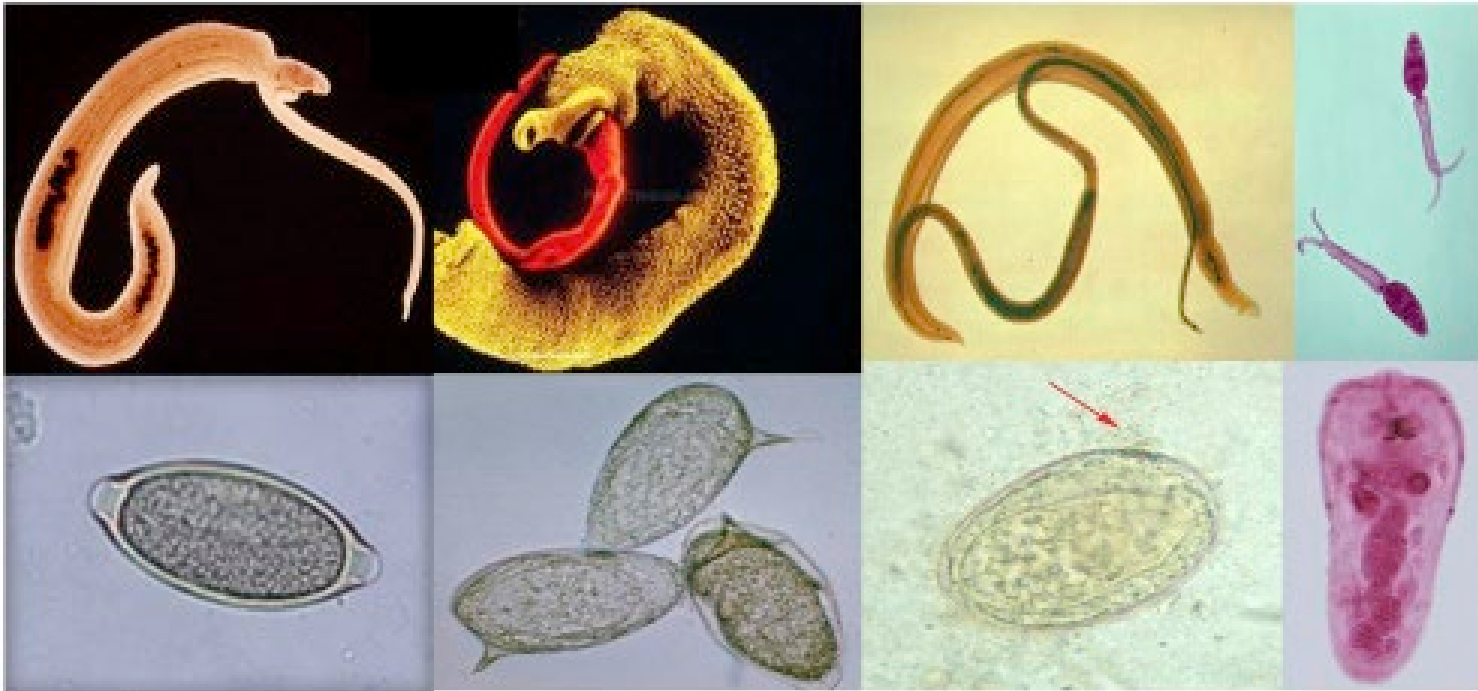
- Among the most relevant and prevalent human infections
- ~230'000'000 annual infections (#2, after malaria)
- 75 countries – Africa, Asia, South America, Carribean islands

