

TREMATODES- SCHISTOSOMES

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General Character of Trematodes

- * Flukes - leaf shaped, unsegmented flat worm
- * Size - 1mm to severalcm in length
- * Suckers - organ of attachment
 - Two strong muscular cup shaped depressions
 - Oral suckers – around mouth
 - Ventral sucker (acetabulum)- on ventral surface of the body
- * Sexes are not separate except schistosomes
- * Body cavity is absent
- * Alimentary canal is present but incomplete
- * Excretory & nervous systems are present
- * Worm is oviparous, eggs are liberated
- * Eggs are operculated except schistosomes
- * Reproductive system is complete & highly developed

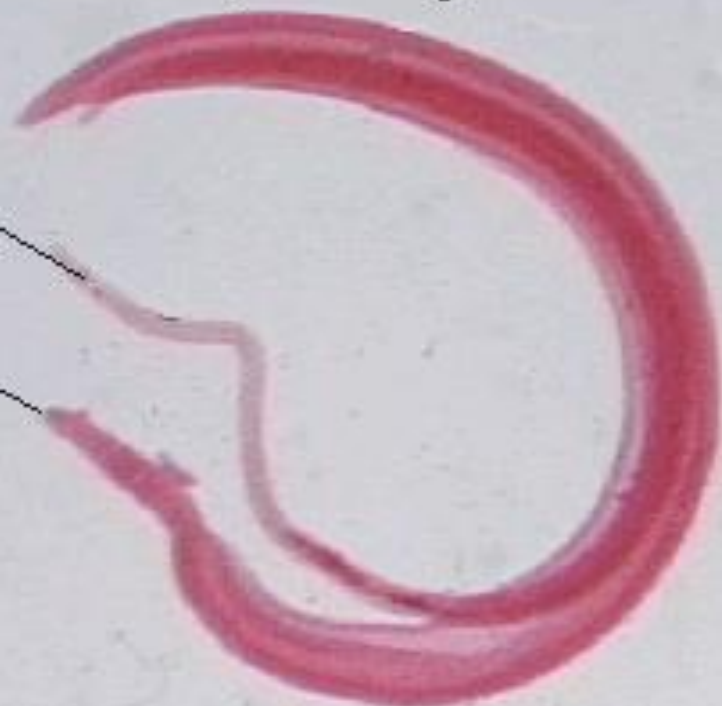
Trematodes description

- Monogenetic- single generation completing life cycle.
- Digenetic- two generation sexual & asexual. In digenetic trematodes asexual multiplication occurs in the larval stages (in sporocyst or redia stage)
- Distomata- has two suckers
- Acetabulum- muscular organ of attachment –sucker
- Gynaecophoric canal – channel formed by the infolding of the lateral margins of body of male behind the ventral sucker for holding the female during copulation
- Miracidium- first larval stage coming out of the trematode egg in water, infective to mollusc only

Schistosoma, in copula

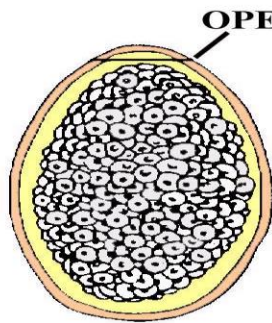
female

male



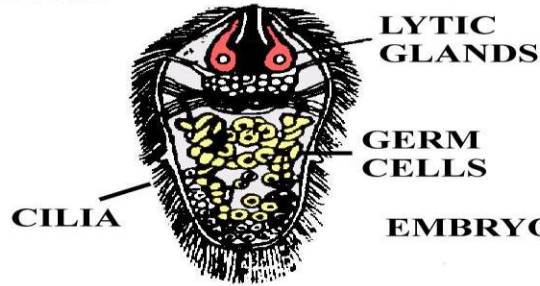
(by P.W. Pappas and S.M. Wardrop)

