

The Acoelomates (continued)



- Trploblastic animals without a coelom



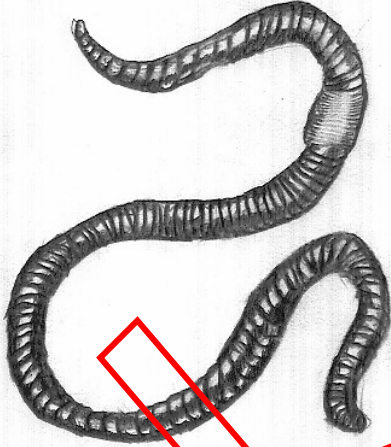
Acoelomate Characteristics:

No coelom

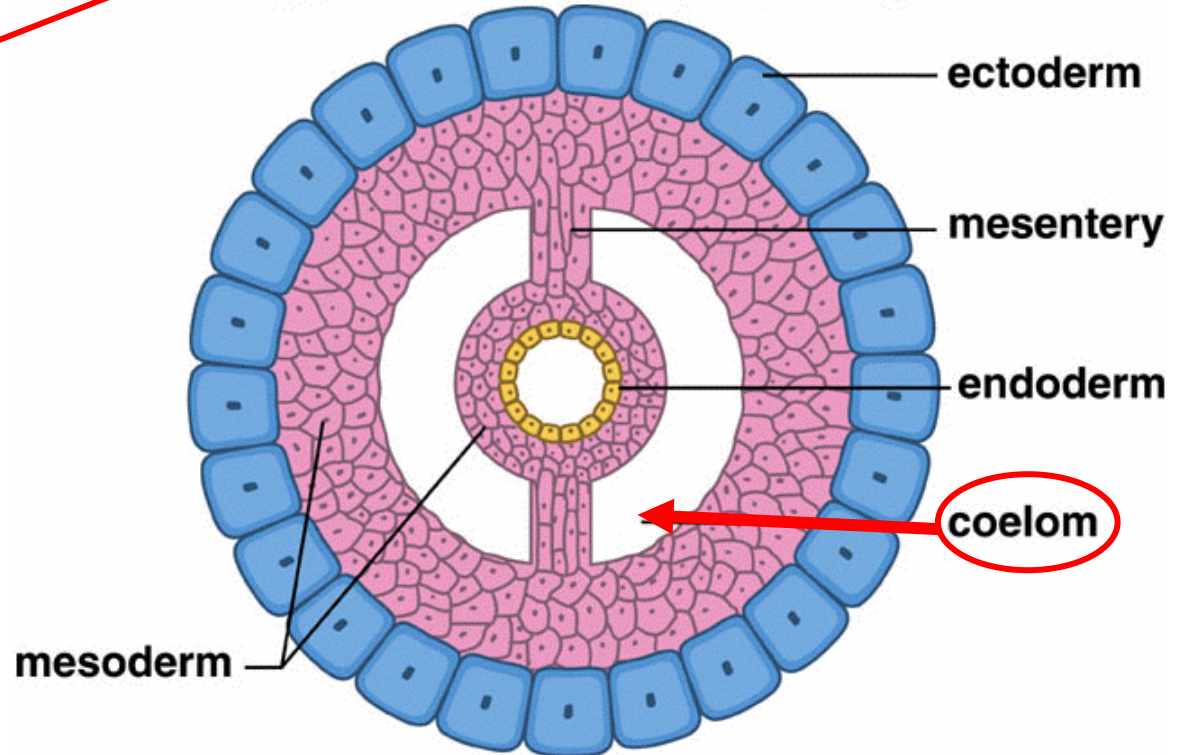
What is a coelom?

A body cavity that is completely surrounded by mesodermal tissue. A coelom is not open to the outside of the animal.

What is a coelom?

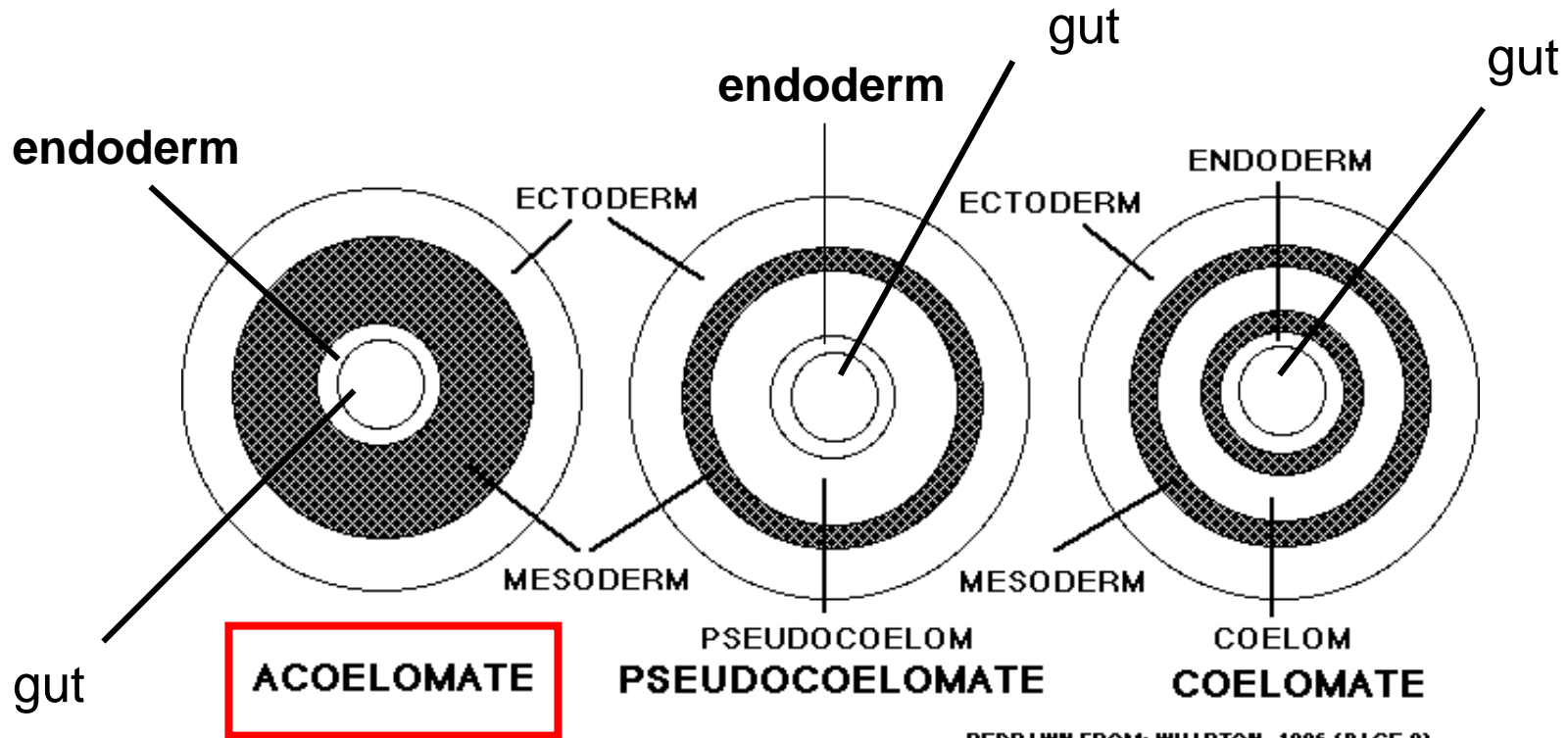


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c. Coelomate molluscs annelids arthropods
echinoderms chordates

