



Immuno-Parasitology


Helminths



protozoa



helminths




arthropods

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HELMINTHS (multicellular worms)

nematodes




roundworms

cestodes



tapeworms

trematodes



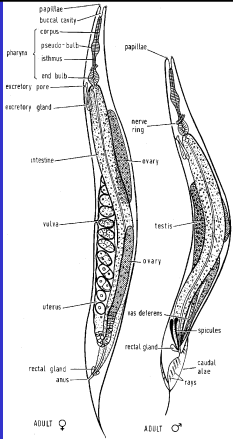
flatworms/flukes

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NEMATODES (roundworms)


Characteristics

- long thin tube, a hydrostatic skeleton
- morphological elaboration concentrated around openings
- straight gut with highly variable pharynx (oesophagus)
- sexes separate



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GENERALIZED LIFE CYCLE



EGG

ADULT M/F

LARVAE L1-4


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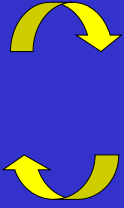
ENTERIC NEMATODES


Simple life cycles	- eggs ingested - larvae/adults in gut e.g. <i>Enterobius</i> (pin worm)
More complex	- egg ingested - larvae migrate through lungs - adults in gut e.g. <i>Ascaris</i> (round worm)
Most complex	- larvae penetrate skin - larvae migrate through lungs - adults in gut e.g. <i>Ancylostoma/Necator</i> (hookworm)

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Enterobius (pinworm)





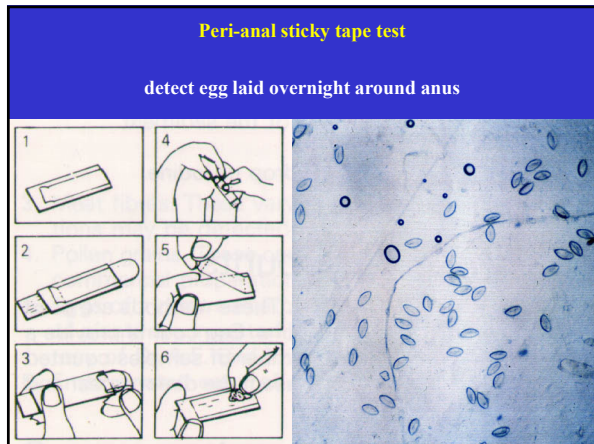


adult worms 1 cm in caecum

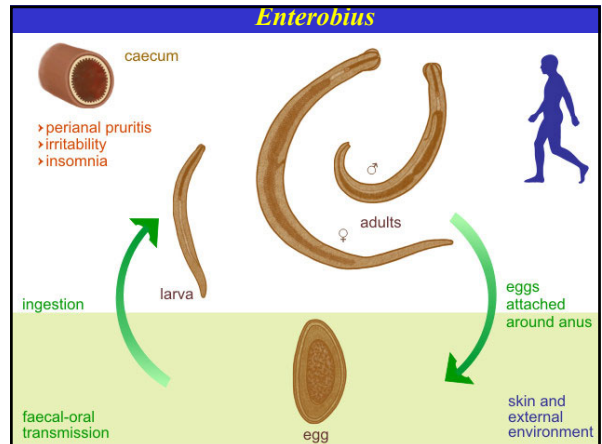
eggs 25 x 50 µm attached peri-anally

numerous pinworm species in vertebrate and invertebrate hosts

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Pathogenesis

- asymptomatic
- perianal pruritis (itching)
- insomnia, restlessness
- irritability
- sometimes diarrhoea
- rarely, extra-intestinal granuloma

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Immunoparasitology (enterobiasis)

Parasite

- extracellular (large intestinal lumen)
- immuno-diagnosis (not required)

Host immunity

- strong protection (against disease)
 - worm expulsion
 - but inflammation
- vaccination (none yet)
 - anti-infection

Problems

- immuno-evasion (luminal location, adult leave gut)

