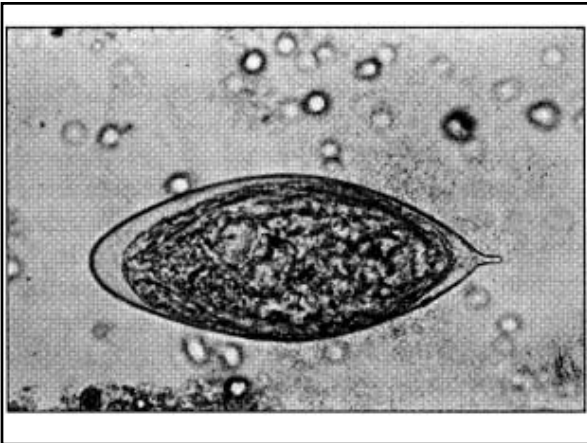


BIO 475 - Parasitology Spring 2009

Stephen M. Shuster
Northern Arizona University

<http://www4.nau.edu/isopod>

Lecture 14



Schistosoma haematobium

The diagram illustrates the life cycle of Schistosoma haematobium. It shows the transition from a miracidium (labeled 'Miracidium') to a sporocyst, then to a cercaria (labeled 'Cercaria'), and finally to a mature adult (labeled 'Adult'). The adult stage is shown in a human host, with eggs being excreted in urine or feces. The diagram also shows the pathogenesis, where eggs migrate to the liver and cause damage. A reservoir host, a monkey, is shown with the text 'Eggs migrate to liver' and 'Reservoir host'.

