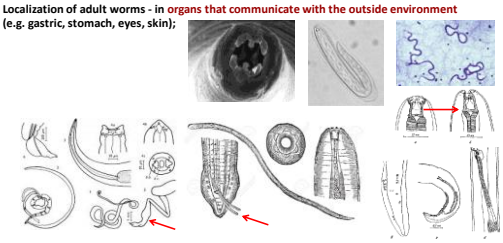
Order: SPIRURIDA

prof. Alica Kočišová, PhD.

SPIRURIDA – general characteristics

- Small to medium sized nematodes (0,3-15 cm);
- Two lips around the mouth;
- An esophagus composed of the front muscular and posterior gland;
- The males have 2 spikules of the same or different lengths;
- Female - ovovivipara (small eggs with coarse packets, embryonated); vivipara (larvae);
- Life cycle – indirect (IH – insects e.g. coprophagous beetles, flies, cyclops);
- Localization of adult worms - in organs that communicate with the outside environment (e.g. gastric, stomach, eyes, skin);



Order: SPIRURIDA

Suborder: CAMALLANINA

Camallanidae: *Camallanus*
Anguillicolidae: *Anguillicola*
Philometridae: *Philometra, Philometroides*
Dracunculidae: ***Dracunculus***, *Avioserpens*

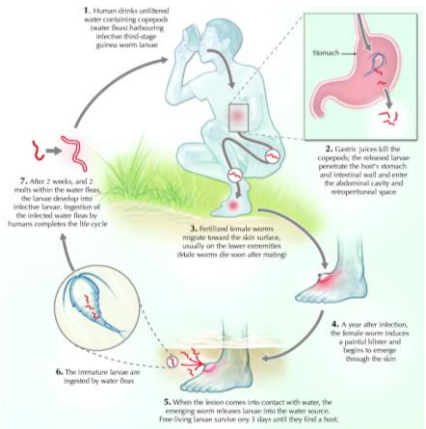
Suborder: SPIRURINA

8 superfamilies

Guinea Worm Disease – Dracunculiasis / *Dracunculus medinensis*

What is it?

- Parasitic worm infection;
- It is caused by the parasite ***Dracunculus medinensis***.



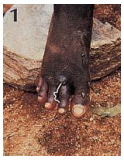
How do you get infected?

1. Infection occurs when larvae of the ***Dracunculus*** is ingested through the drinking water.
2. The larvae has to be first swallowed by an intermediate host. This host is a ***Daphnia***, but often called "water fleas".
3. Daphnia are small crustaceans that are found in lakes where they are a valuable source of food for other marine life.
4. They mature inside of the Daphnia and become infective in about 10 days.
5. Once they have matured they can be swallowed and infect a person.
6. After the infected Daphnia is ingested by a person the stomach acids will digest the Daphnia, but not the mature worms.
7. Males are 40 mm; Females grow up to 1200 mm

The adult female worm measures 50-120 cm by 1 mm and the male is half that size

8. After growing, the female worms migrate to the surface of the body causing a blister to form.
9. This blister causes the person infected to seek water to relieve swelling and pain. This only causes the blister to rupture so that the worm can be exposed and it can lay its larvae.
10. For several days after the worm has been exposed it will release millions of immature worms whenever it comes in contact with water.





Pathology

- Female becomes **swollen** with larvae and body wall breaks;
  - **Releasing larvae just under skin**.
  - Causes **inflammation** which results in a **blister;**
  - Blister breaks and part of worm sticks out
  - **Area of blister is very hot**
    - Relief comes from putting area in **cold water**
    - **Stimulate uterine contractions**
    - Female **releases up to half a million larvae in water**

What are the symptoms?

1. People usually don't develop symptoms until about a year of contact with the contaminated water.
2. A rash accompanied by severe itching develops where the blister is present.
3. Nausea, vomiting, diarrhea, and dizziness might follow right before the worm is about to exit the body.
4. Inadequate access to medical help can lead to some complications.
5. Ulcers may become infected and cause locked joints or even permanent crippling.
6. Some worms may not find their way to the skin surface and become encapsulated in tissues and some found near joints may cause chronic arthritis.




Treatment

1. Only once the worm has emerged from the wound can it be pulled out;
2. Treatment includes the extraction of the adult guinea worm by rolling it a few centimeters per day (which takes weeks or even months to completely remove the worm) or preferably by multiple surgical incisions under local anaesthesia.
3. There are no medications for the complete treatment or prevention of this infection; Metronidazole is effective in killing the worm.
4. Antibiotic ointment is recommended to prevent bacterial infection.



