BIO 475 - Parasitology
Spring 2009

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http://www4.nau.edu/isopod

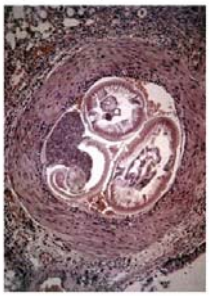
Lecture 20

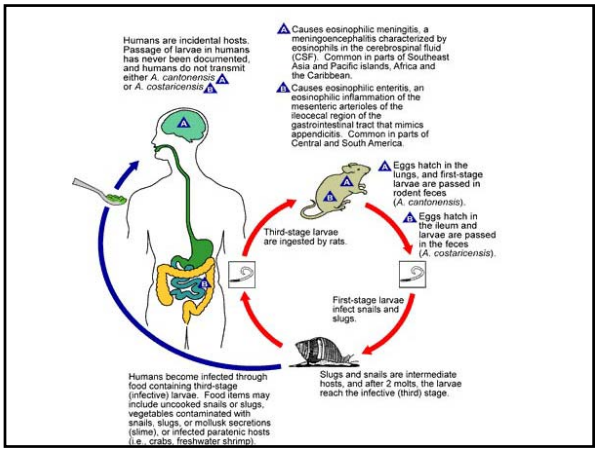
Trichostrongylines

Hairworms in Horses

Eggs hatch when eaten by the horse. Larvae migrate to the stomach and mature. Adult worms in the stomach and in the small intestine irritate and erode the villi, or finger-like projections, of the gut, damaging the capillaries and lymph vessels. Eggs are laid and passed in the manure.

Angiostrongylus cantonensis





Metastrongylines

Metastrongylus – Life Cycle

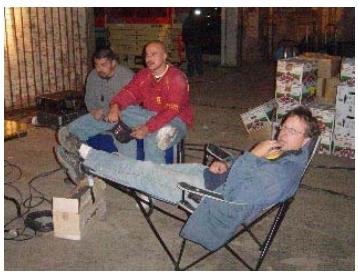
Life Cycle: The eggs are laid in the bronchi and are coughed up, swallowed, and passed in the feces.

The ova hatch after being ingested by earthworms. Infective third-stage larvae develop in 10 days and accumulate in the circulatory system, where they may overwinter.

Pigs become infected by ingesting these worms. The lungworm larvae then penetrate the intestines and proceed via the lymph and blood vessels to the lungs.

The prepatent period is about 2 weeks.

Disclaimer: The stunts described on this web site were designed and supervised by trained professionals. They are extremely dangerous and should not be attempted by anyone, anywhere, anytime. Some episodes contain graphic scenes. Viewer discretion advised.



Order Ascarida

A. Stout worms with 3 distinct lips

1. Muscular esophagus

2. Often with caudal bulb (ventriculus).

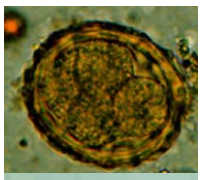
3. Spicules, males often with curved tail

Order Ascarida

B. Eggs are distinctive.

1. Shed unembrionated, often in early stages of development.

2. Outer surface is mammillated - covered with bumps.



Ascaris lumbricoides

a. Parasite of humans

b. Appears very closely related to *Ascaris suum*.

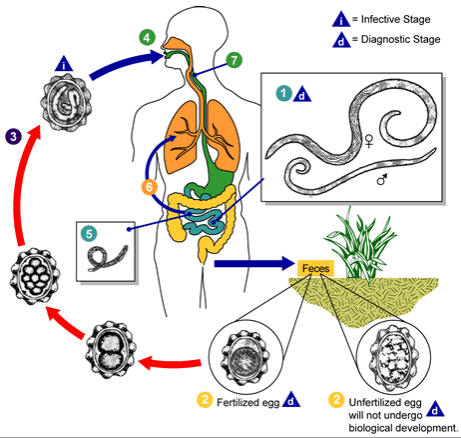
1. Recently distinguished by mtDNA analyses

2. Some gene flow, but seems to be dependent on location and frequency of transfer.

Ascaris lumbricoides

Life Cycle

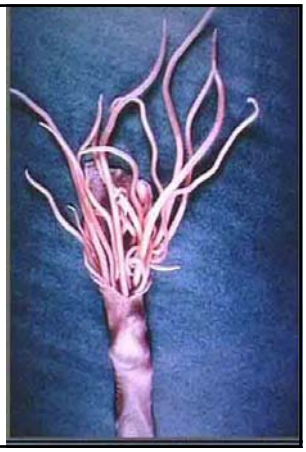
1. Eggs in feces, swallowed in contaminated water, food.
2. J1 hatches in gut.
3. J2 migrates to lungs.
4. J3 is coughed up, swallowed, J4 into gut.
5. Adult develops there.



