

Phylum Ascyhelminthes

Ascyhelminthes

The name Aschelminthes was proposed by Grobben (1910), in place of the older name Nemathelminthes.

It has been derived from two Greek words:
askes = cavity + helmins = worm.

Aschelminthes is group of invertebrate animals characterized by pseudocoelom. Aschelminthes includes unsegmented worms, roundworms, threadworms, eelworms etc... This phylum is closely associated with the Platyhelminthes

ANCYLOSTOMA



WUCHERERIA



ASCARIS



RHABDITIS





Rhabditis



Dracuculus



Ascaris



Enterobium



Trichiuris



Loa loa

Fig: Certain examples of round worms

General Characters

- Mostly aquatic, free living or parasitic.
- Usually small, even microscopic. Some reach a meter or more in length.
- Body slender, vermiform, unsegmented, flator cylindrical, bilaterally symmetrical and triploblastic.
- Organ system grade of body organization.
- Head not distinctily formed with well-defined sense organs.
- Body wall with a syncytial or cellular epidermis externally covered with thick cuticle of scleroprotein.
- Cilia absent except anterior cilia of rotifers.
- Musculature includes mostly longitudinal fibres.

Phylum: Nematelminthes/Ascahelminthes



Ascaris



Wucheria



Enterobius



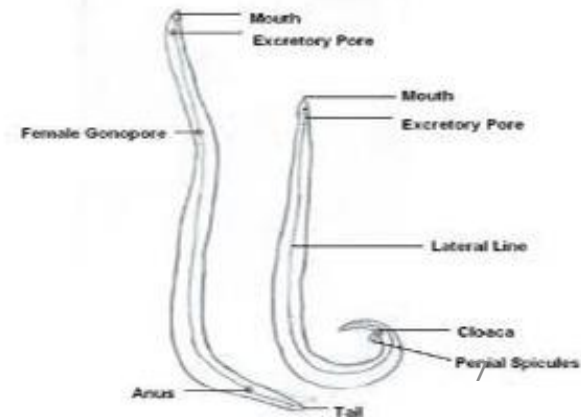
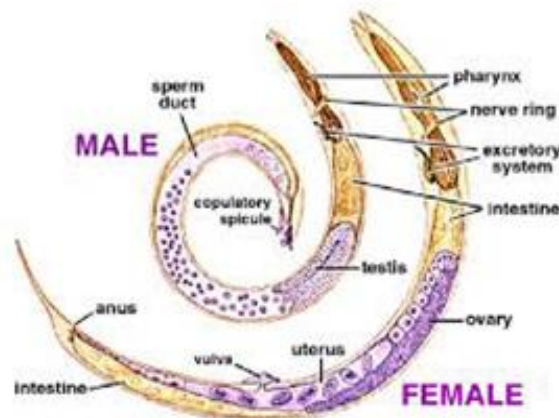
Rhabditis

- Body cavity pseudocoel i.e. not lined by mesoderm.
- Digestive canal complete with mouth, specialized pharynx, straight non-muscular intestine and posterior anus.
- No circulatory and respiratory systems.
- Excretory system is of protonephridia and canals.
- Cloaca is present in some species.
- Nervous system of cerebral ganglia, or of circumenteric nerve ring with anterior and posterior nerves.
- Gonads and ducts single or double.
- Eggs with chitinous shell. Cleavage is determinate and spiral.
- Development usually direct with no larval stages, or indirect with a complicated life history.

- Mostly dioecious. Male usually smaller than female.

Examples

- *Ascaris lumbricoides* (Round worm)
- *Wuchereria bancrofti* (Filarial worm)
- *Enterobius vermicularis* (pin / thread / seat worm / churna)
- *Necator americana* (Hook worm)
- *Trichinella spiralis* (Trichina worm)
- *Loa loa* (eye worm)
- *Dracunculus medinensis* (Guinea worm)



Classification

Aschelminthis includes four smaller groups (Rotifera, Gastrotricha, Kinorhyncha and Nematomorpha) and one very large group (Nematoda)

Classes:

1. ROTIFERA
2. GASTROTRICHA
3. KINORHYNCHA
4. NEMATOMORPHA
5. NEMATODA

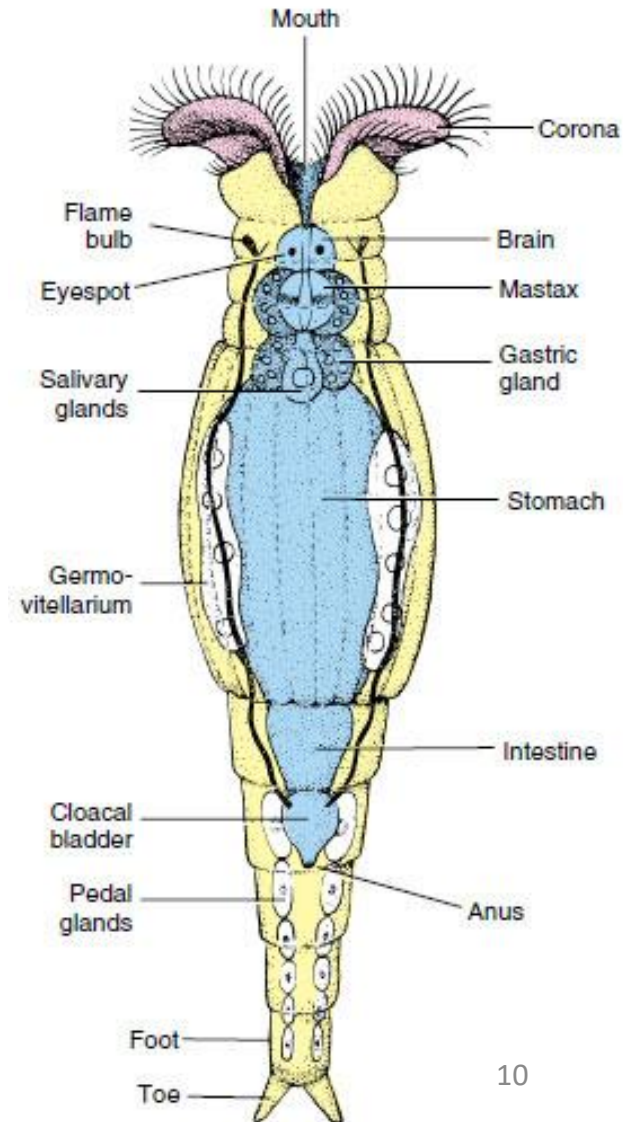
1. Class – Rotifera (Gr., rota - wheel + ferre - to bear)

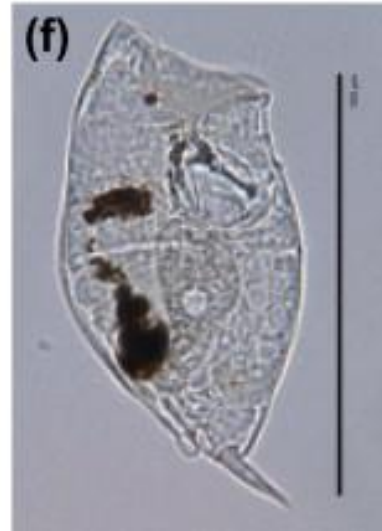
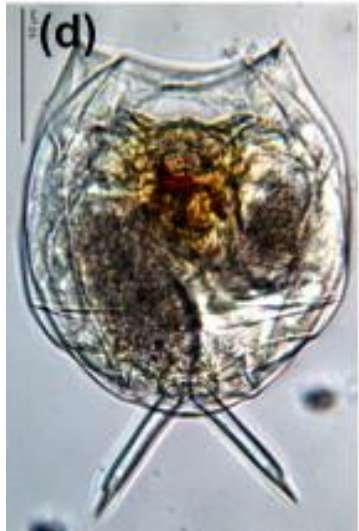
- ✓ Microscopic animals found in ponds, lakes and streams, rarely in oceans.
- ✓ Body wall thickened into stiff plates or lorica into which head may retreat.
- ✓ Anterior end with ciliary disc or corona (wheel organ), used for feeding and locomotion.
- ✓ Post –anal tail or with two toes and adhesive glands for attachment.
- ✓ Body musculature includes longitudinal and transverse muscle bands and strands.
- ✓ Digestive system with a grinding organ, mastax, lined internally by strong cuticle.



