



Microbiology

Lecture No: 31.....

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Sheet Slide

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Parasites

The world of the microorganisms that cause diseases is divided into four varieties: bacteria, viruses, fungi and parasites.

Our topic for this lecture is the parasites.

Generally we don't have much disease caused by parasites, because their infections is associated with poor countries, and that's why we don't consider them as a BIG DEAL

But nerveless it's a branch of the microorganisms, and we should know about them.

the parasites are very different from the other microorganisms, because of the variety of their morphology , and they grow in different environmental conditions , they also have very complicated life cycle , unlike bacteria and viruses , these parasites can change their morphology to adapt the environmental conditions , and they also have several groups .

the name parasite indicates the behavior of being a guy with no shelter or food and you need others to provide them to you , and those " others " are what we call " hosts " , so **the patient** who *harbors the parasite* and is infected by the parasite is called **host** .

The host can be any thing: humans, animals, etc , but our main concern is the humans.

Now, we call the patient a "**primary host**", because he is the one who is providing food, shelter and environment. Then the parasite can be transmitted directly from one person to another, or it can go to another media which is called an **intermediate host**, it harbors the parasite only for a short transition period.

News flash: we are not required to know all details of each parasite, we will take it in next terms "and in those next terms he will say" as we took it last year LOL ".

So what we said for now is that we have, primary host intermediate host, and a complicated life cycle.

The studying of parasites is really important, because it gives you a survey of the developing world. for example : blindness , and the most common *infective* cause for it is the bacteria *Chlamydia trachomatis* , and the second most common cause of blindness is by a parasite is a worm that cause what is called river blindness .

Nematodes are roundworms (for example; *Ascaris* and Threadworm). **Threadworms** commonly infect children nowadays but *Ascaris* is not very common nowadays. **Pinworm** also very commonly infects children. You maybe get shocked but we have a thousand million people (1/7 of people in the world) suffer from nematodes. It's not that lethal, but it's considered as a burden on the society. **Schistosoma** or **bilharzia** " a lot of Egyptians are infected by this disease , this parasite infect the bladder and it cause a bloody urination " and they got a rumor that if you don't urinate blood , then you're are not normal Egyptian :p (so this disease is so common and widely spread there and millions have it) ". In the world, we have 200 to 300 million people suffer from **Schistosomiasis**.

We have another nematode worm that is called **Filaria** (the cause of Filariasis) they inhabit/live in the blood vessels, and the lymphatics. **Elephantiasis** a complication of chronic Filariasis, and it results from blocking of the lymphatic vessels causing extreme enlargement of legs. And again a lot of

morbidity is caused by these Filarial worms; around 200 to 300 million people worldwide suffer from this parasite.

Another microorganism; *Plasmodium* which causes **malaria**, it's very common disease and several hundred million cases a year. In Jordan we had malaria in the 40s and 50s up to the 95s. This disease is spread/transmitted by mosquitoes. Unfortunately, it's the cause of death for at least 1 million children every year because they have immature immune system.

So these parasitic diseases cause a lot of morbidity and also they tend to be chronic, and its chronic because they can't afford to kill the host since they are their source of food and living flashback: parasites are microorganisms that fed on others (unsustainable person). In their life cycle humans are called primary hosts. Transition of diseases by direct contact or by what we call an "intermediate host" like insects and sometimes we call them **vector** "ps this word applies to insects".

The dead end host is the last one that gets the infection, so we have the following, two hosts that may have in between an intermediate host that could be an insect, a cowthe intermediate host could be a human! like in **toxoplasmosis** disease that infect cats , this disease if it transferred to a pregnant lady it will cause abortion or infants malformation , so in the toxoplasma the primary host is cats and the intermediate is humans , we have another intermediate host for toxoplasma which is mice , the mouse eats the infected cats feces and other cat will eat the mouse, this is the normal life cycle of toxoplasma. But sometimes a person or a child " Avery dummy dummy child " can somehow eat sth contaminated with

the fesses of the cat , but logically there is no cat in the world can eat a child so in this case he is an intermediate host but is also called a dead end host, because the life cycle has not been completed.

Balantidium this parasite causes bloody diarrhea like dysentery, it passes from one to another by fecal contamination. This *Balantidium* can infect boars, so there is a reservoir in the nature "the wild boars" that serves as source for the infection. ***DO NOT confuse, a reservoir (ex. Wild boar) is NOT an intermediate host, this disease can infect both; humans and boars. It can be transmitted from person to person without the need of boars as intermediate hosts.***

And remember any disease that exists/occurs in humans and animals is called **zoonosis**.

So the disease that is caused by *Balantidium* and infects humans and wild boars is a zoonosis.

We have another disease called **leishmania** this parasite affects humans, rodents and dogs, and this is another example of zoonosis.

We have two types of parasites, the first one is called endoparasite, and the other one is called ectoparasite

Endoparasite is a parasite that lives inside your body, and by that we mean maybe in your gastrointestinal tract " but some people disagree with that because they consider the lumen of the intestinal tract as outside of the body since it opens to the outside from above and below and it is not sterile" , the cerebrospinal fluid , other tissues , etc

Ectoparasite is a parasite that lives on your skin such as: lice, scabies and bugs that live on your body and feed on your blood, but they aren't actually inside your body.

The endoparasites can be subdivided into: **luminal parasite** that live on the lumen of the gastrointestinal tract or any cavity in your body, the other type is the **tissue parasites** that live in tissues; brain, blood, liver, etc... and depending on their sizes they can be intracellular "if they are too small" or extracellular.

