BIO 102
Introductory Biology

Phylum Nematoda

Phylum Nematoda

- nema = Thread
- eidos = form
- Common name: round worms
- >20,000 extant species
- Mostly widespread and abundant of all metazoans


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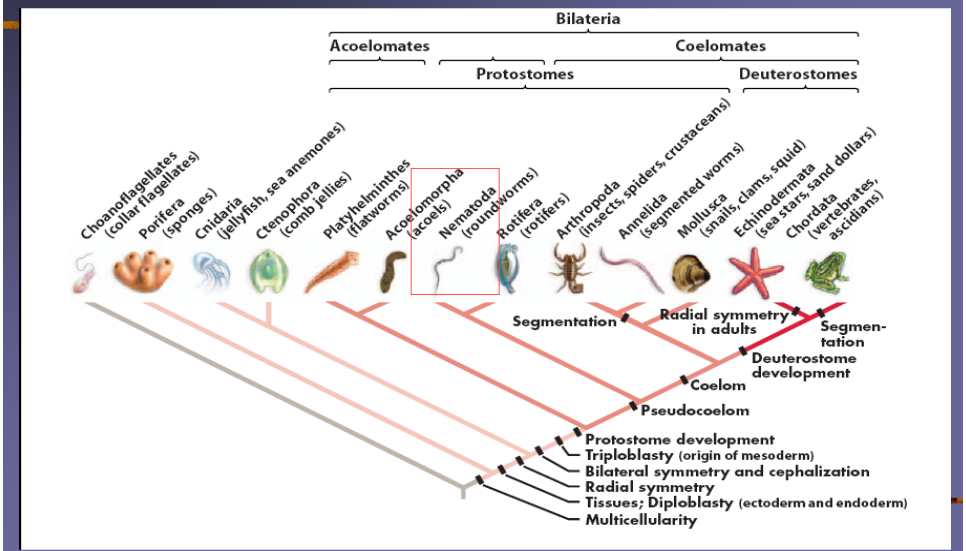
Helminthology: Study of animal parasitic nematodes

Nematology: Study of (plant parasitic nematode)

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.

Phylogeny: Based on body plan & development



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).

There are 17 Orders in the Phylum Nematoda. Important orders are

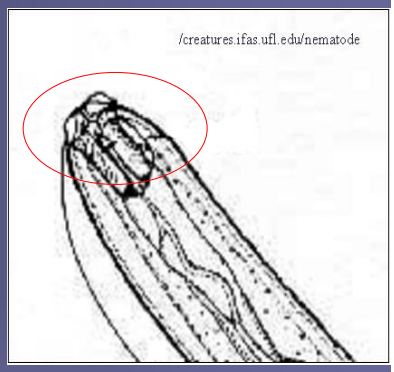
- Order Ascaroidea - *Ascaris*
- Order Strongyloidea – *Ancyclostoma*
- Order Filarioidea - *Wuchereria*
- Order Trichuroidea - *Trichuris*

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,

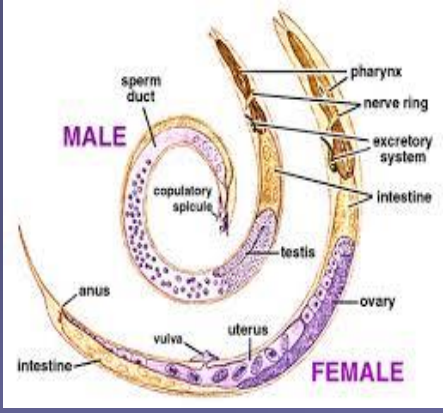
- **Possession of six lips (Labia) fused up in some.**
- **Presence of olfactory chemoreceptors called Amphids**

Posteriorly,

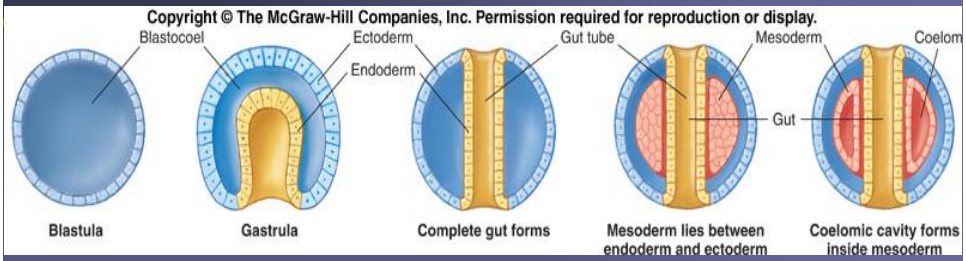
- **Presence of anus with thick lips**
- **Male has cloaca from which two equal chitinous spicules (penial setae) projects.**

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.



