

Invertebrate parasites

Ph. Nematoda (50% parasitic)

Ph. Platyhelminthes (80%)

Ph. Annelida (10%, Subcl. Hirudinea)

Ph. Acanthocephala (100%)

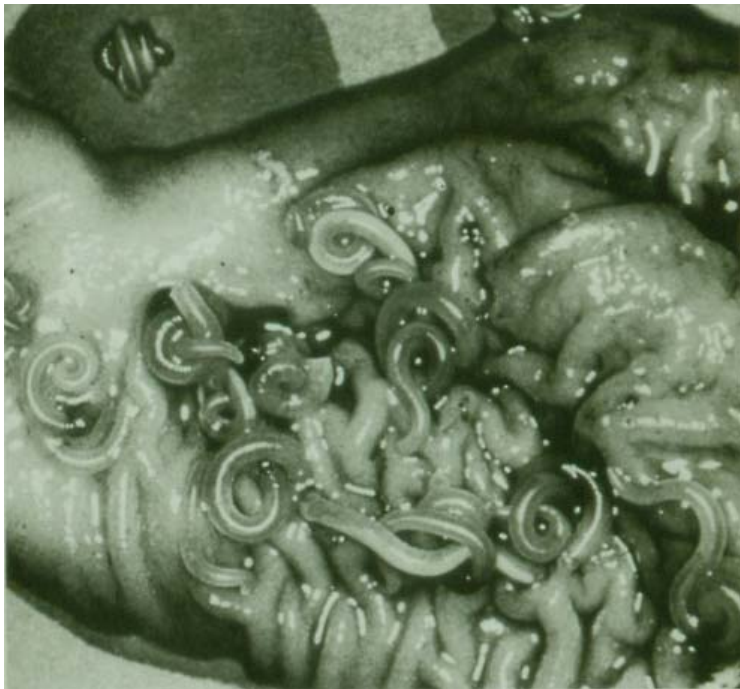
Ph. Nematomorpha (100%)

? **Myxozoa** (100%)

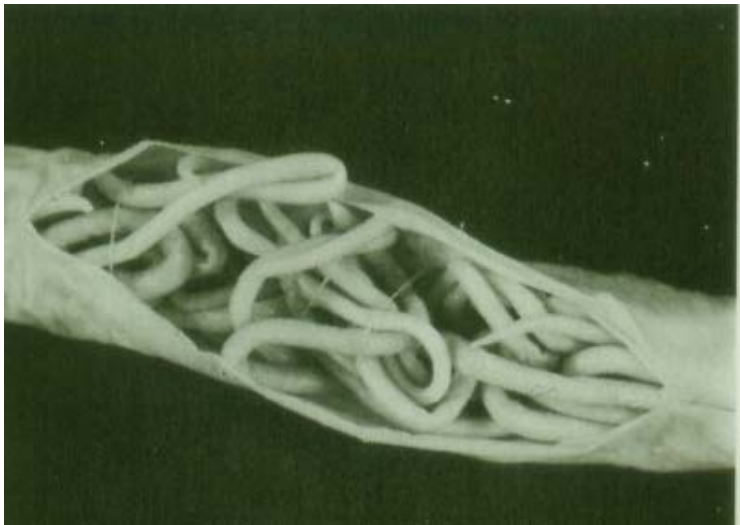
Themes: human ecology, complex life cycles

1) Nematodes: roundworms (*Ascaris*)

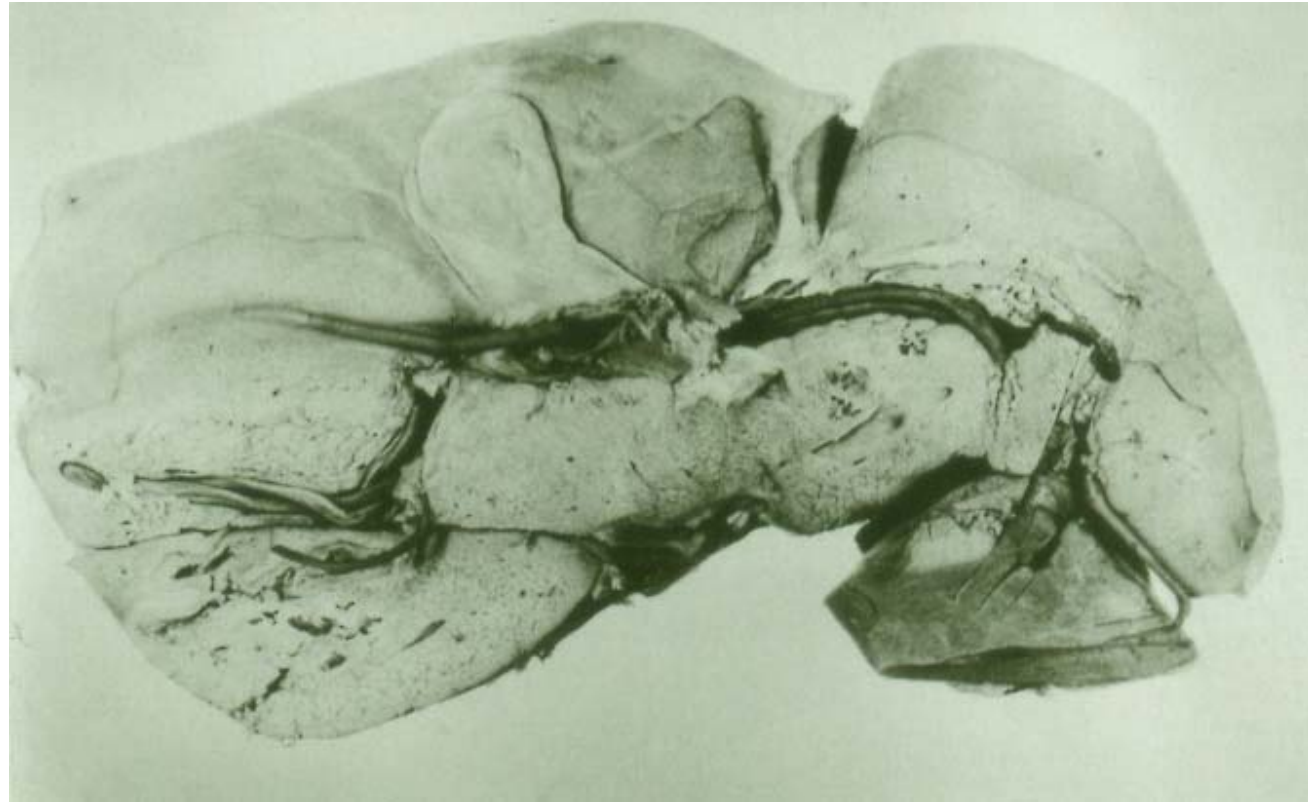
- intestinal, chyme feeders
- disease: malnutrition and migration
- ingestion of eggs from feces
- largest: sperm whale placenta, 9 m!



cat intestine



pig intestine



migratory phase (human liver)

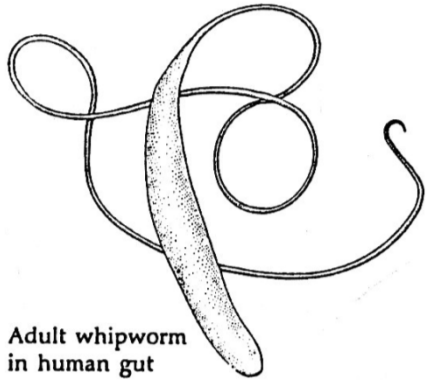
Invertebrates in history!