Ascaris lumbricoides

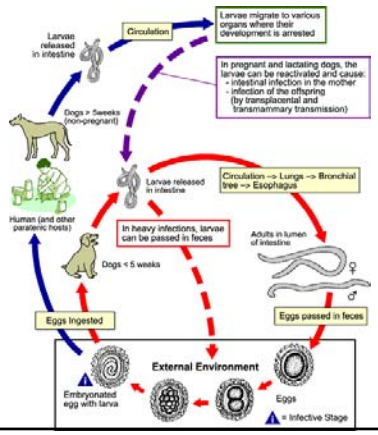
Other Notes:

1. Long standing infectivity of eggs
2. Migrating larvae - immune reactions
3. Migrating adults - blockages, tissue invasion.



Massive Ascaris infection in child. A large bolus of roundworms expelled following anthelminthic treatment.

Toxocara canis

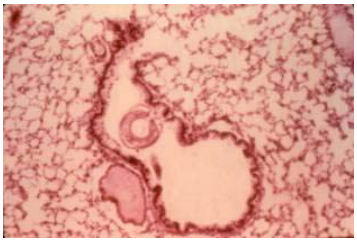


Toxocara canis

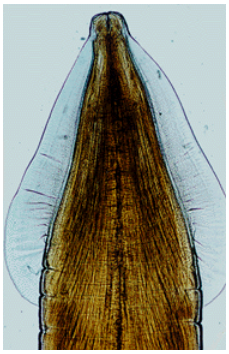
Visceral Larval Migrans

a. Similar life cycle to *Ascaris*.

b. Larvae migrate in wrong host.



Toxocara catti



***Toxocara cati* eggs were found in the faeces of 42.5% of house cats in Mexico City. 20.7% of apartment cats and 49.1% of house cats were infected.**

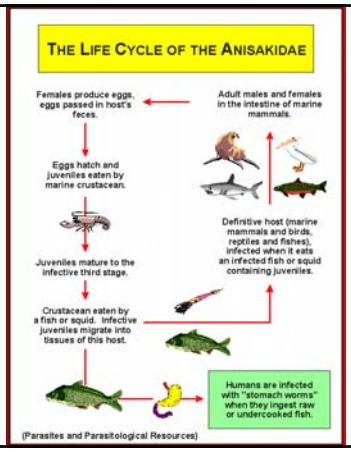
Anisakis spp.

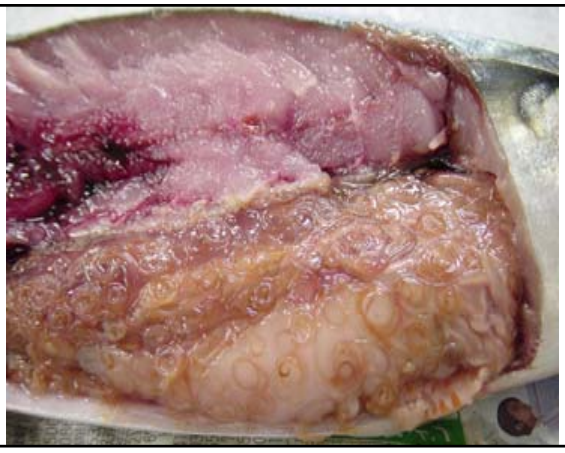
a. Several intermediate hosts:

1. Usually marine mammals.
2. Also bears and humans.

b. Larvae have a tendency to migrate and imbed in tissue.

