Phylum Protozoa

- As per two-kingdom classification, Protozoa was treated as a phylum under animal kingdom
- Under the three-kingdom classification, proposed by Haeckel, it was separated from animal kingdom and was included under the kingdom **Protista.**
- There are about 215000 described species of protists of which about 92000 species are protozoans.
- The first protozoan observed was *VorticeUa convellaria* by Anton Van Leeuwenhoek. Anton Van Leeuwenhoek called Protozoans as animalcules.
- The term Protozoa was coined by **Goldfuss,** for a group of organisms which included protozoans, sponges, coelenterates, rotifers and bryozoans.
- Von Siebold restricted the name Protozoa to apply to all unicellular forms of animal life.
- Hyman preferred the term acellular.

General Characters

- The body is unicellular, however they are preferably be referred to as **acellular** because the single cell performs all the life activities and is functionally equivalent to the whole metazoan animal.
- Division of labour occurs among various organelles of the cell.
- **These may be** solitary (**Euglenaj or** colonial (Proterospongia) Freeliving- **Amoeba**
- Symmetry - **Spherical** - heliozoans, (Actinopodeans), radiolarians (Collozoum) Radial - (Sessile forms) Bilateral - Giardia
- Lobose protozoans and foraminifers are asymmetrical
- Body is naked or covered by pellicle or shell made of silica or calcium carbonate
- Division of body is at subcellular level
- Locomotion is brought about by the locomotory organelles like **flagella** and **cilia,** cellular extensions like **pseudopodia** and in some, pellicular contractile structures like **myonemes.**
- Nutrition is **holozoic** or holophytic or osmotrophic. Euglena shows mixotrophic nutrition.
- Digestion is intracellular.
- Contractile vacuoles, which are common ir freshwater forms mainly, serve for osmoregulation,
- Asexual reproduction by binary ormultiple fissions or plasmotomy or budding.
- Sexual reproduction by syngamy or conjugation.
- The phenomenon to tide over unfavourable conditions is encystment.
- They are immortal - somatoplasm and germplasrr are not differentiated.

Classification

- B.M. Honigberg and others classified Phylurr Protozoa into four subphyla: Sarcomastigophora Sporozoa, Cnidospora and Ciliophora.

Subphylum-1 Sarcomastigophora

- it Is characterized by the presence of pseudopodia or flagella for locomotion, It includes three superclasses – Mastigophora Opalinata and Sarcodina.

Superclass Mastigophora:

- Body is covered by pellicle; locomotoiy organelles are flagella;
- Asexual reproduction by longitudinal binaiy fission.
- It includes two classes – Phytoinastigophon and Zoomastigophora

Class Phytomastigophora:

- Some are with chlorophyll bearing chloroplasts
- Nutrition is holophytic
- Reserve food is paramyl um o Includes euglenoids and dinoflagllates
- Examples: *Ceratium* (dinoflagellate witl chloroplasts) *Noctiluca* (dinoflagellate withoui chloroplasts), Euglena

Class Zoomastigophora:

- Mostly parasitic; Chloroplasts are absent; nutrition is holozoic
- saprobic or parasitic, Reserve food is glycogen or volutin, Examples: *Trichomonas, Trichonympht (Mutualistic), Leishmania.*

Superclass Opalinata:

- Commensals or parasites in the gut of **anurans**
- Body is covered by oblique rows of cilia **but without infraciliary system.**
- Some are binuleate, others are multinucleate but **homokaryotic** i.e. the nuclei are identical,
- Asexual reproduction by longitudinal ***binary fission and*** plasmotomy.
- ***Sexual reproduction is*** syngamy with flagellated gametes ***Examples*** Opalina, Zelleriella

Superclass Sarcodina:

- Locomotion is brought about by pseudopodia.
- It includes three classes - Rhizopodea, Piroplasmea and Actinopodea.

Class Rhizopodea:

- It includes amoebas, foraminiferans and mycetozoans.
- Amoebas have lobopodia or filopodia; foraminiferans have reticulopodia.
- In amoebas, body .is naked (**Amoeba, Entamoeba)** or covered by a **test (Arcella).**
- Foraminiferans have a **calcareous** porous shell.
- Calcareous shells of dead individuals form foraminiferan ooze,

  Examples: **Elphidium** (foraminiferan), * **Physarum** (acellular slime mould with a Plasmodium stage in the life history), **Dictyostelium** (cellular slime mould with pseudoplasmodium stage in the life history). ^

Class Piroplasmea:

Parasitic; locomotory structures absent; spores are absent.

Example: **Babesia** (causes red water fever in cattle)

Class Actinopodea:

- These are the ray footed protozoans
- Locomotory structures are **axopodia**
- Skeleton consists of **siliceous shell** (Radiolaria) or **strontium sulphate spines** (Acantharea) or **siliceous shell or radiating needles** (Heliozoa).
- Silicious shells of radiolarians form ooze Examples: **Collozoum** (radiolarian) **Actinophrys** (heliozoan) **Acanthometra** (acantharean), Actinosphaerium

Subphylum-II Sporozoa or **Apicomplexa:**

- Parasitic; no special locomotory structures;
- pseudopodia, if present, useful only in ingestion, o Sporozoites and merozoites bear anterior apical complex that helps penetrate host cells, o No polar filaments
- It includes three classes - Telosporea,
- Toxoplasmea and Haplosporea.

Class Telosporea:

- Sporozoites are long, o Garrtonts are large, extracellular - **gregarinids**
- Gamonts are small, intracellular - **coccidians**
- Syngamy is isogamy - Gregarinids **Anisogamy - Coccidians**
- Examples: **Monocystis** (parasite in the seminal vesicles of earthworms), **Eimeria, Plasmodium, Gregarina**

Class Toxoplasmea:

- Body covered by two layered pellicle
- Only asexual reproduction, by **endodyogeny.**
- It is internal budding wherein two daughter cells are produced within a mother cell and the mother cell is destroyed in the process, Example: **Toxoplasma**

Class Haplosporea:

- Spores are present and are amoeboid, o Reproduction is only asexual, by multiple fission.
- Each spore contains singl e sporozoite o Example: **Haplosporidium**

Subphylum-III Cnidospora:

- Parasitic.
- No special locomotory structures,
- Spores with 1 or more protoplasmic masses called - **sporoplasms**
- Spores are provided with one or more polar filaments, which are useful for attachment to the host.
- It includes two classes - **Myxosporidea** and Microsporidea.

Class Myxosporidea:

- Extracellular parasites of cold blooded vertebrates
- Spores with typically two capsules each with single polar filament.

Example: Myxobolus

Class Microsporidea:

- Intracellular parasites.
  - Spore with one intrasporal or 1 -2 intracapsular filaments.
  - Spores with single sporoplasm

Example: **Nosema bombycis** (causes pebrine disease in silkworms).

Subphylum IV Ciliophora:

- Complex protozoans.
- Cilia are useful in locomotion and food capture,
- **Suctorian ciliates** are sessile and are with cilia only in young stages. In adult suctorians the cilia are replaced by sucking tentacles that help in food capture,

- **Dimorphic nuclei** - macronucleus (vegetative and polyploid) and micronucleus (reproductive and diploid), o **Infraciliary system** is present, o Sexual reproduction by **conj ugation,** which brings about nuclear reorganization.
- Only class under this subphylum is **Class Ciliata.** o Example: **Paramecium, Balantidium,** (parasitic ciliate in man) Acineta ***(Suctorian)***