Richard III, King of England,
debilitated and killed in battle

*Infected: 1.25 billion humans (25%)
3 million in N.A.*

Deaths: 20,000 per year

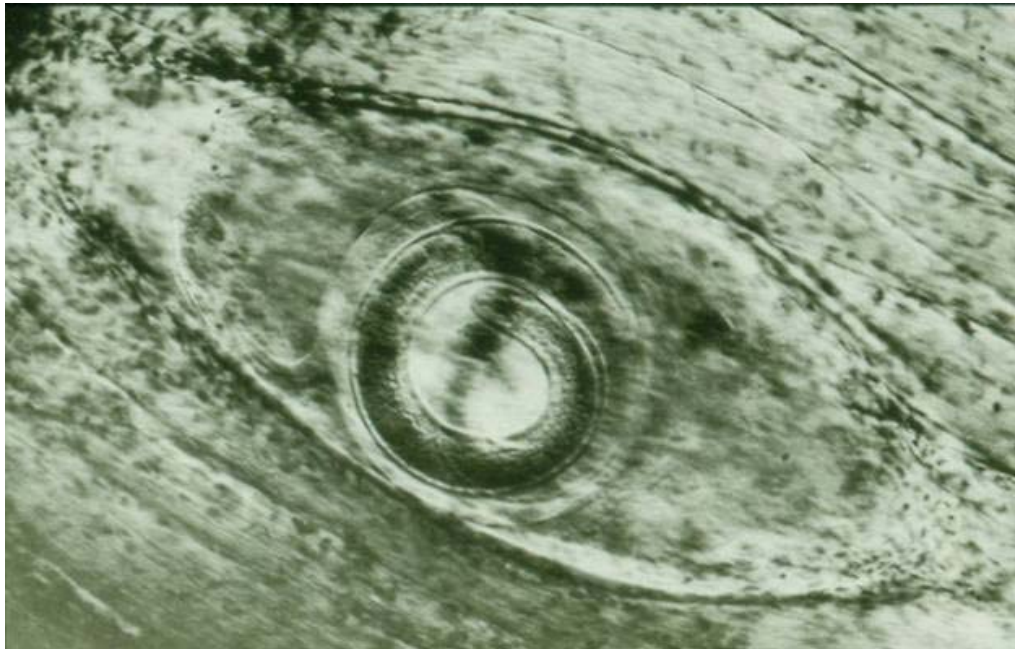
Nematodes:



Adult whipworm
in human gut

whipworms

- gastrointestinal, blood feeder
- malnutrition
- from contaminated food or water



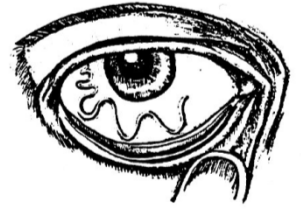
trichina worms

- intestinal blood feeders
- migrate, encyst in muscle
- smallest nematode parasite

*Whipworm infections: >500 million (10%)
deaths: 100,000 per year
Trichinosis infections: 40 million (<1%)*

filarial worms

- no free-living stage
- vector: mosquito



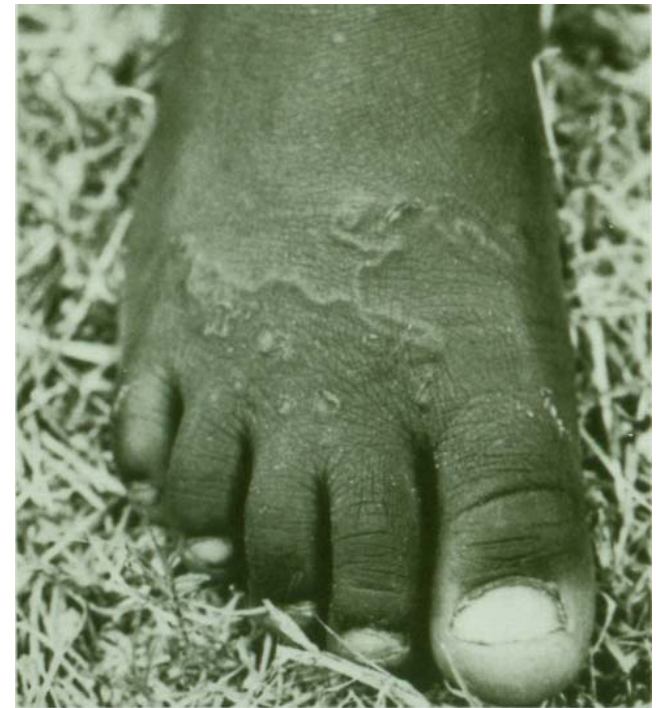
river blindness



elephantiasis

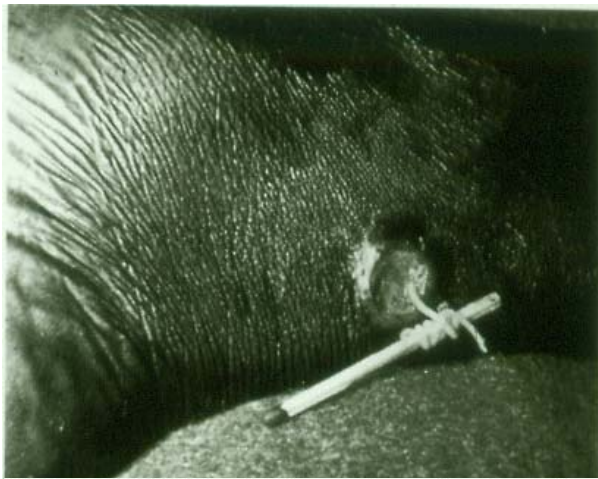
*Filarial infections: 300 million/year
Elephantiasis: 100 million
River blindness: 40 million*

Nematodes: guinea worms

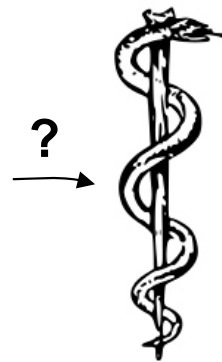


Guinea worm, *Dracunculus medinensis*, beneath the skin of the foot. Ghana, west Africa.

- intermediate host: copepod
- egg release at skin wound
- removal can take weeks



Using a matchstick to wind *Dracunculus medinensis* out of an infected human leg.



The Rod of Asclepius



The Staff of Hermes

People infected annually:

>3.5 million (1990)

3190 (2009)

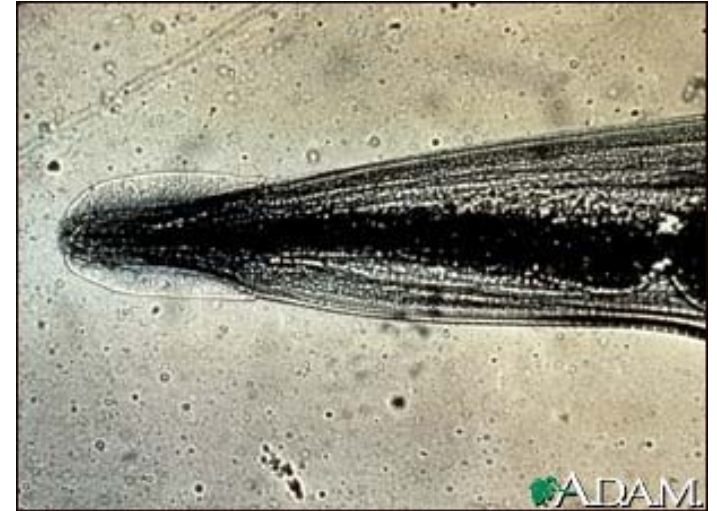
148! (2013)

25! (2016)

But...600 dogs (2016)

Nematodes: pinworms

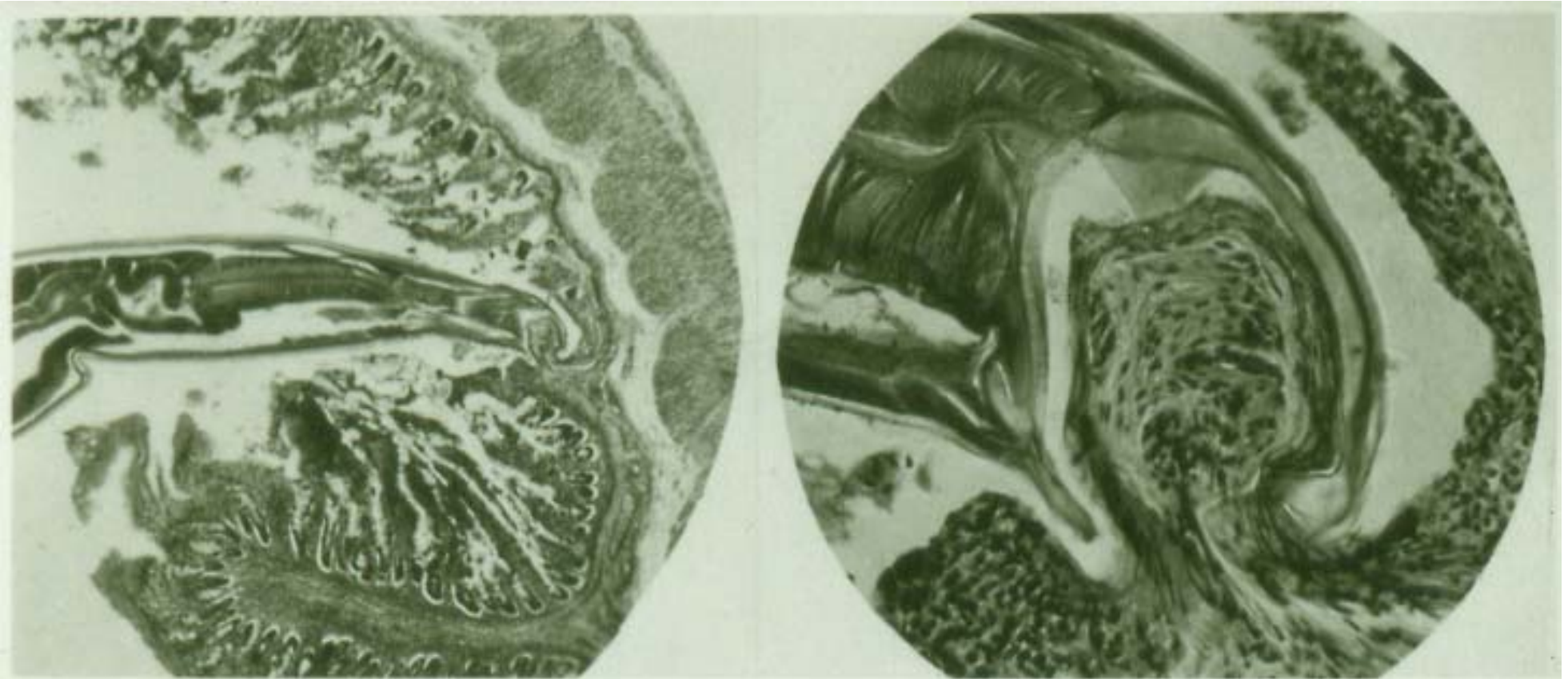
- mild intestinal effects
- non-tropical, esp. children NA & Europe
- transmission: itching and retroinfection



