

BIO 475 - Parasitology Spring 2009

Stephen M. Shuster
Northern Arizona University

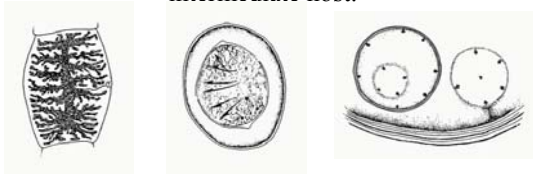
<http://www4.nau.edu/isopod>

Lecture 16

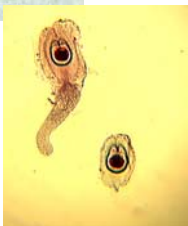
Order Cyclophyllidea

2. Still Other Characters:

- i. Eggs escape by rupture of proglottid
- j. non-operculated eggs are embryonated and develop into a bladderworm (cysticeroid) in the intermediate host.



Two Major Groups



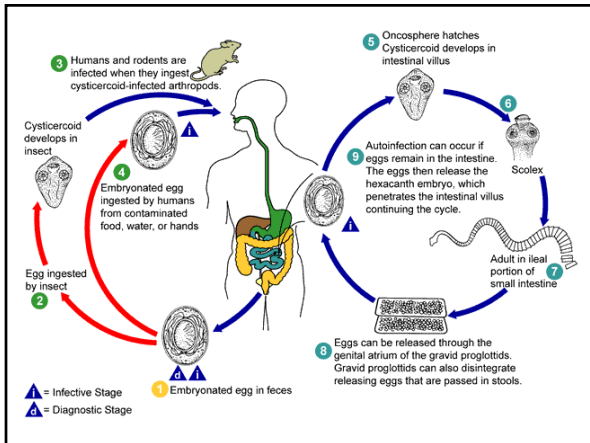
- 2. Nontaenioid cestodes - several families
 - a. Eggs are variable but *never with thick shell*
 - b. Common larval form - *cysticeroid*
 - c. Usually forms in invertebrates and fish
 - d. Definitive host is a mammal.

Non-Taenioid Cestodes

Hymenolepis diminuta,
H. nana

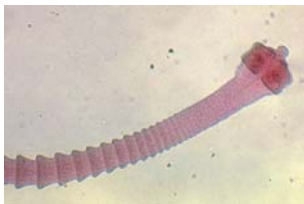
- a. Egg shed in feces
- b. Eaten by beetle, oncosphere hatches, into body
- c. Matures to cysticercus, eaten by mouse or human
- d. mature worm.

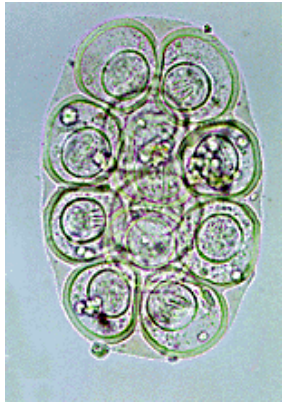




Dipylidium caninum

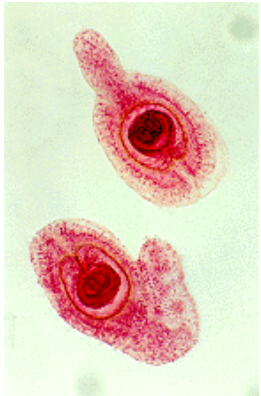
- a. Recognizable by paired gonopores.
- b. Often seen crawling on rugs.





Dipylidium caninum -
egg packets

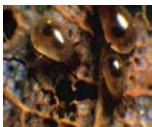
The egg packets contain 15-20 eggs in each and are seldom seen free in the feces. They may, however, be readily expressed from the gravid proglottids.



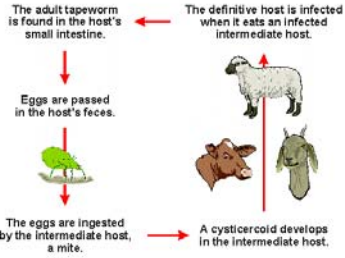
Dipylidium caninum
cysticercoids from flea.

