

Lymphatic Filariasis

Budi Setiawan

(Department of Medical Laboratory Technology –
Poltekkes Kemenkes Yogyakarta)



Introduction

- Filariasis is a group of human and animal infectious diseases caused by nematode parasites of the order Filariidae. Commonly called “filariae”
- 229 species parasitic in mammals, 225 species parasitic in birds, 30 species parasitic in reptiles, 23 species parasitic in amphibians.
- Adult filarial worms live in vessels, tissues and body cavities.
- Females produce embryos called microfilariae.
- Larval development takes place in bloodsucking invertebrate intermediate hosts.



Taxonomic position of human filariae



Order FILARIOIDEA

Family Filariidae

Family Stephanofiliariidae

Family Dipetalonematidae

Subfamily Dipetalonematidae

Genus *Dipetalonema*

Dipetalonema perstans

Dipetalonema streptocerca

Genus *Wuchereria*

Wuchereria bancrofti

Genus *Brugia*

Brugia malayi

Genus *Mansonella*

Mansonella ozzardi

Subfamily Dirofiliariinae

Genus *Loa*

Loa loa

Subfamily Oncocercinae

Genus *Oncocerca*

Oncocerca volvulus





Classification of Human Filarial Worms

- Lymphatic Filariasis
- Subcutaneous filariasis
- Serous cavity filariasis
- Zoonotic filariasis

Lymphatic Filariasis

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Brugia timori*

Subcutaneous filariasis

- Loa loa (Calabar swelling/Fugitive swelling)
- Onchocerca volvulus (River blindness, dermatitis)
- Mansonella streptocerca (Skin diseases)

Serous/Body cavity filariasis

- *Mansonella ozzardi* (Non-pathogenic)
- *Mansonella perstans* (Non-Pathogenic)

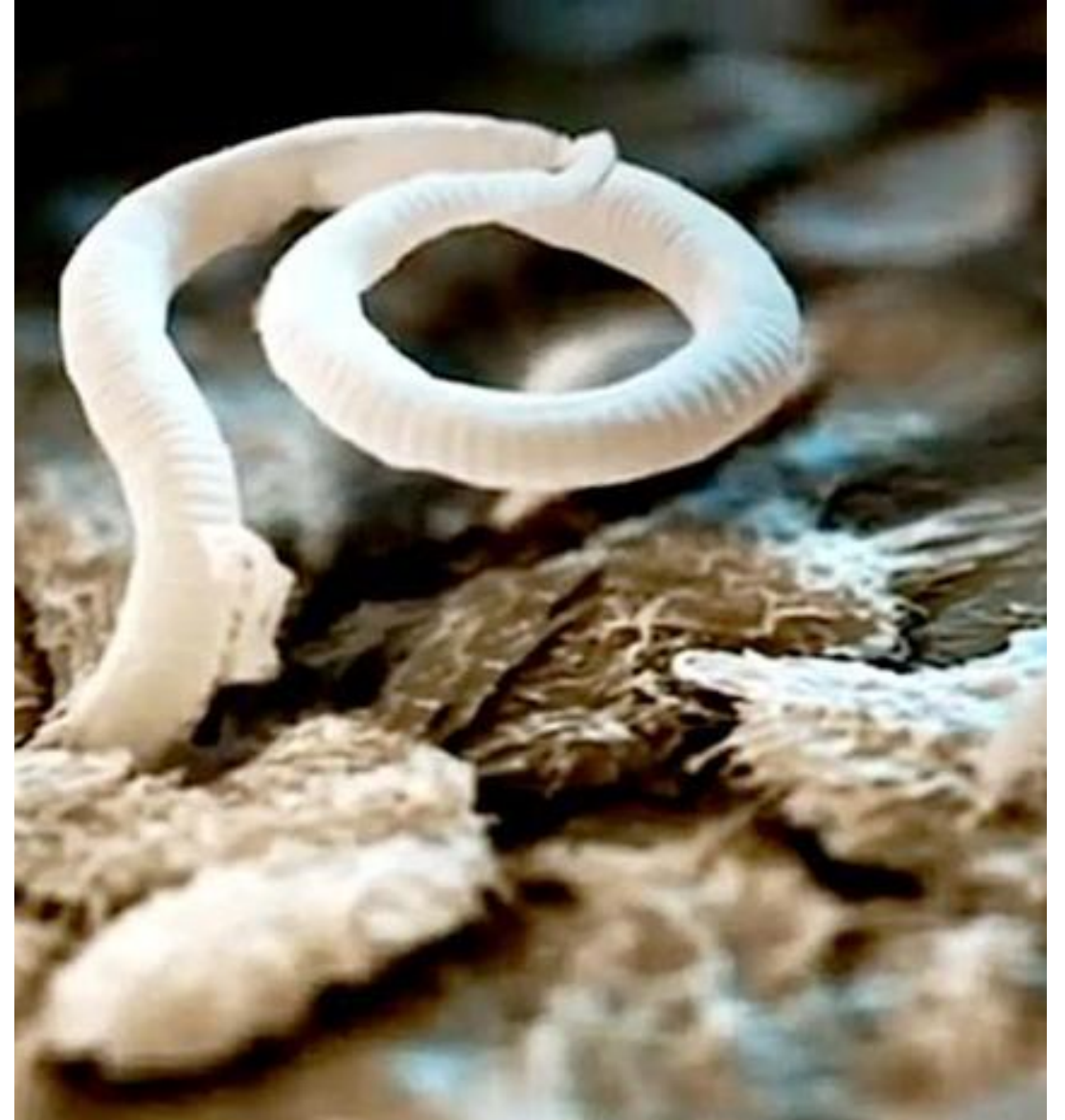
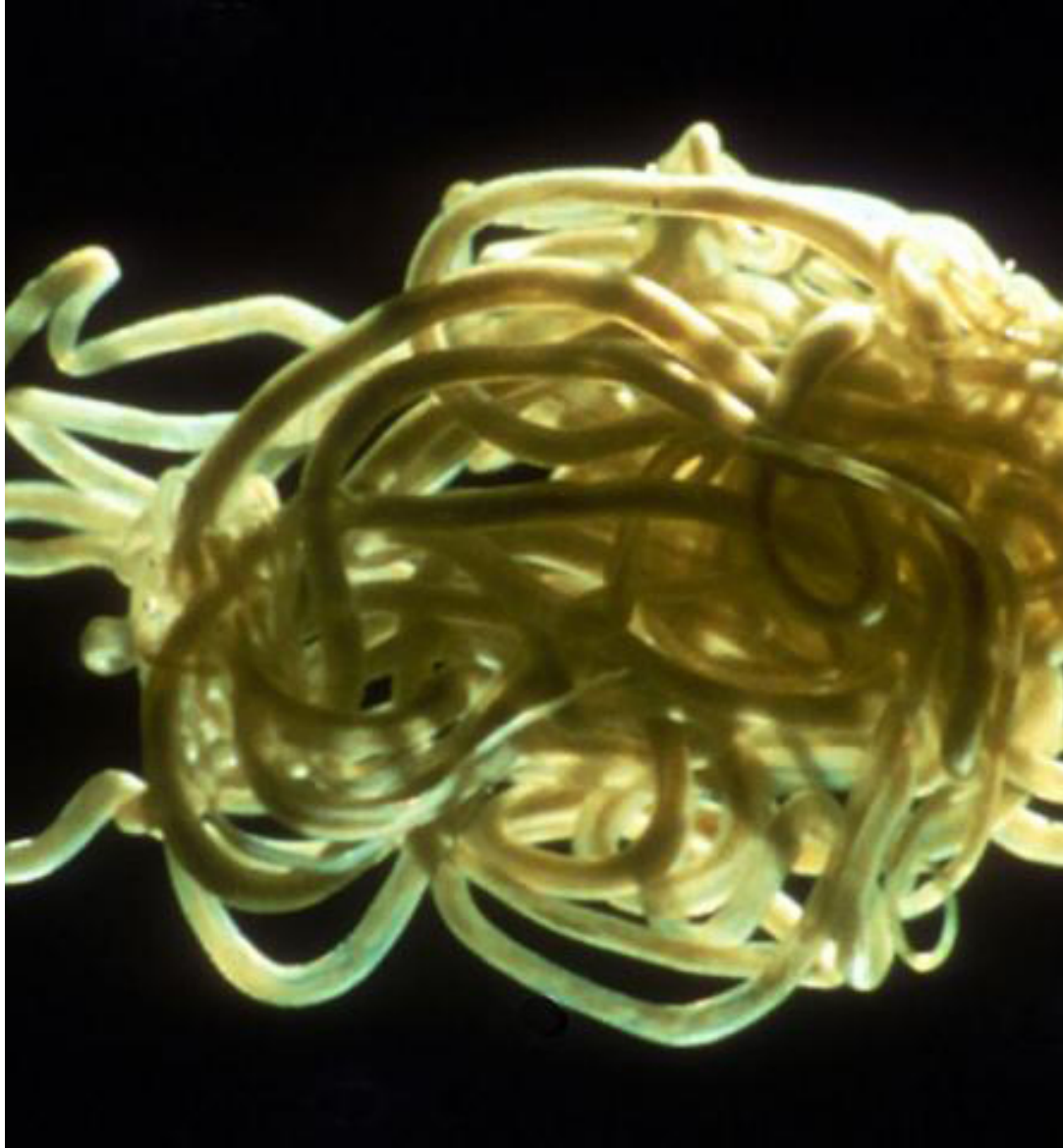
Zoonotic Filariasis

