BIO 475 - Parasitology Spring 2009

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http://www4.nau.edu/isopod

Lecture 19

Order Trichurida

b. *Trichinella spiralis*

1. omnivore parasite
2. larvae encyst in muscle, cause "trichinosis"

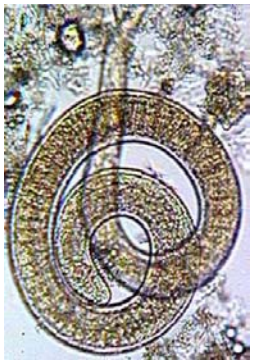
Life Cycle: Unusual Aspects

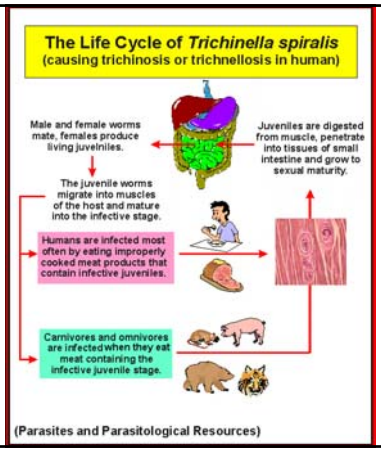
a. Adults inhabit intestine, females embed in intestinal wall.

b. Eggs mature in female uterus, larvae (J1) enter blood and lymph, travel to vascularized muscle.

c. Larvae encyst in muscle, wait to be eaten.

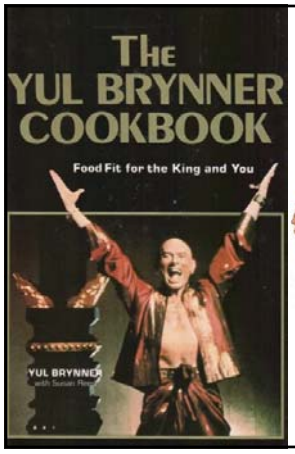
d. J4 hatch and mature into adults.





PROGRESSIVE SYMPTOMS OF TRICHINELLOSIS

TIME post-infection	Stage of infection	Progressive disease symptoms
12 hrs-2 days	initial penetration and development of larval stages	First symptoms, mild nondescript
30 -32 hrs 5 - 7 days	copulation and female penetration of mucosa	intestinal inflammation and pain, nausea, vomiting, diarrhoea. terminates with facial edema and fever
5 days - 6 wks	New born larvae released into tissues and start migration	focal or localized oedema -face and hands. pneumonia, pleurisy, encephalitis, meningitis, nephritis, deafness, peritonitis. Death from myocarditis.
10 days - 6 wks	larvae start to penetrate muscle cells	muscular pain, breathing difficulties, swelling of masseter muscles, weak pulse and low blood pressure, damage to heart. Death as a result of heart failure, respiratory failure, toxaemia or kidney damage.



Mozart may have died from eating undercooked pork

Mozart's death in 1791 at age 35 may have been from trichinosis, according to a review of historical documents and examination of other theories. Medical researcher Jan Hirschmann's analysis of the composer's final illness appears in the June 11 Archives of Internal Medicine.

Hirschmann is a UW professor of medicine in the Division of General Internal Medicine and practices at Veterans Affairs Puget Sound Health Care System.

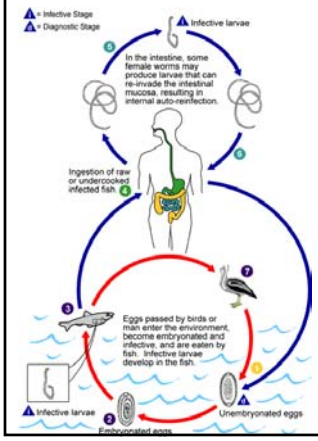
Hirschmann's study of Mozart's symptoms and the circumstances surrounding his death includes a letter in which the composer mentions eating pork cutlets. The letter, written 44 days before he died, correlates with the incubation period for trichinosis.

The nature of Mozart's fatal illness has vexed historians and led to much speculation, because no bodily remains are left for evidence. The official but vague cause of Mozart's death was listed as "severe military fever". The symptoms his family described included edema without dyspnea, limb pain and swelling. Mozart composed music and communicated until his last moments.

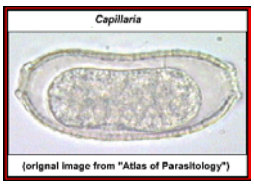
Order Trichurida

Capillaria spp.

