Subclass Rhabditia = Phasmidia = Secernentea

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Subclass Rhabditia = Phasmidia = Secernentea

Order Ascaridida

Superfamily Ascaridoidea

Family Ascarididae

***Ascaris* spp.**

***Toxocara* spp.**

Family Anisakidae

Anisakis

Order Oxyurida

Superfamily Oxyuroidea

Family Oxyuridae

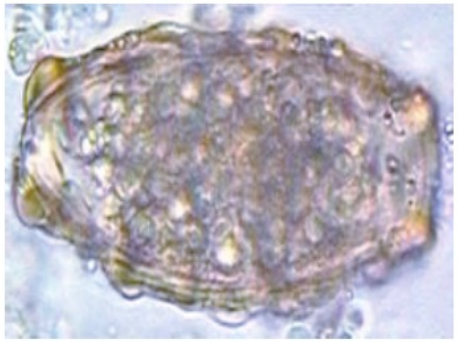
Enterobius vermicularis

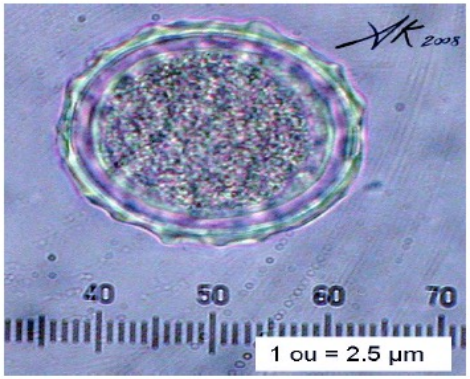
Subclass Rhabditia = Phasmidia = Secernentea

Order Spirurida

- **Superfamily Dracunculoidea**
  - **Family Dracunculidae**
    - ***Dracunculus medinensis***
- **Superfamily Gnathostomatoidea**
  - **Family Gnathostomatidae**
    - ***Gnathostoma spinigerum***
- **Superfamily Filaroidea**
  - **Family Filariidae**
    - **filarial worms**
  - **Family Onchocercidae**
    - ***Onchocercus volvulus***

Ascaris lumbricoides





Ascaris lumbricoides	
Common Name	Giant Intestinal Roundworm
Infective Stage	Embryonated Egg
Habitat	Small Intestine
Mode of Transmission	Ingestion of contaminated food/ water
Diagnostic Specimen	Feces

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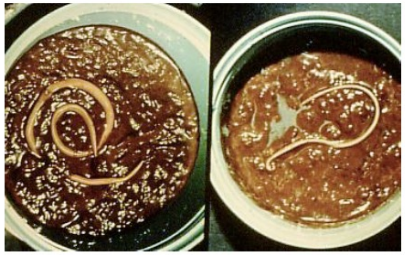
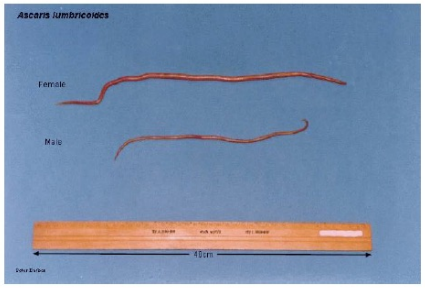
Ascaris lumbricoides





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Ascaris lumbricoides

A. lumbricoides adult worms

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Three lips surrounding mouth

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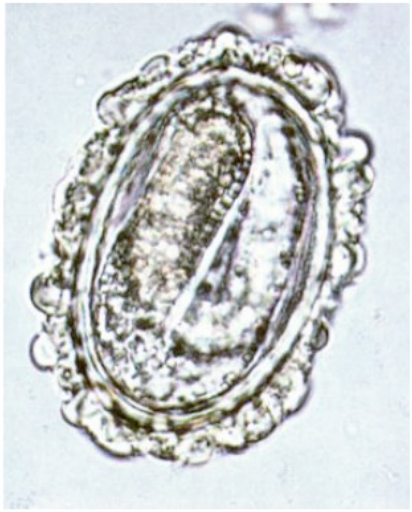
Ascaris lumbricoides

Eggs are unembryonated when passed in the feces.

Embryonation occurs in the soil.



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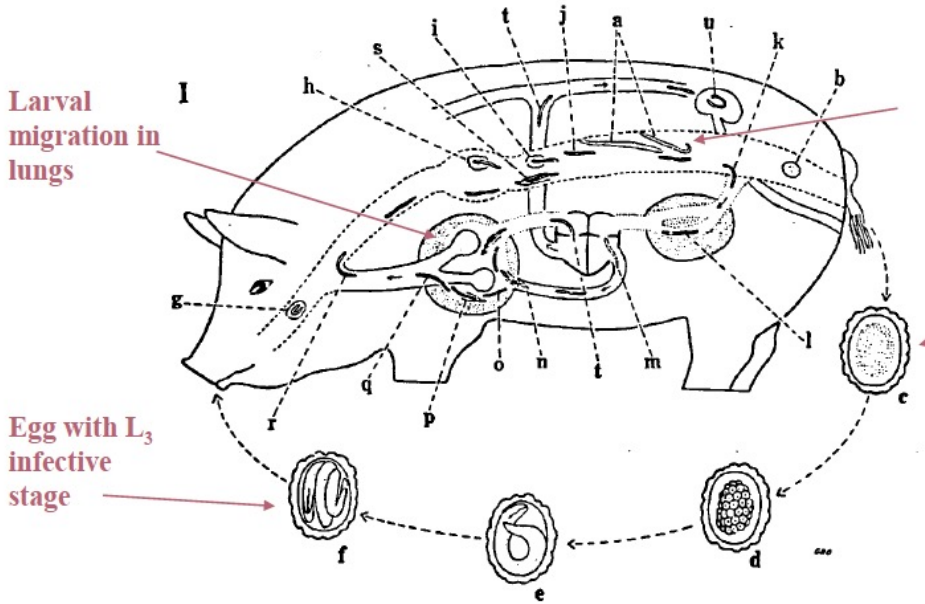
Ascaris suum

- **Single greatest cause of economic loss in the swine industry.**
- **Adults are nearly identical to *A. lumbricoides* in morphology (differences are visible only with scanning EM).**
- **Parasitologists believe that a single species of *Ascaris* infected both humans and pigs at one time but has now evolved into two separate species - one infecting humans and one infecting pigs.**

Ascaris suum

LIFE CYCLE, PATHOLOGY, DIAGNOSIS, AND TREATMENT of *A. suum* are identical with that of *A. lumbricoides* except that pigs are the only hosts.



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Ascaris suum

ROOMMATES INFECTED

Student Charged With Murder Try

MONTREAL, Canada (AP)— A 23-year-old graduate student is being sought on warrants charging attempted murder of four former roommates who are hospitalized with a parasite infection, police said Thursday.

Kranz

Eric Kranz, a graduate student in parasitology at Macdonald College in nearby St. Anne de Bellevue, was reported to have left Canada for New York by air 12 days ago. Officials said they asked New York police to check on his whereabouts, but were told that Kranz' parents, who live there, said they had not seen him in five years.

dents at Macdonald, were "progressing favorably."

They said the poisonous substance apparently had been put into the young men's food.

A professor at Macdonald College said yesterday that he had isolated the parasite involved. He said it was the type of "ascaris" that is found in pigs but has not been detected previously in humans.

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Worm Poisoning Suspect Held

Fall-1969

MONTREAL (UPI) — Eric Kranz, a Long Island science student accused of trying to murder his college roommates with a parasitic pig worm, surrendered to Quebec provincial police Monday.

Kranz has been charged with four counts of attempted murder in the poisoning of his roommates at MacDonald College in Ste. Anne de Bellevue, a Montreal suburb.

He is the son of Dr. Carl Kranz, of West Hempstead, N.Y.

Kranz allegedly dosed the food in the apartment he shareed with four other students, with microsopic eggs of "ascarius sum," a parasitic worm found before only in pigs.

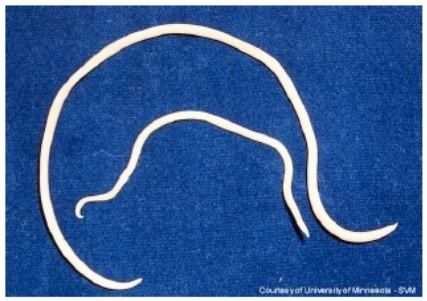
The worms can grow seven inches long, doctors said, and destroy the host body.

Two of the students had "massive infestations" by 300,000 to 400,000 of the larvae, according to authorities, and almost died before mystified medical reasearchers found out what they were suffering from.

Toxocara canis and *Toxocara cati*

Prevalence in dogs and cats is estimated to be 20 to 100%.

Adults are much smaller than *Ascaris*.



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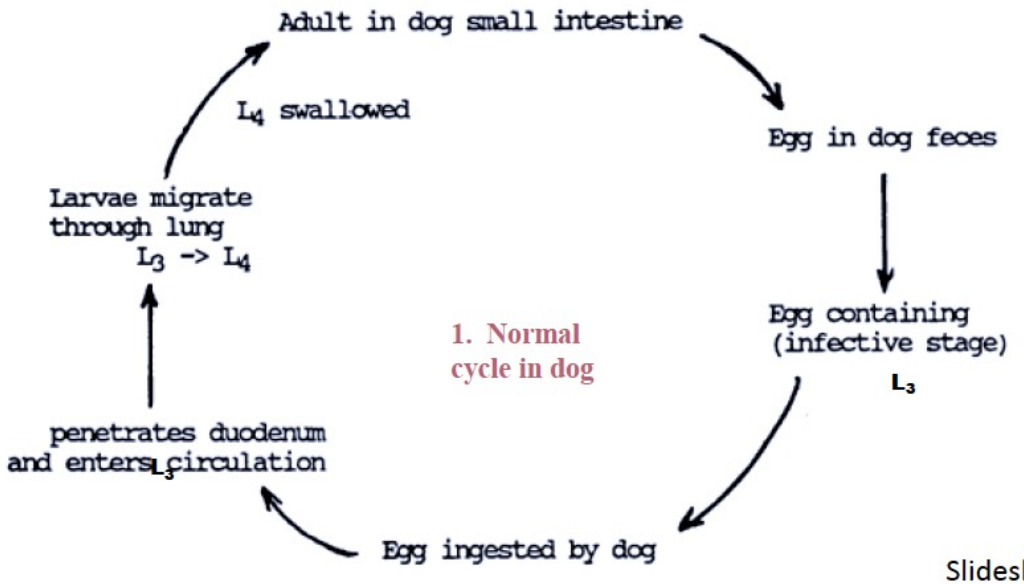
Toxocara canis Life Cycle

4 aspects of the life cycle:

1. Normal cycle in the dog



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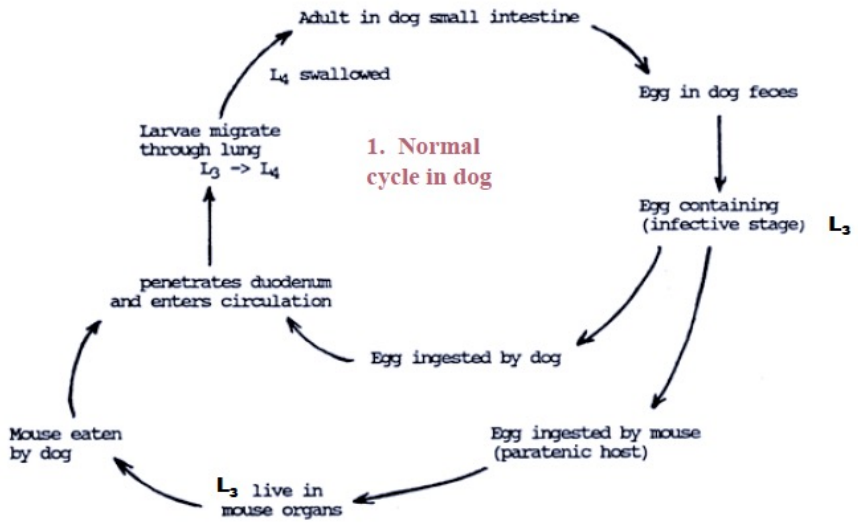
Toxocara canis Life Cycle