Moniezia expansa

1. A sheep tapeworm; proglottids very wide
2. Odd to have an herbivore with a tapeworm
3. Sheep become infected by eating oribatid mites with grass.



THE LIFE CYCLE OF *MONIEZIA EXPANSA*



(Parasites and Parasitological Resources)



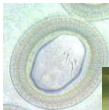
Anoplocephala perfoliata; horse tapeworms, found near ileocecal junction; eggs (right) are eaten by mites, which are consumed by horses in forage.

Two Major Groups

1. Taenioid cestodes (Family Taeniidae)

- a. Eggs with thick shells that appear striated
- b. Larval stages with fluid filled bladders
 - a. cysticercus
 - b. strobilocercus
 - c. coenurus
 - d. hydatid cyst

2. Can form within mammals that have swallowed eggs.

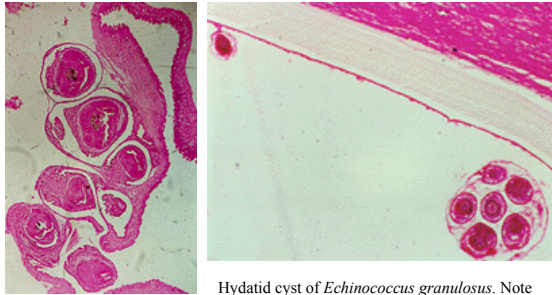




A bottle filled with *Taenia* cysticerci from the peritoneal cavity of a groundhog.

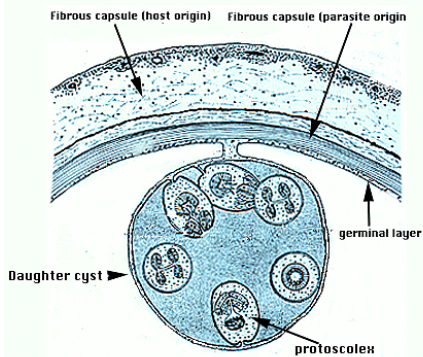


Strobilocercus of *Taenia taeniaformis* removed from an intermediate host (a mouse).

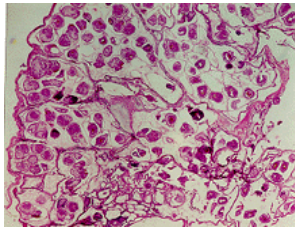


Taenia multiceps - coenurus (Cestoda: Cyclophyllidea) cross section through the coenurus. Note the many protoscolices growing from the germinal layer.

Hydatid cyst of *Echinococcus granulosus*. Note the thick laminated cyst wall and the fibrous host response outside the cyst wall. Also note the daughter cyst with protoscolices within the main cyst.

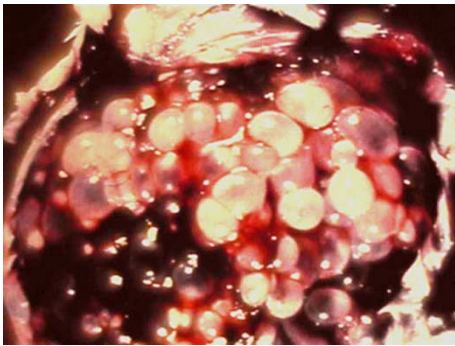


Hydatid cyst



Echinococcus multilocularis
This animal was infected 9 weeks ago. The alveolar cysticerci contain small scoleces.