Schistosoma haematobium

Reservoir host

Schistosoma japonicum

Schistosoma japonicum

Oncomelania

Cercariae leave snail

Schistosoma japonicum

Schistosoma japonicum

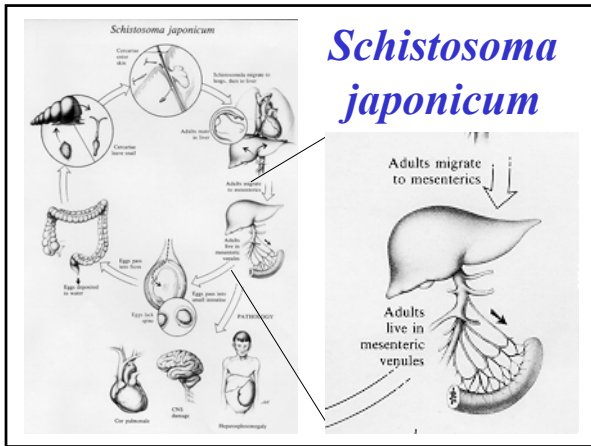
Cercariae enter skin

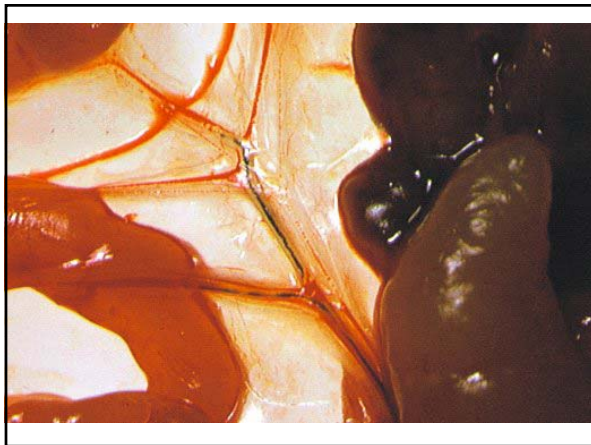
Schistosoma japonicum

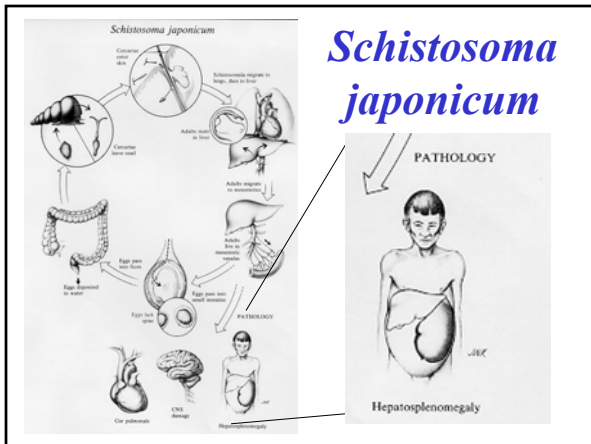
Schistosoma japonicum

Schistosomula migrate to lungs, then to liver

Adults mate in liver



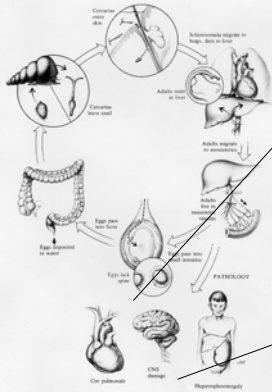




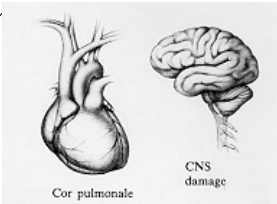
S. japonicum
Pathology



Schistosoma japonicum



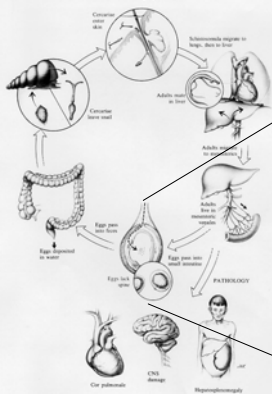
Schistosoma japonicum



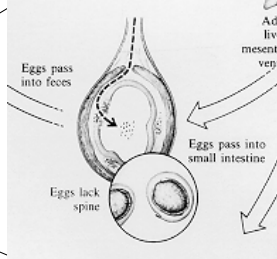
Cor pulmonale

CNS damage

Schistosoma japonicum



Schistosoma japonicum

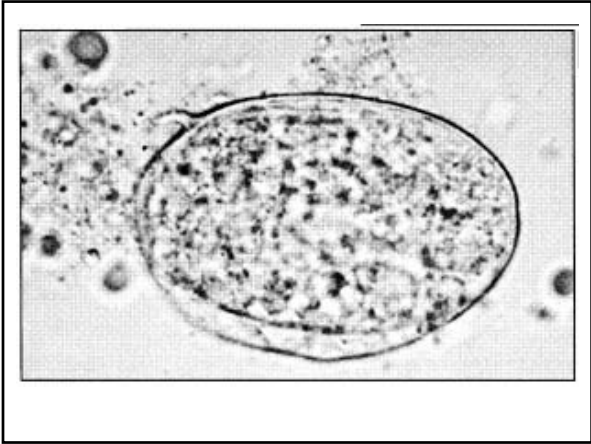


Eggs pass into feces

Ad
liv
mesent
vein

Eggs lack spine

Eggs pass into small intestine



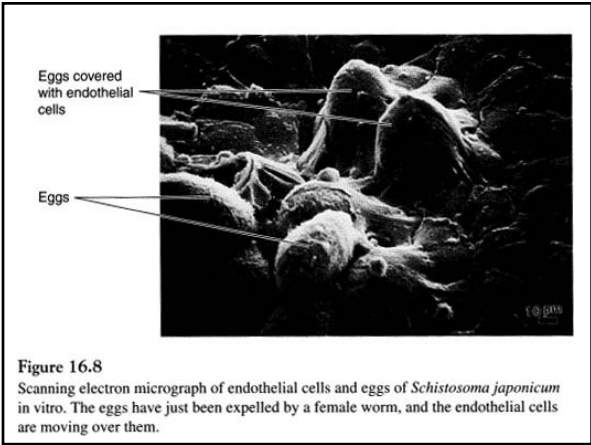
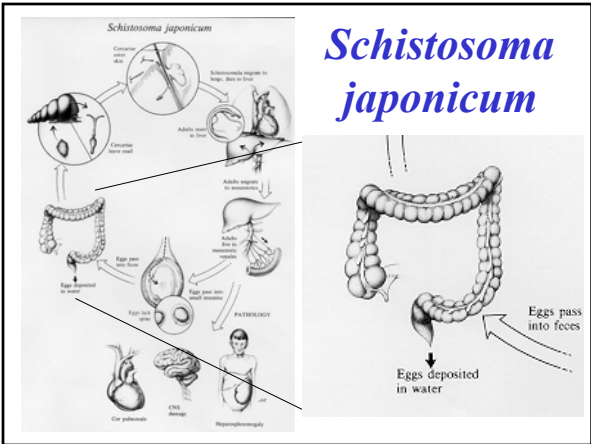