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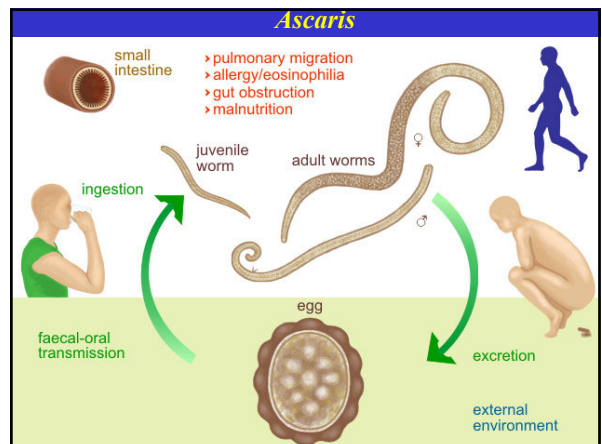
Ascaris (roundworm)

adult worms 15-30 cm
(in small intestinal lumen)

egg 60 x 40 μm
mammillated coat

important species in humans and pigs

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Faecal-oral transmission

cycle
2 months – 5 years

esp. prevalent in communities where nightsoil is used to fertilize vegetable gardens

heavy infections cause symptoms

Ascaris lumbricoides LINNÉ 1758

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Pathogenesis

- allergic reactions (urticaria, eosinophilia)
- larval migration (pneumonitis)
- mechanical blockage (gut obstruction)
- malnutrition (impaired carbohydrate absorption)

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Immunoparasitology (ascariasis)

Parasite

- extracellular (gut lumen)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

- strong protection (against infection)
 - some worm expulsion
- vaccination (none yet)
 - anti-infection

Problems

- immuno-evasion (luminal location)
- large size of worms

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Ancylostoma (hookworm)

adult worm 7-10 mm ingest plug of small intestinal mucosa

eggs 60 x 40 µm hatch in soil releasing larvae

numerous genera/species in mammals

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Ancylostoma

bowel

- > diarrhoea
- > abdominal pain
- > anaemia

worms may also undergo:

- > transmammary transmission
- > arrested larval development

adults

penetrate skin

geohelminth (soil transmission)

external environment

excretion

egg

rhabditiform larva

filariform larvae

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Pathogenesis - larvae

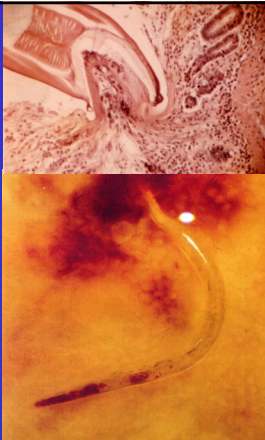
cutaneous larval migrans

- creeping eruption
- local dermatitis
- pruritis (itching)
- inflammation (oedema, erythema)

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Pathogenesis

- biting worms cause tissue necrosis and abdominal pain (acute stage)
- feeding worms cause anaemia, hypoproteinaemia, iron deficiency (chronic stage) 0.03-0.2 ml blood lost per worm per day (wasteful feeders)
- impaired intestinal absorption (diarrhoea with blood/mucus)
- infections may be fatal in severe cases



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Immunoparasitology (hookworm)

Parasite

- extracellular (but feed on blood/tissues)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

- moderate protection (against disease)
 - mucosal immunity (T and B cells)
 - but inflammation, allergy, hypersensitivity
- vaccination (some under development)
 - anti-infection (worm gut and surface antigens)

Problems

- immuno-evasion (haematophagy)
- species/strain specificity

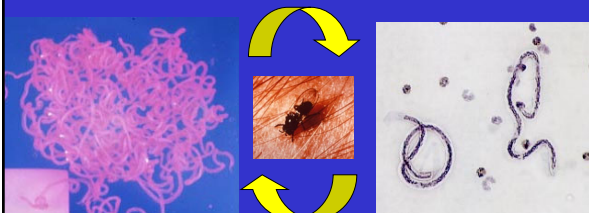
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FILARIAL NEMATODES

<i>Onchocerca</i>	blindness, skin lesions Africa, Central America	adults subcutaneous mf in tissues	blackfly
<i>Wuchereria</i>	Bancroftian filariasis (elephantitis) tropics	adults in lymphatics mf in blood	mosquito
<i>Brugia</i>	Malayan/Timorian fil. (elephantitis)	adults in lymphatics mf in blood	mosquito
<i>Loa</i>	Calabar swellings Central/West Africa	adults subcutaneous mf in blood	tabanids
<i>Mansonella</i>	skin lesions Central America	adults in dermis mf in blood	sandfly/blackfly
<i>Dirofilaria</i>	pulmonary lesions widespread	adults in heart mf in blood	mosquito

