

Microbiology sheet #24

Written by Dareen Mashaqbeh

Corrected by Jumana Kussad

NEMATODES

They have both genders; males and females worms . Both sexes have separate reproductive organs .

They have digestive, nervous and excretory system

Diffusion of materials by simple diffusion through the worm's tissues .

Most of them tend to have anaerobic metabolism since they live in areas deprived of oxygen like the lumen of the small intestine.

Protozoa reproduce by binary fission and they also reproduce sexually .

Nematodes usually produce eggs and the number of eggs vary depending on the worm itself .

The eggs are found in the gastrointestinal tract in order to be excreted in the feaces then these are ingested by another human giving rise to worms there to continue the cycle .

Keep in mind that the number of worms in the host stays the same, they do not increase, they only produce eggs which usually do not hatch in the same host, but are excreted with feaces and ingested by a new host and hatch there.

Eggs produce larvae and larvae grown into a worm.

Yet, not all Nematodes produce eggs some of them produce **Larvae** directly without eggs (as if its delivering a baby), in this case an intermediate host is needed since the larvae is not resistant and can't live outside the body.

- There's a difference between eggs and larvae, eggs can survive in the environment if they had the chance to get out of the body until

ingested by another host, where as larvae require an intermediate host to be transmitted.



In malaria for example, the intermediate host is mosquito . The insect sucks the blood of an infected person, takes the larvae, and once the mosquito attacks another human host, the larvae will be released into his blood and he gets infected.

CESTODES (tapeworms)

These are primitive worms , unlike nematodes that have anterior end with a posterior end ,gastrointestinal tract ,anal opening whereas Cestodes consist of units and each unit is a single entity by its own .

****These units make the Cestodes structure and they're called proglottids .**



- the number of proglottids range from 3-3000 according to the species.
- they are variable in length ,some of them might be 1 cm in length whereas others might have extensive length reaching 10-12 meters according to the number of proglottids
- their lifespan ranges between 6 months up to 15 years within the same host .

-They **ALL** require an intermediate host (could be a pig, a cow or a camel).

RECALL: nematodes do not require an intermediate host ,since eggs can survive in the environment whereas larvae need an intermediate host .

-**Cestodes are hermaphrodites** (male and female at the same time); they have both sex organs; that's why the fertilization of the egg is **self fertilization** and this means that the sperm comes from the same proglottid to fertilize an egg found also in the same proglottid.

UNLIKE nematodes that have male and female worms, and if the egg produced by female is not fertilized by male, it will not hatch.

-At its anterior end there's an apparatus that helps it in anchoring to the organ (GIT) that it wants to infect. Otherwise, the peristalsis and secretions of GIT will flush it away from the body. **This anterior apparatus is known as a scolex .**



-the scolex has **4 sucking discs** to remain attached to the intestinal tract. Some scolex also have hooks that help it attach to the GI tract that are known as **rostellum**.

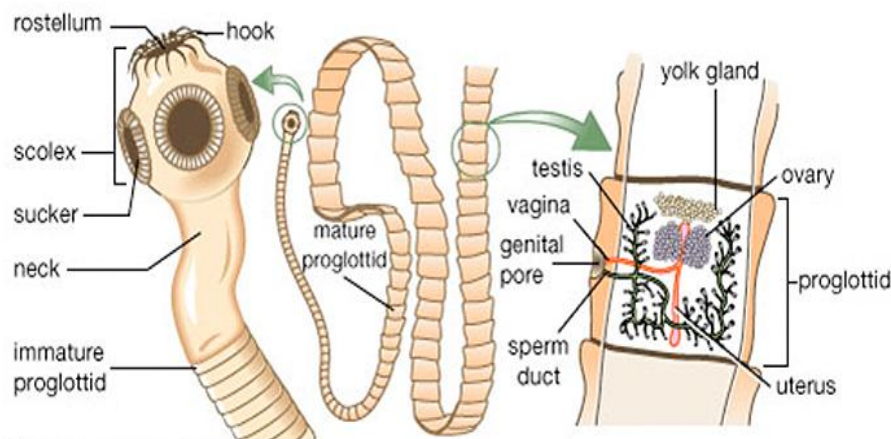
- the surface area of the worm has microtrichia (similar to microvilli) to increase the surface area, because these worms do not have a gastrointestinal tract hence they get their nutrients from the environment from their surface .

