

The Mark Distribution:

- Total marks = 100%
- Course work = 60%
- Final Exam= 40%

Coursework: 60%

- Midterm: Theory (20%) + Practical (10%) = 30%
- Quiz Theory= 5%
- Quiz Lab = 5%
- Class activity: (sample= 3%) + (Drawing= 4%)= 7%
- practical GUE exam= 5%
- Presentation = 8%

Final Exam: 40%

- Theory = 25%
- Practical =15%



Introduction to Medical Parasitology (Protozoology)

Lecturer: Omer Sardar

Parasitology I

Summer School

Lecture 1

11/08/2025

Learning outcomes

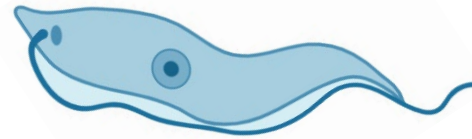
1. To define protozoa and explain their relevance in medical parasitology.
2. To describe the general characteristics and morphological stages of protozoa.
3. To discuss the impact of protozoan infections on human health, including morbidity, mortality, and socioeconomic consequences.

Introduction

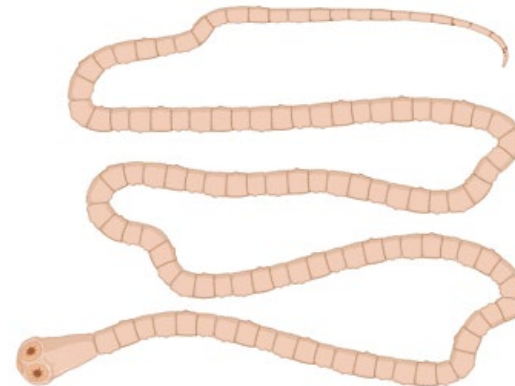
Medical parasitology deals with the parasites, which cause human infections and the diseases they produce.

It is broadly divided into two parts:

1. Protozoology (Unicellular)

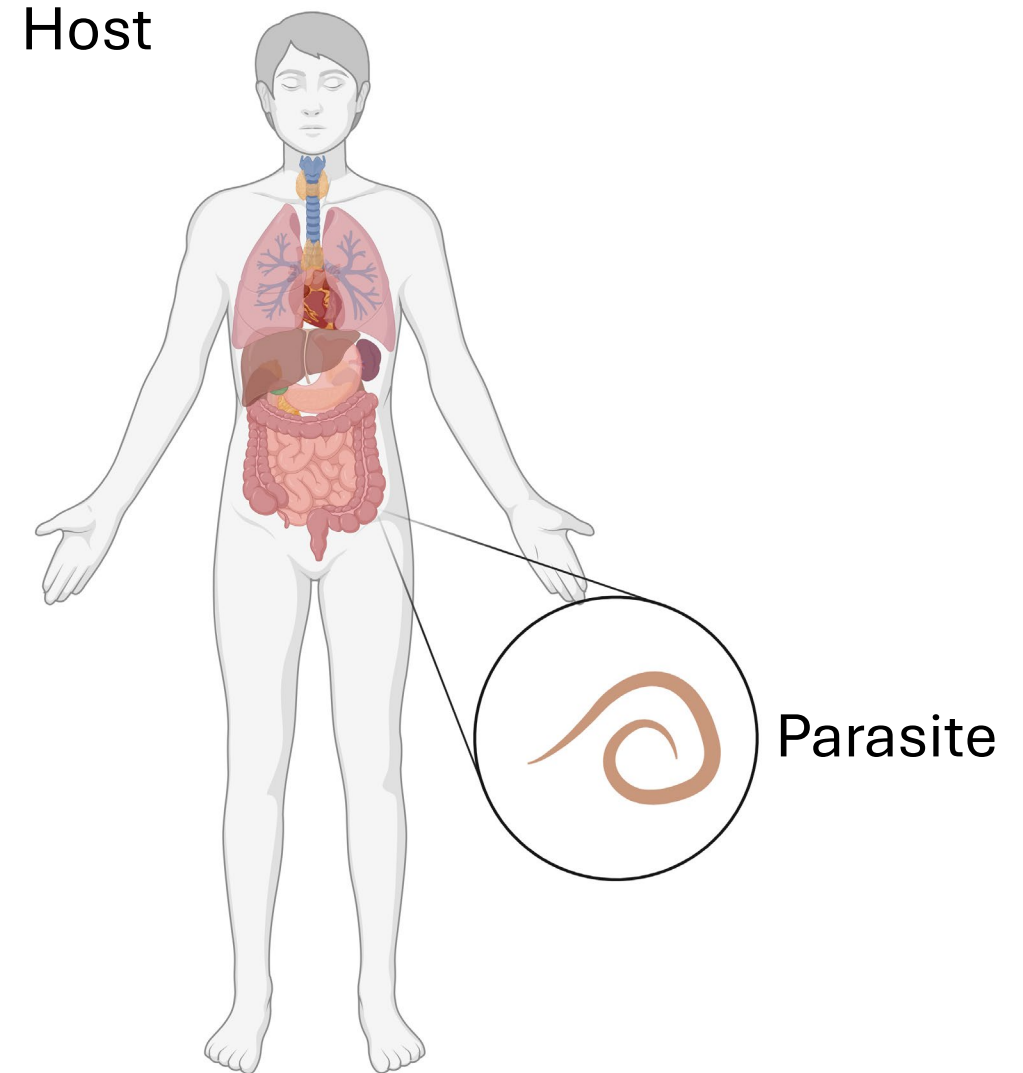


2. Helminthology (Multicellular)



Parasite

Parasites are living organisms, which depend on a living host for their nourishment and survival. They multiply or undergo development in the host.