Acoelomate Characteristics: No coelom



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Acoelomate Phyla

1. Gnathostomulida
2. **Platyhelminthes**
3. **Nemaerthea**

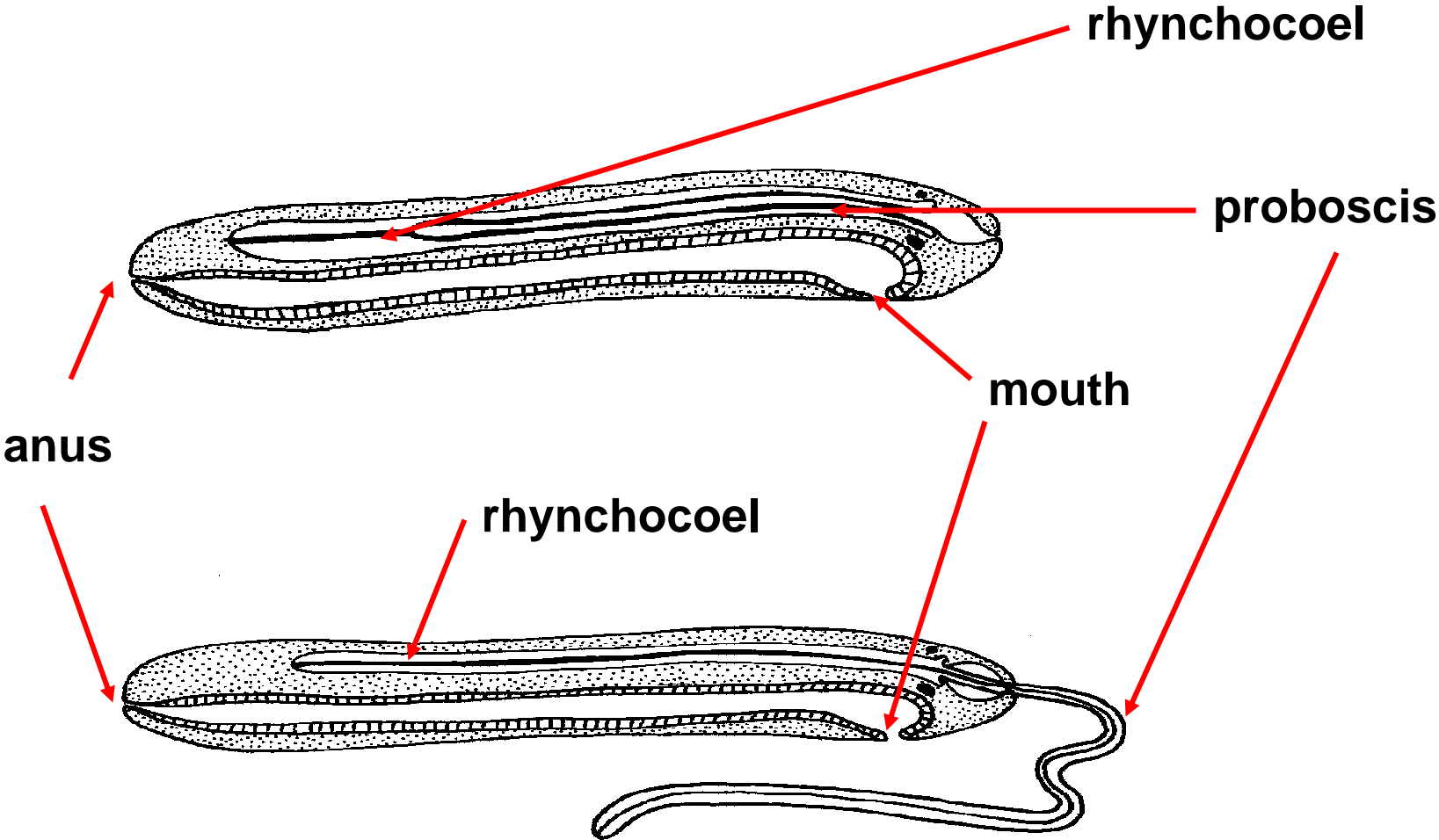


Phylum Nemertea

the ribbonworms

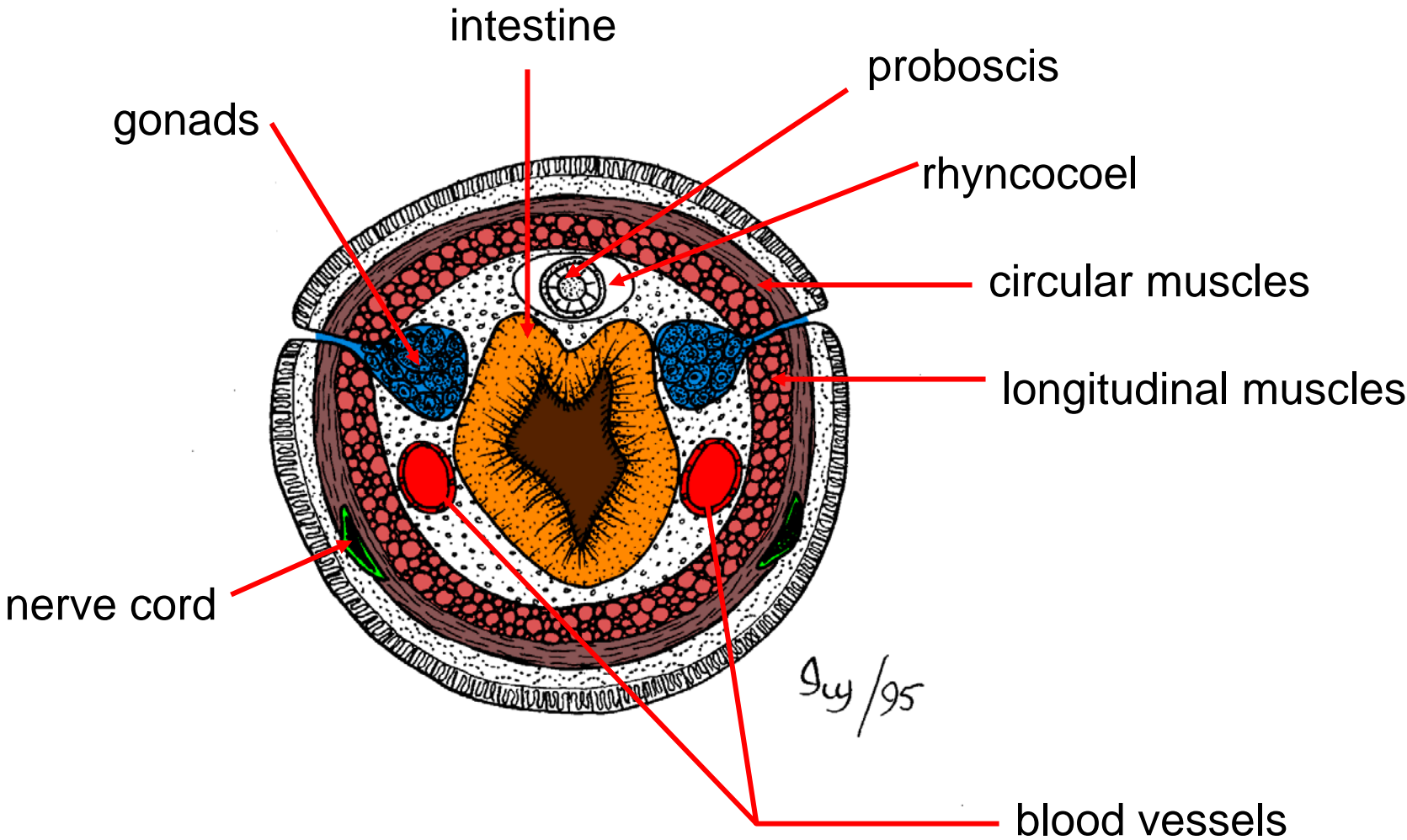


Body Plan



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Body Plan



Feeding and Digestion

Feeding

- Free-living, carnivorous
- Have an eversible proboscis that is not connected to the digestive system



Proboscis: usually tipped with a stylet



Proboscis: not
connected to the gut



Pharynx: an
extension of
the gut

Feeding and Digestion

Digestion

- extracellular (in the intestine)
- intracellular (by gastrodermal cells)
- intestine is unbranched
- complete system (mouth and anus)

Reproduction

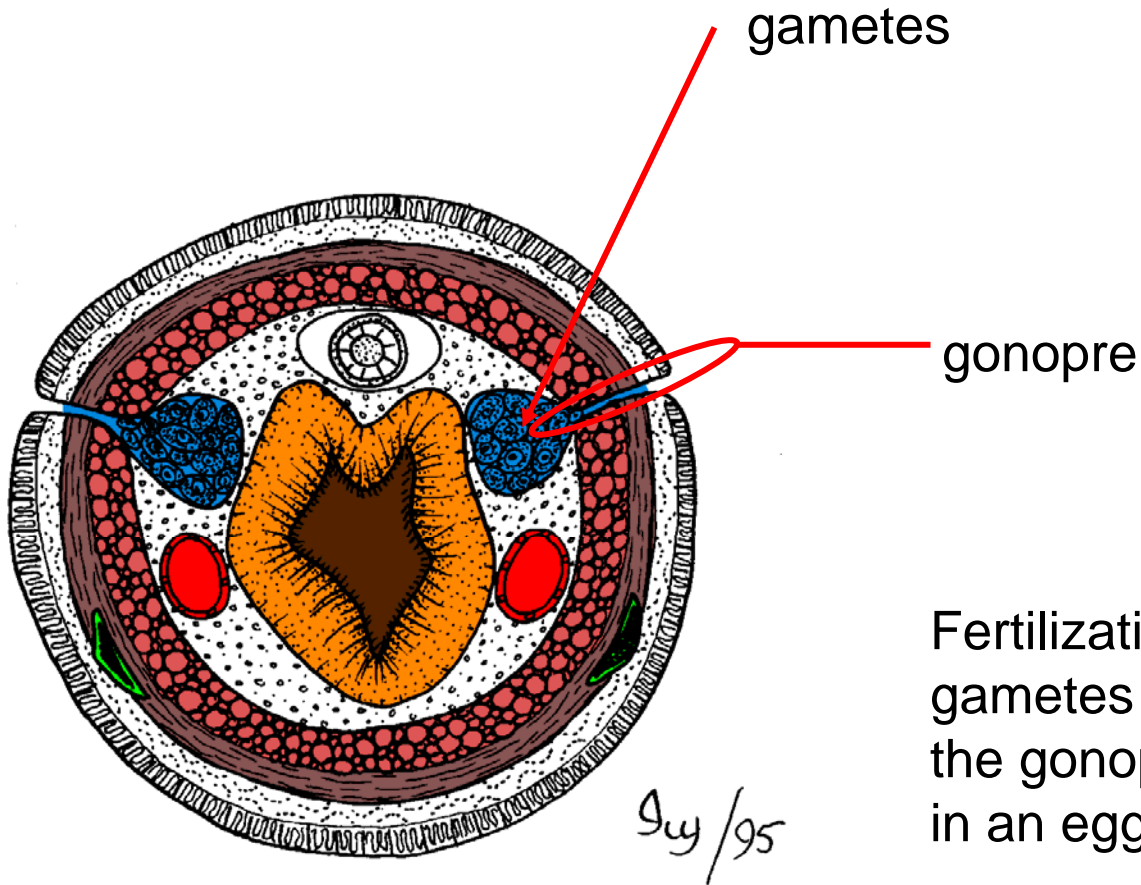
Asexual

- Most species are capable of reproducing asexually through fragmentation and regeneration

Sexual

- Most species are dioecious and have external fertilization

Reproduction



Fertilization is external:
gametes are released through
the gonopore. Eggs are laid
in an egg capsule or burrow.

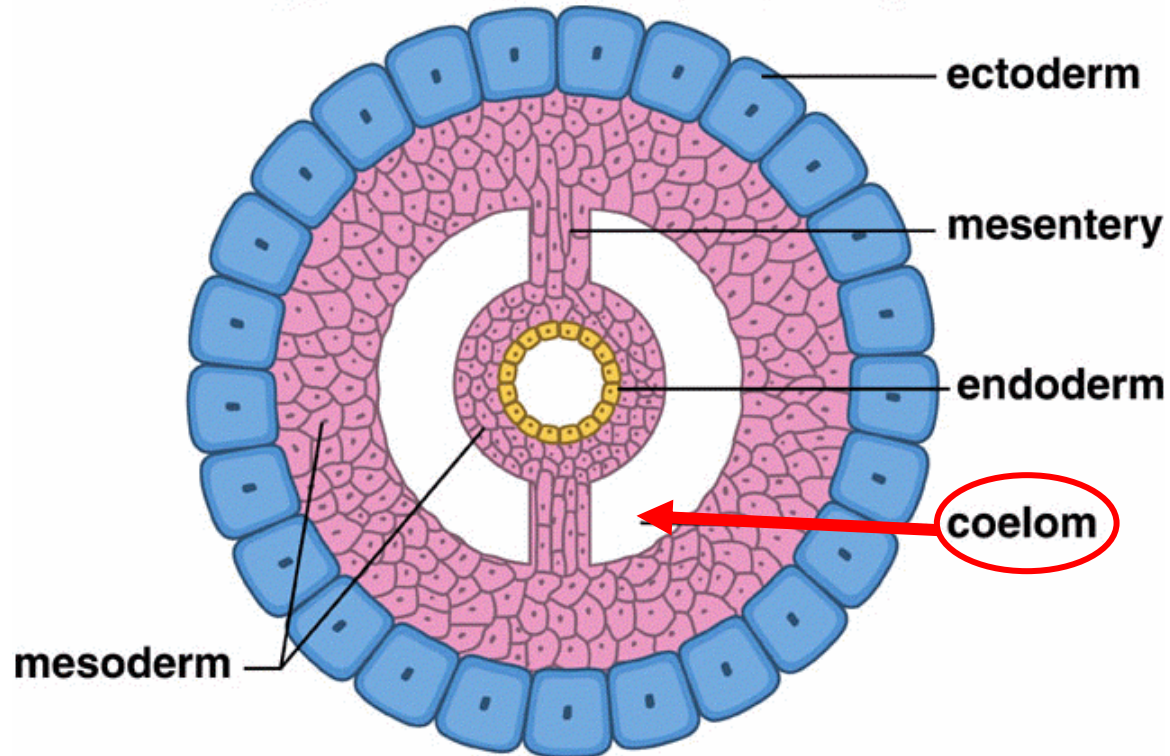
Pseudocoelomates

Triploblastic animals with a “false” coelom

What is a coelom?

A body cavity that is completely surrounded by mesodermal tissue. A coelom is not open to the outside of the animal.

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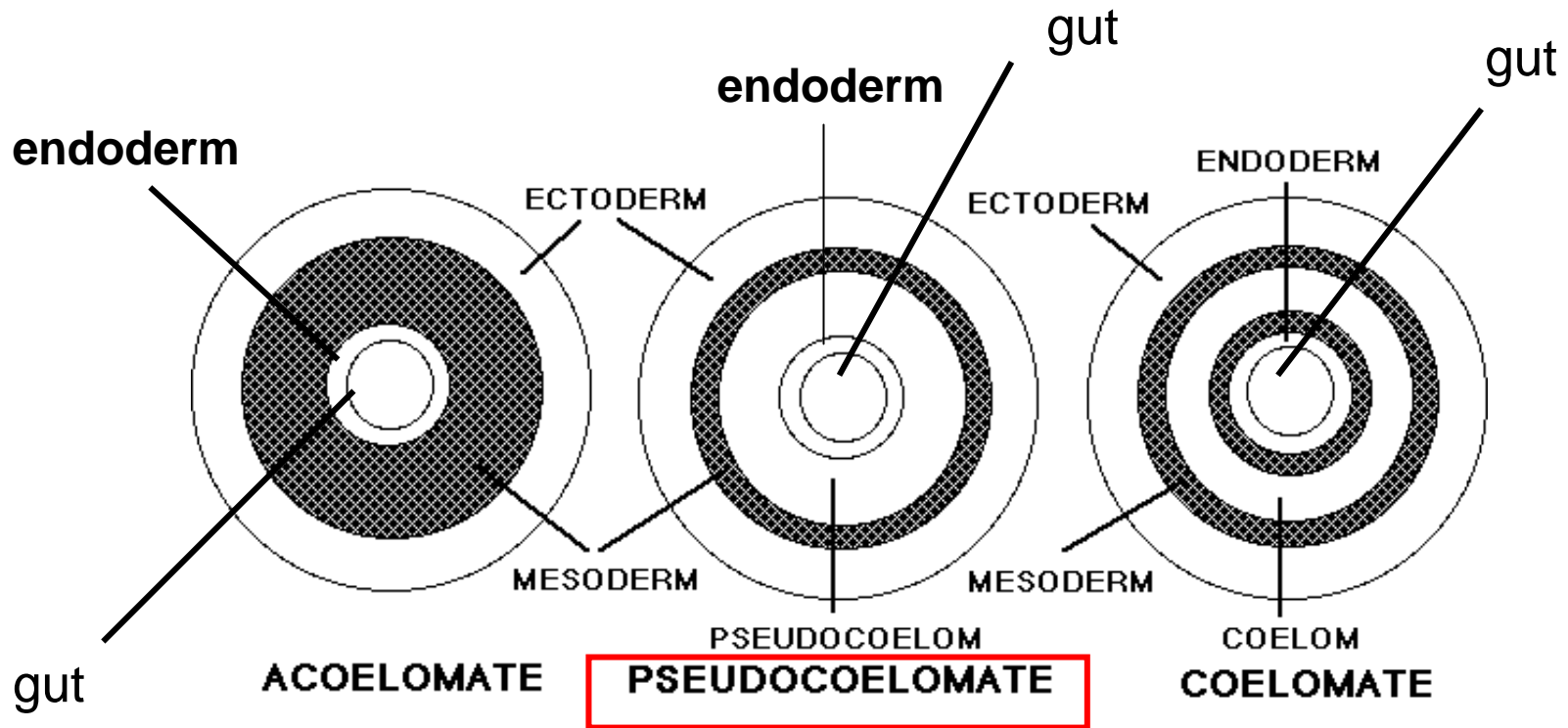
**c. Coelomate molluscs annelids arthropods
echinoderms chordates**

Pseudocoelomates

Triploblastic animals with a “false” coelom (a pseudocoelom)

What is a pseudocoelom?

