

Phylum Nematoda

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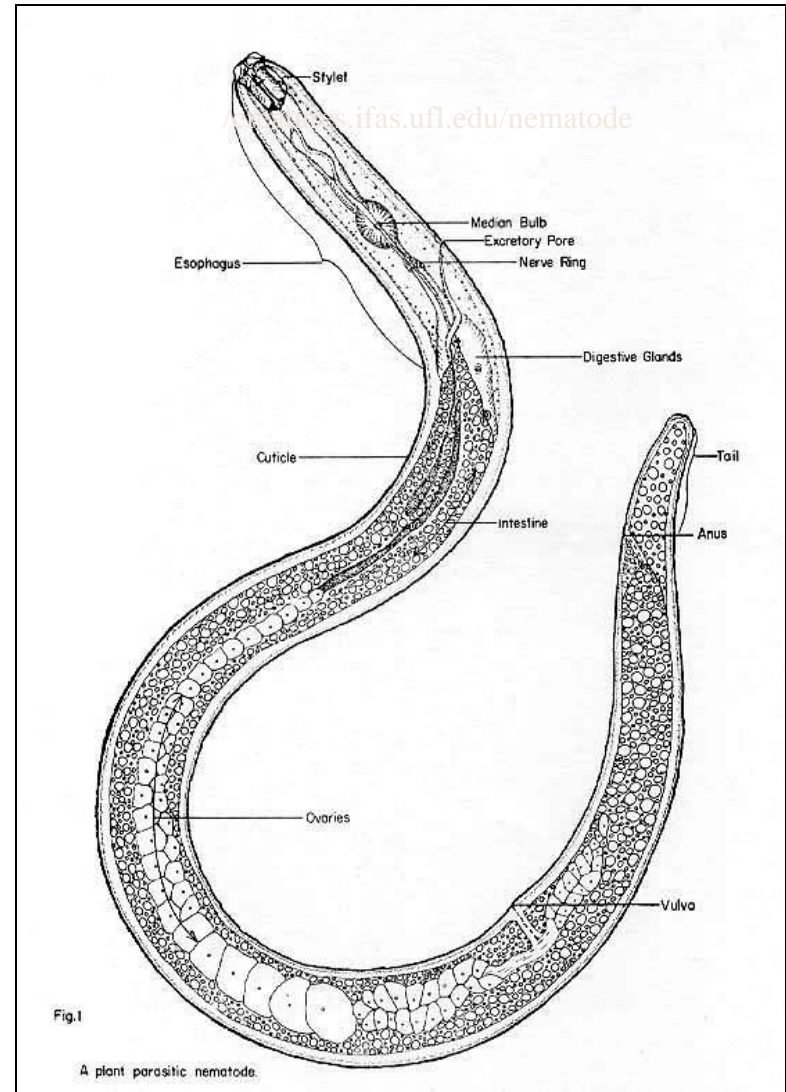
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Phylum Nematoda: Diversity

- Free-living forms found in nearly every environment i.e they are cosmopolitan
 - Free-living marine & freshwater
 - Between grains of beach sand
 - Key soil dwellers (nutrient processing)
 - Polar ice fields
- Key plant & animal parasites.
- Triploblastic and bilaterally symmetrical

Phylum Nematoda: General Biology

1. Habit and Habitat
2. External Features
3. Body Wall
4. Body Cavity
5. Digestive System
6. Respiration
7. Excretory system
8. Nervous system
9. Sense organs
10. Reproductive system



HABIT AND HABITAT

- Cosmopolitan in distribution
- Freshwater, marine and soil dwellers
- Majority are free living, some are parasite in plants and animal
- Mode of Nutrition is Holozoic
- Most free living <2.5 mm in length. Some parasites > 50 cm in length.

EXTERNAL FEATURES

- **Body covered by a tough, smooth and elastic cuticle.**

Anteriorly,

- **Possession of six lips (Labia) fused up in some.**
- **Presence of olfactory chemoreceptors called Amphids**