Prevention

1. Drinking clean water;
2. Preventing people with guinea worm ulcers from entering wells and ponds used for drinking;
3. Filtering Daphnia from the drinking water;
4. Treating contaminated water with chemicals like Abate.
5. Protection of drinking water from being contaminated with Cyclops and larvae are effective preventive measures.

Dog, cat:
➢ ***Dracunculus insignis***

Suborder: **SPIRURINA**

Superfamily: GNATHOSTOMATOIDEA
- **Family:** Gnathostomatidae (*Gnathostoma*)

PHYSALOPTEROIDEA
- **Family:** Physalopteridae (*Physaloptera*)

THELAZIOIDEA
- **Family:** Thelaziidae (*Thelazia, Oxyspirura*)

RICTULARIOIDEA
- **Family:** Rictulariidae (*Pterygodermatites*)

SPIRUROIDEA
- **Family:** Gongylonematidae (*Gongylonema*)
- Spiruridae (*Paraspirura, Protospirura, Spirura*)
- Spirocercidae (*Ascarops, Spirocerca, ...*)

HABRONEMATOIDEA
- **Family:** Habronematidae (*Draschia, Habronema, ...*)
- Tetrameridae (*Tetrameres, Microtetrameres*)
- Cystidicolidae (*Cystidicola*)

ACUARIOIDEA
- **Family:** Acuariidae (*Acuaria, Dispharynx, Echinuria, ...*)

FILARIOIDEA

Suborder: **SPIRURINA**

Superfamily: FILARIOIDEA
- **Family:** Filariidae (*Parafilaria, Stephanofilaria, Suifilaria*)

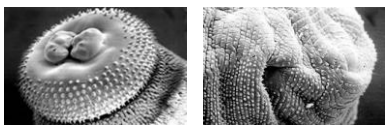
Onchocercidae
- **Subfamily:** Setariinae (*Setaria*)
- Dirofilariinae (*Dirofilaria*)
- Onchocercinae (*Brugia, Onchocerca, Cercopitifilaria, Dipetalonema, Elaeophora, Mansonella, Onchocerca, Wuchereria, ...*)
- Splendidofilariinae (*Cardiofilaria, ...*)
- Lemdaninae (*Eufilaria, Sarconema, ...*)

Superfamily: GNATHOSTOMATOIDEA
Family: Gnathostomatidae - *Gnathostoma*

- Includes several large genera
  - *Tangqua* sp. in reptiles
  - *Echinocephalus* sp. in elasmobranchs
  - *Gnathostoma* sp. in carnivorous, mammals

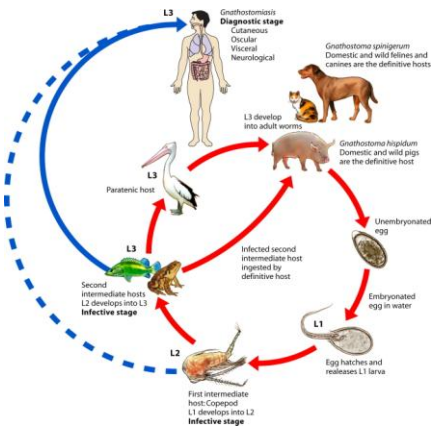
- ***Gnathostoma spinigerum*** can cause infections in **humans**
  - Most common in Japan and Far East
  - Usually from eating undercooked fish, chicken, ducks, or any other amphibian, reptile, or bird.
  - First discovered in stomach of a tiger
  - Can **cause cutaneous larval migrans** (like *A. caninum*)

- ***Gnathostoma spinigerum***
- ***G. hispidum***
- **Geographic distribution:** Asia, especially Thailand and Japan; recently emerged as an important human parasite in Mexico.
- Morphology: Adults: thick short body (1.5 – 3,3 cm)



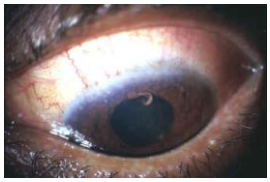
A: Head bulb.
B: Cuticular spines of the posterior body part.

