

WUCHERERIA BANCROFTI

Scientific classification

Kingdom: *Animalia*

Phylum: *Nematoda*

Class: *Secernentea*

Order: *Spirurida*

Suborder: *Spirurina*

Family: *Onchocercidae*

Genus: ***Wuchereria***

Species: ***bancrofti***



Wuchereria bancrofti is commonly known as filarial worm. This worm causes filariasis in humans. Demarquay first discovered the larval form of this worm; later Wuchereria found these larvae in the chylorous urine. Lewis found them in human blood and Bancroft found the adult females. The name of this worm is given *Wuchereria bancrofti* in honor of the two scientists Wucherer and Bancroft who made considerable

contribution in studying the disease caused by these worms.

Distribution:

This pseudo coelomate round worm is spread throughout the world except in Polar Regions. It is prevalent in India, Arabia, Malaya, Korea, Japan, Brazil and south Pacific islands. It is relatively absent in Europe, North America and Africa.

Habit and habitat:

This filarial worm is a dreadful human parasite residing in the human blood and lymph. It is a digenetic parasite requiring two hosts to complete its life cycle. The two hosts are man and female *Culex* mosquito. The adult worms are harbored in a coiled state in human lymph glands and lymph passages. These worms obstruct the passage of the lymph.

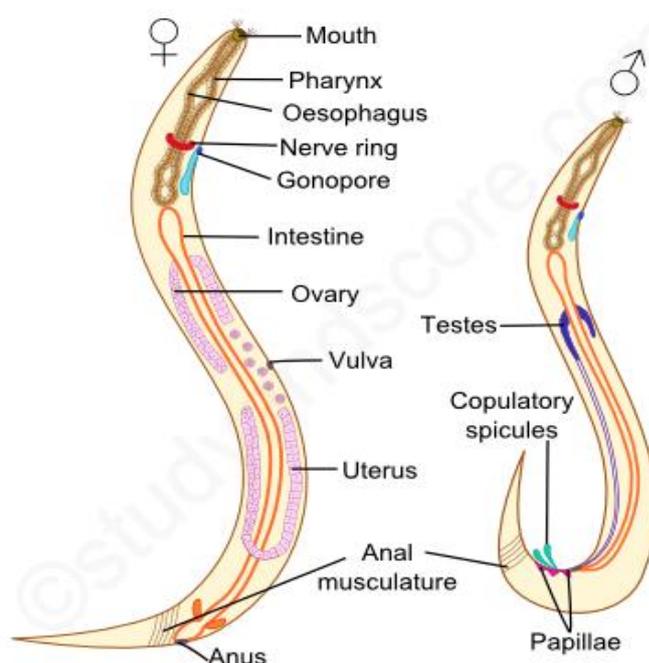
Structure of Filarial worm:

The body of adult filarial worm is elongated, narrow, filiform and cylindrical in shape. These worms are creamy white in color. Anterior ends terminate bluntly whereas the posterior end is a little pointed. The male and female worms are found coiled round each other in the lymph vessels.

A mouth with no oral lips is present at the anterior end. The alimentary canal of this worm includes mouth, pharynx, oesophagus, intestine and anus. The anterior part of the pharynx is muscular and the posterior part is glandular. *Wuchereria bancrofti* is a unisexual worm exhibiting sexual dimorphism.

The female worms are slightly longer and thicker than that of their male counterparts. Each female worm measures around 65-100mm in length and 0.25 mm in diameter. The posterior end of the female is straight and bears anus. The female genital pore also called as vulva is present ventrally at about one third length of the body from the anterior tip.

Male worms are comparatively smaller and thinner than the females. Each male filarial worm measures around 40 mm in length and 0.1 mm in diameter. The posterior end of the male worm is curved bearing cloaca in this region. A pair of unequal penial setae or copulatory spicules is present in cloacal or curved region. Many copulatory papillae are present in the posterior region.