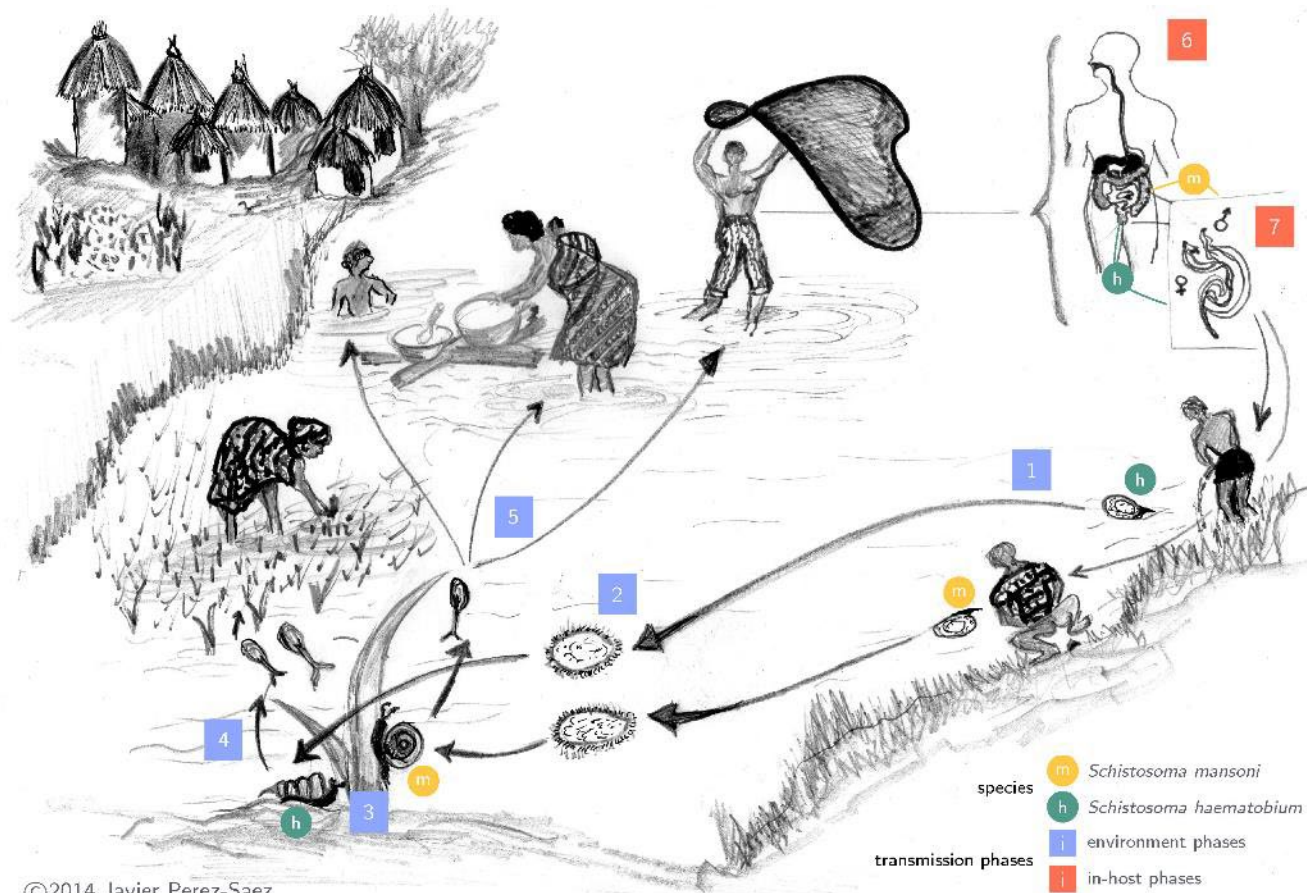
*Schistosoma  
haematobium*

*Schistosoma  
mansoni*

*Schistosoma  
japonicum*

*Cercaria &  
miracidium*





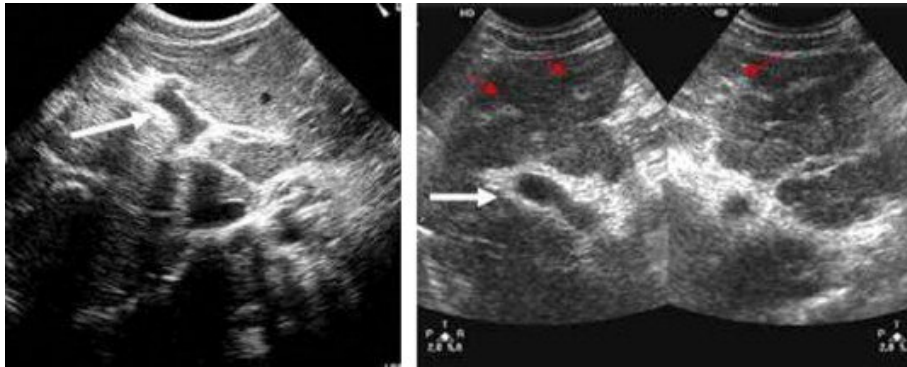
©2014 Javier Perez-Saez

## Human phase

- 6 Parasite migration and maturation in the human host during 1-3 months
- 7 Mature Schistosomiasis in capillary veins around **bladder** or **intestinal lumen**  
300 – 3000 eggs within 3-5 year lifespan

# Schistosomiasis - symptoms

- **Swimmer's itch**  
hypersensitivity upon repeat exposure)
- **Acute schistosomiasis syndrome** (Katayama fever)  
upon egg production (50% of individuals)
- **Intestinal schistosomiasis**  
abdominal pain, poor appetite, diarrhea
- **Genitourinary schistosomiasis**
- **Glomerular disease**
- **Neuroschistosomiasis**  
cerebral microinfarcts, myelopathy