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Onchocerca (filarial worm)

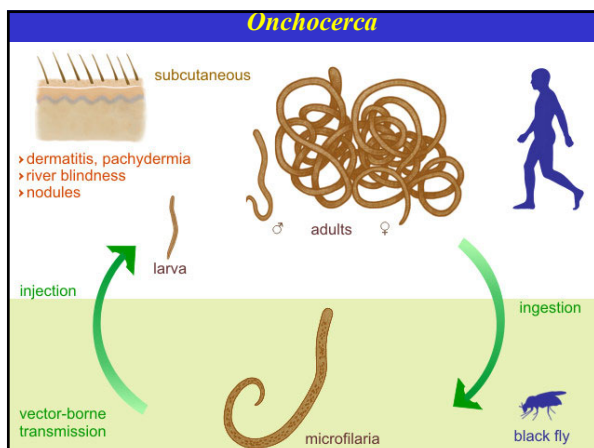


adult worm up to 50 cm
in subcutaneous nodules

microfilariae 220-360 μm
in tissues

O. volvulus pathogenic in humans
several pathogenic species in animals


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Pathogenesis

- subcutaneous nodules usually over bony prominences (especially pelvis in Africa and on head in Mexico)



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Immunoparasitology (onchocerciasis)

Parasite

- extracellular (tissue microfilariae, subcutaneous adults)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

- little protection (chronic infections)
 - inflammation contributes to disease
 - endosymbiotic bacteria *Wolbachia*
- vaccination (none yet)
 - anti-infection, anti-disease

Problems

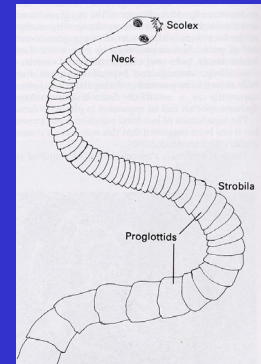
- immuno-evasion (nodule development, huge numbers of mf)
- species/strain specificity

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Cestodes

Morphological characteristics

- scolex (head) for attachment, not feeding
- strobila = the tape (segments/proglottids)
- gut lacking in all stages
- hermaphroditic (male and female organs)

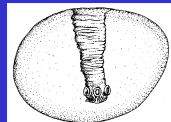


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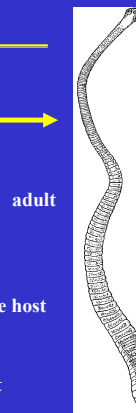
Life cycle



egg



larva
(metacestode)



adult

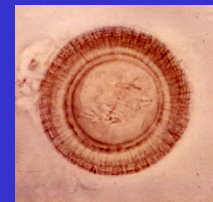
- predator-prey transmission (2-3 hosts)
- eggs/coracidia eaten to infect intermediate host
- larva in intermediate host eaten to infect definitive host
- adults internal parasites of vertebrate gut

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Taenia saginata/solium (beef/pork tapeworm)



adults 2-8m
in small intestines



eggs 30-44 μm
passed in faeces

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Taenia saginata "beef" tapeworm



