**Important Orders**

a. Echinostomatiformes
b. Strigeiformes
c. Opisthochormes

d. Plagiorchiformes
Trematode Phylogeny

Note the sequence of characters

Order Echinostomatiformes

1. Redia with appendages, often with collars.
2. Cercaria encyst "on" things
3. Adults with spines
4. Examples:
   a. liver flukes,
   Fasciola

Order Echinostomatiformes

Fasciola spp.
1. Characteristics
   a. large testes and vitellaria
   b. oral cone and shoulders
   c. life cycle
Order Echinostomatiformes

Fasciola spp.

2. High prevalence in domestic cattle, human populations
   a. 38% of children in Bolivia
   b. 17% of cattle in Montana

Fasciola hepatica Life Cycle
Order Echinostomatiformes

*Fasciolopsis buski*
1. parasite of pigs and humans in orient
2. large, 7.5 cm), causes intestinal obstructions

Order Echinostomatiformes

c. *Fasciola gigantica*
1. very large (7cm long)
2. formerly wild ungulates, now present in domestic species.
**Order Strigiformes**

1. cercaria with 2 eyespots, may encyst or burrow into definitive host.
2. adults with spines, occasionally with expanded anterior end.

**Order Strigiformes**

*Alaria* spp.

1. parasite of foxes; *A. americana* in NA
2. Slight modifications in life cycle.
   a. Mesocercaria in tadpoles, later in frogs.
**Order Strigiformes**

b. Builds up infections in snakes (paratenic host)  
Can massively infect canids or humans.  
c. *Diplostomulum metacercaria* remain circulating in lactating females, be transmitted to offspring.

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**Order Strigiformes**

In humans, mesocercaria can end up in eye, kidney, other organs with high vascularity.

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**Order Strigiformes**

b. *Uvulifer ambloplitis*
1. causes "blackspot" on freshwater fish  
a. this is the neascus metacercaria  
b. eggs shed, miracidium invades snails (*Helisoma*),
**Uvulifer ambloplitis**

c. Two sporocyst generations in 6 weeks.
d. cercariae leave snail, float to surface and chase fish
e. form metacercaria - melanin deposited by fish makes black spots.

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**Family Schistosomatidae**

2. Three primary species
   a. *Schistosoma mansoni*: Africa, Middle East, Central America and Caribbean
   b. *S. japonicum*: far east
   c. *S. haematobium*: Africa
   d. *S. intercalatum* - Africa, similar to *S.h*
e. *S. indicum* - India
World Distribution of Schistosomiasis

Note that the disease is associated with very old human populations.

Geographic distribution of Schistosoma mansoni infection

Table 16.3 Distribution and Host Specificity of Schistosoma spp., modified from Johnston et al.22

<table>
<thead>
<tr>
<th>Species Group</th>
<th>Distribution</th>
<th>Small Host</th>
<th>Mammalian Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schistosoma haematobium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. haematobium</td>
<td>M, R, A</td>
<td>Bovines</td>
<td>Pr</td>
</tr>
<tr>
<td>S. intercalatum</td>
<td>A</td>
<td>Bovines</td>
<td>Pr</td>
</tr>
<tr>
<td>S. mekongi</td>
<td>A</td>
<td>Bovines</td>
<td>Pr</td>
</tr>
<tr>
<td>S. avermanei</td>
<td>A</td>
<td>Bovines</td>
<td>Pr</td>
</tr>
</tbody>
</table>

| Schistosoma mansoni | | | |
|---------------------|--------------|------------|
| S. mansoni | A, M | P. maximus | Pr, B |
| S. mekongi | A | P. maximus | B, C |
| S. japonicum | A | P. maximus | A |

| Schistosoma japonicum | | | |
|----------------------|--------------|------------|
| S. japonicum | A | P. maximus | Pr, A, B, C, Dn |
| S. mansoni | A | P. maximus | Pr, A, B, C, Dn |

| Schistosoma indicum | | | |
|---------------------|--------------|------------|
| S. indicum | A, DnA | Macacus | Ar |
| S. mansonii | A, DnA | Macacus | Ar |
| S. japonicum | A, DnA | Macacus | Ar |

| Schistosoma latum | | | |
|-------------------|--------------|------------|
| S. latum | A | Macacus | Ar, B, C |
Schistosome Hosts

3. Note different snail hosts in different schisto species:
   a. S. haematobium: snail is Bulinus
   b. S. japonicum: snail is Oncomelania and some others

Schistosome Hosts

c. S. indicum: snails are Indoplanorbis, Planorhis, Lymnea.

   d. S. mansoni: snail is Biomphalaria

Schistosomiasis is usually contracted at community water sources.

Control of schistosomiasis often involves use of molluscicides
Schistosome Life Cycles

Each have slightly different pathology due to different locations in definitive hosts.

Figure 10.6: Life cycle of *Schistosoma haematobium*. The tissue (up to the greenish-brown stage) is the connective tissue of the water snail (*Bulinus*).
Schistosoma haematobium

Schistosoma japonicum

Oncomelania

Schistosoma japonicum

Corrosores enter skin
Schistosoma japonicum

S. japonicum Pathology

Schistosoma japonicum
Schistosoma japonicum

Figure 16.8
Scanning electron micrograph of endothelial cells and eggs of Schistosoma japonicum in vitro. The eggs have just been expelled by a female worm, and the endothelial cells are moving over them.
Schistosoma mansoni

Schistosoma mansoni eggs in the liver of an experimentally infected mouse

S. mansoni Pathology
Schistosoma Differences

- a. Eggs
- b. Life cycle
- c. Pathology

Acquired immunity

1. A possible context for baptism?

Order Strigiformes

d. Dioecy

1. High densities of males and females in same host?
2. Specialization as one sex or the other can yield greater fitness than that obtained by individuals with both sexes.
Schistosoma douthetii

e. Swimmers itch

1. The scourge of midwestern prom nights