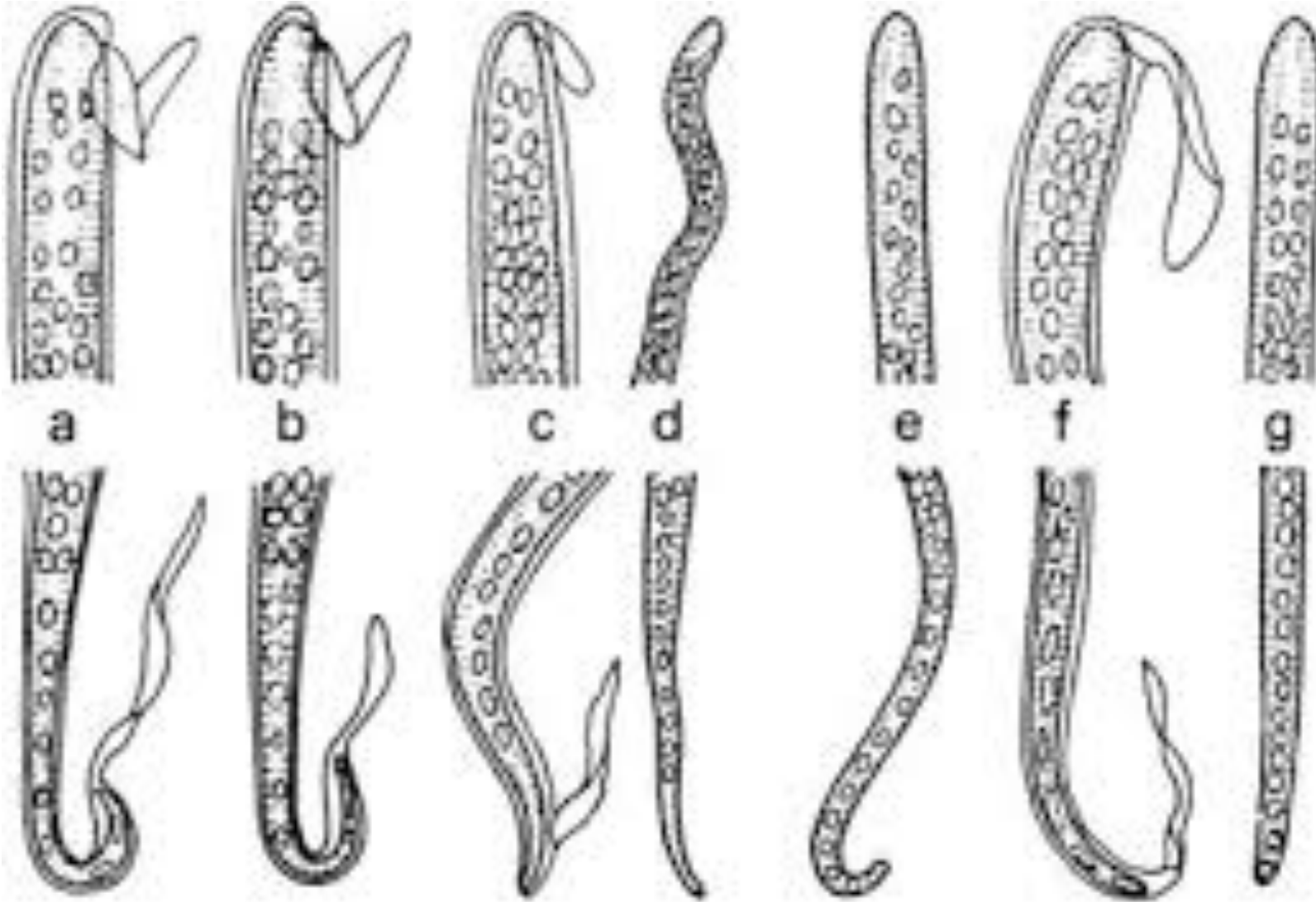
- *Dirofilaria immitis*
- *Dirofilaria repens*
- *Brugia pahangi*
- *Brugia beaveri*
- *Brugia leporis*



Filarial nematode	Habitat of Adults	Habitat of Microfilaria	Vector	Microfilaria periodicity
LYMPHATIC FILARIASIS				
Wuchereria bancrofti	Lymphatic tissue	Blood	Culex quinquefasciatus (W) Anopheles in rural Africa Aedes spp.,	Nocturnal (M) Sub-periodic (R)
Brugia malayi	Lymphatic tissue	Blood	Mansonia spp., Anopheles Mansonia spp., Coquillettidia	Nocturnal (M) Sub-periodic (R)
Brugia timori	Lymphatic tissue	Blood	Anopheles barbirostris	Nocturnal
SUBCUTANEOUS FILARIASIS				
Loa loa	Subcutaneous tissue, Conjunctiva	Blood	Chrysops (Deer fly)	Diurnal
Onchocerca volvulus	Subcutaneous tissue	Skin and eye	Simulium (Black fly)	None
Mansonella streptocerca	Subcutaneous tissue	Skin	Culicoides (Midges)	None
SEROUS CAVITY FILARIASIS				
Mansonella perstans	Body cavities, Mesentry	Blood	Culicoides (Midges)	None
Mansonella ozzardi	Body cavities	Blood	Culicoides (Midges) Simulium (Black fly)	None

Filarial nematode	Characteristic feature of Microfilaria	Epidemiology
LYMPHATIC FILARIASIS		
Wuchereria bancrofti	Sheathed, Pointed tail tip free of nuclei	South America, Africa, Asia
Brugia malayi	Sheathed, blunted tail tip with two terminal nuclei	Pacific Islands
Brugia timori	Sheathed longer than Mf. malayi	SE Asia, India, Indonesia
SUBCUTANEOUS FILARIASIS		
Loa loa	Sheathed, nuclei extending up to pointed tail tip	West and Central Africa
Onchocerca volvulus	Unsheathed, blunt tail tip free of nuclei	S. And C. America and Africa
Mansonella streptocerca	Unsheathed, blunt tail tip with nuclei	W. And C. Africa
SEROUS CAVITY FILARIASIS		
Mansonella perstans	Unsheathed, pointed tail tip free of nuclei	S. And C. America
Mansonella ozzardi	Unsheathed, pointed tail tip with nuclei	S. And C. America Carribean Islands





Microfilariae

Lymphatic Filariasis

- Lymphatic filariasis, commonly known as elephantiasis, is a painful and profoundly disfiguring disease.
- It is caused by infection with parasites classified as nematodes (roundworms) of the family Filariodidea.
- Transmitted through the bites of infected mosquitos. Mosquito-transmitted larvae are deposited on the skin from where they can enter the body. The larvae then migrate to the lymphatic vessels where they develop into adult worms, thus continuing a cycle of transmission.
- In communities where filariasis is transmitted, all ages are affected. While the infection may be acquired during childhood its visible manifestations such as limbs oedema may occur later in life, causing temporary or permanent disability. In endemic countries, lymphatic filariasis has a major social and economic impact.
- Lymphatic filariasis affects over 120 million people in 72 countries throughout the tropics and sub-tropics of Asia, Africa, the Western Pacific, and parts of the Caribbean and South America.