DIGENE LARVAE



OPERCULUM

EGG

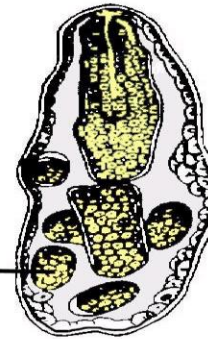


LYTIC GLANDS

GERM CELLS

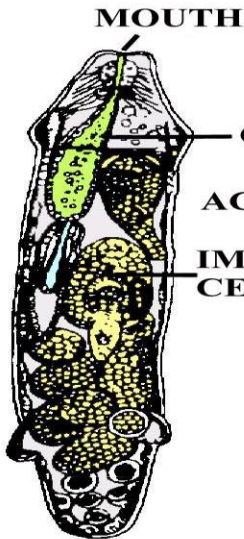
CILIA

MIRICIDIUM



EMBRYOS

SPOROCAST



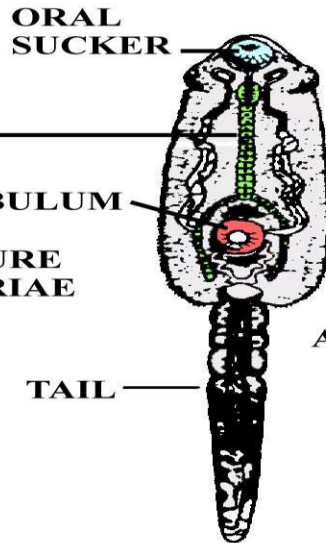
MOUTH

GUT

ACETABULUM

IMMATURE CERCARIAE

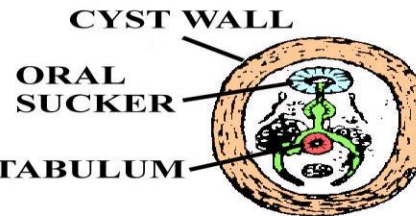
REDIA



ORAL SUCKER

TAIL

CERCARIA



CYST WALL

ORAL SUCKER

ACETABULUM

METACERCARIA

- **Sporocyst**- second larval stage of the trematodes occurring in mollusc. Asexual multiplication occurs at this stage only in schistosomes
- **Redia** - third larval stage of the trematodes occurring in mollusc. Asexual multiplication at this stage occurs in all trematodes except in schistosomes where there is no stage of redia formation
- **Cercaria** - final stage of larval development of trematodes in the mollusc, possessing body and tail. It escapes into the surrounding water & remain either free or encysted on vegetables or in animals. According to the nature of the tail of the cercaria, different names given--

- *Furocercus cercaria*- fork tailed (schistosomes)
- *Microcercus cercaria*- small stumpy tail (paragonimus)
- *Lophocercus cercariae* – large fluted tail (metagonimus, clonorchis, heterophyes)
- *Pleurolophocercus cercaria* – long powerful tail with pair of fin folds (opisthorchis)
- Metacercaria or adolescaria – encysted cercariae without tail, infective to definitive hosts.
- Schistosomules- immature or growing worm of schistosomes in definitive host

Classification of trematodes

Depending on their site of localization:

1. Blood species: *S.haematobium*,
S.mansoni, *S.japonicum*, *S.intercalatum*,
S.bovis
2. Intestinal species : *F.buski*,
H.heterophyes, *Metagonimus yokogawai*
3. Tissue species: (a) liver- *F.hepatica*,
C.sinensis, *Opisthorchis felineus*
(b) lung- *P.westermani*