Parasite

Protozoa
(unicellular)
Kingdom-Protista

Helminths
(multicellular)
Kingdom-Animalia

Amebae

Flagellates

Sporozoa

Ciliates

Entamoeba
Naegleria

Giardia
Trichomonas

Plasmodium
Babesia
Toxoplasma

Balantidium

Nematodes

Cestodes

Trematodes

Ascaris
Ancylostoma

Taenia
Echinococcus

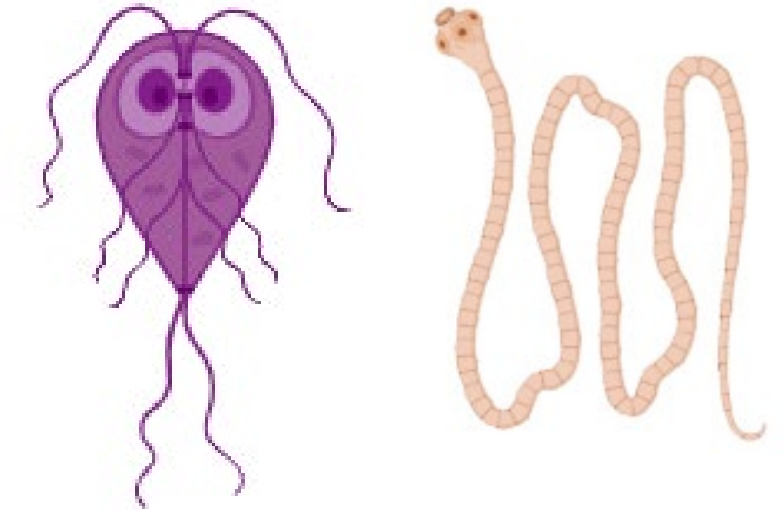
Fasciola
Schistosoma

Parasites classification according to location:

1. Ectoparasite: Ectoparasites inhabit only the body surface of the host without penetrating the tissue. Lice, ticks and mites are examples of ectoparasites.

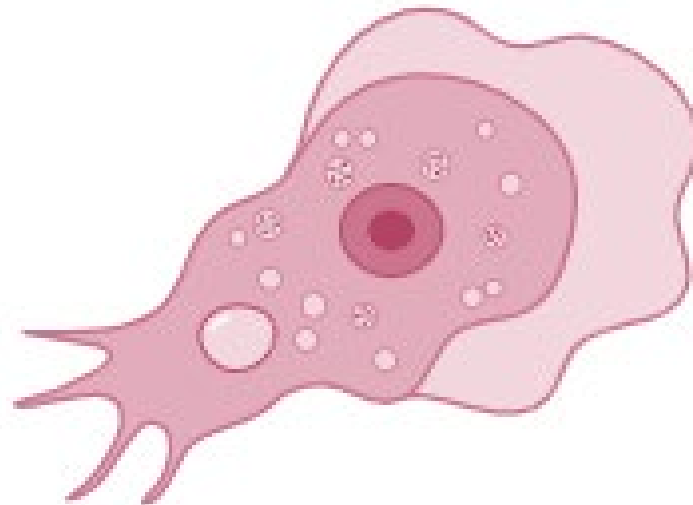


2. Endoparasite: A parasite, which lives within the body of the host and is said to cause an infection, is called an endoparasite. Most of the protozoan and helminthic parasites causing human disease are endoparasites.



Parasites classification according to location:

3. **Free-living parasite:** It refers to nonparasitic stages of active existence, which live independent of the host, e.g. cystic stage of *Naegleria fowleri*.