# Pipe stem fibrosis



## Hepatosplenic schistosomiasis

acute: granulomatous inflammation with eggs in presinoidal spaces

chronic: collagen deposition, pipe stem fibrosis

→ Hepatosplenomegaly, portal hypertension, collaterals

→ Intact liver function

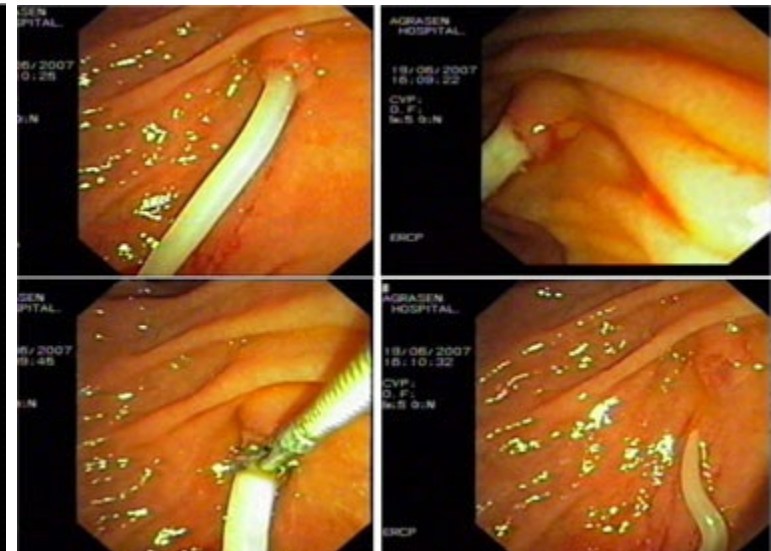
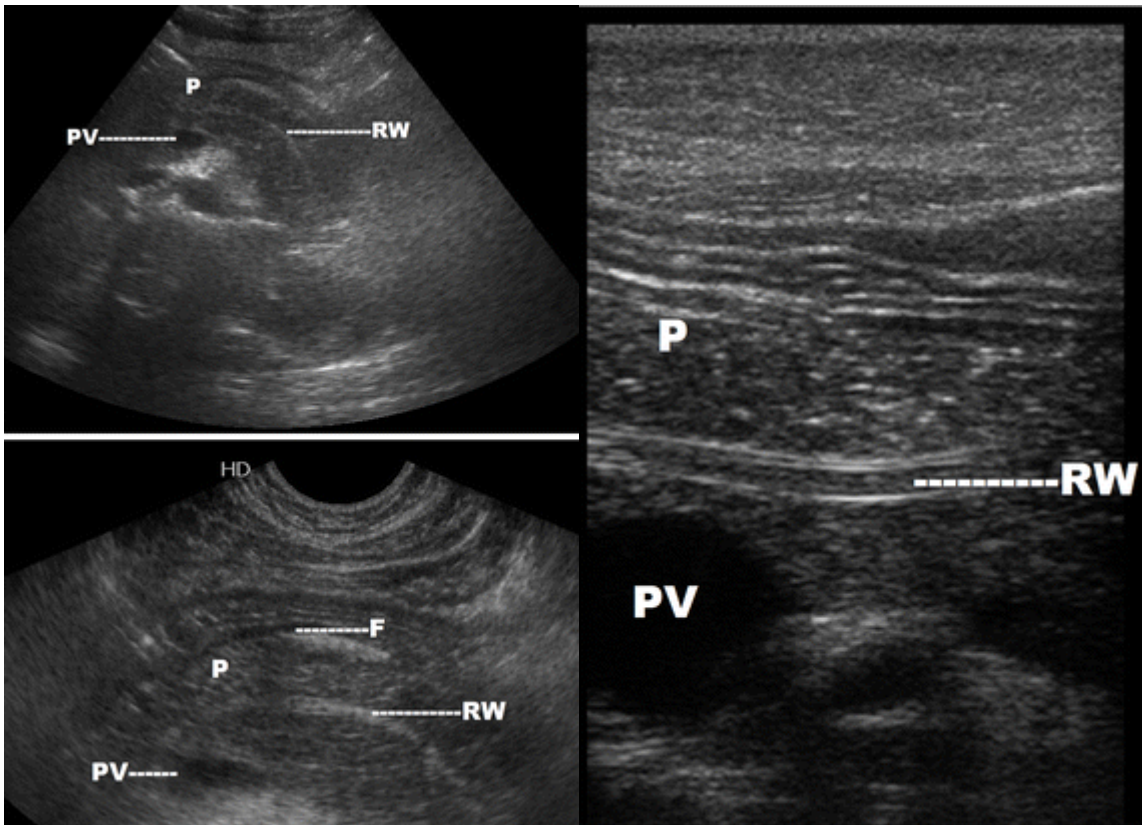
# Schistosomiasis - diagnosis

- Examination of stool and urine for eggs
- Serology (returning travelers)
- PCR based techniques

# Schistosomiasis - treatment

- Acute: steroids 20-40mg/d
- Praziquantel (single dose)  
retreatment when viable eggs visible after 6 weeks  
no (real) resistencies yet
- Treatment of portal hypertension  
→ beta-blocker, variceal band ligation, TIPSS

Young Indian woman with acute abdominal pain



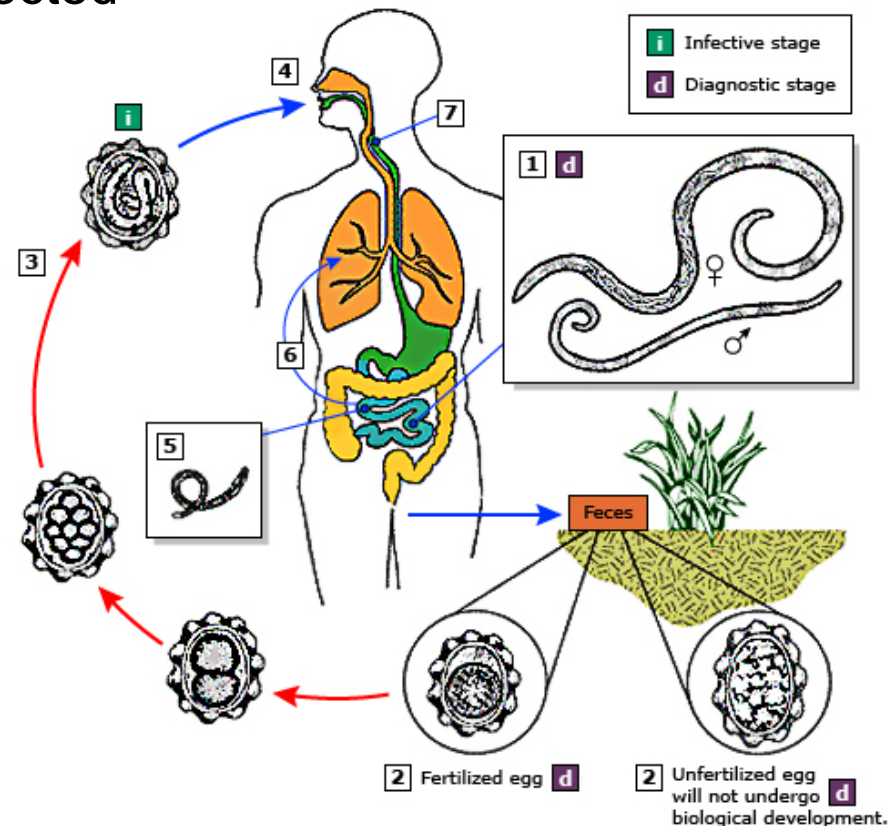
Inner tube sign: «thick echoic stripe with a central longitudinal anechogenic tube»  
Spaghetti sign

