

Protozoa: General Characteristics

Protozoa are single-celled eukaryotic microorganisms belonging to kingdom Protista. The body wall is covered by cell membrane. Its cytoplasm is made up of ectoplasm and endoplasm. The nucleus is usually single but may be double or multiple. Reproduction can be asexual (e.g. binary fission, schizogony, endodyogeny) or sexual (e.g. gametogony).

Protozoa can be divided into the following groups:

1. *Amoebae* (Has pseudopodia as a mean of locomotion)
Amoebae of medical importance:
 - Amoeba in the large intestine: *Entamoeba histolytica*
 - Free-living amoebae in CNS and eye: *Naegleria*, *Acanthamoeba*
2. *Flagellates* (Has flagella as organ of locomotion)
Flagellates of medical importance:
 - Hemoflagellates: *Trypanosoma*, *Leishmania*
 - Gastrointestinal: *Giardia lamblia*
 - Urogenital: *Trichomonas vaginalis*
3. *Apicomplexa* (Has a structure called apical complex which serves as the organ of attachment to host cells. They have an alternating sexual and asexual life cycle)
Apicomplexa of medical importance:
 - Blood: *Plasmodium*, *Babesia*
 - Tissue: *Toxoplasma gondii*, *Sarcocystis*
 - Gastrointestinal: *Cryptosporidium*, *Cystoisospora*, *Cyclospora*
4. *Ciliate* (Has cilia for locomotion)
Ciliate of medical importance:
 - Gastrointestinal: *Balantidium coli*
5. *Microsporidia*
Microsporidia of medical importance:
 - Gastrointestinal: *Enterocytozoon bienersi*

Table 2.1 Protozoa of medical importance to human

Species	Habitat in human	Disease/clinical features
<i>Entamoeba histolytica</i>	Large intestine	Amoebic dysentery, amoebic liver abscess (ALA)
<i>Naegleria fowleri</i> (free-living amoeba, FLA)	Central nervous system (CNS)	Primary amoebic meningoencephalitis (PAM)
<i>Acanthamoeba</i> (FLA)	CNS, eye	Granulomatous amoebic encephalitis (GAE), amoebic keratitis
<i>Giardia lamblia</i>	Small intestine	Malabsorption, diarrhoea
<i>Trichomonas vaginalis</i>	Vagina, urethra	Vaginitis, urethritis
<i>Trypanosoma brucei</i>	Blood, lymph node, CNS	Sleeping sickness
<i>Trypanosoma cruzi</i>	Heart, colon	Chagas' disease
<i>Leishmania donovani</i>	Reticuloendothelial system (liver, spleen, bone marrow)	Kala azar, Post-kala azar dermal leishmaniasis
<i>Leishmania tropica</i>	Skin	Cutaneous leishmaniasis (oriental sore)
<i>Leishmania braziliensis</i>	Naso-oral mucosa	Mucocutaneous leishmaniasis
<i>Toxoplasma gondii</i>	CNS, eye, musculoskeletal	Toxoplasmosis
Microsporidia	Gastrointestinal tract (GIT)	Diarrhoea
<i>Plasmodium</i>	Erythrocytes	Malaria
<i>Babesia</i>	Erythrocytes	Babesiosis
<i>Cystoisospora belli</i>	Small intestine	Diarrhoea
<i>Cryptosporidium parvum</i>	Small intestine	Diarrhoea
<i>Balantidium coli</i>	Large intestine	Dysentery

The important protozoan pathogens of human are as shown in Table 2.1.

Helminths: General Characteristics

Helminths are metazoa which are multicellular worms. They are bilaterally symmetrical. Helminths are classified into 2 phyla: Platyhelminthes and Nematelminthes. Trematodes (flukes) and cestodes (tapeworms) belong to phylum Platyhelminthes and nematodes (roundworms) belong to phylum Nematelminthes.

Body of helminths has a cuticle or integument which is the outer covering. Nematelminthes possess a cylindrical body with a body cavity. Alimentary canal is complete with absence of suckers and they are sexually differentiated.

Platyhelminthes possess a body which is flattened dorsoventrally with absence of body cavity. Alimentary canal is absent or rudimentary. Suckers are present and most of the worms are hermaphrodite.

Most helminths require more than 1 intermediate host for completion of their life cycle. Helminths unlike protozoa do not multiply in the human body apart from few exceptions (those helminths showing autoinfection). Heavy worm load follow multiple infections.

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