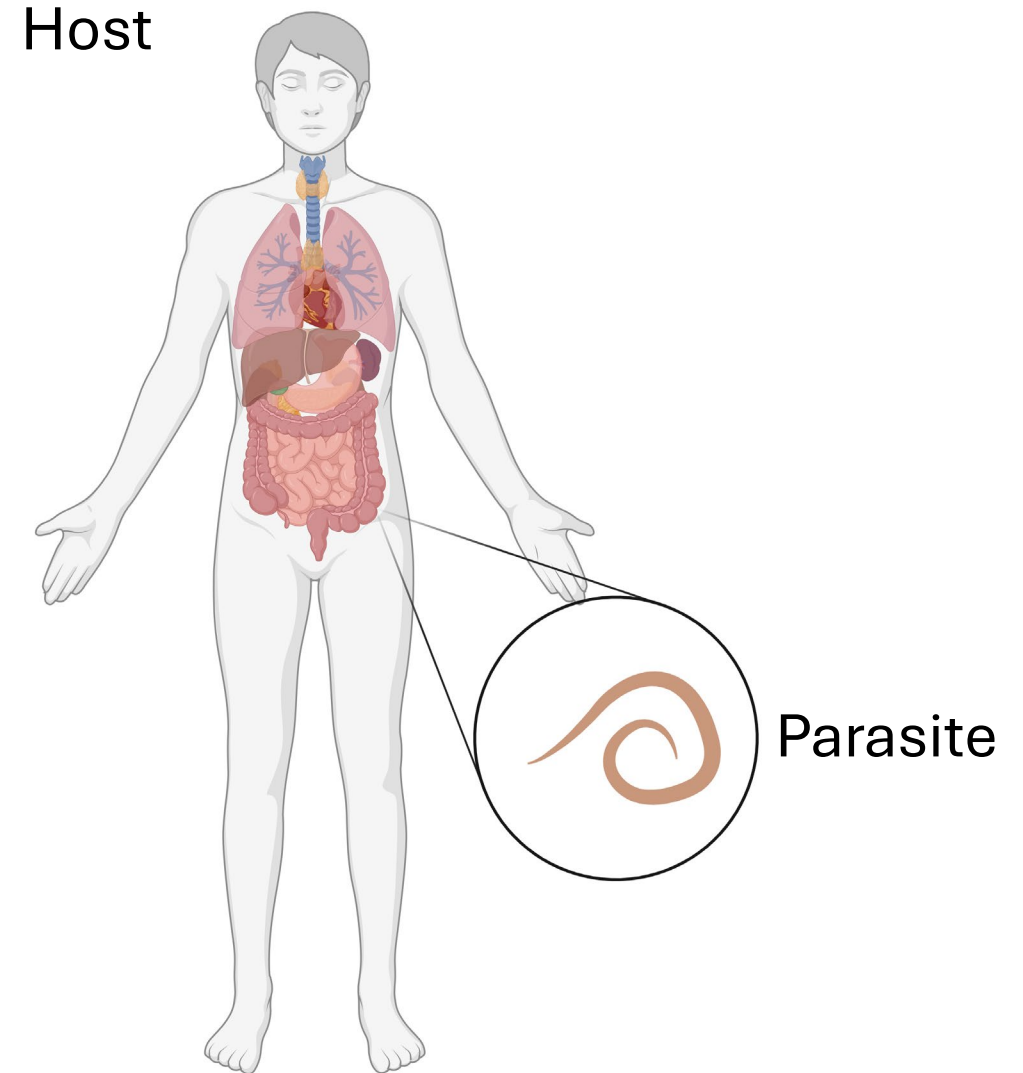


Endoparasites can further be classified as:

1. **Obligate parasite:** The parasite, which cannot exist without a host, e.g. *Toxoplasma gondii* and *Plasmodium*.
2. **Facultative parasite:** Organism which may either live as parasitic form or as a free-living form, e.g. *Naegleria fowleri*.
3. **Accidental parasites:** Parasites, which infect an unusual host, are known as accidental parasites. *Echinococcus granulosus* infects man accidentally, giving rise to hydatid cysts.
4. **Aberrant parasites:** Parasites, which infect a host where they cannot develop further, are known as aberrant or wandering parasites, e.g. *Toxocara canis* (dog roundworm) infecting humans.

Host

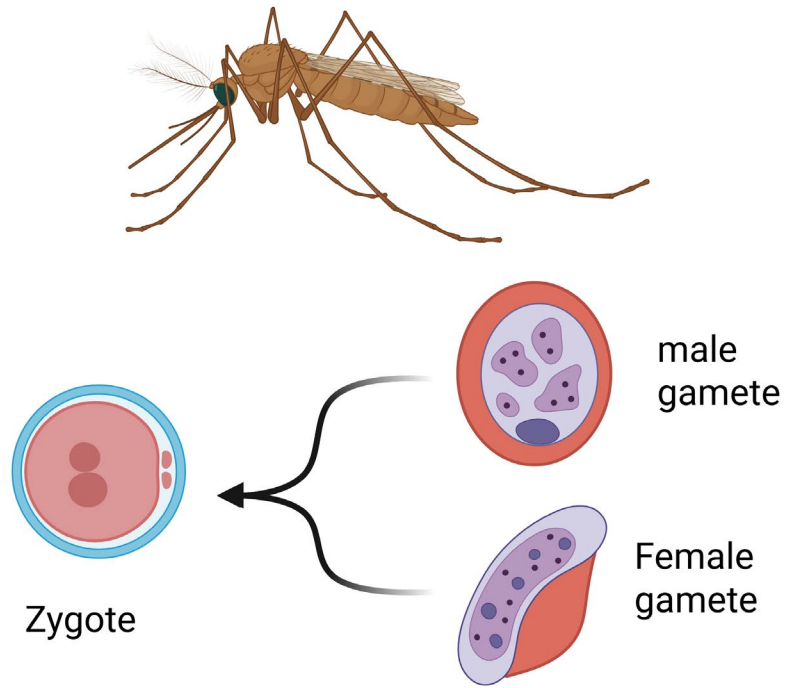
Host is defined as an organism, which harbors the parasite and provides nourishment and shelter to latter and is relatively larger than the parasite.