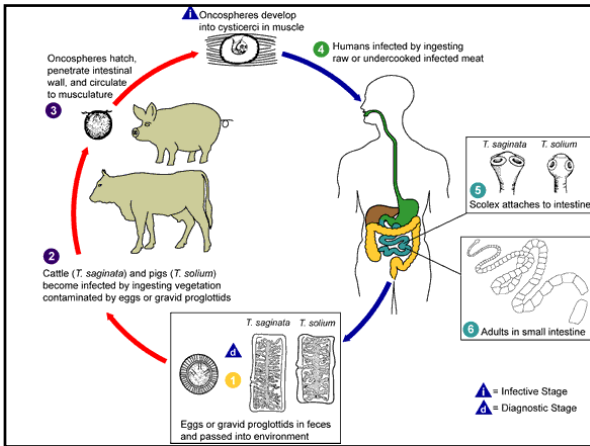
Taenia taeniformis multilocular cysticerci in mouse



Taenioid Cestodes

Taenia saginata

1. Beef tapeworm
2. Common in beef eating countries, SA, Mexico
3. Over 20 m long, but 3-5 most common.
 - a. scolex lack rostellum
 - b. proglottids with more narrow branches

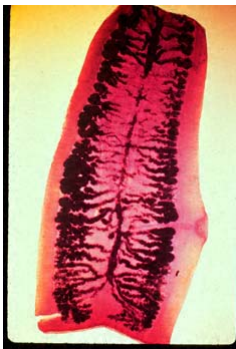


Taenia saginata

Life Cycle:

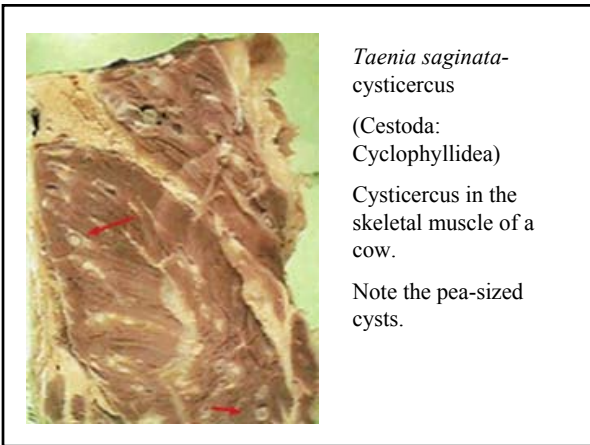
- a. Worm in carnivore gut -> eggs in feces with proglottids.
- b. Cattle contact eggs with forage; hexacanth hatches in gut, penetrates lumen and gets into bloodstream.
- c. Cysticercus forms in flesh; evidently not in humans.

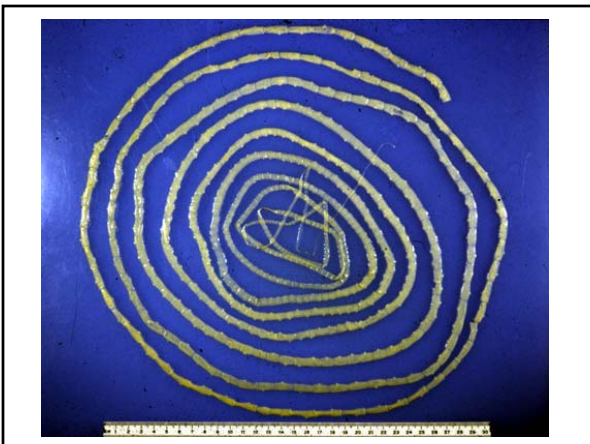
Taenia saginata

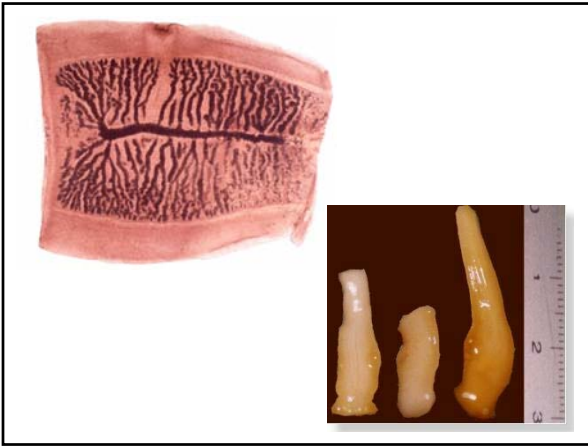


- d. Uncooked or undercooked meat allows cysticercus to hatch and mature in host gut.
5. Humans with worm can infect herds of cattle
6. Symptoms not too severe; NOT hunger.



