


Biomedical Parasitology


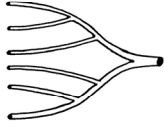

Filarial nematodes



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Nematode infections

gastro-intestinal	vascular	tissues, organs
		
simple cycle (egg infective) diarrhoea/obstruction	vector-borne (microfilariae) oedema	intermediate hosts (larval stages) lesions/malfunction
complex cycle (larvae infective) blood loss/anaemia		

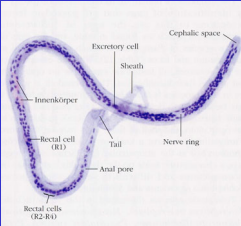
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VASCULAR NEMATODES

Group of spirurid nematodes

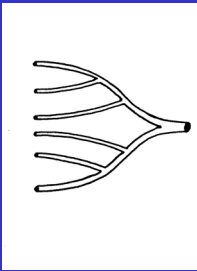
Filarial worms

- thread-like adults in tissues/vessels
- viviparous production of L1 larvae (called microfilariae)
- microfilariae present in blood or tissues
- taken up by insect vectors (develop to infective L3)
- problems caused by mf obstructing micro-circulation



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VASCULAR NEMATODES



Onchocerca volvulus

Wuchereria bancrofti

Brugia malayi

Brugia timori

Loa loa

Mansonella streptocerca

Dirofilaria immitis



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FILARIAL NEMATODES

<i>Onchocerca</i>	blindness, skin lesions Africa, Central America	adults subcutaneous mf in tissues	blackfly
<i>Wuchereria</i>	Bancroftian filariasis (elephantitis) tropics	adults in lymphatics mf in blood	mosquito
<i>Brugia</i>	Malayan/Timorian fil. (elephantitis)	adults in lymphatics mf in blood	mosquito
<i>Loa</i>	Calabar swellings Central/West Africa	adults subcutaneous mf in blood	tabanids
<i>Mansonella</i>	skin lesions Central America	adults in dermis mf in blood	sandfly/blackfly
<i>Dirofilaria</i>	pulmonary lesions widespread	adults in heart mf in blood	mosquito

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Microfilariae

microfilariae in blood blood-sucking vectors e.g. mosquitos	microfilariae in tissues pool-feeder vectors e.g. blackflies
	

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PERIODICITY

Temporal and spatial distribution of microfilariae exhibit phenomenon of periodicity depending on vector feeding habits

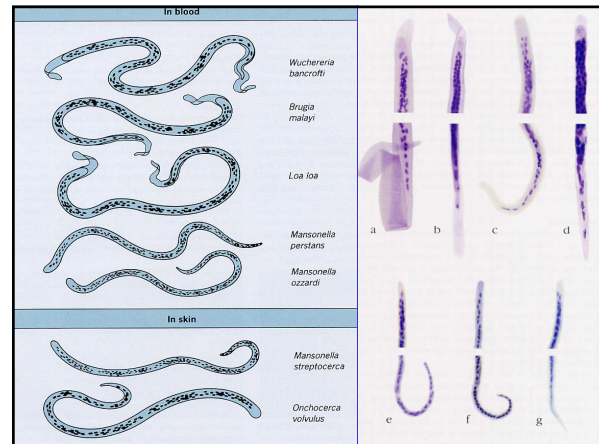
e.g. *Wuchereria* normally exhibits **nocturnal** periodicity to maximize transmission to **night-biting** *Culex* and *Anopheles* mosquitos

but infections in East Pacific Islands exhibit **diurnal** periodicity because vectors are **day-biting** *Aedes* mosquitos

e.g. *Onchocerca* in Africa normally concentrates in **lower body** to maximize transmission to **low-biting** *Simulium damnosum*

but infections in Guatemala concentrate in the **upper body** because vector is **high-biting** *Simulium ochraceum*

