

# Parasitology

Carlos Henrique Marchiori<sup>1</sup>

<sup>1</sup> Instituto Federal Goiano

## Definition:

Generally speaking, Parasitology is the branch of Microbiology that is concerned with the study of parasites. In the process, it gives focus to various characteristics of the parasite (morphology, life-cycle, ecology, taxonomy, etc), the type of host they infect/affect and the relationship between the two (Gunn & Pitt, 2012).

In Parasitology, parasites have traditionally been restricted to three main groups that include protozoa, helminths, and arthropods. However, they are also described based on where they are located on the host: Ectoparasites (those that live on the host- skin, etc) and endoparasites (those that live inside the body of the host (Gunn & Pitt, 2012).

As a sub-discipline that studies a wide variety of organisms and relationship with their hosts, Parasitology also encompasses some elements of such fields as entomology, helminthology, and epidemiology among others (Assafa, et al., 2004 and Gunn & Pitt, 2012).

For the most part, parasites (living organisms) are permanently associated with their respective hosts (or need a host for a given stage of their lives). For this reason, such organisms like tsetse flies that briefly feed on given animals are not necessarily regarded as parasites in medical Parasitology (Gunn & Pitt, 2012).

## Classification

Parasites of medical significance are divided into two main categories that include single-celled parasites (protozoa) and multicellular metazoa (helminths and arthropods) (Assafa, et al., 2004 and Gunn & Pitt, 2012).

Protozoa parasites include malaria parasites (*Plasmodium* species) ciliates (e.g. *Balantidium coli*) and flagellates (e.g. *Leishmania*), and amoeba (e.g. *Entamoeba histolytica*) among others. These are single-celled organisms that generally live inside the body of the host. For instance, whereas *E.*

*histolytica* can be found in the gut, malaria parasites like *P. falciparum* invade red cells inside the body (Assafa, et al., 2004 and Gunn & Pitt, 2012).

In the body, classification of protozoa parasites are based on the mode of movement: Mastigophora - Use flagella for movement. Sporozoa - Are non-motile in the body. Sarcodina - Use amoeboid movement. Ciliophora - Use cilia for movement (<https://www.cdc.gov/parasites/naegleria/general.html>).

As they obtain nutrition from the host (depending on where they are located) parasites are able to multiply and increase in number. This ensures their survival as they can be transmitted from one host to another (Assafa, et al., 2004 and El-Tonsy. 2012).

During unfavorable conditions, they are also able to transform from the active trophozoite stage to inactive cysts that survive unfavorable conditions (Assafa, et al., 2004 and Gunn & Pitt, 2012).

## Helminths

Unlike protozoa, helminths are multicellular parasites that tend to be bilaterally symmetrical. They include members of cestode (e.g tapeworm), trematode (e.g flukes) and nematodes such as roundworms (Assafa, et al., 2004 and Gunn & Pitt, 2012).

Like protozoa, however, helminths are endoparasites that are generally found in the gastrointestinal tract. Using suckers or hooks (found in cestodes and trematodes), these organisms are able to remain attached to the walls of the gastrointestinal tract and continue absorbing nutrients. This not only deprives the host of sufficient nutrients, but also tends to cause injury to the gastrointestinal walls (Assafa, et al., 2004 and Gunn & Pitt, 2012).

Compared to protozoa parasites that tend to proliferate in the host, helminths mostly grow and mature. Offspring are then voided from the host and may through several life stages before infecting a new host. For instance, some eggs may develop into the larval stage in animal hosts before being ingested in their larval stage in a human host (Assafa, et al.2004 and Gunn & Pitt, 2012).

In human hosts, larval and adult forms of these parasites may cause: obstruction, inflammation, anemia, lesions in the gastrointestinal tract, edema as a result of fluid accumulation - This is often related to obstruction (Assafa, et al.2004 and Gunn &

Pitt, 2012).

### Arthropods

Like helminths, arthropods are multicellular organisms that are bilaterally symmetrical. However, unlike helminths, arthropods have jointed appendages used for movement and attachment as well as a hard exoskeleton that protects the internal organs of the parasites (Assafa, et al., 2004 and Gunn & Pitt, 2012).

For arthropods, these are important characteristics that allow these parasites to survive as ectoparasites. Unlike both the protozoa parasites and helminths, arthropods are ectoparasites which means that they are found attached to the skin of the host (Assafa, et al., 2004 and Gunn & Pitt, 2012).

Examples of arthropods include lice, fleas, and ticks. Here, arthropods affect the host by sucking their blood as well as by acting as transmitters/vectors. For instance, lice transmit *Rickettsia* bacteria which causes Trench fever in human beings (Assafa, et al., 2004 and Gunn & Pitt, 2012).

Such animals as mosquito (female *Anopheles* mosquito) that depend on human blood as a source of nutrients are not necessarily included in this group given that they feed on the host momentarily (Assafa, et al., 2004 and Gunn & Pitt, 2012).

Apart from classification based on the location of the parasite (ecto and endoparasites) the different types of parasites in Parasitology have also been classified based on other relationships between the parasite and the host:

- Obligate parasite - Obligate parasites are fully dependent on the host for a specific stage of their life-cycle or the entire length of their lives. *Plasmodium* species are good examples of obligate parasites. Once they enter the body, through a mosquito bite, they invade red cells where they obtain nutrients. Here, *Plasmodium* species are entirely dependent on the host for their survival.
- Facultative parasite - Unlike obligate parasites, facultative parasites are not entirely dependent on the host for survival. As such, they may exhibit parasitic and non-parasitic characteristics by adapting to different conditions. A good example of facultative parasites is the *Naegleria fowleri*. In freshwater, such organisms as bacteria are good sources of food. However, once they get in the body, they cause brain infections (amoebic meningoencephalitis) which can cause death within 5 days.

· Accidental parasites - 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. Rat tapeworms (*Hymenolepis diminuta*) are good examples of accidental parasites. Although they must affect rats, these parasites have been shown to affect human beings.

· Erratic parasites - Erratic parasites are parasites that invade body organs that they do not normally invade. *E. histolytica* is a good example of erratic parasites. Typically, this anaerobic parasite is found in the gastrointestinal tract where they cause amoebiasis (bloody diarrhea). However, the parasite has been shown to wander and invade such organs as the liver and lungs in human beings (<https://www.ncbi.nlm.nih.gov/books/NBK8262/>).

## References

- Assafa, D. et al. (2004). Medical Parasitology. Lecture Notes. Funded under USAID Cooperative Agreement. 139 pp.
- Gunn, A. & Pitt, S. J. (2012). Parasitology: An Integrated Approach. John Wiley & Sons. 416 pp.
- <https://www.cdc.gov/parasites/naegleria/general.html>
- <https://www.ncbi.nlm.nih.gov/books/NBK8262/>