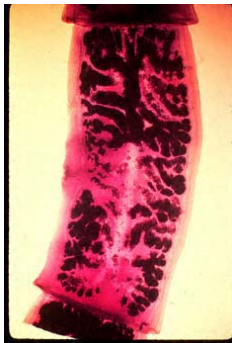


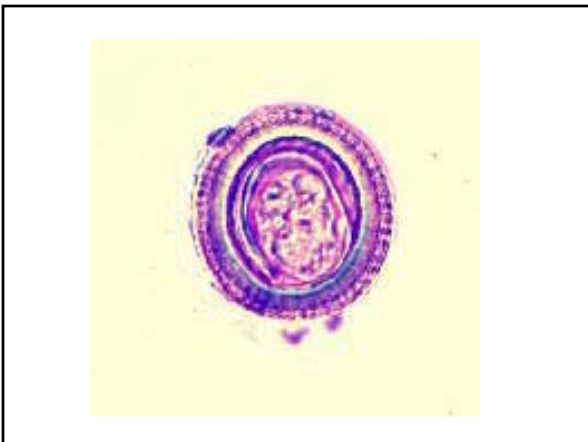




Taenia solium

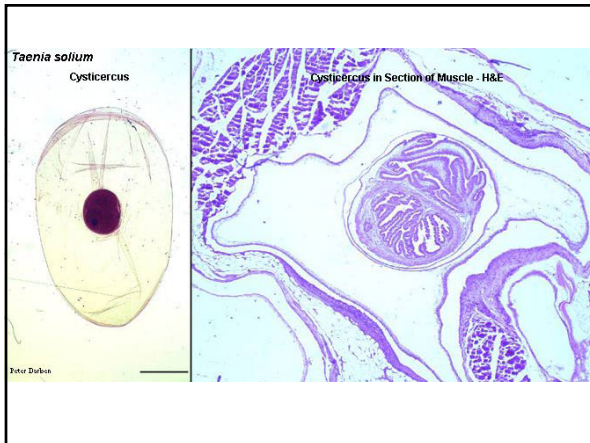
1. Most infections in Africa, Mexico; also Asia
2. 2-7 m long
2. proglottids with wide branches
 - a. rostellum with hooks
3. Life cycle similar to that of *T. saginata* except
 - a. hosts are pigs and humans
 - b. eggs are infective to humans.