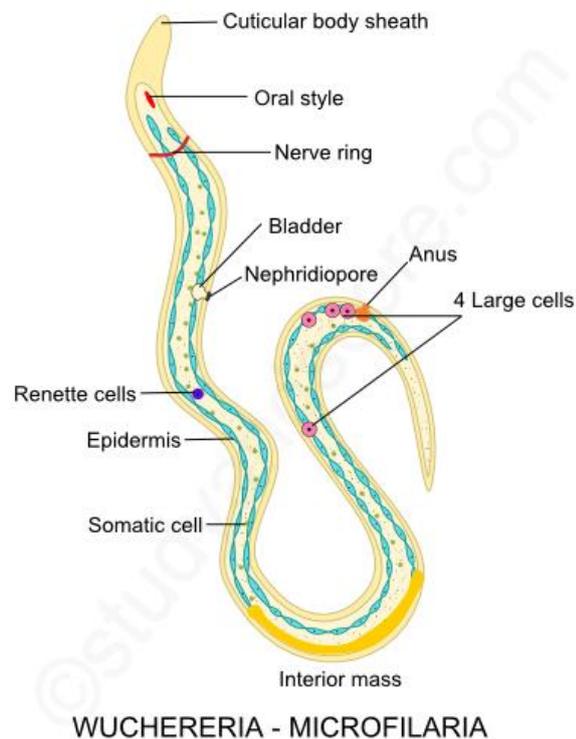
WUCHERERIA - ADULT FEMALE AND MALE

LIFE CYCLE OF WUCHERERIA

Wuchereria is a heterogeneous parasite which completes its life cycle in two different hosts namely man and female culex mosquito.

Life cycle in Man:

This cycle is also known as Human Phase. The process of copulation takes place in the lymphatic system of the human. The male and female worms copulate when they are present in the same lymph gland. The female worms are ovoviviparous that is they produce eggs which hatch within the body of the female without obtaining nourishment from it. Numerous microscopic juvenile larvae called microfilariae are released into the lymph.

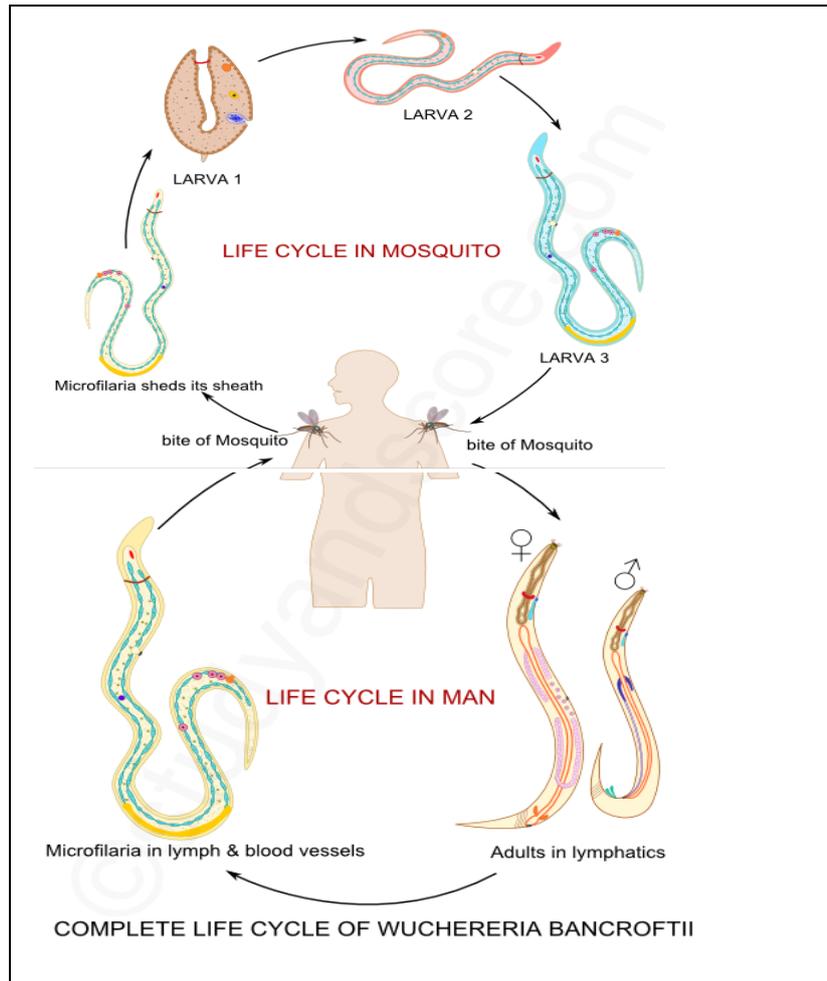


Each microfilaria is about 0.2 to 0.3 mm in length. It is surrounded by loose cuticular sheath. This cuticular sheath is also known as egg membrane. The surface of this larva is covered by flattened epidermal cells. Its body contains columns of cytoplasm with a number of nuclei. An oral style is present at the anterior end where the mouth develops in the future. Microfilaria also bears the following parts:

- A nerve ring around the pharynx
- Excretory pore
- Renette cells
- Four large germinal cells
- Future anal pore
- Inner cell mass
- Somatic cell mass

The microfilaria after being released into the lymph vessels, enter the blood vessels and circulate with the blood. Ultimately they migrate to the visceral organs and reside in the deeper blood vessels of thorax region.