Types of host

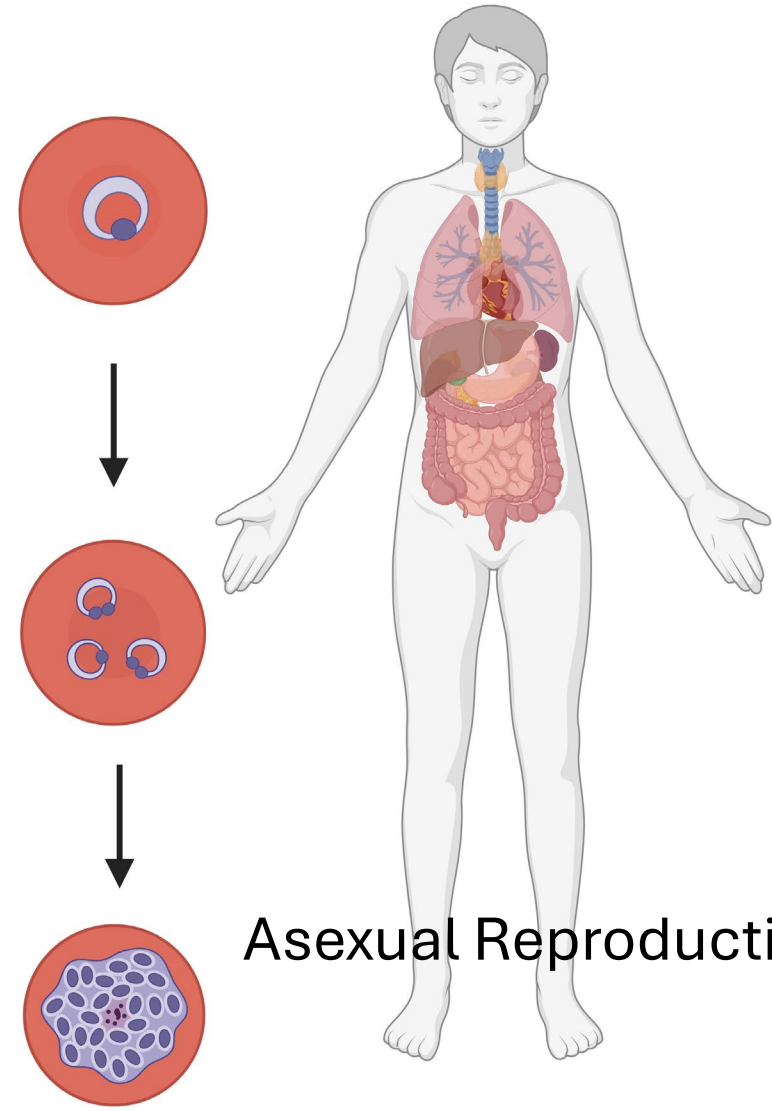
1. **Definitive host:** The host, in which the adult parasite lives and undergoes sexual reproduction is called the definitive host
2. **Intermediate host:** The host, in which the larval stage of the parasite lives or asexual multiplication takes place is called the intermediate host. In some parasites, two different intermediate hosts may be required to complete different larval stages. These are known as first and second intermediate hosts, respectively