A body cavity that is surrounded by mesoderm on one side.



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Pseudocoelomates

There are 9 different phyla that are classified as pseudocoelomates.

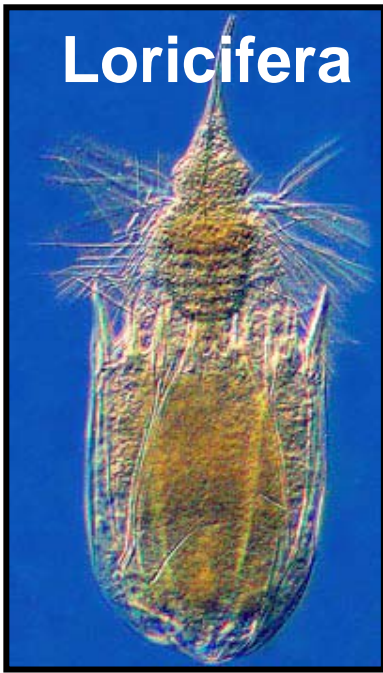


Nematoda



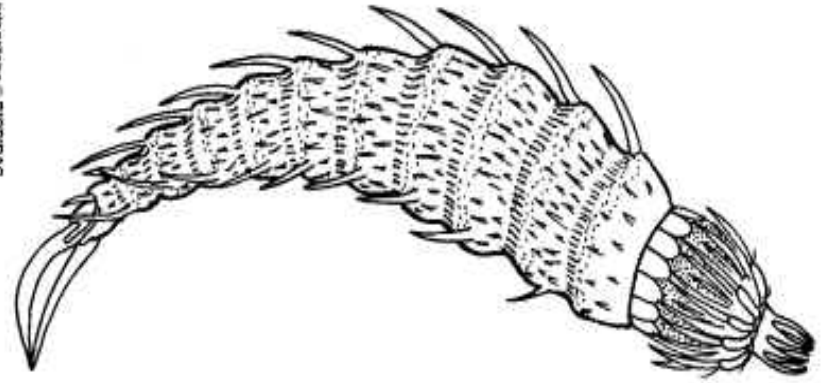
Rotifera

Loricifera



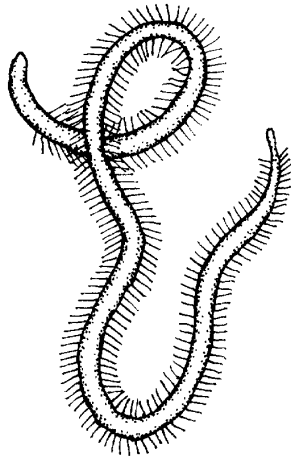
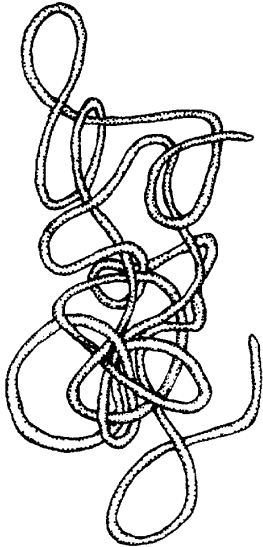
Kinorhyncha

Livingstone © BIODIDAC



9y/96

Nematomorpha



Bec/01
Stritch, © BIODIDAC

Priapulida

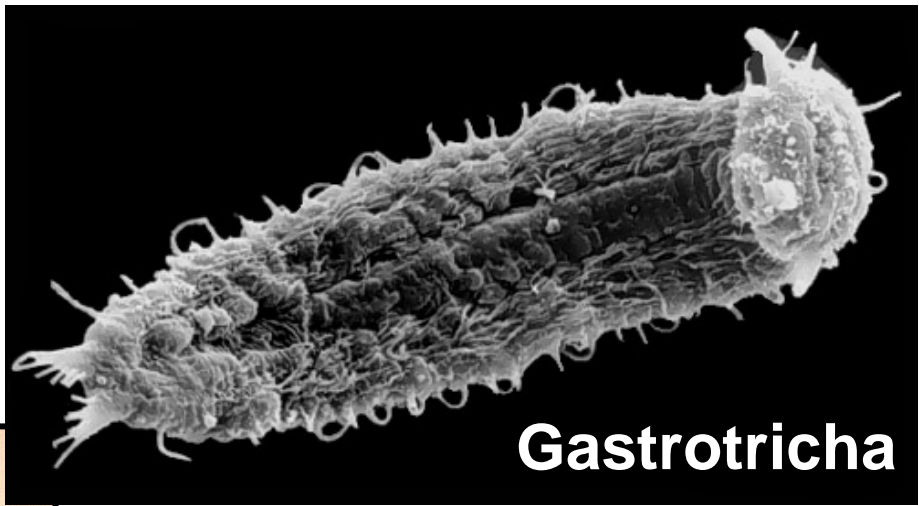


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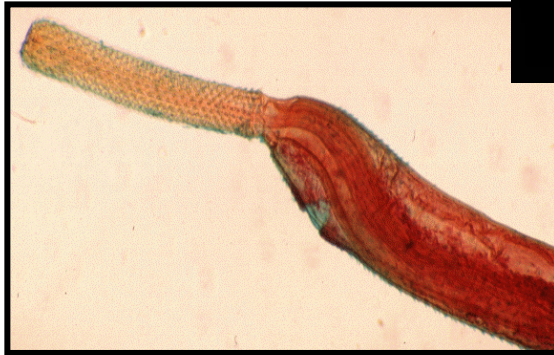
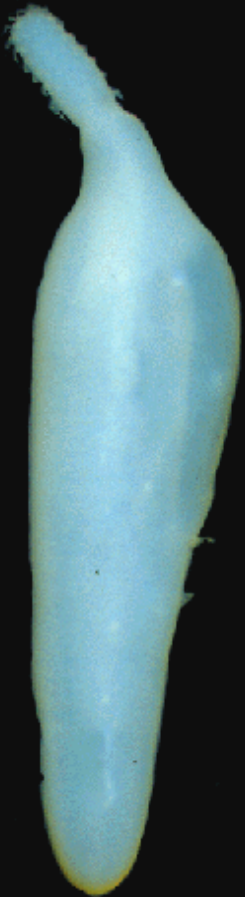


BIODIDAC, © Houseman

Acanthocephala



Gastrotricha



Entoprocta



Pseudocoelomate Characteristics

Organ level of organization

Tissues are organized to form organs which are used to accomplish physiological functions

Pseudocoelomate Characteristics

Triploblastic

3 Germ Layers

endoderm



mesoderm



ectoderm



3 Tissue Layers

gastrodermis

mesoderm

epidermis

Pseudocoelomate Characteristics

the pseudocoelom

- is a closed, fluid filled cavity
- contains digestive, excretory, and reproductive structures
- the fluid within acts as a circulatory system
- the fluid within acts as a hydrostatic skeleton against which the muscles work

Pseudocoelomate Characteristics

Bilateral Symmetry

- with anterior and posterior ends

Cephalization

- concentration of sensory organs in the head of the animal

Pseudocoelomate Characteristics

Digestive System

- complete
- some regional specialization

Circulation System

- no system (or organs)
- performed by the pseudocoelomic fluid

Pseudocoelomates



Nematoda

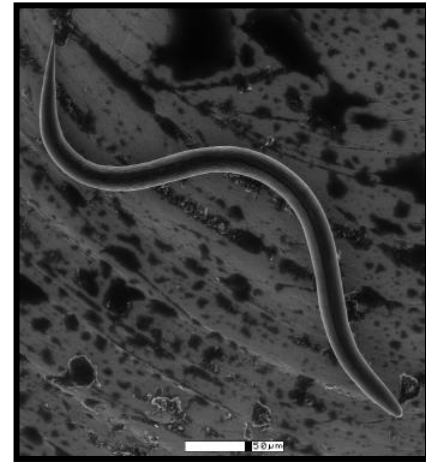


Rotifera



Phylum Nematoda

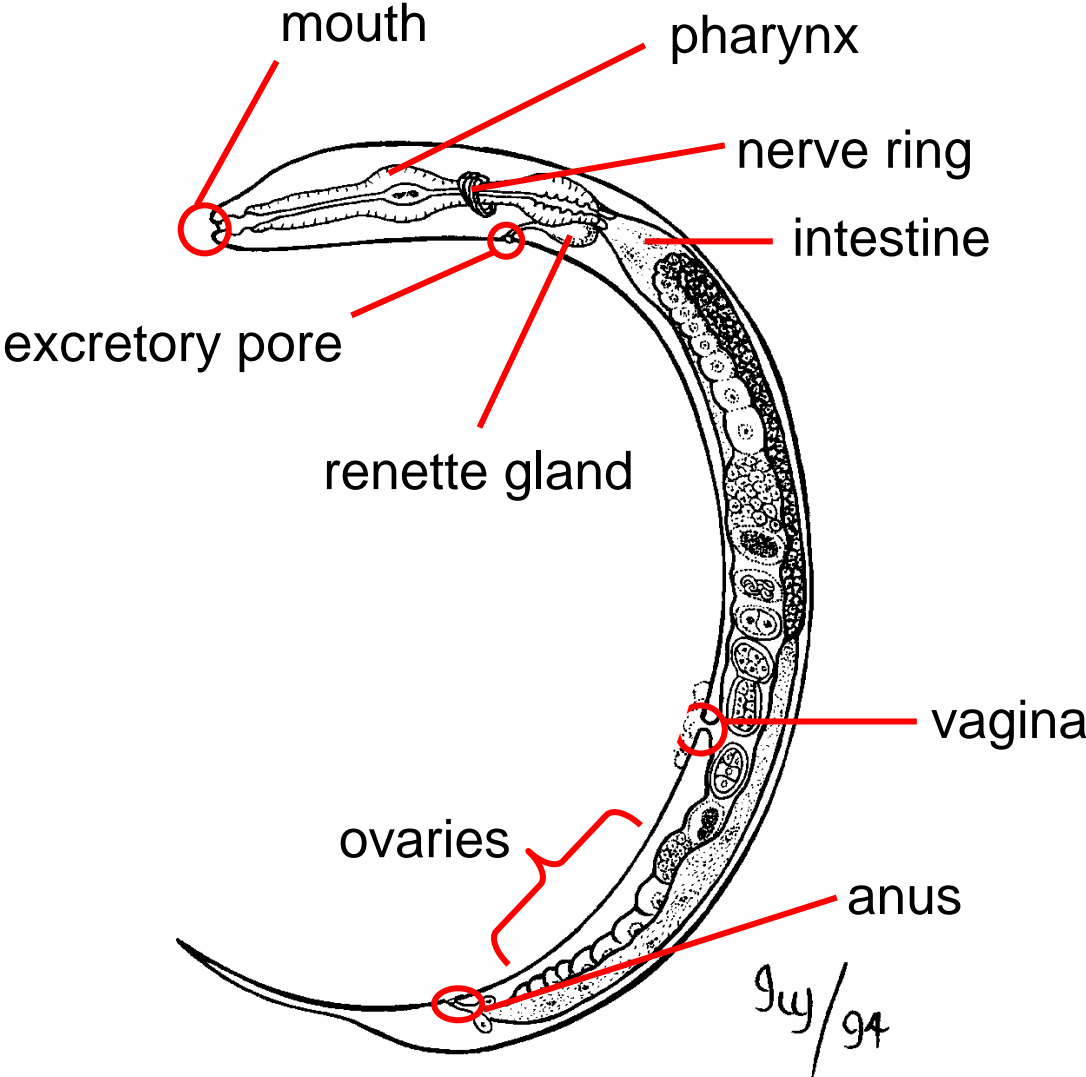
the roundworms



Phylum Nematoda

- There are >12,000 species that are found in almost all habitats (marine, freshwater, underground, inside plants and animals, etc...).
- They are also incredibly abundant. For example:
 - a m² of soil may contain >4 million nematodes
 - a decomposing apple may contain >90,000 nematodes of a single species

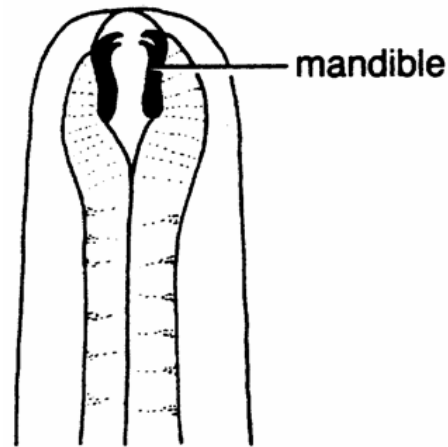
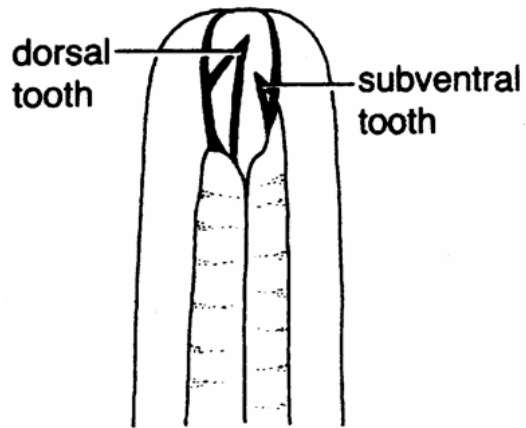
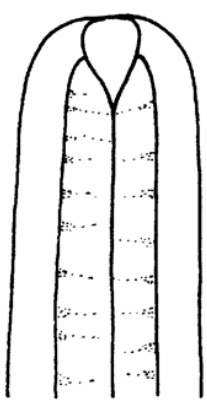
Body Plan