# *Ascaris lumbricoides*

- Largest nematode affecting humans
- Worldwide; >1'000'000'000 people infected
- Clustering in families  
mainly children 2-10 years
- Infection via fecal contamination  
of soil, water and food

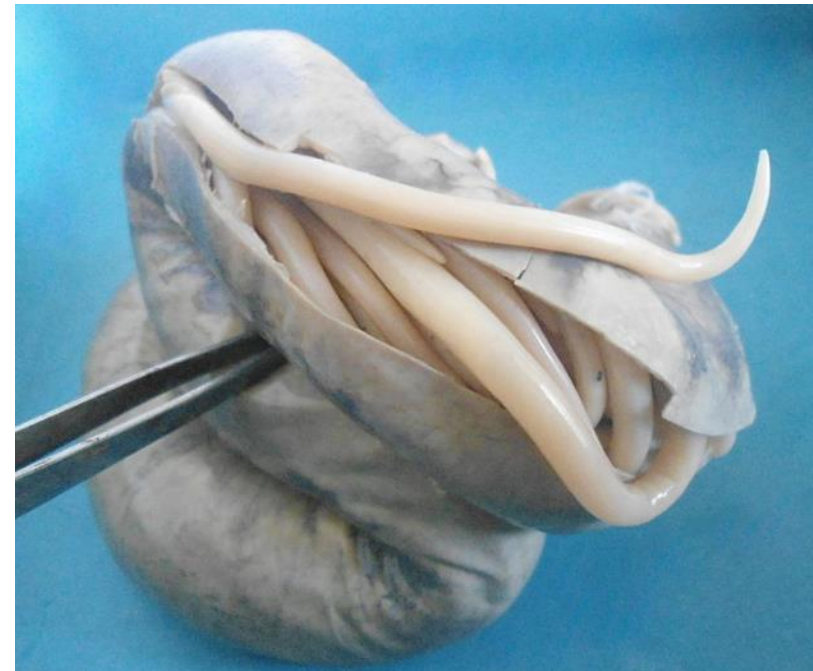
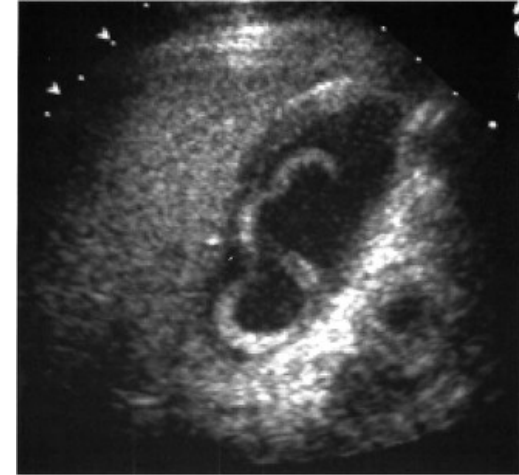
## Within the human host

- Larvae hatch in the small intestine
- Migrate via V. portae to lungs
- Mature within alveoli
- Ascend via trachea
- Coughed up & swallowed
- Reside mainly in jejunum



# ***Ascaris lumbricoides* - symptoms**

- None (for most patients)
- Pulmonary manifestations (rare): eosinophilic pneumonitis (Loeffler syndrome)
- Intestinal: discomfort diarrhea, nausea vomiting, passage of worms
- Intestinal obstruction: >60 worms, ileocecal valve  
5-35% of bowel obstructions in endemic areas  
85% in children
- Malnutrition, growth retardation
- Pancreatitis, cholangitis, bile duct stones  
1/3 if biliary & pancreatic diseases in India
- Nose, lacrimal duct, umbilicus, inguinal canal



# Ascaris lumbricoides – Diagnosis & Treatment

Stool inspection (microscopy)

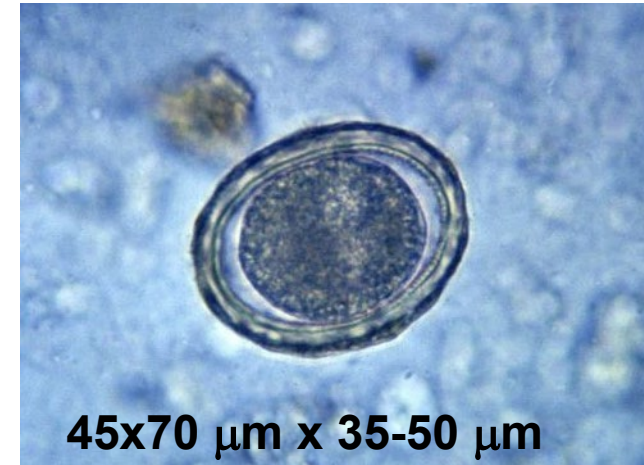
Not diagnostic if:

- < 40 days
- male worm only

## Treatment

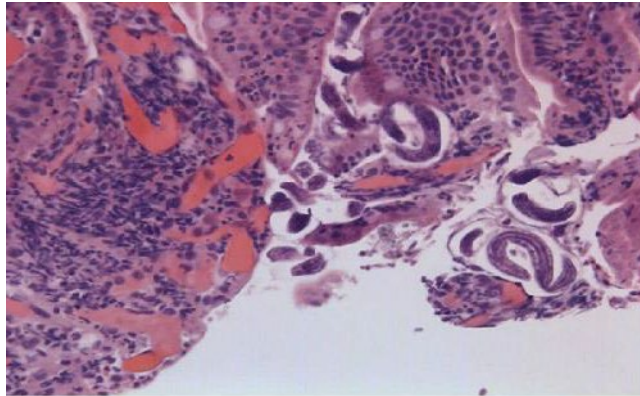
- Albendazol 400mg single dose
- Mebendazol 500 mg single dose
- Pyrantel pamoate

No follow-up



# The special case...

37 year old female, acute lymphoid leukemia  
Nausea and vomiting for 3-4 days



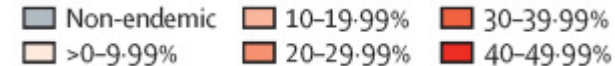
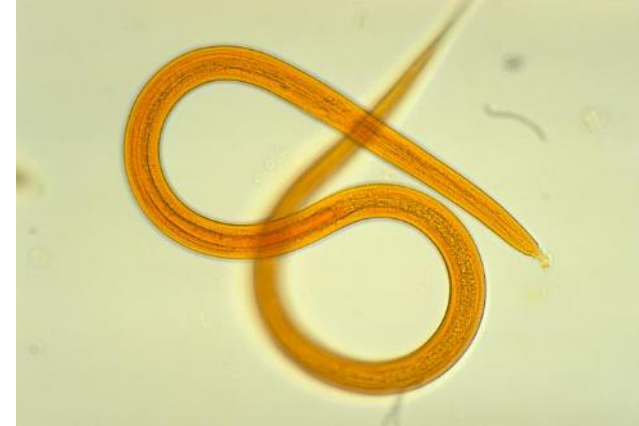
*Strongyloides stercoralis*

→ Delay chemotherapy  
→ Ivermectin



# Strongyloides stercoralis

- Smallest pathogenic nematode (2.5 x 0.05 mm)
- Endemic in tropical and subtropical rural regions  
sporadic in Europe, North America
- >1'00'000'000 cases worldwide
- Infection via contact with contaminated soil  
Life cycle similar to Ascaris  
reside below enterocytes in mucosa
- Able to complete life cycle within a human  
e.g. with reduced motility, immunosuppression  
→ internal autoinfection → larvae penetrate intestinal mucosa  
→ external autoinfection → larvae penetrate skin
- Can persist in individuals >40 years



# Strongyloides stercoralis

**Immuncompetent host** – no symptoms or

- Skin irritation: immediately and upon autoinfection
- Dry cough
- Non-specific GI-symptoms

**Any immunosuppression**

**Hyperinfection syndrome** = accelerated autoinfection

- Skin: «larva currens»
- Dyspnoe, alveolar hemorrhage, ARDS
- Colitis, proctitis, perforation, protein losing enteropathy