*Infection: >500 million (10%)
Most common North America, Europe*

Nematodes: hookworms

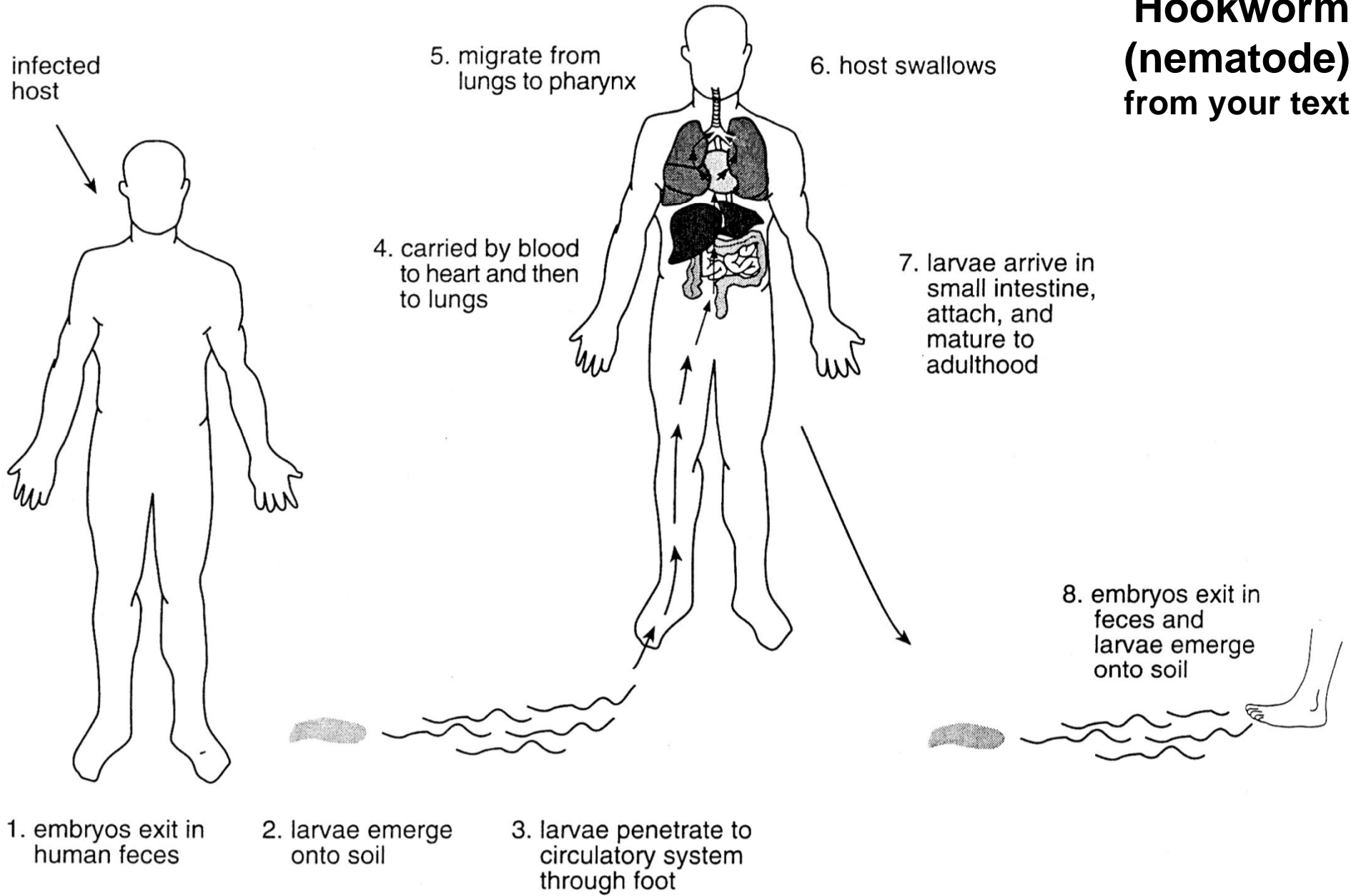
- intestinal blood feeders
- ill-health, anemia, weakness to other infection



Hookworm attached to intestinal wall, in section of preserved material. *Left*, anterior portion of worm, including muscular sucking pharynx. Close-up, *right*, shows the worm firmly holding in its mouth cavity a small portion of the host's intestinal lining. When actively feeding, the worm **sucks 120 to 200 times per minute**. *Necator americanus* takes about 0.013 to 0.1 ml blood per worm per day, *Ancylostoma duodenale*, **0.15 to 0.25 ml**. In a well-nourished adult, an infection with fewer than about **50 worms has little effect**, but heavier infections produce measurable to severe **anemia**. The results are more serious in a person, especially a child, simultaneously suffering from some degree of malnutrition.

Infected: > 1 billion (20-25%)