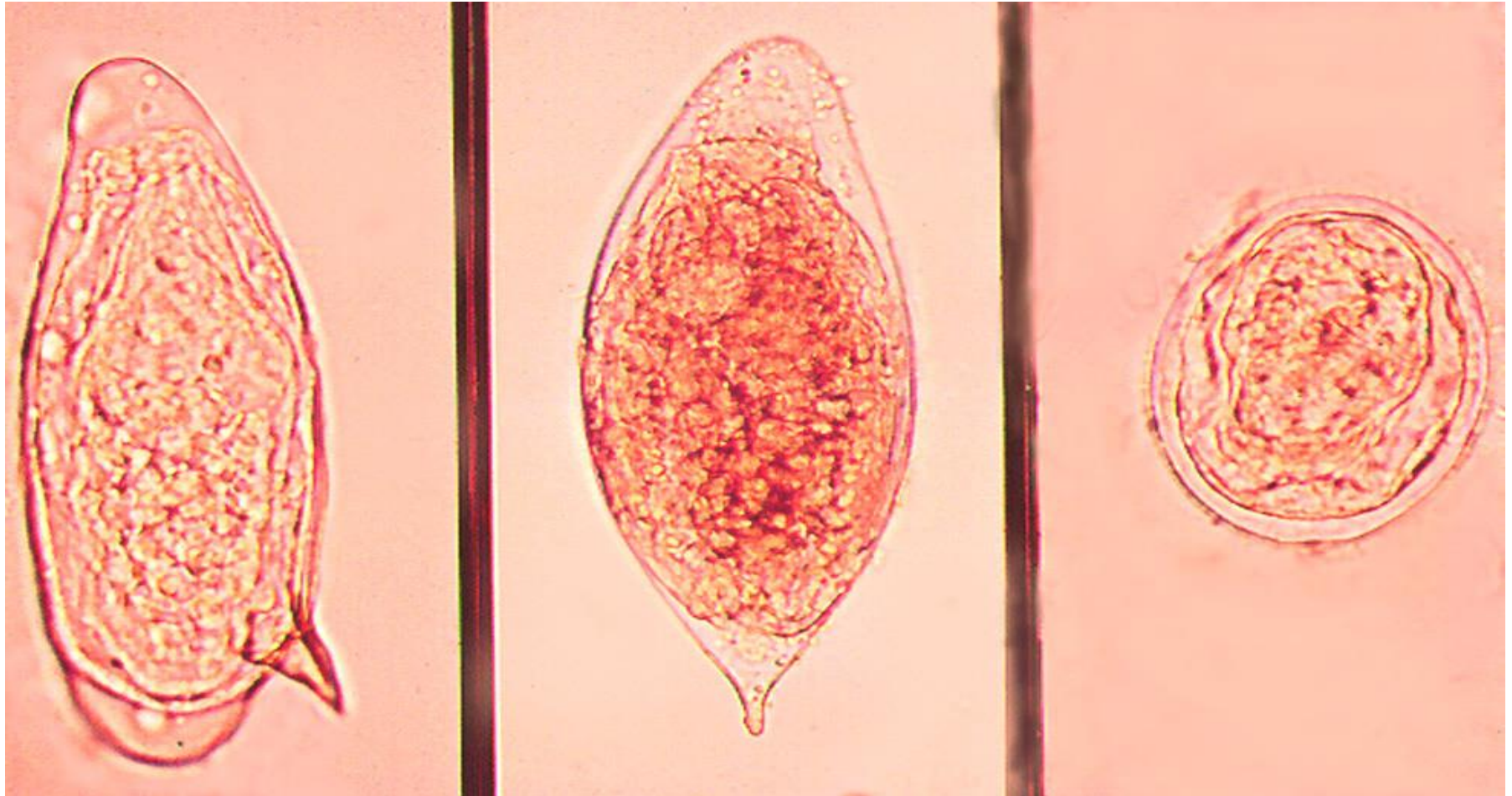
Schistosomes species

- World wide seen
- 3 major species known : *S.haematobium*, *S.mansoni* & *S. japonicum*
- Common name : vesical, manson's & oriental blood fluke respectively known
- Wide spread in Africa & Middle –East area
- Adult worm live in copula, in pelvic venous plexus-vesicle, prostatic & uterine plexuses of veins

Organism characteristics

- *S. haematobium* exists in 5 forms:
adults, miracidium, sporocyst, cercaria, & schistosomules
- Dieocious (sexes are separate) fluke
- Adult males : 10-15mm x 1mm,
2 suckers – oral & ventral
tegument is finely tuberculated
flattened sides of body, beneath the ventral
sucker form the gynaecophoric canal
adult female live in gynaecophoric canal of the
male

- Adult females – cylindrical, longer & slender than males 15-20mm x 0.25mm
- 2 suckers- oral & ventral
- M & F worms live in copula for as long as 40 yrs & produce several eggs daily.
- Eggs laid in small venules of vesical plexus
- Eggs: oval & terminal spine
110-170umx40-70um
brownish yellow in colour
- Eggs pass from venules to urinary bladder with the help of spine & lytic substances
- Mounting pressure in the venules in which they were lodged due to laying of more eggs
- Eggs contained ciliated larva – miracidium
- Miracidium: ciliated, actively motile larvae that infect snail