- **FH** - cat and carnivorous „**gastric tumor**"
- **IH1** – water crustaceans
- **IH 2** – exp. fresh water fish
- **paratenic host** – amphibians,reptiles, birds, mammals

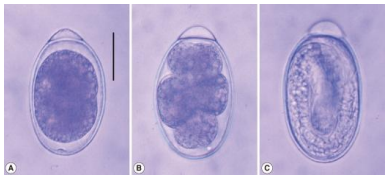


Clinical signs

- In FH – **migration (cca 3 months)**, from stomach into peritoneal cavity, liver, skeletal muscles and connective tissues, and finally back to the stomach, where it embeds its spiny head to mucosa;
- **Gastritis, perforation of the stomach, fatal peritonitis**;
- The clinical manifestations in human gnathostomosis are caused by **migration of the immature worms L_3** following by eating uncooked fish.
- Migration in the subcutaneous tissues causes intermittent, migratory, **painful, pruritic swellings** (**cutaneous larva migrans**).
- Migration to other tissues (**visceral larva migrans**), can result in cough, hematuria, and ocular involvement, with the most serious manifestations eosinophilic meningitis with myeloencephalitis. High eosinophilia is present.



Diagnosis: coprology;



Te: unknown

Prevention: thorough heat treatment of fish meat and gills

THELAZIOIDEA

Family: Thelaziidae - *Thelazia, Oxyspirura, ...*

- **Location –** conjunctival sac, ductus nasolacrimalis
- **Found in birds and mammals**
- **Two species have been found in humans**
  - ***Thelazia callipaeda* – dogs, cat, humans**
  - ***Thelazia californiensis* parasite of dog, cat, sheep, humans, deer and other mammals in western U.S.;**
- **Use face flies as I.H.**
- ***T. skrjabini, T. rhodesi* and *T. gulosa* occur in cattle**
- ***T. lacrimalis* is found in horses**

Pathogenesis, clinical signs

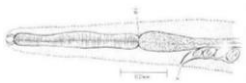
- Infection is frequently inapparent;
- A burden of 10 – 15 worms may cause conjunctivitis, lacrimation, photophobia;
- In more severe cases also keratitis, opaque cornea, ulceration and perforation of the cornea, iridocyclitis, weight loss;
- Eyeworm infection may act as a predisposing factor to bacterial infections;

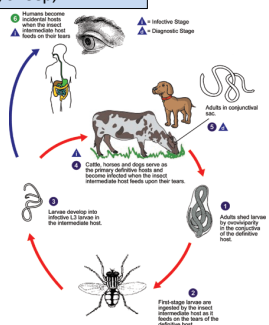
The occurrence of follicular conjunctivitis, ulcerative keratitis and ophthalmia

Therapy:
- Levamizol 5 mg/kg, SC; Ivermectin or doramectin, 0.2 mg/kg, SC / IM; Fenbendazol (10 mg/kg/day/5 ays);
- Pour-on ivermectin or doramectin

Eyeworms of carnivores

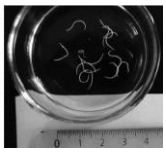
- ***Th. callipaeda*** - dog, fox, cat, man
- ***Th. californiensis*** – US – dog, cat, sheep, ...





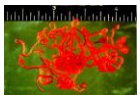
- Conjunctive sac, tear canals, tear glands;
- 8-12 mm;
- Ovoviviparic female - thin-walled egg with a larva collected in tears;
- IH (flies, Drosophilidae) – infection stages L_3 will develop in 2 weeks;
- The larvae actively penetrate into FH - juvenile for about 1 month;

- **Eye irritation;**
- **conjunctivitis;**
- **itching;**
- **swelling;**
- **photophobia;**
- **Surgical removal in total anesthesia;**
- **moxidectin, milbemycin**
- **zoonoses**



Spirocerca, spirocercosis in canids and felis.