BODY CAVITY or PSEUDOCOEL

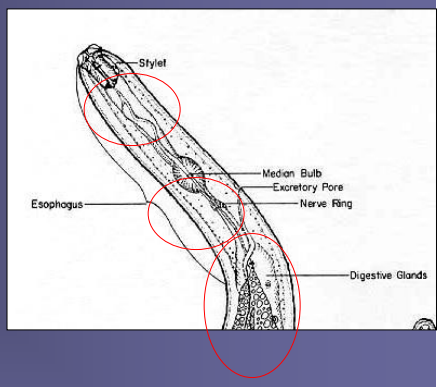


Nematodes are pseudocoelomate i.e there is a space (cavity) between the endoderm and mesoderm.

DIGESTIVE SYSTEM

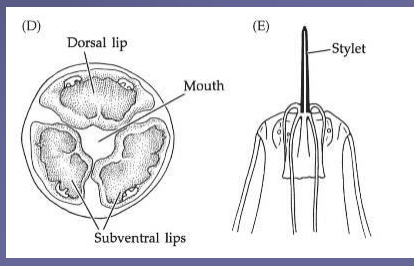
Consist of :

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



Oesophagus forms

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

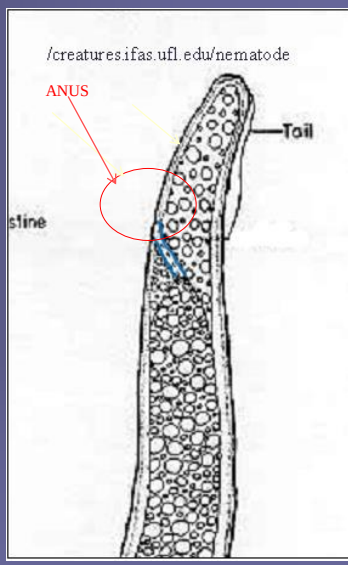


Digestive system cont"d

- 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 feacal materials to be discharged.

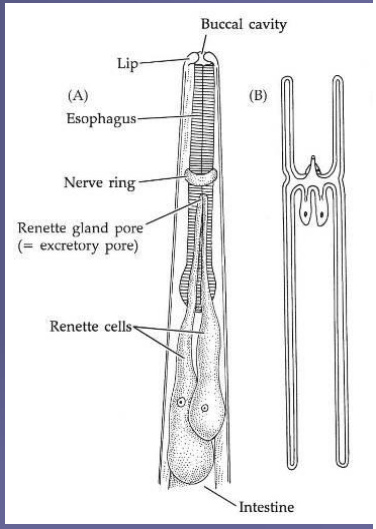


FOOD AND FEEDING

- 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

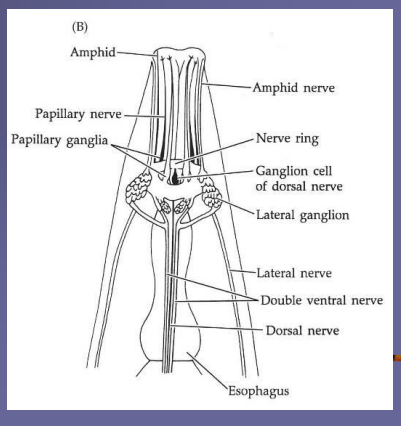
EXCRETION

- 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



RESPIRATORY SYSTEM

- RESPIRATORY ORGAN IS ABSENT.
- However Parasites carry on ANAEROBIC respiration.
- They break down glycogen into CO_2 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

ECONOMIC IMPORTANCE

- Nematodes are of economic importance as they are causative agents of diseases in plants and animals….
- Plant parasitic nematode such as root-knot nematode (*Genus Meloidogyne*) infect about 2000 plants worldwide and they cause approximately 5% of global crop loss.

ECONOMIC IMPORTANCE

- Animal Parasitic nematodes causes diseases in human and animals. Over 5000 species are known to infect animal and human. Many of Tropical Diseases are of nematode origin. These include
  - Onchocerciasis, Lymphatic filariasis, Loa loa, Strongyloides, ascariasis, hookworm, trichuriasis, enterobiosus,
  - In animal, there is Ascarida, Heterakis,in Chicken, Haemonchus and Oesophagostomum in Cattle/Sheep

Ascaris Lumbricoides (Common name: roundworm)

- Phylum Nematoda
- Class: Secernentea
- Order: Ascaroidea
- Family: **Ascaridae**
- Genus: Ascaris
- Species : lumbricoides

Parasitic life cycle, medical importance

Ascaris lumbricoides (Life cycle)

- Adult worms live in the lumen of the small intestine of human. Over 2 billion people are infected worldwide. Thus it is the commonest human helminth infection.
- 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*

Massive Ascaris infection in child. A large bolus of roundworms expelled following anthelminthic treatment.