Hookworm (nematode) from your text



Indirect effects: loss of food production

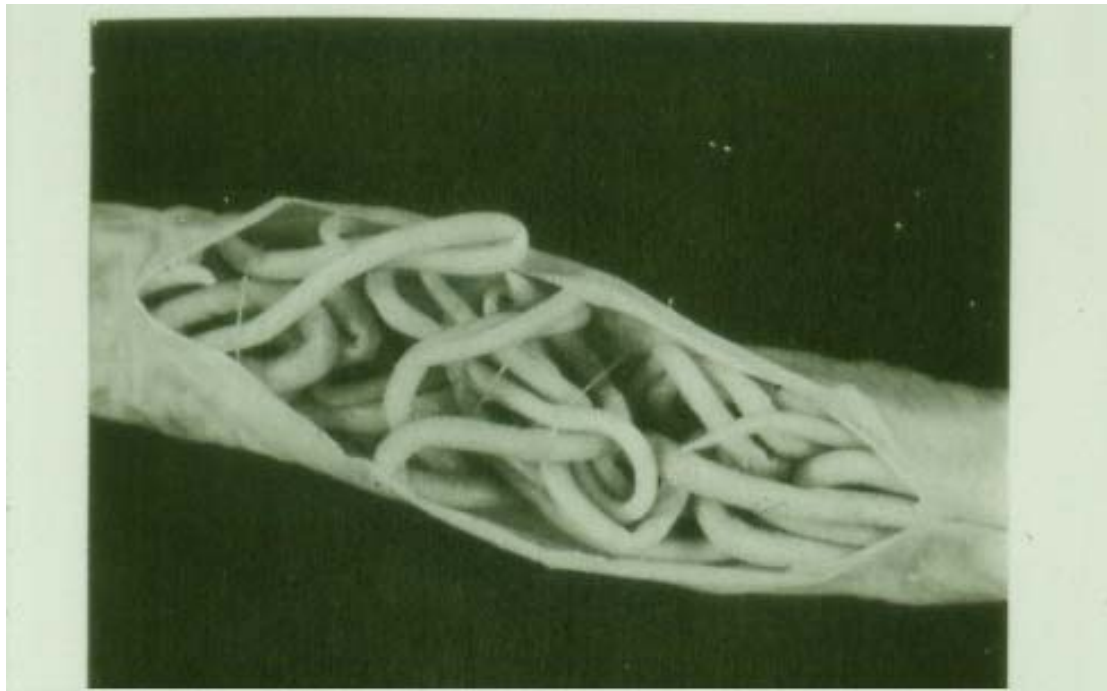
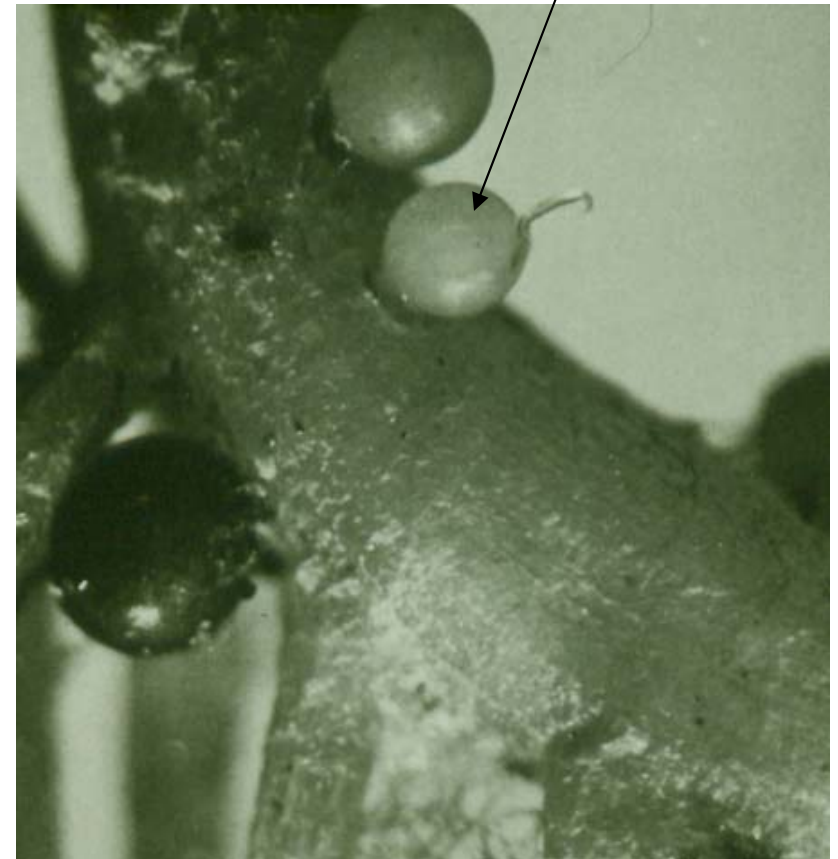


FIGURE 8-25 Adult specimen of *Ascaris suum* within the small intestine of a pig. *Ascaris lumbricoides*, which affects humans, is similar.



Costs: millions of \$\$, heavy use of preventative drugs

Monogeneans
e.g., fish gill ectoparasite



Digeneans
e.g., human liver fluke



schistosome worms (male/female)

*Schistosomiasis: 200 million
deaths: >1 million/year*

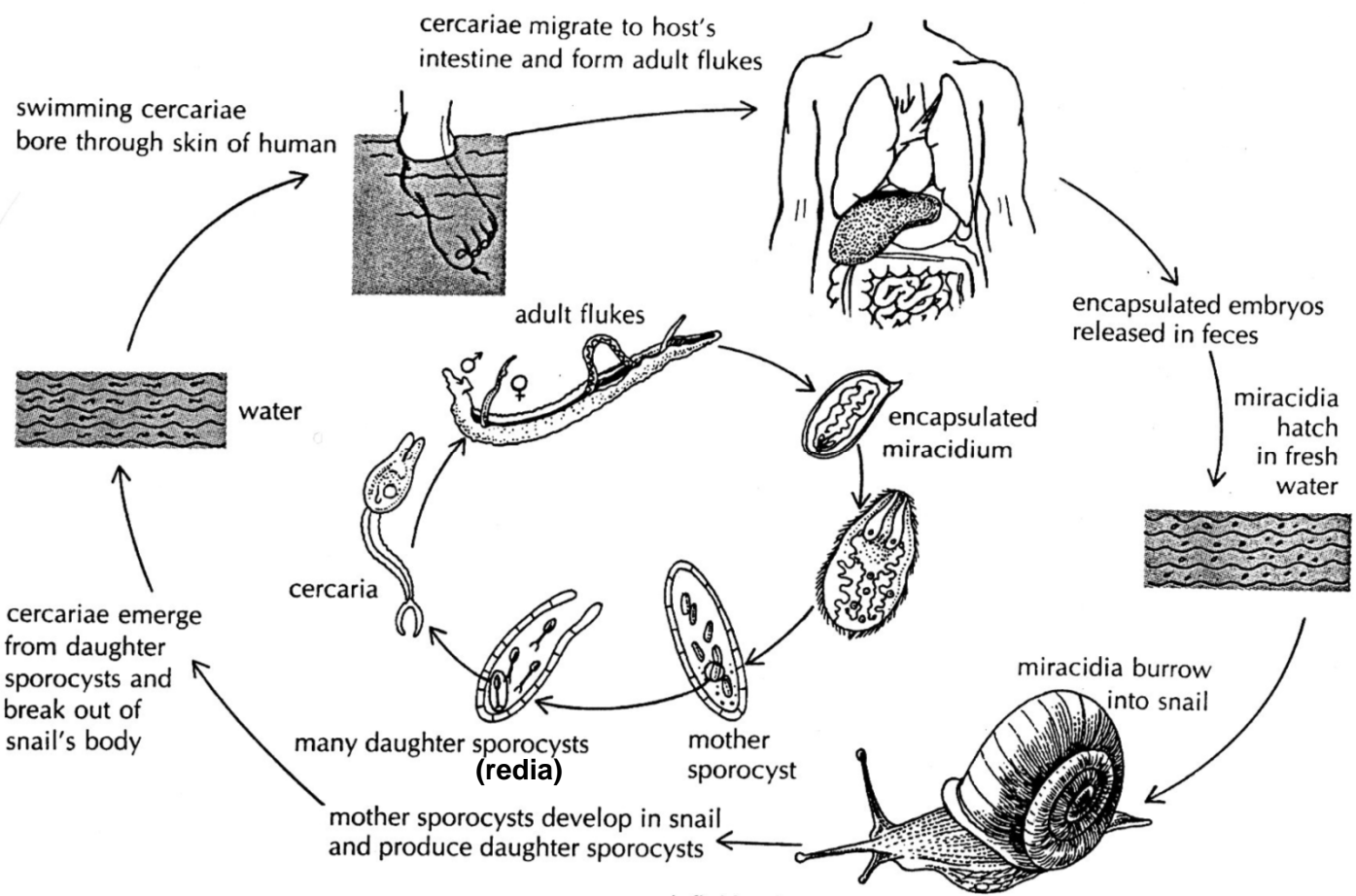
2) Flatworms: a. trematodes



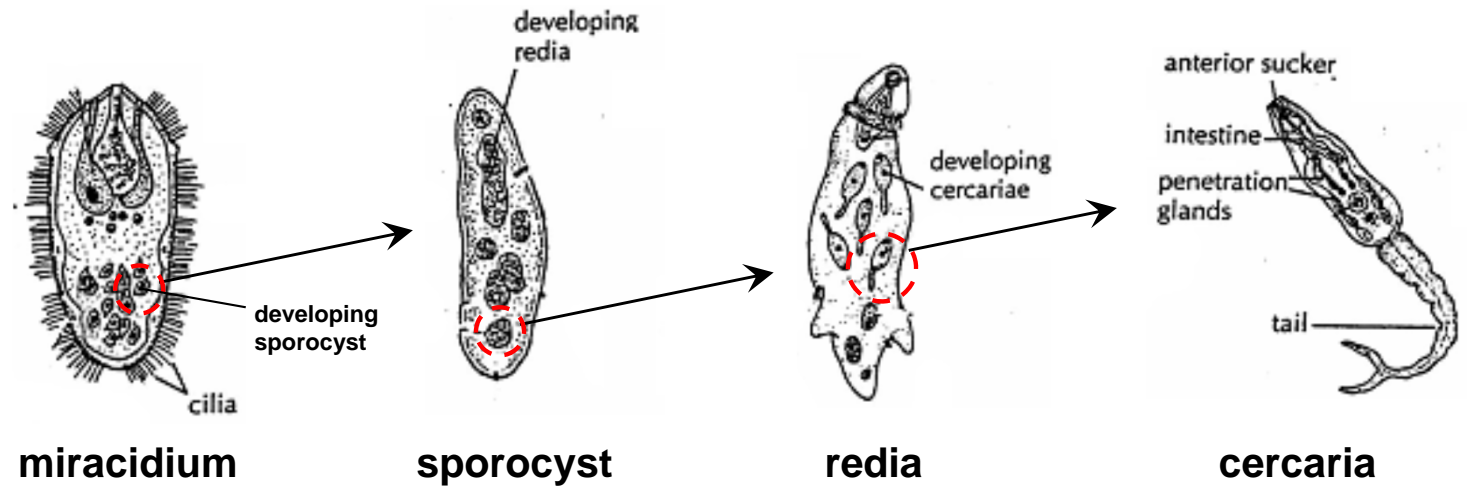
**Distended bellies typical of infection
by *Schistosoma japonicum***