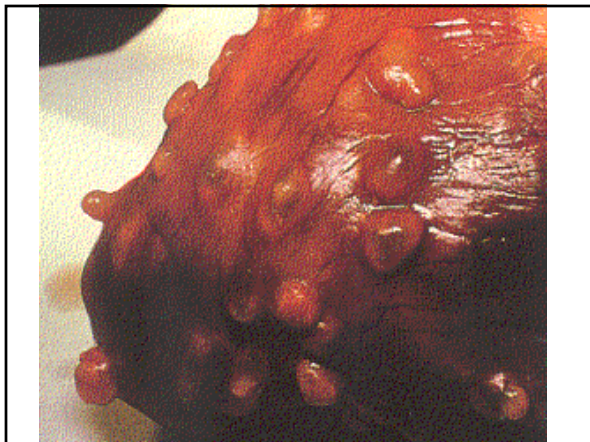


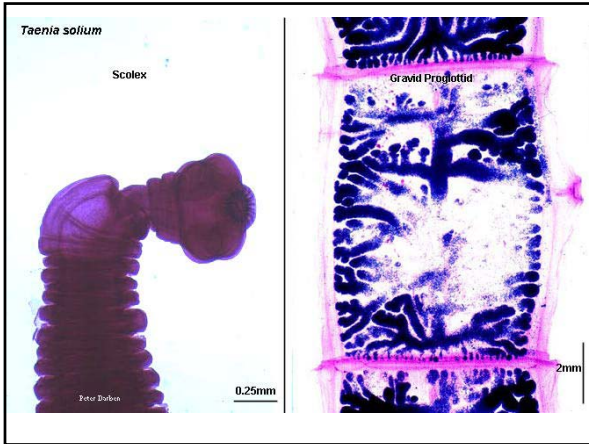


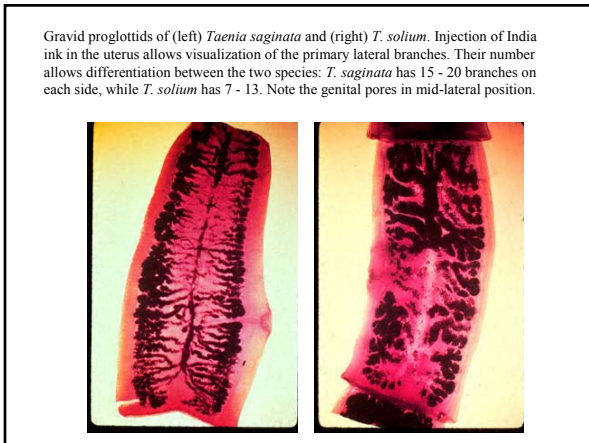
Taenia solium

- c. Cysticerci form in brain and other locations
 - 1. adaptive value probably to enhance transfer
- d. in host intestine, long sections of proglottids shed.
 - 5. epidemiology
 - a. 138 cases in LA between 1988-1990.
 - b. Has been used as biological warfare in Iran, Java and Papua New Guinea






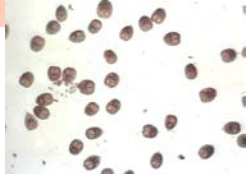




Echinococcus granulosus

- a. egg
- b. oncosphere
- c. hydatid cyst
- d. adult worm
- e. epidemiology

1. a problem in locations with grazing animals and canids

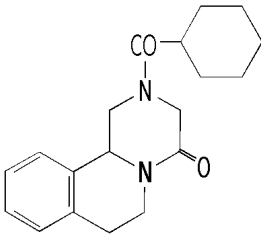
Echinococcus granulosus



Numerous hydatid cysts in the liver of a horse. A horse may become infected with a number of cysts at one time (each egg ingested will result in one cyst).

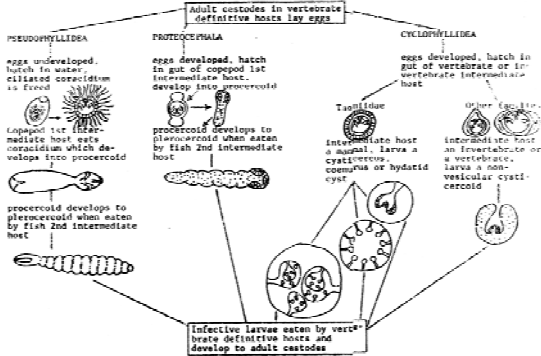


Praziquantel



Praziquantel* is the drug of choice for most helminth infections

DIAGRAM OF LIFE CYCLES OF THREE COMMON ORDERS OF CESTODES (from Olson, 1967)





Taenia pisiformis
Dog/Cat Tapeworm



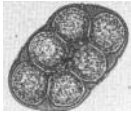
Echinococcus granulosus
Dog/Cat Tapeworm



Taenia taeniiformis
Dog/Cat Tapeworm



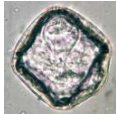
Taenia solium
Pig/Human Tapeworm



Dipylidium caninum
Dog/Cat Tapeworm



Hymenolepis diminuta
Rat/Human Tapeworm



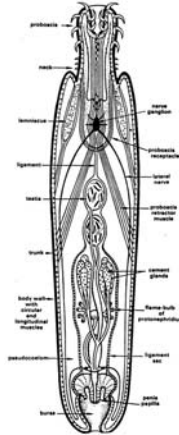
Moniezia expansa
Sheep Tapeworm



Anoplocephala magna
Horse Tapeworm

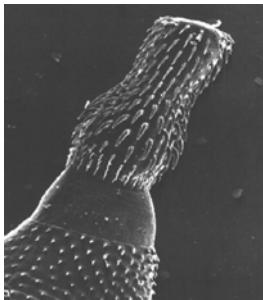
Phylum Acanthocephala

1. A phylum consisting entirely of intestinal parasites of vertebrates.
 - a. Generally with an invertebrate intermediate host.
 - b. Affinities with other phyla were somewhat obscure.



