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Parasitology

Parasitology is the branch of science which mainly deals with all the parasites and its infectious diseases.Whole parasitology covers mainly parasites, host and its association between them.

Medical Parasitology is the branch of medical sciences dealing with organisms (parasites) which live temporarily or permanently, on or within the human body (host). other parasitic animals such as parasitic bacteria,viruses,fungi and insects are not involved even if they live parasitically because they have their concerned sciences (bacteriology,virology,mycology and entomology)

Importance of parasitology

1-Public health importance:some parasites infect human and may cause death or pathological changes in the body.

2- Economic importance:

-some parasites infect animals and cause economic loos or may cause direct or/and indirect harm to human.

-some parasites infect plants and cause economic loos or cause indirect harm to human.

3-Control:some parasites can be used as tools for the biological control of some harmful animals or pests.

parasite : is a living organism that lives in (endoparasite) or on (ectoparasite) another organism, termed its host. It obtains nourishment and protection while offering no benefit in return. Consequently, the host suffers from various diseases, infections, and discomforts. However, in some cases, the host may show no signs at all of infection by the parasite(asymptomatic).

Types of Parasites:

According to the nature of the host-parasite interactions and the environmental factors، parasites classified according to the following criteria:

1-According to their presence within the hosts

Ectoparasites(external parasites):are found on the external surface of their hosts as in the presence of human lice on skin

Endoparasites(internal parasites):are found in viscera,coeloma ,muscles of their hosts such as in tapeworms found in small intestine.

2-According to the nature of living

•An obligatory parasite that is completely dependent on its host and can't survive without it e.g. hookworms.

•A facultative parasite that can change its life style between free-living in the environment and parasitic according to the surrounding conditions. e.g. Strongyloides stercoralis.

•An accidental parasite that affects an unusual host e.g. *Toxocara canis* (a dog parasite) in man.

3-According to their duration with their hosts

•A temporary parasite that visits the host only for feeding and then leaves it. e.g. Bed bug visiting man for a blood meal

•A permanent parasite that lives in or on its host without leaving it e.g. Lice.

•An opportunistic parasite that is capable of producing disease in an immunedeficienthost (like AIDS and cancer patients). In the immuno-competent host, it is either found in a latent form or causes a self limiting disease e.g. Toxoplasma gondii.

4- According to their affinity with their hosts

- Intraspecific parasites:both the parasites and the hosts belong to the same species such as in human fetus
- Interspecific parasites:parasite belongs to a species and its host belongs to another species such as in the majority of parasites

•A zoonotic parasite that primarily infects animals and is transmittable to humans.e.g. Fasciola species

Types of Hosts

Hosts are classified according to their role in the life cycle of the parasite into:

•Definitive host (DH) that harbours the adult or sexually mature stages of the parasite or in whom sexual reproduction occurs) e.g. man is DH for Schistosoma haematobium, while female Anopheles mosquito is DH for Plasmodium species malaria parasites.

•Intermediate host (IH) that harbours larval or sexually immature stages of the parasite (or in whom asexual reproduction occurs) e.g. man is IH of malaria parasites. tapeworms and other parasitic flatworms have complex life-cycles, in which specific developmental stages are completed in a sequence of several different hosts.

- Carrier host is a person or other organism that has contracted an infectious disease, but who displays no symptoms. Although unaffected by the disease themselves, carriers can transmit it to other

•Reservoir host (RH) refers to a living (human, animal, insect, or plant) or non-living (soil, water) entity where a disease-causing organism can normally live and multiply. It maintains the life cycle of the parasite in nature and is therefore, a source of infection for man. e.g. sheep are RH for *Fasciola hepatica*. Hosts often do not get the disease carried by the pathogen

•Paratenic or transport host in whom the parasite does not undergo any development but remains alive and infective to another host. Paratenic hosts bridge gap between the intermediate and definitive hosts. For example, dogs and pigs may carry hookworm eggs from one place to another, but the eggs do not hatch or pass through any development in these animals.

•Vector is an arthropod that transmits parasites from one host to another, e.g. female sand fly transmits Leishmania parasites

Host-Parasite Relationship

The term refers to the relationship between the host and the parasite and the competition for supremacy that takes place between them.