Schistosome fluke (trematode)

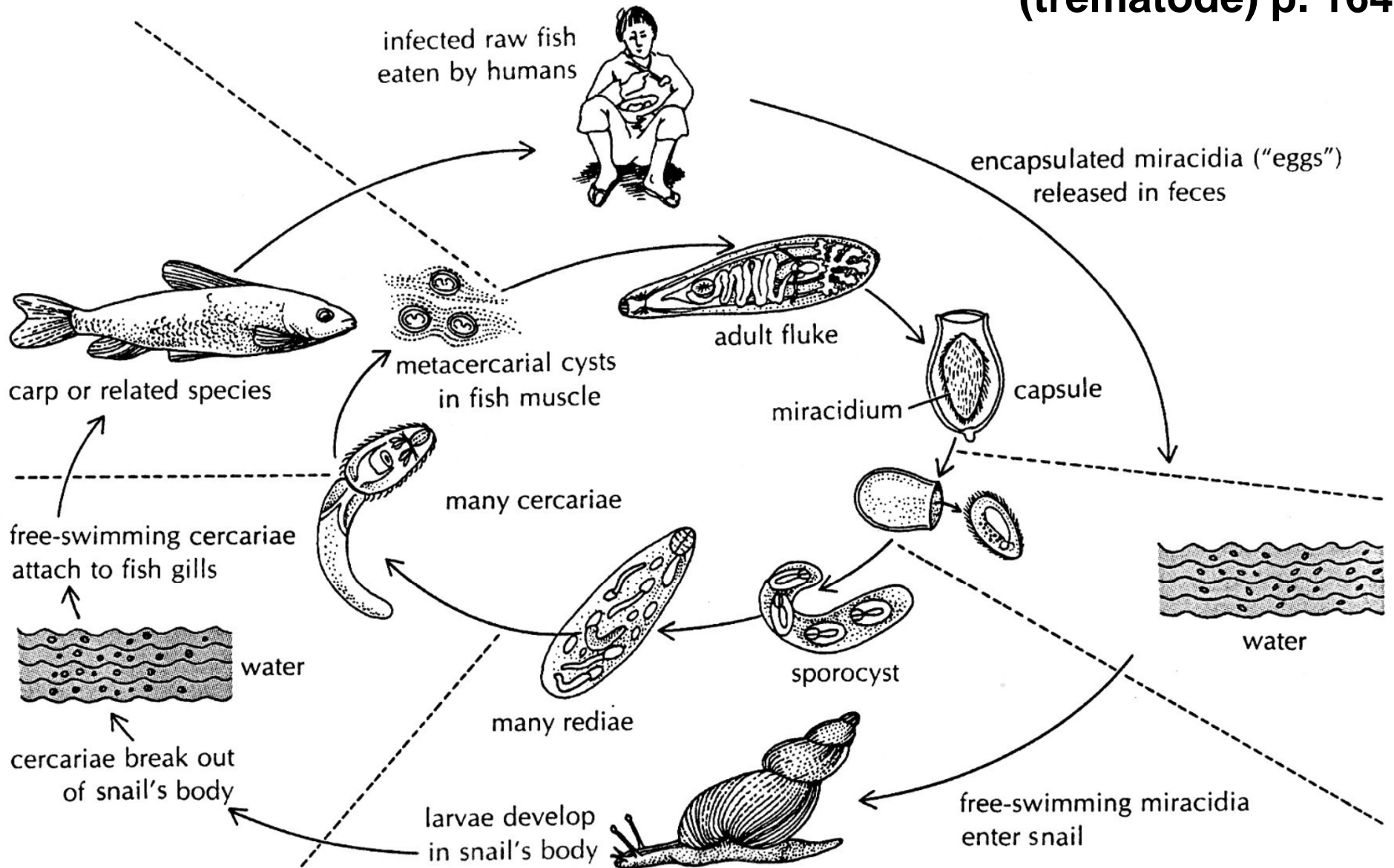
p. 165



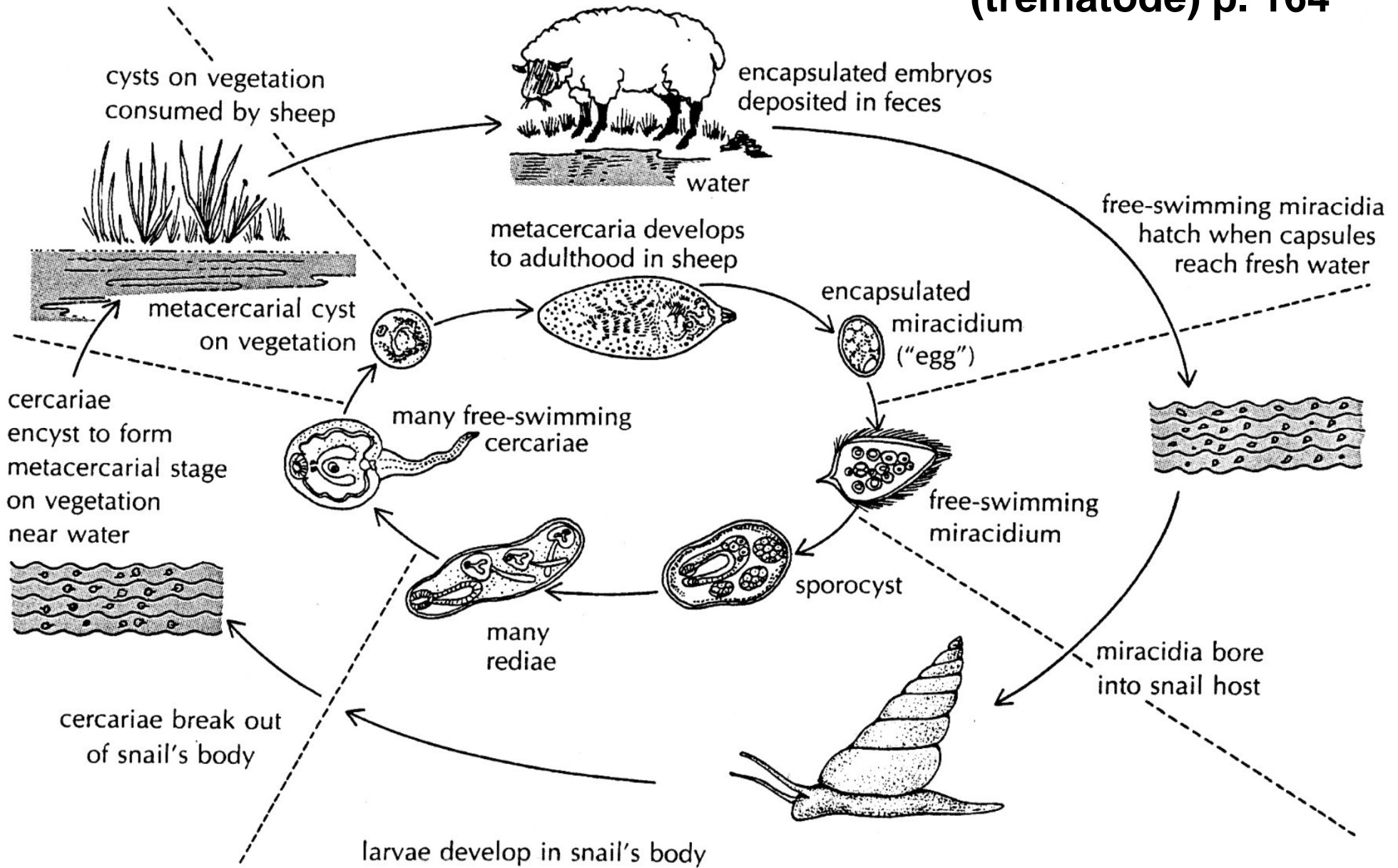
Asexual amplification (100x each)