- ✓ Excretory system of proto-nephridia and two proto-nephridial tubes which empty into a bladder.
- ✓ Nervous system of three major ganglia and nerves.
- ✓ Sensory organs antennae and eye spots.
- ✓ Males smaller than females.
- ✓ Parthenogenesis common.
- ✓ No larval stage.

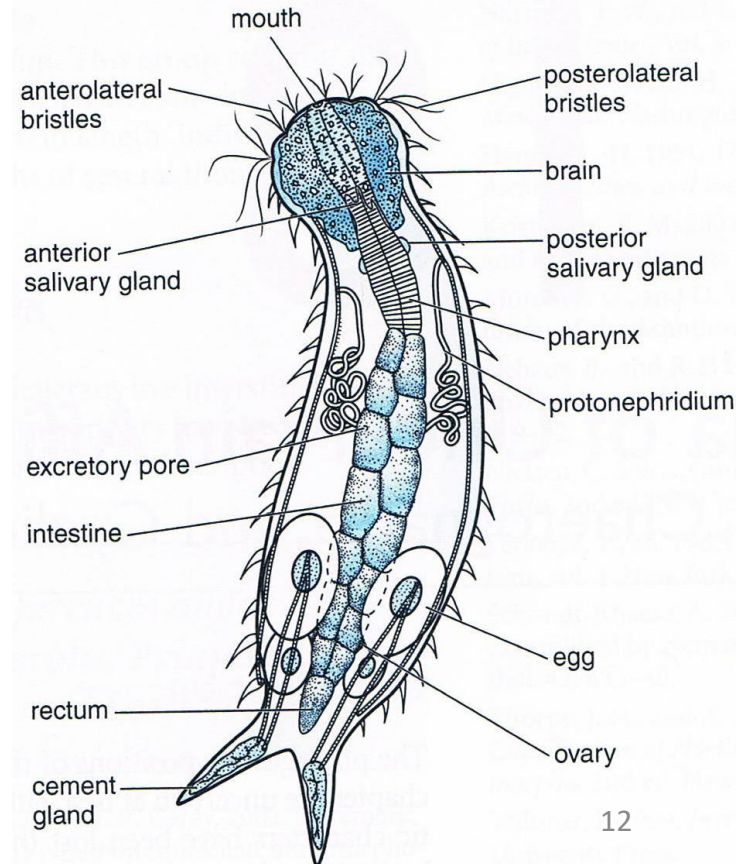
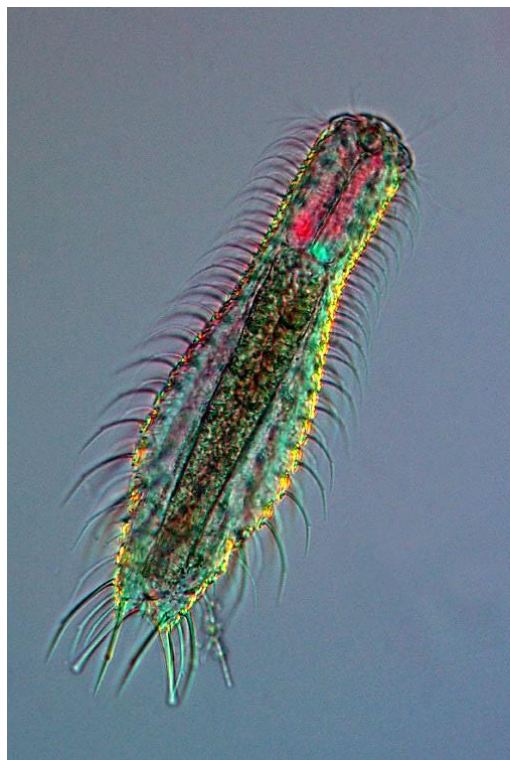
Examples: **philodina, asplanchna, rotaria, epiphanes (=hydatina).**



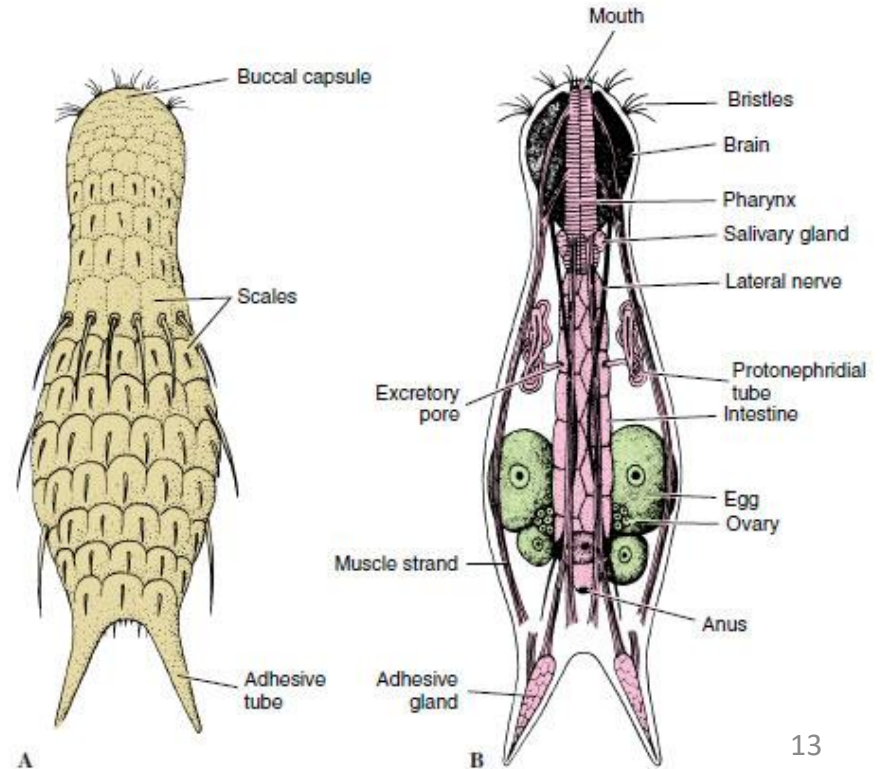


2. Class- Gastrotricha (Gr., gaster- stomach + trichos- hair)

- ✓ Microscopic, marine and fresh water.
- ✓ Body wall with cuticle bearing short, covered, dorsal spines.
- ✓ Corona absent cilia on ventral surface for locomotion.
- ✓ Posterior end forked and with adhesive tubes and glands for attachment.
- ✓ Body musculature includes six pairs of longitudinal muscles.
- ✓ Mouth surrounded by bristles.