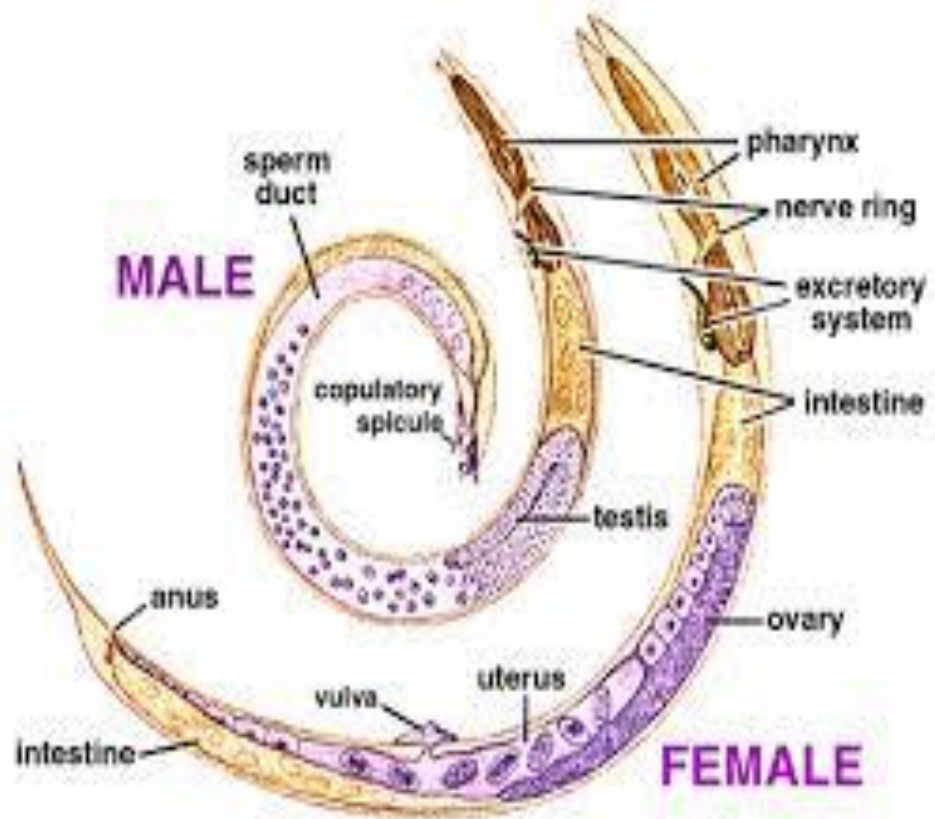
Posteriorly,

- **Presence of anus with thick lips**
- **Male has cloaca from which two equal chitinous spicules (penial setae) projects.**



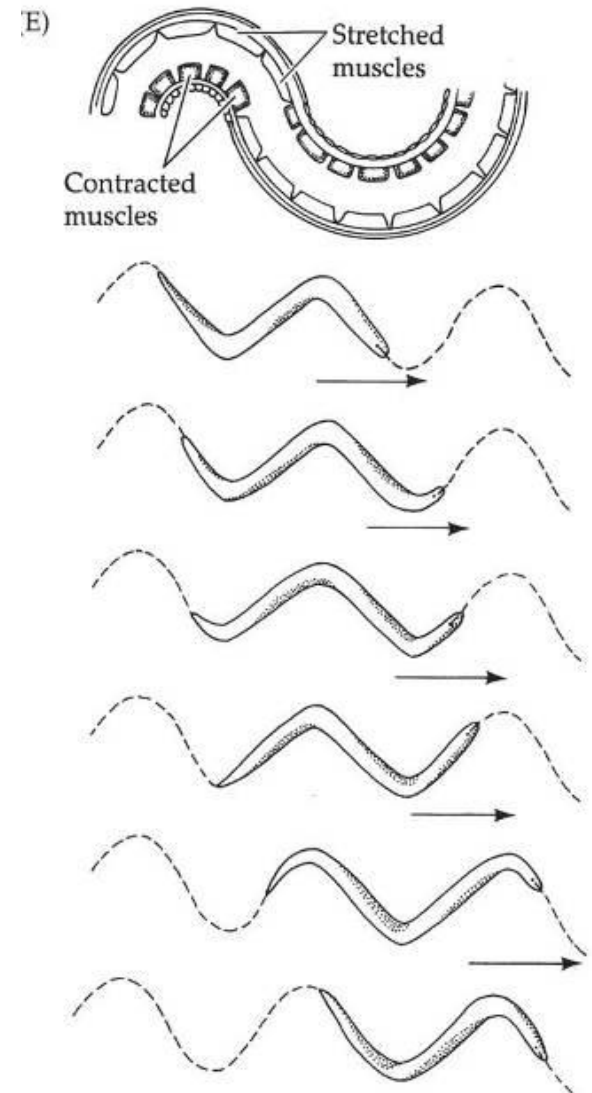
External Features cont'd

- Presence of papillae in male connected with copulation.
- Presence of short post-anal tail. Straight in female, curled in male
- Male smaller and thinner than females
- Presence of genital aperture (vulva or gonopore) in female on the ventral side.
- Presence of excretory pore at mid ventral location.



Movement

- Muscles
 - Longitudinal muscles only
 - Several along body length
 - Must push against solid surface to move forward
 - Elasticity of cuticle may aid in movement
- Antagonistic muscle action
 - Right contracted → left relaxed



BODY CAVITY

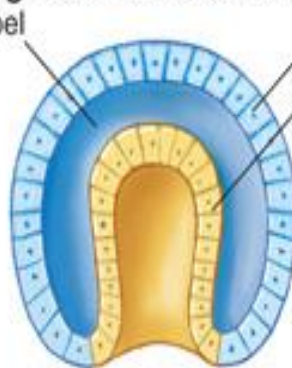
**Nematodes are pseudocoelomate
i.e mesoderm lines up the
blastocoel**