Definitive host



Sexual Reproduction

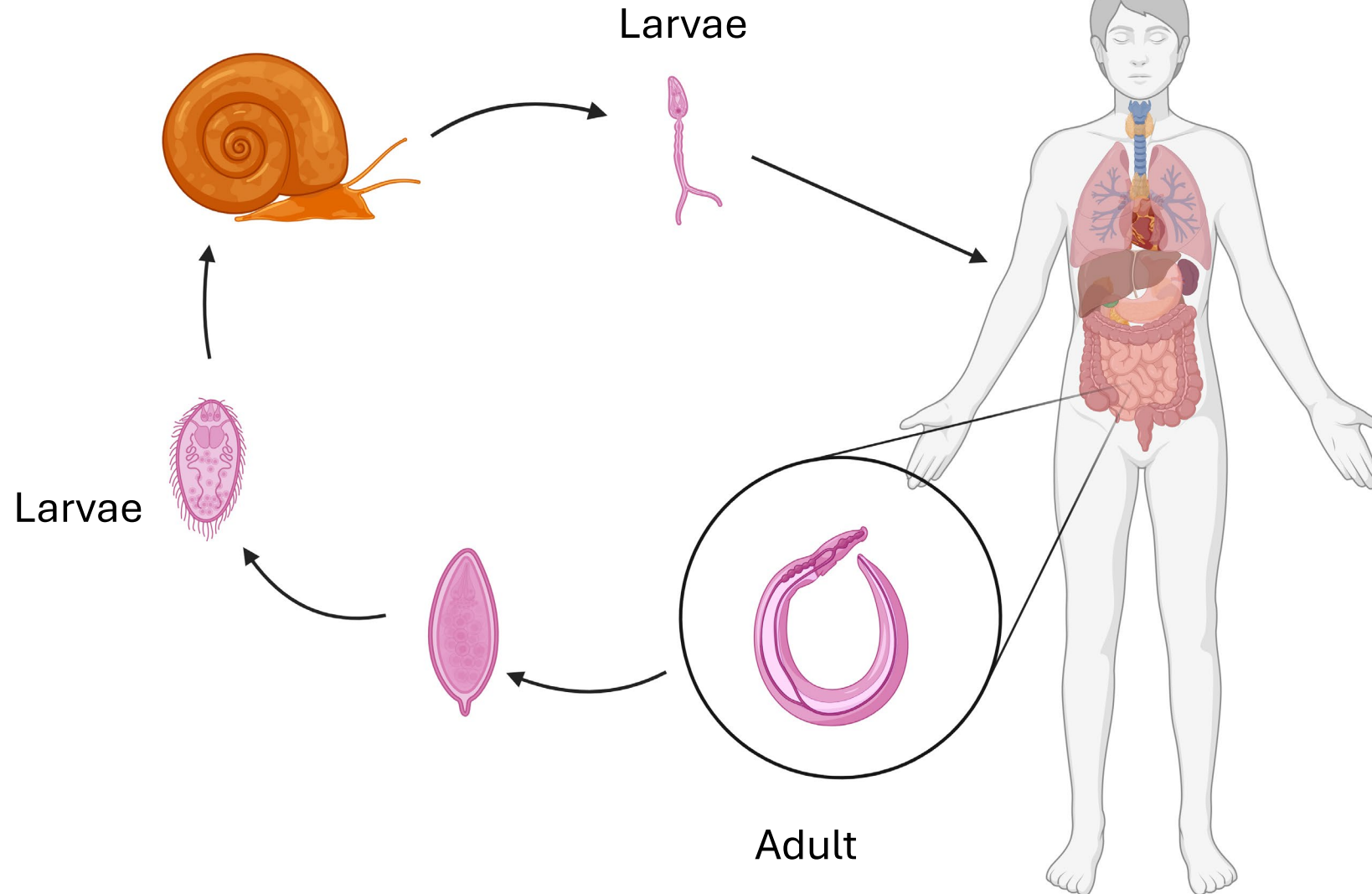
Intermediate host



Asexual Reproduction

Intermediate host

Definitive host

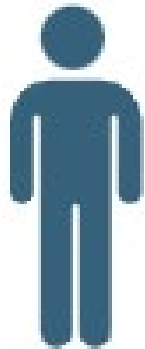
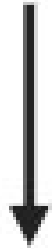
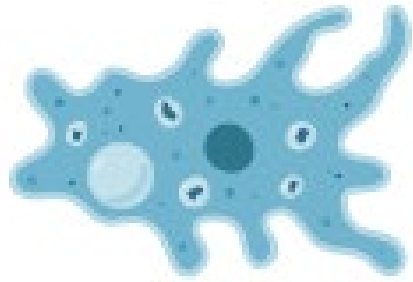


Types of host

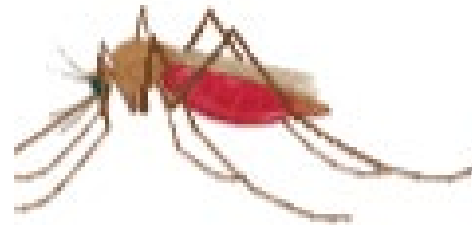
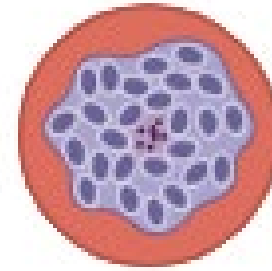
- 3. Reservoir host:** In an endemic area, a parasitic infection is continuously kept up by the presence of a host, which harbors the parasite and acts as an important source of infection to other susceptible hosts,

Life cycle of parasites

1. **Direct life cycle:** When a parasite requires only single host to complete its development, it is called as direct life cycle, e.g. *Entamoeba histolytica* requires only a human host to complete its life cycle.
2. **Indirect life cycle:** When a parasite requires two or more species of host to complete its development, the life cycle is called as indirect life cycle, e.g. malarial parasite requires both human host and mosquito to complete its life cycle



Direct lifecycle



Indirect lifecycle

Protozoa

Single-celled eukaryotic microorganisms belonging to kingdom Protista are classified as Protozoa (Greek protos: first; zoon: animal).

- Parasitic protozoa are adapted to different host species.
- Out of 10,000 species of parasitic protozoa, man harbours only about 70 species.

General features

- Unicellular eukaryotes with a true nucleus and organelles, no cell wall.
- Locomotion by pseudopodia, flagella, cilia, or gliding.
- Reproduction mainly asexual (binary/multiple fission), some sexual forms.
- Habitat: free-living or parasitic in blood, tissues, intestines, urogenital tract.