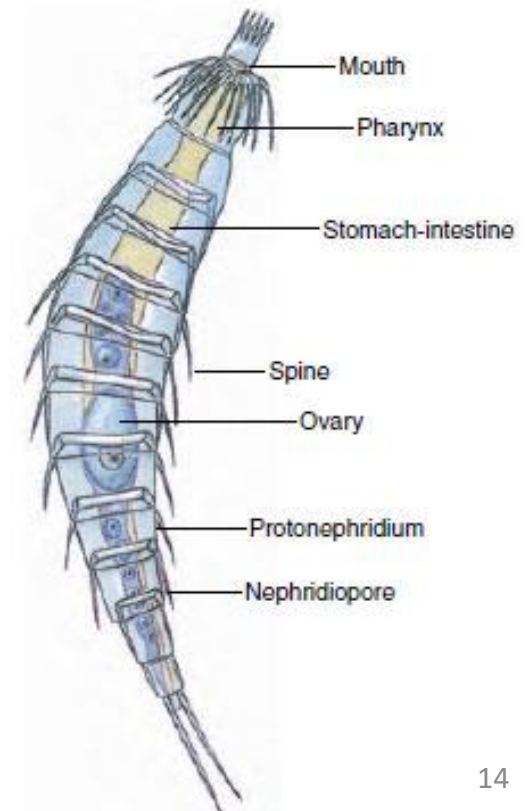


- ✓ Pharynx tri-radiate and muscular.
- ✓ Excretory system with two proto-nephridia.
- ✓ Nervous system with a saddle –shaped ganglion and two lateral nerves.
- ✓ Dioecious or monoecious.
- ✓ Fresh water females parthenogenetic.
- ✓ Development direct.



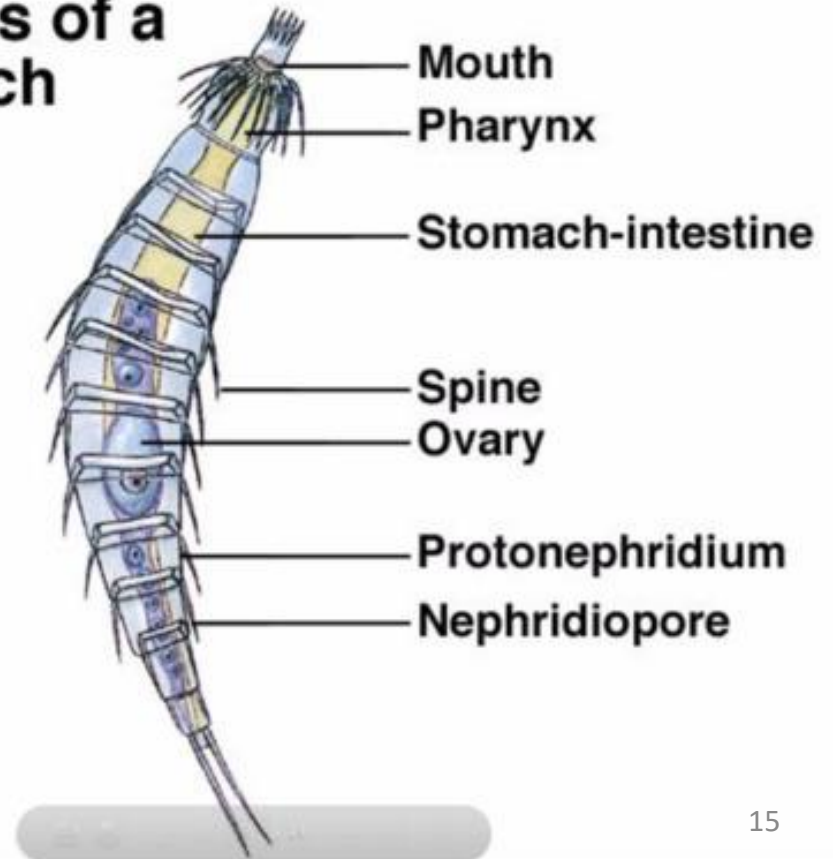
3. CLASS - Kinorhyncha /Echinodera (Gr., kineo- to move + rhynchos- beak)

- ✓ Marine, microscopic worm like animals.
- ✓ Superficial segmentation of body into 13 or 14 overlapping rings.
- ✓ Body surface with spiny cuticle but no cilia.
- ✓ Mouth cone or head protrusible and covered with scalids.
- ✓ A pair of adhesive tubes in front part of the ventral surface.
- ✓ Pseudocoel with fluid containing anoebocytes.



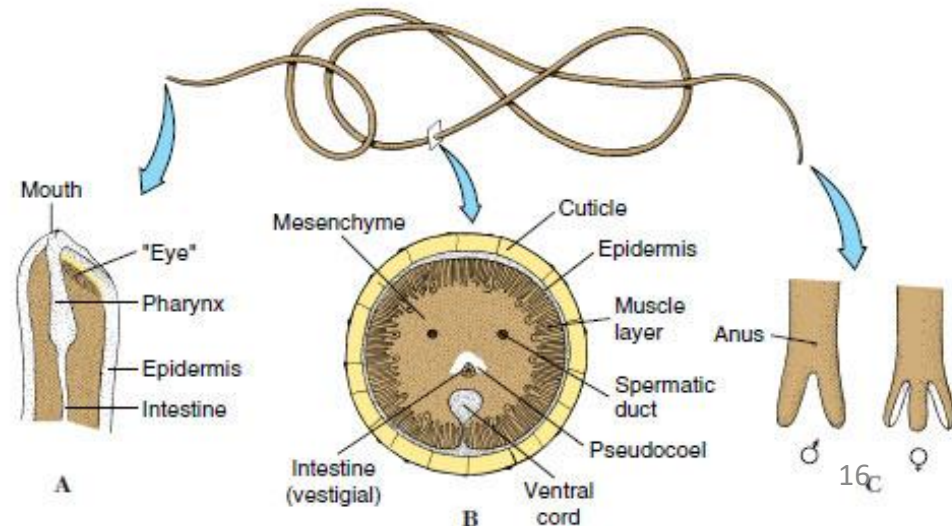
- ✓ A nerve ring with ventral cord with a ganglion in each zonite.
- ✓ Eyespots in some.
- ✓ Digestive system complete, with salivary glands.
- ✓ Dioecious gonads as a pair of tubular sacs.
- ✓ Penial spicules in males.
- ✓ Fertilization internal.
- ✓ Metamorphosis with several larval stages.

Structures of a kinorhynch

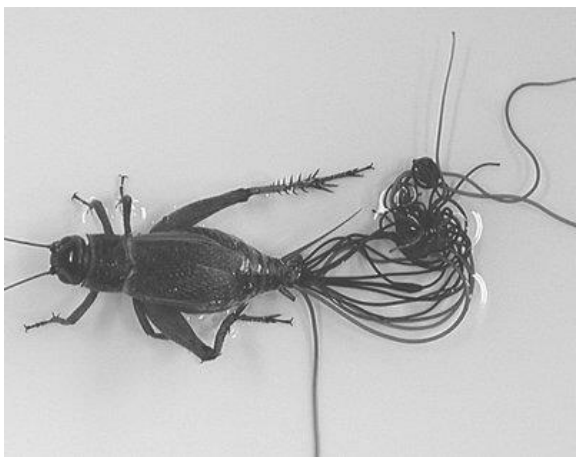


4. CLASS- Nematomorpha (Gr., Nema- thread + Morphae- shape)

- ✓ Hair worms, found in fresh water. One genus marine.
- ✓ Body long, slender and cylindrical.
- ✓ Cuticle thick bearing small papillae. Epidermis cellular, single layered.
- ✓ Digestive system complete in larva but degenerates in non-feeding adults. Cloaca present.