Feeding and Digestion

Life Style

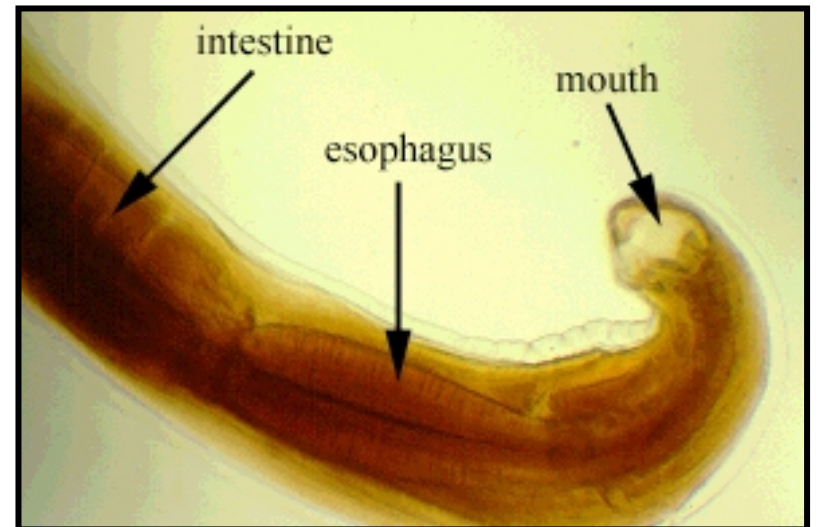
- free-living
- parasitic



Feeding and Digestion

Digestion

- complete system (have an anus)
- some regional specialization (e.g. an esophagus)

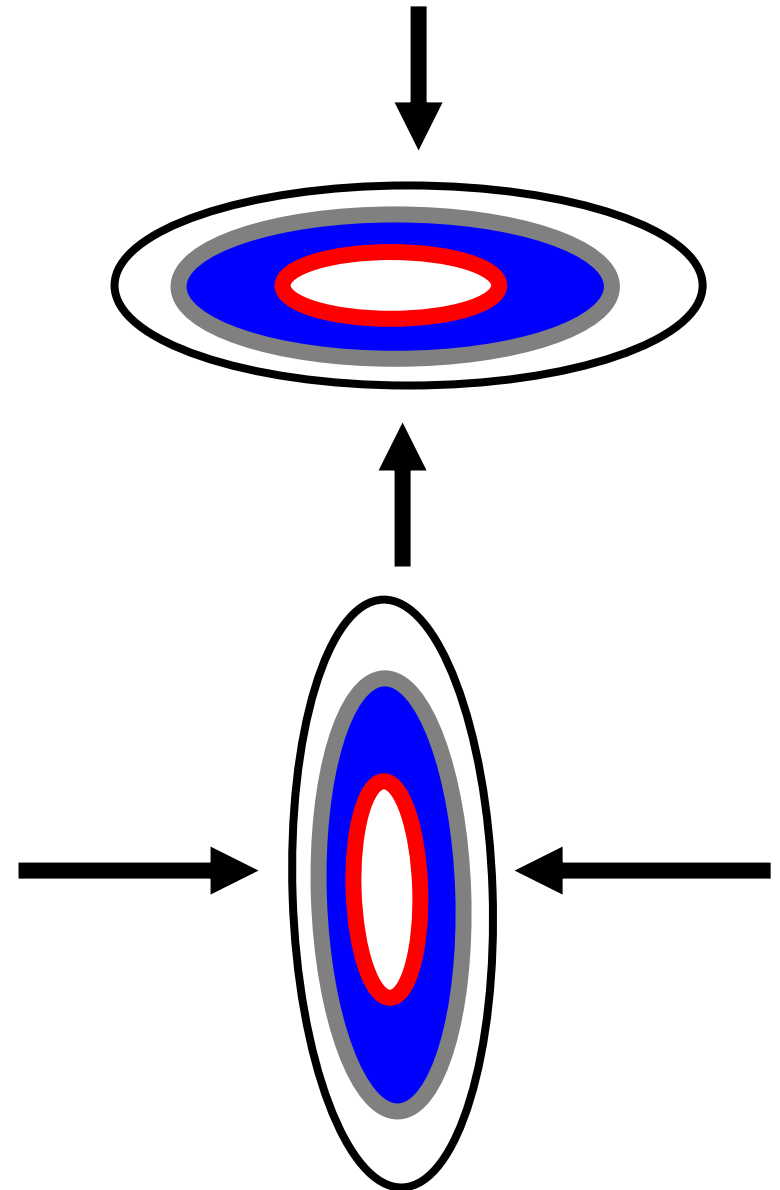
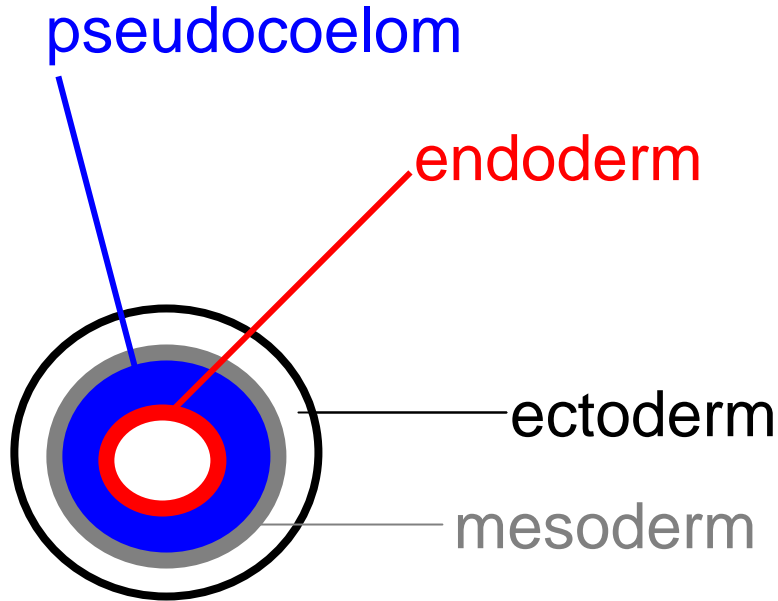


Support and Locomotion

Skeletal system

- fluid in pseudocoelom acts as a hydrostatic skeleton

Support and Locomotion



Support and Locomotion

Cuticle

- covers body (secreted by epidermis + composed mostly of collagen)
- functions as a primitive external skeleton
- must be molted for animal to grow

Support and Locomotion



Nematode cuticle

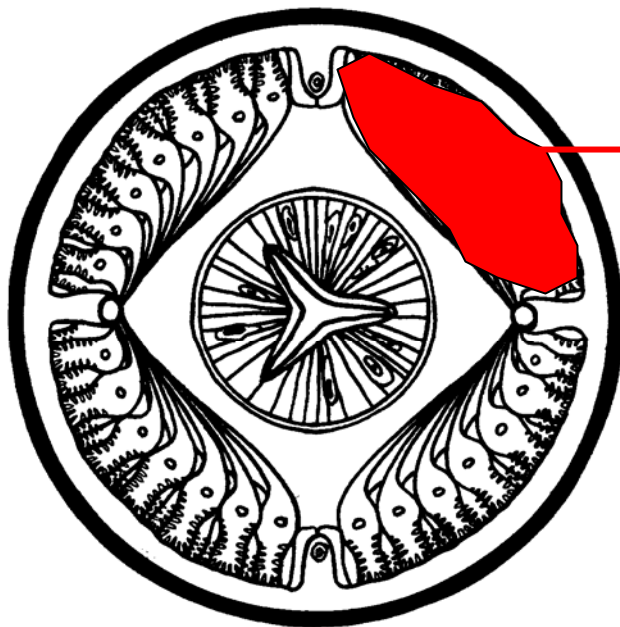
The cuticle appears to be segmented. However the external rings (annuli) do not correspond to internal segments.

These external rings make the cuticle flexible and may help the cuticle grip the surface.

Support and Locomotion

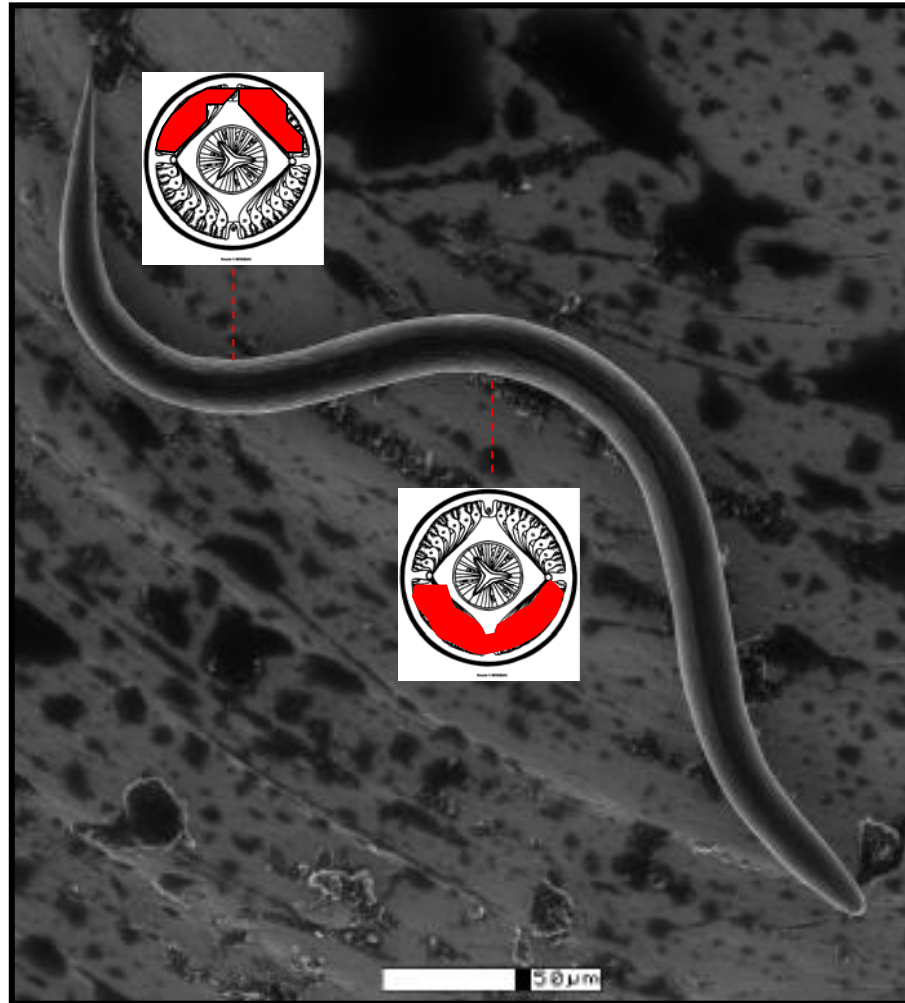
Locomotion

- longitudinal muscles ONLY: they act against the cuticle and pseudocoel
(results in “whiplike” motion)