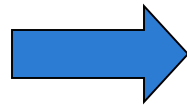


- Miracidium transforms into sporocyst in snail
- Sporocysts are sac-like tubular structures
- 1st generation sporocyst → 2nd generation sporocyst
- Cercariae seen in 2nd generation sporocyst
Size: 175-240 x 55-100 μm
Bifurcated tail
- Schistosomules occur in human – it is cercaria without tail

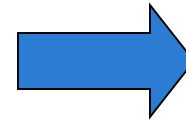
Life cycle



feces and urine



miracidia

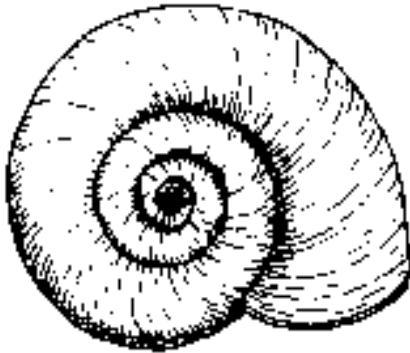


intermediate
fresh water
snail host

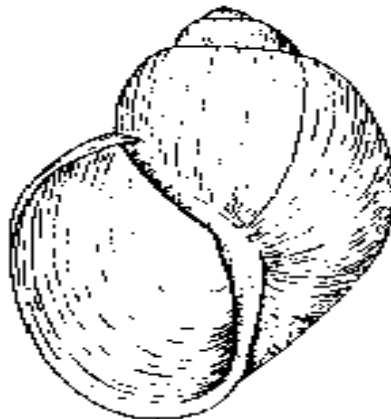
Intermediate Snail Hosts

- *S. mansoni*: *Biomphalaria* (Africa)
- *S. haematobium*: *Bulinus* (Africa)
- *S. japonicum*: *Oncomelania* (Asia)

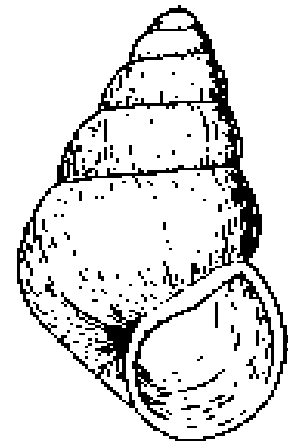
Biomphalaria



Bulinus



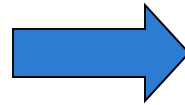
Oncomelania



Life cycle



**intermediate fresh
water snail host**

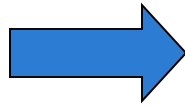


cercariae

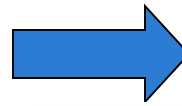
Life cycle in Human



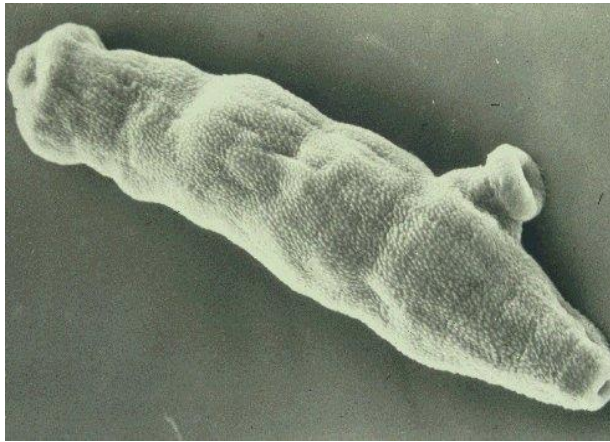
cercariae



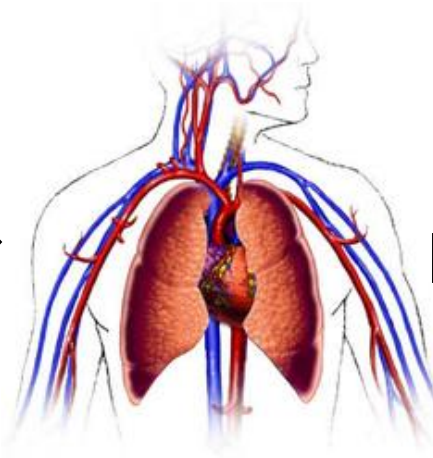
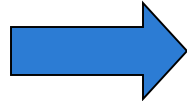
human host