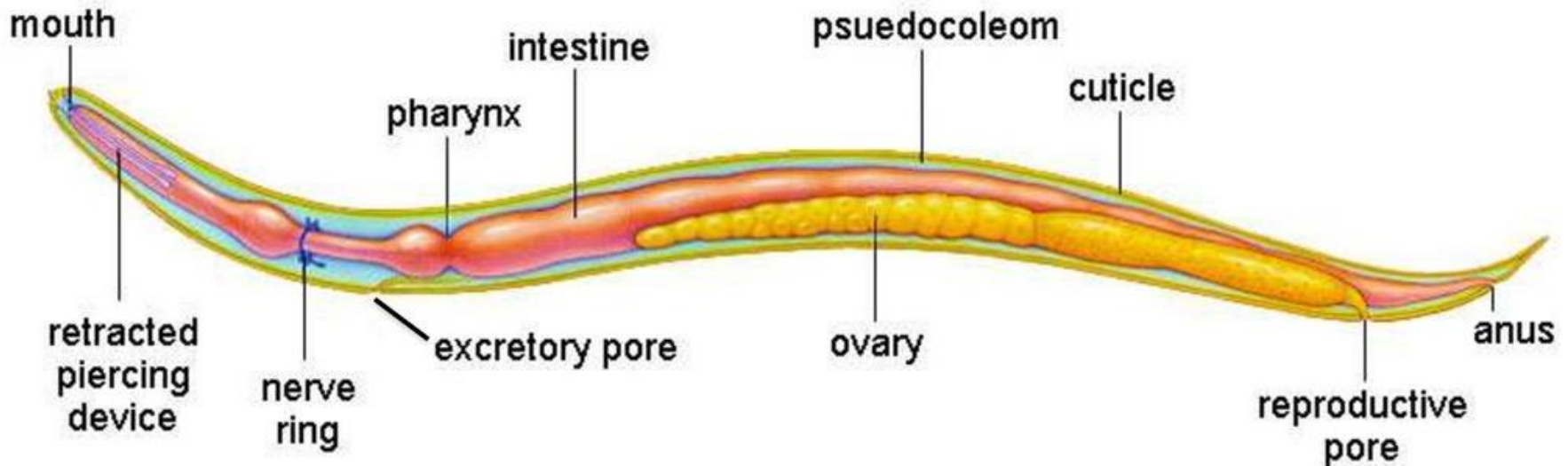


- ✓ Pseudocoel mostly filled with parenchyma.
- ✓ No circulatory, respiratory and excretory systems.
- ✓ Nervous system with a circumventric nerve ring and a mid ventral nerve cord.
- ✓ Dioecious, gonads and gonoducts paired. Oviducts also open into cloaca.
- ✓ Juveniles parasitic in grasshoppers, crickets and other insects.

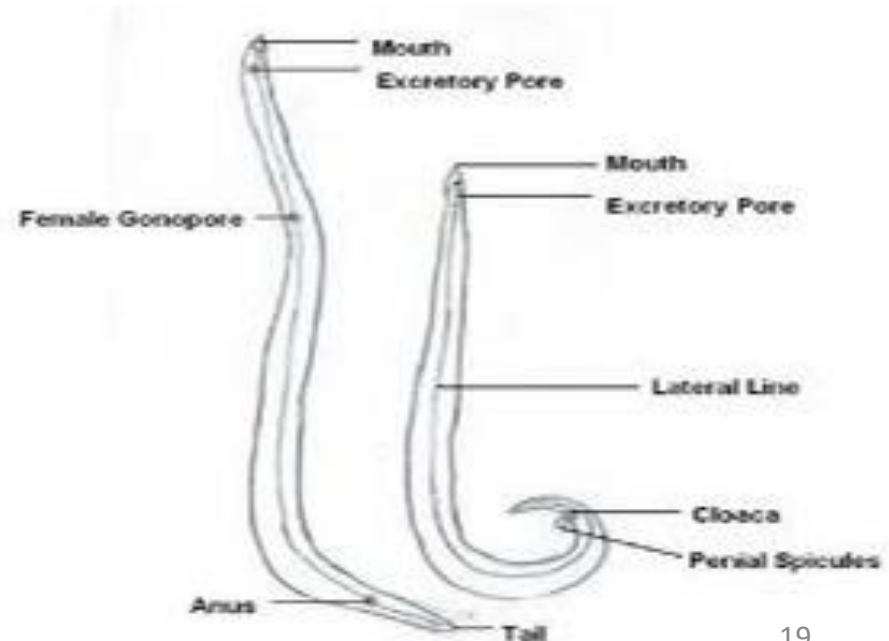
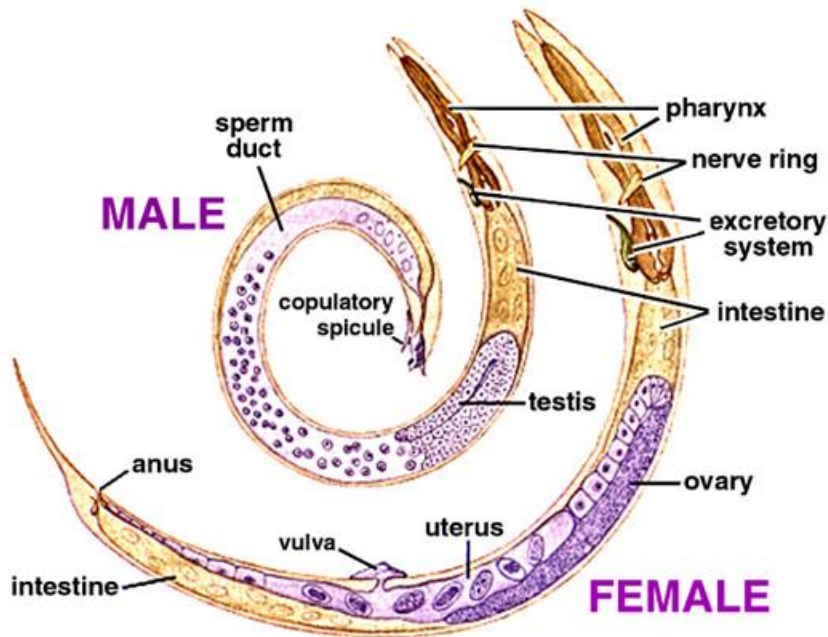


5. CLASS- Nematoda (Gr., Nema-thread + Eidos- form)

- ✓ Aquatic, terrestrial or parasitic roundworms.
- ✓ Body elongated, cylindrical and unsegmented.
- ✓ Body wall with thick cuticle, cellular or syncytial epidermis and longitudinal muscle cells in four bands.
- ✓ No cilia, circulatory and respiratory systems.
- ✓ Digestive system complete with muscular pharynx and glands.