In this thorax region the larvae do not undergo any additional change as further development can happen only inside the intermediate host (mosquito). Thus, these larvae move to the peripheral blood vessels during the night time between 10:00 pm to 4:00 am to suit the feeding habit of the mosquito. This movement of the larvae is called as nocturnal periodicity. During the day time these larvae live in the large deep-seated blood vessels but during night they migrate to the peripheral blood vessels. Hence it can be said that microfilariae show day and night periodicity also known as diurnal rhythm. The microfilariae die if they are not transferred to the mosquito within 70 days. This microfilaria is the infective stage to the mosquitoes.



Life cycle in Mosquito:

This cycle is also known as Mosquito Phase. When the female culex mosquito sucks the blood from the *Wuchereria*-infected person, the microfilaria from the peripheral blood, enter the midgut of the mosquito. In the midgut they shed their protective sheath within 6 hours. After shedding the sheath they penetrate the stomach wall and migrate to the thoracic muscles where they metamorphose and grow. Initially they metamorphose into a flat sausage-shaped larva also called as first-stage larva. Later this larva undergoes first moulting and grows into a slender elongated second-stage larva. Finally this second stage larva undergoes second moulting transforming into a long infective stage also called as the third-stage larva. All these changes take place within 10-20 days. The final third-stage larva moves to the labium of the mosquito so that it can be transferred to the definitive host (man).

In man the filarial larva first enters the blood circulation through the bite of the mosquito and then it enters into the lymphatic vessels where it

undergoes third and fourth moulting and transforms into adult. The adult male and female worms copulate and the female delivers microfilariae.

FILARIASIS

Filariasis or Elephantiasis is a disease caused by *Wuchereria bancrofti* in humans. These filarial worms reside in the lymphatic vessels of the man and obstruct the flow of lymph there by causing severe condition known as elephantiasis in which the limbs and other infected body parts grow in to enormous size.

Pathogenesis:

Light infection causes filarial fever, mental depression and headache. The infection of the parasite causes inflammatory effects. The inflammation in the lymph vessels is called as lymphangitis and the inflammation in the lymph glands is called lymphadenitis.

Heavy infection is caused when the microfilaria density is more than 20,000 per ml of blood. In this case the accumulation of the dead worms and the inflammatory reactions of the worms block the lymph vessels and glands resulting in immense swelling in the extremities of the limbs, scrotum of males and mammary glands of females. The condition of the swelling of the extremities is called as lymphedema.

The increased permeability of the wall in the lymph vessels leads to accumulation of lymph in the tissue. The fibroblasts accumulate in the oedematous tissues causing fibrosis. Thus fibrous tissue is formed in these regions.

In severe cases, the sweat glands in the affected regions disintegrate causing the skin to become dry and rough. Other manifestations of this disease include,

- **Lymphangiovarix**– dilation of lymph vessels in inguinal, scrotal and abdominal regions
- **Lymphorrhage**– rupture of lymph vessels
- **Hydrocele**– accumulation of fluid due to the obstruction of spermatic cord
- **Occult filariasis**– hypersensitivity reaction to filarial antigens

Diagnosis:

The diagnosis includes the study of microfilariae after staining. Microfilariae of different species are identified based on their specific shape and morphological characters.