- after the scolex there's the neck region where there'll be proliferation of the proglottids .

- as we go distally in the worm's structure ,proglottids become larger since they become mature .

- at the proximal end of the neck region proglottids are *immature* ; they're not differentiated yet, however as we go to the middle of the worm they become *mature* which means they contain both male & female genitalia .

****proliferation starts at the neck region .**



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_As we can see from the picture, the ovary will produce eggs that are going to be fertilized by sperms formed by the testis, the fertilized egg will go to the uterus and now the uterus will be dilated ,we'll end up by having a proglottid with nothing but a big dilated uterus stuffed with eggs .

** the proglottid is now known as **Gravid proglottid** .

Then proglottids will separate from the distal end and will be excreted with feces of the host (the number of proglottids that will separate varies , might be one ,two or even ten ..) .

***the worm itself is called Strobila.**

- the morphology of the eggs is similar in many of the tape worms. They're rounded with an embryo in the middle that has six hooks and therefore the embryo inside the egg is known as hexacanth (hexacanth :hexa -→ means six , canth → means hooks .)

***cestodes have nerves and muscles fibres; the fact that they can't move, but they're motile . (unlike nematodes which are very muscular and can move)**

-proglottids that contain eggs, *usually* get out of the GI of host intact without being burst, once they're out they disintegrate to release eggs, these eggs are ingested by an intermediate host .

*The type of the intermediate host depends on the species of the worm; *tinea saginata* affects cows , *tinea solium* affects pigs .

- when the eggs are eaten by the intermediate host ,the outer layer of the egg disintegrates to release the embryo -*the hexacanth*s, which anchors to the intestinal wall by its hooks , then the worm will be distributed all over the intermediates host's body. They might reach heart,kidney,liver, brain and the muscles .

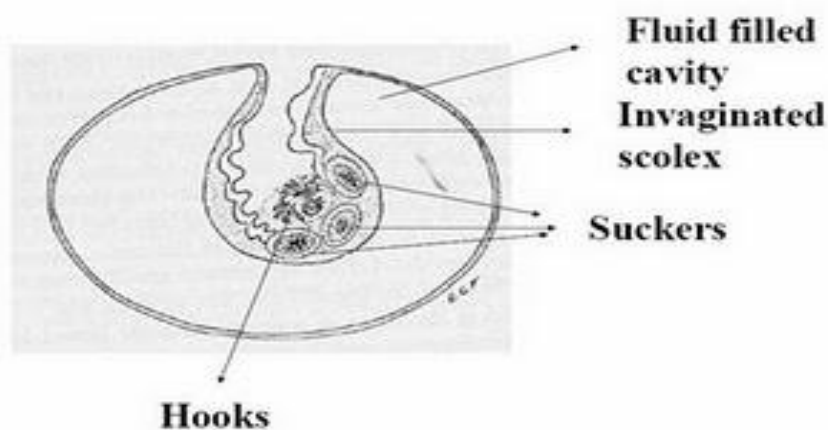
once the worm settles in an organ in the intermediate host (pig/cow) ,it changes its morphology to what is called as **Cysticercus .

***Cysticercus is the worm within the tissues of the intermediate host consists of a balloon with a yellowish fluid and an invagination from one side looks like a rudimentary the scolex .**

[further explanation from google : a tapeworm larva that consists of a fluid-filled sac containing an invaginated scolex, is situated in the tissues of an intermediate host, and is capable of developing into an adult tapeworm when eaten by a suitable intermediate host .]

-Cysticercus are killed by cooking, so intermediate hosts (meat) with cysticercus, if not cooked, will infect human host when they eat it . Once it gets in the body, scolex in the embryo will be released to attach to the wall of intestines and their proliferation starts from the neck region to repeat the cycle we've talked about to produce new eggs in the host .

Diagrammatic representation of a cysticercus



**usually* we find only one worm in the host and it's length ranges between 6-10 meters .

-although we said that they have self fertilization, in some cases cross fertilization occurs which means that sperms of one proglottid go and fertilize the eggs of **another** proglottid of the same worm. This cross fertilization can also occur in case of the presence of two worms in the host and the sperms of one worm will fertilize the eggs of another worm .

TREMATODES

-Trematodes are flattened worms .

-they are similar to the nematodes by existing as a single unit and having gastrointestinal tract,unlike cestodes that lack GIT and are made of many units.