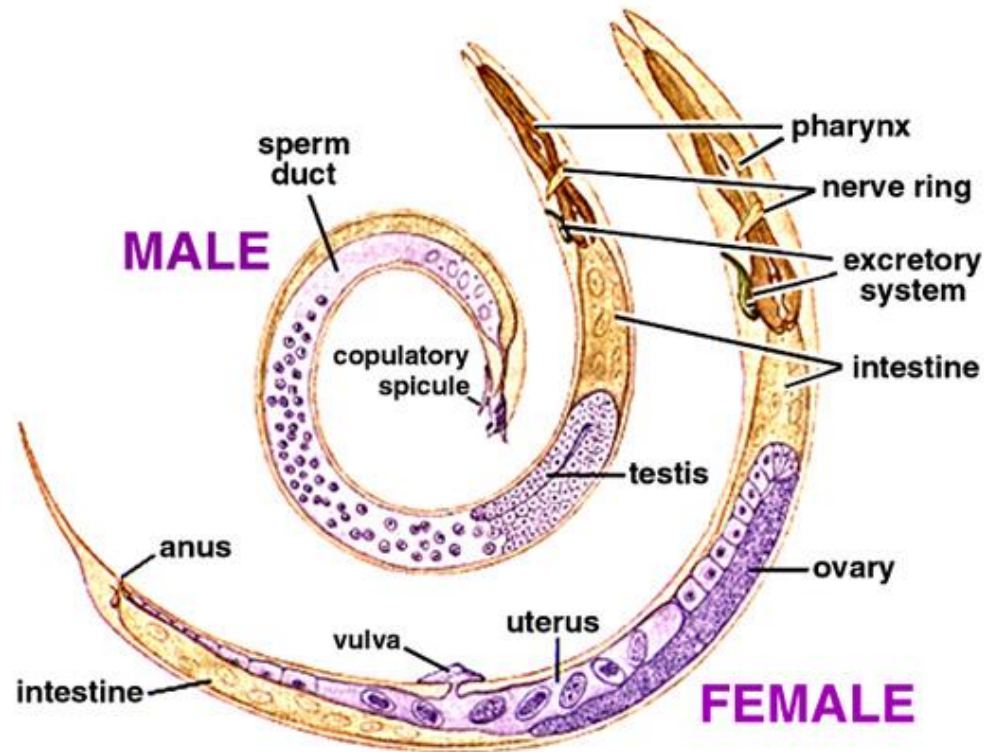


- ✓ Excretory system of glandular organs, canals or both.
- ✓ Nervous system with circumenteric ring and anterior and posterior nerves.
- ✓ Sense organs simple.
- ✓ Dioecious. Male with penial spicules and smaller than female.
- ✓ Gonads one or two. Male genital ducts lead into cloaca, female genital duct with a separate opening.
- ✓ Fertilization internal. Development usually direct.
- ✓ No asexual reproduction or regeneration.



Life Cycle of *Ascaris lumbricoides*

Kingdom – Animalia
Phylum – Ascyhelminthes
Class – Nematoda
Genus – Ascaris
Species - Lumbricoides



- Commonly called as Roundworm
- Monogenetic endoparasite of man.

They are the largest of the common nematode parasites of humans; females measure 20 to 35 cm long and the males are 15 to 31 cm long

- Present in the small intestine of man (usually jejunum).
- Occurs in the pigs and gorilla (*A.suum*) *also*.
- It is cosmopolitan in distribution, but more prevalent in the tropics (India, China, SE Asia etc).
- *Present in about 25% human population.*
- Sexual maturity is attained in about 65 to 70 days. Fertilization is internal.
- Females produce enormous number of eggs i.e about 20,000 per day.
- After fertilization eggs get enclosed in a chitinous shell.
- Shelled eggs are released into the small intestine and then these are carried by faeces outside.
- Through unhygienic conditions it reaches new host

- Both unfertilized and fertilized eggs are passed.
- Fertilized eggs will become infective within 2 weeks if they are in moist, warm soil where they may remain viable for months or even years.
- The fertilized egg is broadly oval, with a thick, mammilated coat, usually bile-stained a golden brown. These eggs measure up to 75µm long and 50µm wide. Unfertilized eggs are usually more oval, measure up to 90 µm long, and may have a pronounced mammilated coat or an extremely minimal mammilated layer. The total absence of fertilized eggs means only female worms are present in the intestine.

□ UNFERTILIZED EGGS

PARAMETER	DESCRIPTION
SIZE	85-95 µm by 38-45 µm; Size variations possible
SHAPE	Varies
EMBRYO	Unembryonated; Amorphous mass of protoplasm
SHELL	Thin
Other features	Usually corticated

A. lumbricoides, unfertilized egg



Heavy Albuminous Coating

Thin Shell

□ FERTILIZED EGGS

PARAMETER	DESCRIPTION
SIZE	40-75 µm by 30-50 µm
SHAPE	Rounder than non-fertilized version
EMBRYO	Undeveloped unicellular embryo
SHELL	Thick chitin
Other features	May be corticated or decorticated