Disease should not be confused with infection; a person may be infected without becoming diseased. If the host has upper hand, due to increased host resistance, it remains healthy and the parasite is either driven away or assumes a benign relationship with the host, but if the host loses the competition, a disease develops .

In biology, the relationship between two organisms is mainly in the form of symbiosis،defined as "life together", i.e., the two organisms live in an association with one another. Thus, there are at least three types of relationships based on whether the symbiont has beneficial, harmful, or no effects on the other.

Types of Symbiotic Association:

•Mutualism is a relationship in which both partners benefit from the association. Mutualism is usually obligatory, since in most cases physiological dependence has evolved to such a degree that one mutual cannot survive without the other Blood-sucking leeches cannot digest blood, and overcome that by harbouring certain intestinal bacterial species to do the digestion for their hosts. At least 20% of insect species, as well as many mites, spiders, crustaceans, and nematodes, are mutually.

•Commensalism: in which one partner benefits from the association, but the host is neither helped nor harmed. Commensalism may be facultative, in the sense that the commensal may not be required to participate in an association to survive Humans harbor several species of commensal protozoans, that colonize in the intestinal tract such as Entamoeba dispar, Entamoeba hartmanni.

•Parasitism: is a relationship between two different organisms where one of the organisms actually harms the other through the relationship. The organism that is harming the other one is called a parasite. parasites are different from predators in that the host of a parasite is not necessarily killed. Fleas or ticks that live on dogs and cats are parasites. They are

living off of the blood of the host animal.. However, in some cases, the impact of parasites on a host is great enough to cause disease, and in extreme cases, the death of the host may also occur

Classification and General Characters

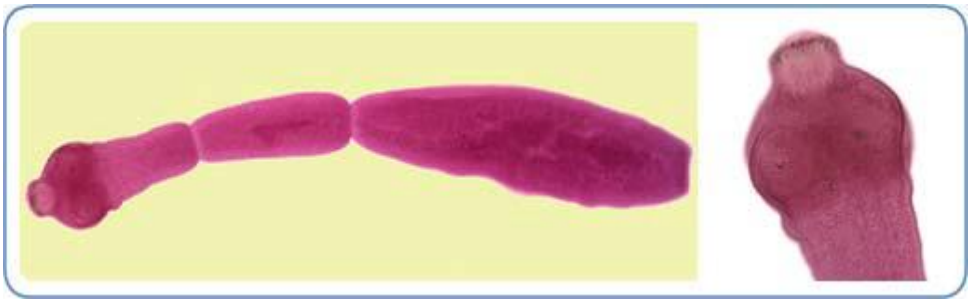
The classification of parasites is controversial as there is no universally accepted system.

Parasites form part of the animal kingdom which comprises about 800,000 identified, species categorized into 33 phyla.

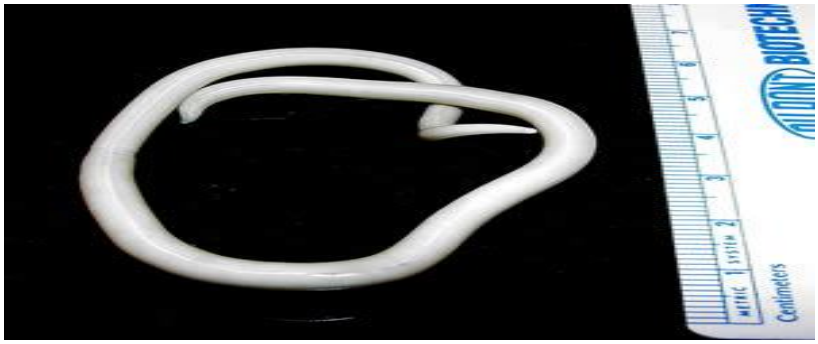
The most acceptable taxonomic classification of human parasites includes

Endoparasites and Ectoparasites. Endoparasites are sub-classified into Helminthic parasites (multicellular organisms) and Protozoan parasites (unicellular organisms. Helminthic parasites are either flat worms (Trematodes), segmented worms (Cestodes) or cylindrical worms (Nematodes**).**