scolex

unarmed

Taenia solium "pork" tapeworm



scolex

armed



proglottid

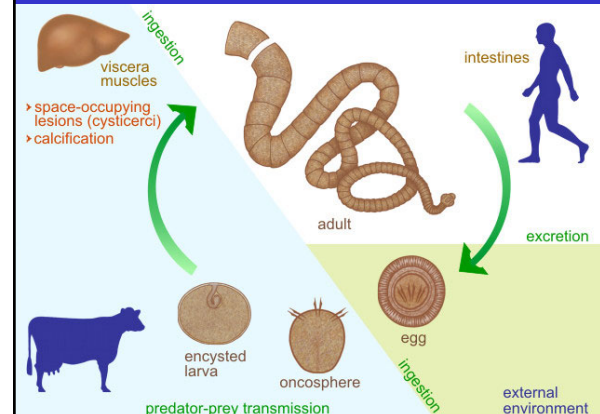
single genital pore



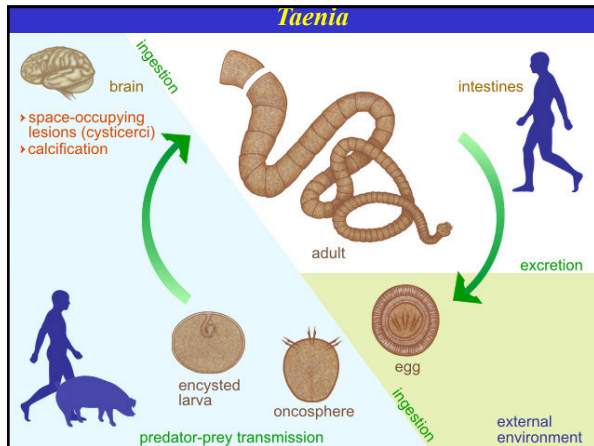
proglottid

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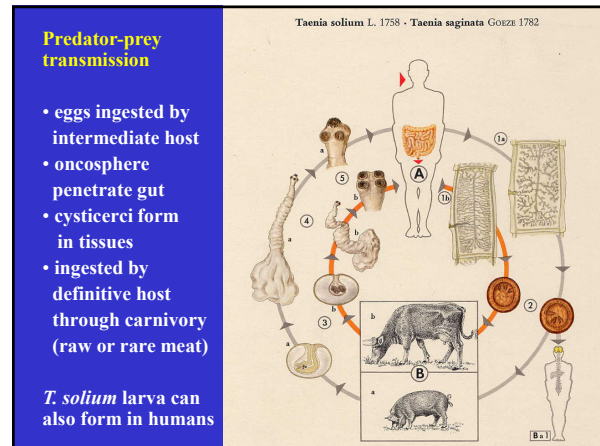
Taenia



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Pathogenesis – adult tapeworms

- adult beef/pork tapeworms in humans
- light infections asymptomatic
- vague abdominal pains, diarrhoea/constipation
- generalized allergic manifestations (urticaria, pruritis ani, eosinophilia)

- treatment
 - anthelmintic (praziquantel/niclosamide)
- prevention
 - meat inspection
 - cook meat

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Pathogenesis – larval stages (*T. solium* only)

- eggs may hatch in humans (after ingestion/reverse peristalsis)
- oncospheres hatch, penetrate gut
- swept to tissues and form cysticerci (space-occupying lesions)
- especially in skeletal musculature and connective tissue
- cysticerci degenerate and calcify

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Immunoparasitology (cysticercosis)

Parasite

- extracellular (adults in gut, larvae in tissues)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

- some protection (against infection by adults) – gut immunity
- some protection (against infection by larvae) – tissue responses
- vaccination (several excellent candidates under trial)
 - anti-disease (oncosphere antigens)

Problems

- immuno-evasion (poor access to transient stages)
- number of hosts to vaccinate (cattle, pigs)

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Echinococcus granulosus (hydatid tapeworm)

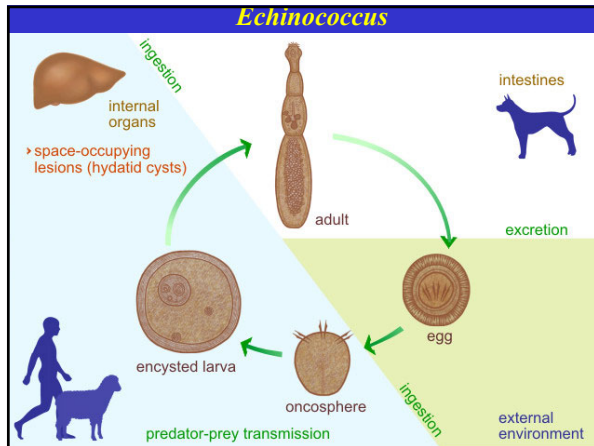
adults 2-6 mm in small intestines of dogs