human host



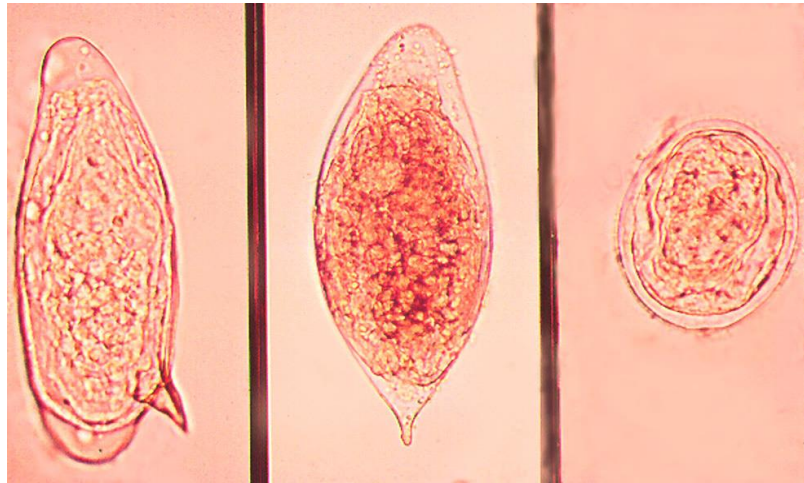
schistosomulum



human host



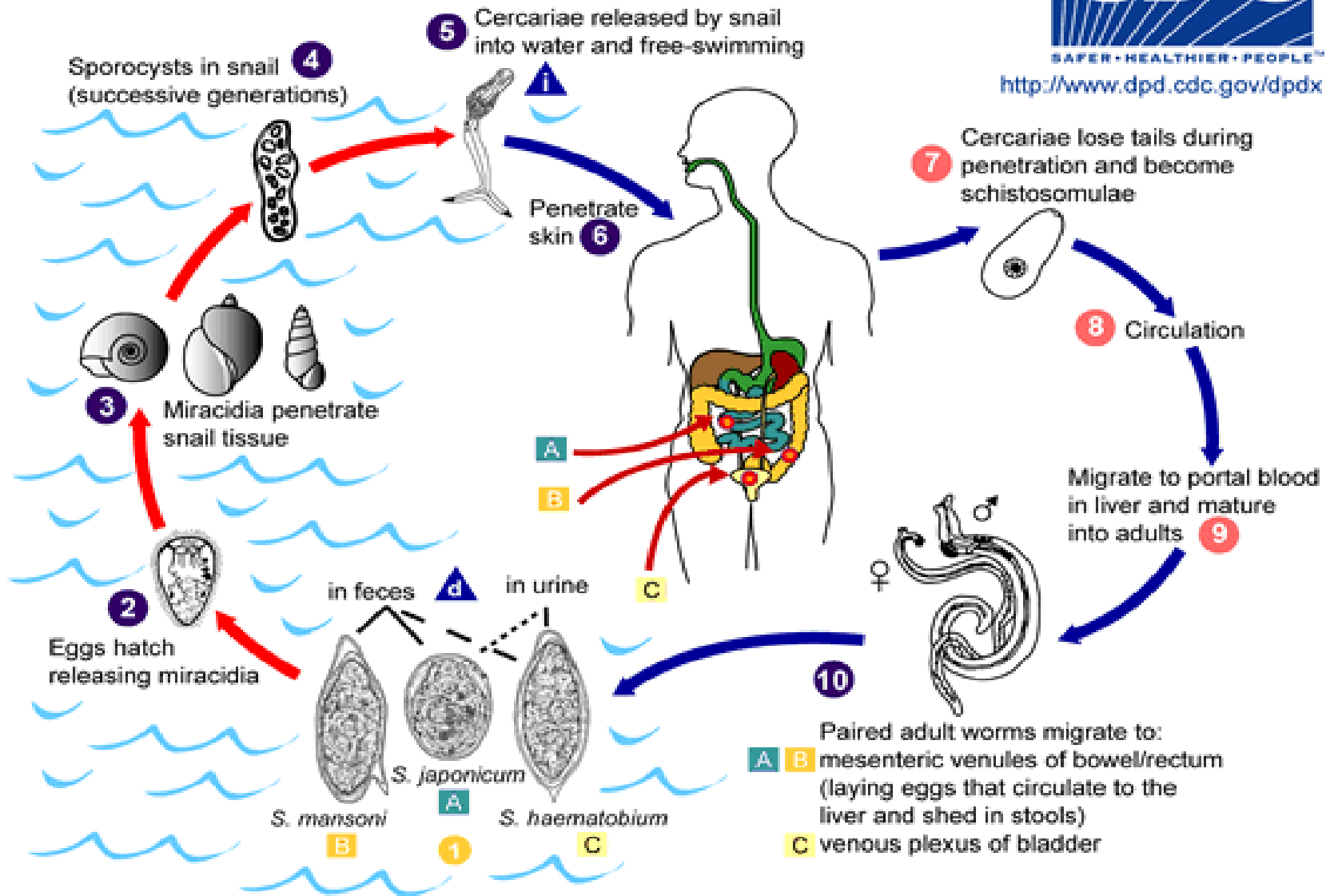
adult schistosome



i = Infective Stage
d = Diagnostic Stage



<http://www.dpd.cdc.gov/dpdx>



Clinical features and pathology

- Urinary schistosomiasis or bilharziasis
- Irritation & skin rash due to cercarial penetration within 24 hrs
- Cercarial dermatitis-swimmer's itch
- Fever, cough, lymphadenopathy, liver & spleen enlargement or urticaria-katayama fever
- Dysuria & painless terminal haematuria
- Friable masses in bladder & ureters
- Vesical carcinoma

- As the schistosomes mature they refractory to immune attack
- Produce blocking antibodies
- Schistosomes cover their surface with host protein
- Cellular response—granuloma formation around eggs

Laboratory diagnosis

- Gross or microscopic haematuria in endemic area
- Demonstration of eggs in urine
- Cystoscopy and biopsy of urinary bladder- HPE
- Blood test
- Serology – ectopic schistosomiasis
- “cercarian Hullen” reaction, circumoval precipitation, miracidial immobilization detect Abs against cercaria, egg and miracidium respectively
- IHA, IFA, ELISA, RIA
- **Treatment**
- **Drugs**
 - **Praziquantel** - effective in the treatment of all forms of schistosomiasis, with virtually no side effects *