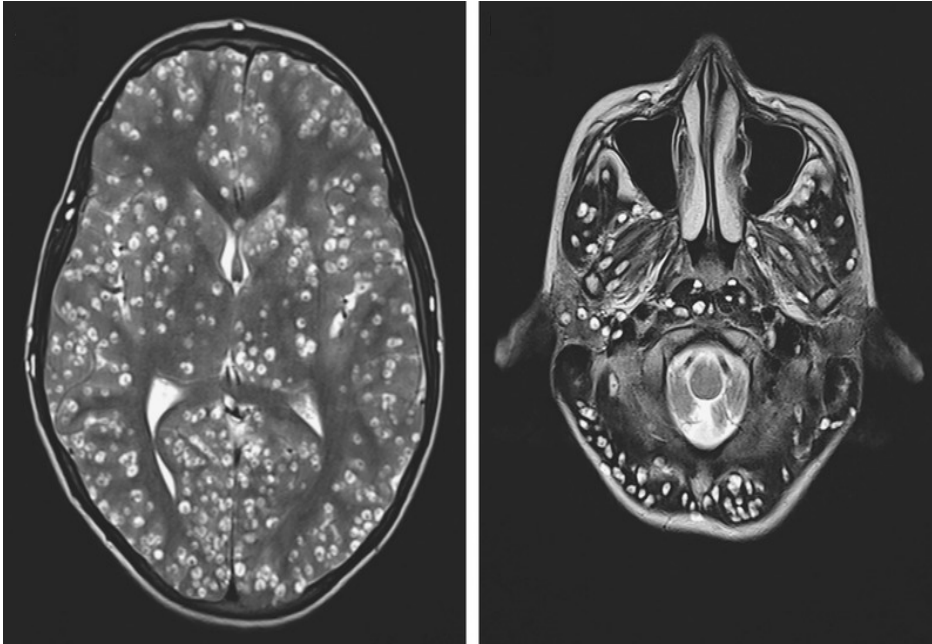
**Diagnosis: challenging**

- Stool test sensitivity <50%, Agar-plate: most sensitive, pathology

**Therapy: Ivermectin**



# The special case...



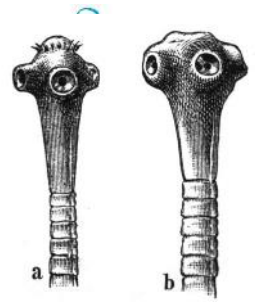
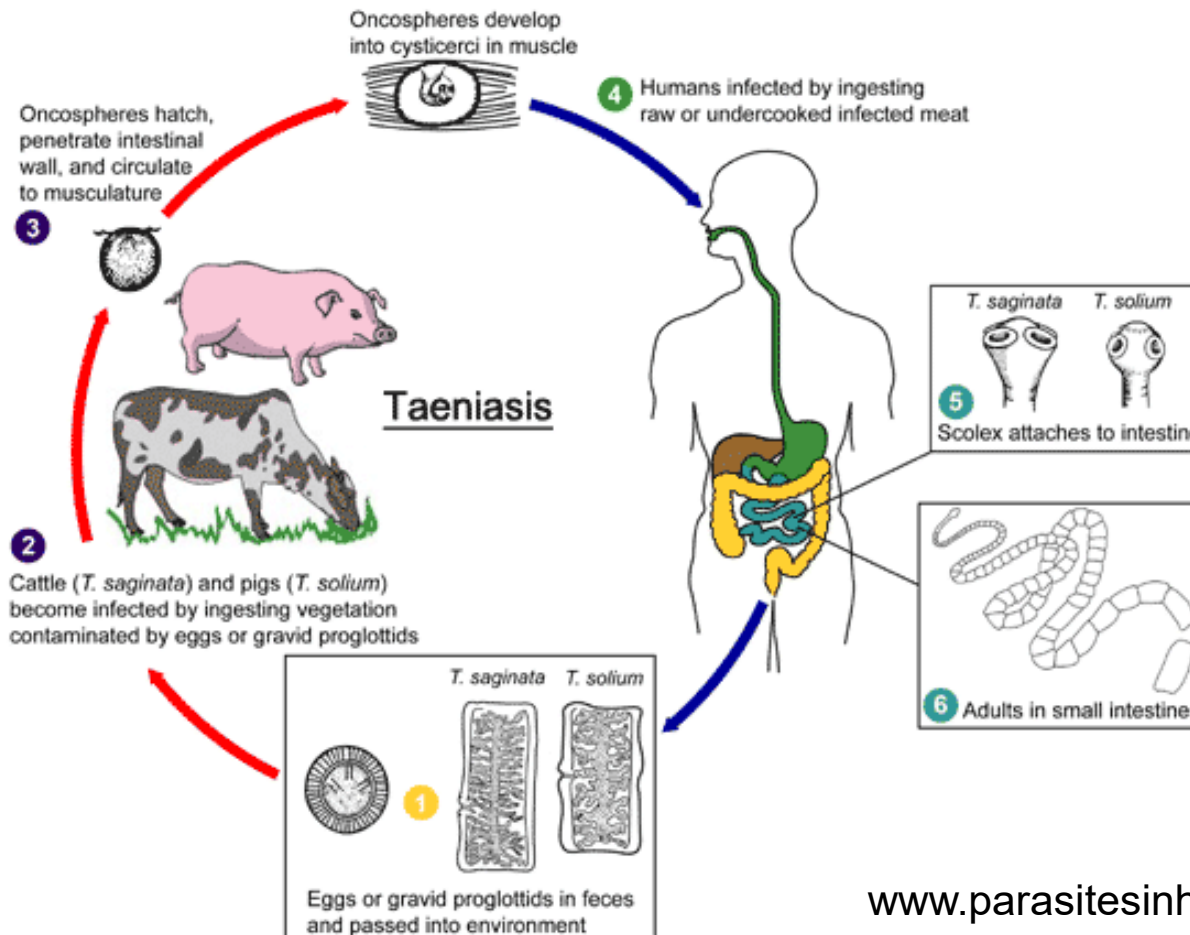
18-year old man  
Tonic-clonic seizures  
Tenderness right eye, testes

No treatment  
Death after 2 weeks

# Taenia

*Taenia solium* – pork tapeworm

*Taenia saginata* – beef tapeworm



**Proglottids, eggs**

**Oncospheres**

intermediate host

**Cysticerci**

intermediate host, muscle

**Adult worms**

host

# Taenia solium, taenia saginata

Scolex: 2mm, 2000 proglottides 16-20 x 5-7 mm  
5-10 m long, 25 years life span

## Symptoms:

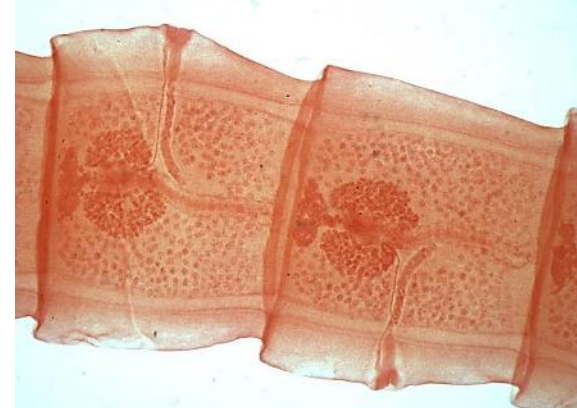
- None (most individuals)
- GI-symptoms (nausea, epigastric pain, anorexia)
- Urticaria, eosinophilia
- Rare: Appendicitis, cholangitis, pancreatitis

## Diagnosis

- Stool morphology (cave infectious)