A. lumbricoides, fertilized egg

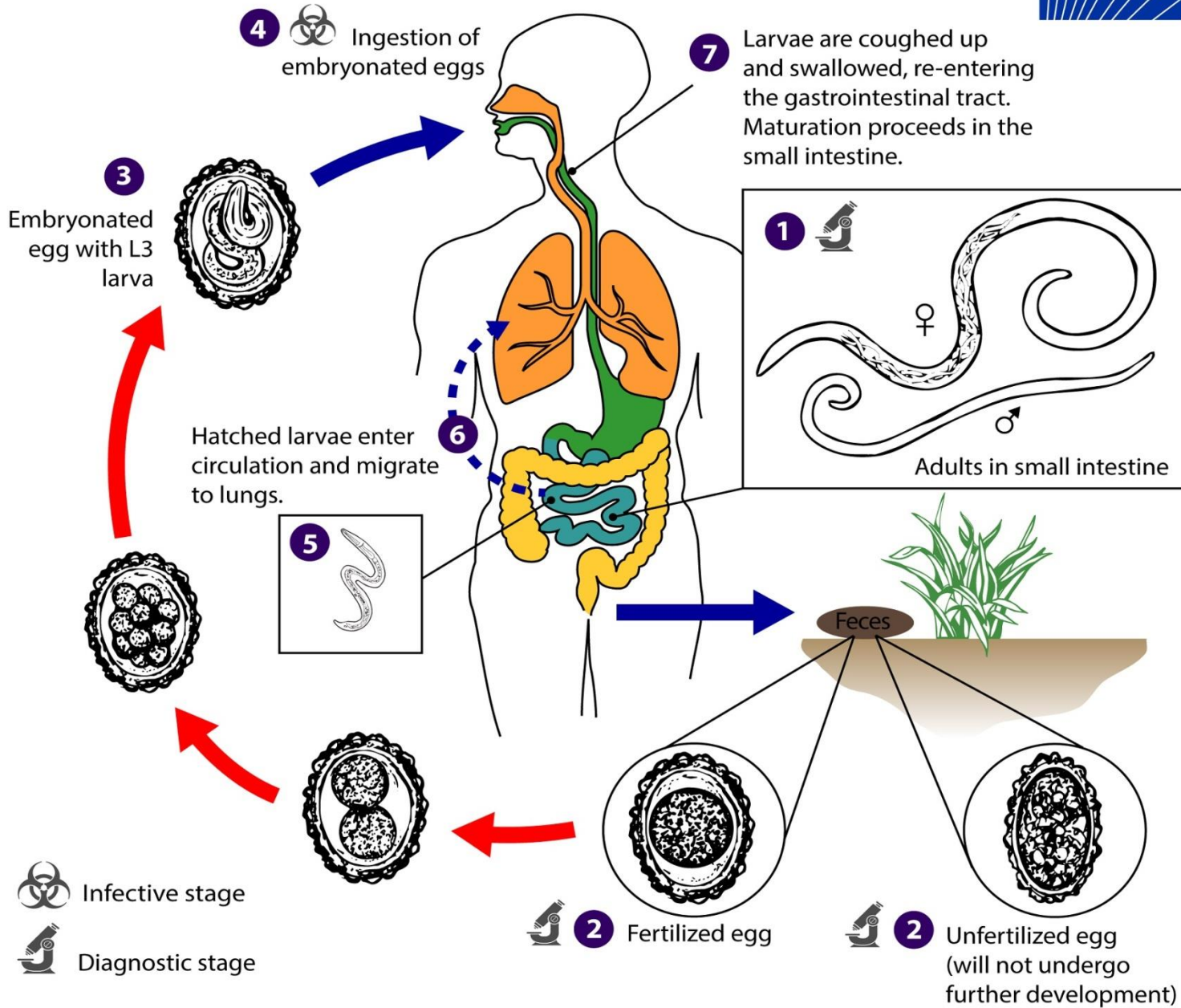


Coarse Mammilated Albuminous Coating (Corticated)

Thick chitin shell

- In favourable condition it develops into the larva. First stage larva is formed in about two weeks.
- Fertilized eggs may remain viable for months and even years.
- Second stage larva is formed in about a week.
- Since it resembles the nematode *Rhabdites* it is known as the *Rhabditiform larva*. This stage is infective





- On ingestion, the eggs hatch in the stomach and duodenum, where the larvae actively penetrate the intestinal wall; they then begin their primary migration towards lungs, and from there secondary migration back to intestine.
- First they travel to liver through Hepatic portal vein, from there they are then carried to the right heart via the Post caval vein.
- Then the larvae are carried to lungs by the pulmonary circulation, approximately within 10-12 days in the lungs they develop into 3rd and 4th stage larvae, then these larvae break into the alveoli.
- Then the larvae begin their secondary migration and they travel to intestine via the bronchial tree by coughing process until they reach the trachea and pharynx, and are then swallowed.
- The worms then mature and mate in the intestine, with the eventual production of eggs which are passed in the stool. The entire developmental process from egg ingestion to egg passage from the adult female takes from 8 to 12 weeks. During her life span, egg deposition may reach a total of 27,000,000 eggs.

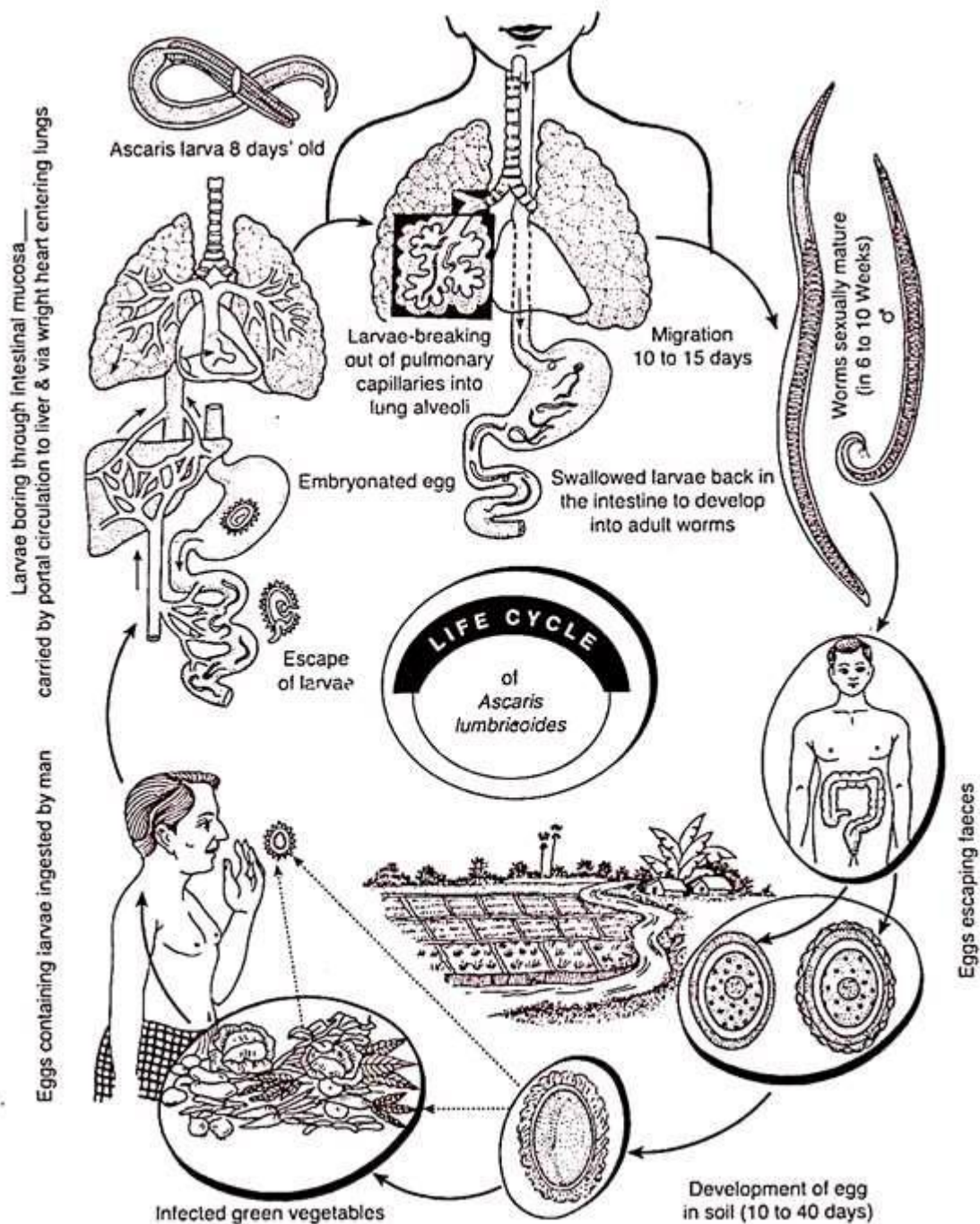


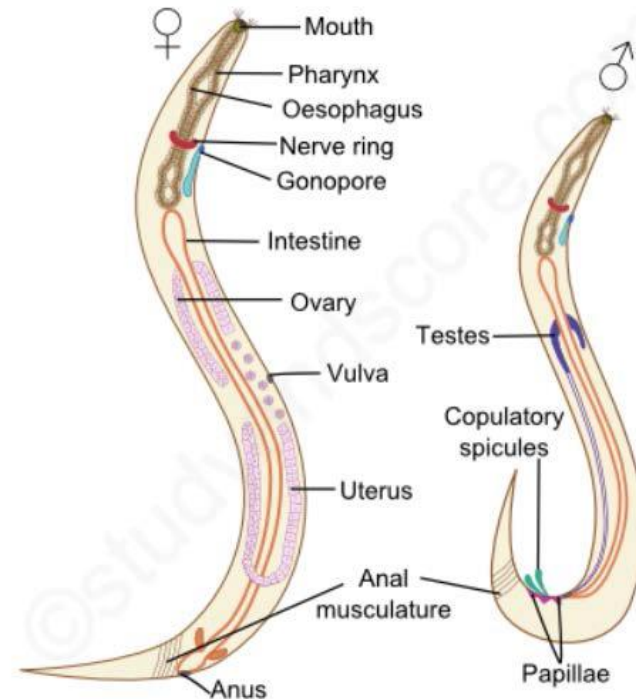
Fig. 11.4: Round worm—Life cycle of *Ascaris lumbricoides*

Life Cycle of *Wuchereria bancrofti*

Wuchereria bancrofti is a human parasitic worm also termed as “Filarial worm” that is the chief cause of lymphatic filariasis/bancroftian Filariasis or elephantiasis in which the lymphatic and genital organs get disabled either temporarily or permanently.