1. Especially stomach and gums.





Heterakis gallinarum

a. Intestinal worm of fowl

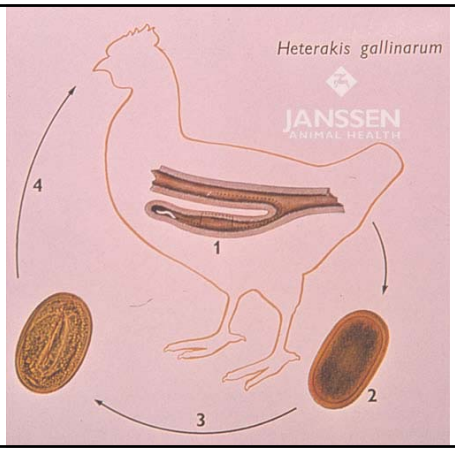
1. Recognized by sharp tail, often with sucker.
2. Eggs shed into soil, larvae eaten by earthworms.

a.Also eaten by birds.

3. Birds eat earthworms and get adults

b. Vector for *Histomonas.*

1. Protozoan eaten by worm, protozoan multiplies in ovaries.
2. Gets into eggs, and thereby infects birds



The principal economic importance of caecal worms lie in their role as a carrier of **blackhead**, caused by the protozoan *Histomonas meleagridis*. It is passed via the worm eggs in the faecal material of infected birds. It remains viable in the eggs of the caecal worm and occurs in the caecum and liver of young turkeys, partridges and occasionally of chickens. Blackhead develops 2 to 3 weeks after ingestion of the worm eggs.

Oxyurids

A. Generally small worms with nearly spherical enlargement of esophagus.

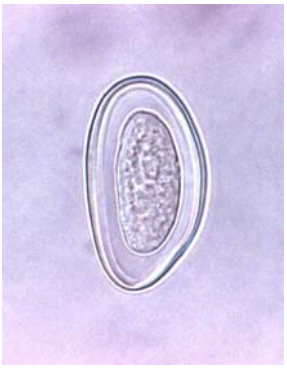
1. Males with single copulatory spicule.

2. Parasties of large intestine.

Oxyurids

B. Eggs are distinctive.

1. Flat on one side.



Oxyurids

Females oviposit outside of anus, sometimes even exploding on contact with air.

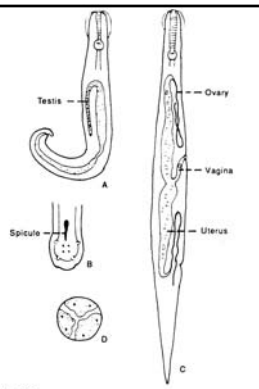
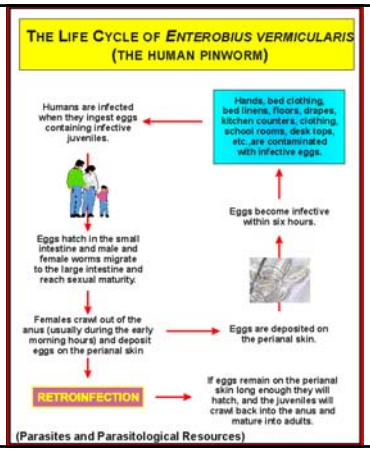


Figure 5.24
Enterobius vermicularis. (A) Adult male; (B) ventral view of caudal end of male, showing spicule and papillae; (C) adult gravid female; (D) en face view, showing three lips, each with two papillae.


THE LIFE CYCLE OF ENTEROBIUS VERMICULARIS
(THE HUMAN PINWORM)
Humans are infected when they ingest eggs containing infective juveniles.
Hands, bed clothing, bed linens, floors, drapes, kitchen counters, clothing, school rooms, desk tops, etc. are contaminated with infective eggs.
Eggs become infective within six hours.
Eggs hatch in the small intestine and male and female worms migrate to the large intestine and reach sexual maturity.
Females crawl out of the anus (usually during the early morning hours) and deposit eggs on the perianal skin
Eggs are deposited on the perianal skin.
RETROINFECTION
If eggs remain on the perianal skin long enough they will hatch, and the juveniles will crawl back into the anus and mature into adults.
(Parasites and Parasitological Resources)

Butt It Itches

The pinworm is a parasite
That makes a journey every night,
from the intestine where it resides
to lay its eggs on the outside.

The usual symptom's an itchy bottom
though in the appendix it can cause a problem.
It generally lives in tiny tots
but can infect both moms and pops.