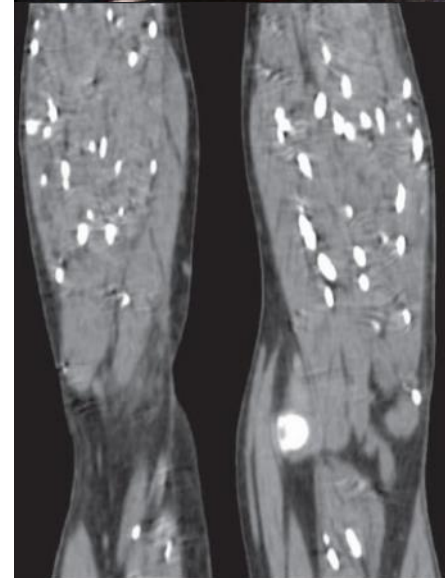
## Treatment

- Single dose Praziquantel 5-10 mg/kg



# Cysticercosis

- Ingestion of eggs from a human carrier (housemate) sometimes autoinfection
- **Neurocysticercosis**  
in endemic areas 25-40% of cases of epilepsy  
in US 2% of cases of epilepsy
- Spinal, ocular, subcutaneous, muscular... lesions
- **Diagnosis:** imaging, serology
- **Management:**
  - screen for ocular lesions
  - manage obstructive hydrocephalus (steroids)
  - albendazol ± praziquantel



# The special case...

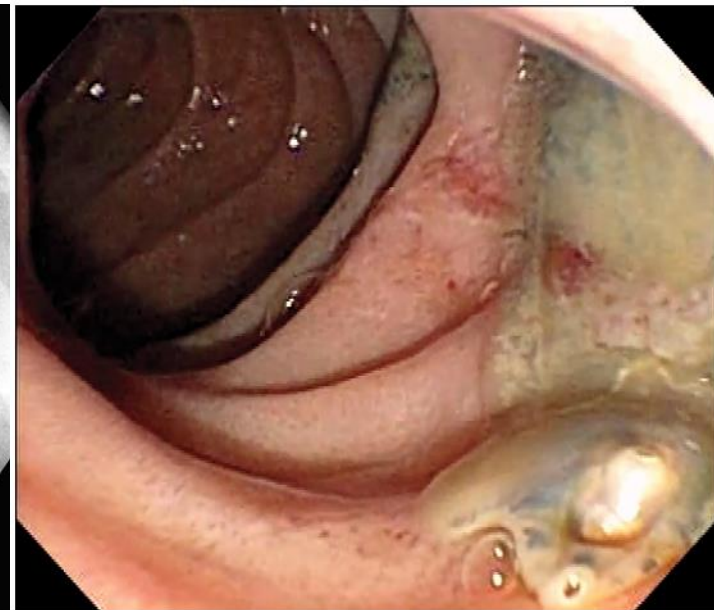
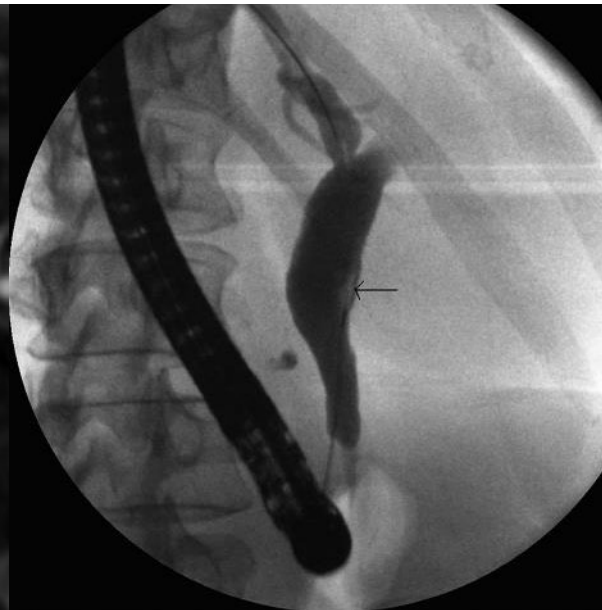
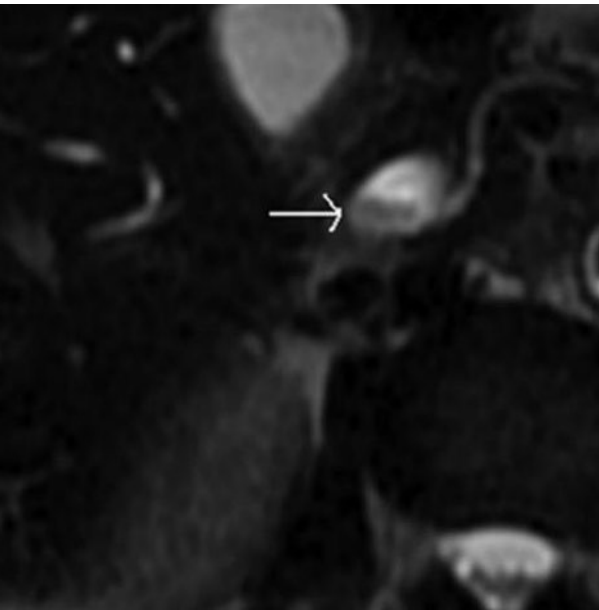
65 year old retired female teacher