COELOM

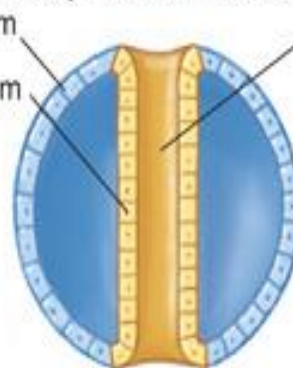
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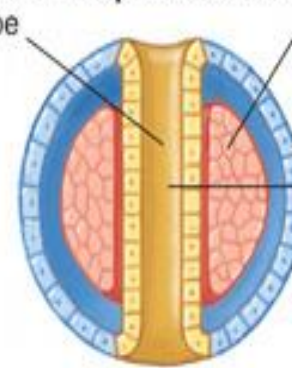
Blastula



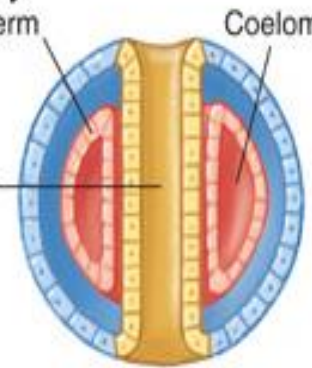
Gastrula



Complete gut forms

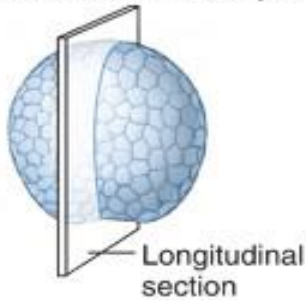


Mesoderm lies between
endoderm and ectoderm

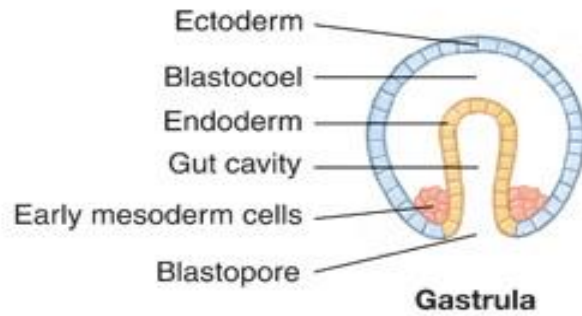
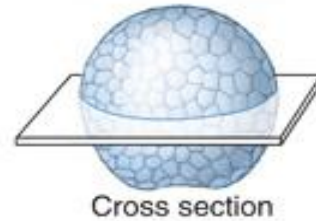


Coelomic cavity forms
inside mesoderm

External view
of a gastrula



Longitudinal section



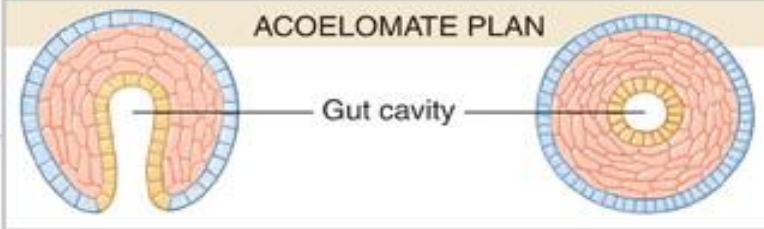
Mesoderm fills blastocoel

Mesoderm lines one
side of blastocoel

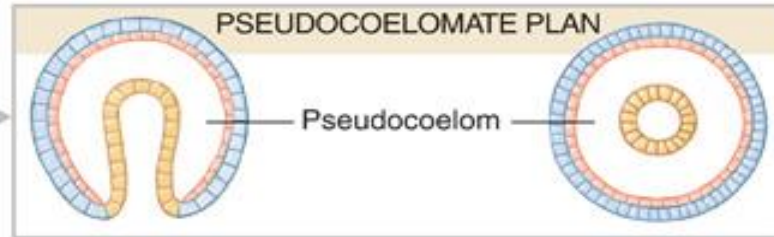
Band of mesoderm surrounds
gut and then splits open