Classification of Protozoa

Protozoan parasites of medical importance have been classified into the kingdom Protista, subkingdom Protozoa, which is further divided into the following four phyla:

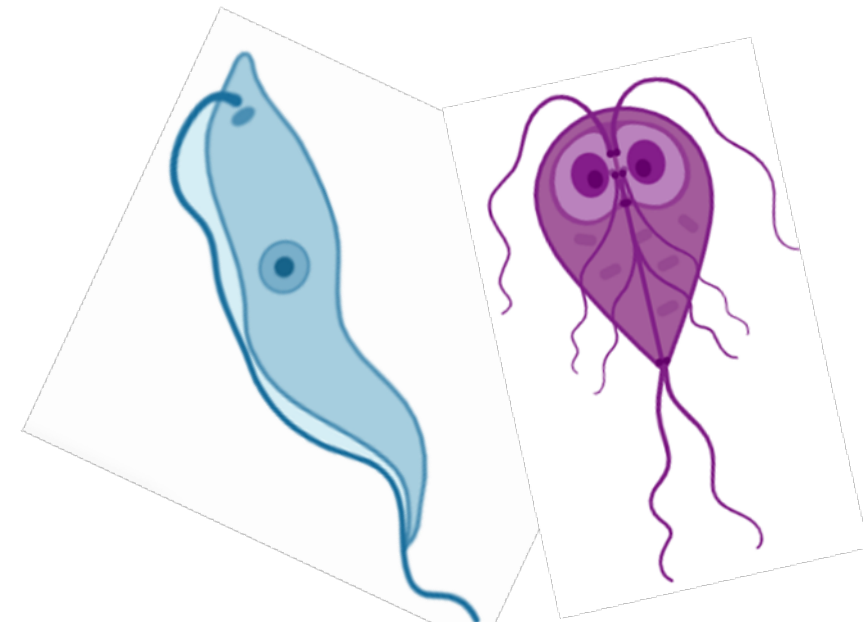
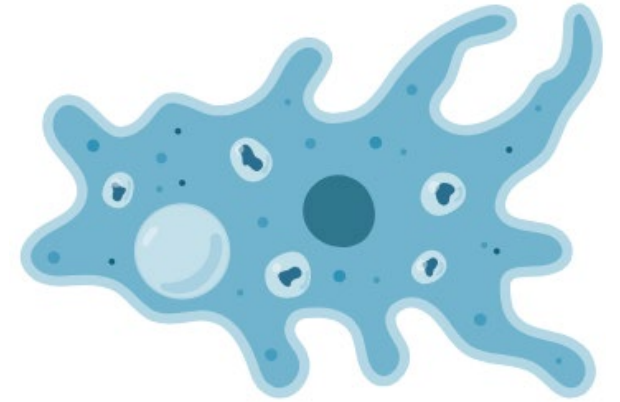
1. Sarcomastigophora
2. Apicomplexa
3. Microspora
4. Ciliophora

Phylum Sarcomastigophora

Phylum Sarcomastigophora has been subdivided into two

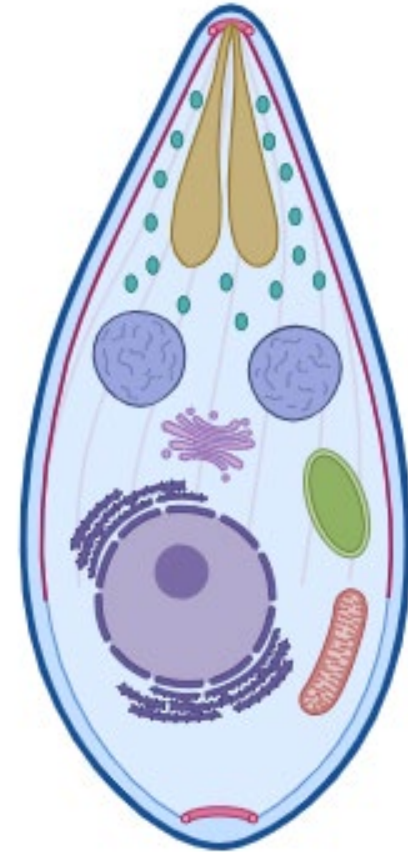
Subphyla based on their modes of locomotion:

1. **Sarcodina** (sarcos meaning flesh or body): It includes those parasites, which have no permanent locomotory organs, but move about with the aid of temporary prolongations of the body called pseudopodia (e.g. amebae).
2. **Mastigophora** (mastix meaning whip or flagellum): It includes those protozoa which possess whip-like flagella (e.g. Trypanosoma and Trichomonas).