eggs 30-43 µm passed in dog faeces

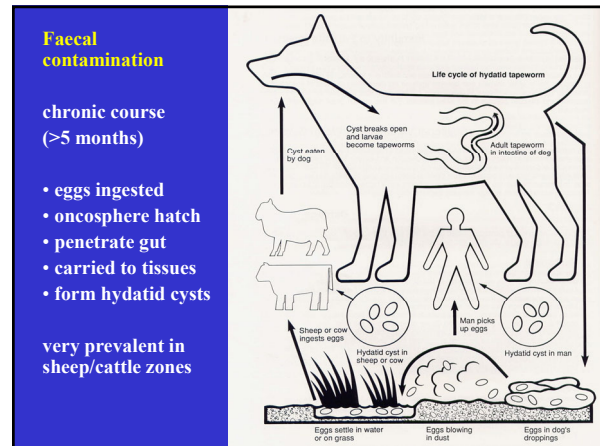
predator-prey

hydatid disease caused by larval metacestodes

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Pathogenesis

- cysts produce chronic space-occupying lesions
- cause organ enlargement accompanied by various signs (abdominal distention, epilepsy, blindness, etc.)
- acute signs associated with:
 - cyst rupture (peritonitis, pneumothorax)
 - allergic responses to fluid (asthma, anaphylaxis)

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Hydatid cycles

domestic cycle
dog-sheep

sylvatic cycle
dingo-macropod

same species
same strains

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Immunoparasitology (hydatid disease)

Parasite

- extracellular (cyst formation)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

- limited protection (against disease)
 - cyst formation
- vaccination (several candidate vaccines under development)
 - anti-infection (oncosphere antigens)

Problems

- immuno-evasion (poor access to transient stages)
- species/strain specificity

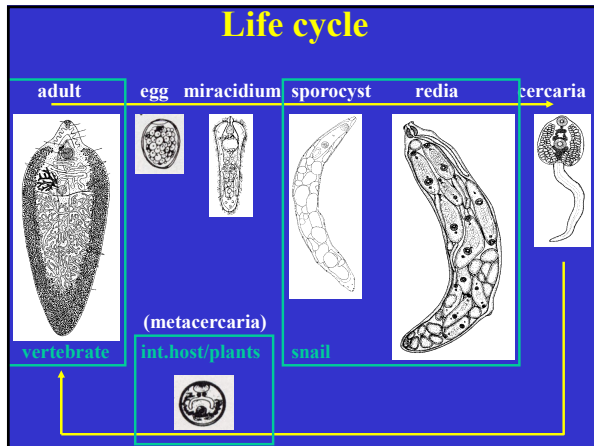
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Trematodes

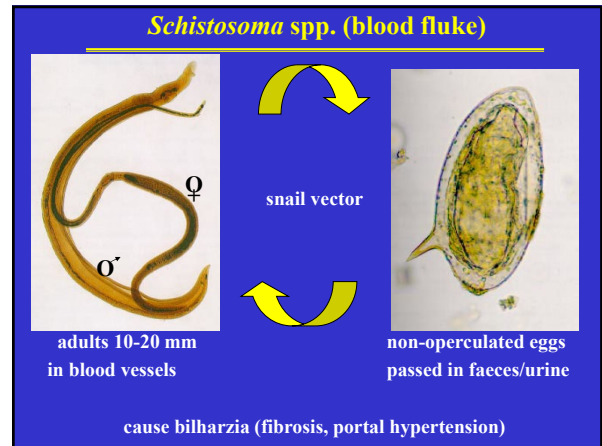
Characteristics

- body 1-50mm, soft, with suckers
- hermaphroditic (male and female organs)
- life-cycle with distinct generations (= di-genea)
 - vertebrates are definitive hosts
 - molluscs are obligate intermediate hosts
- distribution linked to host biology (molluscs abundant in aquatic cf. terrestrial environments, more trematodes in aquatic animals)
- various species of medical and veterinary importance