Human liver fluke (trematode) p. 164

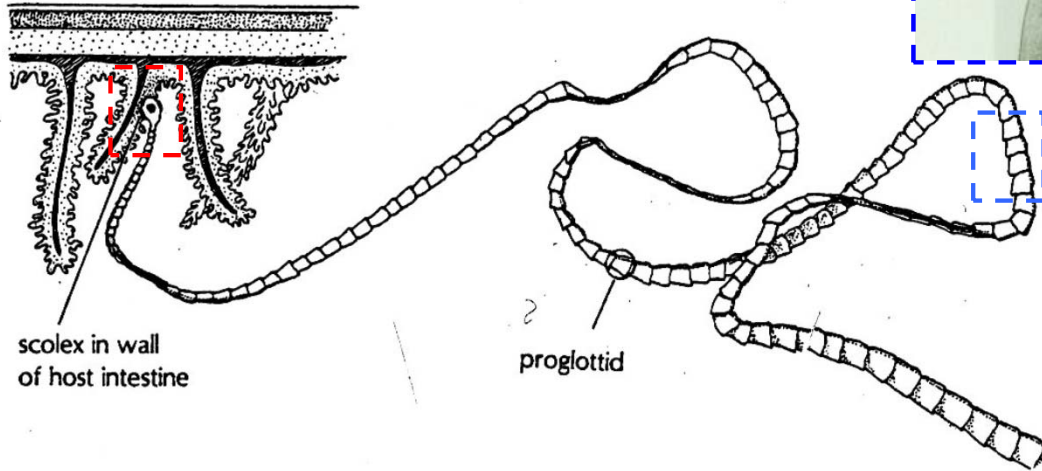
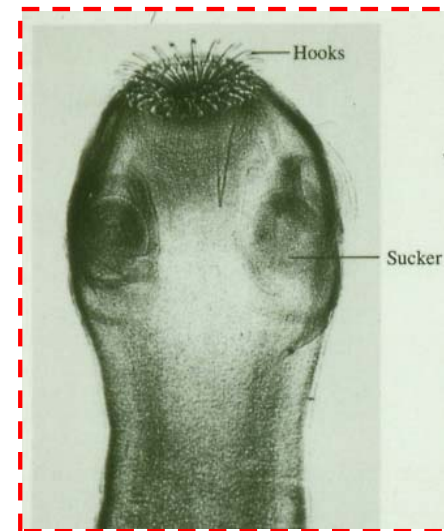
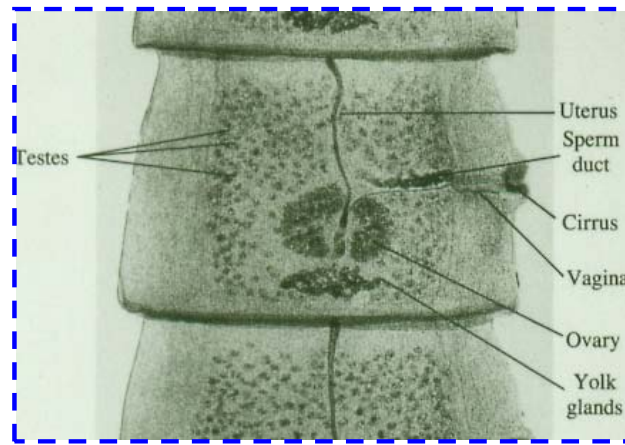


Sheep liver fluke (trematode) p. 164



Flatworms:

b. cestode tapeworms

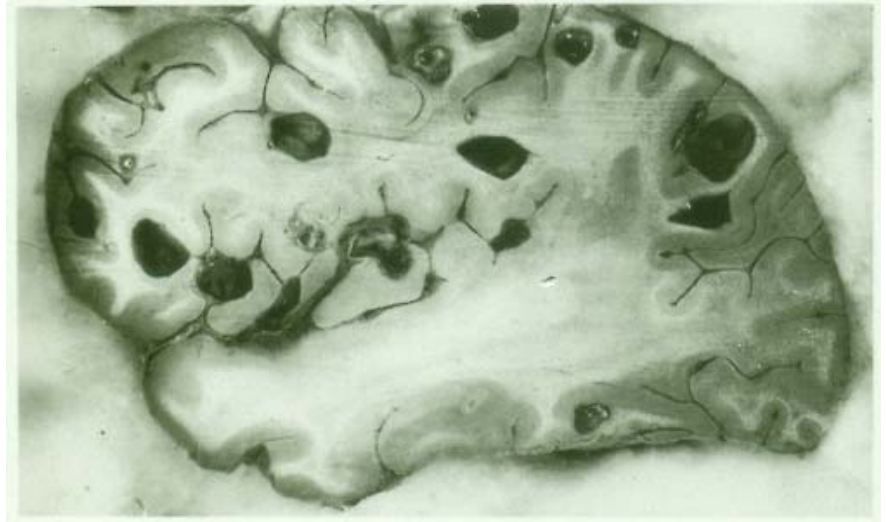


- loss of digestive system
- intestine-like integument
- largest: sperm whales, 30 m!
- intermediate host (for cats: fleas; for humans: beef, pork, fish)



Removal of tapeworm from a child is not a big event in some parts of the world. (L. Braithwaite)

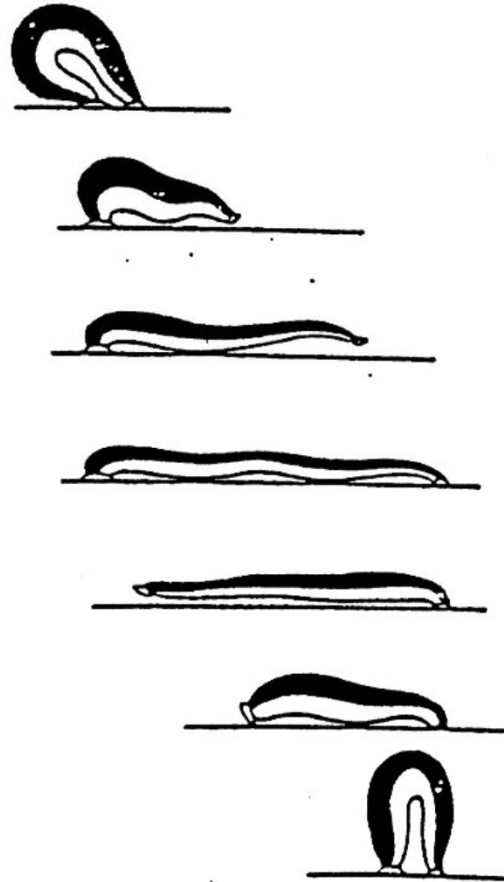
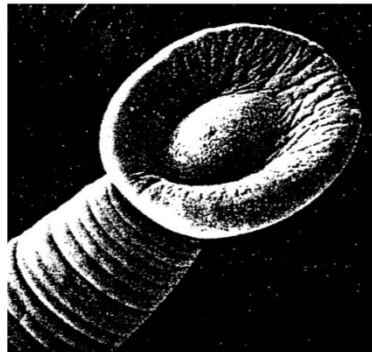
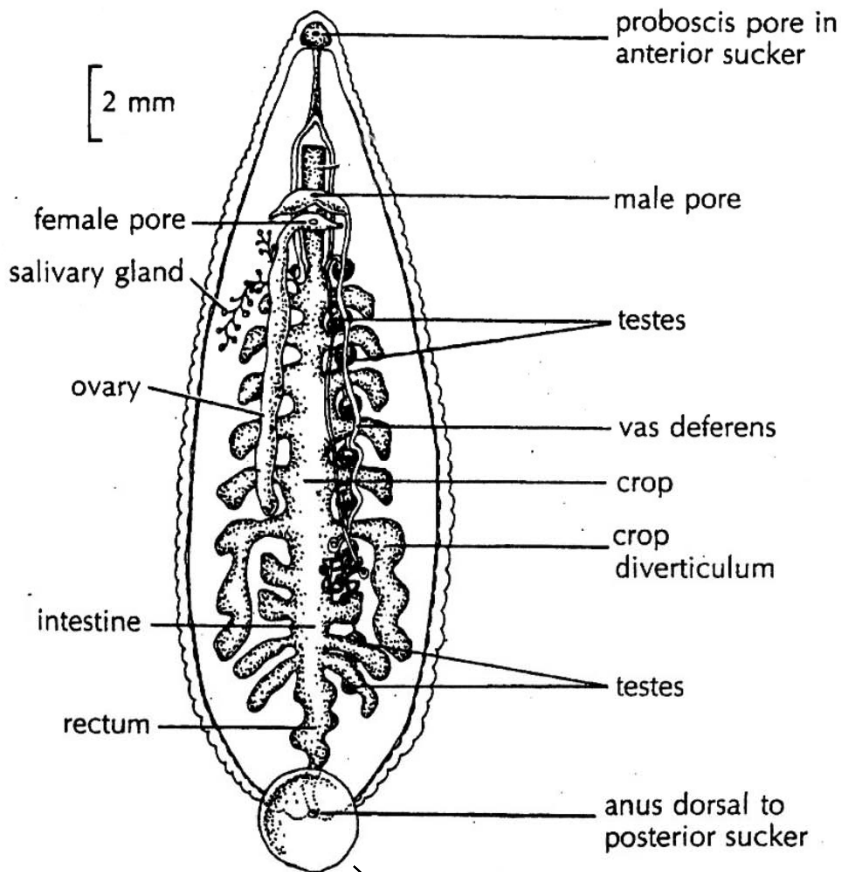
Bladder worms in brain of a 34-year-old woman, who was brought to the hospital with a history of seizures. These became more frequent until 3 days before her death, when convulsions set in every half-hour. Her brain (shown in longitudinal section) contains 100 to 150 bladders.