2. Addition of a paratenic host (mouse)



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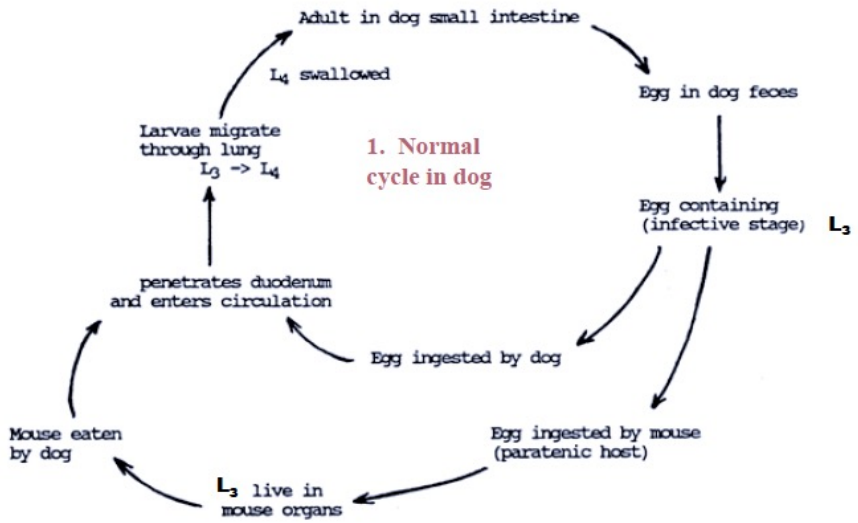
Toxocara canis Life Cycle

2. Addition of a paratenic host (mouse)



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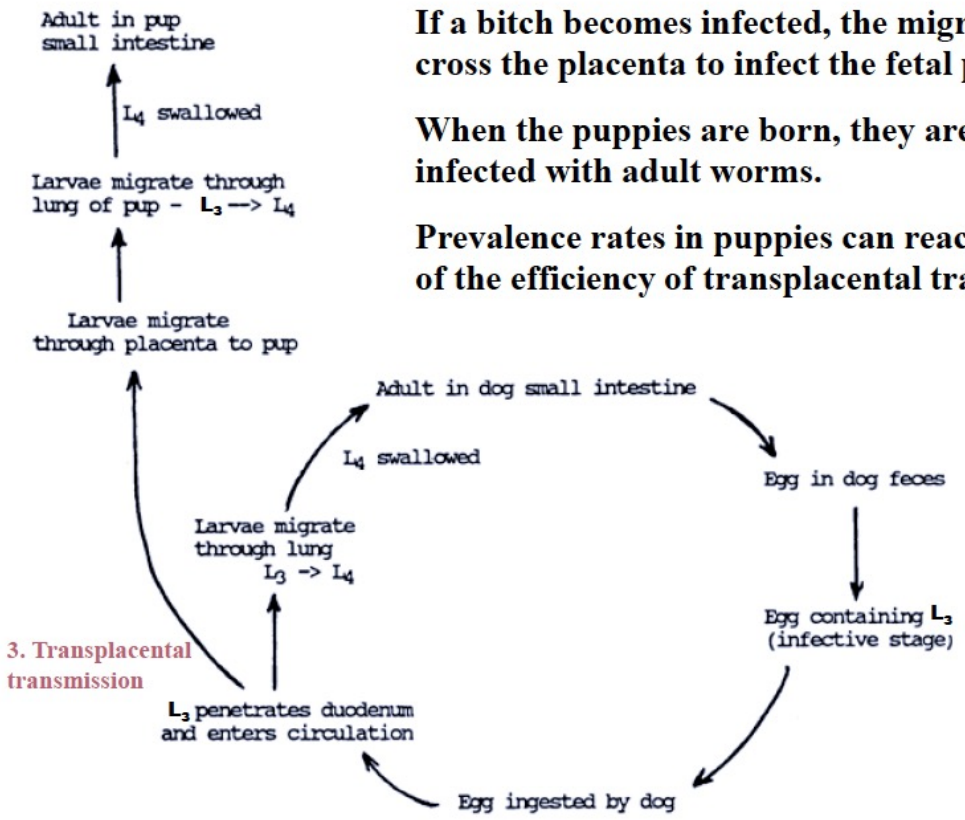
3. Transplacental transmission

If a bitch becomes infected, the migrating L_3 can cross the placenta to infect the fetal puppies.

When the puppies are born, they are already infected with adult worms.

Prevalence rates in puppies can reach 100% because of the efficiency of transplacental transmission.



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Toxocara canis Life Cycle

4. Human infection

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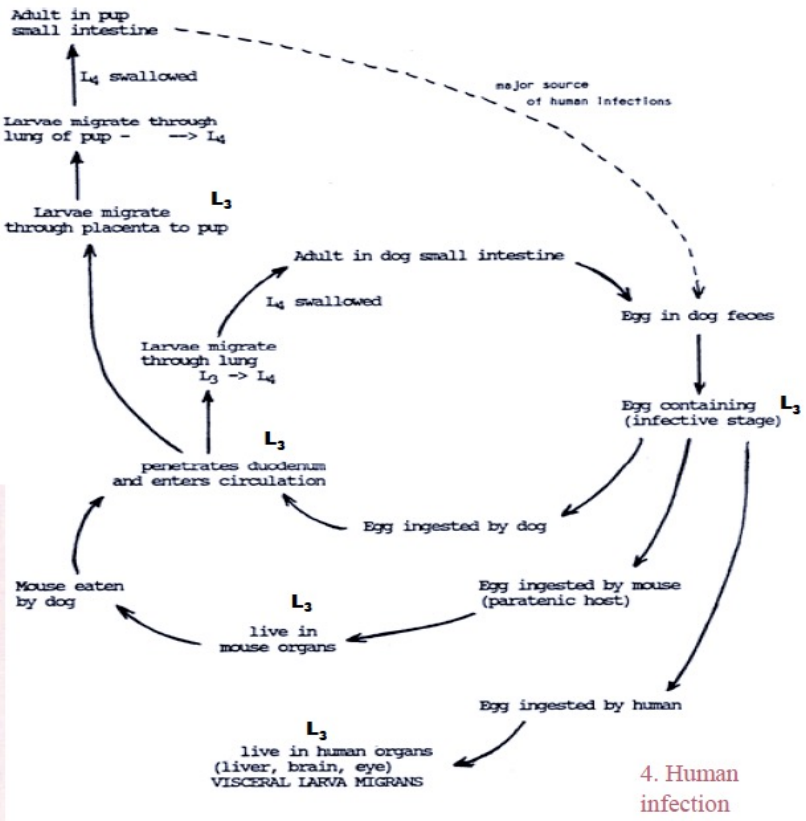
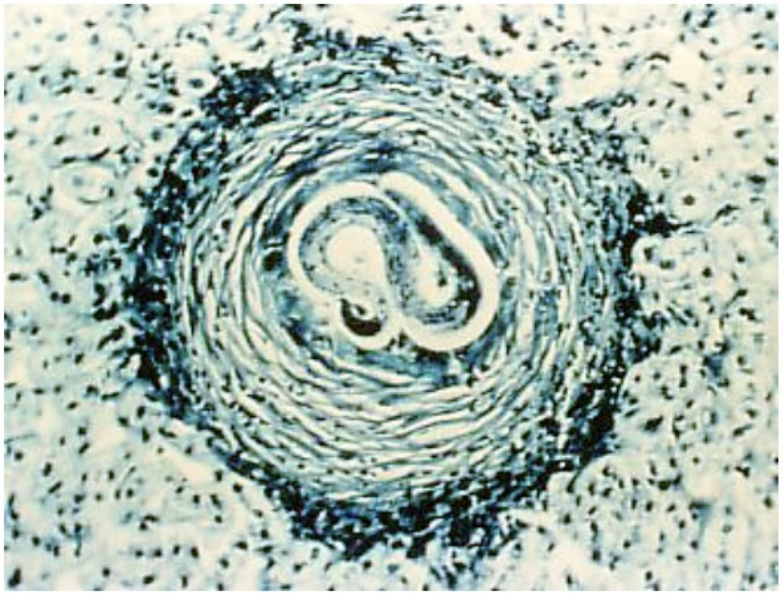


Toxocara canis Life Cycle

Eventually, the human immune system recognizes the parasite, encapsulates it with granuloma and the L_3 is killed.



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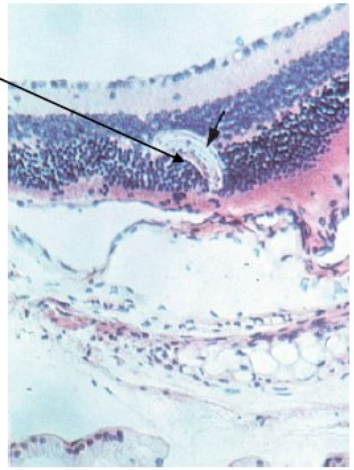
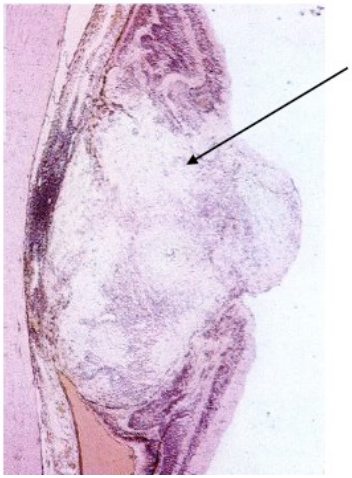
Pathology of Visceral Larva Migrans

PATHOLOGY - dependent upon which organs are invaded by the L_3

1. **The liver is commonly invaded - hepatomegaly & cirrhosis may occur.**
2. **Larval invasion results in a severe tissue reaction that can result in death.**
3. **The eyes may be invaded - scar tissue deposition in the retina can result in blindness.**

L_3 in retina





Scar tissue in retina

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Tragically, most human cases involve children due to their close association with pets.

Larvae of Dog Worms Infect 19 Month Old Milwaukee Boy

When a 19 month old Milwaukee boy named Jimmie was examined at County General Hospital last fall, doctors thought at first he might be suffering from kidney disease. The child's hands, feet and face were swollen and such edema often is a symptom of the kidney disorder called nephrosis.

But Jimmie had other symptoms, among them fever, wheezing, an enlarged liver and at least twice as much lead in his blood as is normal for children his age. Batteries of tests were performed before the puzzled doctors decided on a diagnosis.

Jimmie, they are now convinced, was infested with the larval form of the ordinary dog roundworm, Toxocara canis, which is common in puppies.

sample of dirt from under the porch, but microscopic examination failed to show dog roundworm eggs. This often is the case, even when dogs infested with roundworms defecate in soil.

The diagnosis was based mainly upon Jimmie's symptoms and upon two different kinds of blood tests. One showed an abnormally large number of a certain kind of white cell, which often accompanies parasitic infestation. The other indicated that Jimmy had developed antibodies in his blood to substances in dog roundworms.

Symptoms Subside

Jimmie was hospitalized for more than a month while the doctors investigated his illness and treated the symptoms, which gradually subsided. Part of the treatment was a drug to kill the larvae. How successful

mented that children did not have to eat dirt to become infested as Jimmie was. Dust and dirt brought into the house from places where dogs defecate can get into food and cause the infestation, he said.