A Trematode worm, *Fasciola hepatica*



A Cestode worm, *Echinococcus granulosus*



A Nematode worm, *Ascaris lumbricoides*

Endoparasites

Most parasites of humans live inside the host (endo- means internal). These are helminthes (worms of various types), protozoa, or sometimes larval stages of arthropods)insects, mites, etc. Both helminthic and protozoan parasites can infect different tissues and organs of the human body. A great number of endoparasites live in the intestines, or at least pass through the intestines, having been swallowed in food or water. Virtually any organ can be affected, however some parasites like Trichinella spp. and Toxoplasma gondii live in muscles, larvae of Echinococcus spp. and liver flukes occupy the liver, Schistosoma

hematobium targets the urinary bladder and most of the protozoan parasites circulate in blood.

Ectoparasites

Human ectoparasites live on the host (ecto- means outside of). They include fleas, lice،mosquitoes, bugs, mites, ticks etc. In general, ectoparasites attach to the skin to feed and remain on the host for their entire lives.

Many ectoparasites are known to be vectors of pathogens, which the parasites typically transmit to host while feeding

Pediculus humanus capitis (male) as an example of ectoparasites.

Life cycle

Parasitic life cycles occur in a variety of forms, all involving the exploitation of one or more hosts. Those that must infect more than one host species to complete their life cycles are said to have **complex or indirect** life cycles, while those that infect a single species have **direct** life cycles.

Life cycles differ greatly between major types of parasites and are generally classified as direct or indirect. Direct life cycles do not require an intermediate host. For direct life cycles, only a definitive host is required: the species in which the parasite reaches sexual maturity and produces progeny. Indirect life cycles may involve one or more intermediate hosts. Intermediate hosts are required by the parasite for completion of its life cycle because of the morphological and physiological changes that usually take place in the parasite within those hosts.

Infective stage of parasites

The infective stage is the part of the life cycle of the parasite, which upon its contact with the host cause the infection.The stage vary according to different parasites.These included the following stages:

1-Egg or ovaum:which enters with the food or drink as in the case of some intestinal worms.

2-Larva:which enters the host through its skin as in Ancylostoma ,or blood as in Wuchsrcria,or meet as in Taenia,or vegetables as in Fasciola.

3-Cyst:which enters through the food or water as in the case of Entamoeba histolytica.

4-Adult :as in the case of lice.

Sources of infection

Is the way in which the infective stage of the parasites become in contact with the host to perform the infection.

1-Soil:the direct contact with the soil gives the possibility for the establishment of som parasitic infection as eggof som worms and cyst of som protozoa.

2-Water:water contaminated with cyst, eggs and larvae of some parasites through drinking, swimming, washing.Diseases in whichwater is considered as the source of infection are known as waterborne diseases.

3-Food(plant and animal):the infective stage of many parasites are found in the food.Diseases for which food is considered as the source of infection are known as foodborne diseases.

4-Blood- sucking animals:many blood sucking insects, mites, ticks and leeches are considered as sources of infection when such animals feed on human or animals blood and hence transmit the concerned parasite.

5-Wild and domestic animals:cats, dogs, birds…ect.play important role in spreading the infection with many parasitic diseases through their direct or indirect contact with human. Some of wild and domestic animals act as final, intermediate, carrier, vector or reservoir hosts for many parasites.

6-Fomites: Hair combs and brushes,tooth brushes, cloths, vaginal specula, syringes….ect,have important role in introducing some parasites to new hosts as in case of human lice, Entamoeba gingivalis and Trichomonas vaginalis.

Entries and Exits of infection

The infective stages enter host body or leave it through one or more of the following portals

1- mouth as in case of most intestinal parasites.

2-Skin as in case of bilharzial and malarial parasites.

3-Nose as in some cases of infection with the pinworm.

4-Urino-genital tract as in Trichomonas vaginalis.

5-Placenta as in the cases of Toxoplasma gondii from the infected pregnant woman to her foetus.

6-Blood transfusion and organ transplantation as in some cases of malaria.

Zoonoses

Zoonoses are the diseases,which are naturally transmitted from animals to human and vice versa.