It is a digenetic endoparasite of man these filarial worms are multiply and get well distributed in human populations by a variety of mosquito vector species.

Kingdom – Animalia
Phylum – Ascyhelminthes
Class – Nematoda
Genus – Ascaris
Species - Lumbricoides

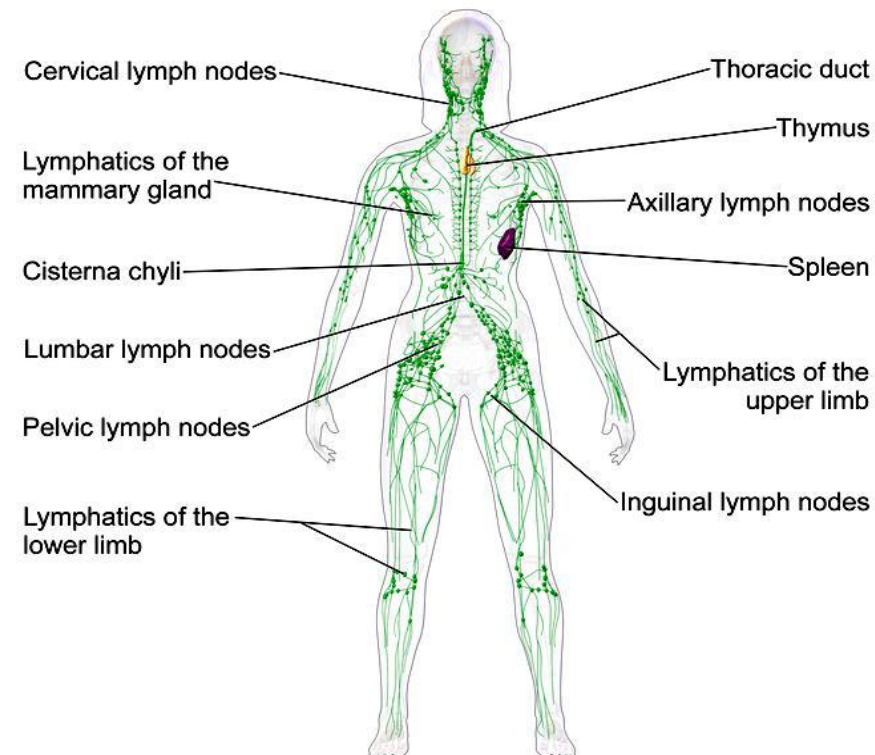


WUCHERERIA - ADULT FEMALE AND MALE

Wuchereria bancrofti has been named after its discoverers - Brazilian Physician **Otto Edward Henry Wucherer (1820 – 1873)** and British Parasitologist **Joseph Bancroft (1836 – 1894)**. Both scientists are considered pioneers in studying filarial infections .

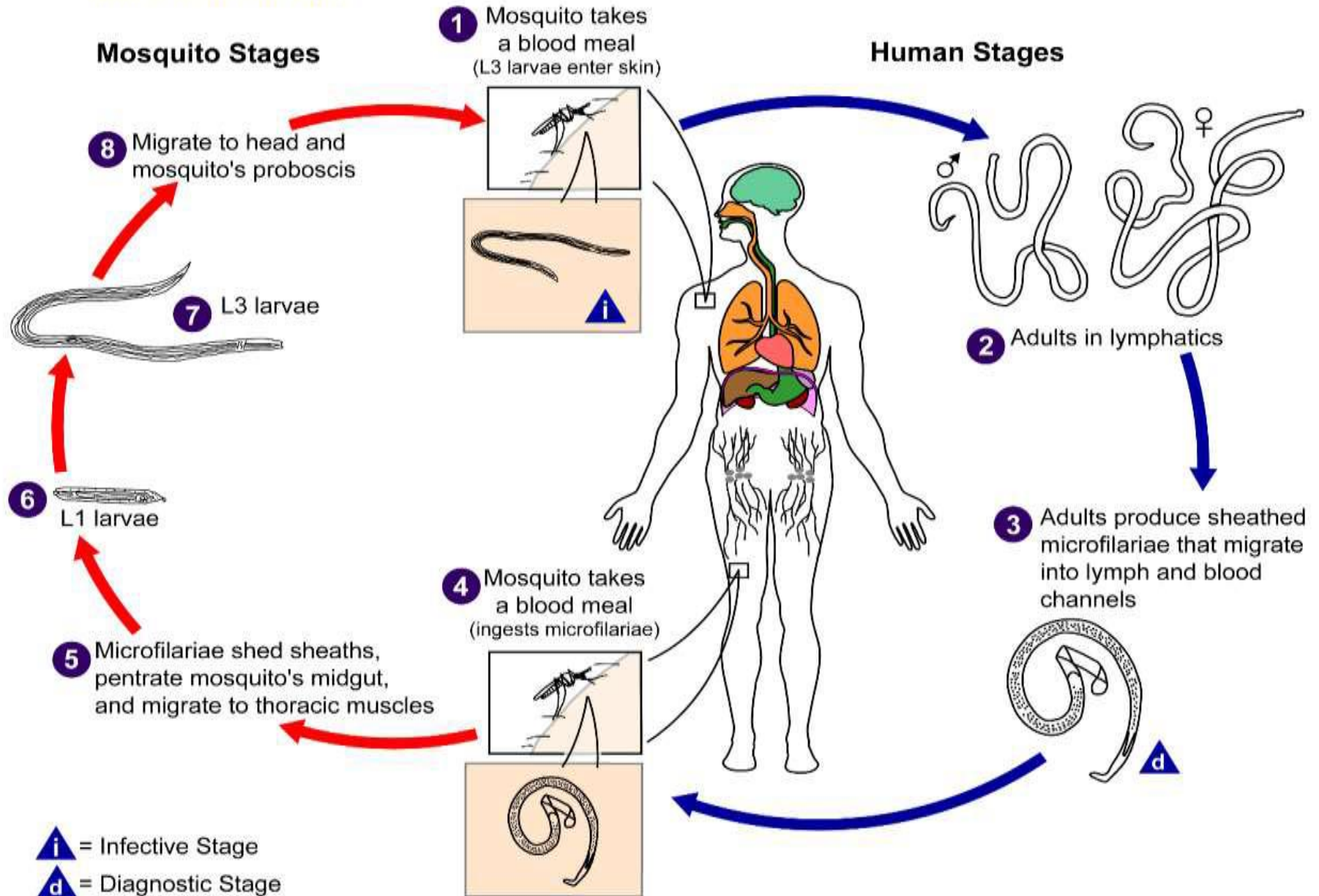
Wuchereria bancrofti is largely confined to the tropical and sub-tropical regions of the world. According to the WHO reports, 73 countries are affected with the parasite. Some of these countries include India, West Indies, South America, West and Central Africa, Southern China, Japan, Pacific Islands and Korea.