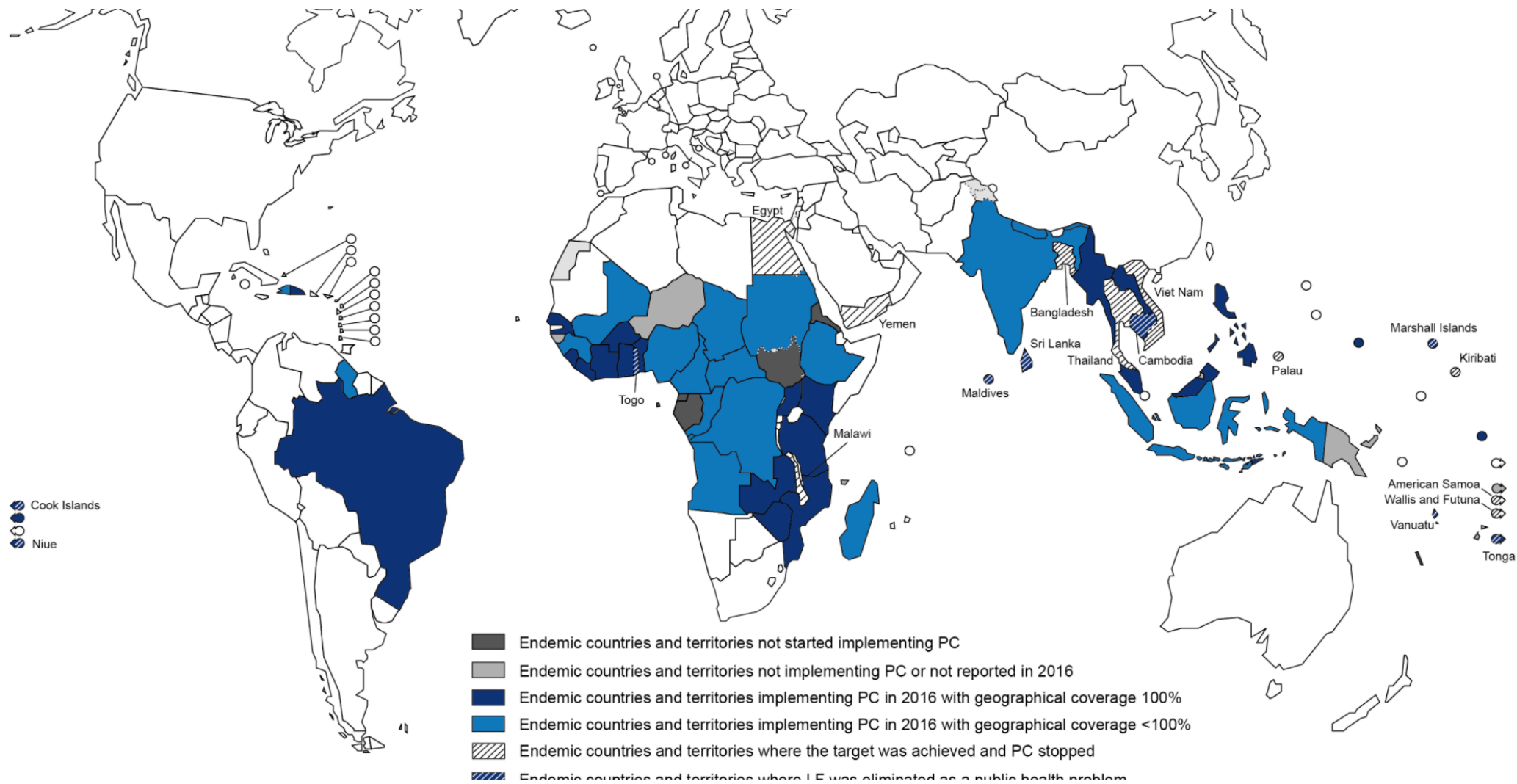
Con't

Infection with 3 closely related Nematodes

- *Wuchereria bancrofti*
- *Brugia malayi*
- *Brugia timori*
- * Transmitted by the bite of infected mosquito responsible for considerable sufferings/deformity and disability
- * All the parasites have similar life cycle in man
- * Adults seen in Lymphatic vessels
- * Offsprings seen in peripheral blood during night

Con't

- Parasitic disease where worms enter the blood stream through numerous mosquito bites over a number of years.
- Affects 120 million individuals in over 80 countries in the tropical regions due to stagnant water and poor irrigation systems



Distribution



Lymphatic filariasis

Reported number of people treated for lymphatic filariasis: 2019

[View more indicators/years](#)

[Filter by WHO region](#)

[Access the PCT databank](#)

[Static maps](#)

[Help](#)

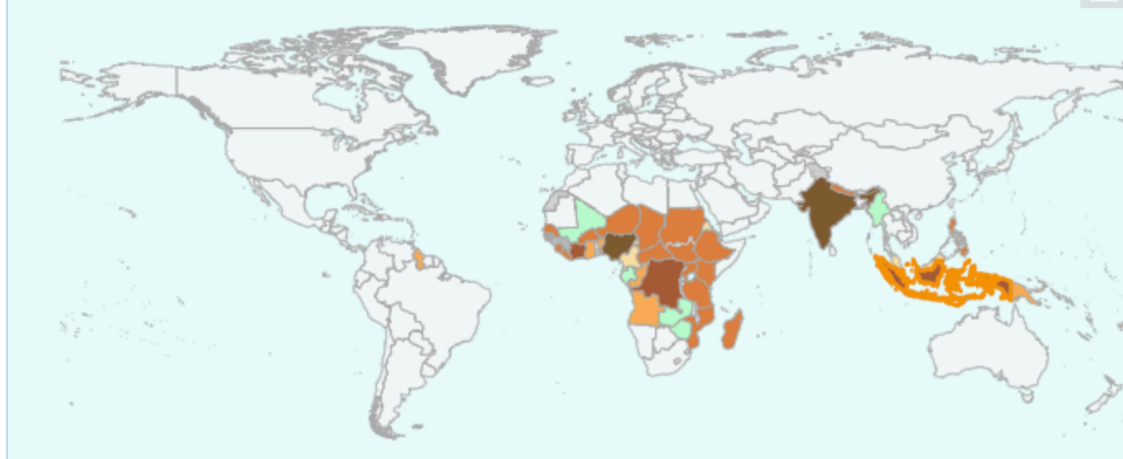
[Print](#)

Data table

Country or territory	Data
Indonesia	30,343,787
Iran (Islamic Republic of)	No PC required
Iraq	No PC required
Ireland	No PC required
Israel	No PC required
Italy	No PC required
Jamaica	No PC required
Japan	No PC required
Jordan	No PC required
Kazakhstan	No PC required
Kenya	3,814,995
Kiribati	No PC required
Kuwait	No PC required
Kyrgyzstan	No PC required
Lao People's Democratic Republic	No PC required
Latvia	No PC required

Clear Filter

Map



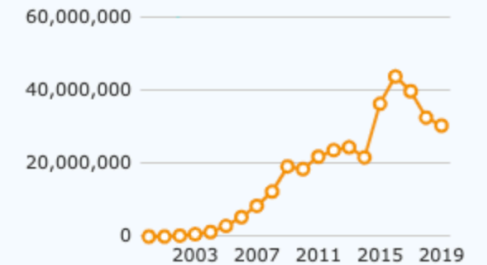
Map disclaimer

The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement. The borders of the map provided reflect the current political geographic status as of the date of publication (2020). However, the technical health information is based on data accurate with respect to the year indicated (2019). The disconnect in this arrangement should be noted but no implications regarding political or terminological status should be drawn from this arrangement as it is purely a function of technical and graphical

Data aggregated at regional and global level

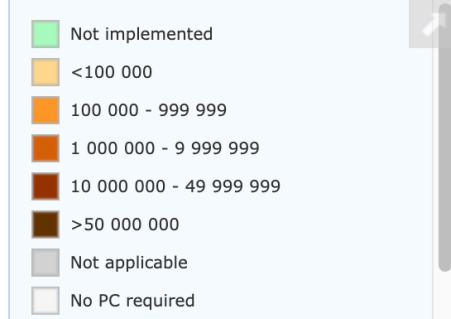
Name	Value
Africa	183,672,314
Americas	1,683,045
Eastern Mediterranean	4,408,107
Europe	N/A
South-East Asia	348,758,115
Western Pacific	3,140,621