"If you live with dogs and cats," Peterson said, "you can be infected."

Jimmie's is the fifth case of its kind to be diagnosed here since the first one eight years ago, but Blodgett said he doubted that larval infestation was that unusual.

He told the doctors: "When you see another respiratory infection — not very interesting — it may be a minor version of this case, so keep it in mind and look for it."

Law Officers' Parley

Madison, Wis. –UPI– Atty. Gen. Robert W. Warren said Monday that his 1971 Law En-

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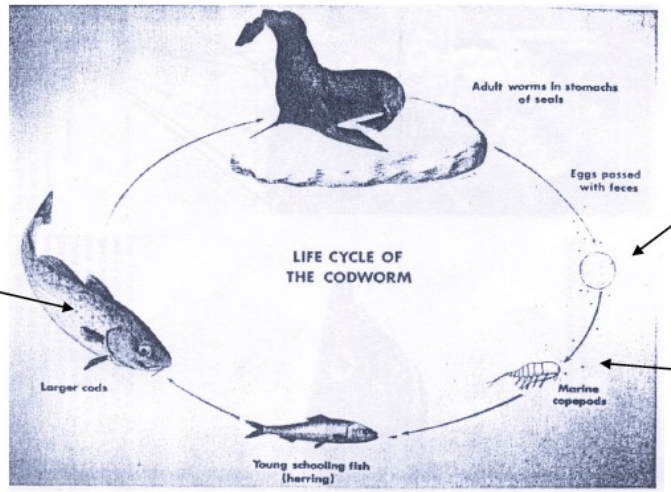
Anisakis spp.

***Anisakis* is parasitic in the stomach and small intestine of marine mammals.**

Copepods are 1st intermediate hosts of this parasite.

Many species of marine fish serve as 2nd intermediate hosts of these ascarids - Pacific salmon, Atlantic cod, haddock, herring, & mackerel.



Egg with L_2

L_3 in marine fish

L_2 in copepod or krill

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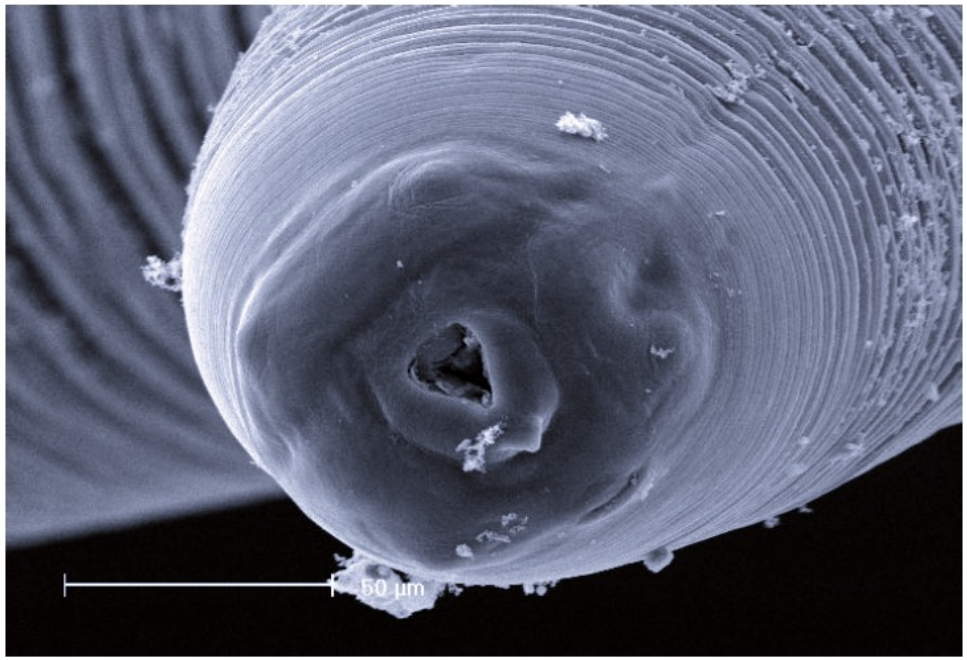

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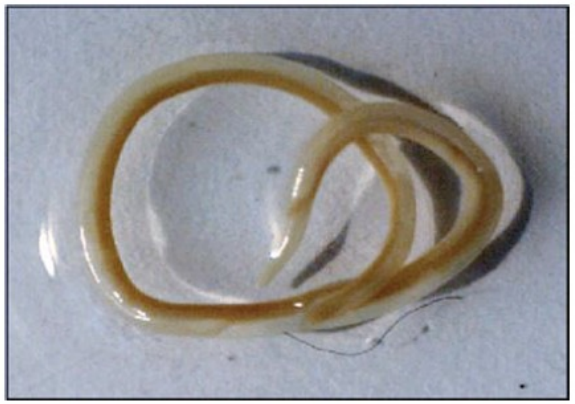
Anisakis spp.



Anisakis L_3 from marine fish are about 1 inch long. L_3 normally occur in the fish intestine but migrate to the musculature when the fish is frozen and warmed up during transportation.

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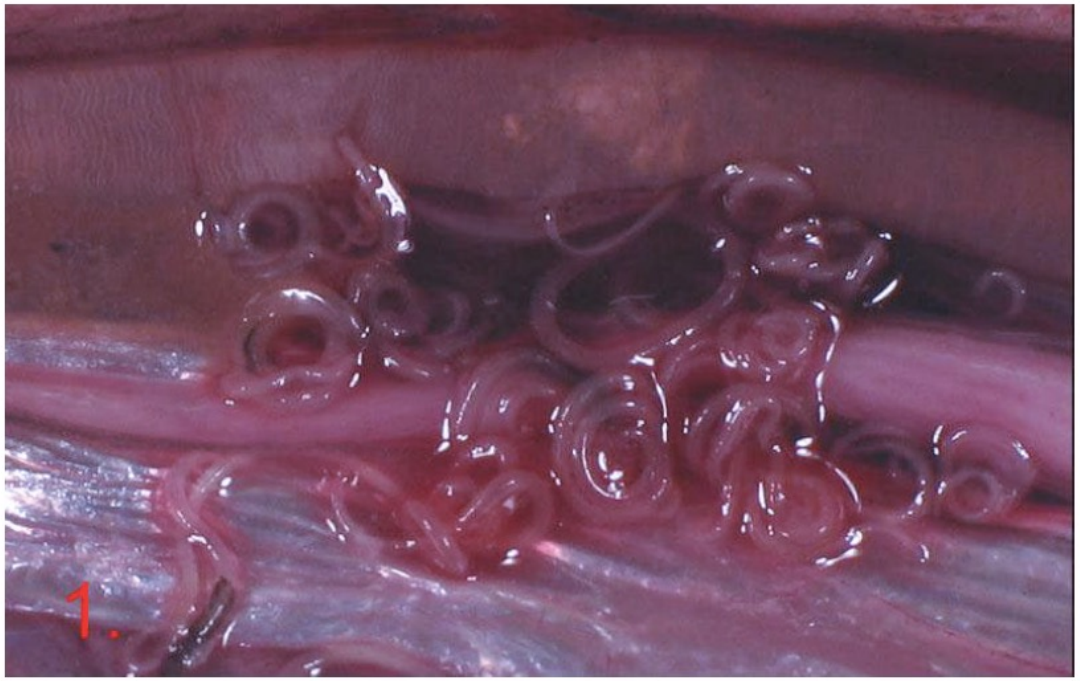

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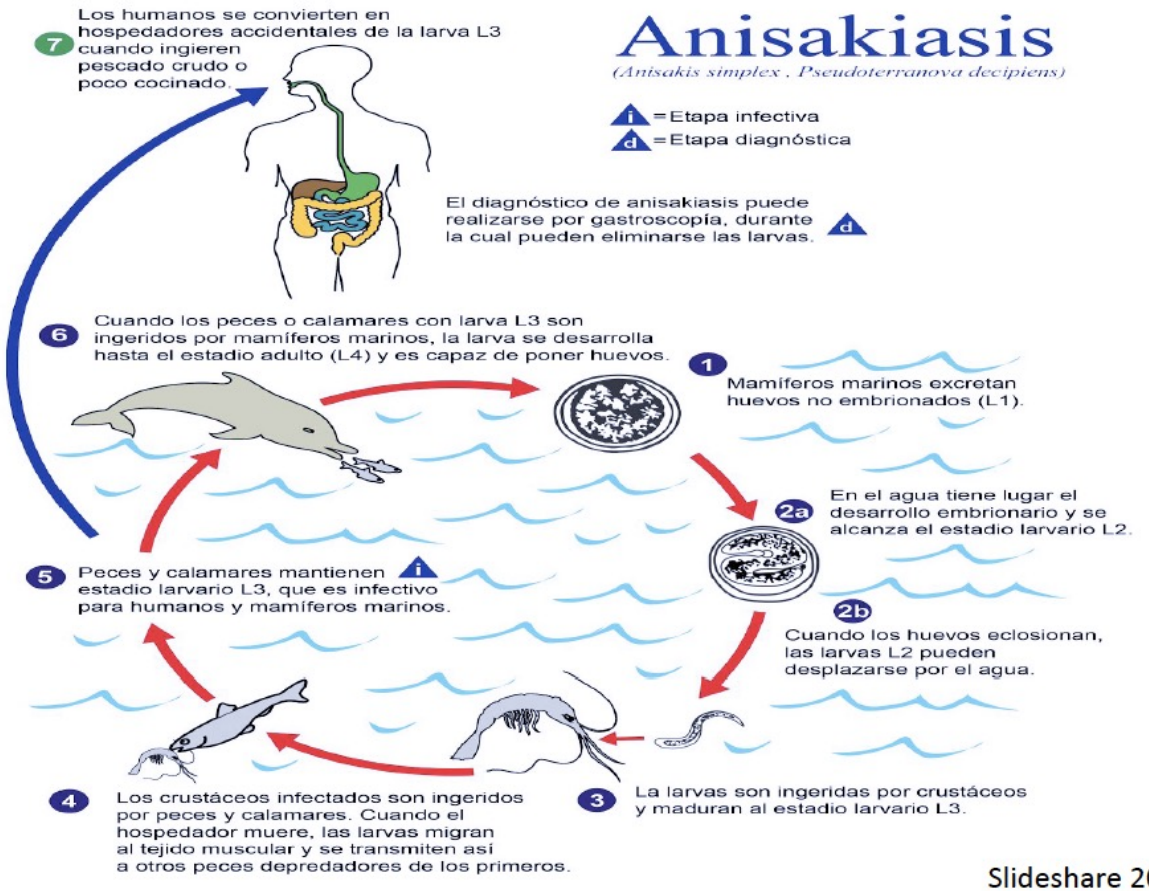

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Pathology of *Anisakis* in humans

PATHOLOGY:

1. Larval *Anisakis* (an L_3) burrows into the wall of the stomach or small intestine

2. Larva eventually dies (humans are abnormal hosts) resulting in an allergic reaction to the dead worm

- this response mimics an ulcer or acute appendicitis

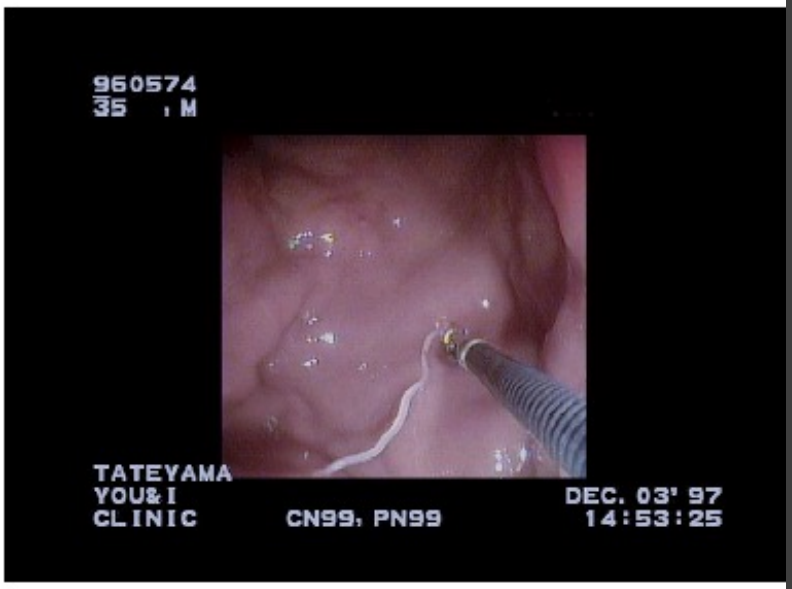
- fatalities have occurred.