Its thin walled eggs float in the air
so they can end up anywhere.
So if tonight you start to squirm,
remember it might be this worm.

But, this nematode's easy to diagnose
By affixing scotch tape to the host;
then examining the microscope slide
for eggs that are flatter on one side.

And if you have him, don't be embarrassed.
Anyone can have *Enterobius vermicularis*.

Order Spirurida

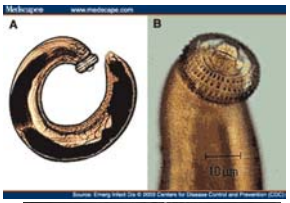
Characteristics:

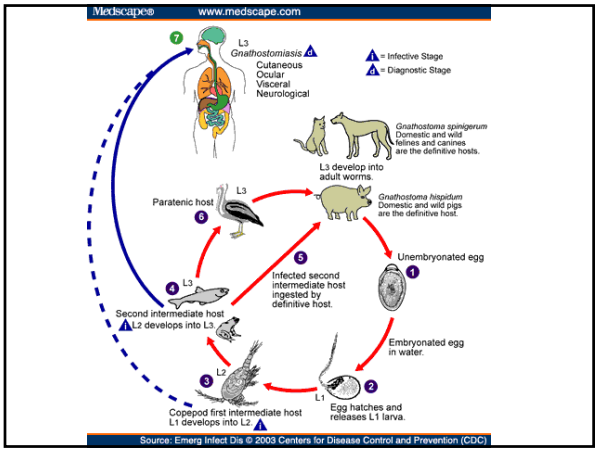
1. Adults with pseudolabia, or with lips (or not!).
2. Esophagus with anterior muscular portion, posterior glandular portion; never a bulb.
3. J1-J3 in arthropod hosts; J4-adult in intestine or deep tissue.

Family Gnathostomatidae

a. *Gnathostoma* spp.

1. Carried by several hosts before infecting humans or other carnivores.
2. Forms cutaneous lumps, but can cause worse.





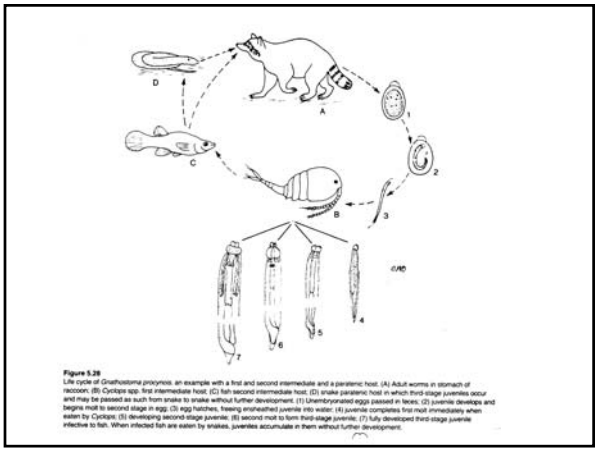
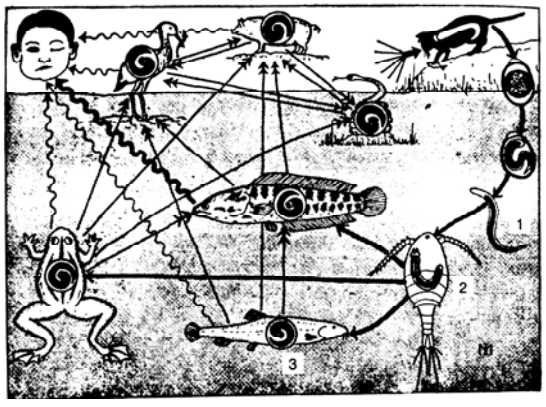


Figure 5.28
Life cycle of *Gnathostoma procyonis*, an example with a first and second intermediate and a paratenic host. (A) Adult worms in stomach of raccoon; (B) Cyclops spp. first intermediate host; (C) fish second intermediate host; (D) snake paratenic host in which third-stage juveniles occur and may be passed as such from snake to snake without further development. (1) Unembryonated eggs passed in feces; (2) juvenile develops and begins molt to second stage in egg; (3) egg hatches, freeing ensheathed juvenile into water; (4) juvenile completes first molt immediately when eaten by Cyclops; (5) developing second-stage juvenile; (6) second molt to form third-stage juvenile; (7) fully developed third-stage juvenile infective to fish. When infected fish are eaten by snakes, juveniles accumulate in them without further development.