Phylum Acanthocephala

1. Similar to other organisms called "blastocoelomates"
 - a. Fluid filled body cavity
 - b. Outer nonliving cuticle
 - c. Often with *eutely* - constant cell number in body
2. Several unique differences as we shall see.

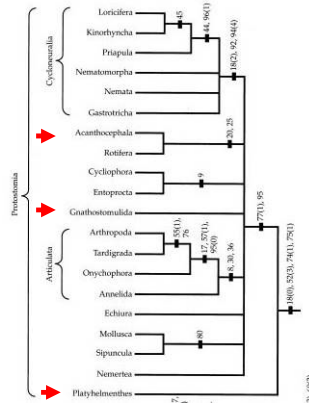


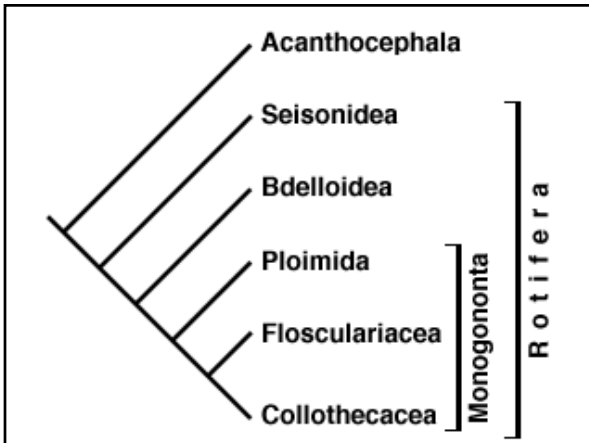
Phylogenetic Relationships

Flatworm allies?

1. Gnathostomulida
2. Acanthocephala

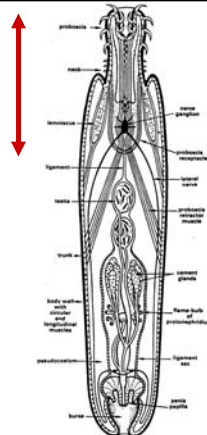
Yet other relationships seem more concrete based on molecular evidence...





Acanthocephala: Characteristics

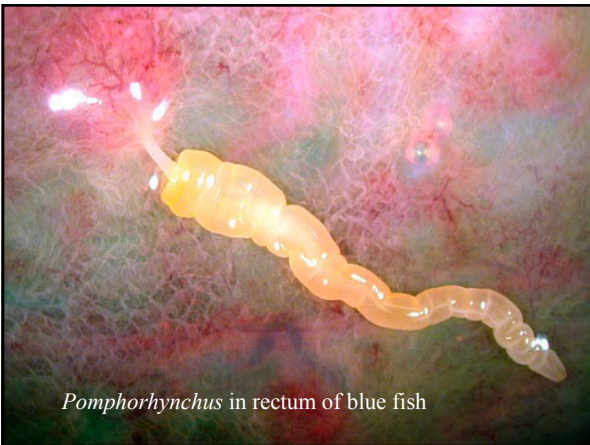
1. Presoma - anterior attachment organ + receptacle.
 - a. Hooked proboscis for attachment to intestine.
 - b. Eversible by hydraulic pressure.
 - c. Retractable by muscles that attach within body.





Acanthocephala: Attachment to the Vertebrate Host

Southwellina hispida
(Acanthocephala)
perforated the whole
layers of
Phalacrocorax carbo
(Aves) intestine.



Pomphorhynchus in rectum of blue fish



Pomphorhynchus in
rectum of blue fish:
Note the inflatable
proboscis.

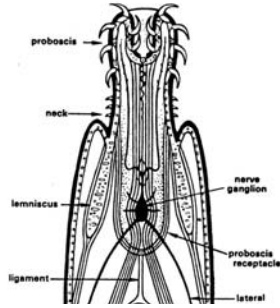


Acanthocephala: Anterior

d. *Lemnisci* - may be related to eversion, but actual function is not clearly known.