Time trend chart



Selected data: 2019 [Select country or territory]

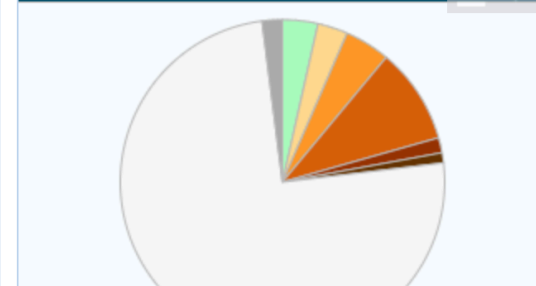
Indonesia
Type of Mass Drug Administration : DEC + ALB
Mapping status : Completed
Population requiring preventive chemotherapy for lymphatic filariasis : 38,258,683
Proportion of global population requiring preventive chemotherapy for lymphatic filariasis (%) : 4.4513
Number of districts requiring preventive chemotherapy for lymphatic filariasis : 118
Number of districts implementing preventive chemotherapy for



Statistics: 2019



Pie chart





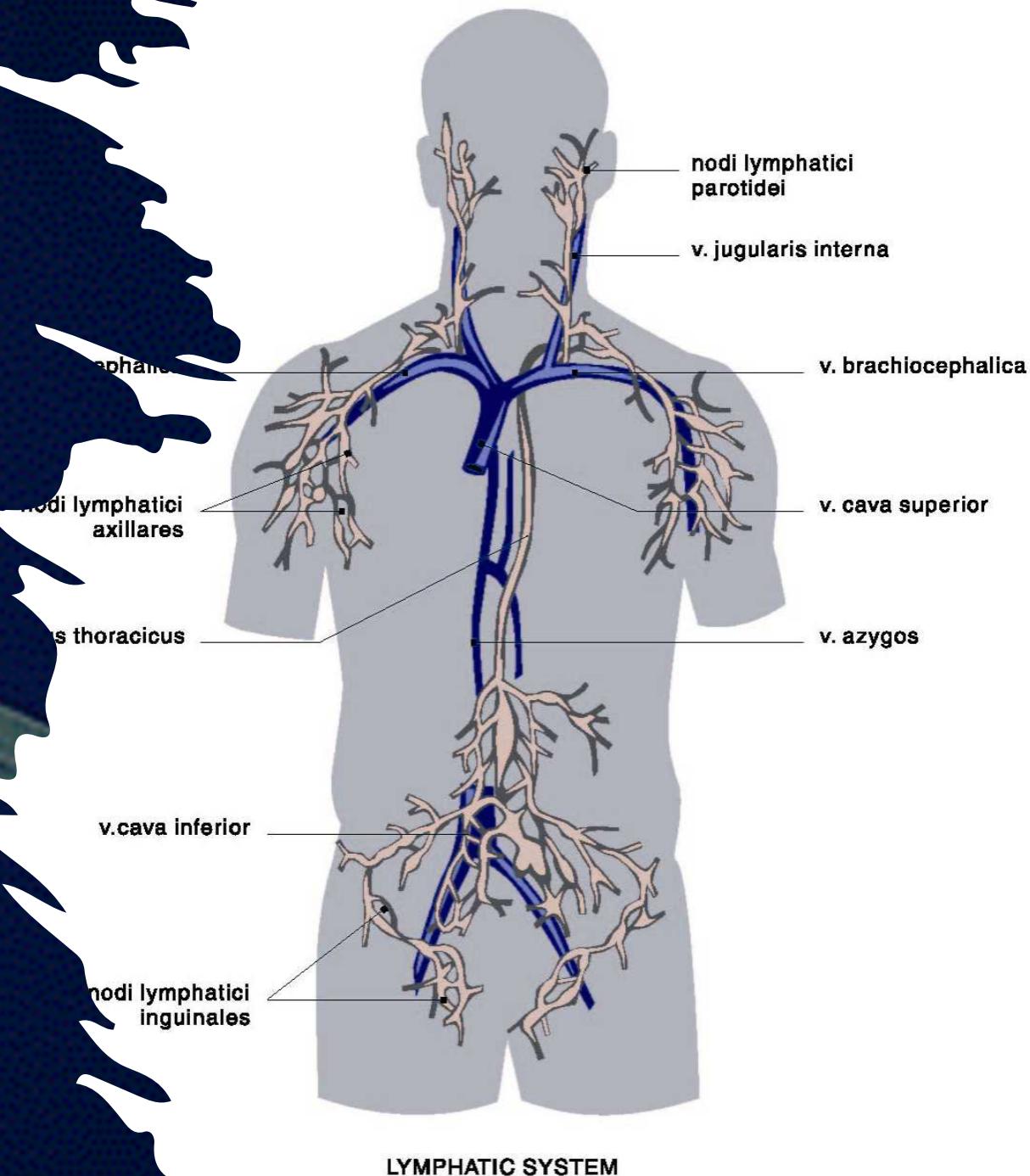
History

- Pre-1876
 - The only known symptom of this disease was elephantiasis because of its outward appearance.
- 600BC
 - Ancient Hindu medical workers referred to elephantiasis in Sanskrit texts.
- 600- 250BC
 - Men affected by elephantiasis were not allowed to become Buddhist priests.
- 10th- 13th Centuries
 - Persian and European physicians have accurate descriptions of elephantiasis.
- 1876
 - Joseph Bancroft discovered the parasite that causes lymphatic filariasis in an abscess on the arm of a butcher.



Parasites

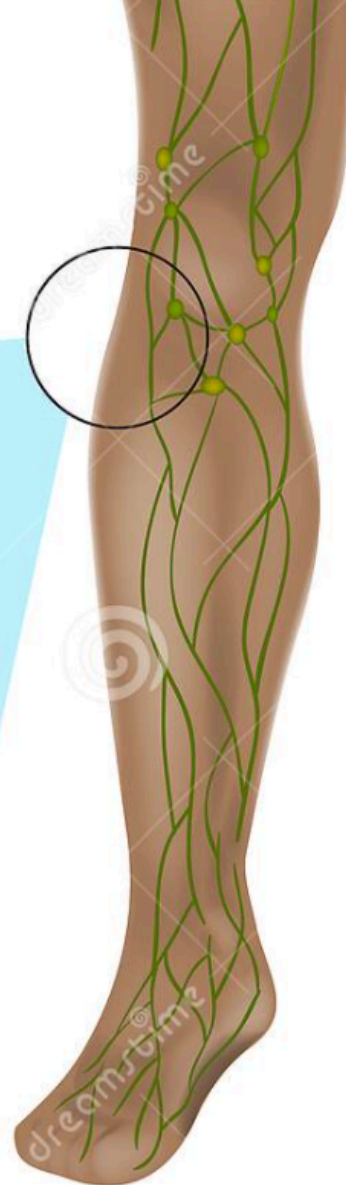
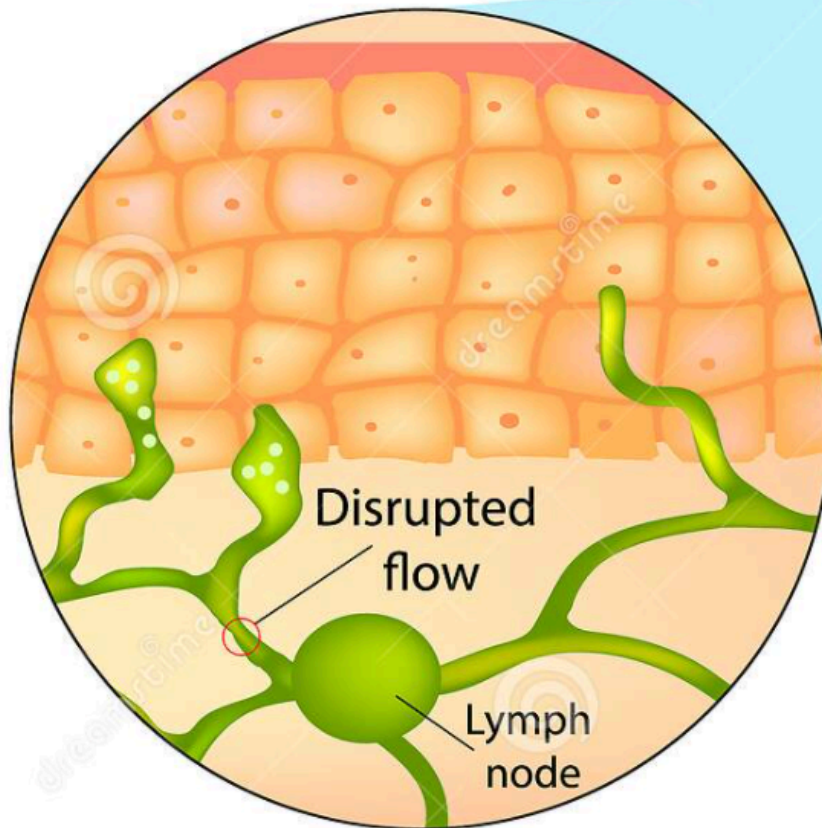
- White, slender roundworms
- Three types: *Wuchereria bancrofti*, *Brugia malayi*, *Brugia timori*
- Live for 5-7 years, produce millions of offspring
- Block the lymphatic system
 - Network of channels and lymph nodes that help maintain fluid levels in the body
 - Blockage leads to edema (collection of fluid in tissues)