Mesodermal
pouches
surround gut

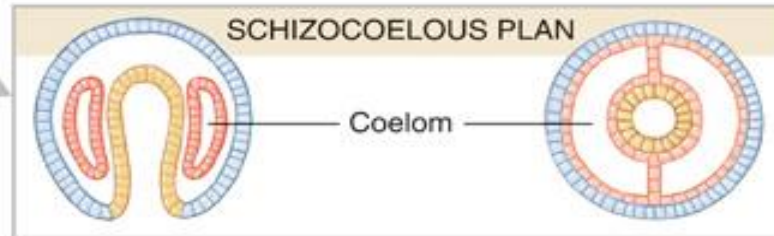
ACOELOMATE PLAN



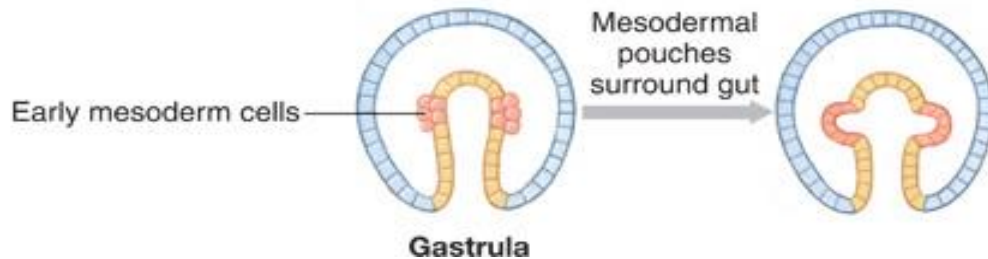
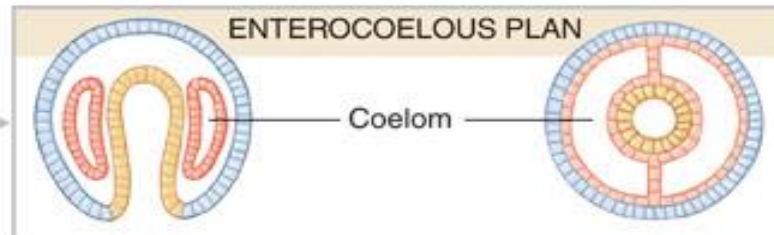
PSEUDOCOELOMATE PLAN



SCHIZOCOELOUS PLAN



ENTEROCOELOUS PLAN

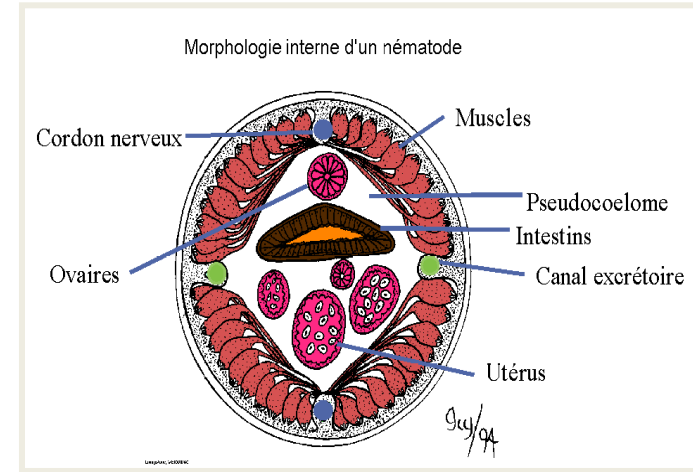


A

B

BODY CAVITY or PSEUDOCOEL

1. Pseudocoels have fibrous tissue and fixed cells called coelomocytes or giant cells.
2. The pseudocoel is filled with fluid called pseudocoelomic fluid and perienteric fluid.
3. This fluid distributes digested fluids and various metabolites.
4. It is composed of 93% water and 7% solids like protein, glucose, sodium chloride, phosphate e.t.c.