Figure 16.8
 Scanning electron micrograph of endothelial cells and eggs of *Schistosoma japonicum* in vitro. The eggs have just been expelled by a female worm, and the endothelial cells are moving over them.



Schistosoma japonicum

Schistosoma mansoni

Schistosoma mansoni

Biomphalaria

Miracidia penetrate snail

Cercariae leave snail

Eggs hatch in water

Eggs pass into small intestine

Eggs pass into feces

Eggs deposited in water

Cercariae enter skin

Schistosomula migrate to lungs, then to liver

Adults mate in liver

Adults migrate to mesenteric veins

Adults live in mesenteric veins

Schistosoma mansoni

Schistosoma mansoni

Cercariae enter skin

Schistosomula migrate to lungs, then to liver

Adults mate in liver

Adults migrate to mesenteric veins

Adults live in mesenteric veins

Eggs pass into small intestine

Eggs pass into feces

Eggs deposited in water

Eggs hatch in water

Cercariae leave snail

Eggs pass into small intestine

Schistosoma mansoni

Schistosoma mansoni

Schistosomula migrate to lungs, then to liver

Adults mate in liver

Adults migrate to mesenteric veins

Adults live in mesenteric veins

Eggs pass into small intestine

Eggs pass into feces

Eggs deposited in water

Eggs hatch in water

Cercariae leave snail

Eggs pass into small intestine

Cercariae enter skin

Schistosoma mansoni

Schistosoma mansoni

Cercariae enter skin
 Schistosoma migrates to lungs, then to liver
 Adults migrate to mesenteric veins
 Adults live in mesenteric venules
 Eggs pass into small intestine
 Eggs deposited in water
 Egg hatch in water
 Cercariae leave shell
 Cercariae penetrate skin
 Eggs pass into feces

Schistosoma mansoni

Schistosoma mansoni

Cercariae enter skin
 Schistosoma migrates to lungs, then to liver
 Adults migrate to mesenteric veins
 Adults live in mesenteric venules
 Eggs pass into small intestine
 Eggs deposited in water
 Egg hatch in water
 Cercariae leave shell
 Cercariae penetrate skin
 Eggs pass into feces

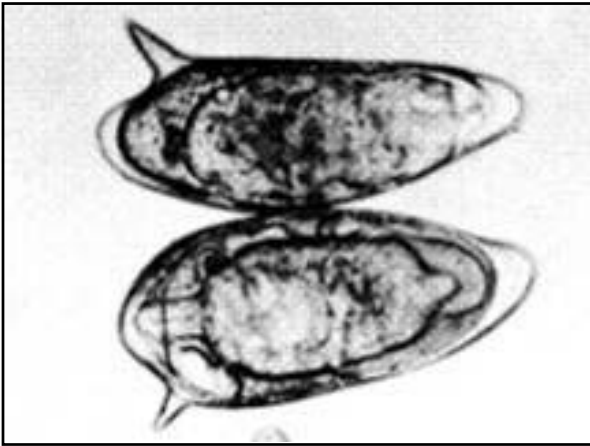
Eggs pass into small intestine

Schistosoma mansoni

Schistosoma mansoni

Cercariae enter skin
 Schistosoma migrates to lungs, then to liver
 Adults migrate to mesenteric veins
 Adults live in mesenteric venules
 Eggs pass into small intestine
 Eggs deposited in water
 Egg hatch in water
 Cercariae leave shell
 Cercariae penetrate skin
 Eggs pass into feces

