Trematodes (Flukes)

Part I: General Morphology

Shape:

- flattened,
- oval shaped
- look like a tree leaf

Length:

- few centimeters (up to 8 or 9 cm)

Surface:

- An integument with ridges, tubercles, and spines which anchor the worm in the place where they live, so they are used for attachment and locomotion.
- They usually have an operculum (lid or cover-like specialization of a parasite eggshell through which the larva escapes) on one end.
There are two suckers distinguish the appearance of each worm:

- Anterior sucker around the mouth → called: oral sucker.
- A sucker that’s located on the ventral aspect → called: ventral sucker.

Trematodes - generally speaking - are either:

- luminal trematodes or,
- Tissue trematodes.

They are found in one of main three locations inside the body where the cause pathogenicity:

1. Gastrointestinal tract & biliary tract
2. Blood vessels
3. Lungs

Although - as you’ll see later-, some strains could be found in the bladder

Gastrointestinal tract:

- Trematodas’ GI has a pharynx → esophagus → bifurcates into two → ends up blindly towards the posterior extremity of the worm with no anal opening i.e they don’t open up to the outside, Unlike Nematodes.
- Execration of solid and semi-solid waste occurs by: regurgitation (vomiting).
Nervous system ... A rudimentary one:

- Ganglia with many nerve bundles extending in both directions; forward and backward.

Excretory system (for fluid waste):

Secretion begins in the flame cells which are distributed around the edges of the worm (functions like a kidney) ➔ to specialized secretory ducts ➔ to the collecting receptacle (bladder) ➔ out of the worm via special opening

** This figure illustrates the major parts of a trematoda, refer to it for further understanding and it’s advisable to refer to it for the coming parts as well 😊
Part II: Reproduction & Life cycle:

Self-fertilization

With the exception of Schistosoma (the cause of bilharziasis), All Trematodes are hermaphrodites (i.e. have both male and female genital systems within the same worm).

1. An ovary produces eggs & two Testes produce sperms
2. Both systems open to a genital opening (located near the ventral sucker) where self-fertilization of the eggs occurs.
3. Eggs produce worms ... but first, they must get out to the environment.

Trematodes are released to the outside in:

1. Sputum ... if it was in the lungs.
2. Urine ... if somehow it reached the bladder.
3. Feces ... if it was in the GI.

Schistosoma eggs can exist in the blood vessels of GI and of urinary tract. So they can exit by feces or urine.
Now let’s take a look at the egg morphology:

1. large
2. Operculated: with operculum (cap like structure).
3. When the egg is released into water, the operculum opens. (water is where it must be released in order for the life cycle to progress, because it’s where the intermediate host is present, they have to adapt to the existence there after excretion from the body where they produced).
4. ciliated structure with pointed end gets out of the egg, it’s called miracidium (cilia for swimming and the pointed end for penetration into the intermediate host)

The Journey of the miracidium ...

- first you should know that all trematodes with NO exception need fresh water snail as an intermediate host (unlike tapeworms, where there is actually an exception which is: *hymenolepis nana* that requires no intermediate host).
- The miracidium penetrates the tissues of the intermediate host and fold itself into a rounded ball of cells called sporocyst – an elongated sac that produces either rediae or more sporocysts
- a sporocyst can divide to give more sporocysts.

- Within the sporocyst, buds called Rediae develop ... they are rudimentary worms in which you can identify many structures similar to those found in an adult worm (oral sucker for example).

- They can divide (reproduce asexually) and produce more redia.

- so basically you can have lots of redia produced from a single miracidium

- those redia develop tails and undergo further maturation ...becoming cercariae – the larval form of the parasite

- They are capable now to leave the intermediate host ➔ swim in the water ➔ find their victim ➔ they get into their host.

✓ remember: miracidium swims by cilia and cercariae swims by a tail

✓ note: cercariae is actually a worm but with a tail

how do they get into their host? ... two ways:

1. penetration of the skin ➔ to the tissues..... and remain cercariae, such as Schistosoma.
2. Enter by the mouth in association with sea food (like: aquatic plants, some kinds of fish, crab ... uncooked) \(\rightarrow\) to the GI ..... transform into a cystic form (called \textit{metacercariae} or simply cyst)

\textbf{Morphology of the metacercariae ... Worm in a coat:}

1. Lacking the tail.
2. Covered with a protective coat.
3. In addition to the other normal structures which are found in worms.

\textbf{Metacarcariae can: ** refer to the figure below}

1. stay in the intestine
2. penetrate intestinal wall \(\rightarrow\) to the peritoneal cavity \(\rightarrow\) then to the liver
3. it can also penetrate intestine \(\rightarrow\) peritoneal cavity \(\rightarrow\) diaphragm \(\rightarrow\) further penetration \(\rightarrow\) lung

\textbf{Thus they can later form:}

1. Intestinal flukes .......
2. Hepatic flukes ..... 3. Pulmonary flukes .....
Part III: schistosomiasis

Now we’re going to discuss an interesting trematoda; schistosomiasis

Why is it interesting?

We said that trematoda are:

1. hermaphrodite
2. flattened
3. eggs are operculated

Well ... schistosomiasis is an exception for these rules: *refer to the figure:

1. Two sexes present separately; male schistosomiasis and female schistosomiasis.
2. Schistosomiasis is not flattened, the male is rounded to flattened - elongated maybe - and the female is completely rounded, just looks like Nematodes.
3. eggs are not operculated

But still!! Schistosomiasis is a Trematoda
Schistosomiasis is found in the blood vessels, specifically, post capillary venules.

Schistosomiasis does not elicit an inflammatory response because it is usually camouflaged (it covers itself with the host’s own molecules like blood antigens) ... immune system identify the camouflaged schistosomiasis as a normal blood component, but once it dies, it can't cover itself anymore, so it produces an inflammatory reaction.

Schistosomiasis can live for a very long period within the body (up to 30 years!!)

Schistosomiasis causes bilharzia.

Schistosomiasis worm ➔ causes no manifestations along their life, BUT schistosomiasis eggs ➔ are the ones responsible for bilharziasis' symptoms because they cause hypersensitivity \ allergy reactions.

Their eggs are:

- large
- not operculated
- Each has a spine (could be anywhere; terminal, on a side...) for adhesion to the vascular wall and for penetration of blood vessels.
Penetration:

- eggs could penetrate way to the urinary bladder and get out with the urine,
- or to the intestines and get out with the feces in defecation,
- or even to the lungs by penetrating the diaphragm, and get out with sputum
  (if the infected person – in this case – swallows his sputum he’ll get intestinal
  schistosomiasis which may get out by feces).

All eggs must reach water and get into the intermediate host to complete the life cycle.

Penetration process causes many problems and contributes to schistosomiasis pathogenicity and symptoms too, for example, blood might be apparent in the urine due to the inflammatory reaction.

Schistosomiasis life cycle outside the body is identical to that of any typical trematoda

Thank you for being patient enough to finish this sheet I am really sorry for any mistake ...

My last words to you .... Whenever you feel tired, stressed or depressed ... stop thinking how great is your problem and start thinking how great your God,

Just say is: Ya Rab...  Done by: Anood A. Alasraf.