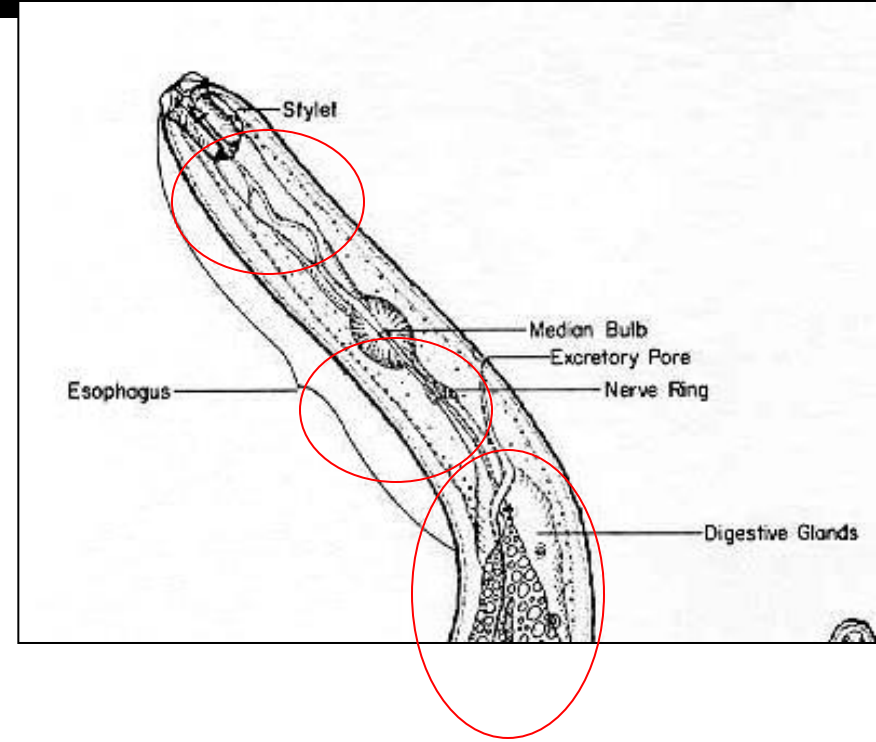
BODY SYMMETRY

- Bilateral symmetry
- Triploblastic

DIGESTIVE SYSTEM

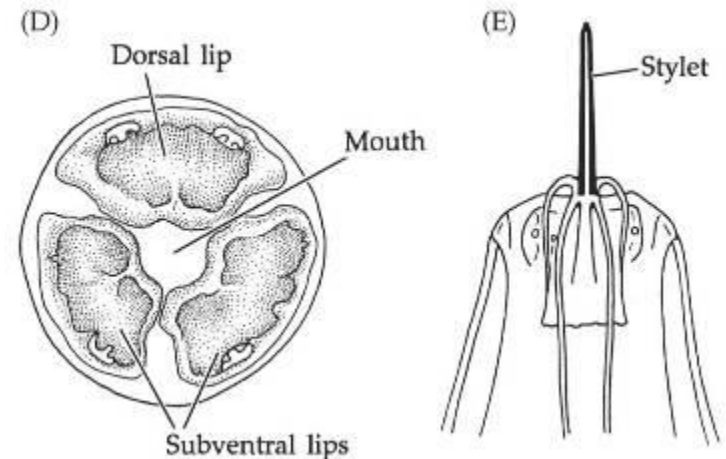
Consist of :

- Mouth (lips, teeth , stylet and jaw)
- Short Muscular pharynx
- Oesophagus



Oesophagus forms

- 1. Foregut; long intestine
- 2. Midgut
- 3. Hindgut: Short rectum



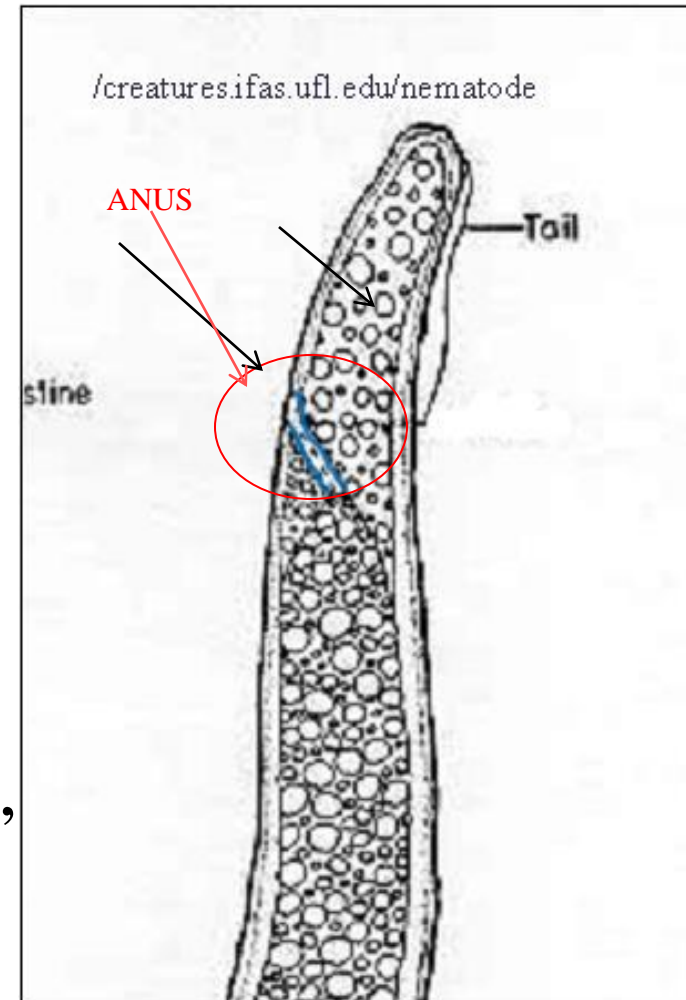
Digestive system cont'd

■ Buccal Cavity varies depending on prey

- Bacteria - no teeth or stylet
- Plant root - stylet
- Carnivore - small teeth and sometimes stylet
- Intestine - large hook-like teeth

Hindgut

- Hindgut opens to a cloaca in male, but in females open to an anus.
- Contraction causes fecal materials to be discharged.

