



Microbiology

Lecture No:33.(3-parasites)

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Sheet Slide



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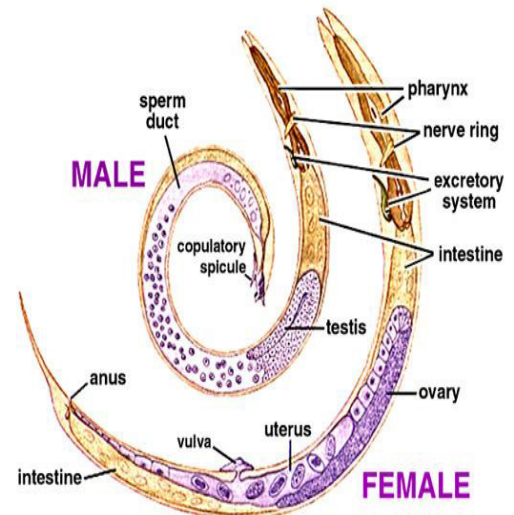
Nematodes and Cestodes

The virology lecture that was scheduled at this time has been postponed to next Thursday. Something came up and DR. Hamed could not come.

-Nematodes:

- Size: varies from 2mm to 1m.
 - Life span: could be a few weeks (for 6weeks, 8 weeks or 10 weeks) to 6/10 or 15 years.
 - They are separate sexes
 - Luminal nematodes produce eggs which go out in feces and go on to infect the next organism.
 - Tissue nematodes produce larvae and usually need an intermediate host to infect the next patient.
 - Morphology: they are cylindrical and have a protective layer on the surface known as the cuticle. It protects the organism from the bad conditions in the lumen of the intestines so they don't die from the digestive juices.
- They have a **gastrointestinal tract** with an anterior oral opening (the mouth), an esophagus, intestine which opens at the back to an anal opening (posterior opening).
- They have **tubules for excretion** and they open up anteriorly. So they have a digestive tract and an excretory system.
- They have a **rudimentary nervous system** With some ganglion tissue around the esophagus. Nerve fibers that go anteriorly and others that posteriorly.

-They have separate **sexes**. Female Worms are larger than male worms. In males you can see testes, vas deferens, seminal vesicles and an opening for sperms to go out. There is also spicules which allows attachment to the female and helps the process of fertilization to occur.



Females have a uterus that opens to the anterior aspect of the worm and there is a vagina. There are also ovaries there. When the eggs are released to the uterus, they can get fertilized by the sperm from the male. Fertilized eggs are passed to the outside of the worm. Normally, as we previously mentioned, this happens in the gastrointestinal tract of the human and the eggs would go out with the feces.

There must be male and female worms to have fertilized eggs. If you have a female egg on its own, you will get eggs that are not fertilized. As such, they will not be able to pass the infection on. An unfertilized egg will be unable to produce a worm in the other patients.

-**Attachment** is important in the gastrointestinal tract, because otherwise peristalsis and the flow of the contents of the tract will move the worm outside. Attachment is achieved via structures that are teeth like. Some worms are very muscular and are able to stay in the rugae of the small intestine.

Life cycle:

infected person defecates » eggs pass with feces» eggs pass into soil» people eat the egg» egg goes through stomach and reaches the small intestines and its shell disintegrates and the larvae exits and

matures» the mature worm makes eggs and the whole process starts again.

This is a direct spread (worm, egg, worm) with no need of an intermediate host, unlike tissue nematodes which need an intermediate host. Tissue nematodes produce larvae (known as microfilaria) which are sucked up by the intermediate host (usually an insect) and transferred on to the next host.

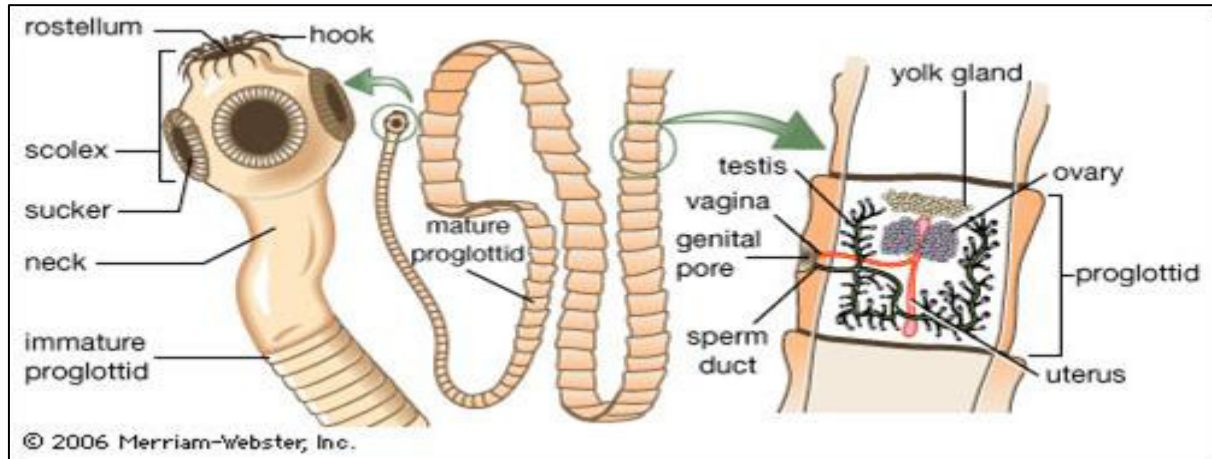
-Nematode eggs come in different shapes and sizes. When we come to discuss the worms separately, we will mention the morphology of the eggs. For now, you don't need to know about it.