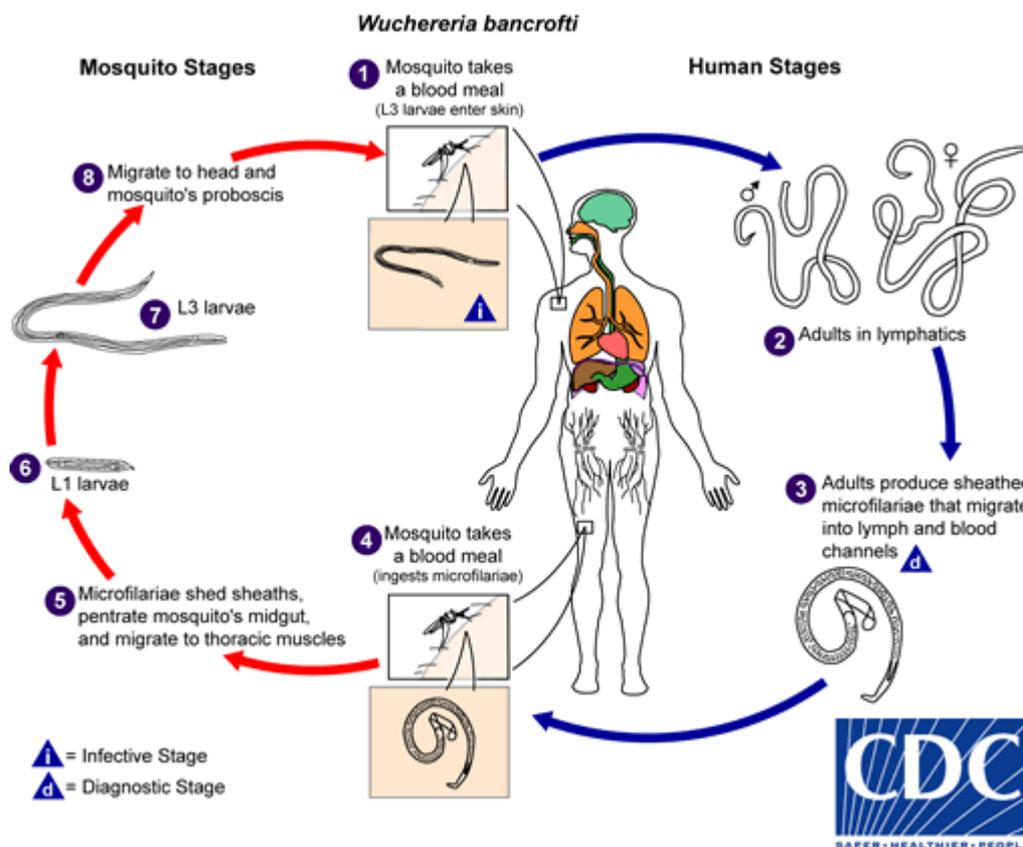
Therapy and control:

Complete satisfactory treatment is not yet known though the disease can be reduced or eliminated by eradication of microfilariae from the circulation by administration of heterazan and compounds of antimony and arsenic.

Prevention:

Filariasis can be controlled by the following methods,

- **Protection against adult mosquitoes**– The adult mosquitoes can be controlled by spraying the insecticides like organochlorides like DDT and BHC in the homes. Fumigation of the dwelling places is also effective measure to kill the mosquitoes. Using mosquito nets is the safest method to avoid the mosquito bite.
- **Destruction of mosquito larvae**– Spraying of kerosene pyrethrum oil on the sewage gutters and ditches is recommended to kill the mosquito larvae. Insecticides are used in the breeding places to kill the larvae. Biological control using larvivorous fishes like Gambusia is much safer.

LIFE CYCLE IN BRIEF

Different species of the following genera of mosquitoes are vectors of *W. bancrofti* filariasis depending on geographical distribution. Among them are: *Culex* (*C. annulirostris*, *C. bitaeniorhynchus*, *C. quinquefasciatus*, and *C. pipiens*); *Anopheles* (*A. arabinensis*, *A. bancroftii*, *A. farauti*, *A. funestus*, *A. gambiae*, *A. koliensis*, *A. melas*, *A. merus*, *A. punctulatus* and *A. wellcomei*); *Aedes* (*A. aegypti*, *A. aquasalis*, *A. bellator*, *A. cooki*, *A. darlingi*, *A. kochi*, *A. polynesiensis*, *A. pseudoscutellaris*, *A. rotumae*, *A. scapularis*, and *A. vigilax*); *Mansonia* (*M. pseudotitillans*, *M. uniformis*); *Coquillettidia* (*C. juxtamansonia*). During a blood meal, an infected mosquito introduces third-stage filarial larvae onto the skin of the human host, where they penetrate into the bite wound **1**. They develop in adults that commonly reside in the lymphatics **2**. The female worms measure 80 to 100 mm in length and 0.24 to 0.30 mm in diameter, while the males measure about 40 mm by .1 mm. Adults produce microfilariae measuring 244 to 296 μm by 7.5 to 10 μm , which are sheathed and have nocturnal periodicity, except the South Pacific microfilariae which have the absence of marked periodicity. The microfilariae migrate into lymph and blood channels moving actively through lymph and blood **3**. A mosquito ingests the microfilariae during a blood meal **4**. After ingestion, the microfilariae lose their sheaths and some of them work their way through the wall of the proventriculus and cardiac portion of

the mosquito's midgut and reach the thoracic muscles ⑤ . There the microfilariae develop into first-stage larvae ⑥ and subsequently into third-stage infective larvae ⑦ . The third-stage infective larvae migrate through the hemocoel to the mosquito's proboscis ⑧ and can infect another human when the mosquito takes a blood meal ① .

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