Gnathostoma spinigerum



Family Spirocercidae

a. *Spirocera lupi*

1. Encysts in esophagus of dogs.

2. Can cause cancer.

Superfamily Filaroidea

Characteristics

1. Adults are tissue dwelling forms
2. Often vectored by biting insects

a. J3s deposited on skin

b. They crawl into wound and enter tissues.

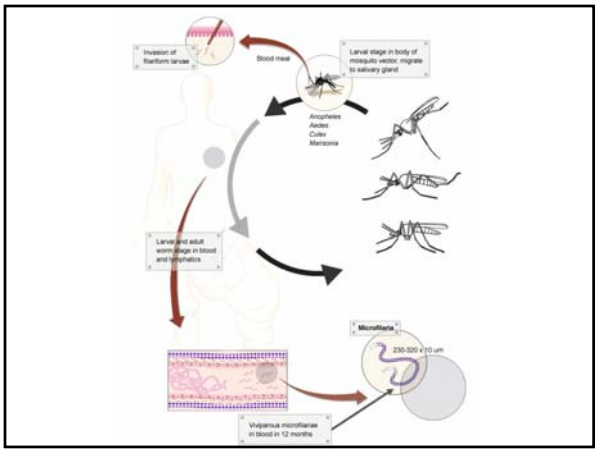
Family Onchocercidae

1. *Wuchereria bancrofti*

a. Vectored by several genera of mosquito.

1. *Aedes, Anopheles, Culex*, can *support* filariae

2. But do not always transmit it



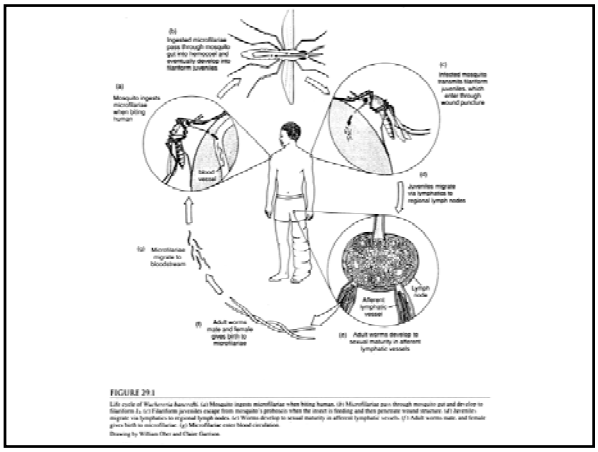


FIGURE 29-1

Life cycle of *Wuchereria bancrofti*. (a) Mosquito ingests microfilariae when biting human. (b) Microfilariae pass through mosquito gut and develop to filariform (L3) (c) Filariform juveniles escape from mosquito's proboscis when the insect is feeding and then penetrate wound structure. (d) Juveniles migrate via lymphatics to its regional lymph nodes. (e) Worms develop to sexual maturity in afferent lymphatic vessels. (f) Adult worms male and female grows forth to microfilariae. (g) Microfilariae enter blood circulation.

Drawing by William Ober and Claire Garrison.

Family Onchocercidae

2. *Brugia malayi*

a. Similar to *W. bancrofti*

b. Spread by mosquitos (*Culex*)

c. primarily in South Pacific

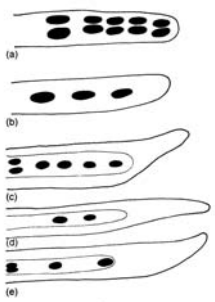


FIGURE 29.4

Presence or absence of a sheath and the arrangement of nuclei in the tail are useful criteria in identifying microfilariae. (a) *Mansonella perstans*; (b) *Mansonella ozzardi*; (c) *Loa loa*; (d) *Wuchereria bancrofti*; (e) *Brugia malayi*.