Human Cases of *Anisakis* spp.

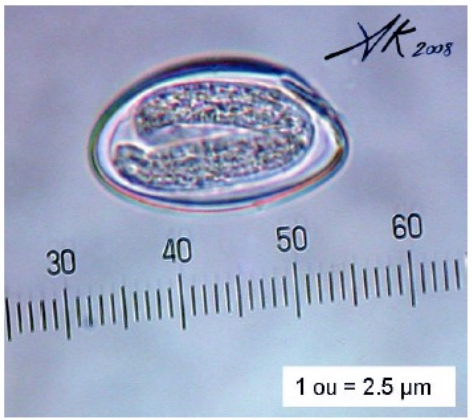
U.S. has ~12 cases/year - mostly in west coast and Hawaii

Japan has about 1,000 cases/year

DIAGNOSIS and TREATMENT - find L_3 by probing and remove it



Enterobius vermicularis



Enterobius vermicularis	
Common Name	Pinworm
Infective Stage	Embryonated Egg
Habitat	Large Intestine
Mode of Transmission	Ingestion of egg/ autoinfection
Diagnostic Specimen	Feces/ Cellophane Tape prep

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Enterobius vermicularis

- Greek: *enteron* = intestine, *bios* = life
- Has the broadest geographic range of any helminth
- Small, white, and thread-like
- Females: ranging between 8-13 mm x 0.3-0.5 mm
  - Possess a long pin-shape posterior end
- Males: ranging between 2-5 mm x 0.1-0.2 mm
- Dwells primarily in the cecum of the large intestine
- Females migrate at night to lay 15,000 eggs on the perineum

Enterobius vermicularis

1. Eggs are deposited at night by the gravid females.

2. Eggs are ingested via person-to-person transmission through the handling of contaminated surfaces (such as clothing, linen, curtains, and carpeting), or airbourne eggs may be inhaled and swallowed. Self-infection may also occur if eggs are transferred from to the mouth by fingers that have scratched the perianal area.

3. After ingestion, larvae hatch from the eggs in the small intestine. The adults then migrate to the colon. The life span of the adults is about two months. Adults mate in the colon, and the males die after mating.

4. Gravid females migrate nocturnally to the anus and ovideposit eggs in the perianal area. The females die after laying their eggs. The time period from ingestion of infective eggs to the ovideposition of eggs by females is approximately one month.

5. The larvae develop and the eggs become infection within 4-6 hours. Newly hatched larvae may also migrate back into the anus, and this is known as retroinfection.

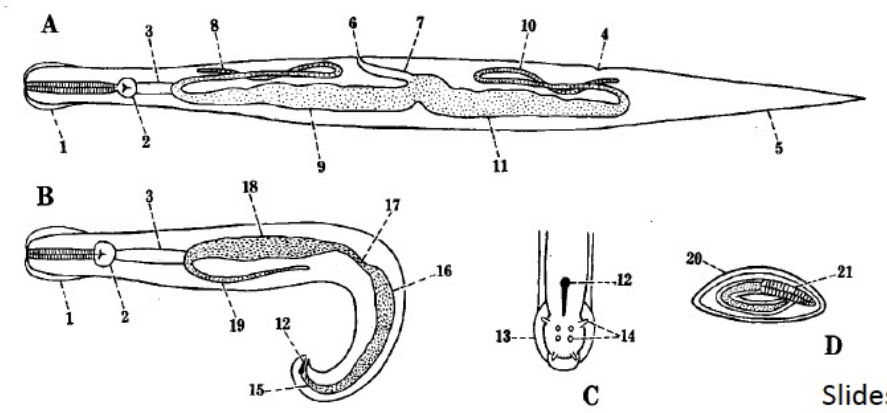
Adults of *Enterobius vermicularis*

Adults live in the caecum.

They feed on bacteria and dead intestinal cells - they do not invade tissue.

Pinworms are recognized by 2 structures:

1. Cephalic alae - winglike extensions of the cuticle at the anterior end
2. Esophageal bulb - muscular bulb at end of esophagus



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Enterobius vermicularis - morphology

Adult Female: *E. vermicularis* have a long, pointed tail (arrow) leading to the common name of pinworm. They are about 8-13 mm in length.

Adult Male: The adult male is about 2-5 mm in length and has a curved, relatively blunt posterior end (arrow).

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Adults of *Enterobius vermicularis*

Female showing esophageal bulb & cephalic alae

Male with curved posterior end

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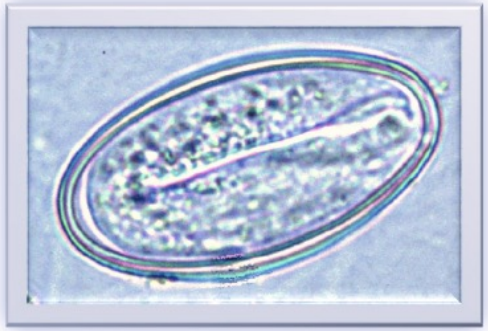
E. vermicularis eggs

- Flattened asymmetrically on one side
- Ovoid
- Approximately 55 mm x 25 mm in size
- Embryonate in six hours
- Can remain viable for about twenty days in a moist environment
- Viable eggs and larvae were found in the sludge of sewage treatment plants in Czechoslovakia in 1992



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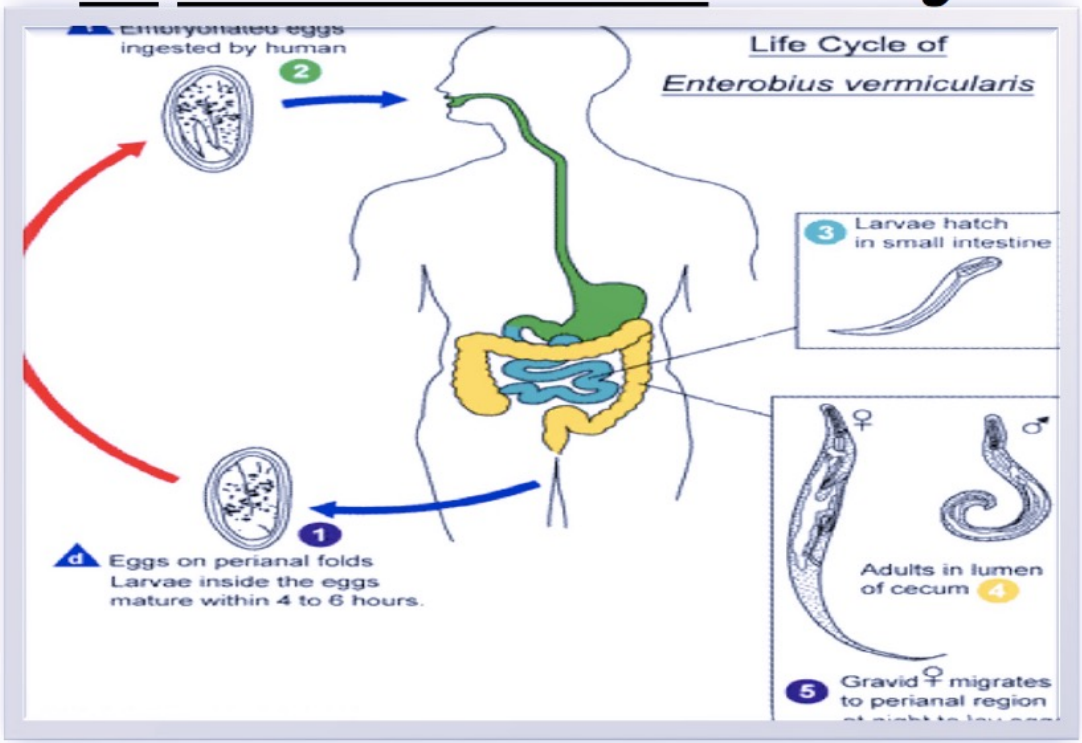
E. vermicularis life cycle



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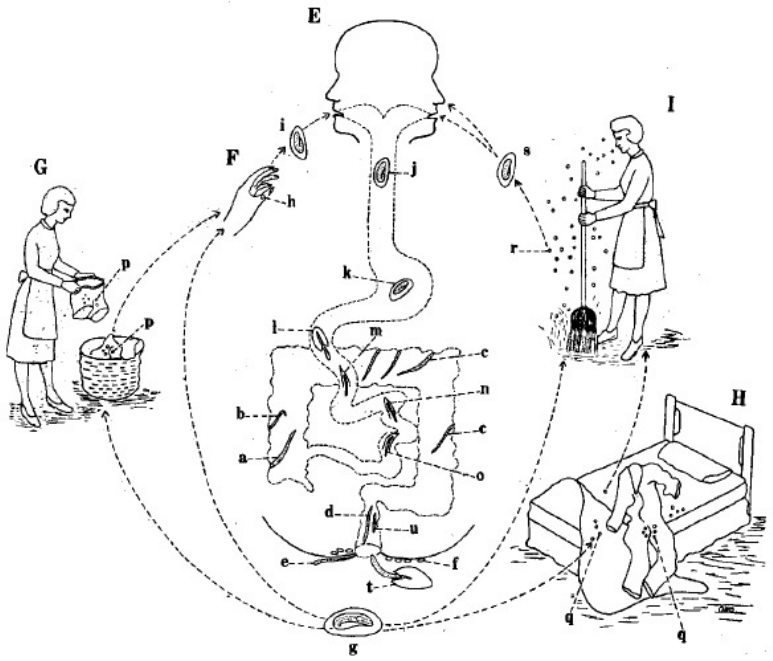
Life Cycle of *Enterobius vermicularis*

1. Adults copulate in the human digestive tract. Male dies after copulation.

2. Female migrates at night to the perianal folds of the anus and deposits eggs (commonly over 10,000) in the skin of the perineum. Female dies after all eggs have been laid.