Eggs pass into feces
Eggs deposited in water



Schistosoma mansoni eggs in the liver of an experimentally infected mouse

S. mansoni
Pathology

Schistosoma Differences

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

160 • Phylum Platyhelminthes

S. HAEMATOBIIUM

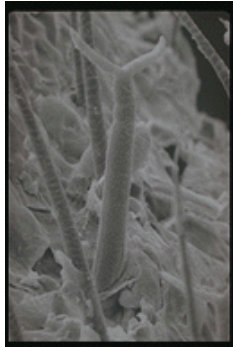
S. MANSONI

S. JAPONICUM

FIG. 10-9. Egg of Schistosoma.

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.

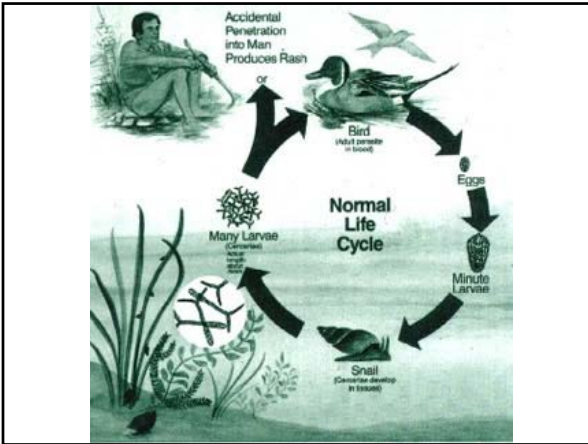


Schistosoma douthettii

e. Swimmers itch

1. the scourge of midwestern prom nights

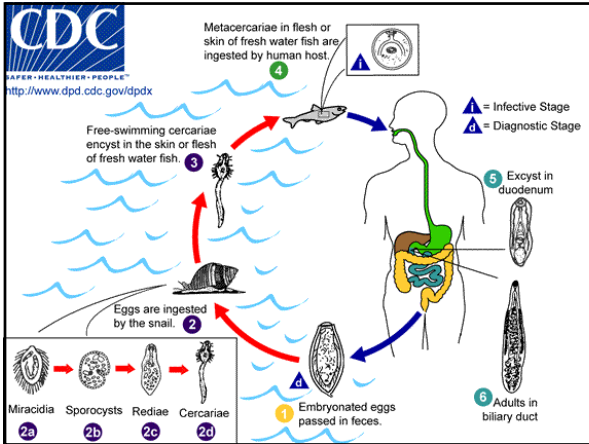






Order Opisthorchiformes

1. *Opisthorchis sinensis*
also *Clonorchis*
 - a. oriental liver fluke
 1. life cycle (next)
 2. very common in locations where raw fish is eaten (26% in NYC)
 3. long term infections and cancer.



Order Opisthorchiformes

Heterophyes heterophyes

a. parasite of marine fish carnivores; mainly mullet

- live in small intestine, but can reach high densities and can migrate
- eggs in feces, miracidia penetrate coastal snails

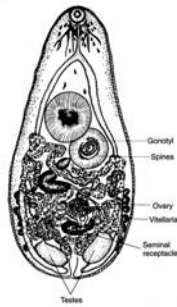
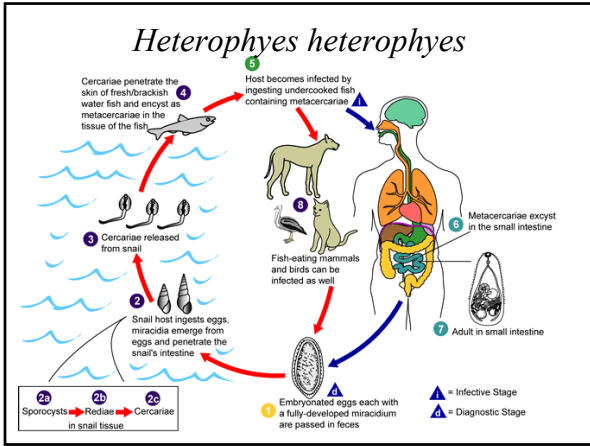


Figure 18.26
Heterophyes heterophyes. Its size is 1.0 to 1.7 mm long.
Drawing by Jan Green.