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-**Cestodes:** flat worms/ tapeworms. الديدان الشريطية

- Size: varies according to worm. Could be 1cm to 10m.
- Lifespan: could be few weeks , couple of month or it may reach 20 years.
- All of them need an **intermediate host**, with one exception that we will mention later. The intermediate host could be a cow, pig, fish, and sometimes even a human according to the species .
- They all are **hermaphrodites or bisexual** (the worm is both male and female at the same time).Therefore, they don't need more than one worm to produce fertilized eggs because they can self-fertilize. If there is more than one worm present, there could be cross fertilization as well.

- Morphology: these worms are primitive compared to the nematodes. To start with, the worm isn't exactly a worm. For example, it doesn't have a **digestive tract**. Feeding happens via



simple diffusion from the surroundings, through the outer layer of the worm.

- Anteriorly, there is a specialized apparatus known as a **scolex**. It's not really a head. It's an organ by which the worm anchors itself to the wall of the digestive tract.

The scolex has **suckers** (4 or 2, according to species, could be rounded or elongated). *Some* worms also have hooks on the scolex. Hooks come in rows. Sometimes they have one row or two rows. A row of hooks is known as a **rostellum**. This is how the scolex helps the worm anchor and attach itself.

The worm itself isn't a worm, per say . It's made up of units called **proglottids** which are arranged in sequence (like a مسبحة). Some worms are made of 3 proglottids and others are made of 3000 proglottids.

These proglottids proliferate from the distal end of the scolex. They get bigger and mature towards the tail end of the worm. The proglottids in the neck region are known as **immature proglottids**.

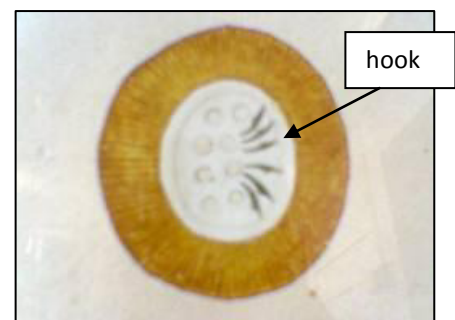
They are just a collection of connective tissue and nuclei which are dividing and developing. Further down, towards the middle of the worm, we get **mature proglottids**. Mature proglottids have both male and female sexual organs.

Looking at a mature proglottid, you can see a uterus and a genital opening. You can also see 2 or 3 ovaries, as well as testes. The eggs are produced by ovaries, become fertilized then get settled in uterus. The uterus becomes more full of those eggs, gets bigger and bigger until it occupies all of the proglottid, so you can't see anything else. At that stage, we call it a **gravid** (meaning pregnant) **proglottid**.

-Gravid proglottids can separate from the worm and be passed out with the feces. It's *rare* for the eggs to be released inside the abdomen. It's *more common* for a number of proglottids to be released together. They can be quite big, and may be mobile as they have muscular and nerve tissue. Your patient may mention that he passes something moving in his feces. This is really a collection of proglottids that are gravid.

-The surface of the worm (the **tegument** of the worm) has structures like microvilli that are called **microtriches**. We mentioned that they don't have a digestive tract so they take nutrients via absorption. Microtriches increase the surface area and thus increase diffusion/absorption.

-The **eggs** are not as varied as those of the nematodes. Most of the tapeworm eggs have the same structure. They are rounded with a striated outer covering. In the middle, there is an embryo with 6 hooks (**hexacanth**, Hexa means 6 and canth means hooks). When the



eggs are passed outside, the proglottid will rupture and get eaten by the intermediate host (like a cow).

lifecycle:

let's take the tapeworm of the cow as an example. The *primary host is the human* and they pass the proglottids on the grass, cow will eat grass and proglottids. The hexacanth will be released in the intestine of the cow (intermediate host). The hooks penetrate the wall of intestine of the cow. That's way it can travel in the body and settle in the brain or liver or muscles,.. etc. Once settled in the tissue, it changes morphology and becomes known as a cysticercus. This cysticercus is like a balloon invaginated in it a rudimentary scolex. When you eat the cow meat (which is the muscle of the cow)without cooking it ,in your small intestine the cysticercus will evaginate itself, the scolex emerges and attaches to the wall of the small intestine and then we have proliferation from the neck region, producing a new tape worm.

- ❖ **Note**: freezing the meat at - 21C for couple of days and heat kill cysticercus. As long as the meat is red it may contain cysticercus. Of course not all meat is infected, but it's better to cook it well.