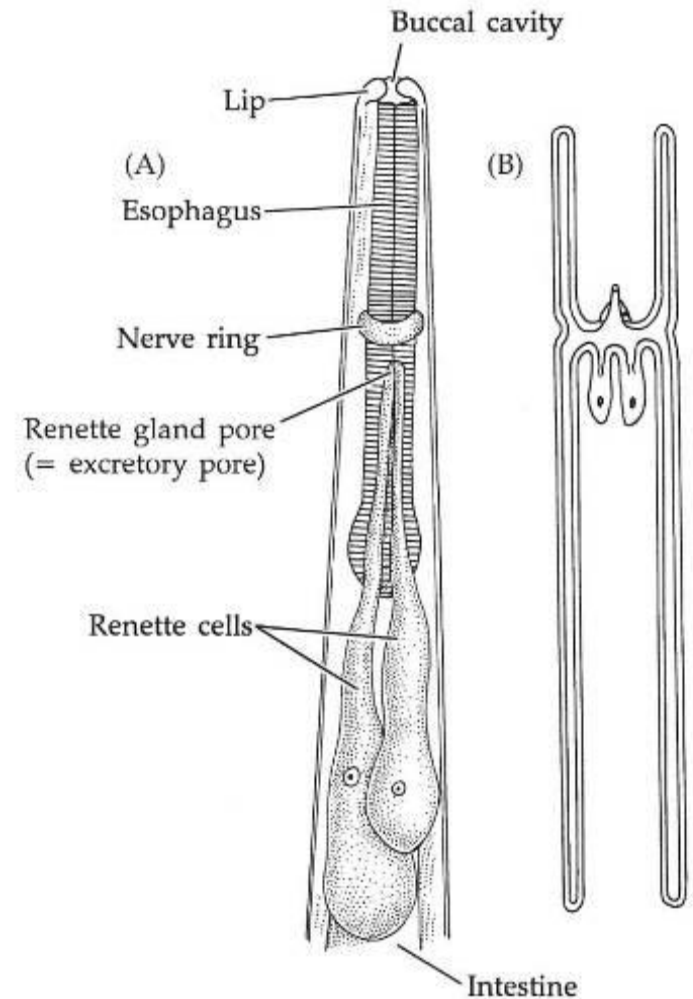


FOOD AND FEEDING

- Foods comprising blood, tissue, bacteria, plants are partly or fully digested food of host.
- Food sucked in by suctorial action of pharynx
- Digestion is extracellular in intestinal lumen
- Digestion facilitated by proteases, amylases and lipases secreted by glands of the pharynx
- Digested nutrients absorbed by microvilli on intestinal wall and distributed in pseudocoelomic fluid.
- Excess food stored as reserve glycogen in intestinal wall and muscles

EXCRETION

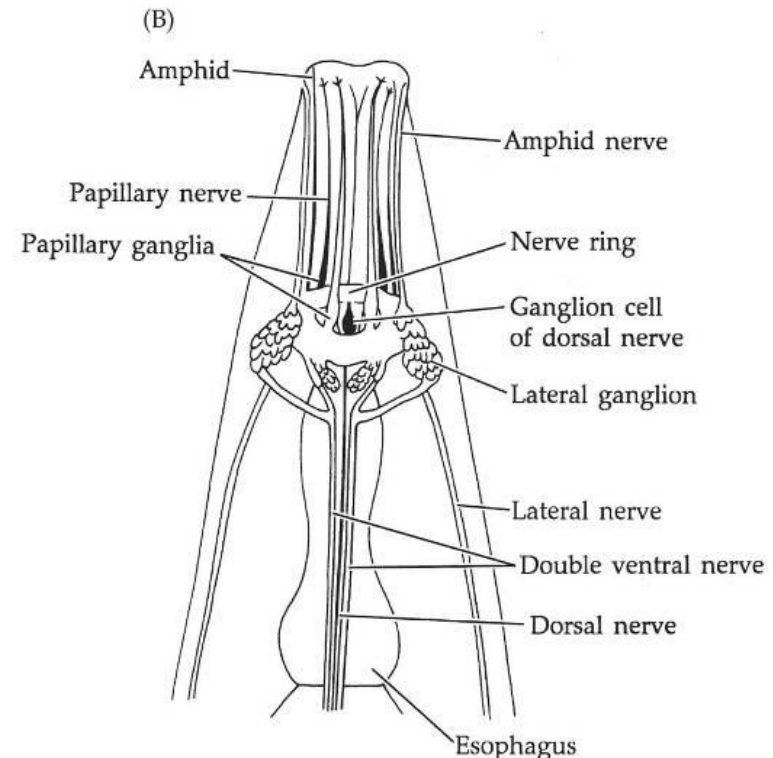
- Excretory system consists of one or two large RENETTE glands cells lying in the pseudocoel near the pharynx and intestine.
- A duct arise from each RENETTE gland cell and open by an excretory pore
- Excretion also via the digestive system
- Excretory system regulates, Water-salt balance, Ionic balance
- Body wall helps to excrete Ammonia



Nervous system

- Nervous system is well developed, complicated and hypodermic (situated in the body wall)

- It is organized into:
 - Nerve ring
 - Plus associated ganglia
 - Sensory nerve input
 - Four major nerve cords:
 - 1 dorsal,
 - 1 ventral,
 - 2 lateral



Sensory structures

SN	Sensory Structure	Locaion	Function
1	Labial Papillae	Anterior	Taste
2	Amphids	Anterior	Olfactory chemoreceptors
3	Phasmids	Posterior	Chemoreceptors
4	Cephalic Papillae	Anterior	Chemoreceptors
5	Cervical Papillae	Anterior	Tactile
6	Genital Papillae	Posterior	Tactile and copulation

RESPIRATORY SYSTEM

- RESPIRATORY ORGAN IS ABSENT.
- However parasites carry on ANAEROBIC respiration.
- They break down glycogen into Carbon dioxide and Fatty acids which are excreted through the cuticle.