ROYALTY-FREE VECTOR



Lymphedema



Lymphedema

DOWNLOAD PREVIEW



Social Impact of Disease

- Sexual Disability
- Communities frequently shun those disfigured.
- Inability to work
- Women with visible signs may never marry or spouses and families will reject them.



Host Factors

- Human – Natural Host
- Age – All age (6 months) Max: 20-30 years
- Sex – Higher in men
- Migration – leading to extension of infection to non-endemic areas
- Immunity – may develop after long year of exposure (Basis of immunity-not known)

Social & Environmental Factors

- Associated with Urbanization, Poverty, Industrialization, Illiteracy and Poor sanitation.
- Climate: is an important factor which influences:
 1. The breeding of mosquito
 2. Longevity (Optimum temperature 20-30°C & Humidity 70%)
 3. The development of parasite in the vector
 4. Sanitation, Town planning, Sewage & Drainage.

Mode of Transmission & Incubation Period

- Lymphatic Filariasis is transmitted by the bite of Infected mosquito which harbours L_3 larva.
- L_1 : 1-3 hours
- L_2 : 3-4 days
- L_3 : 5-6 days
- Pre-patent period: (L_3 to Mf) Not known
- Clinical Incubation period: 8-16 months

Lymphatic Filariasis - Life Cycle

Sexual reproduction



The adults form 'nests' and mate in the lymphatic vessels.



Wuchereria bancrofti

- is a human parasitic roundworm that is the major cause of lymphatic filariasis
- Have 2 type based on epidemiological status (Rural and Urban)
- Nocturnal Periodic



Otto Wucherer



Joseph Bancroft

Morphology (Adult)

- Threadlike worm
- Life span is usually 5-10 years
- Creamy white
- Smooth cuticula
- Head: two rings of small sessile papillae
- Microfilaria are found in the peripheral blood, hydrocele fluid and chylous urine.
- Mouth: unarmed and lack the buccal vestibule
- Female : 80 – 100 mm in length
 - : 0.24 – 0.30 mm in diameter
 - : Ovoviviparous
- Male : 40 mm in length;
 - : 0.1 mm in diameter
 - : Caudal extremity is Curved

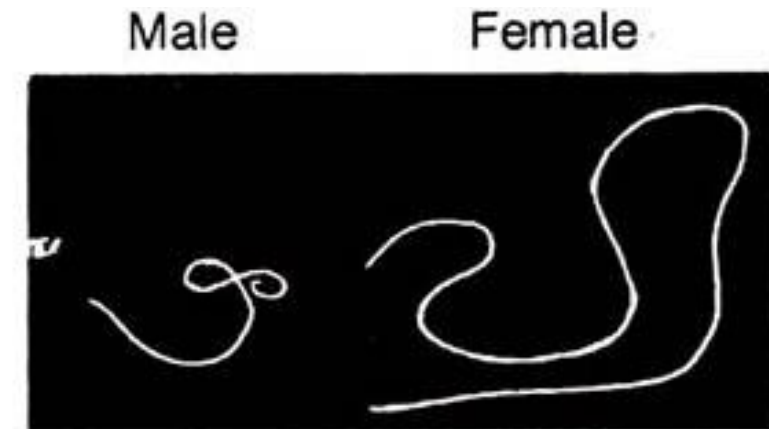
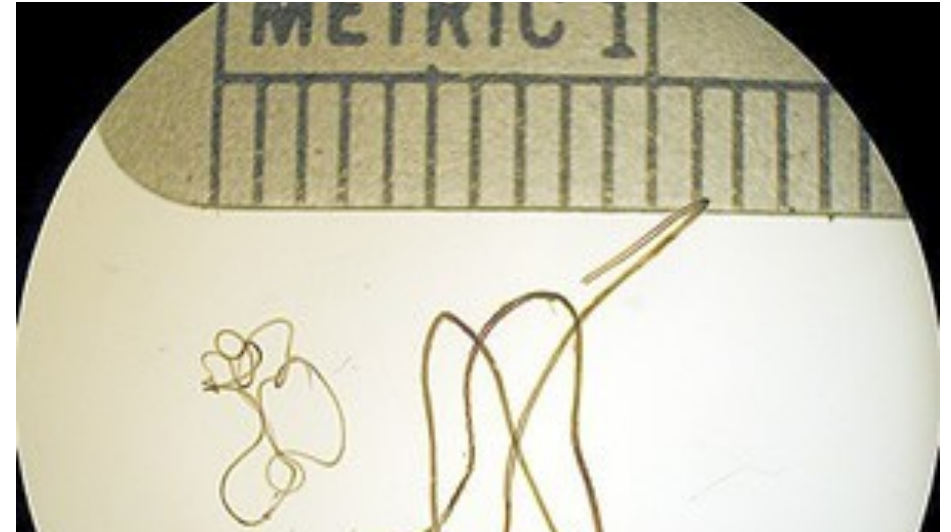


Fig. 6.10 : Adult worms of *W. bancrofti* (natural sizes)

Morphology (*Microfilariae*)

