

# CLASSIFICATION OF PROTOZOA

The classification of the protozoa is based on the modified form of that proposed by Levine *et. al.* (1980). The subkingdom Protozoa is divided into 7 phyla of which 4 mainly Sarcomastigophora, Apicomplexa, Microspora and Ciliophora have representative that are parasitic.

## Kingdom - **Protista**

### *Sub-kingdom* - *Protozoa*

<b>Phylum</b>	- <b>Sarcomastigophora</b>	- with flagella, pseudopodia or both single nucleus, No spore/cyst formation
<b>Subphylum</b>	- <b>Mastigophora</b>	- one or more flagella in trophozoite Asexual reproduction by binary fission
Class	- Phytomastigophorea	- chromatophores present, mostly free living. No vet/medical importance.
Class	- Zoomastigophorea	- chromatophores absent, one to many flagella present, predominantly parasitic.
Order	- Kinetoplastida	- 1-4 flagella & Kinetoplast with mitochondria amenities, Mostly parasitic
Family	- Trypanosomatidae-	leaf like, May be rounded
Genera	- <i>Trypanosoma</i> and <i>Leishmania</i>	
Order	- Retortamonadida	- 2 & 4 flagella, One fused posteriorly & associated with ventral cytostomal area
Family	- Retortamonadidae	- 2 or 4 flagella
Genus	- <i>Chilomastix</i>	
Order	- Diplomonadida	- Bilaterally symmetrical with two karyomastigotes each with four flagella, mostly parasitic.
Family	- Hexamitidae	- Bilaterally symmetrical, 6 or 8 flagella, 2 nuclei
Genera	- <i>Giardia</i> and <i>Hexamita</i>	
Order	- Trichomonadida	- Typically 4 or 6 flagella, One recurrent & attached to undulating membrane, parasitic.

Family	- Monocercomonadidae	- 3-5 anterior flagella, recurrent flagellum usually free
Genera	- <i>Histomonas</i> and <i>Parahistomonas</i>	
Family	- Trichomonadidae	- 4-6 flagella, one recurrent & attached to an undulating membrane
Genera	- <i>Tritrichomonas</i> , <i>Trichomonas</i> , <i>Tetratrichomonas</i> & <i>Pentatrichomonas</i>	
<b>Subphylum</b>	- <b>Sarcodina</b>	- pseudopodia usually present, asexual reproduction by fission
Super class	- Rhizopoda	- locomotion by formation of podia, nutrition phagotrophic
Class	- Lobosea	
Order	- Amoebida	- Naked, uninucleated
Family	- Endamoebidae	- parasitic in digestive tract
Genera	- <i>Endamoeba</i> and <i>Entamoeba</i>	

<b>Phylum</b>	- <b>Apicomplexa</b>	- apical complex including conoid, rhoptries micronemes subpellicular microtubules, wall forming body etc. present at some stage. Single vesicular nuclear, cilia & flagella absent (except microgametes) syngamy & cyst often present, all parasitic.
Class	- Sporozoa	- apical complex well-developed, sexual & asexual reproduction, oocyst present.
Sub class	- Coccidia	- Typically intracellular parasite of vertebrates chiefly.
Order	- Eucoccidida	- parasites of epithelial cells & blood cells. Schizogamy & gametogamy occur sporogamy outside or inside the host.
Sub order	- Eimeriina	- macro & micro gametocytes develop independently, Zygote non motile, sporozoites in sporocysts, endodyogeny absent or present.
Family	- <u>Eimeriidae</u>	- Monoxenous, development in host cell [intestinal cells], Oocyst with/without sporocyst with sporozoites, Schizogamy in host, Sporogamy outside.
Genera	- <i>Eimeria</i> , <i>Isospora</i> , <i>Tyzzeria</i> and <i>Wenyonella</i>	
Family	- <u>Cryptosporidiidae</u>	- Monoxenous, development in microvillar border, intracellular but extra cytoplasmic
Genus	- <u><i>Cryptosporidium</i></u>	- Oocyst without sporocyst contain 4 sporozoites only
Family	- <u>Sarcocystidae</u>	- Heteroxenous with a prey predator life cycle, oocyst with 2 sporocyst Asexual stage in intermediate host and gametogamy in definitive hosts, parasite of vertebrates, endodyogeny present. syzygy absent.
Sub-family	- Toxoplasmatinae	- pseudocyst present, sporogamy outside the host.
Genera	- <u><i>Toxoplasma</i></u> , <u><i>Besnoitia</i></u> and <u><i>Hammondia</i></u>	
Sub-family	- <u>Sarcocystinae</u>	- sporogamy inside the host, tissue cyst septate, often elongated

- Genera - *Sarcocystis*
- Sub-order - Haemosporina - Heteroxenous, Zygote motile, Macro & micro gametes develop independently, Schizogamy in vertebrate, Sporogamy in blood sucking insects, Pigment usually form in host cell
- Family - Plasmodiidae - As character of sub order
- Genera - *Plasmodium*, *Haemoproteus* and *Leucocytozoon*
- Sub order - Adeleina - Macro & microgametocytes associated in syzygy,
- Family - Klossiellidae - Monoxenous, Zygote inactive, Typical oocyst not formed sporozoites develop in host cell often in kidney
- Genus - *Klossiella*
- Family - Haemogregarinidae - Heteroxenous, ookinete present in cells of circulatory system of vertebrates
- Genus - *Hepatozoon*
- Sub class - Piroplasmia - Apical complex reduce, pigment not formed in host cell, parasite of cells of haemopoietic system . Vectors are tick
- Order - Piroplasmida - As characters of sub class
- Family - Babesidae - Relatively large, pyriform, round or oval. Apical complex reduced, development stages usually in RBC  
Vector are tick
- Genus - *Babesia*
- Family - Theileriidae - Small, round, ovoid & irregular or pleomorphic forms, apical complex reduced, schizogony in lymphocytes & other cells followed by invasions of RBC in mammals. Vectors are ticks
- Genus - *Theileria*
- Phylum** - **Microspora** - Spores with one or more polar filaments
- Class - Microsporea - Spores of unicellular origin, one long tubular filaments
- Genus - *Encephalitozoon*
- Phylum** - **Ciliophora** - Cilia present in at least one stage of life cycle, usually two types of nucleus, Transverse binary fission, sexuality involving conjugation.
- Class - Kinetofragminophorea - do -
- Order - Trichostomatida
- Family - Balantidiidae - Cytostome & oral cavity present, ciliation uniform, holotrichous
- Genus - *Balantidium* - Occurs in the digestive tract