Reproduction

- Sexual reproduction
 - Sexes are separate i.e dioecious
 - internal fertilization
 - Male has cuticular spicules
 - Males have curled end and are shorter
 - sperm lack flagella (amoeboid)
 - Oviparous or ovoviviparous
 - High incidence of parthenogenesis
 - In some, mating occurs but sperm nucleus not used.
 - Some are hermaphrodites

Male Reproductive organs

- Testis
- Vas deferens
- Seminal vesicle
- Ejaculatory duct
- Penial setae

Female Reproductive organs

- Ovaries
- Oviducts
- Uteri
- Vagina

ECONOMIC IMPORTANCE

- Nematodes are either freeliving or parasitic.
- Plant Parasite
- Animal Parasite
 - Veterinary importance (Livestock, ruminants e.t.c)
 - Medical importance (humans)

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PHYLUM NEMATODA: CLASSIFICATION

- KINGDOM - Animalia
- Classified based on the presence or absence of a caudal sense organ- PHASMID
 - 1. Class Adenophorea
(Aphasmidea- those without phasmids)
 - 2 . Class Secernentea
(Phasmidea- those with phasmids).

CLASSIFICATION OF PARASITIC NEMATODES

- Soil Transmitted Nematodes
 - Infection usually through the feacal oral route
 - Exceptions, skin penetration
- Blood/Tissue dwelling Nematodes
 - Infection usually through bites of an arthropod
 - Exceptions, feacal oral route

17 Orders

- 1. Order Enploidea - *Enoplus*
- 2. Order Dorylaimoidea - *Dorylamius*
- 3. Order Mermithoidea- *Mermis*
- 4. Order Chromadoroidea - *Paracytholamius*
- 5. Order Araelaimoidea- *Plectus*
- 6. Order Monhysteroidea - *Cylindrolaimus*
- 7. Order Desmoscaleicoidea - *Tricoma*
- 8. Order Rhabditoidea- *Rhabditis*

Order Cont'd

- 9. Order Rhabdiasoidea- *Entomelas*
- 10. Order Oxyuroidae - *Oxyuris*
- 11. Order Ascaroidea- *Ascaris*
- 12. Order Strongyloidea – *Ancylostoma*
- 13. Order Spiruroidea- *Oxyspirura*
- 14. Order Dracunculoidea - *Dracunculus*
- 15. Order Filarioidea - *Wuchereria*
- 16. Order Trichuroidea - *Trichuris*
- 17. Order Dioctyphymoidea - *Eustronglides*

Ascaris Lumbricoides

(Common name: roundworm)

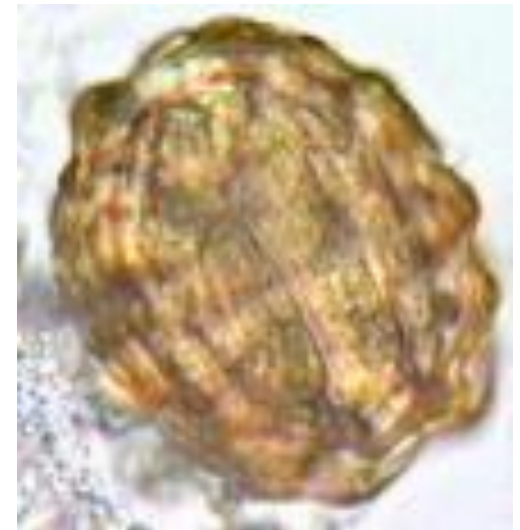
- Phylum Nematoda
- Class: [Secernentea](#)
- Order: Ascaroidea
- Family: **Ascaridae**
- Genus: *Ascaris*
- Species :*Ascaris lumbricoides*

Parasitic life cycle, medical importance

Ascaris lumbricoides

- Adult worms live in the lumen of the small intestine.
- A female may produce approximately 200,000 eggs per day, which are passed with the feces
- After infective eggs are swallowed, the larvae hatch, invade the intestinal mucosa, and are carried to the lungs.
- The larvae penetrate the alveolar walls, ascend the bronchial tree to the throat, and are swallowed.
- Upon reaching the small intestine, they develop into adult worms.

Forms and Shapes of *A. lumbricoides*



Forms and Shapes of *A. lumbricoides* cont'd

- **Egg** - characteristic of the genus. Size & shape are relatively consistent.
- **Larvae** - undergo several molts
 - Rhabditiform Larvae
 - Filariform Larva (third stage usually the infective stage).
- **Adult** - varies in size from genus to genus; Range from less than 1 mm to over one meter.