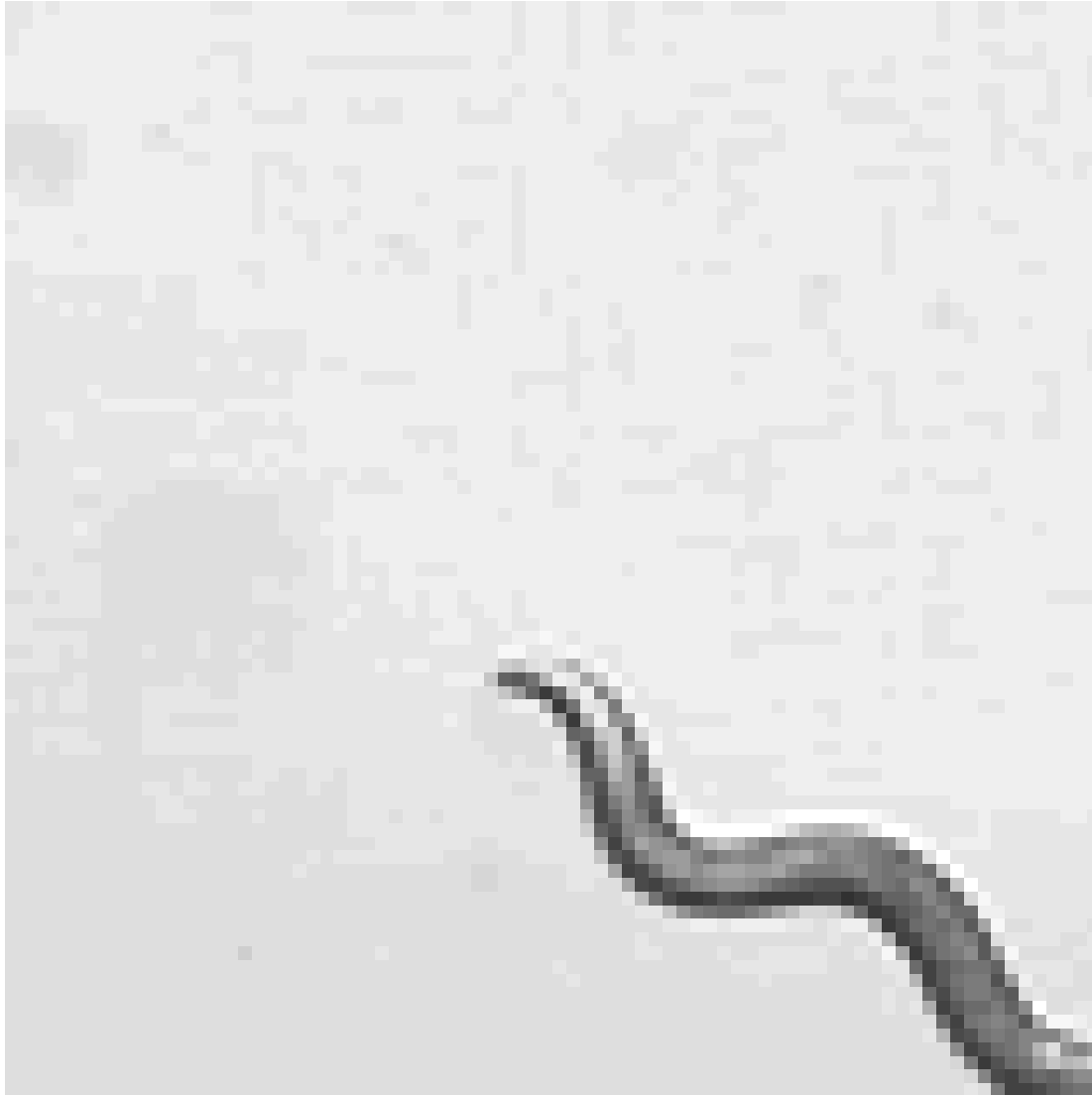


longitudinal muscles

Support and Locomotion



Support and Locomotion

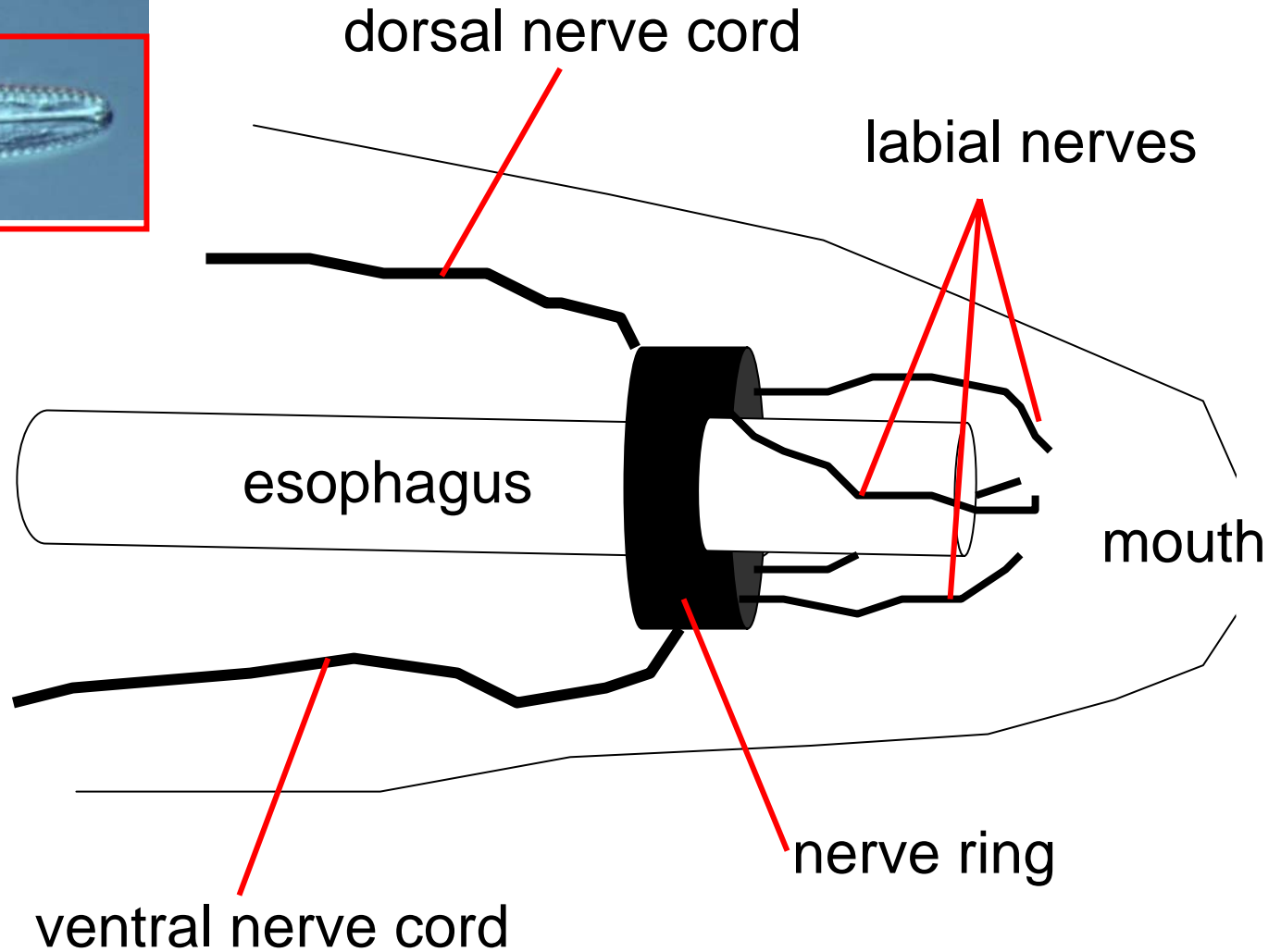
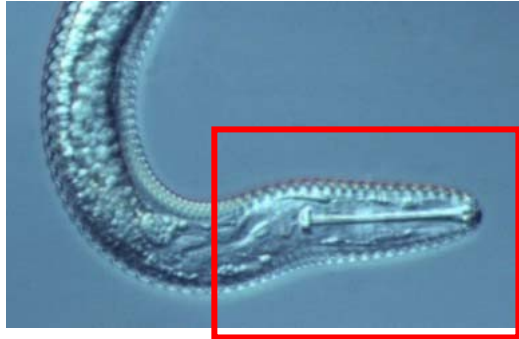


Nervous System

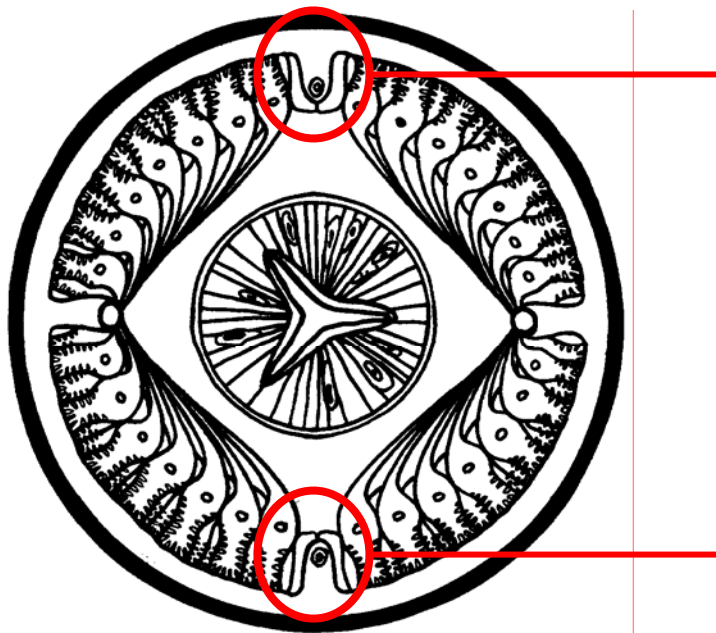
Nervous system

- entirely epidermal: all nervous tissue derived from ectoderm
- cephalization: nerve ring and labial nerves
- dorsal and ventral nerve cords

Nervous System



Nervous System



dorsal nerve cord

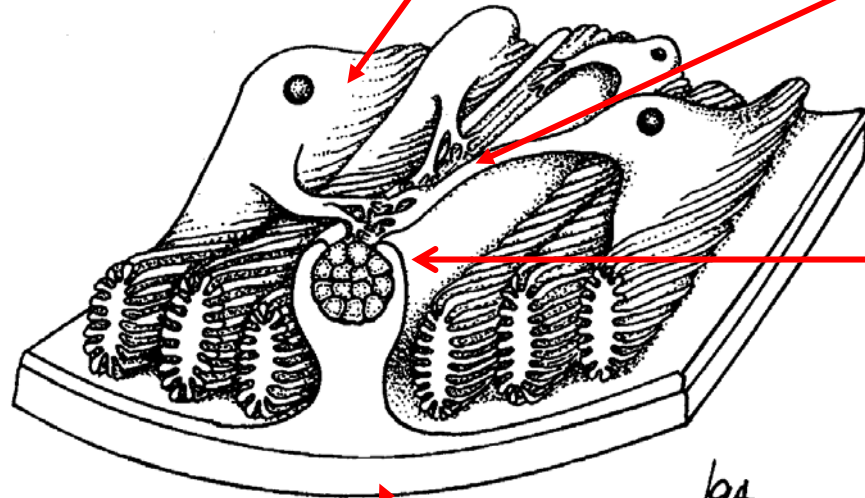
ventral nerve cord

muscle cell body

muscle cell arm

nerve cord

cuticle



I. Livingstone © BIODIDAC

Nematode muscle cells are unique: they have “arms” that contact the nerve cord. In most species, nerve cells have processes that touch muscles.

Circulation/ Excretion

Circulatory system

- No system (no organs)
- performed by fluid in pseudocoelom

Excretion

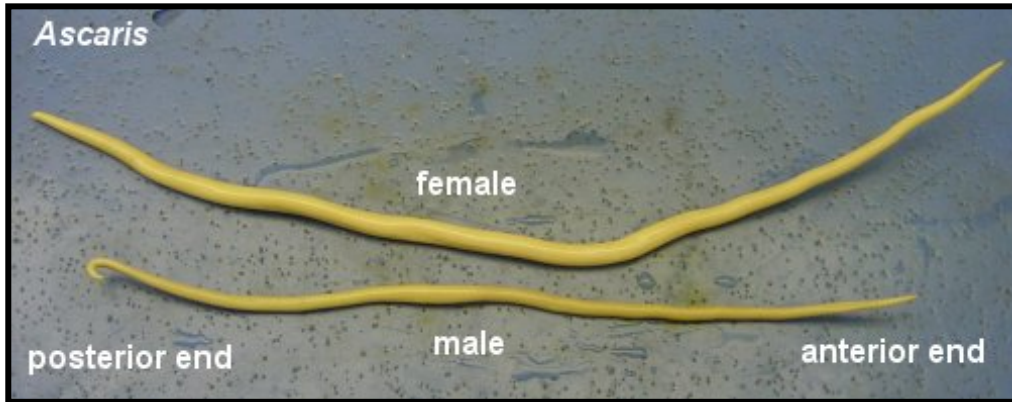
- Diffusion, or Renette glands

Reproduction

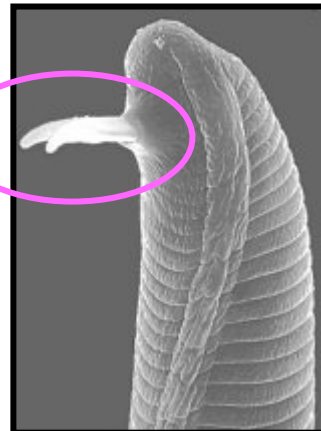
Sexual

- usually dioecious
- often the sexes are sexually dimorphic (males and females look different)