244- 296 um by 7.5- 10 um

Nuclei not reaching tail end

No terminal nuclei

Nuclei regularly spaced, dispersed

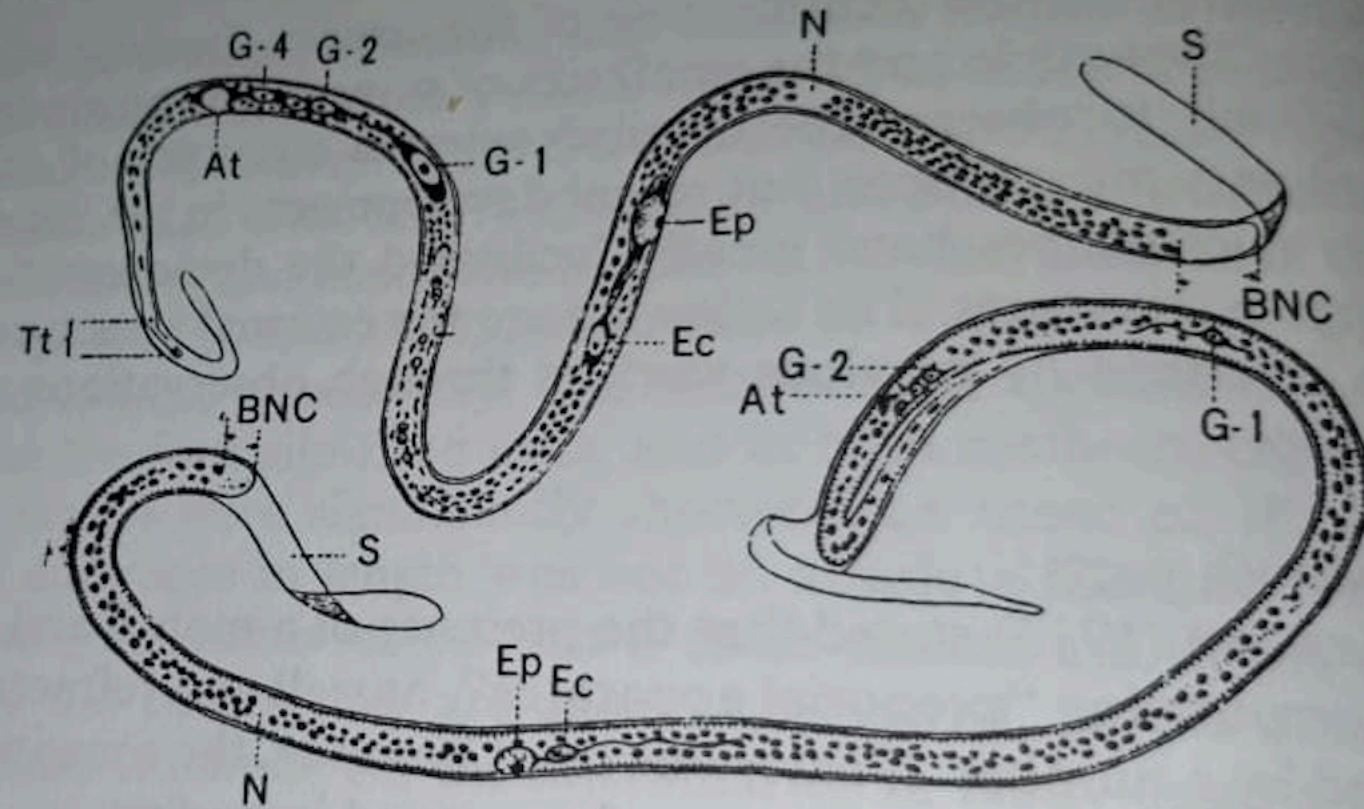
Bigger, wider than B. Malayi

Graceful sweeping curves

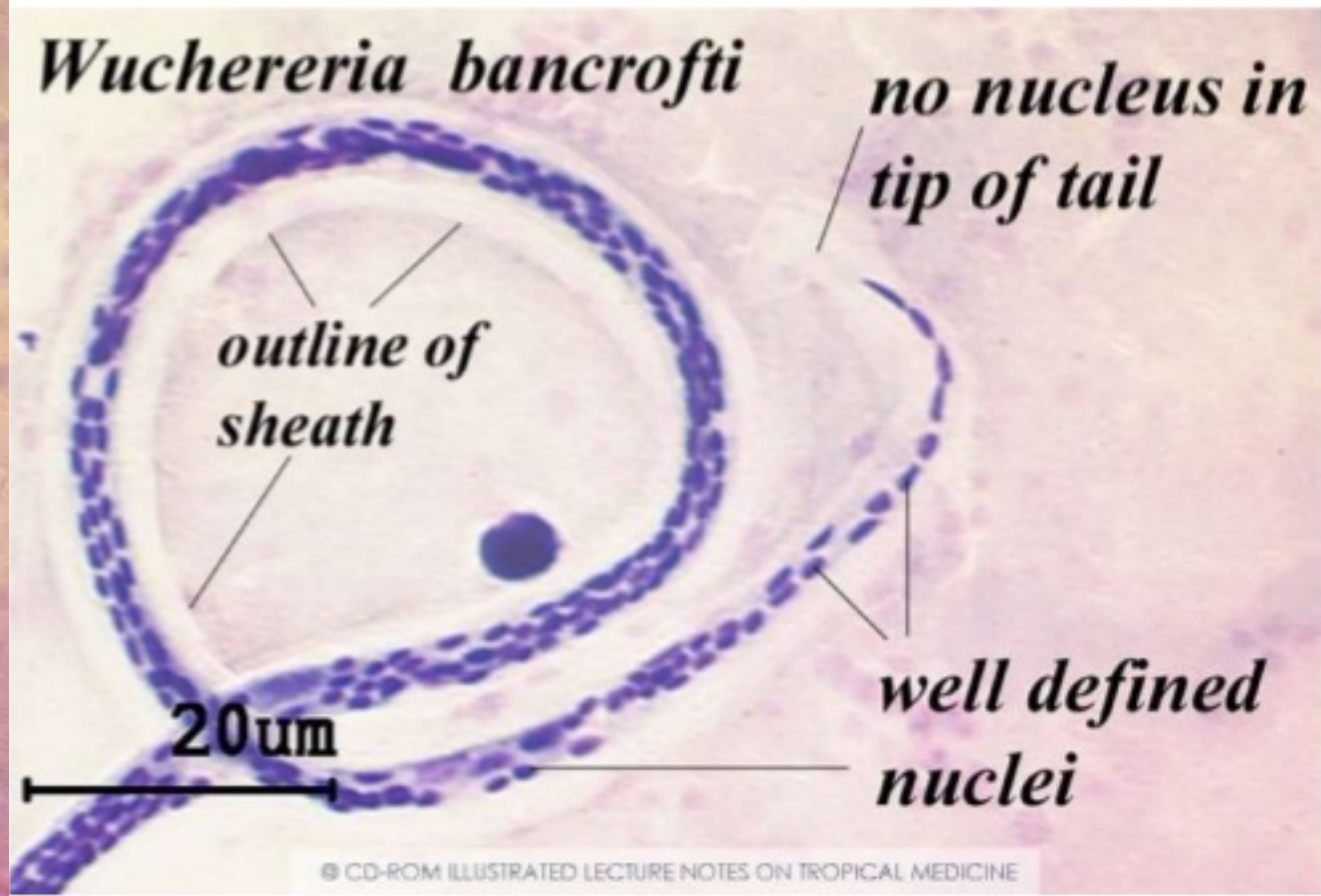
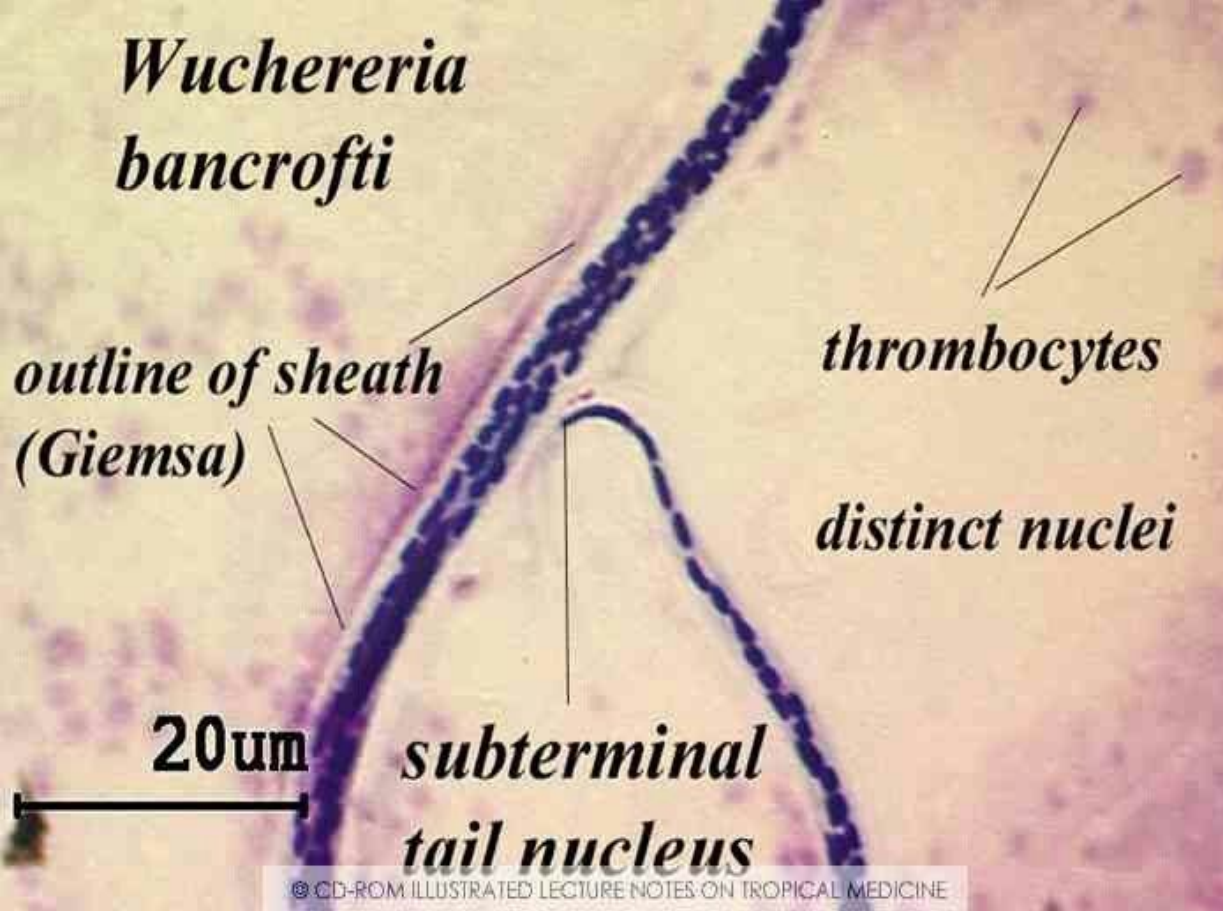
Short head space (as long as broad)