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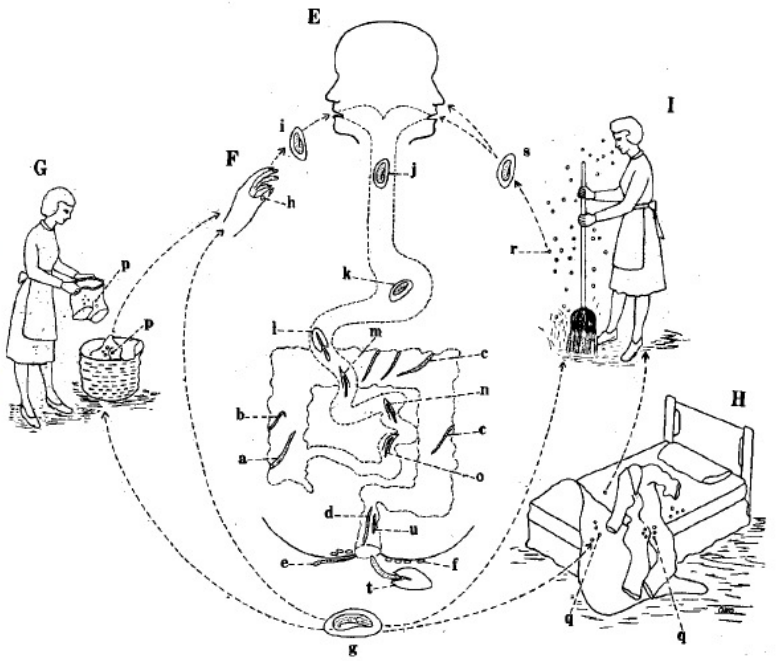
Life Cycle of *Enterobius vermicularis*

3. Eggs contain L_1 larvae when laid, but within 6 hours larvae molt twice in the egg to the L3 stage.

4. Embryonated eggs are infective and when ingested by a human, the L_3 hatch in the small intestine.

5. L_3 molt twice to the adult stage as the worms move into ileum and large intestine.



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E. Vermicularis diagnostic test

- **Scotch tape test**
  - **Most common test**
  - **A clear adhesive cellulose tape is applied to the anal area early in the morning before bathing or defecation**
  - **It is then observed under the microscope for the presence of eggs**
  - **These eggs may also be stained blue with lactophenol cotton blue, which aids in detection and identification**
  - **Sensitivity of this test when performed for three consecutive mornings is 90%**

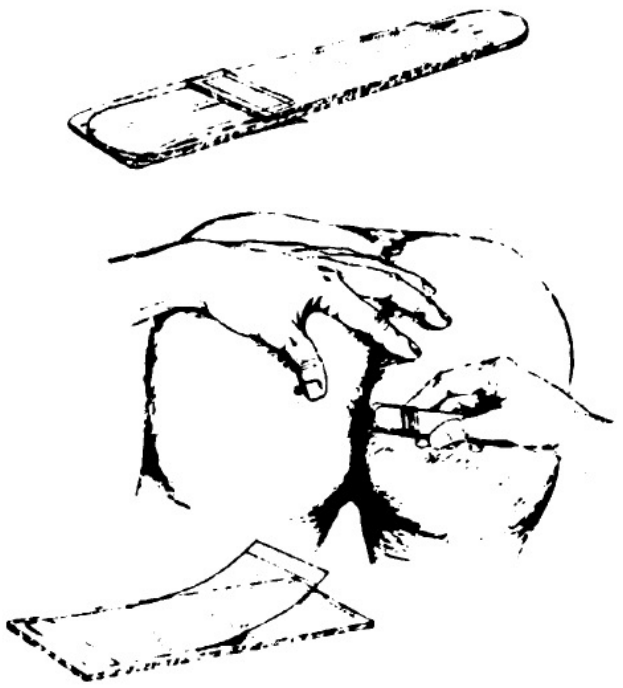
Diagnosis of *Enterobius vermicularis*

Peri-anal swab is commonly used.

Use of double-stick tape on a tongue depresser.

This is pressed against the perianal folds where eggs will stick to the tape.

Tape is then stuck onto a microscope slide and examined for eggs.



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Diagnosis of *Enterobius vermicularis*

DIAGNOSIS - Eggs are distinct.

- football-shaped with one side flattened
- eggshell is smooth

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Enterobius vermicularis

Pathology: itchiness, secondary bacterial infection, nocturnal pruritus ani

Lab diagnosis: Scotch Tape Swab

Treatment of Choice: Mebendazole

Enterobius vermicularis

Almost anybody can become infected with this parasite. No social class is exempt. These parasites soon become "family affairs".

Once one person, usually a child becomes infected, other family members will undoubtedly also become infected.

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Subclass: Spiruria

- **Suborder**: Spirurida

Superfamily:

- **Filarioidea** → **Species**: *Onchocerca volvulus* , *Loa loa*, *Mansonella* , *Dirofilaria repens*, *Wuchereria bancrofti*, *Brugia malayi*, *Brugia timori*
- **Thelazioidea** → **Species:** *Gnathostoma spinigerum*

- **Suborder**: Camallanina → **Species**: *Dracunculus medinensis*

NON-FILARIAL TISSUE NEMATODE INFECTION

Nematode species	Disease	Mode of transmission	Location in human	Diagnosis	treatment
Dracunculus medinensis	Dracunculiasis, Guinea worm disease	Ingestion of infected cyclops in water	Subcutaneous, mainly in lower limbs	clinical	Surgical extraction

Suborder Camallanina

Suborder of nematodes

- Species: *Dracunculus medinensis* (human as final host)
  - Parasites of terrestrial and aquatic vertebrates
  - Copepods as obligatory secondary hosts

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- Also known as:
  - **Guinea worm**
  - **Medina Worm**
  - **Serpent worm**
  - **Dragon worm**

–Disease

- **Dracunculiasis OR Dracontiasis**

- **Males:**
  - » Smaller than females
  - » Coiled posterior
  - » Pairs of caudal papillae (4 pre-anal and 6 post anal)
  - » Copulatory spicule (subequal)
  - » Gubernaculum

- **Females:**
  - Elongated
  - Cylindricaly bluntly round anterior end
  - Recurved caudal
  - Oval shield (anterior end)
  - Minute triangle mouth (Quadrate prominence)
  - Ovarian tubules,oviduct, and uteri –Paired
  - Vagina – not Paired

- **IH – Cyclops**

- **Life Span:**
  - **MALE- 6 MONTHS**
  - **FEMALES- 1 YEAR**
    - **Viviparous**

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- **Larvae:**
  - **Coiled bodies**
  - **Cuticle is striated**
  - **SET FREE – when submerged in water**

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- **Disease:**
  - **– Dracunculiasis or Dracontiasis**
    - **Cutaneous blister**
    - **Secondary bacterial – TETANUS**
    - **Sequelae:**
      - **Arthritis**
      - **Synovitis**
      - **Ankylosis**
      - **Anything involving LIMBS**

- **Diagnosis:**
  - Symptoms followed after development of CUTANEOUS LESION
  - Fluid Discharge by the worm- Rhabditiform
  - No Serologic Test

  - Other tests:
    - Intadermal test
    - Xray
    - Eosinophilia

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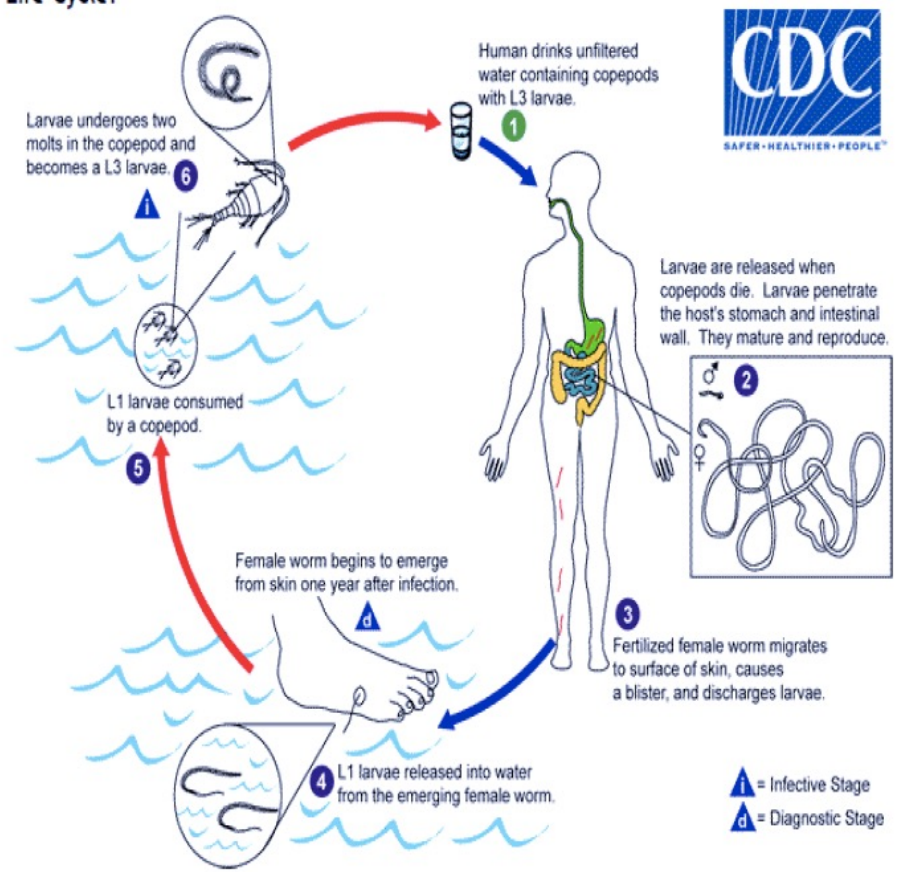
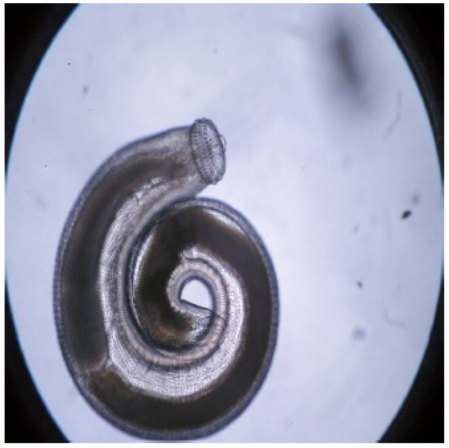
Life Cycle:

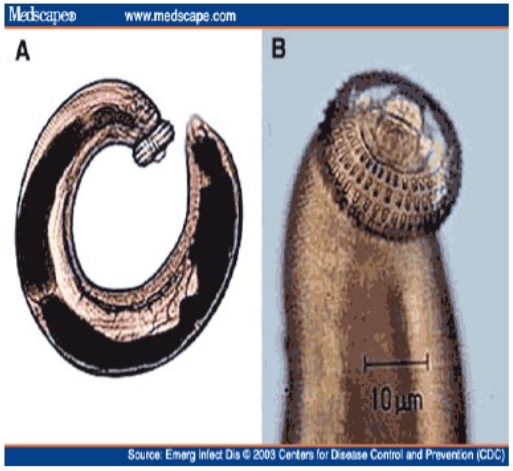

Human drinks unfiltered water containing copepods with L3 larvae.
1
Larvae are released when copepods die. Larvae penetrate the host's stomach and intestinal wall. They mature and reproduce.
2
Fertilized female worm migrates to surface of skin, causes a blister, and discharges larvae.
3
L1 larvae released into water from the emerging female worm.
4
L1 larvae consumed by a copepod.
5
Larvae undergoes two molts in the copepod and becomes a L3 larvae.
6
Female worm begins to emerge from skin one year after infection.
d
= Infective Stage
= Diagnostic Stage

Superfamily: Thelazioidae

Thelazioidea is a superfamily of spirurian nematodes in the large order Spirurida. Like all nematodes, they have neither a circulatory nor a respiratory system.

Species: *Gnathostoma spinigerum*





Gnathostoma spinigerum

Several species of the genus *Gnathostoma* are responsible for the zoonotic infections of man.

The most common being the species *G. spinigerum* commonly found in dogs, cats and several other carnivores.

Human infections have been reported from Japan, China, Thailand, the Far East and the Philippines, mostly acquired from consumption of infected freshwater fish.

- Stout, reddish, slightly transparent with sub-lobose cephalic swelling separated from the remainder of the worm by a cervical constriction
- Curved ventrad at both ends
- Posterior half is aspinous except for a few small terminal spines.
- Cephalic portion is covered with 4-8 rows of sharp, recurved hooks.