1. Various species infecting birds, carnivores
2. Eggs shed in feces, eaten by small fish,
3. Piscivorous animals get nematodes in intestine
4. Various other life cycles



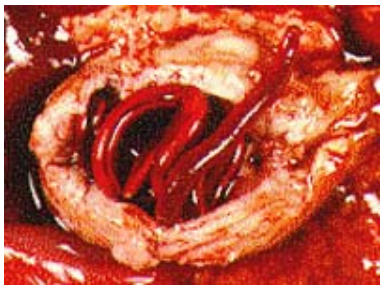
The nematode (roundworm) *Capillaria philippinensis* is the causative agent of human intestinal *capillariasis*. It was first discovered in the Philippines in 1963.



Order Dioctophymatida

1. *Dioctophyme renale* - kidney worm

1, parasitic in mink, but also dogs, humans



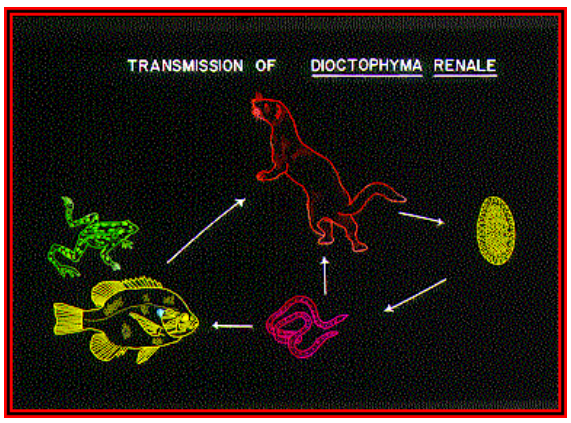
Dioctophyme renale

2. Eggs in urine -> eaten by aquatic oligochaetes

-> worms eaten by fish or from

-> mammals infected by eating worms or paratenic host

-> juveniles leave stomach migrate to liver then to kidney - often right one.



Class Rhabditea

(includes previous Secernentea, Phasmida)

A. Now subdivided in to several Subclasses

1. Chromadoria, Monohysteria, Leptolaimia (all free living)
2. Subclass Tylenchia - in plant and insects or free living.
3. Subclass Rhabditia (previously Secernentea, Phasmida)

Subclass Rhabditia

Characteristics

1. Club shaped, cylindrical or bulbed and muscular pharynx.
2. Bilobed copulatory bursa in males
3. Phasmids present, but often difficult to see.

Subclass Rhabditia

5 Representative Groups (usually orders)

1. Rhabditida - females are only known parasites
2. Strongylida - hookworms
3. Ascarida - intestinal worms
4. Oxyurida - pinworms
5. Spirurida - spirurids, dracunculids, filaroids

Order Rhabditida

A. small parasites, appear to be transitional forms - include for free-living and parasitic forms.

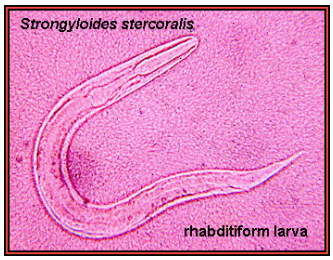
1. Recognizable by:

a. Reduced male forms

1. Led to early conclusion that males were absent.

2. Appears that females are parasitic, males are often not.

Order Rhabditida



b. Muscular esophagus

1. Usually with proximal bulb - "rhabditiform"

2. term also used to describe

a. muscular pharynxes in general

b. free living juvenile forms - usually J1

Order Rhabditida

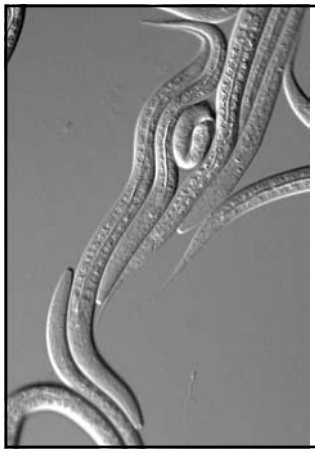
c. huge diversity of life cycles

1. usually includes free living stages

Caenorhabditis elegans

Caenorhabditis elegans

is a free-living soil nematode used widely in genetic studies. It reproduces sexually and possesses digestive, excretory and neuromuscular systems, providing a model for complex organ systems in an easily cultured organism.