Heterophyes heterophyes

- One host is *Cerithidia*, common in Japan, also NA
- sporocyst and redia generations, lots of cercaria
- high densities of metacercaria







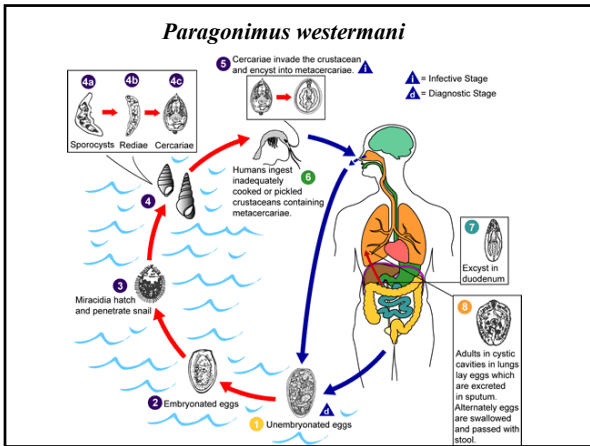


Order Plagiochiformes

2. Common in places where raw crustaceans are eaten.

3. Diagnosis by red sputum in which eggs are

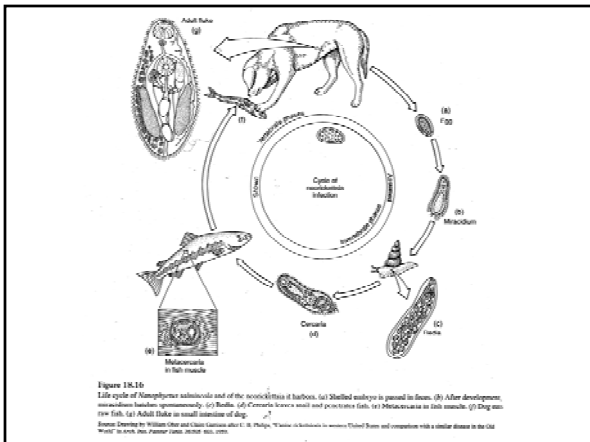





Order Plagiochiformes

Nanophyetus salmonicola

1. Parasite of dogs that eat raw salmon.
2. Standard trematode life cycle, but also involves *Neorickettsia* bacteria; causes “salmon poisoning.”
 - a. Worms don't hurt dogs much, but bacteria do.



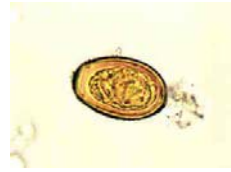
Order Plagiochiformes

Dicrocoelium dendriticum

a. interesting trematode of sheep livers

1. worm with ancestral aquatic component to life history.

2. becomes adapted to terrestrial environment.



Order Plagiochiformes

b. Life cycle:

1. eggs passed in sheep feces

2. terrestrial snails feed on feces, ingest eggs

3. eggs hatch, miracidia burrow into snail tissues

4. two sporocyst generations, migrate to "lung"



Order Plagiochiformes

5. cercaria shed in slime balls

6. ants eat slime balls

7. metacercaria encyst in subesophageal ganglion

a. ganglion controls mandibular muscles

b. also influences geotactic response



Order Plagiochiformes

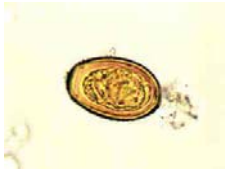
- c. metacercaria's effect is temperature dependent
1. warm temperature, ant behavior is normal
 2. when cold
 - a. ants climb grass
 - b. mandibles clamp on to blade and hold
 8. grazing sheep (early morning) pick up ants.