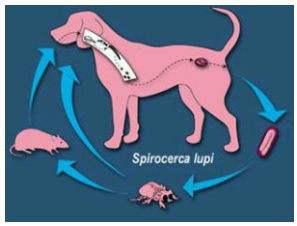
- Parasitic diseases of oesophagus and stomach of dogs and cats, especially in the tropics and subtropics;



- ***Spirocerca lupi***
- 3-8 cm, pink-red worms
- in the nodes of the distal part of the oesophagus, in the stomach and intestinal wall, the thoracic part of the aorta, and or freely in the stomach
- Life cycle – indirect – IH – coprophagous beetles;
- Paratenic hosts - reptiles, birds, small rodents, etc.
- **Eggs**: 30 – 40 µm, oval, 2 thin shells, embryonated, transparent;

Life cycle

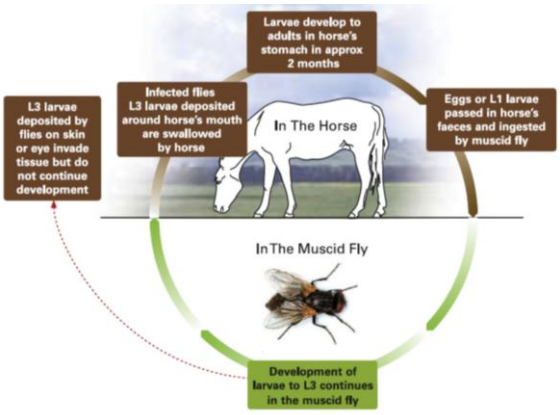
- Egg - IH (beetle) - L_3 (in each beetle approximately 30 larvae);
- In paratenic host larvae encysts in various organs;
- In FH larvae migrate through the stomach mucosa, arteries, and in about 3 weeks they reach the aorta;
- After about 10-12 weeks in the aorta, they migrate to the oesophagus, where they create fistula-associated nodules in the wall;
- Here they reach an adult stage, producing eggs;
- The **pre-patented period** is about 5 to 6 months.



- **Pathogenesis**
  Migrations of L3 larvae develop in the **wall of the aorta of bleeding** and **nodules**; stenoses and aneurysms;
  In the osophagus - **granulomas** in submucosa and connective tissue;
  - ✓ Nodules - the cause of **aortic rupture** and **obstruction**, as well as **oesophageal rupture**.
- **Clinical signs**
  - ✓ Clinical symptoms depend on the location and amount of parasite nodules; **asymptomatic course**;
  - ✓ vomiting, regurgitation, esophageal obstruction, digestive disorders, difficulty breathing and weight loss;
- **Diagnosis**
  - ✓ Endoscopically, sonographically or radiographically;
  - ✓ Examination of the faeces and the finding of oval, embryonated eggs (12 x 30-40 µm) with thick shells;
  - ✓ Post-mortem spirocercus nodes - esophagus and stomach.
- **Therapy**
  - ✓ **Doramectin**;
  - ✓ **Dietylkarbamazine-citrate**
  - ✓ **Milbemycin**
- **Prognosis** - Dubious to unfavorable;
- **Prevention** - is difficult, it is not possible; frequent sources of infection are chickens that are parathenic hosts - cooking.
- ***Spirura rytipleurites*** is a parasite of cats and fewer dogs. Parasites in the stomach wall, rare in the esophagus.

Habronemiasis

➢ Habronemiasis (also called summer sores, **granular dermatitis**, jack sores, bursati, and other terms) is a complex parasitic disease of donkeys, horses, mules, zebras, and dogs and is most commonly in temperate, subtropical, and tropical regions;
➢ is caused by the invasion of ***Draschia megastoma***, ***Habronema majus***, and ***H. muscae*;**
➢ The pathogenic nematode larvae are transmitted by ***house flies***, **face *flies***, and ***stable flies*** while feeding on preexisting **wounds** or on **moist mucus** including **genitalia, eyes, nostrils**, **lips**, and **prepuce**;
➢ The adult nematodes live in the **horse's stomach**, laying eggs, which pass out in the horse's feces.
➢ The most common **aberrant forms** (**conjunctival** and **cutaneous habronemiasis**) are associated with the nematode larvae being deposited in these areas, **not completing its life cycle, with resultant signs probably associated with local hypersensitivity**.
➢ Typical signs include **non healing skin lesions**, **ulceration** of moist areas, **intense itching**, and **formation of exuberant granulomatous tissues;**
➢ In the **gastric form**, nematode larvae are deposited near the mouth, are swallowed, and are able to mature into adults and produce eggs in the stomach of equids;



Conjunctival Habronemiasis produces granulomatous lesions caused by invasion by Habronema spp. larvae occurring on the third eyelid, the eyelid proper, or on the conjunctiva of the medial canthus. Excessive tearing and squinting often accompany these lesions.