It is particularly well-suited for genetic studies:

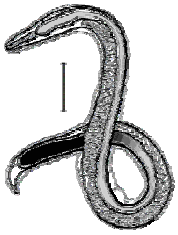
1. It is small, only 1mm in length and easy to culture, and it has a short life cycle (2 wks).
2. It is transparent, and each of its 959 somatic cells is visible through a microscope, making it an ideal organism for developmental studies.

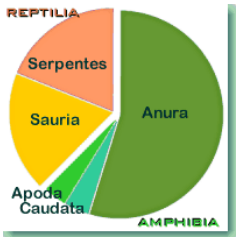
Family Rhabdiasidae

1. Lungworms

a. Common in amphibians and reptiles

b. Recognizable by short esophagus, irregular cuticle.

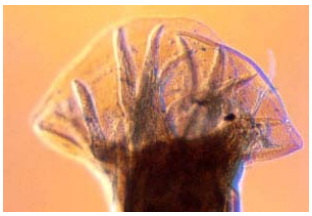




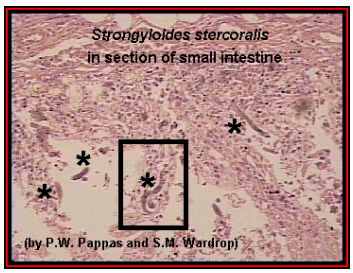
Family Strongyloididae

a. Long, slender worms (threadworms), with long esophagus (in females).

b. Tend to be parasitic in intestine; females only, males are usually free living.



Strongyloides stercoralis



1. Parasite of human intestine

a. also known as "threadworm" -

2. most of pathology associated with larval stages that move through tissues

Strongyloides stercoralis

Life Cycle

a. Females in intestinal mucosa

b. Eggs laid in gut lumen, hatch in gut as J1, passed in feces

c. Two possible routes

1. Free living adults - mate in soil and produce infective eggs.

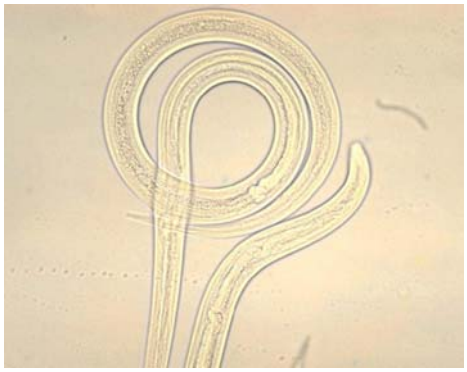
Strongyloides stercoralis

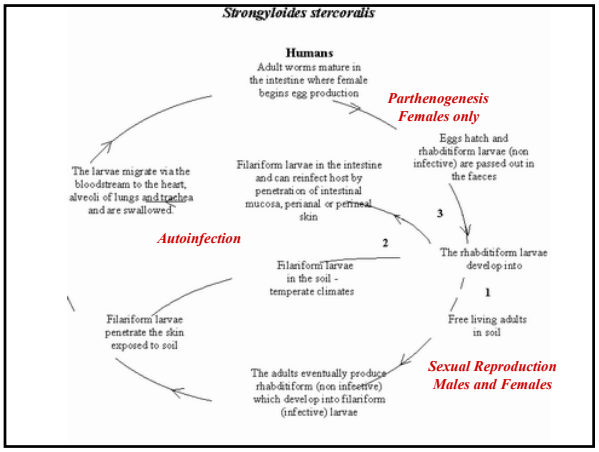
2. Filariform juveniles (J3) wait in soil and infect new hosts

d. Larvae get to lungs or migrate to intestine, however they can.

1. Either coughed up and swallowed or
2. move to intestine directly.

Strongyloides filariform larva





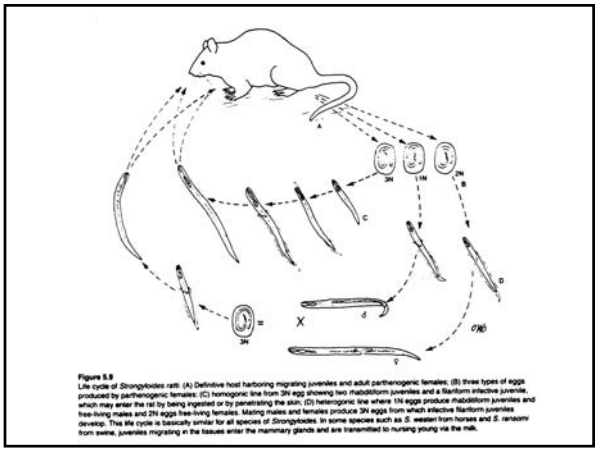
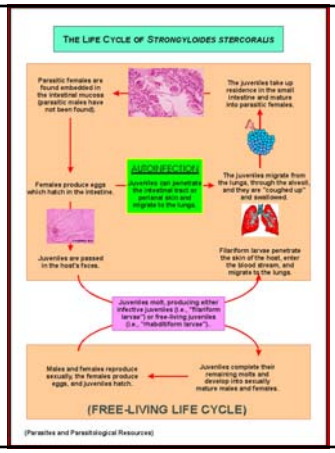