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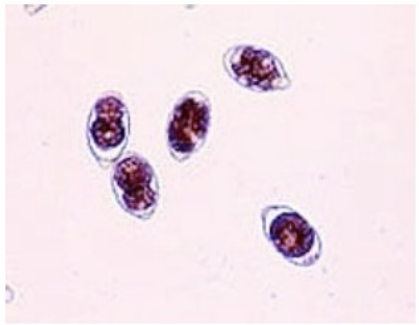
Adult worm

- Female
  - 25-54 mm long
  - More curved tails than males
  - larger
- Male
  - 11-25 mm long
  - Males have red tails

Eggs

- 65-70 by 38-40 µm
- Ovoid, transparent, mucoid plug on one end, unembryonated



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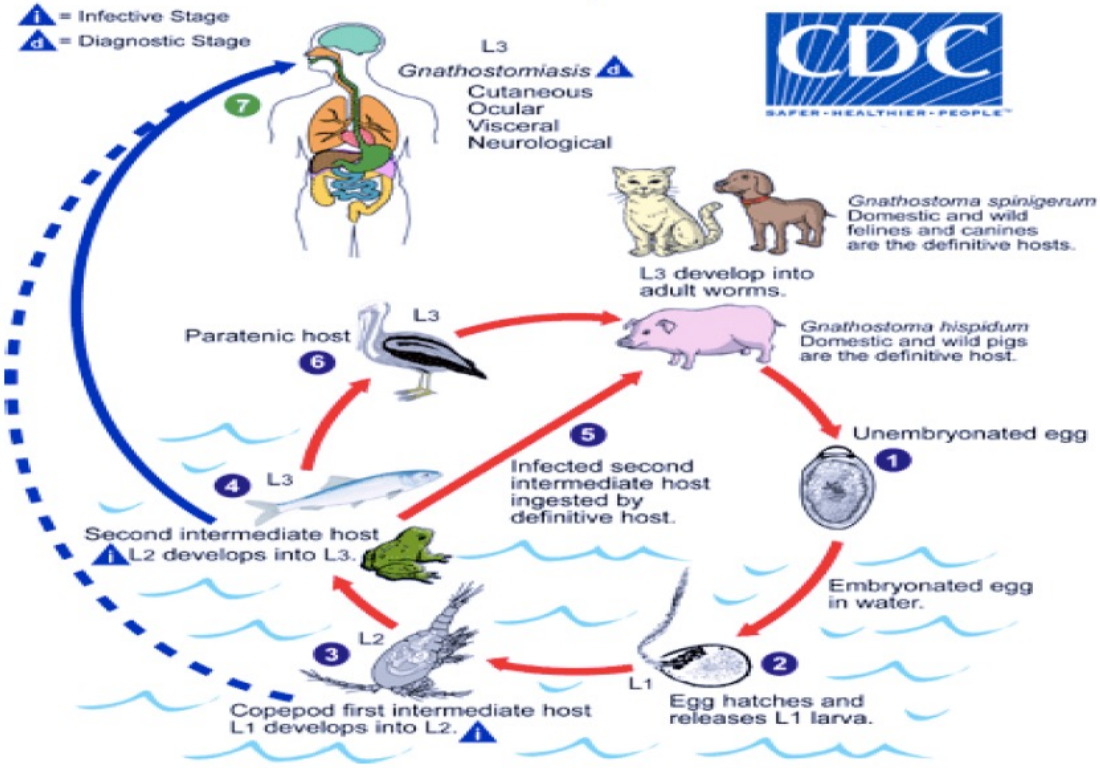
Life cycle

- Natural DH : Domestic and wild felines, dogs, and foxes
- Unnatural DH : Man
- Habitat : Tightly-coiled within tumors of the intestinal walls of the definitive hosts
- Intermediate host
  - 1^{st}: Cyclops
  - 2^{nd}: Fresh water fish, snakes, crabs, crayfish and amphibians

Life Cycle


= Infective Stage
= Diagnostic Stage
L3
Gnathostomiasis
Cutaneous
Ocular
Visceral
Neurological
Gnathostoma spinigerum
Domestic and wild felines and canines are the definitive hosts.
L3 develop into adult worms.
Paratenic host
L3
Gnathostoma hispidum
Domestic and wild pigs are the definitive host.
Unembryonated egg
Infected second intermediate host ingested by definitive host.
L3
Second intermediate host
L2 develops into L3.
Embryonated egg in water.
L2
L1
Egg hatches and releases L1 larva.
Copepod first intermediate host
L1 develops into L2.

Local Epidemiology

- The human cases of Gnathosomiasis (*G. hispidum*) are attributed to the consumption of the fresh water fish *Misgurnus angillicaudatus.*
- In the Philippines the larvae of *G. dolorosi* are found in “dalag” (*Ophicephalus striatus*) in Laguna

Clinical Diagnosis

- **Gnathostomiasis interna**
  - Adult worms are coiled inside tumors of the definitive hosts
- **Gnathostomiasis externa**
  - Due to 3rd stage larva in humans
  - Deep cutaneous and subcutaneous tunnels – visceral larva migrans
- Migration to other tissue results in cough, hematuria, ocular involvement, in serious manifestations eosinophilic meningitis with myeloencephalitis.

Diagnosis

- Presumptive diagnosis may be made on the basis of clinical symptoms.
- Definitive diagnosis is based on the removal and identification of the worm: presence of spines on the cuticle specially on the anterior end of worm, presence of large lateral chords, pigmented granular material in the intestinal cells.

- Intradermal test : antigen extracted from adult or larva of the worm
- Precipitin reaction – specific
- Leukocytes with marked eosinophilia – highly suggestive

Superfamily: Filarioidea

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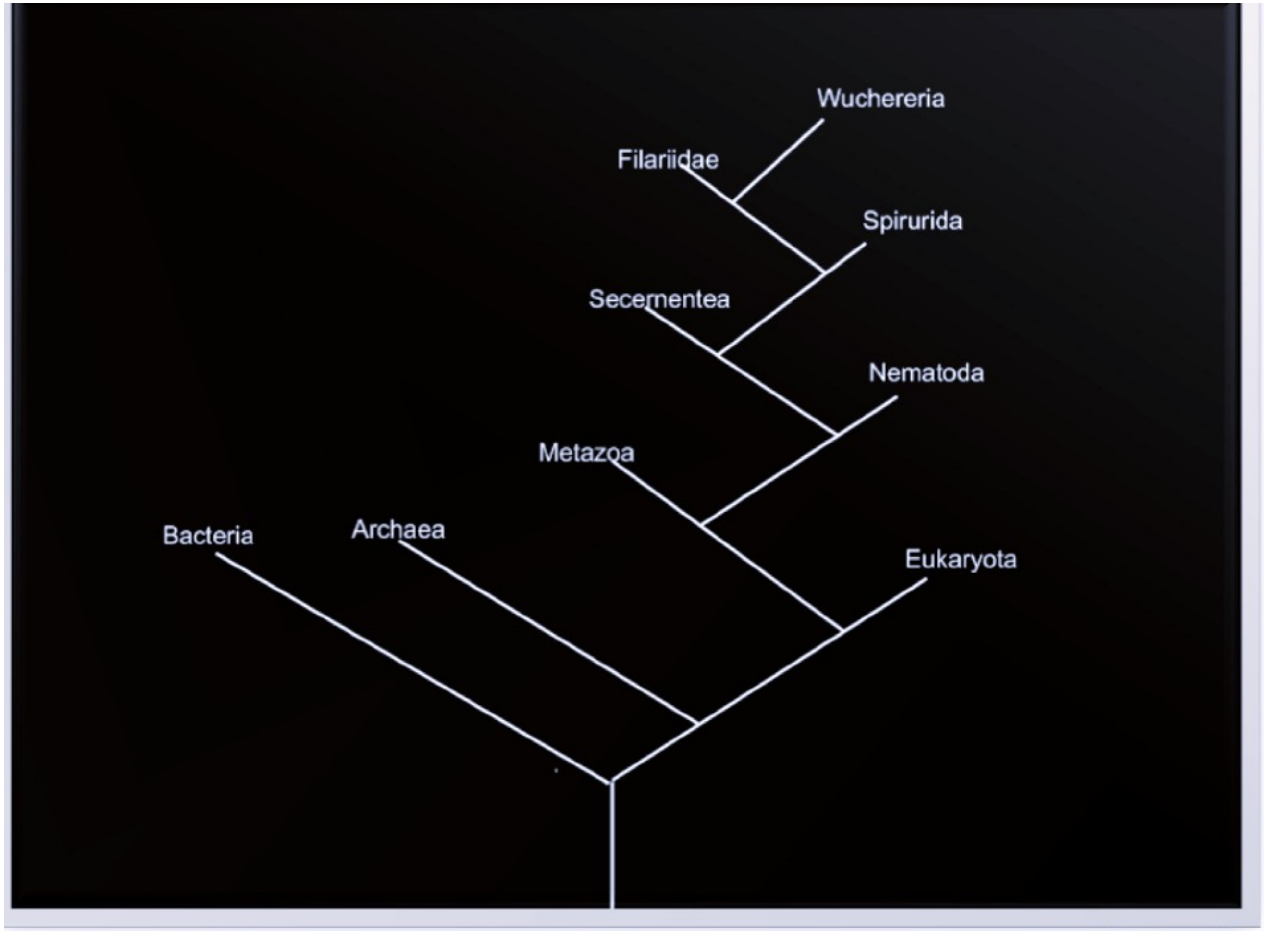

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FILARIAL WORMS

Family Filariidae

Slender filarial worms

Arthropod-transmitted parasite of the circulatory and lymphatic system

Medically important species in the Philippines are *Wuchereria bancrofti* and *Brugia malayi*

The Filariae- General characteristics

- Two morphologic forms: Adult worms and Microfilariae
- Adult worms are usually creamy white and assume a filariform shape
- Have both male and female forms
- Females lay live microfliariae
- Require arthropod vectors
- Exhibit periodicity (Nocturnal/ diurnal)

Filarial Worms' General Features

- Live in tissues or body cavities of a vertebrate host
- Slender, threadlike worm usually 2 to 1 cm
- Common habitat: circulatory system, lymphatic system, connective tissue and serous cavities
- These are transmitted by blood sucking insects
- Requires two hosts to complete the cycle.

