**Chapter 9: Phylum Nematoda**

**Phylum Nematoda**

Genera: ***Cephalobus***sp., ***Ascaris lumbricoides***

Introduction

*Cephalobus* is a small, free-living nematode, of which we have prepared slides. You will need to recognize the structures indicated in Fig. 9.1. *Cephalobus* is a desirable organism for observation because of its size and transparency.

*Ascaris* *lumbricoides* is a large, parasitic nematode. All students should perform a dissection of both male and female *Ascaris.*  Since *Ascaris* is large, it will also be used for histological study. Prepared slides are available for this purpose.

Both of the nematodes described above have the same basic structure. Nematode anatomy is very consistent between species, regardless of their behavior or ecological niche.

Also, although we do not have specimens of it, another important nematode that you should know about is *Caenorhabditis elegans*. *C. elegans* is an interesting nematode that is often studied by geneticists and developmental biologists. It was the first organism to have its entire genetic code determined in 1997. The 1 mm-long adult is usually a hermaphrodite. The organism's life cycle is only 3 1/2 days long. *C. elegans* is composed of only about 900 somatic cells, of which approximately 300 are nerve cells.

The entire development of the organism (i.e. fate of each individual cell) has been followed. Serial electron microscope sections have been examined so that the location of every neuron is known. The adults are remarkably consistent, morphologically. Over four hundred genes affecting development, structure and behavior have been mapped on the six pairs of chromosomes. Males occur in very small numbers and are produced by a meiotic irregularity called non-disjunction. All of these features make it an excellent research organism. Its structure is not unlike that of *Cephalobus*, except for minor differences in the female reproductive system.

Nematodes are not thought to be capable of directed movement. Some, however, climb plants and are negatively geotaxic. Others are able to find a specific location within a host and are positively chemotaxic.



**Figure 9.1.** *Cephalobus* structures A) male and B) female.

*Ascaris*

Each pair of students should dissect a male and female *Ascaris*. Please be careful handling these organisms and be sure to wash hands thoroughly after dissection, as well as clean your dissection materials and table space. It is possible that eggs can survive preservative, so cleanliness is a necessity. Most structures are similar to those of *Cephalobus,* although the reproductive structures are greatly enlarged, as is typical among parasitic organisms.

Pin the *Ascaris* at the anterior and posterior ends. With a sharp pin or scalpel, carefully cut through the cuticle and epidermis (hypodermis) along the entire length of the organism. Pin the epidermis to the dissecting tray to fully expose the organs. The following structures can be seen: anterior end with **lips**, **pharynx**, **intestine**, **posterior acute end**, **vagina**, **uterus**, **oviduct**, **ovary**, **testis**, **vas deferens**, **seminal vesicle,** **spicules**, **lateral hypodermal cords**.

Prepared slides are available to view cross sections of both male and female *Ascaris* through the mid body region of each. Use Figure 9.3 as a guide. You should find the following features in both sexes:

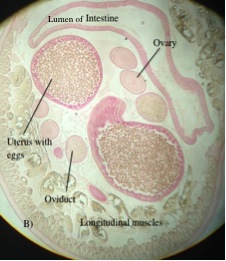
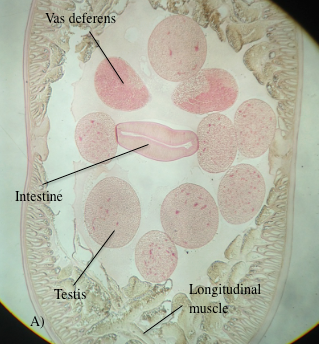
* Body wall composed of **cuticle**, **hypodermis**, and **longitudinal muscle layer**
* Cuticle: external, non-cellular, non-living; can be subdivided into several layers:
* Hypodermis: immediately deep to the cuticle. It is a very thin layer around most of the periphery, but bulges out in four places to form longitudinal ridges called **dorsal, ventral** and **lateral hypodermal** **cords**. In cross-section, each lateral hypodermal cord frequently contains an **excretory duct**. The dorsal and ventral hypodermal cords contain the **dorsal** and **ventral nerve cords**. Only the hypodermal cords within the hypodermis contain nuclei.
* Longitudinal muscle: this is a thick layer (**contractile - spindle)** with processes (**noncontractile – muscle arms**) of muscle going toward the dorsal and ventral nerve cords. It is very unusual for muscle cells to send out processes to synapse with nerve cells. In other phyla, neurons send out processes (axons) that seek out muscle cells before forming nerve-muscle synapses called neuromuscular junctions. There is no circular muscle in nematodes as was present in the earthworm. This is a second peculiar phylum characteristic.
* A third peculiar feature is the absence of an epithelium lining the body cavity. The body cavity is thus called a false cavity, or a **pseudocoelom**. Its embryological derivation is also different from the true coelom of earthworms and other organisms.
* **Intestine**: as you saw in the dissected specimen of *Ascaris,* the intestine is collapsed. This is reflected in the cross-section as well. The intestine is lined with a tall epithelium on the inside that is classified as a simple columnar epithelium

Male Reproductive System:

* **Testis**: smallest cross-sections and usually the most numerous. They should stain very darkly since they are filled with closely packed spermatozoa which, therefore, have nuclei close together.
* **Vas deferens**: larger in cross-section than the testis, less numerous with sperm not as close together. Stains lighter than testis.
* **Seminal vesicle**: not present in every section, is large and light staining.

Female Reproductive System:

* **Ovary**: numerous cross-sections resembling a cross-section of an orange. Each pyramidal cell is a developing egg.
* **Oviduct**: larger cross-section than ovary with the eggs larger, more rounded, and arranged randomly.
* **Uterus**: very large and usually a single cross-section. Eggs shelled with fine spine-like processes.
* **Vagina**: large with muscular walls, no eggs, *cannot be seen in our sections*

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**Figure 9.3.** Labeled micrographs ofcross-sections through A) male and B) female *Ascaris.*

**Other Pseudocoelomates**

**Phylum Nematomorpha** (means "thread form")

* horsehair worms
* legend says that they form from horse hairs that have fallen into water
* body wall similar to nematodes
* have no lateral hypodermal cords
* vestigial digestive system (pharynx lacks lumen), lipless
* no amphids or phasmids
* parasitic juveniles, free-living adults