Wuchereria bancrofti **(*Filaria* worm)**

- Kingdom: [Animalia](#)
- Phylum: [Nematoda](#)
- Class: [Secernentea](#)
- Order: Filarioridea
- Family: [Onchocercidae](#)
- Genus: ***Wuchereria***
- Species: *Wuchereria bancrofti*

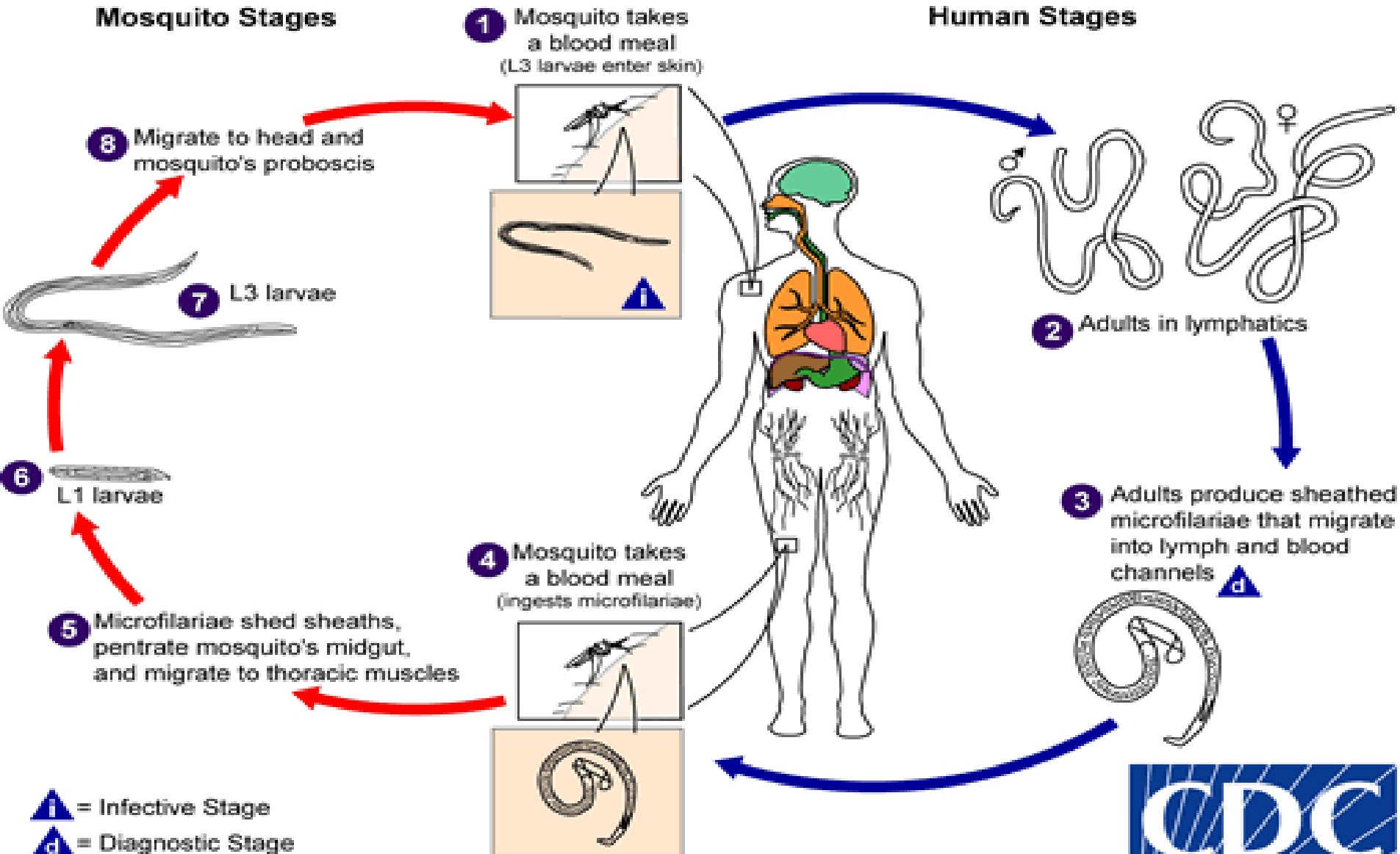
Wuchereria bancrofti (Life cycle)

- During a blood meal, an infected mosquito (*Anopheles* or *Culex* spp) introduces microfilarial larvae onto the skin of the human host, where they penetrate into the bite wound.
- They develop into adults that commonly reside in the lymphatics.
- The microfilariae migrate into lymph and blood channels moving actively through lymph and blood.
- Another mosquito ingests the microfilariae during a blood meal and work their way to the mosquito's midgut and develop into infective larvae.
- The infective larvae migrate through to the mosquito's proboscis and can infect another human when the mosquito takes a blood meal.

Wuchereria bancrofti

Mosquito Stages

Human Stages



Pathology: hydrocele



Elephantiasis



READ MORE!!

- *Trichuris trichiura* (whip worm)
- *Ancylostoma duodenale* (hook worm)
- *Necator americanus* (hookworm)
- *Strongyloides stecoralis* (thread worm)
- *Trichinella spirallis*
- *Onchocerca volvulus* (Filaria worm)
- Their Biology and Classification?

RECOMMENDED TEXT

- INVERTEBRATE ZOOLOGY by E.L Jordan and Dr. P.S. Verma.

- GOOD BYE!