Habronemiasis (swamp cancer)

➢ **Conjunctival h.** — granulomatous lesions caused by invasion by ***Habronema*** **spp. larvae occurring on the third eyelid, or the eyelid proper, or on the conjunctiva of the medial canthus;**
➢ **Cutaneous h.** — **is manifested by granulomatous lesions caused by the invasion of skin wounds or excoriations by the larvae of *Habronema* spp. and *Draschia megastoma*. Called also summer sore, bursati, granular dermatitis and jack sores.**
➢ **Gastric h.** — **large granulomatous masses in the gastric mucosa caused by invasion by *Draschia megastoma* larvae. They are usually clinically silent unless perforation of the gastric wall occurs. The larvae of *Habronema majus* and *H. muscae* cause mild gastritis but without the formation of tumors.**

TREATMENT

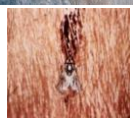
Many different treatments have been used, most with poor results.
- **insect repellents**;
- Some products (such as those containing **ivermectin** or **moxidectin**) with broad-spectrum activity against **adult** parasites have been shown to be effective;
- **Surgical removal** or **cauterization** of the excessive granulation tissue may be necessary;
- **Control of the fly hosts** and regular collection and stacking of manure may reduce the incidence of the disease;
- As with many other diseases, **good sanitation practices significantly reduce the number of cases of cutaneous habronemiasis**;

Superfamily: FILARIOIDEA
Family: Filariidae (*Parafilaria, Stephanofilaria, Suifilaria*)
Onchocercidae
Subfamily: Setariinae (*Setaria*)
Dirofilariinae (*Dirofilaria*)
Onchocercinae (*Brugia, Onchocerca, Cercopitifilaria, Dipetalonema, Elaeophora, Mansonella, Onchocerca, Wuchereria, ...*)
Splendidofilariinae (*Cardiofilaria, ...*)
Lemdaninae (*Eufilaria, Sarconema, ...*)

Blood & tissues (lymphatic) nematodes

PARAFILARIOSIS

- **Equine parafilariosis, commonly known as 'summer bleeding', 'bloody sweats, or "parasitic dermatorrhagia' is a nodular skin disease;**
- **Cased by *Parafilaria multipapillosa* (7 cm);**
- **The small white worm lives in subcutaneous connective tissue.**
- **Mature females pass from the dermis to lay eggs on the skin, causing nodules that bleed. The eggs or liberated microfilariae exit through the bleeding nodules and are, in turn, ingested by blood sucking flies. The intermediate hosts are flies which are attracted by the haemorrhagic discharges and ingest eggs and/or microfilariae;**



- in cattle ***Parafilaria bovicola*;**
- They are thin nematodes reaching length **28-70 mm**
- **Life cycle – indirect – IH – flies;**
- Females living in the subcutaneous tissue wounding the skin, from which the blood comes out of the skin or the exudate. These eggs are excreted in these fluids (ovovivipara), from which larvae are rapidly hatched, **microfilaria (160-190 µm).**
- **Pre-patent period: 5-7 months.**

- With parafilariosis in horses there are associated **small subcutaneous haemorrhages, containing microfilariae**, which are **most prevalent in the summer**;
- *P. multipapillosa* in horses - a common filarial parasite that causes ***dermatorrhagia parasitica*;**

Clinical signs

- The principal clinical signs seen are very **severe subcutaneous inflammation and oedema**;
- With chronicity it may develop a **gelatinous greenish-yellow appearance and a metallic odour**;

Diagnosis

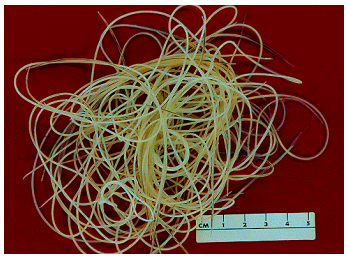
- A diagnosis may normally be based on the presence of typical **clinical signs**;
- When laboratory **confirmation** is required **embryonated eggs** or **microfilariae** may be demonstrated in exudates;
- An **ELISA** technique has been developed in Sweden for the serodiagnosis of parafilariosis. It was shown to have a 95% specificity and 92% sensitivity.