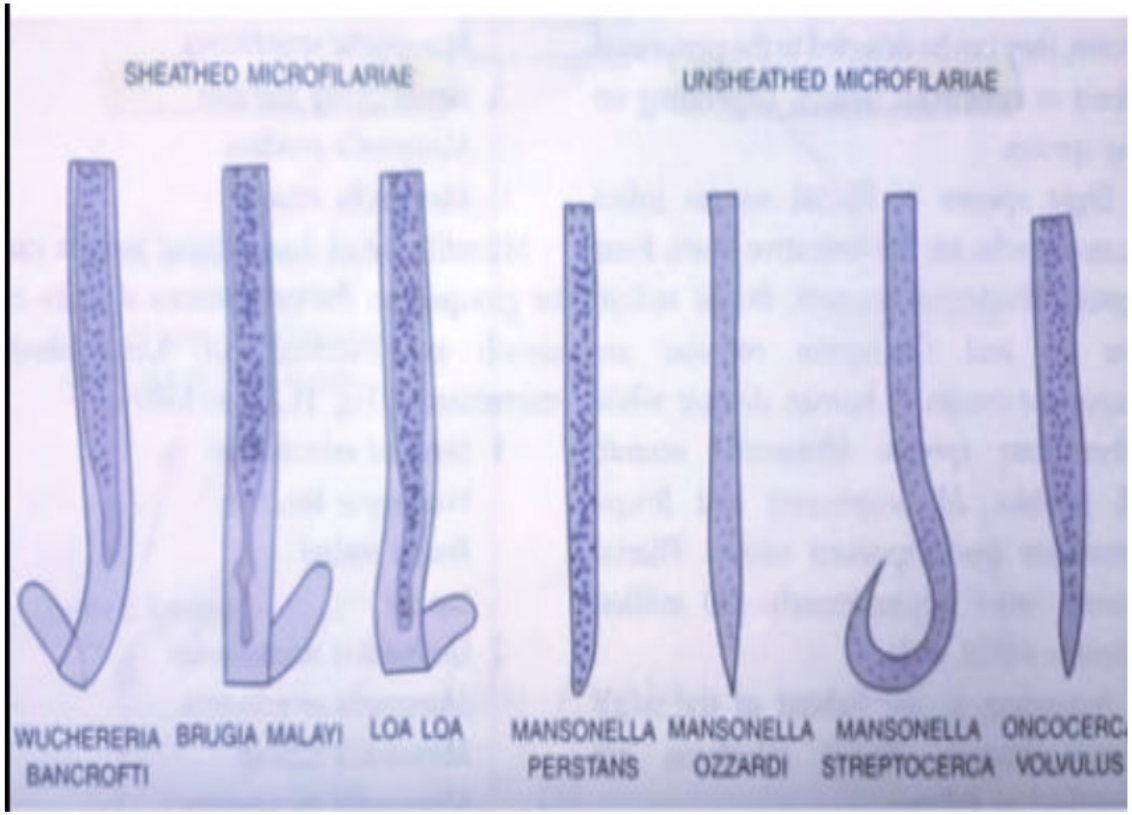
Morphology

Female worms are viviparous and produce less differentiated microfilariae. Males are smaller than the females.

Microfilariae are highly motile threadlike larval forms that in some species retain the egg sheath and hence described as sheathed and in others shed the sheath and described as unsheathed.

Microfilariae can live for a while in the vertebrate host but are unable to develop any further unless taken up by an insect vector.

Microfilariae henceforth develop into filariform larvae in the insect vector which are transferred to the vertebrate host.



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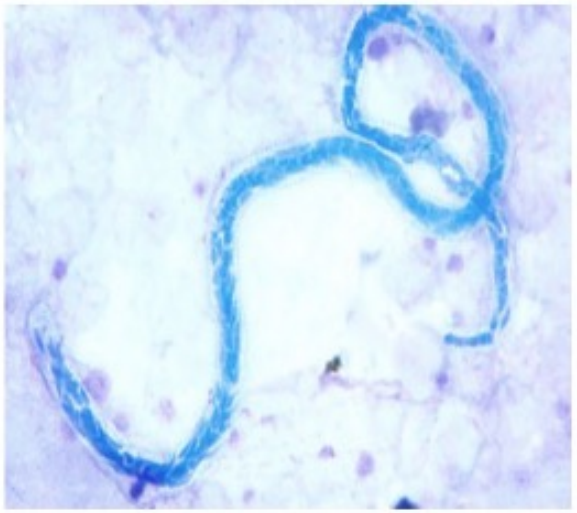
Sheathed

Brugia malayi

- *Wuchereria bancrofti*
- *Loa loa*

Unsheathed



- *M. perstans*
- *M. ozzardi*
- *M. streptocerca*
- *O. volvulus*

Parasites	Adult	Microfilaria	Periodicity	Vector
W. bancrofti	Lymphatic	blood	Nocturnal	*Culex, Aedes, Anopheles*
B. malayi	Lymphatic	blood	Nocturnal	*Aedes, Anopheles, Mansonia*
B. timori	Lymphatic	blood	Nocturnal	*Anopheles*
SUBCUTANEOUS				
L. loa	Connective	blood	Diurnal	*Chrysops*
O. volvulus	Connective	skin	Non periodic	*Simulium*
M. streptocerca	Dermis	skin	Non periodic	*Culicoides*
SEROUS CAVITY				
M. perstans	Body cavity	blood	Non periodic	*Culicoides*
M. ozzardi	Body cavity	blood	Non periodic	*Culicoides*

Species	Disease	Geographic distribution	Location of adult in humans	Location of microfilaria	vector	Lab. diagnosis
Wuchereria bancrofti	elephantiasis	Tropical and subtropical areas	Lymphatic vessels	Blood (nocturnal periodicity)	mosquitoes	Blood film
Brugia malayi	elephantiasis	Asia	Lymphatic vessels	Blood (nocturnal periodicity)	mosquitoes	Blood film
Onchocerca volvulus	Onchocerciasis (river blindness)	Africa, Central and South America, Yemen	Subcutaneous nodules	Skin, eyes, no periodicity	Simulium spp. (black fly)	Skin snip
Loa loa	loiasis	Central Africa	Moving in subcutaneous tissues	Blood (diurnal periodicity)	Chrysops spp. (deer fly)	Blood film

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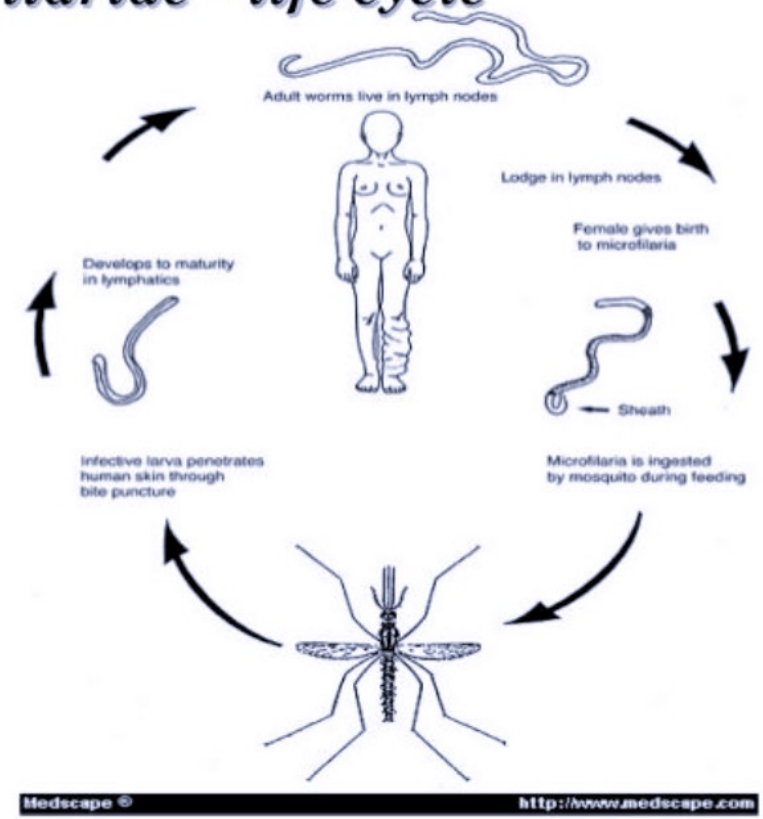
General Life cycle

- Infective third stage larvae are transmitted to man by infected biting arthropods during a blood meal.
- Inside the arthropod, the microfilariae develop in 1 to 2 weeks into infective filariform (third stage larvae).
- The adults dwell in various human tissues where they can live for several years.
- Larva migration and development take place in the tissue.
- Definitive host: man

Microfilariae – life cycle



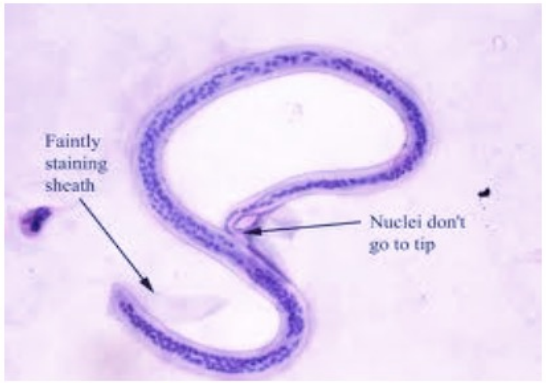
Periodicity

- Nocturnal – when largest number of microfilariae can be found in peripheral blood at night.
- Diurnal - when largest number of microfilariae can be found in peripheral blood during the day.
- Non-periodic – microfilariae circulating at somewhat constant levels all through the day.
- Sub-periodic – microfilariae maybe detected all throughout the day but a larger number can be detected at a certain period during the day.

Lymphatic filariasis

- This disease is transferred by mosquitoes and is found mainly in the tropics and sub-tropics
- Very rarely found in Western countries
- Onset of symptoms is usually slow, but after a couple of years, the lymphatic system will no longer work like it should
- Lymph nodes become enlarged and clogged
- Swelling, discoloration, and thickening of the skin occurs
- Without treatment, the tissue infected with Lymphatic filariasis develops into Elephantiasis

Wuchereria bancrofti



Wuchereria bancrofti	
Common Name	Bancroft's Filaria
Infective Stage	L3 Larva
Habitat	Lymphatics and blood
Mode of Transmission	Bite from infected mosquito (*Culex, Aedes* or *Anopheles*)
Diagnostic Specimen	Giemsa stained smear (collected at night)/ Knott's Technique

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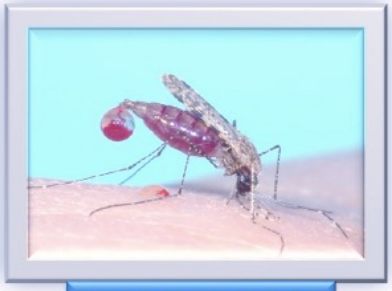
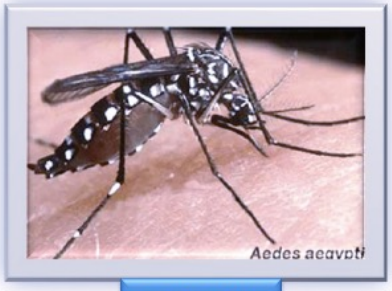
W. bancrofti - epidemiology

- Interactions are with humans and mosquitoes
- Mosquitoes are intermediate hosts
- Humans are definitive hosts
- Microfilariae inhabits the mosquito and the mosquito then transfers the microfilariae to humans when it takes a blood meal
- Some of the common vectors are the *Culex*, *Anopheles*, and *Aedes* mosquito

CULEX



ANOPHELES



AEDES

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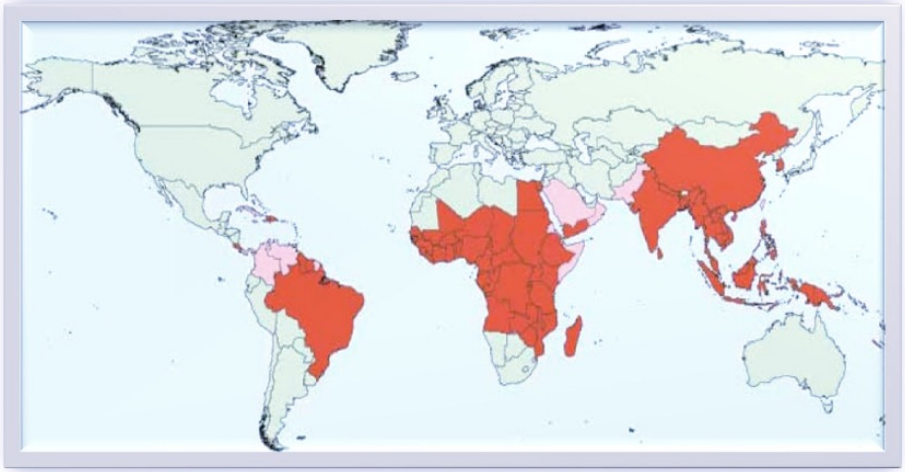
W. bancrofti - epidemiology