Approximately 120 million people are believed to have filarial infection out of which 25 million men suffer from genital disease while almost 15 million, mostly women, have developed elephantiasis of the leg. Approximately 66% of those at risk of infection are reported to live in the South-East Asia Region and 33% in the African Region.

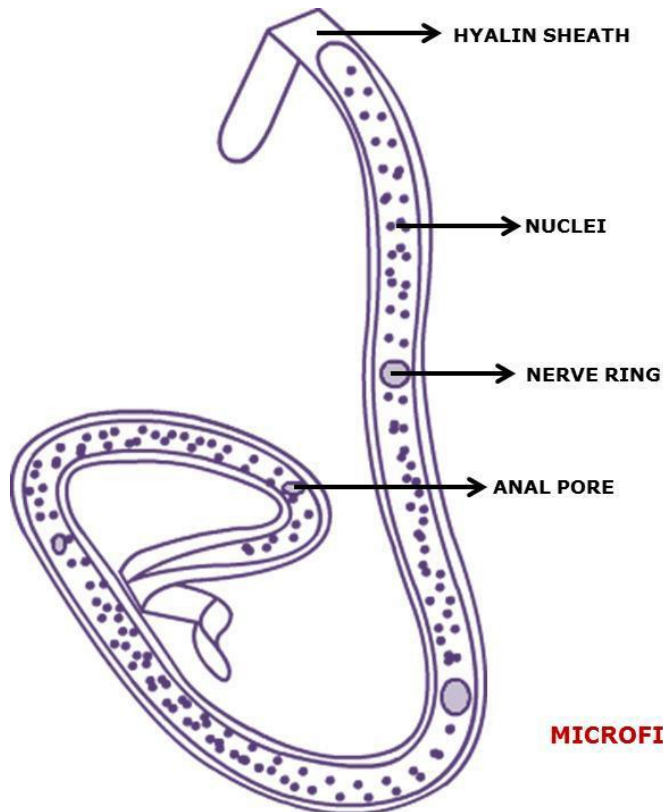


Filariasis

(*Wuchereria bancrofti*)



The females of *Wuchereria bancrofti* are ovo-viviparous. Thus, instead of laying eggs like many other nematodes, they liberate numerous active embryos, called juveniles or microfilariae in the lymphatic channels

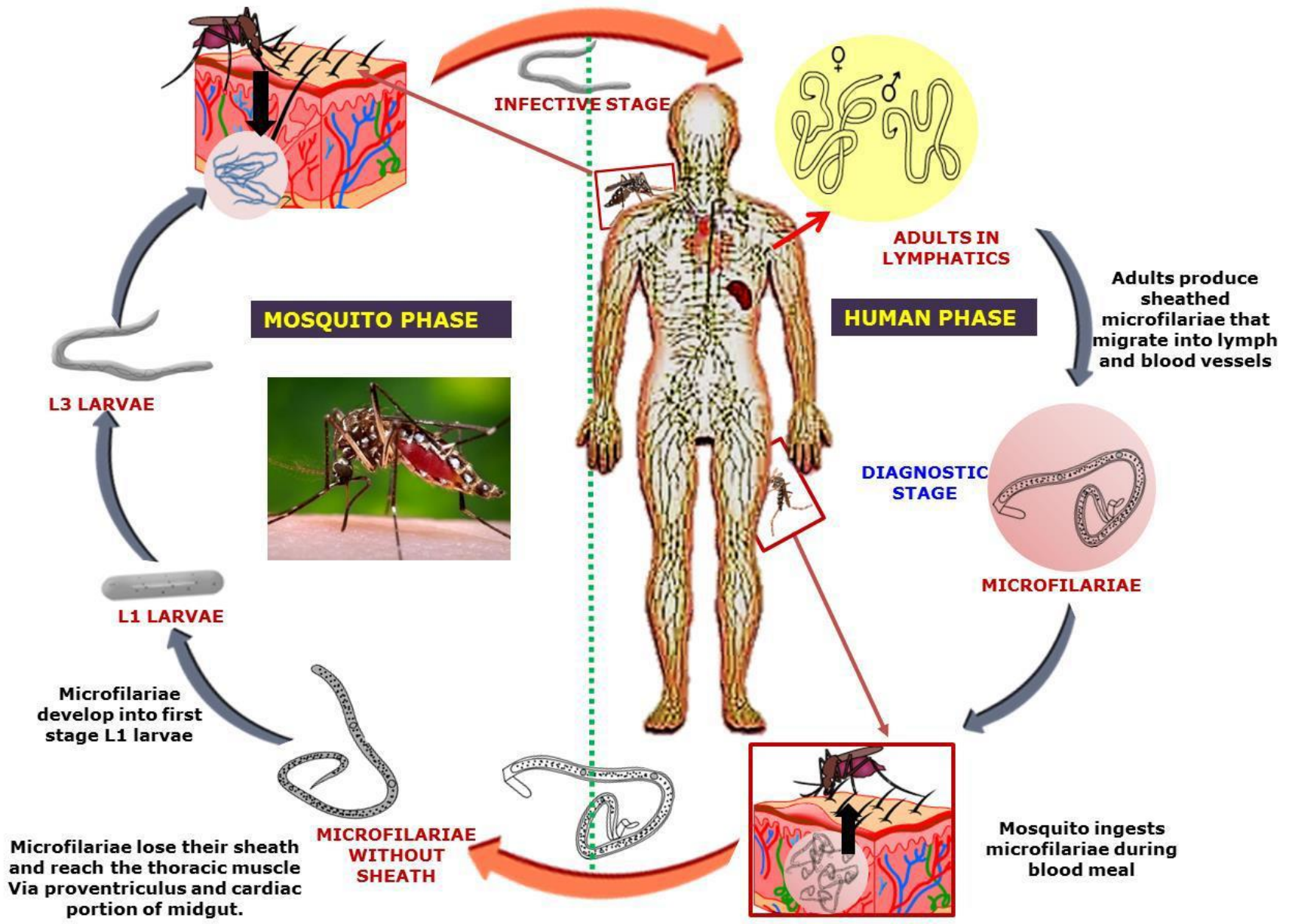


MICROFILARIA



- The female *Wuchereria* are *ovo-viviparous and liberate numerous microfilariae in her lifetime.*
- The microfilariae are covered with a hyaline sheath and possess numerous nuclei which are absent from head, anal region, nerve ring and excretory pore of the body.
- The microfilariae enter the circulating blood and do not undergo any further development in the human beings as they need a lower temperature for their development.
- Microfilariae exhibit nocturnal periodicity as during night, they appear in the peripheral blood vessels, especially between 10 pm to 4 am, to be sucked by *Culex*; *while during day time they reside in the large and deeper blood vessels of various organs.*

- When mosquitoes suck the blood of an infected individual, the sheathed microfilariae are ingested with the blood and reach the stomach of mosquito.
- Within 1-2 hrs they lose their sheaths and penetrate the wall of stomach migrating to thoracic muscles or wing muscles for further development.
- Within next 14 days, the microfilariae pass through three larval stages, third larval stage being the only infective stage which migrates to the proboscis of mosquito.
- Infection to a new host takes place when the infected mosquito bites a human being.
- The larvae are deposited on the human skin from where they enter human body generally through the site of mosquito bite.
- The larvae accumulate in the lymph glands and attain sexual maturity within 5-18 months.



Filariasis



THANK YOU

End