Family Onchocercidae

3. *Onchocerca volvulus*

a. responsible for river blindness in Africa and SA

b. Vectored by *Simulium*

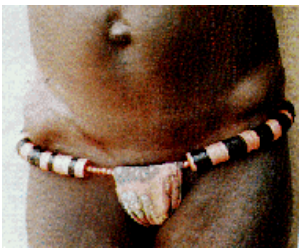
Onchocerca volvulus

Onchocerca volvulus

a. Life Cycle

1. Host with adult worms in sheathes in skin

2. Microfilariae remain in skin where they are ingested by blackflies



Onchocerca volvulus

3. Microfilariae migrate to thoracic muscles of fly

4. Develop into J1 and then J2 (sausage stage)

5. Become filariform J3s (infective)

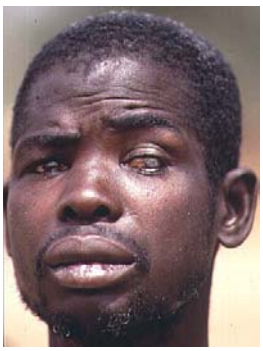
6. J3s transferred in fly bite

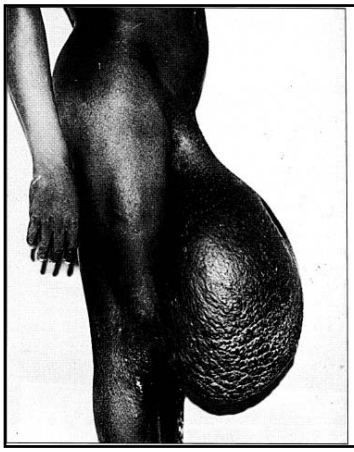
7. Cutaneous adults appear in year.

Onchocerca volvulus

c. Microfilariae invade cornea and after death cause scarring;

d. *Wolbachia* bacteria in worms seems to be responsible.





Onchocerca volvulus

1. Invasion of lymphatic system can also cause elephantiasis, particularly in genitalia and mammary glands.

A Note On Microfilaria

Your book states (p. 447), that *microfilaria* are not as differentiated as normal J1 larvae and hence are not to be considered as such.

The J1 stage does not develop until they are within the insect vector's stomach; after 8 more days, they molt to J2s and after another 4 days molt to slender J3 larvae.

These are the infective *filariform larvae* that leave the insect and enter the definitive host during a bite.

A Note On "Bursate Rhabditidians"

There may have been some confusion over the orders of Secernentea we mentioned in class. Those mentioned were: Rhabditida, Strongylida, Ascarida, Oxyurida and Spirurida.

A mislabeled slide in Lecture 21 may have given you the impression that what your book calls "bursate rhabditidians" belong within the Order Rhabditida. They DO NOT. They are actually part of the Order Strongylida, which includes the hookworms, Trichostrongylines and Metastrongylines.

The Order Rhabditida include the lungworm *Rhabdiasias,* and the intestinal worm, *Strongyloides*.

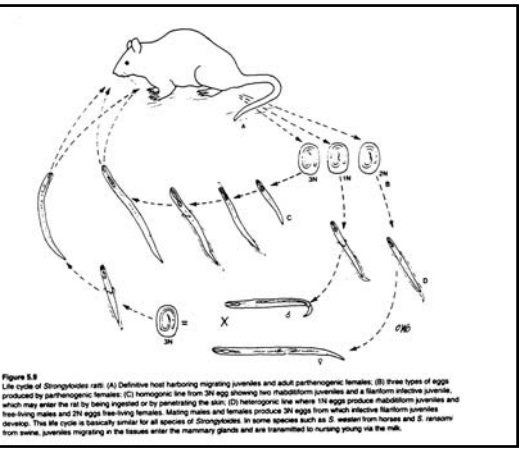


Figure 5.9
Life cycle of *Strongyloides ratti*: (A) Definitive host harboring migrating juveniles and adult parthenogenic females; (B) three types of eggs produced by parthenogenic females: (C) homogonic line from 2N egg showing two rhabditiform juveniles and a filariform infective juvenile, which may enter the rat by being ingested or by penetrating the skin; (D) heterogonic line where 1N eggs produce rhabditiform juveniles and free-living males and 2N eggs free-living females. Mating males and females produce 2N eggs from which infective filariform juveniles develop. This life cycle is basically similar for all species of *Strongyloides*. In some species such as *S. westeri* from horses and *S. ransomi* from swine, juveniles migrating in the tissues enter the mammary glands and are transmitted to nursing young via the milk.