2. Neck - connects proboscis to rest of body.

3. Nerve ganglion - associated with *proboscis receptacle*.



Acanthocephala: Posterior

4. *Metasoma* - rest of body - also called *trunk*.

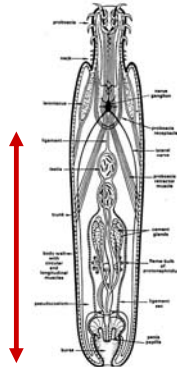
a. Lacks a digestive tract:

1. Not surprising for an intestinal parasite.

b. Other viscera hang from a central ligament.

1. Part of confusion over relationships with other taxa.

a. Possible mesentery?



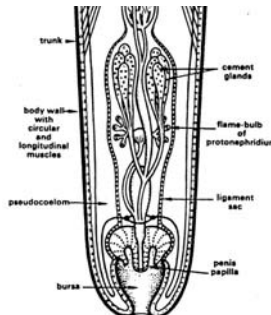
Acanthocephala: Characteristics

c. Excretory system - flame bulbs associated with reproductive organs.

1. Seem to have little osmoregulatory ability.

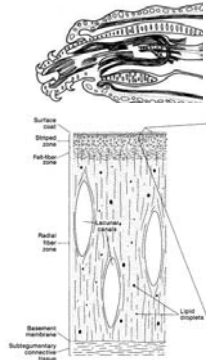
2. Again, not surprising.

3. Useful for preserving specimens - put them in tap water to get their proboscises to evert.



Acanthocephala: External

- d. External covering
1. extremely complex system of canals and musculature.
 2. Layers in integument:
 - a. lots of surface area
 - b. Multiple mitochondria - seems associated with combined osmoregulatory and excretory function.



Acanthocephala

- b. Canals are called lacunae
1. Anterior part involves the lemnisci.
 2. Posterior is the lacunar system.
 3. Each section seems separate.

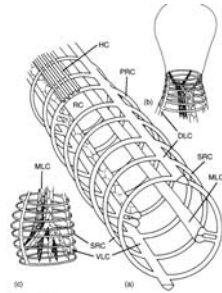
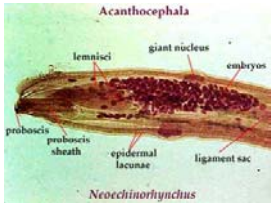
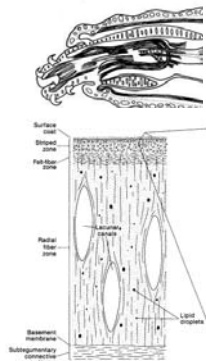


Figure 31-5 Organization of lacunar system in *Macracanthorhynchus* (Amelinozoua). (a) Midmetastomal region, (b) region near neck, with preoral lacunar system not indicated, (c) near posterior end of metacoma. DGC, dorsal longitudinal channel; SRC, secondary ring canal; VLG, ventral longitudinal channel; HC, hypodermal canal (in radial fiber zone); MLC, medial longitudinal channel; PWC, primary ring canal; RC, radial canal.

From: M. Miller and T. T. Denno, Study with organization of the acanthocephalan, *Macracanthorhynchus* (Amelinozoua) - a representation of the lacunar system. In Proc. Helv. Soc. Zool., 43:199-206, Copyright © 1976. Reprinted by permission.