Reproduction

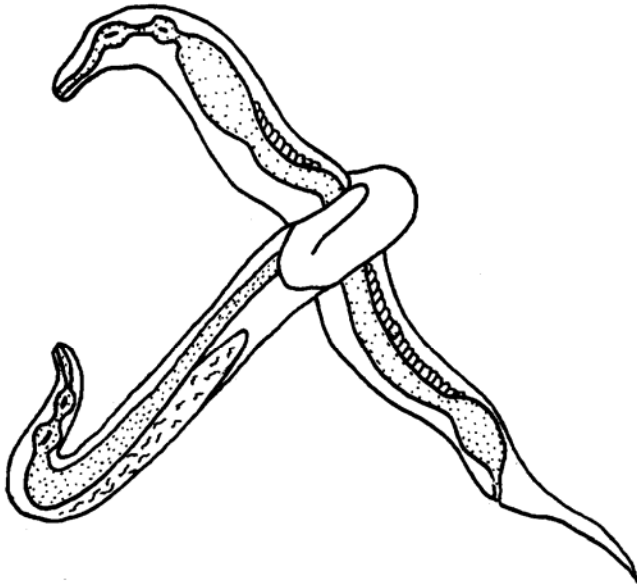


Males often have a spicule at the end of their tail used to insert their sperm into the female

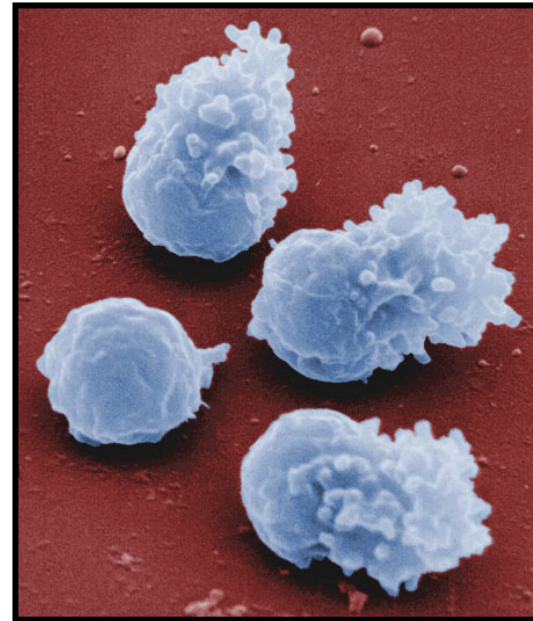


Reproduction

- internal fertilization
- males have ameoboid sperm (nematodes are the only animals to have this kind of sperm)



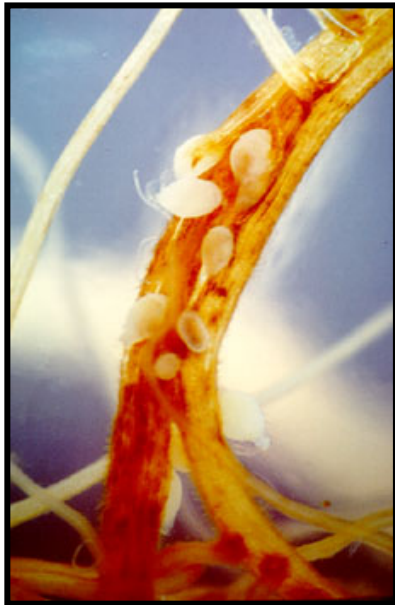
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Ameoboid sperm

Parasitism

- Many nematodes are important parasites of both plants and animals.



parasite of
soybean plants

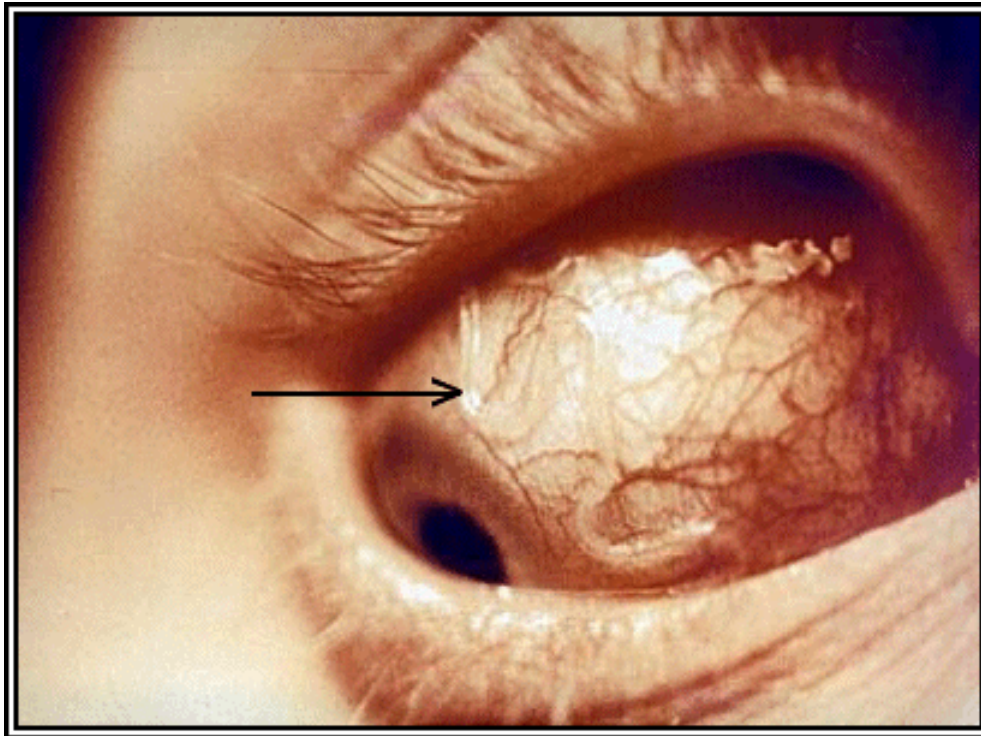


parasite of
tomato plants

Parasitism

Eye worm (*Loa loa*):

- transmitted by fly bites
- larvae go through bloodstream
- adults live in subcutaneous tissue



Parasitism

Intestinal roundworm (*Ascaris*):

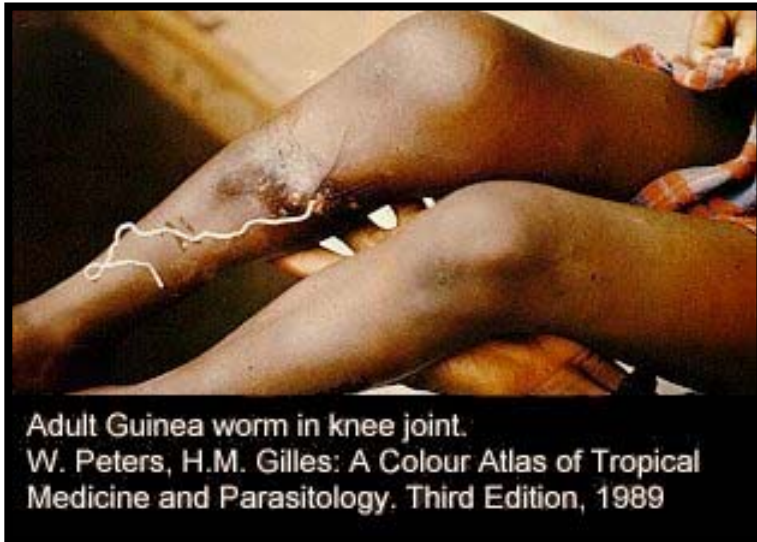
- transmitted by contaminated food
- adults live in small intestine
- it's estimated that 20% of world's population is infected (~1.3 billion people)



Parasitism

Guinea worm (*Dracunculus medinensis*):

- transmitted by infected copepods in drinking water
- larvae move into the body cavity
- female adult migrates to the subcutaneous tissue, causes an ulcer/blister, and releases eggs through hole when host comes in contact with water



Parasitism

Guinea worm (*Dracunculus medinensis*):

- traditionally removed by winding the worm around a matchstick over the course of several days



Parasitism

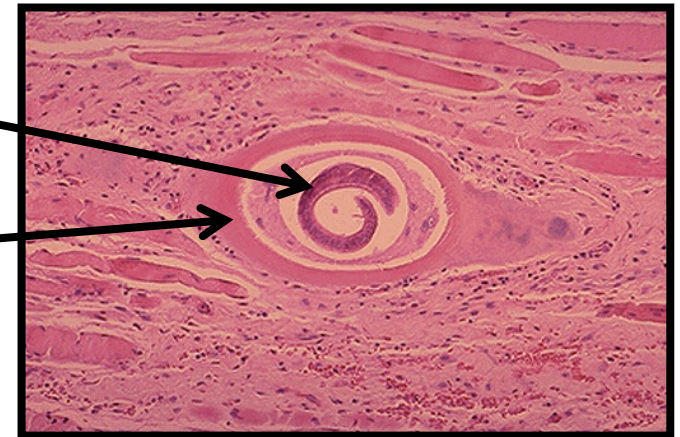
Trichinella spiralis:

- causes Trichinosis
- transmitted by eating undercooked pork
- juveniles encyst within host muscle cells



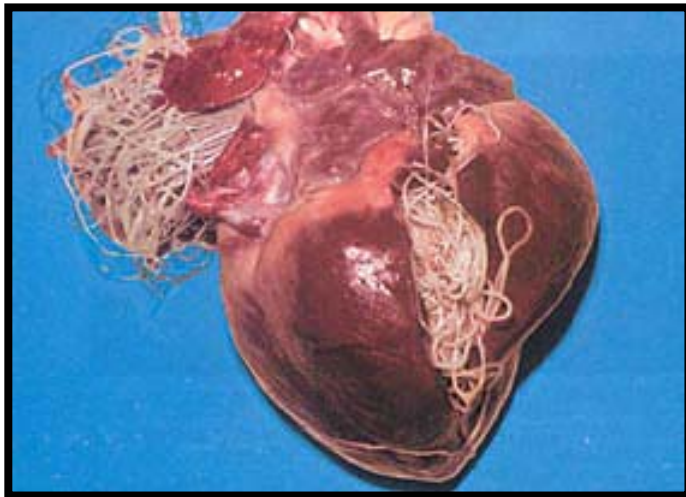
juvenile

Host
muscle cell



Parasitism

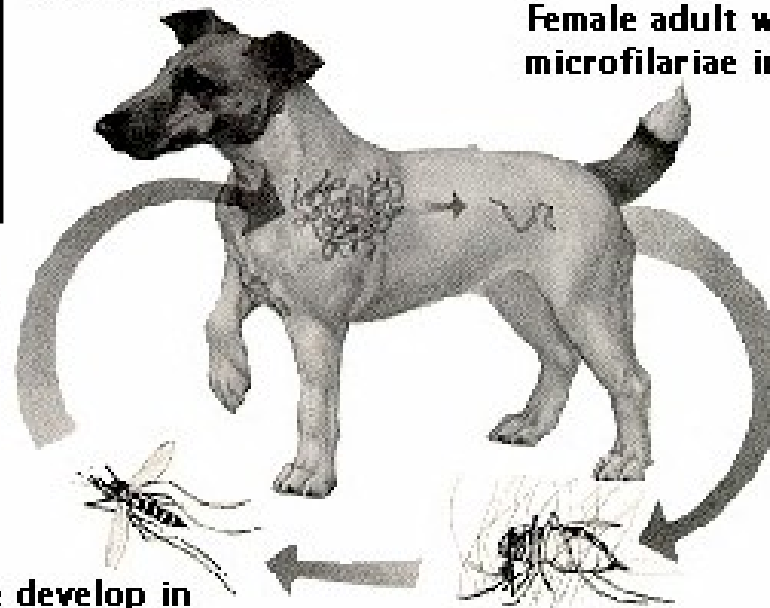
Heartworms (*Dirofilaria immitis*):



Larvae mature into adults in heart

Female adult worms release microfilariae in blood

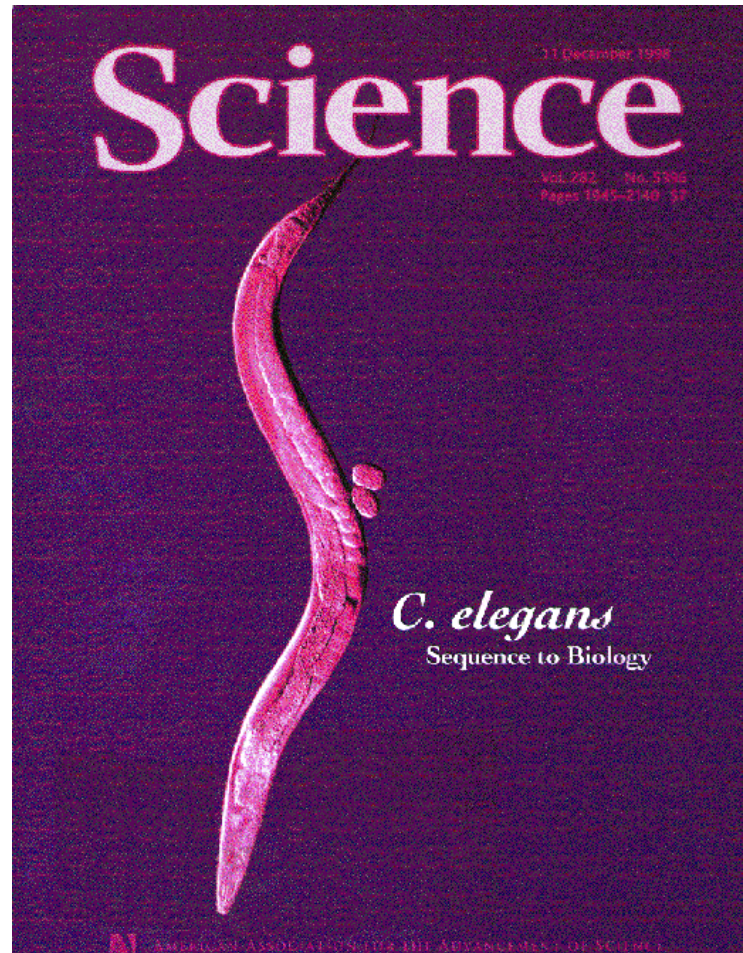
Mosquito bites dog or cat and transmits infective larvae