3 months history of upper abdominal discomfort and nausea

Traveling history to Cuba and Morocco

→ ultrasound: liver abscess

→ 6 months antibiotics



Filling defect in dilated bile duct

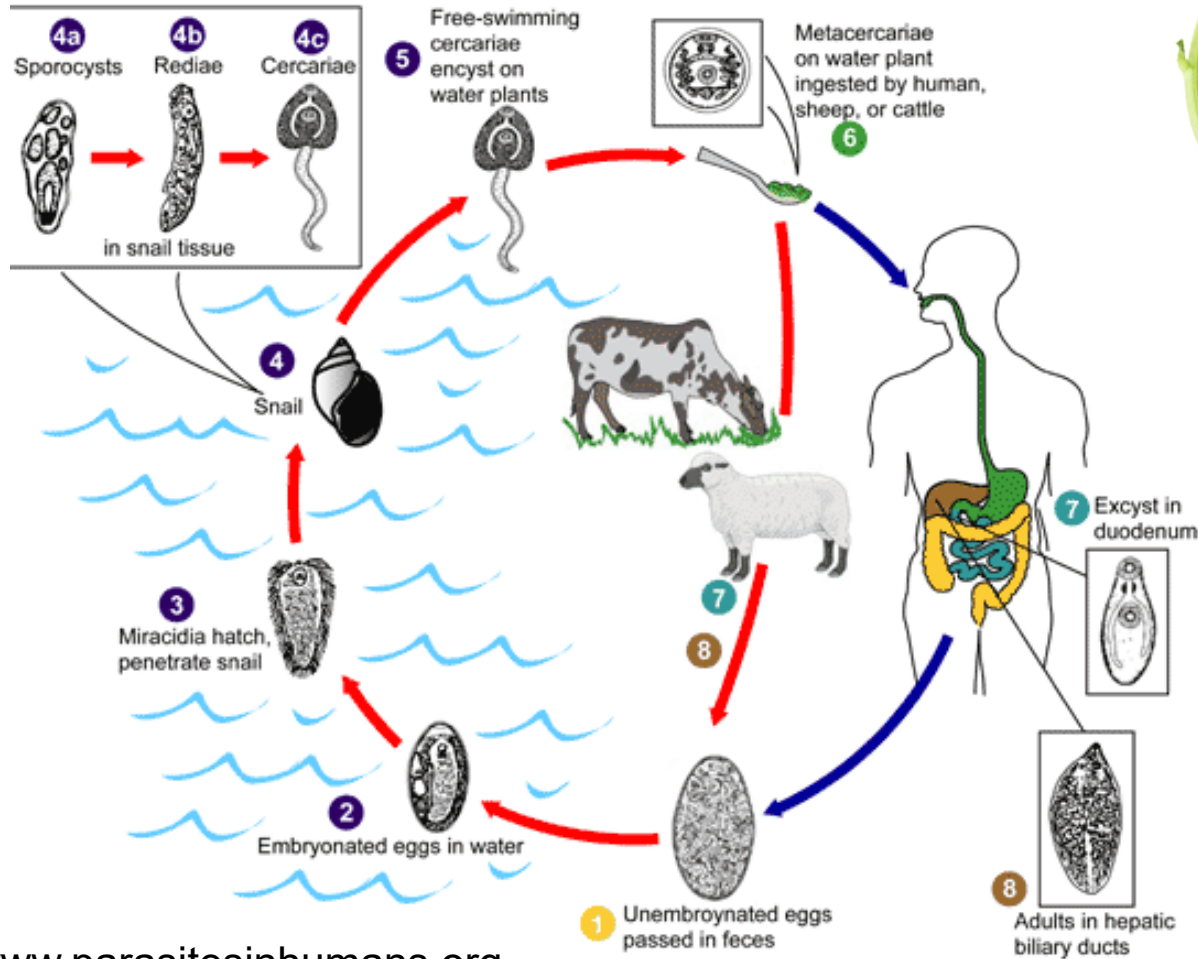
ERCP

ERCP

ERCP, papillotomy, balloon extraction

Praziquantel, Nitazoxanid 7 days → normal MRI 9 months later

# Liver fluke – *Fasciola hepatica*



watercress

**Egg**

**Miracidia**

**Cercaria**

**Metacercaria**

water plant

**Fluke**

host

**Snail**

# Liver fluke - symptoms

## Acute liver phase (6-12 weeks)

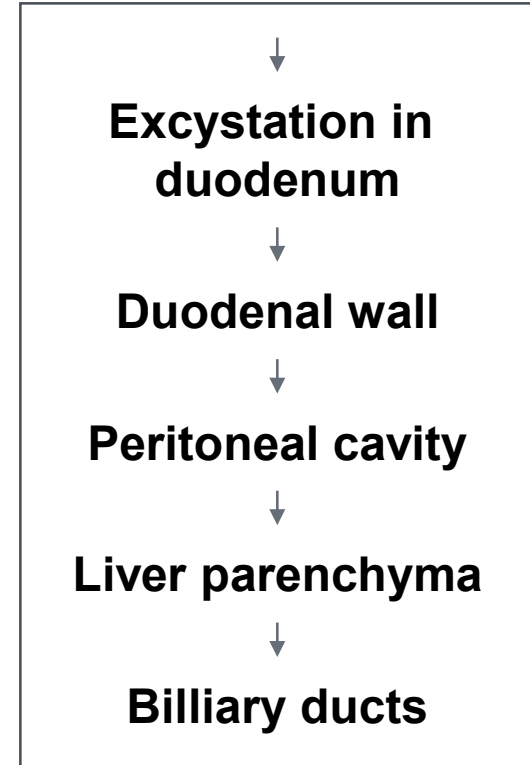
- Fever, right upper quadrant pain
- Hepatomegaly, jaundice

## Chronic liver phase (>6 months)

- Usually asymptomatic
- Occasionally biliary symptoms
- Sclerosing cholangitis biliary cirrhosis

## Ectopic fascioliasis

- Subcutaneous tissue, lung, brain
- Heart, muscle, eye



**Diagnosis: Stool, serology, specimen**

**Treatment: Triclabendazol 10mg/kg, 1-2 days**

08-10-2012  
12:11:42

SCV: 71

Ct: N Et: A1  
Ce: O  
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XZ  
A10 99■