Figure 5.9
Life cycle of *Strongyloides ratti*. (A) Definitive host harboring migrating juveniles and adult parthenogenic females; (B) three types of eggs produced by parthenogenic females: (C) homogonic line from 3N egg showing two rhabditiform juveniles and a filariform infective juvenile, which may 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 3N 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.



Strongyloides stercoralis

e. Infection can come from free living or parasitic adults

1. also, larvae can complete development in gut and remain to autoinfect

Bursate Rhabiditians

Family Ancylostomatidae

1. Commonly known as 'hookworms.'

a. Anterior end curved dorsally to form hook.

2. Buccal capsule with cutting plates.

a. Distinctive oral attachment structures.

3. Males with conspicuous *copulatory bursae*.

Necator americanus

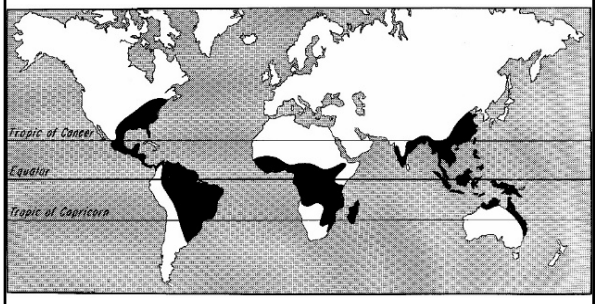
1. American hookworm, cause of anemia, lethargy, retardation.

a. Common in warm humid areas - killed by frost.

b. A good reason to wear shoes.

c. Probably came over in slave trade - also found in Old world.

Necator americanus



Necator americanus

recognizable by:

1. dorsal tooth
2. fused spicules

Necator americanus

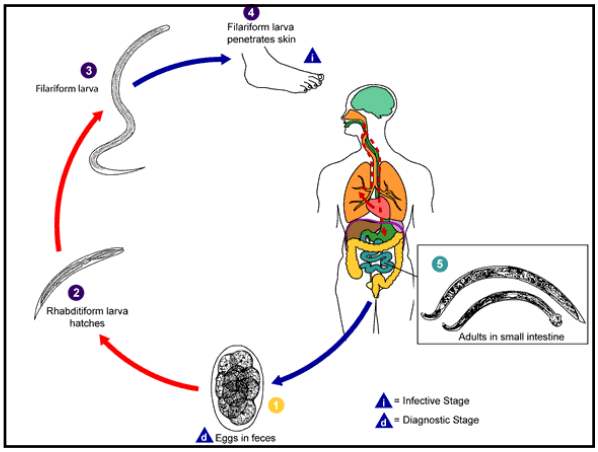
Life Cycle:

a. Eggs in feces, develop in soil,

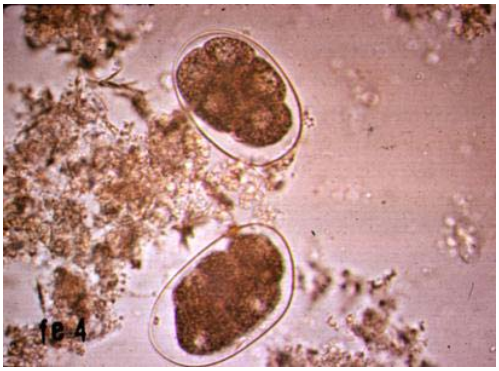
b. Rhabditiform larva (J1) hatches, molts,

c. Filariform (J3) penetrates skin, enters circulation.

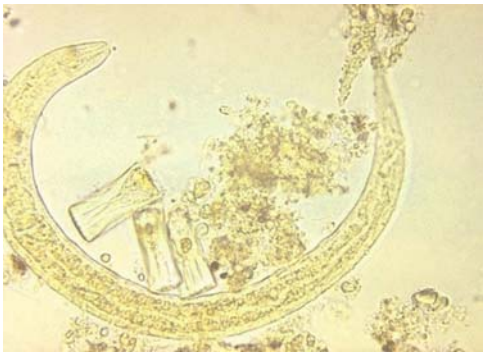
d. Moves to lungs, coughed up, swallowed, matures in intestine.