Infected: 135 million (2.5%)

3) Ph. Annelida (Subcl. Hirudinea)

- land or water-based ectoparasites
- engorge on blood meals
- changes in coelom, locomotion



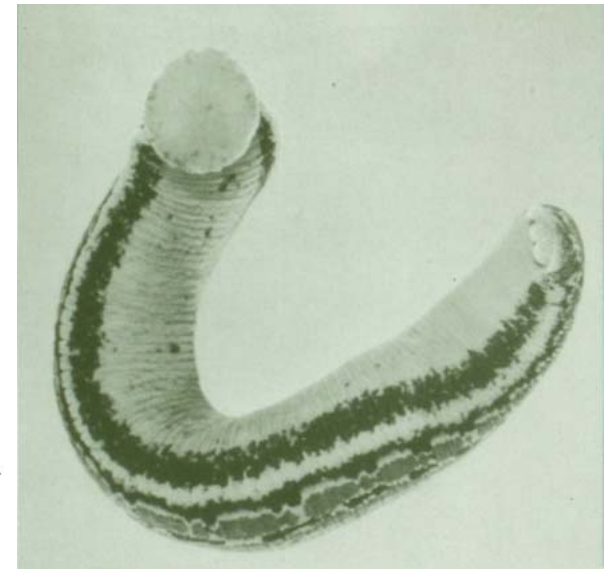
Entire scalp reattached with surgery and leeches

The Associated Press

LOS ANGELES — Doctors combined microsurgery and leeches to reattach the skin and air of a woman who was scalped from her eyelids to the back of her neck by an industrial blender.

me! . . . I was afraid I was going to die."

Bogle would probably have survived, doctors said, but would have needed extensive skin grafts and would never have looked the same. She also would have to have worn a wig.

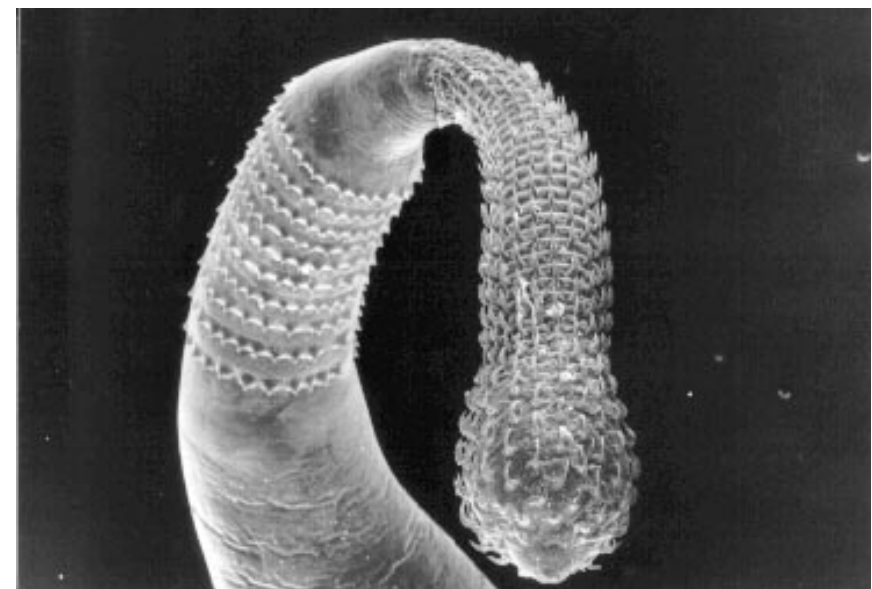
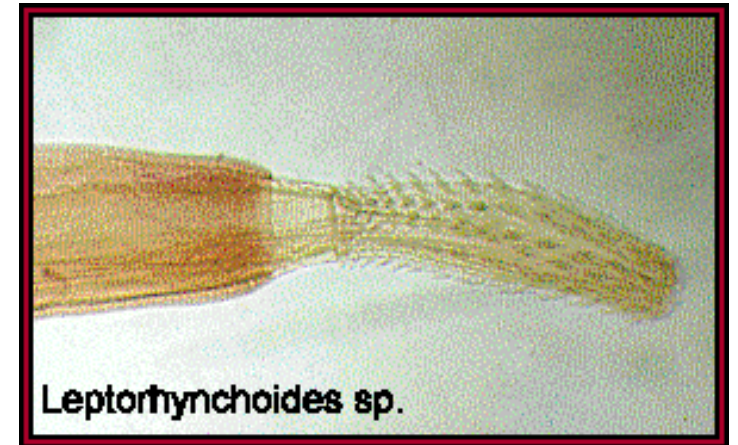
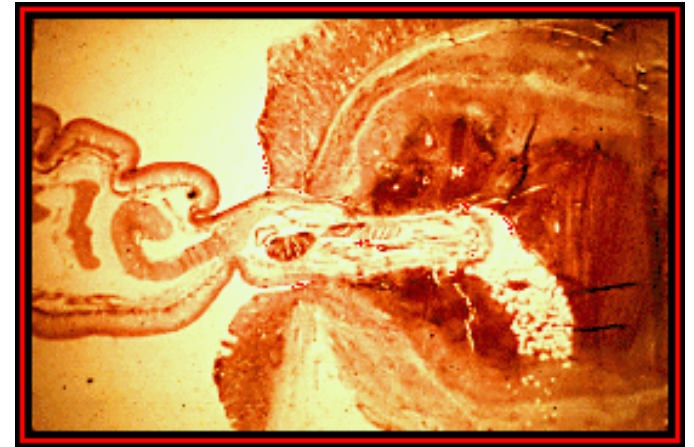
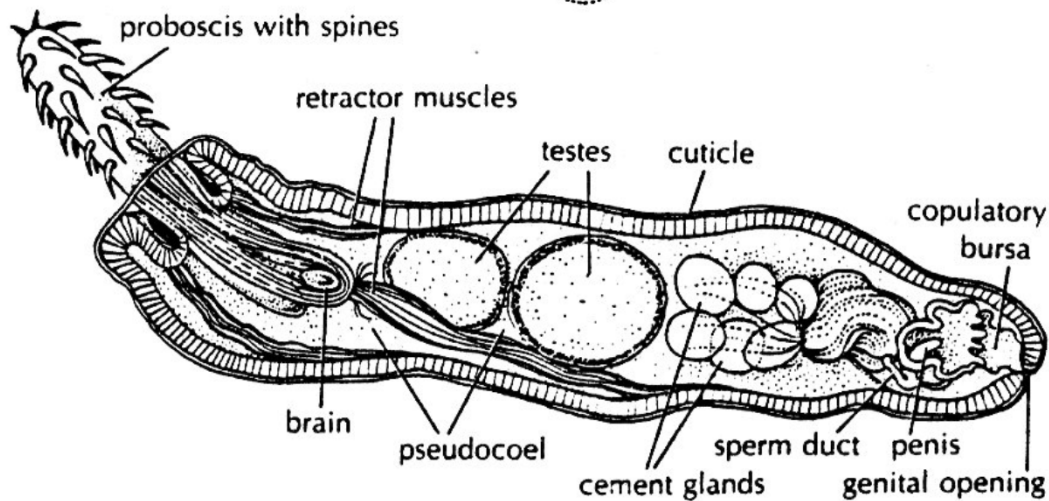
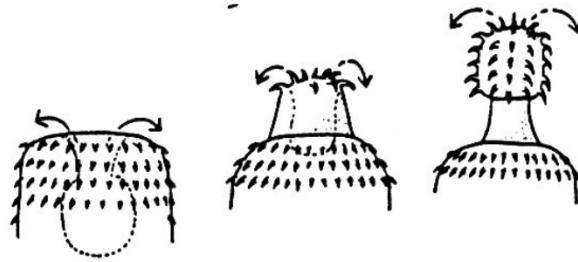


Medicinal leech, *Hirudo medicinalis*, is a European leech that was once used by the millions for bloodletting.