Acanthocephala: External

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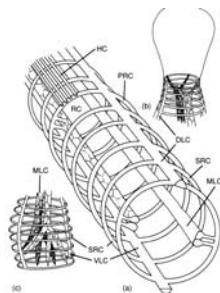
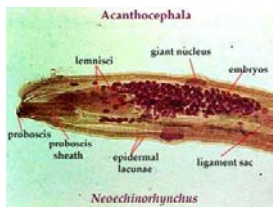
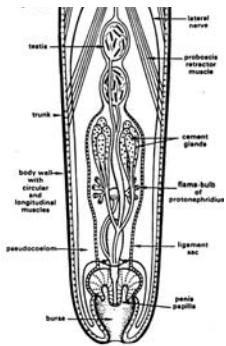


Figure 31.5
 Organization of lacunar system in *Macrorhynchus* *Acanthocephala*. (a) Midventral region; (b) region near neck, with personal lacunar system not indicated; (c) near posterior end of neosome. *DLG*, dorsal longitudinal channel; *HC*, hypodermal canal (in radial fiber zone); *MLC*, medial longitudinal channel; *PRC*, primary ring canal; *RC*, radial canal; *SRC*, secondary ring canal; *VLC*, ventral longitudinal channel.
 From D. M. Miller and F. T. Dempsey, "Study wall organization of the acanthocephalan *Macrorhynchus* for *Trichostrongylus*: a reevaluation of the lacunar system" in *Proc. Helv. Soc. Zool.*, 43:99-108, Copyright © 1976. Reprinted by permission.

Acanthocephala: Reproduction

- 1. Sexes are separate
 - a. Males
 - 1. Suspended testes
 - 2. Cement glands
 - 3. Copulatory bursa



Acanthocephala: Reproduction

- 4. Saeftigen's pouch - permits penis to evert.

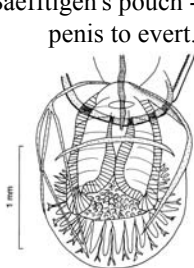
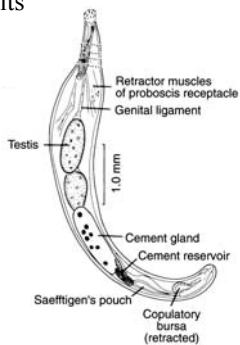
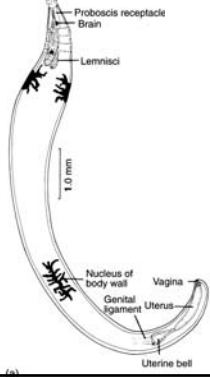


Figure 31.7
 Extended copulatory bursa of *Oesofondia colenti*. Note the numerous sensory papillae.

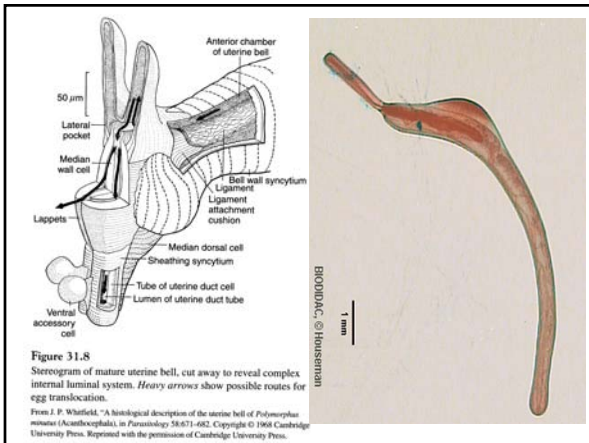
From G. D. Schmidt and R. E. Katz, "Revision of the Pterochisinae (Acanthocephala: Platyhelminthes) with descriptions of two new genera and three new species" in *J. Parasitol.*, 53:130-141, Copyright © 1967 Journal of Parasitology. Reprinted by permission.



Acanthocephala: Reproduction



2. Females
- Ovarian balls - free floating uterine tissue within ligamental sac.
 - Fertilization occurs within the sac.
 - Embryos circulate and are later sorted by the uterine bell.



Acanthocephala: Life cycle

- Involves intermediate hosts - usually arthropod.
 - Eggs fertilized in female, early development there.
3. Uterine bell sorts out mature *acanthor* larvae
4. Larvae shed in feces of host, ingested by intermediate host.



Acanthocenhala: Life Cycle

5. *Acanthor* hatches, to *acanthella* that burrows through intestinal lining.
6. May go through several *acanthella* stages.
7. Encysts as *cystacanth* - awaits transmission to final host.

