

Exercise 5.3 – Helminths & Arthropod Vectors

LEARNING OUTCOMES

1. Explain why helminths and vectors are included within the discipline of microbiology.
 2. Identify and describe several examples of pathogenic nematodes and platyhelminthes.
 3. Identify and describe several examples of insect and arachnid arthropod vectors.
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Helminths and vectors are often included within the study of microbiology despite being macroscopic in appearance. Helminths are parasitic worms that are often identified by their microscopic eggs and larvae, and vectors are most commonly insects or arthropods that act as intermediate hosts for disease-causing microorganisms that can be carried to humans and animals. Both groups are multicellular eukaryotes that are classified in the kingdom *Animalia*.

Helminths

There are two major groups of parasitic helminths: the nematodes (roundworms) and the platyhelminthes (flatworms). Parasitic forms may have complex reproductive cycles with several different life stages and more than one type of host. Some are hermaphroditic, having both male and female reproductive organs.

Nematodes (Roundworms)

Nematodes are members of a diverse phylum that contains more than 15,000 species. Pinworm infection, characterized by severe anal itching, is caused by the thin, small, white roundworm *Enterobius vermicularis*. It is transmitted by the fecal-oral route and most common among children in day care and preschool settings. Diagnosis is made by observing the eggs microscopically after collection using a small paddle with cellophane tape pressed against the anus. Eggs can persist on bedding and clothing for several weeks, so good hand hygiene and meticulous laundering of potentially infected items with hot water is required during treatment.

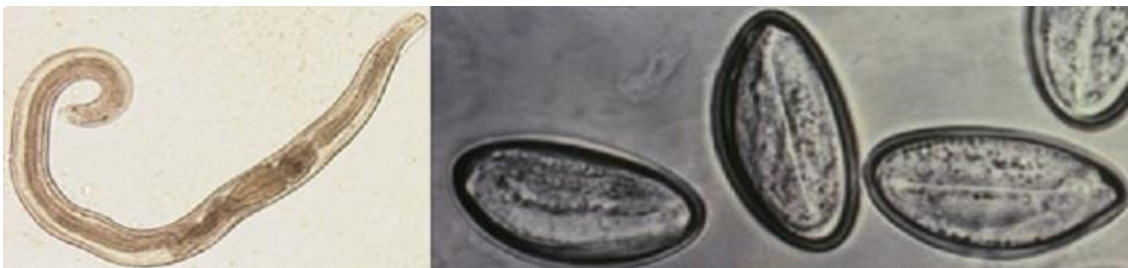


Figure 5.16: Adult male pinworm (left) and eggs captured on cellulose tape.

Another nematode, *Ascaris lumbricoides*, is the largest nematode intestinal parasite found in humans (Figure 5.17). Females may reach lengths greater than 1 meter. It may cause symptoms ranging from relatively mild abdominal pain to severe intestinal blockage.



Figure 5.17: *Ascaris lumbricoides* removed from a 14-year-old patient with intestinal obstruction.

Platyhelminthes (Flatworms)

This group includes flukes, tapeworms, and planarians. Flukes and tapeworms are medically important parasites that attach to the inner walls of the intestines and other organs, causing anemia, malnutrition, abdominal pain, and sometimes death.

Tapeworms of the genus *Taenia* are segmented flatworms having a *scolex* at the head region that contains a circle of hooks and suckers which attach to intestinal wall of the host (Figure 5.18). The body of the worm is made up of segments called *proglottids* that contain reproductive structures and can detach following fertilization. The beef tapeworm *T. saginata* and the pork tapeworm *T. solium* are transmitted to humans through ingestion of contaminated undercooked meat. Some human tapeworms can grow to lengths of several meters or more.

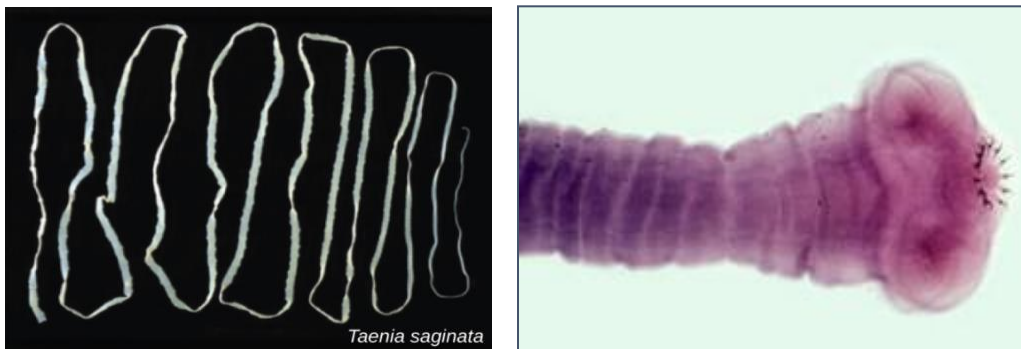


Fig 5.18: *Taenia saginata*, approximately 4 meters long (left); hook-like scolex of *Taenia solium* (right).

Arthropods

Arthropods are biological vectors such as insects and arachnids that carry pathogenic microorganisms in or on their bodies (Figure 5.19). Organisms multiply within the vector and are introduced to the host through physical contact, usually a bite. Mechanical transmission occurs when an infectious agent is carried on outside of the body of a vector. For example, flies that land on feces can pick up bacteria on their feet and then transfer it to food.

Common insect vectors are mosquitoes, flies, and fleas. Insects have six legs and bodies that are divided into three segments: head, thorax, and abdomen. The *Anopheles* mosquito is an intermediate host to *Plasmodium* protozoa, the pathogen that causes malaria. *Glossina*, also known as the tsetse fly, carries *Trypanosoma* protozoa, which cause African sleeping sickness. Bacterial diseases are also associated with insect vectors. Bubonic plague, or Black Death, is caused by bacteria which are transmitted to humans by rat flea vectors.

In contrast to insects, arachnid vectors have eight legs and two body segments: cephalothorax and abdomen. Examples of arachnids are ticks, spiders, and mites. The bacteria that cause Lyme disease in humans are carried in the saliva of ticks. The deer tick *Ixodes* has multiple intermediate hosts, including mice and coyotes.

While treatment and/or vaccines are available for many diseases that are transmitted by vectors, controlling the vector population in the wild is an important strategy for limiting the spread of these diseases.



Figure 5.19: Insects such as the *Anopheles* mosquito (left) and arachnids such as the deer tick *Ixodes* (right) are significant disease-associated arthropod vectors.

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OBJECTIVE

Distinguish representative helminths and vectors by microscopic observation.

MATERIALS

- ☐ EQUIPMENT: Microscope, lens paper, lens cleaner, Sta-clear paper
- ☐ MORGUE: Preserved flat and roundworms
- ☐ SLIDES: *Taenia scolex*, *Enterobius* eggs, *Anopheles* mosquito, *Ixodes* tick

PROCEDURE – STUDENTS WORK IN SMALL GROUPS

1. Obtain prepared slides and clean them with lens cleaner and Sta-Clear paper.
2. Bring the organisms in focus with the scanning objective.
3. Record your observations in the lab report.
4. Return the slide to the slide tray.
5. Observe the preserved specimens of flatworms and roundworms and complete the report.