Necator americanus



Rhabditiform larva of a hookworm



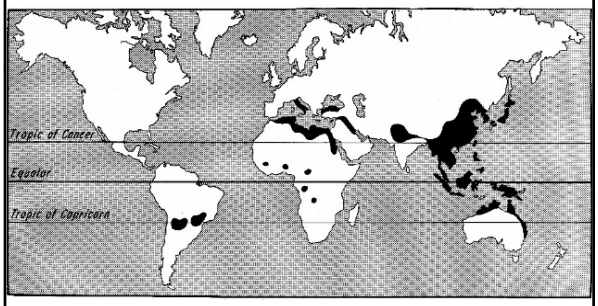
Necator americanus

Other Related Genera:

Ancylostoma duodenale

1. Commonly called old world hookworm
2. Tends to be larger; nastier because it feeds on more blood.

Ancylostoma duodenale



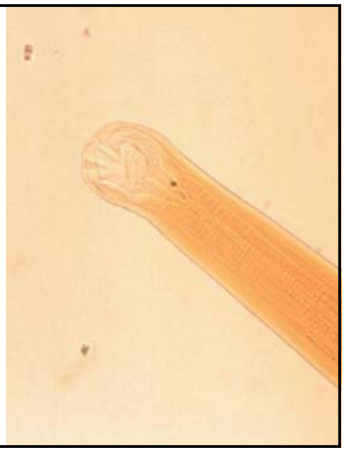
Ancylostoma duodenale

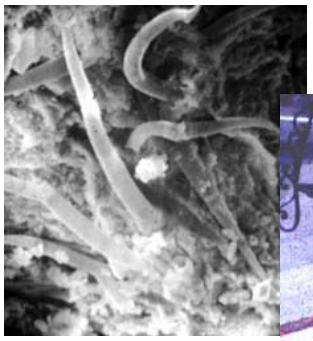
Recognizable by:

a. 2 ventral teeth

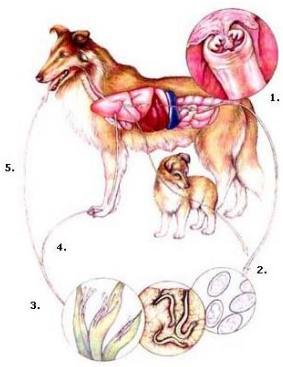
b. Unfused spicules

3. Other old world species exist





Ancylostoma caninum



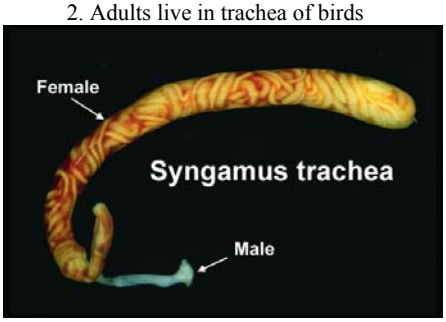
Ancylostoma caninum

cuticular larval migrans

Syngamus trachea

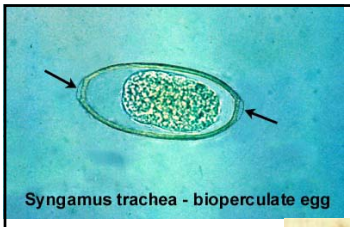
- Gapeworm in fowl

1. Similar life cycle - intermediate stages in worms
2. Adults live in trachea of birds

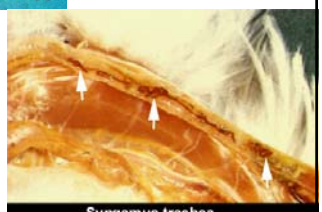


Syngamus trachea – Life Cycle

- In the pre-parasitic phase, J3s develop inside the eggs at which time they may hatch.
- Earthworms serve as transport (paratenic) hosts. Larvae have been shown to remain viable for more than three years encapsulated in earthworm muscles.
- Other invertebrates serve as paratenic hosts; terrestrial snails and slugs as well as the larvae of *Musca domestica* (the house fly) and *Lucilia sericata* (the greenbottle fly).
- The parasitic phase involves substantial migration in the definitive host.



Syngamus trachea - bioperculate egg



Syngamus trachea
- adult worms in the trachea of a turkey