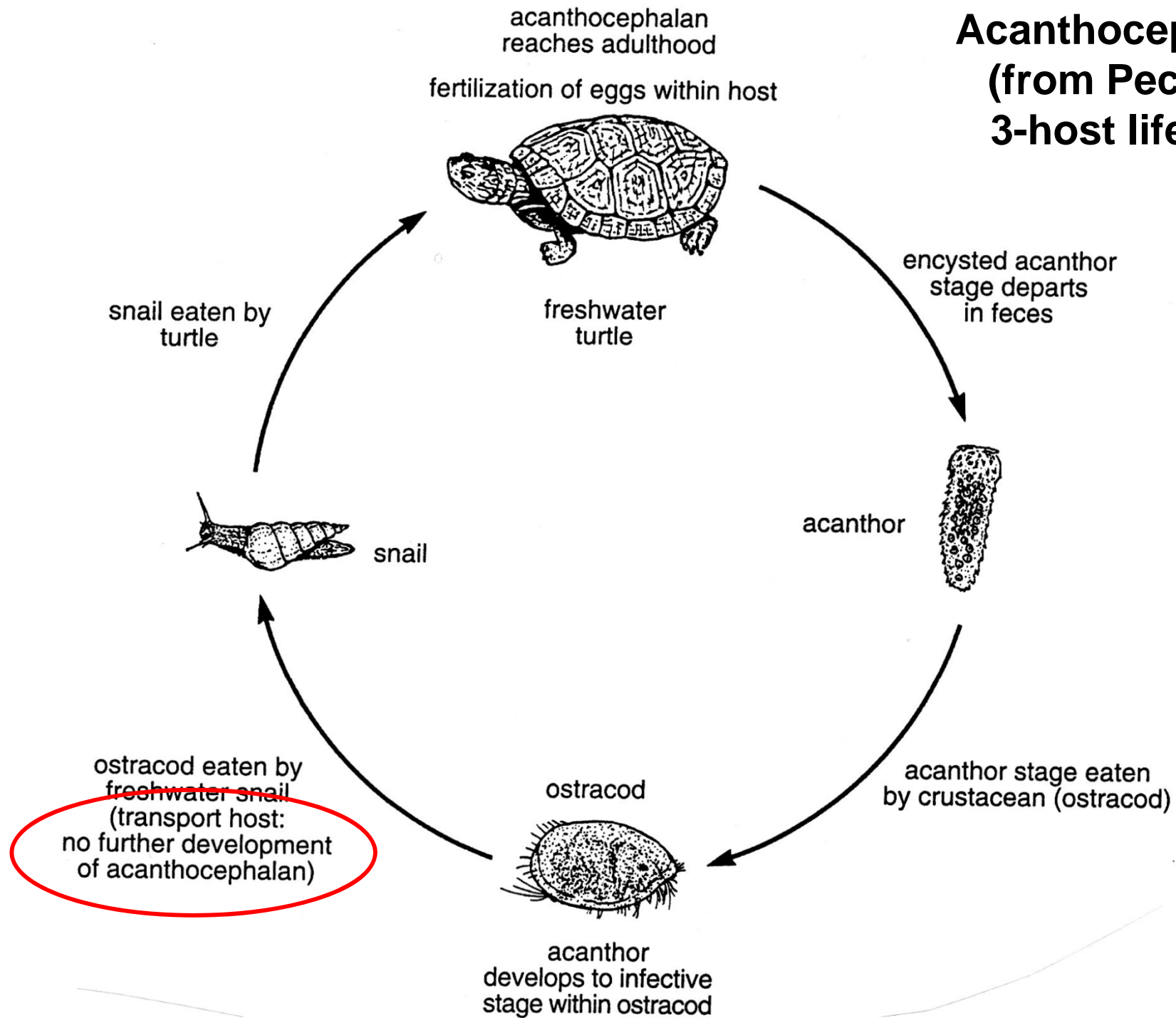
Three holoparasitic taxa

4) Ph. Acanthocephala

- parasite of vertebrate gut
- loss of digestive system
- microcrustacean, snail intermediate hosts
- alter behavior of hosts

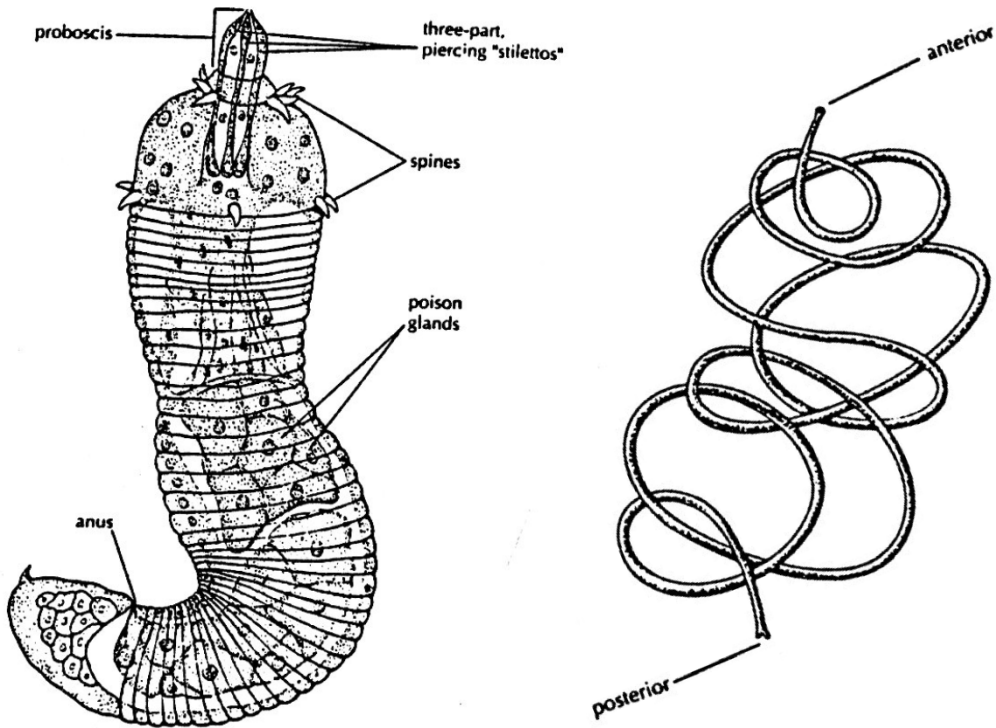


Acanthocephalan (from Pechenik) 3-host life cycle



Three holoparasitic taxa

5) Ph. Nematomorpha

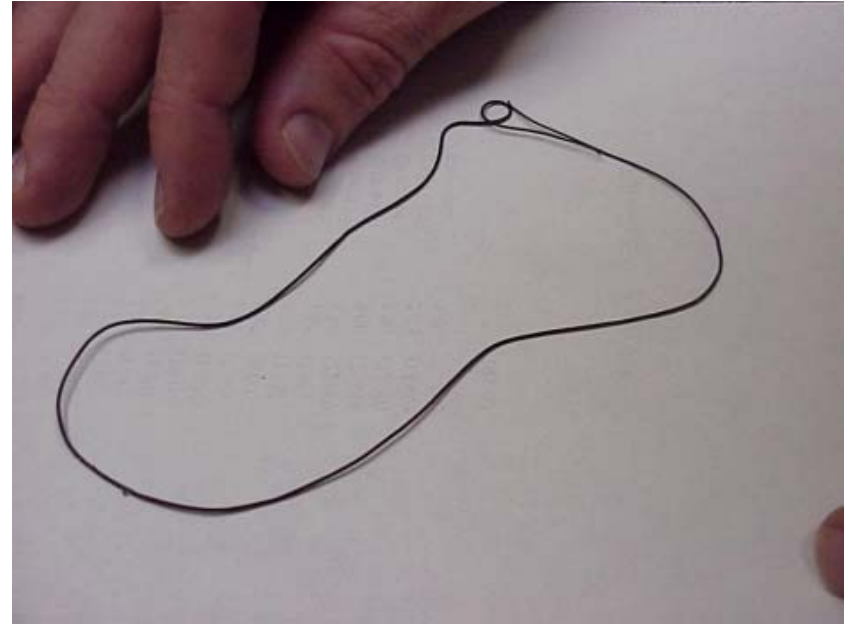


juvenile

- arthropod parasite
- ingestion & absorption
- grim fate for host
- control host behavior
- intermediate hosts

adult

- free-living
- non-feeding (loss of digestive system)



Three holoparasitic taxa

6) ? Myxozoa

Life cycle