Treatment and control

- Treatment and control of parafilariosis is **difficult** due the **long prepatent period** during which time drugs are thought to be ineffective.
- There are two basic approaches, which are **firstly to kill the parasite in animals** to be slaughtered, and **secondly to reduce or eliminate transmission** of parasites on the farm.
- **Macrocyclic lactones** and **nitroxynil** are the predominant medications registered for parafilaria control. The former is given parenterally as a single dose whereas two doses of nitroxynil are required at an interval of three days.
- Bleeding spots still occasionally occur in treated animals due to the long prepatent period of ***Parafilaria spp.*, and are probably as a consequence of survival of small numbers** of worms rather than re-infection.
- The use of insecticide-impregnated **ear tags** has also been recommended for vector control.

Onchocercidae:

Dirofilariinae: *Dirofilaria*

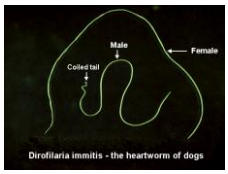


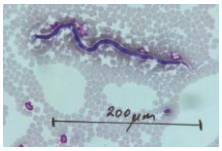
DIROFILARIOSIS

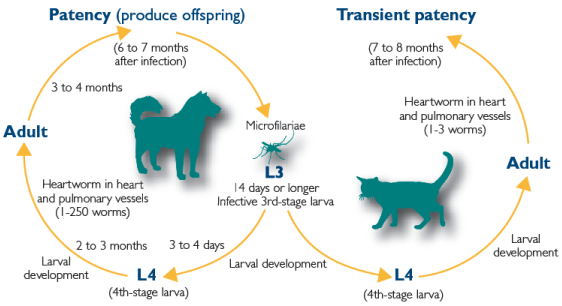
➢ ZOONOSIS

- **1626;**
- Hairy worms - filarias that parasite in the heart and lungs (***Dirofilaria immitis***), or in subcutis (***D. repens***) of carnivores, especially dogs and foxes, but also humans;

- Localization: heart, pulmonary artery; subcutis;
- Size of adult worms: 25-31 cm (female); 12-20 cm (male) - *D. immitis*;
- 10-17 cm (female), 5-7 cm (male) - *D. repens*;



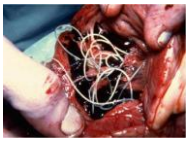


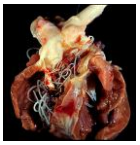


PATHOGENESIS AND CLINICAL SIGNS - *D. immitis*

- general disease - changes in the lungs, right heart, liver and kidney;

- About 3 months after infection - **inflammatory changes** (subendothelial edema, vacuolization, cell infiltration, proliferation and thickening of the vascular wall);
- Alveoli - extended, filled with macrophages and eosinophils;
- **Thrombotic Changes in Pulmonary Arteries and Granulomatous Bone Changes - Chronicity = Pulmonary**;





Dirofilaria immitis

- **Symptoms:** Vomiting, Respiratory insufficiency, chronic cough, exercise intolerance. Death usually comes from cardiopulmonary failure
  - Human cases are rare but can result in chest pain, cough, coughing up blood, fever, malaise
- **Diagnosis:** ELISA test; microfilariae in blood;

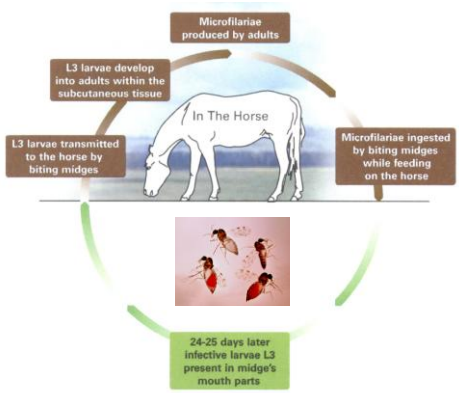
- **Treatment:** Difficult. Early cases can be cured. Dead adult worms may cause more damage than live ones. Can be prevented by giving Ivermectin (Heartguard) during mosquito season.

Subfamily:
Onchocercinae (*Brugia, Onchocerca, Cercopitifilaria, Dipetalonema, Elaeophora, Mansonella, Wuchereria, ...*)

Equine Onchocerciasis

- Is a parasitic infection of horses, with world-wide distribution;
- Caused by a filiarial worm of the genus Onchocerca.
- The adults of *Onchocerca cervicalis*, Railliet and Henry 1910, are found in the ligamentous tissue (sesamoidean ligaments, tendons of distal limbs) adjacent to the nuchal attachment of the thoracic vertebral spinous processes and in and around the supraspinous bursa.