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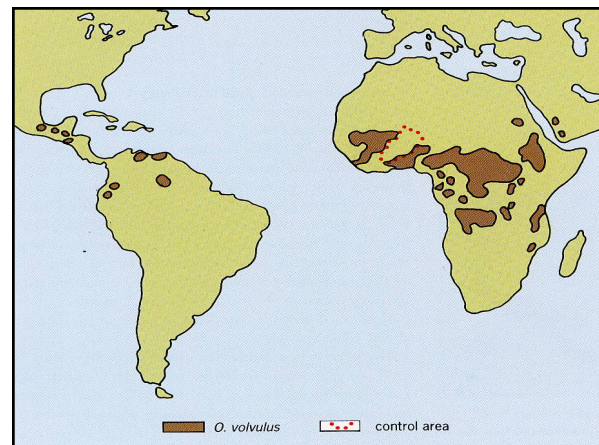
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Onchocerca (nodule worm)

Order: Spirurida
Family: Filariidae

- thread-like worms coiled in nodules in connective tissues
- microfilariae in tissues
- blackfly vectors
- originated in Africa, taken to Central America

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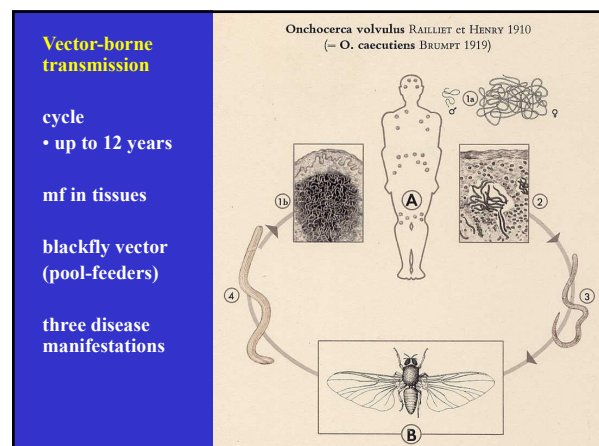
Onchocerca (filarial worm)

adult worm up to 50 cm in subcutaneous nodules

microfilariae 220-360 μm in tissues

O. volvulus pathogenic in humans
several pathogenic species in animals

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Pathogenesis

chronic inflammatory responses in skin

- dermatitis, pruritis, oedema, depigmentation
- pachydermia = wrinkling (crocodile/elephant skin)




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Pathogenesis

river blindness, two types of lesions


- anterior lesions (mf in cornea), sclerosing keratitis, corneal opacities, conjunctivitis
- posterior lesions (mf in retina), marked sclerosis (hardening) of choroidal vessels, chorioretinal lesions



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Pathogenesis

- subcutaneous nodules usually over bony prominences (especially pelvis in Africa and on head in Mexico)



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Wuchereria/Brugia/Loa/Mansonella

Order: Spirurida Family: Filariidae

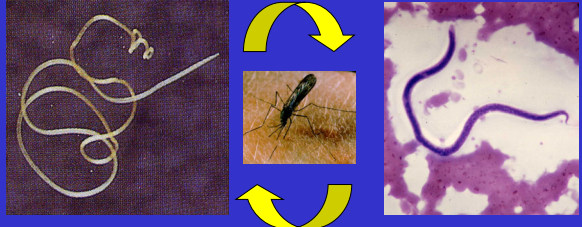
- thin thread-like adults in lymph vessels/skin
- cause lymphatic obstruction or painful swellings



An illustration in 'Yama'zoshi' of leg elephantiasis in a woman approximately 800 years ago, which is preserved in the Tokyo National Museum. Reproduced