Sheath unstained with Giemsa

Bluntly rounded anteriorly and pointed caudally



g. 1-2. A schematic drawing of the microfilariae of *Brugia malayi* (above) and *Wuchereria bancrofti* (below); from Sasa & Hayashi (1953). AP: anal pore; BNC: cephalic space, and beginning of nuclear column; EC: excretory cell; EP: excretory pore; G-1 to G-4: the G-cells; N: nerve ring; S: sheath; TN: terminal or caudal nuclei





Characteristics

- Habitat of Adult worm : Lymphatic system
- Habitat of Microfilaria: Blood
- Intermediate Host : Anopheles sp (rural), Culex Sp (Urban)
- Definitive Host : Man

Characteristics

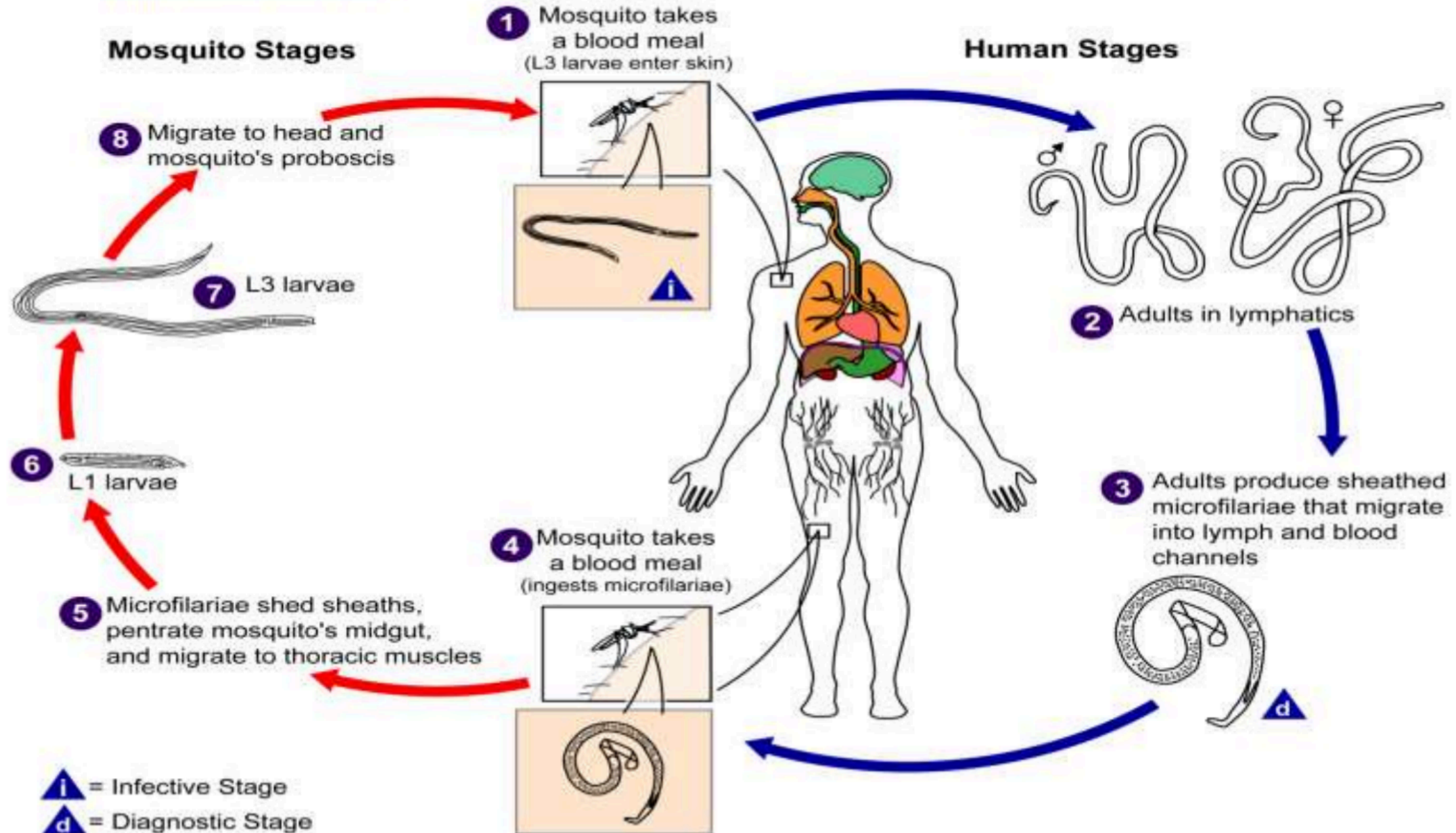
- Periodicity: Nocturnal periodicity, EXCEPT South Pacific microfilariae
- Nocturnal periodicity: 8 PM- 4 AM = best time to collect
- Microfilariae may not be demonstrable in peripheral blood if:
 - ✓ low intensity of infection
 - ✓ dead worms
 - ✓ obstructed lymphatics

Filariasis

(*Wuchereria bancrofti*)