Order Plagiochiformes

- Dicrocoelium dendriticum*
- a. Digenean trematode infecting of sheep livers
 1. Worm with ancestral aquatic component to life history.
 2. Becomes adapted to terrestrial environment.



Order Plagiochiformes

b. Life cycle:

1. Eggs passed in sheep feces
2. Terrestrial snails feed on feces, ingest eggs
3. Eggs hatch, miracidia burrow into snail tissues
4. Two sporocyst generations, migrate to "lung"



Order Plagiochiformes

5. Cercaria shed in slime balls
6. Ants eat slime balls
7. Metacercaria encyst in subesophageal ganglion
 - a. Ganglion controls mandibular muscles
 - b. Also influences geotactic response



Order Plagiochiformes

- c. Metacercaria's effect is temperature dependent
 1. Warm temperature, ant behavior is normal
 2. When cold
 - a. ants climb grass
 - b. Mandibles clamp on to blade and hold
8. Grazing sheep (early morning) pick up ants.





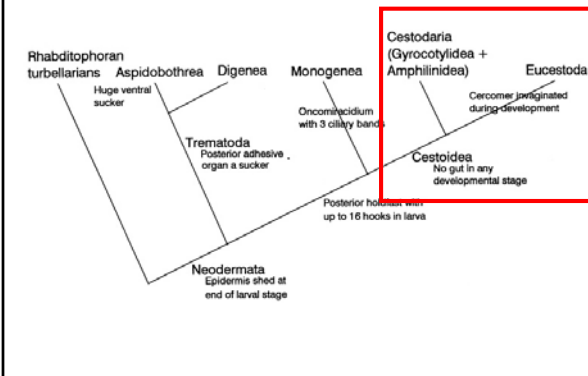
Infraclass Cestodaria

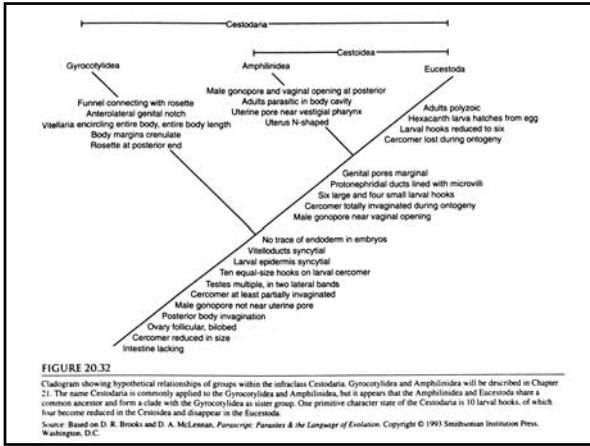
(Formerly Class Cestoda)

A. General characteristics

1. highly specialized intestinal parasites
2. Usually characterized by
 - a. Attachment organ – *cercomer, scolex*
 - b. digestive tract *absent* (adaptation to intestine)
 - c. body divided into *proglottids*
 - a. protandry
 - b. terminal proglottids filled with eggs.

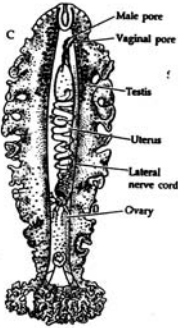
Euplatyhelminth Systematics







Order (Subcohort) Gyrocotylidea

1. Unusual parasite of cartilaginous fish, occasionally turtles
2. Short and lack proglottid specialization
 - a. Instead have increased surface area along lateral body margin.
3. Some evidence that they are related to acanthocephalans.
4. Little known about their life cycle.





