**Overview of Medical Parasitology**

Medical parasitology is the branch of medical sciences dealing with organisms (parasites) which live temporarily or permanently, on or within the human body (host). Or Medical parasitology is the biomedical discipline of parasitology has traditionally been concerned with the parasitic protozoa, helminthes and arthropods. This overview of medical parasitology offers a brief survey of the protozoan and helminthic parasites of medical importance. Human parasites are either unicellular (protozoa) or multicellular (helminthes and arthropods). Parasite are living organisms able to live in or on a host and cause disease. If parasite living on the host surface, known as ectoparasite and within the host, known as endoparasite. The competition for supremacy that takes place between the host and the parasite is referred to as host-parasite relationship. Host-parasite relationship, refers to the relationship between the host and the parasite and the competition for supremacy that takes place between them. 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. The three types of host-parasite relationship are- Parasitism, Commensalism and Mutualism. Parasitism in which one of the participants, the parasite, either harms or lives at the expense of the host. Parasites may cause mechanical injury, such as boring a hole into the host or digging into its skin or other tissues, stimulate a damaging inflammatory. Commensalism in which one partner benefits from the association, but the host is neither helped or harmed. Mutualism is a relationship in which both partners benefit from the association.

According to the nature of host-parasite interactions and the environmental factors, the parasite may be one of the following types-

1. . Obligatory parasite- Obligatory parasites are completely depend on its host and cannot survive without it. Example Hookworm
2. Facultative parasite- An [organism](https://www.biologyonline.com/dictionary/organism) that lives independent of a [host](https://www.biologyonline.com/dictionary/host) but may occasionally be parasitic under certain conditions. It is normally [saprophytic](https://www.biologyonline.com/dictionary/saprophytic) or lives freely but can become parasitic on certain occasions, such as the [flea](https://www.biologyonline.com/dictionary/flea) and *Strongyloides stercoralis*. Flea is a flightless parasite of [mammals](https://en.wikipedia.org/wiki/Mammal) and [birds](https://en.wikipedia.org/wiki/Bird). Fleas live by consuming blood, or [hematophagy](https://en.wikipedia.org/wiki/Hematophagy), from their host. Strongyloidiasis is a disease caused by a nematode, or a roundworm, in the genus Strongyloides. *Strongyloides stercoralis* is classified as a soil-transmitted helminth. This means that the primary mode of infection is through contact with soil that is contaminated with free-living larvae. When the larvae come in contact with skin, they are able to penetrate it and migrate through the body, eventually finding their way to the small intestine where they burrow and lay their eggs
3. Accidental parasite- Also known as incidental parasites, accidental parasites are those that attack or establish themselves in unusual hosts (hosts that they do not normally parasitize). Here, the host is referred to as an unnatural host. In this case, the parasite infects the host and is able to survive and continue growing as it would in the natural host. *Toxocara* spp. are the most common parasites living in the intestines of dogs and wild canids worldwide. Humans are accidental hosts who may become infected by ingesting embryonated eggs through contaminated vegetables/water or by direct contact with dogs.
4. Temporary parasite or Intermittent parasite-These are parasites, for example, mosquitoes or bedbugs, that only feed on the host then leave.  Another example is the 'tumbu fly' or 'skin maggot fly', *Cordylobia anthropophaga*- a muscid fly that causes myiasis in man, small rodents, monkey and dogs.  The fly lives through its several stages in the skin of man, and only leaves the skin in order to continue its development into a pupa and adult outside the body of man. Temporary parasites are often referred to as micropredators as they usually "prey" on several different hosts or the same host on several different occasions.  Predation and parasitism are similar as both live at the expense of the host or prey.  The parasite, however does not usually kill its host, is small relative to the size of the host, has only one host or one host at each stage in its life cycle, and is symbiotic.  On  the other hand, the predator kills its prey, is large relative to the prey, has numerous prey, and is not symbiotic.
5. Permanent parasite- These are parasites that live their entire adult lives within or on their hosts.  Examples include the filarial worm, *Wuchereria bancrofti*which causes the disease known as elephantiasis in man; the digenean blood fluke, *Schistosoma haematobium*which causes the disease known as schistosomiasis in man, and the human malarial parasite, *Plasmodium falciparum.*

Sucking **lice** (Phthiraptera: Anoplura) are **permanent** and obligate ectoparasites of eutherian mammals. These highly specialized blood-sucking insects **live** in close association with their hosts and complete their entire life cycle on the host

1. Opportunistic parasitism can be defined as a symbiotic association between opportunistic parasites and immunocompromised hosts; so that the parasite causes opportunistic parasitic infection (OPI). OPI occur enthusiastically with organisms that are recognized pathogens, but are commonly caused by commensals or other normally nonpathogenic agents when host resistances are weaken by different environmental or natural factors . OPI may not cause severe pathological changes in immunocompetent hosts as long as the immune system is functioning normally. However when the immune system is weaken due to particular conditions, opportunistic parasites take this advantage to initiate an infection. Many people have impaired immune systems as a result of many factors: diseases (like HIV infection or malignant diseases), medical procedures (such as organ transplants), aging, chemotherapy and others. For these reasons, the system acquired different defects (humeral or cell mediated). The protozoan *Toxoplasma gondii* is a human pathogen that causes severe opportunistic disease (toxoplasmosis) in congenitally infected babies and immuno-compromised individuals (e.g., AIDS)
2. Zoonotic Parasite- zoonotic parasite that primarily infects animals and is transmittable to humans. Example *Fasciola species*

Classification of parasite- In medical parasitology, parasites are categorized into two gropus: Parasitic Protozoa and Parasitic helminthes.