Mosquito Stages

Human Stages



Brugia malayi



Sub-periodic nocturnal
(Zoonosis) --> Kalimantan
Tengah



Periodic nocturnal

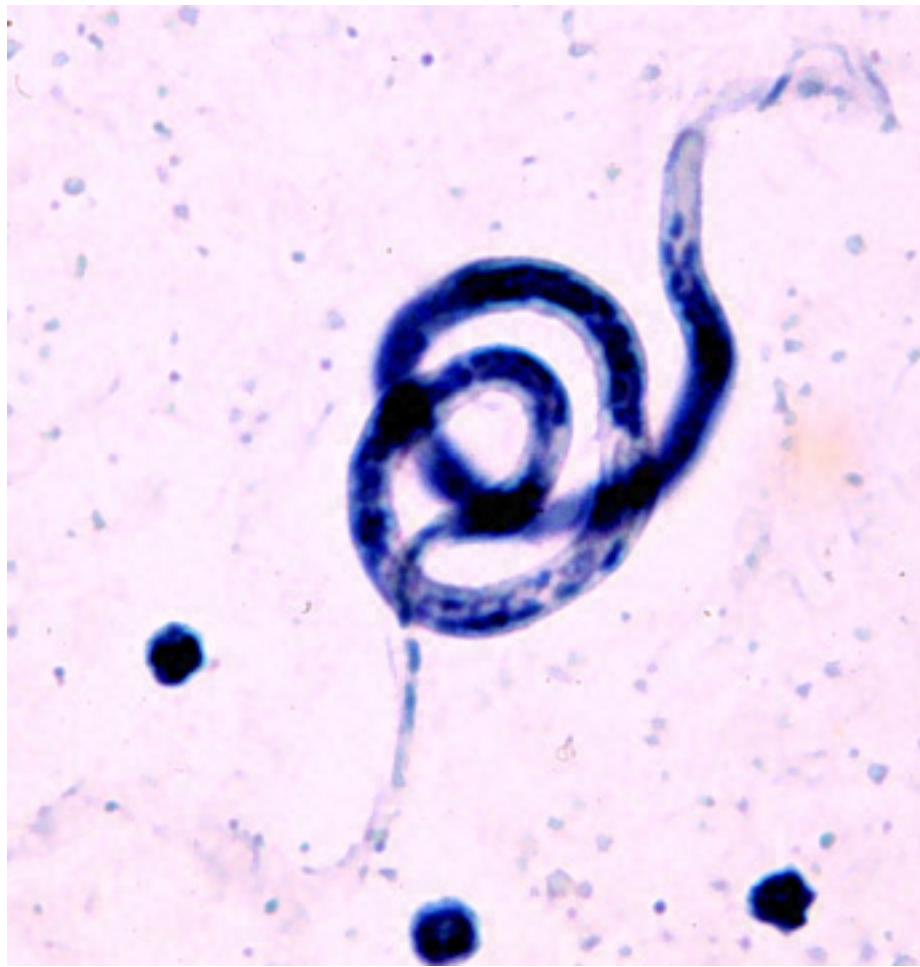


Non-periodic → Kalimantan
Timur

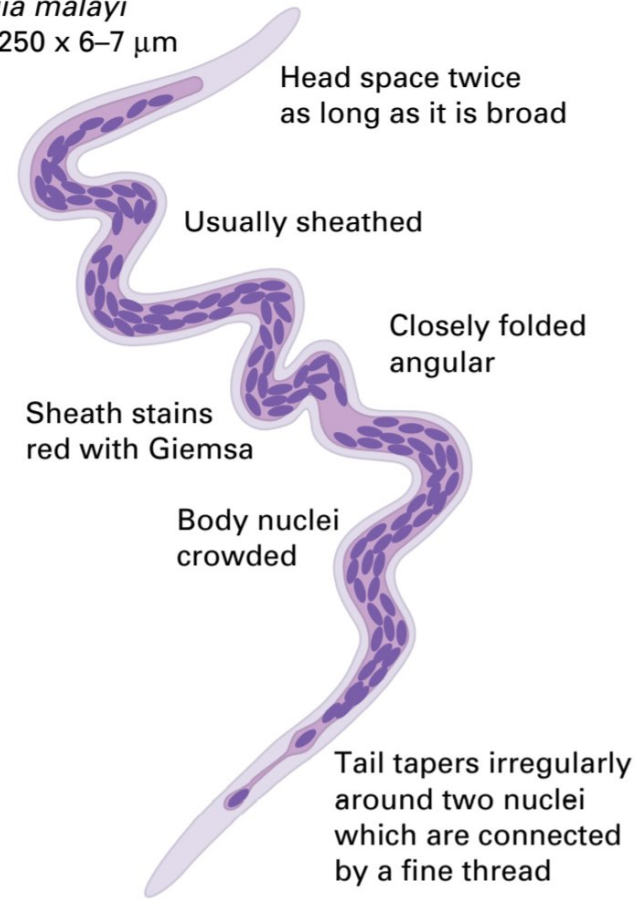
- is a roundworm nematode, one of the three causative agents of lymphatic filariasis in humans.
- Lymphatic filariasis, also known as elephantiasis, is a condition characterized by swelling of the lower limbs.
- The two other filarial causes of lymphatic filariasis are *Wuchereria bancrofti* and *Brugia timori*, which differ from *Brugia malayi* morphologically, symptomatically, and in geographical extent
- *B. malayi* infection is endemic or potentially endemic in 16 countries, where it is most common in southern China and India, but also occurs in Indonesia, Thailand, Vietnam, Malaysia, the Philippines, and South Korea

Morphology

- Female adult worms measures between 43-55 mm in length by 130-170 um in width.
- Male adult worms measures between 13- 23 mm in length by 70-80 um in width.
- *B. malayi* microfilariae measures 177-230 um in length and 5-7 um in width and have a round anterior end and a pointed posterior end.
- The sheath is actually the egg shell, a thin layer that surrounds the egg shell as the microfilariae circulates in the bloodstream.
- The microfilariae retain the sheath until it is digested in the mosquito midgut



Brugia malayi
220–250 x 6–7 μm



Head space twice
as long as it is broad

Usually sheathed

Closely folded
angular

Sheath stains
red with Giemsa

Body nuclei
crowded

Tail tapers irregularly
around two nuclei
which are connected
by a fine thread

Pictorial Key for the Detection of Microfilariae in Blood

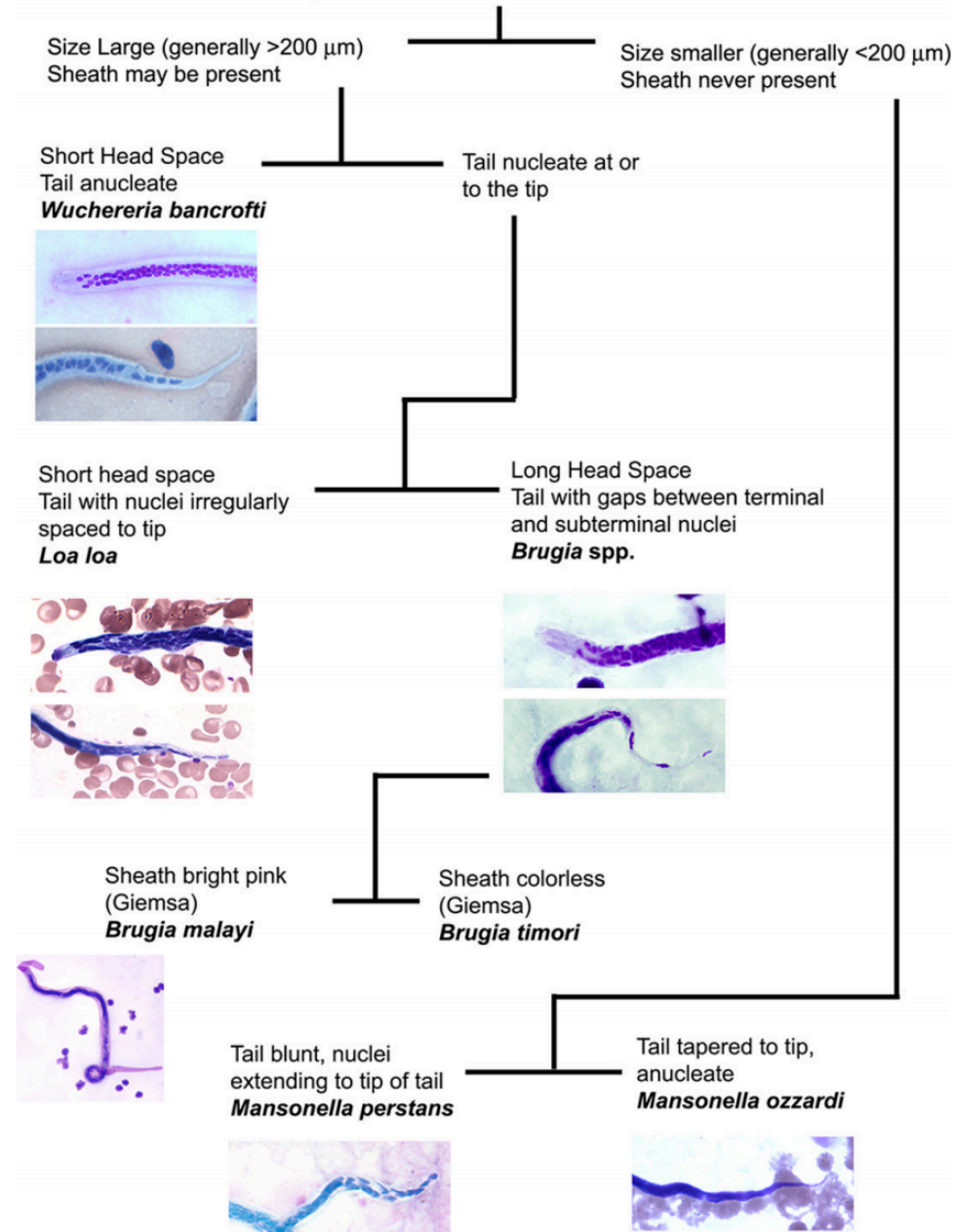


FIG 1 Illustrated key to the microfilariae observed in blood specimens.



Microfilaria of *Wuchereria bancrofti*. Figure A:
Microfilaria of *W. bancrofti* in a thick blood smear stained with Giemsa and captured at 500x oil magnification



Microfilaria of *Brugia malayi*. Figure B:
Microfilaria of *B. malayi* in a thick blood smear, stained with Giemsa and captured at 500x oil magnification



Microfilaria of *B. timori* in a thick blood smear, stained with Giemsa and captured at 500x oil magnification

**Courtesy:
CDC**

Treatment

A thick yellow horizontal bar spanning the width of the slide, with a vertical yellow bar extending downwards from its right end.

- DEC + Albendazole + Paracetamol

- <https://jcm.asm.org/content/57/10/e00706-19>
- https://en.wikipedia.org/wiki/Brugia_malayi
- https://twitter.com/underthe_scope/status/1262283726047916032
- <https://www.slideshare.net/RangineniPrada/lymphatic-filariasis-jp>
- Sasa, Manabu (1976). *Human Filariasis: A Global Survey of Epidemiology and Control*. University of Tokyo Press. Tokyo