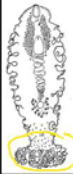

Gyrocotylidea



Class: Cestoda

1 genus

- Enteric parasites of holocephalans
- Characterized by a rosette-shaped, posterior holdfast organ
- Life cycle may be direct (?)
- Postlarvae frequently found in the parenchyma of adults, possibly absorbed as a means of regulating parasite population size within the host
- Number of genera & species widely disputed

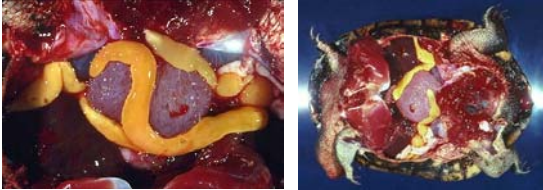



Cohort Cestoidea

1. A group identified as including as subcohorts, the Amphilinidea and the Eucestoda.
 2. The "Cestodaria" used to include the Gyrocotylidea and the Amphilinidea.
- a. However, it now appears that Gyrocotylinidea is ancestral to the Amphilinidea and Eucestoda.
- b. The primary character appears to be the relative development of the cercomer, a posterior enlargement that appears to various degrees in larval stages.

Order (Subcohort) Amphilinidea

- a. Small, non-strobiliated body cavity parasites of acipenseriform fish and turtles.
- b. Have a single segment, with "N" shaped uterus.



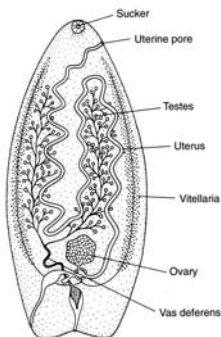
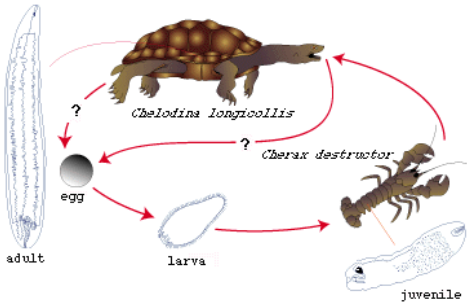
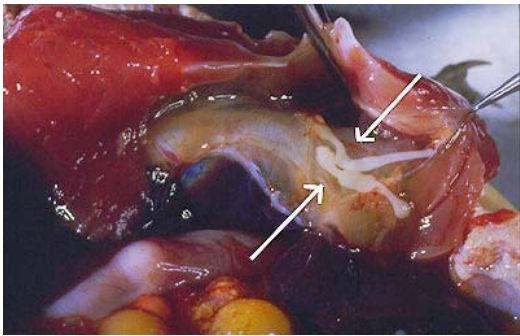


Figure 21.41
The monozoic tapeworm *Amphilina foliacea*.
Source: R. A. Wadell and J. A. McLeod, *The Zoology of Tapeworms*, 1952, Hafner Publishing Co., New York, NY.

Life cycle of *Austramphilina elongata*





Juvenile *Austramphilina elongata* (arrows) migrating along trachea and esophagus of long-necked turtle.

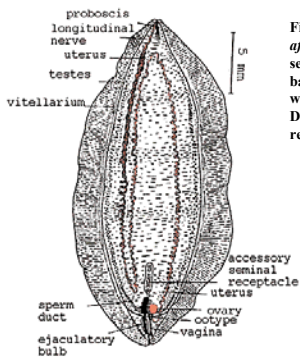


Figure 1. *Nesolecithus africanus*. Note accessory seminal receptacle consisting of basal narrow and distal widened part. According to Dönges and Harder (1966), redrawn from Dubinina (1982).

Order (Subcohort) Eucestoda

1. The true tapeworms 5,000+ species
2. Often very large (10 m)
3. Complex life cycles
4. Highly adapted to intestinal parasitic existence:
 - a. length
 - b. flattened shape
 - c. integument (syncytium)
 - a. surface area



Order (Subcohort) Eucestoda

2. Other Characters:
 - a. mitochondria, active transport in integument.
 - b. anaerobic respiration
 - c. attachment organs
 1. rostellum
 2. suckers (bothria)
 3. hooks
 4. prolific reproduction (sexual and asexual)



Eucestoda: Body Regions

- a. scolex (attachment organs)
 - b. neck (germinal area)
 - c. strobila (proglottids)
- d. Proglottids - self contained egg factories
 1. male structures mature 1st, mate with other worms
 2. female structures operate similar to those of trematodes
 3. mature proglottids are tissue surrounding full uterus.