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Wuchereria/Brugia

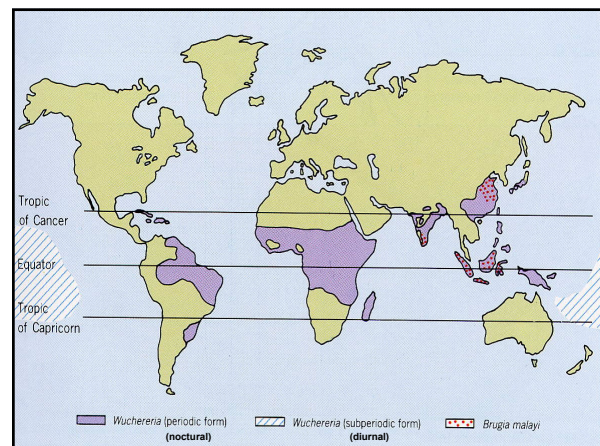


adults 40-100 mm in lymph vessels

microfilariae 230-260 µm in blood

transmitted by mosquitos
cause lymphatic filariasis (elephantiasis)

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Vector-borne transmission (mosquitos)

cycle
3 months – 17 years

esp. prevalent in tropics where vectors abound

chronic infections may cause severe disfiguring disease

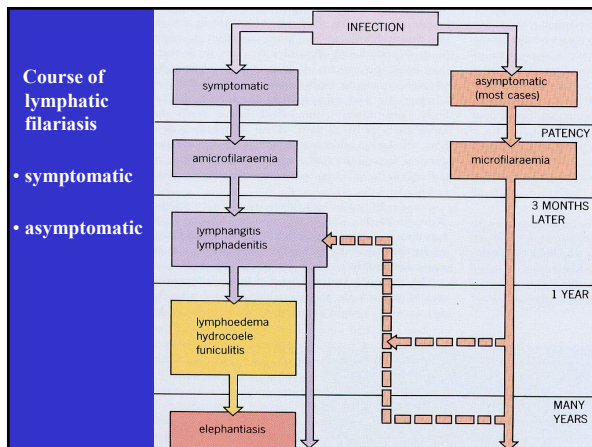
Wuchereria bancrofti SEURAT 1921
W. malayi RAO et MARLESTONE 1940

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Pathogenesis

- occlusion of lymphatic vessels (by worms producing numerous microfilariae)
- exacerbated by inflammation (cellular infiltrates)

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Disease

acute manifestations

- recurrent adenolymphangitis (inflammation of lymph ducts) especially in groin
- fever, nausea, headaches, rash, eosinophilia

chronic manifestations

- lymphoedema (elephantiasis)
- tropical pulmonary eosinophila (TPE) rarer

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Disease

chronic manifestations

- calcified lymph nodes
- obstruction of spermatic lymph vessels and chyluria (urine containing lymph)

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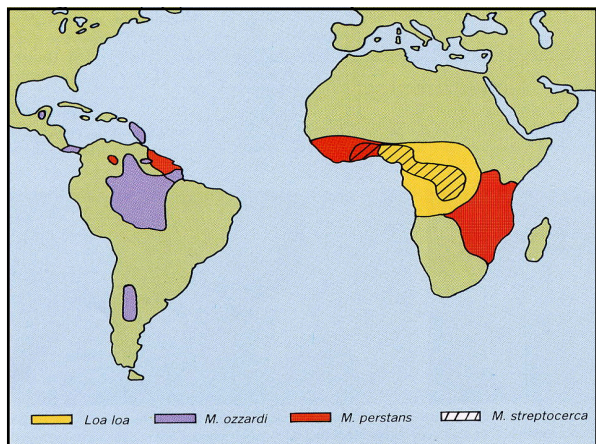
Loa/Mansonella

adults 60-90 mm in skin

microfilaria 200-300 μm in blood

transmitted by tabanid/sand/blackflies/midges cause painful swellings

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Vector-borne transmission
(tabanid, sandfly, blackfly)

cycle
3 months – years

esp. prevalent in tropics where vectors abound

infections may cause transient swelling and eye lesions

Loa loa CASTELLANI et CHALMERS 1913

The diagram illustrates the life cycle of *Loa loa*. It shows a human figure (A) with arrows indicating the entry of larvae into the eye and the exit of adults. A circular inset shows the life cycle stages: 1. Larva in blood, 2. Larva in eye, 3. Larva in skin, 4. Larva in blood, 5. Larva in eye, 6. Larva in skin, 7. Larva in blood. A mosquito (B) is shown as the vector, with arrows indicating the transmission of larvae between the human and the mosquito.