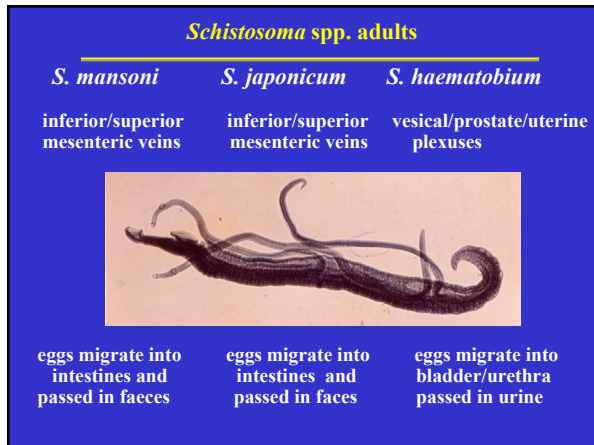
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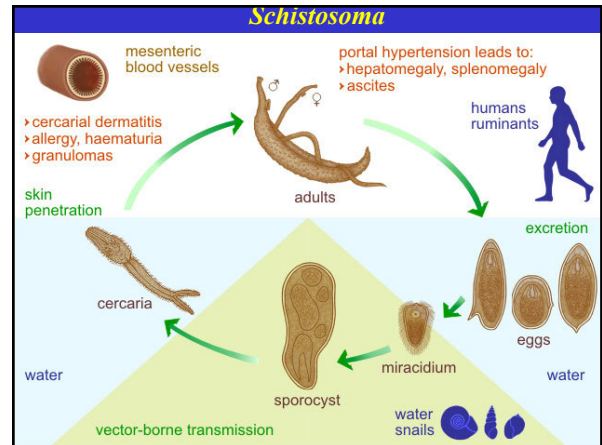
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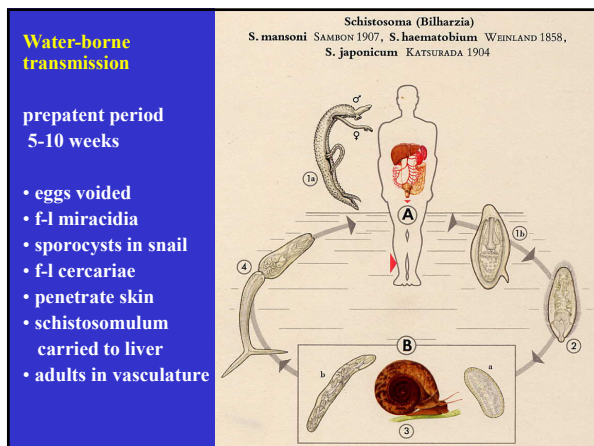
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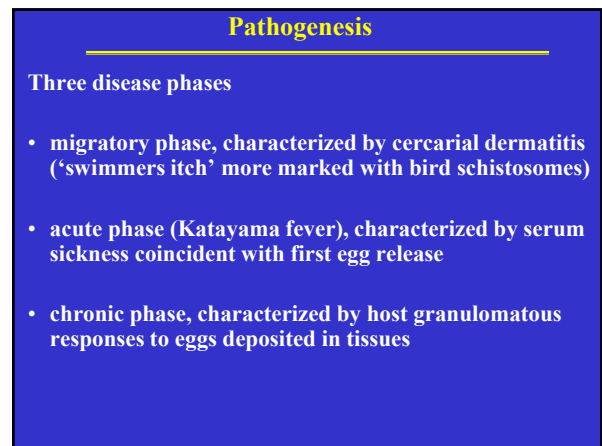
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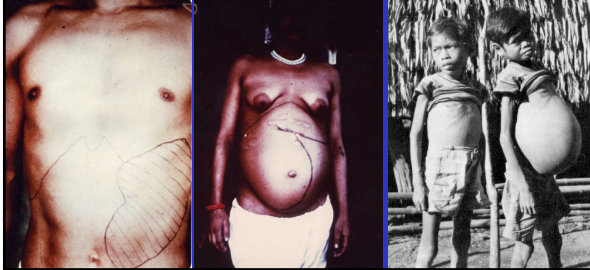
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Pathogenesis - chronic

- portal hypertension leads to hepatomegaly, splenomegaly, and possibly ascites
- also gross enlargement of oesophageal and gastric veins (varices) which sometimes burst



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Immunoparasitology (schistosomiasis)

Parasite

- extracellular (adults in blood, eggs in tissues)
- immuno-diagnosis (antibody, antigen, DNA)

Host immunity

- limited protection (chronic infections)
 - survive bathed in blood
 - granuloma formation (immuno-pathology)
- vaccine development
 - anti-infection (schistosomula), anti-disease (tegument, S/EM)

Problems

- immuno-evasion (vary surface coat)
- species/strain specificity

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