A student asked: we said that parasites are microorganisms and "by definition they must be unicellular", but lice isn't a unicellular organism?

The doctor answered that parasites come with a variety of shapes and sizes; we have parasites about 3 to 4 microns (the size of RBC is nearly 7 microns, and of a lymphocyte is about 10 microns, a monocyte ~15 microns,, so these parasites "with a size of 3-4 microns" can live inside those cells and can be intracellular). On the other hand some worms can be 10 m so it's up to you to call it microorganisms or not.

Direct transmission of a parasite from one host to another is not really efficient because it dies quickly if it goes outside the body, so it has to change its morphology, because the parasite that lives in our body is very delicate that means it dies very quickly if it goes outside the body, so it has to change its morphology so that it produces *a resistant morphology to the outside environment* to go out to infect somebody else, so the direct spread is not performed by the parasite itself it happens by the eggs. And these eggs that transmit the diseases become the parasite, other parasites produce cysts which transmit the diseases, and rarely the parasite can be transmitted in one piece from one to another by and here you

need to have a direct contact, which is achieved by sexual intercourse in STD "like spirochete and Neisseria gonorrhoea, Chlamydia". And there is only one exception that doesn't need to have eggs or cysts

As we said parasites adapt to different morphologies in different environmental conditions, in the intermediate media and some time you will see different morphologies (two or three) in the same primary host "but this isn't count as mutation"

Now let's talk about the parasites themselves after we took a general look

The parasites are divided into two groups; **protozoa** and **helminthes**, protozoa are unicellular organisms that act as parasites; each parasite is a single cell. and their size varies from 4 microns to 100 microns in diameter. Examples: *Amoeba*, *Paramecium*.

Helminthes are the worms, they are multicellular organisms; each organism is composed of many cells. And they have all kinds of structures; mouths, gastrointestinal tracts, etc

Protozoa because of their small size they can be intracellular or extracellular. Helminthes can only be extracellular parasites and cannot be intracellular; "the smallest helminthes is about 2 mm so it can't squeeze itself into one cell since they are multicellular"

Usually the **vegetative form** of the parasite "active form that eats, moves, excretes, divides, etc..", that causes diseases.

In the protozoa the vegetative form is called **trophozoite** this vegetative form is active and by that we mean it drinks eats,

moves, multiplies, etc , but it doesn't transmit itself, because the trophozoite is very delicate, and if it goes outside the body it will die quickly. so that's why they must transform themselves into a structure that can endure the harsh environment outside the body and be transmitted to other places.

Corrected by: Bushra Maaqbeh.

**Additional notes
for Sheet 31
(Parasitology 1)**

By

Bushra Maaqbeh

Parasitology

Those notes are taken according to section 1 recording for the very first lecture for Dr.Hassan

Some pieces of information were not mentioned in the sheet

-Parasites could be transmitted *directly* from person to person, or through an intermediate host. Transmission could be through *eggs* or *cysts* and it is rarely for the parasite to be transmitted in its vegetative form.

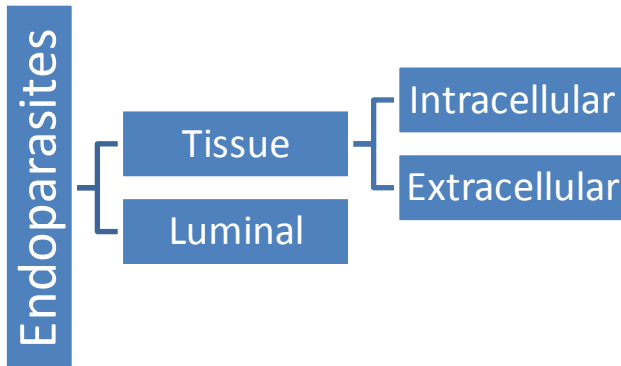
-One exception is ***Trichomonas vaginalis***, a parasite that causes Trichomoniasis which is a sexually transmitted disease (STD). This parasite is the “only” one that can *transmit itself directly from person to another in the vegetative form*.

-Parasites like *Amoeba* cannot live outside the body for a long time, it dies quickly within a couple of hours or less. However, if we assume that somebody eats something contaminated with *Amoeba* trophozoites → they will go to the stomach and be killed by hydrochloric acid (HCl) there.

-But if it (*Amoeba*) transforms itself into a cyst, it will be resistant to HCl. Cysts can go outside the body with feces and can live for weeks. If they (cysts) are eaten by somebody → they will go to the stomach where they are resistant and NOT affected by HCl → then cysts go to the intestines and under the effect of digestive enzymes, the outer cover (of the cyst) is dissolved/degraded → the inner part becomes trophozoite (the vegetative form).

-**Direct spread of protozoa is through cysts** (usually).

-**Worms usually lay eggs.**



-All tissue parasites need an intermediate host because it is difficult for them to come out of the body.

-Majority of luminal parasites does NOT need an intermediate host; however, some of them do need an intermediate host. (ex. Tapeworm)

-Tapeworms are luminal parasites that live in the GIT. The eggs that come out with feces are eaten by an intermediate host (ex. Cow, pig). A human eats cow for example and then the disease is transmitted.

-Protozoa and helminthes (both of them) can be either luminal or tissue parasites.

-Protozoa size varies from **0.4** micron to 100 microns.

****Correction for sheet #31 →**

Page 4 → Line 5

Actually the parasite's name is **Balantidium Coli** and it lives in the intestines.

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