- Most of infected horses do not develop clinical signs: it is supposed that cutaneous onchocercosis represents a hypersensitivity reaction to microfilarial antigens.
- The cutaneous onchocercosis treatment uses endectocids, that only kill microfilariae and not adult forms. Both ivermectin (0.2 mg/kg) or moxidectin (0.4 mg/kg) can be used .



Large ruminants

- ***Onchocerca gutturosa***; nuchal ligament and ligaments in distal limbs (36 cm female; 2,7 cm male)
- ***O. lienalis***; gastrosplenic ligament
- ***O. gibsoni, O. ochengi***; subdermal nodules
- ***O. armillata***; in the chest aorta wall
- Migrating microfilaria damages the eyes;

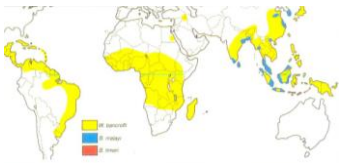
Human filariosis
(*Onchocerca, Brugia, Wuchereria, Loa*).

FILARIOSIS OF LYMPHATIC SYSTEM are severe diseases caused by nematoda endemic in tropical and subtropical regions that are **transmitted by blood to insects** (mosquitoes or horseflies) and characterized by damage to the lymphatic system, resulting in disturbances of lymphatic circulation.

Human lymphatic filariasis

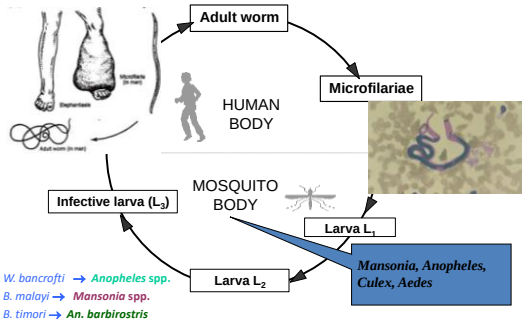
Epidemiology

- 120m people infected in >80 countries in Africa, Asia, the Pacific islands and South and Central America
- 40 m of those infected are disfigured or severely incapacitated
- 95% cases due to ***Wuchereria bancrofti***, other species include ***Brugia malayi*** and ***Brugia timori***



- Vessel and lymph node
- Can live 10-18 years
- Microfilaria in blood, penetrate placenta

LYMPHATIC FILARIASIS LIFE CYCLE



- *W. bancrofti* → *Anopheles* spp.
- *B. malayi* → *Mansonia* spp.
- *B. timori* → *An. barbirostris*

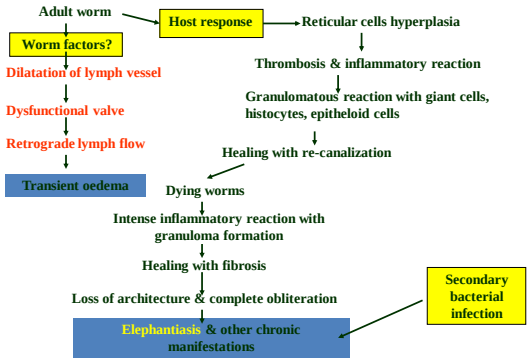
Lymphatic filariasis: Clinical manifestations

1. Acute adenolymphangitis (ADLA)
2. Hydrocoele
3. Lymphoedema
4. Elephantiasis
5. Chyluria
6. Tropical pulmonary eosinophilia (TPE)

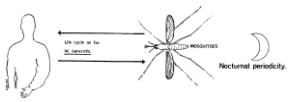
Symptoms and signs – 3 stages

1. **Asymptomatic stage**
2. **Acute stage – Filarial lymphangitis**
3. **Chronic stage**
   - Usually results in **elephantiasis** as a result of chronic lymphoedema
   - There is a massive overgrowth of tissue resulting in **severe deformities**

Chronic manifestations: Pathology



Brugia malayi



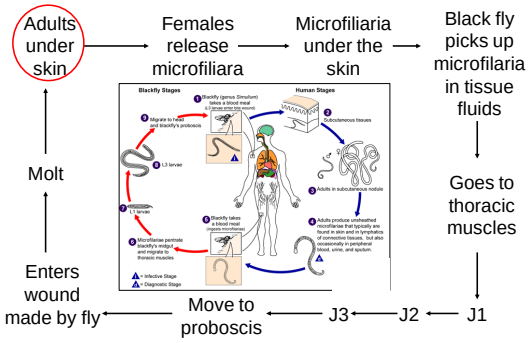
- Very **similar** biology to *W. bancrofti*
- Limited to **Far East** and **Philippines**
  - Not found in Africa or the New World
- Pathology and symptoms similar to *W. bancrofti*
  - **Elephantiasis** generally restricted to distal portions of **arms and legs**