Microfilariae develop in mosquito to infective larvae

Mosquito ingests microfilariae with blood meal

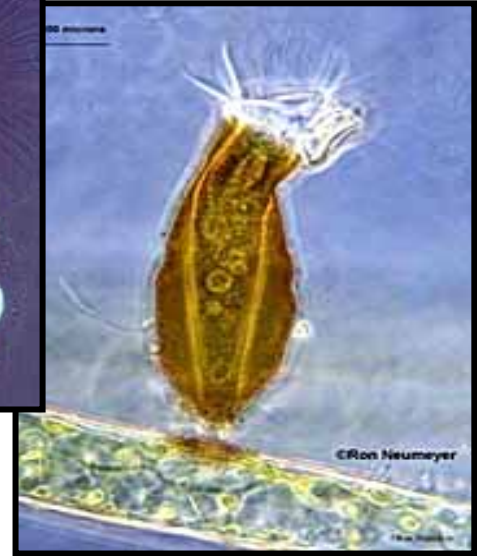
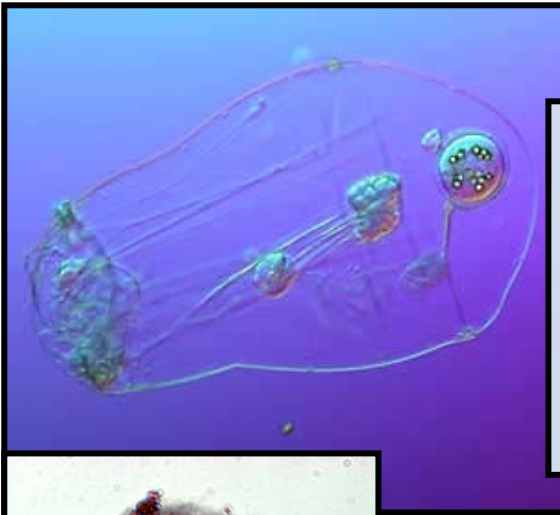
- The study of the model nematode *Caenorhabditis elegans* has resulted in important discoveries in genetics and development.





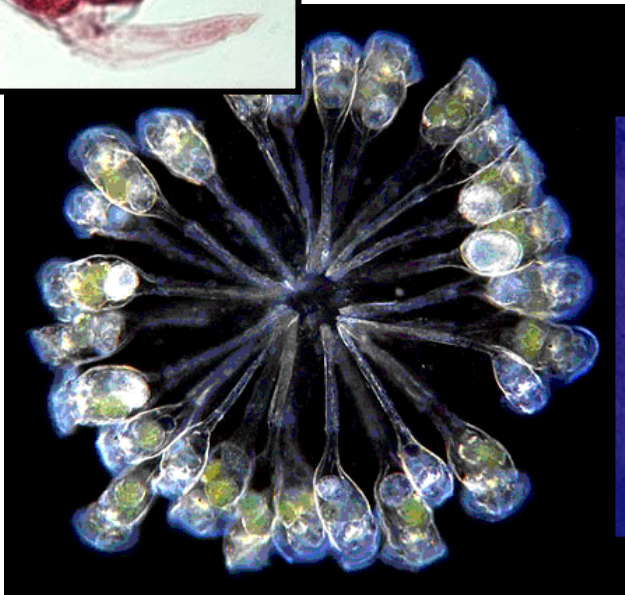
What is so special about *C. elegans*

- It is a simple animal that shares many of the essential biological characteristics that are central to problems of human biology
- It displays eutely: having an invariant and genetically fixed number of cells.
- It's genome has now been sequenced

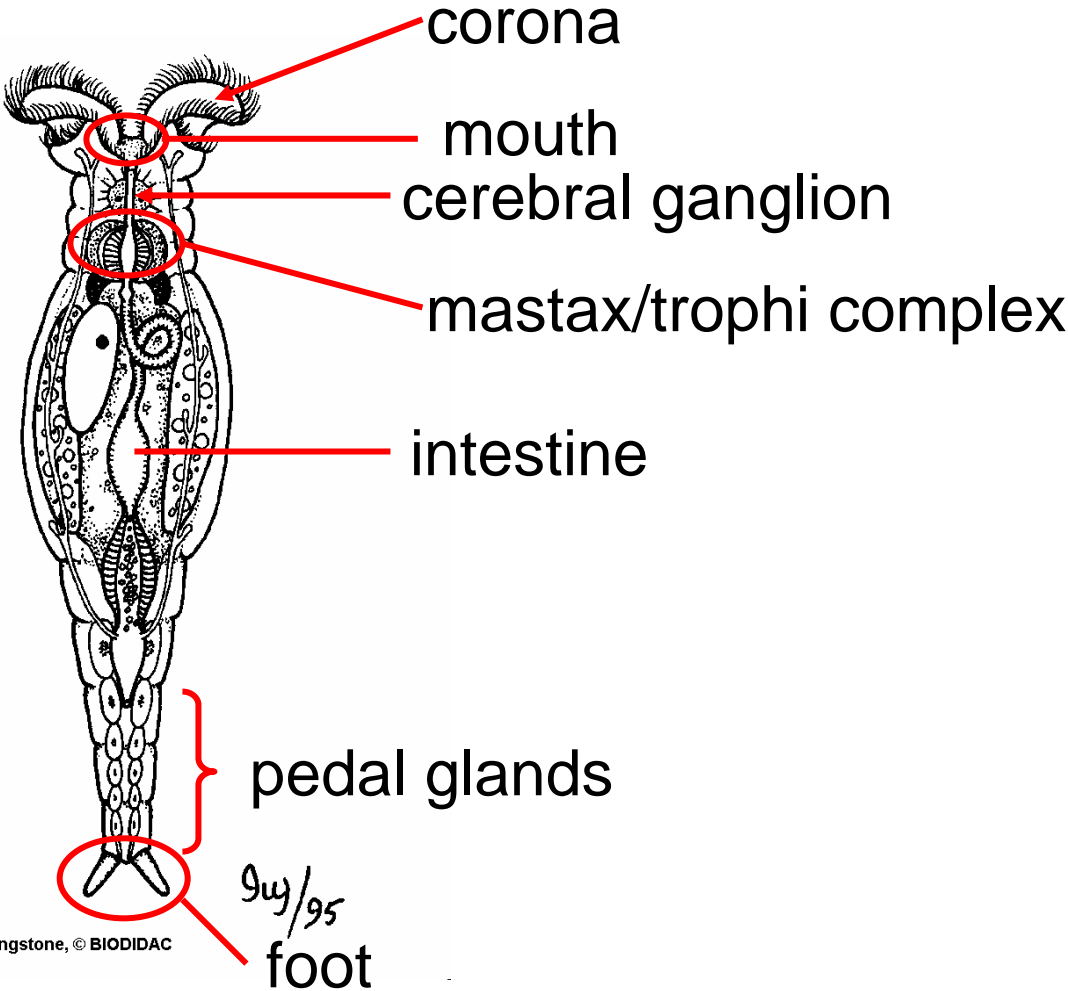


Phylum Rotifera

the rotifers

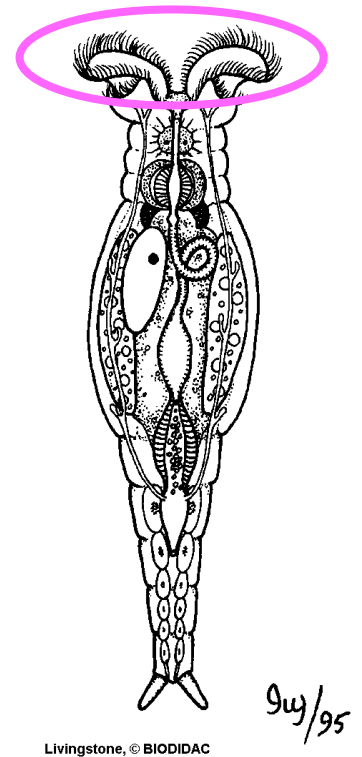
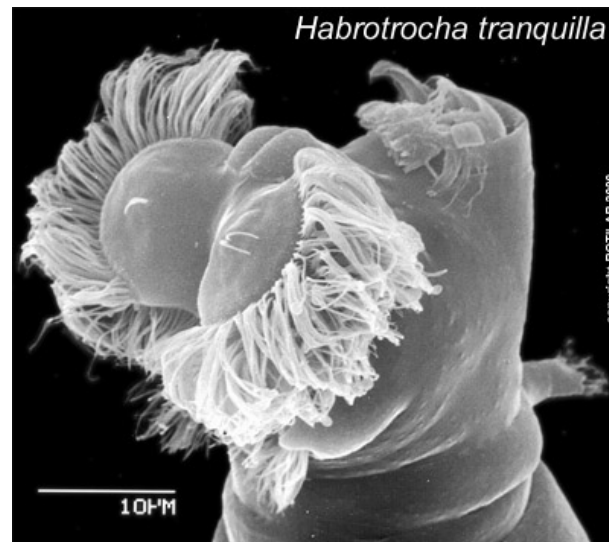


Body Plan



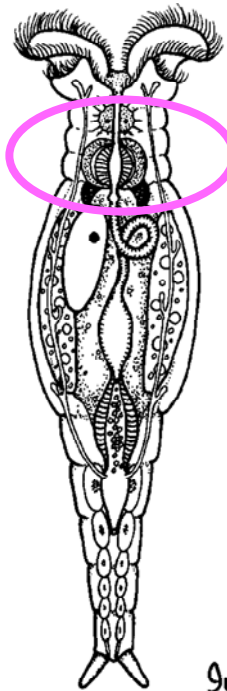
Feeding and Digestion

- have a “crown” of cilia called a corona
- the corona creates a current to bring food into the mouth