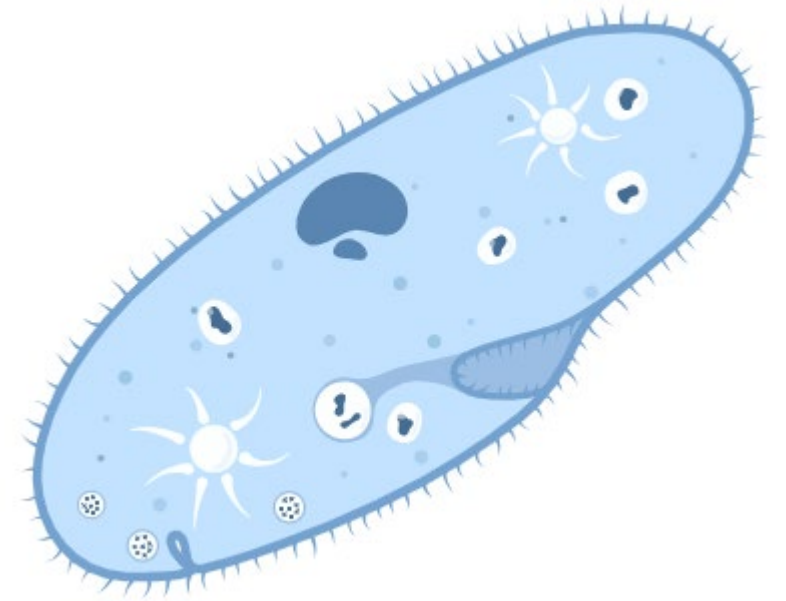
Phylum Apicomplexa

Phylum Apicomplexa was formerly known as Sporozoa. Members of this group possess, at some stage in their life cycle, a structure called the apical complex serving as the organ of attachment to host cells.



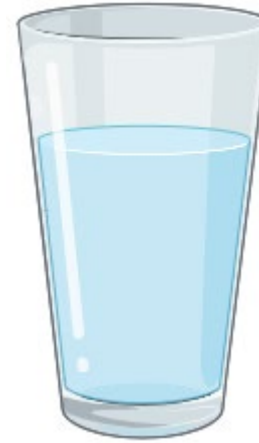
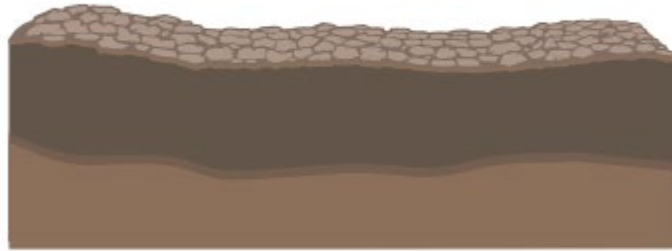
Phylum Ciliophora

These protozoa are motile by means of cilia, which cover their entire body surface. The only human parasite in this group is *Balantidium coli*, which rarely causes dysentery.

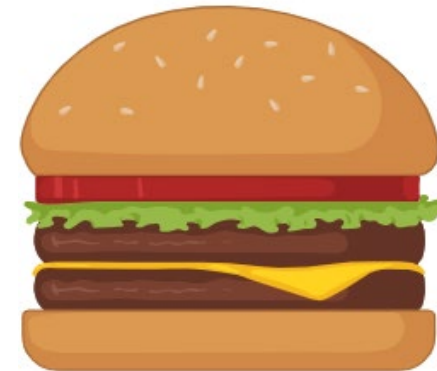
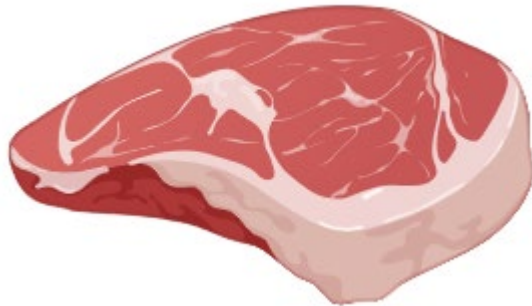


Source of infection

1. Contaminated soil and water



2. Food

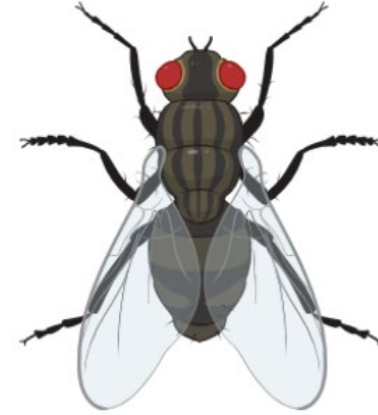


Source of infection

3. Vector

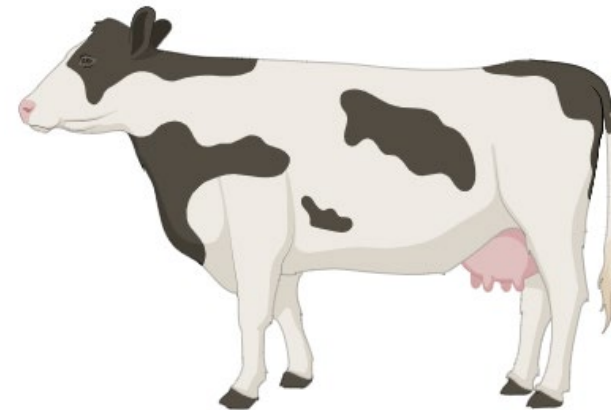
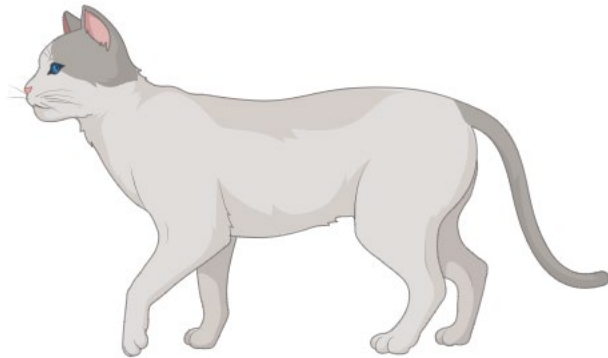