 - **Oxamniquine** - used exclusively to treat intestinal schistosomiasis in Africa and South America *
 - **Metrifonate** - effective for the treatment of urinary schistosomiasis

Prevention

- Avoid swimming in fresh water in countries where schistosomiasis is prevalent.
- Drink clean water
- scrape body down after accidental exposure
- water-resistant creams
- Snail Control

Differentiating features of schistosomes

	S.haematobium	S.mansoni	S.japonicum
Male	1-1.5cm x1mm	1cm by 1mm	1-2cm by 0.5mm
cuticula	Finely tuberculated	Grossly tuberculated	Non-tubercular
testes	4to5 , in groups	8to9 zigzag row	6to 7 single file
Female	2cm by 0.25mm	1.4cm by 0.25 mm	2.6cmby 0.3mm
Uterus	20-30 eggs	1-3 eggs	50 or more eggs
Egg	150 ×50 μ Terminal spine	150 ×60 μ Lateral spine	100 ×65 μ Lateral knob

Intermediate host	Bulinus & planorbis	Biomphalaria	Oncomelania
Definitive host	Man	Man	Man & domestic animals
G.D.	Africa, & Middle East	Africa, S. America	Far East
Habitat	Vesical & prostatic vesical plexus	Inferior mesenteric vein & its radicals	Superior mesenteric vein & its radicals
Disease	Urinary schi. Or bilharziasis	Intestinal bilharziasis, Egyptian splenomegaly	Katayama disease
Common name	Vesical blood fluke	Manson's blood fluke	Oriental blood fluke