**Protozoa** are unicellular eukaryotes that form an entire kingdom. Classifying protozoan parasites into taxonomic groups is an ongoing process, and their status is often in a state of flux. For this reason, in overview of medical parasitology separates the parasitic protozoa into four traditional groups based on their means of locomotion and mode of reproduction: flagellates, amebae, sporozoa, and ciliates.

1. **Flagellates** have one or more whiplike flagella and, in some cases, an undulating membrane (eg, trypanosomes). These include intestinal and genitourinary flagellates (*Giardia* and *Trichomonas,* respectively) and blood and tissue flagellates (*Trypanosoma* and *Leishmania* ).

**(2) Amebae** are typically ameboid and use pseudopodia or protoplasmic flow to move. They are represented in humans by species of *Entamoeba, Naegleria,* and *Acanthamoeba.*

**(3) Sporozoa** undergo a complex life cycle with alternating sexual and asexual reproductive phases. The human parasites *Cryptosporidium, Cyclospora,* and *Toxoplasma* and the malarial parasites ( *Plasmodium* species) are all intracellular parasites.

**(4) Ciliates** are complex protozoa bearing cilia distributed in rows or patches, with two kinds of nuclei in each individual. *Balantidium coli,* a giant intestinal ciliate of

humans and pigs, is the only human parasite representative of this group.

**Parasitic helminths,** or worms of humans, belong to two phyla: Nematoda (roundworms) and Platyhelminthes (flatworms).

**(1) Nematodes** are among the most speciose and diverse animals. They are elongated and tapered at both ends, round in cross section, and unsegmented. They have only a set of longitudinal muscles, which allows them to move in a whiplike, penetrating fashion, a complete digestive system that is well adapted for ingestion of the host’s gut contents, cells, blood, or cellular breakdown products; and a highly developed separate-sexed reproductive system. They shed their tough cuticles (molt) as they undergo development from larvae to adults, and the eggs and larval stages are well suited for survival in the external environment. Most human infections are acquired by ingestion of the egg or larval stage, but nematode infections can also be acquired from insect vectors and skin penetration.

**(2) Platyhelminthes** are flatworms that are dorsoventrally flattened in cross section and are hermaphroditic, with a few exceptions. All medically important species belong to two classes: **Trematoda** (flukes) and **Cestoda** (tapeworms).

**Trematodes** are typically flattened and leaf shaped with two muscular suckers. They have a bifurcated gut and possess both circular and longitudinal muscles; they lack the cuticle characteristic of nematodes and instead have a syncytial epithelium.

Trematodes are hermaphroditic, with the exception of the schistosomes (blood flukes), which have male and female worms that exist coupled together within small blood vessels of their hosts.

The life cycle of human trematodes is typically initiated when eggs are passed into fresh water via feces or urine. Eggs develop, hatch, and release a ciliated miracidium, which infects a snail host that is usually highly specific to the fluke species. Within the snail, the miracidium develops into a sporocyst, which contains germinal cells that ultimately develop into the final larval stage—the cercariae. These swim out of the snail and encyst as metacercariae in a second intermediate host or on vegetation, depending on the species. Most fluke infections are acquired by ingestion of the metacercariae. The cercariae of schistosomes, however, directly penetratethe skin of their hosts and do not encyst as metacercariae.

**Cestodes**, or tapeworms, are flat and have a ribbon-like chain of segments (proglottids) containing male and female reproductive structures. Adult tapeworms can reach lengths of 10 m and have hundreds of segments, with each segment releasing thousands of eggs. At the anterior end of an adult tapeworm is the scolex, which is often elaborated with muscular suckers, hooks, or structures that aid in its ability to attach to the intestinal wall. Adult tapeworms have no mouth or gut and absorb their nutrients directly from their host through their integument.

The life cycle of cestodes, like that of the trematodes, is usually indirect (involving one or more intermediate hosts and a final host). Eggs are excreted with the feces and ingested by an intermediate host (invertebrate, such as a flea, or vertebrate, such as a mammal); the larvae develop into certain forms that are peculiar to the specific species within the intermediate host (eg, cysticercus in the case of *Taenia solium* or hydatid cyst with *Echinococcus granulosus*). Cestode larvae are generally eaten, and the larva develops into an adult worm in the intestine of the final host.