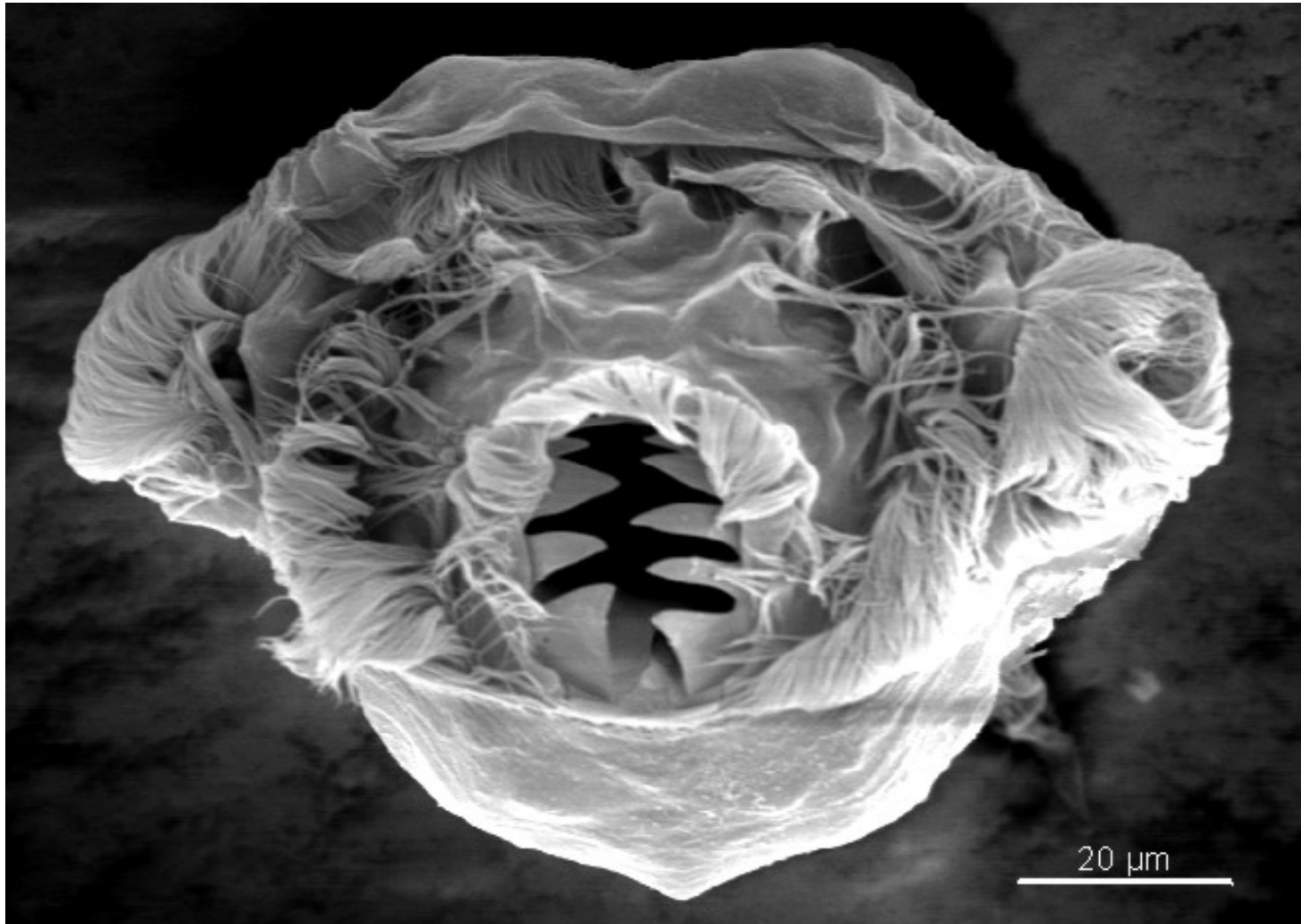
Feeding and Digestion

- have a specialized feeding structure called the: mastax-trophi complex

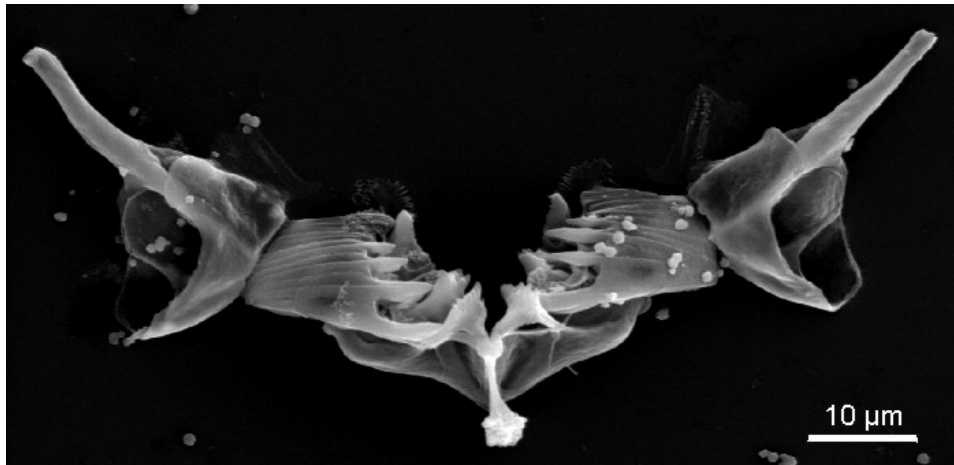
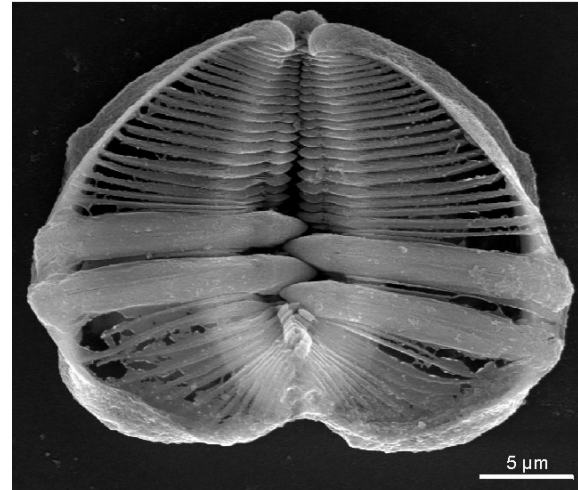
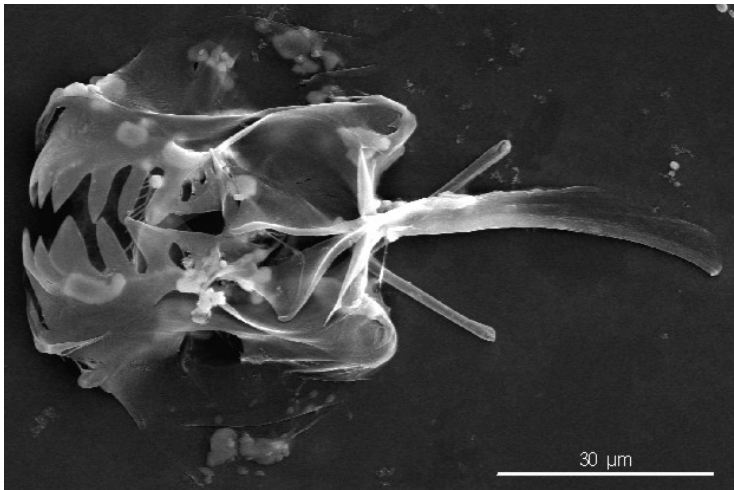


Mastax: a modified muscular pharynx

Trophi: modified jaws within the mastax



Some of the trophi (jaws):



Feeding and Digestion

Life Style

- Free-living

Digestion

- complete system (have an anus)
- some regional specialization (e.g. mastax-trophi complex)

Support and Locomotion

Skeletal system

- fluid in pseudocoelom acts as a hydrostatic skeleton

Movement

- the corona
- pedal glands (adhesive), as well as foot and toe (spurs) for attachment to substrate

Physiology

Nervous system

- cephalization, cerebral ganglia
- dorsal and ventral nerve cords

Circulatory system

- no system (no organs)
- performed by fluid in pseudocoelom

Excretion

- protonephridia and flame cells
- cloacal bladder (collects wastes)

Reproduction

Sexual

- complex life cycle with different types of eggs

Reproduction

Amictic eggs

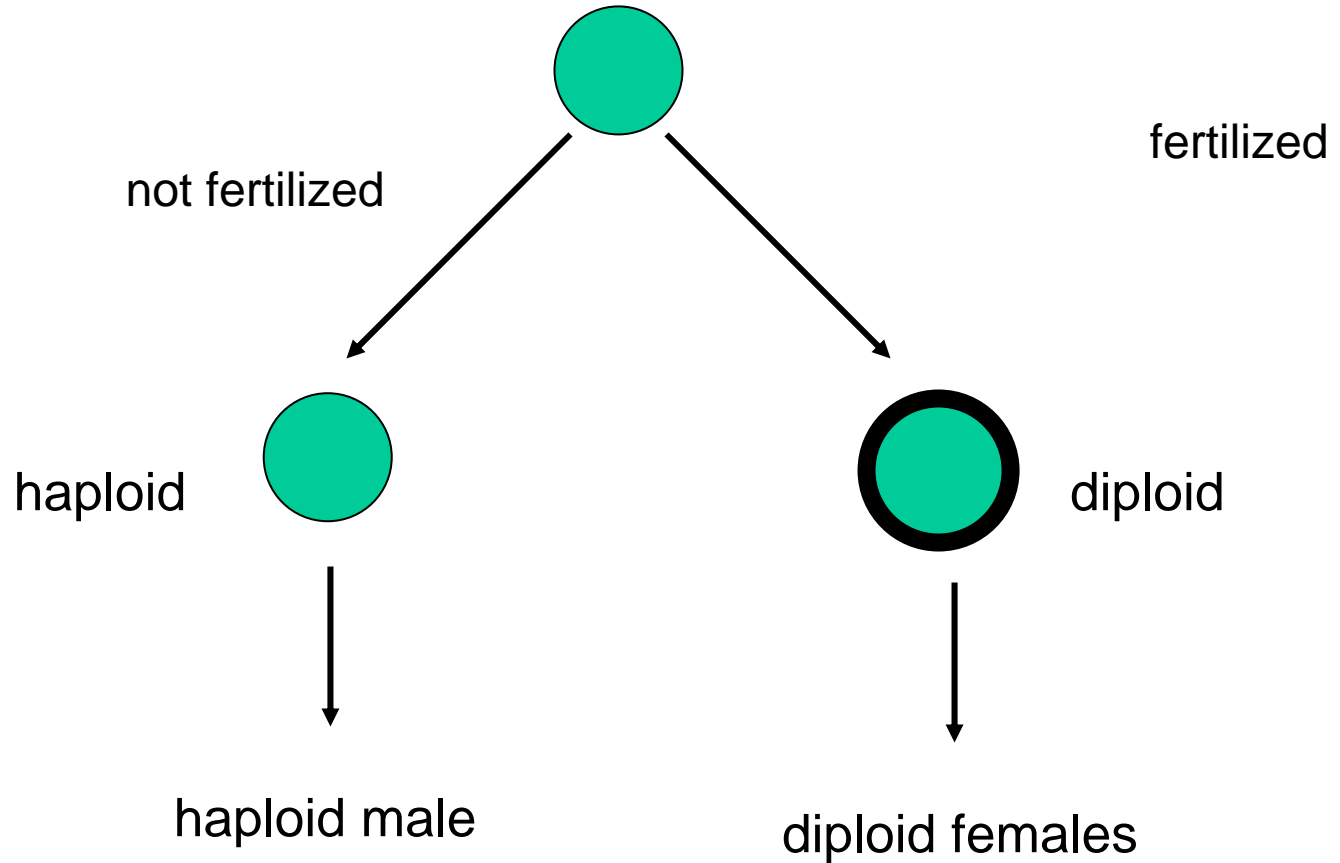
- diploid (mitotically produced)
- can't be fertilized
- develop into diploid, amictic females

Reproduction

Mictic eggs

- haploid (meiotically produced)
- produced after some sort of environmental stimulus (eg. high density, change in temperature)
- if unfertilized, develop into haploid males
- if fertilized, secrete a thick, protective shell until the environment is favorable again, after which they develop into diploid, amictic females

Mictic egg (haploid)



Reproduction

Sexual

- complex life cycle with different types of eggs
- In sexual species males often represent a small percent of the population (< 1 %).
- Males do not feed (no digestive system).

Reproduction

Asexual:

Parthenogenesis: unisexual reproduction where females produce offspring from unfertilized eggs, diploid eggs (virgin birth)

Bdelloid Rotifers

The benefits of sex (from an evolutionary perspective):

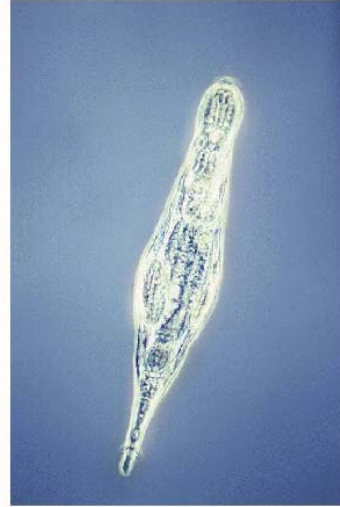
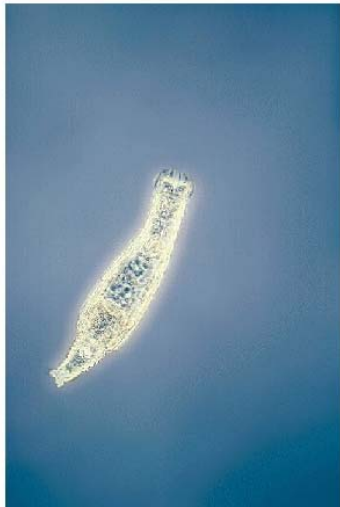
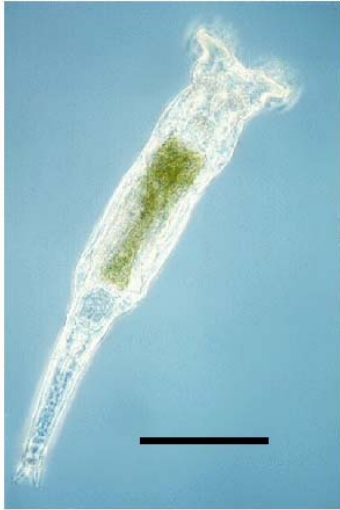
1. Purge mutations
2. Create genetic variation (through recombination)

Bdelloid Rotifers

Complete asexuality is generally thought to be an evolutionary dead end.

There are very few organisms that are completely asexual.

Bdelloid Rotifers



Bdelloid Rotifers:

- Completely asexual
- At least 45 million years old
- 4 families, 18 genera, and 360 described species

Bdelloid Rotifers

How have Bdelloid Rotifers been able to be so successful when most completely asexual species go extinct quickly?