Biological



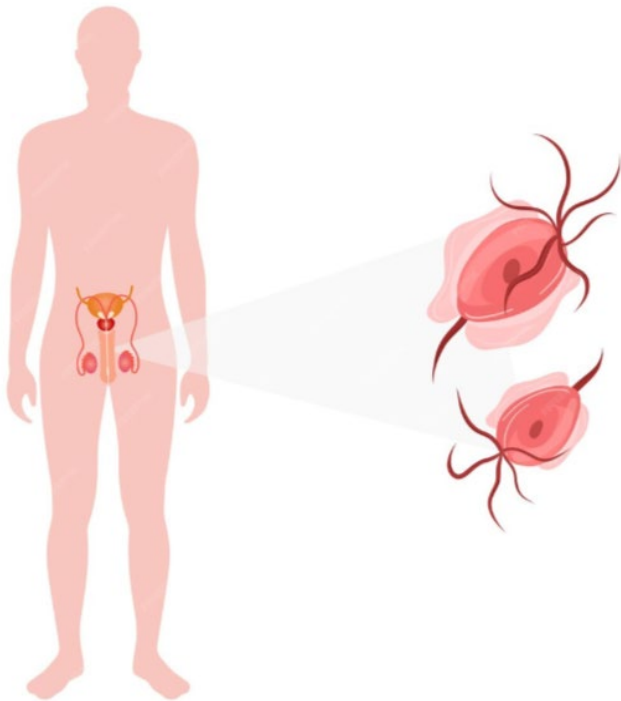
Mechanical

4. Animal

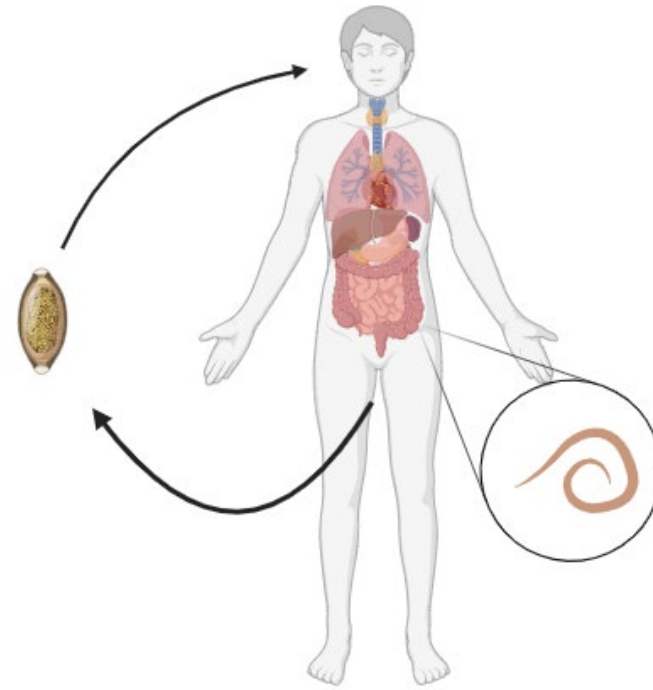


Source of infection

5. Carrier



6. Self (Autoinfection)



Mode of transmission

1. Fecal–oral (contaminated food/water)

Ex/ *Entamoeba histolytica*, *Giardia lamblia*, *Balantidium coli*

2. Vector-borne (mosquitoes, sandflies, tsetse flies)

Ex/ *Plasmodium* spp. (mosquito), *Leishmania* spp. (sandfly),
Trypanosoma brucei (tsetse fly)

3. Direct contact (sexual, skin penetration)

Ex/ *Trichomonas vaginalis* (sexual), *Acanthamoeba* spp. (skin/eye contact)

4. Congenital (placenta)

Ex/ *Toxoplasma gondii*

Why We Study Medical Protozoa – Medical Importance

1. Cause major human diseases such as malaria, amoebiasis, giardiasis, leishmaniasis, and toxoplasmosis.
2. High global burden – millions infected annually; some diseases have high mortality (e.g., *Plasmodium falciparum* malaria).
3. Chronic health impact – can cause anemia, malnutrition, organ damage, and developmental delays.
4. Public health relevance – outbreaks linked to water, food, and travel; some are vector-borne.
5. Economic and social impact – reduce productivity, increase healthcare costs.
6. Prevention and control – understanding biology aids diagnosis, treatment, and control programs.

References

- Paniker, C. K. J. & Ghosh, S. 2021. *Paniker's textbook of medical parasitology*, New Delhi, Jaypee Brothers Medical Publishers.