-they have spines on their surfaces that help them to anchor to the host's tissues. They also have two suckers that allow the worm to stick to the tissues, one sucker is found anteriorly around the oral opening >>oral sucker ,

and another sucker at the ventral aspect of the worm >>ventral sucker .

*oral sucker is opened from an end whereas the ventral sucker is closed .

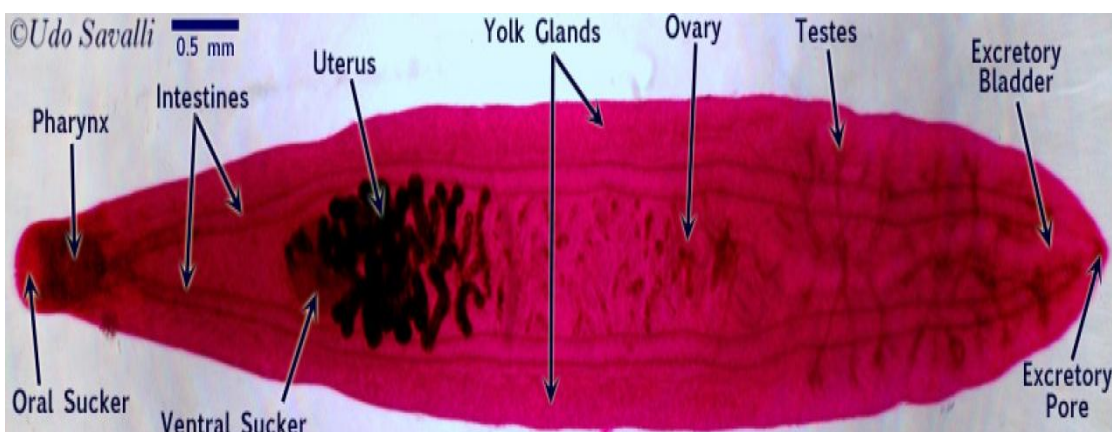
-their GIT is bifurcated and ends without an anal opening thus having a blind end , that's why if anything is not digested it regurgitates (vomitted) from the oral opening .

-the longest worm is 8 cm .

-lifespan varies but might reach up to 15-20 years .

-they have an excretory system , tubules that collect waste materials from the worm in order to be released from an excretory pore (this pore is not from the GIT) .

- these worms are hermaphrodites ; there's male and female reproductive system found on top of each other .



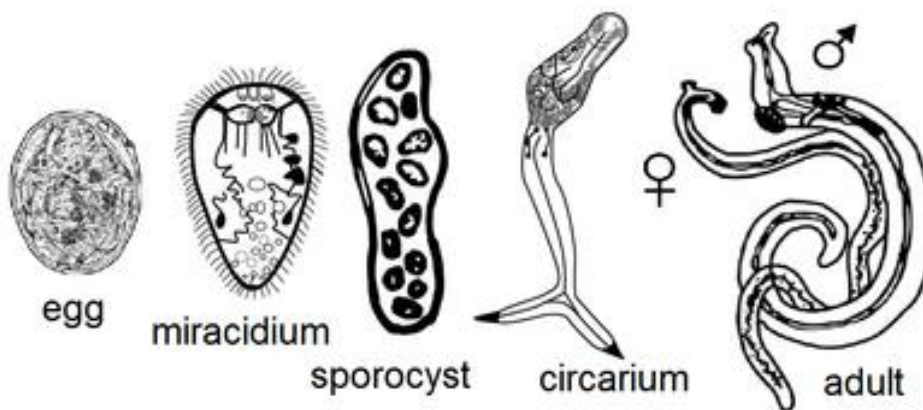
-their eggs are usually very large and have a lid known as **operculum**, the embryo that is inside is called **miracidium**, this miracidium is *ciliated* with a *pointed end* anteriorly .

-they have muscular tissue and nervous tissue like ganglia .

-they need an intermediate host which is usually a type of fresh water snails (mollusks).

-eggs of trematodes pass to water (eggs are passed either through urine, sputum or saliva or faeces), the lid is removed so that miracidium gets out and they swim using the cilia until they reach the watery snail and when enter the snail the miracidium changes into **Cercaria** .In turn these cercaria get out to the water until they find a new host and get inside either through the skin or orally to reach GIT .

*note: They change into cystic form on fish or water plants in order to be ingested by a new host



GOOD LUCK ^_^