RED: Endemic
PINK: Unknown
GREEN: Unaffected

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Brugia malayi

Brugia malayi	
Common Name	Malayan Filaria
Infective Stage	L3 Larva
Habitat	Lymphatics and Blood
Mode of Transmission	Bite from infected mosquito (*Anopheles, Aedes, Mansonia, Amigeres*)
Diagnostic Specimen	Giemsa stained smear (collected at night)/ Knott's Technique

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	Wuchereria bancrofti	*Brugia malayi*
Common name	**Brancroft's Filarial Worm**	**Malayan Filarial Worm**
Final Host	***Anopheles, Aedes, Culex***	***Mansonia bonneae , M. uniformis***
Host – adult	**Lower lymphatic**	**Upper lymphatic**
Diagnostic Stage	**Microfilaria**	**Microfilaria**
Infective Stage	**L_3 filariform**	**L_3 filariform**
Mode of Transmission	**Skin penetration**	**Skin penetration**
Periodicity	**Nocturnal**	**Periodic-nocturnal subperiodic**

	Wuchereria bancrofti	*Brugia malayi*
Cephalic space	**1:1**	**2:1**
Sheath affinity to Giemsa	**Unstained**	**Stained- pink**
Body nuclei	**Regularly shaped**	**Overlapping/ irregular**
Terminal nuclei	**None**	**Two nuclei**
Appearance	**Graceful curve**	**Kinky/ stiff**
Pathology	Bancroftian Filariasis	Malayan Filariasis

Wuchereria bancrofti	*Brugia malayi*

Microfilaria

Wuchereria bancrofti v.s. *Brugia malayi*

Distinguishing Characteristics	*Wuchereria bancrofti*	*Brugia malayi*
Sheath in Giemsa	unstained	Pink
Nuclei	Regularly spaced, separately situated	Irregularly spaced and overlapping
Tail	none	Single row of nuclei that reach tail's end
Terminal Nuclei	None	2 nuclei, which bulge the cuticle; conspicuously placed
Appearance in Blood film	Smoothly curved	Kinky

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Manifestation

- Acute filarial disease “acute attacks”
- Episodes of febrile lymphangitis and lymphadenitis
- Adenolymphangitis (ADL) dermatoadenolymphangitis (DADL)
- Pain, tenderness and swelling of affected areas (limbs, genitals, breast) w/ or w/out fever
- Epididymo-orchitis in males may occur

Pathology

- Clinical manifestations mainly by the adult worms
- Immunologic responses, both humoral and cell-mediated
- Dead or dying worms elicit the most severe inflammation
- Calcification of necrotizing granulomas with dead worms lead to lymphatic obstruction

Elephantiasis

- The thickening of skin and other tissues to produce huge growths on a person's body
- Growths result from the blocking of lymphatic vessels by the parasite
- Usually found in the lower regions of the body
- *W. Bancrofti* can affect the arms, legs, and breasts

PRESENCE OF PARASITE IN LYMPHATIC SYSTEM CAN LEAD TO:

Lymphedema- An abnormal accumulation of lymph in tissues causing swelling of legs , arms, breasts, or genitals

Elephantiasis- disabling and disfiguring lymphedema of the limbs, breast and genitals, accompanied by marked thickening of the skin

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DIAGNOSIS

1. Blood smear examination

   Sample obtained between 10:00 PM – 2:00 AM

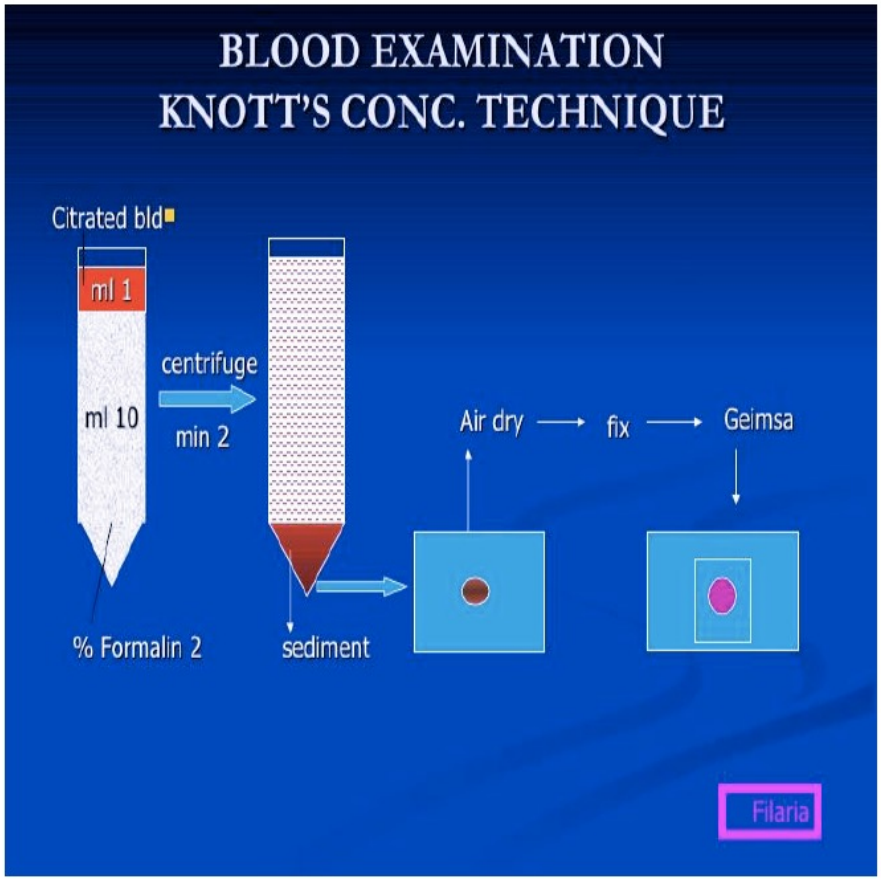
2. Knott's concentration technique

   (2ml blood:10ml of 2% formalin)

3. RDT- ICT- antigen detection (CFA)

Methods of Identification

- **Blood concentration technique**
  - Knott's concentration technique: 2% formaldehyde, centrifuge, methanol, giemsa smear
  - Membrane filtration: Nucleopore, Syringe



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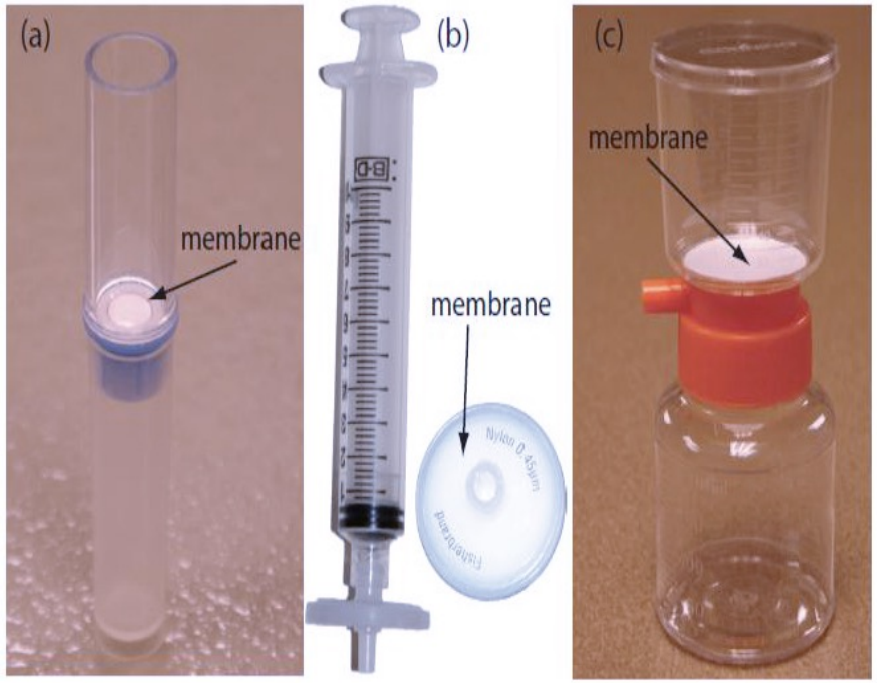

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Treatment, Prevention and Control

1. Single dose
   - Diethylcarbamazine(DEC)
   - Ivermectin
2. DEC-medicated table salt

Treatment, Prevention and Control

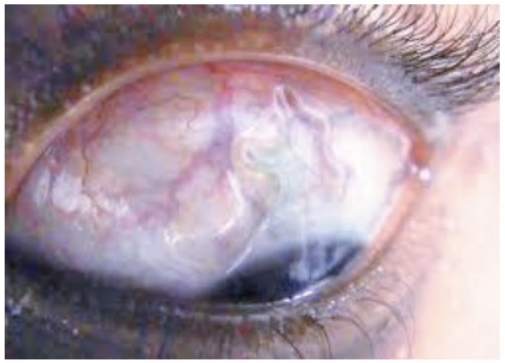
Educate communities about :

- The value of intensive local hygiene

- Awareness on etiology, prevention and control of filariasis

Personal protective measures may help prevent contact with mosquito vectors

Loa loa



Loa loa	
Common Name	African Eye Worm
Infective Stage	L3 Larva
Habitat	Subcutaneous tissue, the eye and bridge of nose
Mode of Transmission	Bite from infected *Chrysops silacea* or *C. dimidiata* (Deer Fly)
Diagnostic Specimen	Giemsa stained smear (collected at midday 10:15to 2:15)/ Knott's Technique

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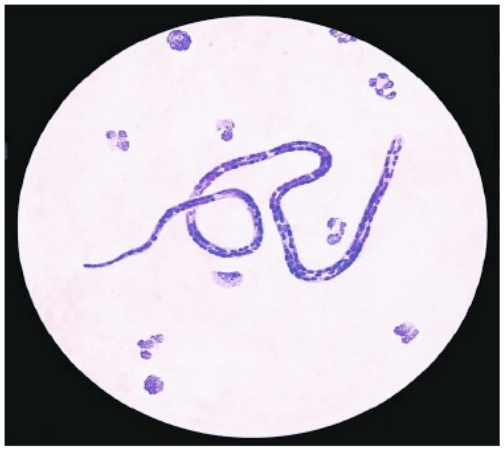
Mansonella ozzardi and *Mansonella perstans*



Mansonella ozzardi and Mansonella perstans	
Common Name	Ozzard's Filaria and Perstans Filaria
Infective Stage	L3 Larva
Habitat	Blood and various tissue
Mode of Transmission	Bite from infected *Simulium* Blackfly or *Culicoides* (sucking midge fly)
Diagnostic Specimen	Fresh Giemsa stained blood smear

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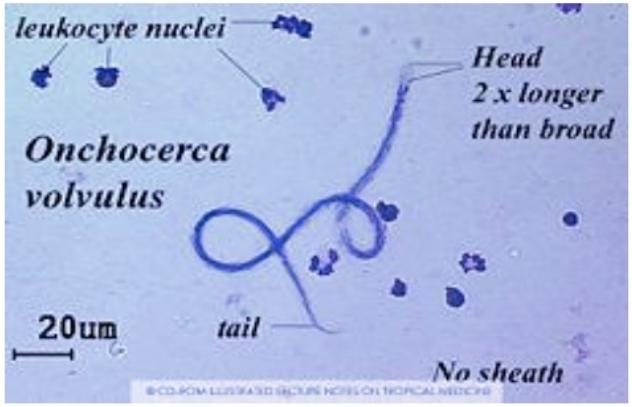
Onchocerca volvulus



Onchocerca volvulus	
Common Name	Blinding Filaria
Infective Stage	L3 Larva
Habitat	Subcutaneous tissue, nodules and eyes
Mode of Transmission	Bite from infected *Simulium* Blackfly
Diagnostic Specimen	Giemsa stained smear of skin snips

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Thank you.