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Disease

- painful oedematous Calabar swellings transient (disappear and reappear elsewhere)
- pruritis, fever
- eosinophilia
- sometimes encephalitis, myocardial fibrosis

A close-up photograph of a person's hand showing a large, raised, oedematous swelling (Calabar swelling) on the back of the hand.

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Disease

- adults cross conjunctiva
- extreme discomfort
- loss of vision
- surgical removal

Three photographs showing eye lesions caused by *Loa loa*. The first shows a conjunctival lesion, the second shows a larva on the conjunctiva, and the third shows a surgical procedure to remove a larva from the eye.

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***Dirofilaria* (heartworm)**

Order: Spirurida
Family: Filariidae

- adult in heart
- microfilaria (L1) in blood
- mosquito vectors

Image of a box of Heartgard 30 (ivermectin) chewables for dogs. The box includes a caution label, the product name, and instructions for use.

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***Dirofilaria* (heartworm)**

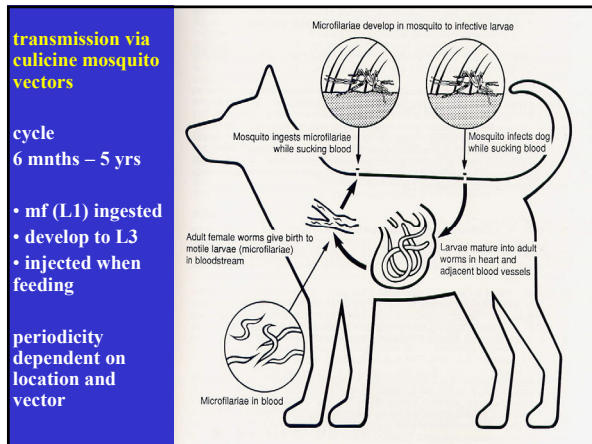
The diagram shows the life cycle of *Dirofilaria immitis*. It includes a mosquito (vector), a scale bar, and a microscopic image of a microfilaria. Yellow arrows indicate the cycle between the mosquito and the host.

adult 12-30 cm in heart

microfilaria 310 μm in blood

major pathogenic species in dogs (sometimes cats and humans)

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Pathogenesis

in dogs/cats

- interfere with circulatory function
- cardiac insufficiency
- chronic cough, lack of stamina, exercise intolerance, listlessness
- chemotherapy - adults killed with arsenamide (but dead worms dislodge to lungs to occlude pulmonary arterial branches causing infarction)
- chemoprophylaxis - systemic anthelmintics used to kill infective larvae

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Pathogenesis

in humans

- pulmonary granuloma formation

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TREATMENT - nematocides

Anthelmintic	diethylcarbamazine		ivermectin	
	mf	adults	mf	adults
<i>Onchocerca</i>	++	+	+++	+
<i>Wuchereria/Brugia</i>	++	+	+++	+
<i>Loa/Mansonella</i>	++	+	+++	+
<i>Dirofilaria</i>	++	+	+++	+

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Treatment

- nodulectomy (removal of *Onchocerca* nodules from superficial aspects to stop microfilariae production and attendant pathology)

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SUMMARY - FILARIAL NEMATODES

<i>Onchocerca</i>	blindness, skin lesions	adults subcutaneous mf in tissues	blackfly
<i>Wuchereria Brugia</i>	Baneroftian filariasis Malayan/Timorian fil.	adults in lymphatics adults in lymphatics mf in blood	mosquito
<i>Loa Mansonella</i>	Calabar swellings skin lesions	adults in skin adults in skin mf in blood	flies
<i>Dirofilaria</i>	pulmonary lesions	adults in heart mf in blood	mosquito

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