Therapy
Diethylkarbamazine
Suramin
Ivermektin

Onchocercosis

- Disease information: Distribution 35 countries in total. 28 in tropical Africa, where 99% of infected people live. Isolated foci in Latin America (6 countries) and Yemen.
- Causative agent:
- A parasitic worm, ***Onchocerca volvulus*** (**Blinding filariasis**; **river blindness**), which lives in the human body for **up to 14 years**. Each adult female worm produces millions of microscopic larvae (microfilariae), that migrate throughout the body to cause a variety of symptoms.

- Transmission **via the bite of infected blackflies** (*Simulium spp.*) that carry immature larval forms of the parasitic worms from human to human.
- Adult female onchocerca measure **50 cm** by 300 micrometers, male worms are much smaller. Infective larvae of *O. volvulus* are 500 micrometers by 25 micrometers.



Symptoms

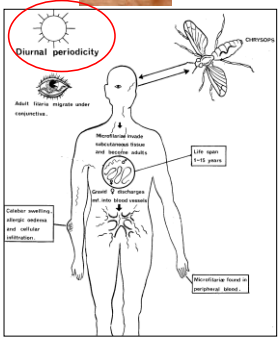
- Onchocerciasis results in **nodular** and **erythematous lesions** in the skin and subcutaneous tissue due to a chronic inflammatory response to persistent worm infection.
- During the incubation period of 10 to 12 months, there is eosinophilia and urticaria.
- **Ocular** involvement consists of trapping of microfilaria in the cornea, choroid, iris and anterior chambers, leading to photophobia, lacrimation and blindness.

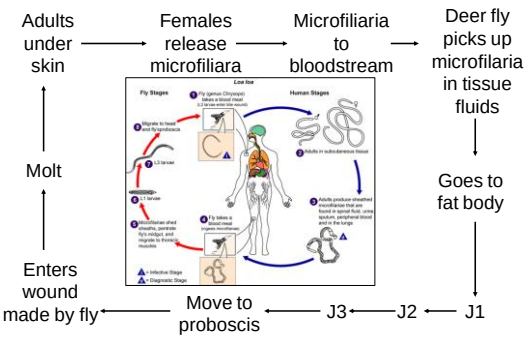
- **Diagnosis:** Microfilaria in *bloodless* skin snip. Microfilaria can also be seen in eye during exam.
- **Treatment:** Ivermectin kills microfilaria and eventually kills adults
- **Prevention:** reduction of Black Fly populations

Loa loa

Intermediate Host: Deer fly, horse fly

- The infection results in **subcutaneous (Calabar) swelling**, measuring **5 to 10 cm** in diameter, marked by erythema and angyoedema, usually in the extremities.
- **migrates under the skin** at a rate of up to an inch every two minutes.
- Consequently, the swelling appears spontaneously, persists for 4 to 7 days and disappears, and is known as fugitive or Calabar swelling.
- The worm usually causes no serious problems, **except when passing through the orbital conjunctiva or the nose bridge**.
- The diagnosis is based on symptoms, history of deer fly bite and presence of eosinophilia. Recovery of worms from the conjunctiva is confirmatory.
- Treatment and control are the same as those for onchocerciasis





Loa loa

- **Diagnosis:** Microfilaria in the peripheral blood during the day
  - Microfilaria move to lungs at night
- **Treatment:** DEC (**Diethylcarbamazine**) is usual treatment but is worse than the worm. Ivermectin does not kill adults but prevents re-infection. Adults just under the skin or in eye can be removed surgically.
- **Prevention:** Avoid deer fly bites and reduction of deer fly populations.

Other filarial worms of humans

- ***Mansonella ozzardi***
  - Live in the mesenteries and peritoneum
  - Found in New World only
  - Uses mosquitoes and black flies as IH.
- ***Mansonella perstans***
  - Tropical Africa and South America
  - Uses primates as reservoir host
  - Live in coelom
  - Use mosquitoes as IH.
- ***Mansonella streptocerca***
  - Lives just under skin of humans in rainforest of Africa