

CHAPTER-02

BIOLOGICAL CLASSIFICATION

Biological classification is the scientific procedure of arranging organisms into groups and subgroups on the basis of their similarities and dissimilarities and placing the group in a hierarchy of categories.

Importance of classification-

- It is not possible to study every organism. Study of one or two organism of a group gives sufficient information about the essential features of the group.
- It helps in identification of new organism.
- Classification helps in knowing the relationship amongst different groups of organisms.
- The organism of past cannot be studied without a proper system of classification.

Classification

- Artificial system of classification
- Natural system of classification
- Phylogenetic system of classification

Artificial system of classification- Only one or two morphological characters for grouping of organism is used. Flowering and non-flowering plants, enaima and anaima. Aristotle classification.

Natural system of classification- Takes into consideration comparable study of a number of characters so as to bring out natural similarities and dissimilarities and hence natural relationships among the organisms. Bentham and Hooker classification, etc.

Phylogenetic System of Classification- Based on the evolutionary relationship of organisms. In this system organism are classified on the basis of their evolution on earth from primitive to highly evolved. Engler and Prantl classification and Hutchinson

classification, etc.

Depending upon the type of system of classification organism are classified into following kingdom system.

Kingdom system of classification

- Two kingdom : *Plantae Animalia*
- Three kingdom : *Plantae Protista Animalia*
- Five kingdom : *Monera Protista Fungi Plantae Animalia*
- In two kingdom system of classification organisms are grouped on the basis of presence and absence of cell wall as proposed by Linnaeus(father of taxonomy).
- Three kingdom systems- Haeckel separated unicellular animals, algae and fungi on the basis of lack of tissue differentiation and new kingdom Protista was introduced.
- Five kingdom systems- R.H.Whittaker divided all the organism into five kingdom in order to develop phylogenetic classification.

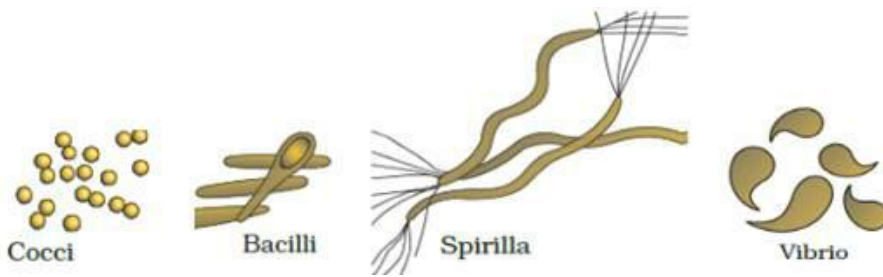
1. **Monera**- The kingdom includes all prokaryotes- mycoplasma, bacteria, actinomycetes and cyanobacteria.

1. Unicellular, prokaryotes and contain the most primitive of living forms
2. The cells are microscopic and cell wall is generally present.
3. Genetic materials are not organized into nucleus and contain naked DNA.
4. Membrane bounded organelles are absent.
5. Reproduction is asexual except gene recombination.
6. Flagella may be present and are of single stranded.

Example- Blue-green algae, Bacteria, etc.

Bacteria are the most abundant micro-organism that can survive in all kinds of climate.



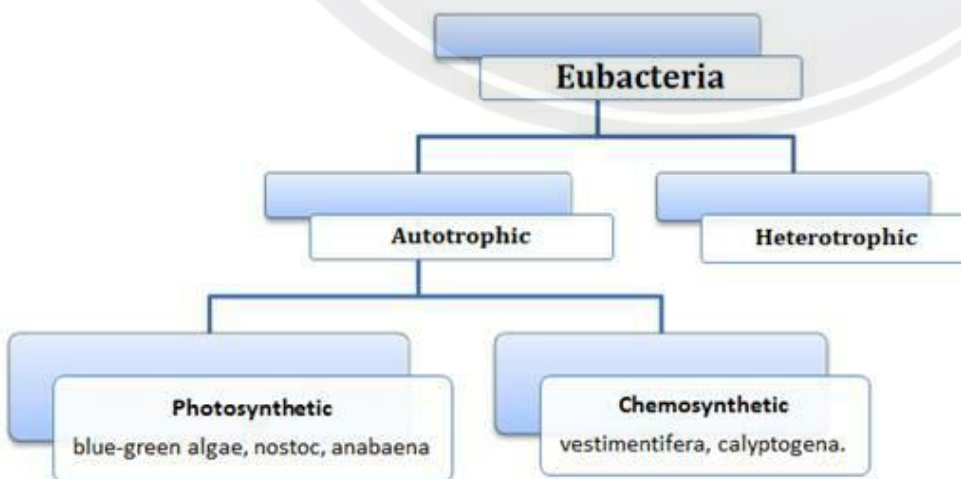


- They are group of most primitive prokaryotes which live under most hostile conditions like extreme salty area (halophiles), hot springs (thermoacidophiles) and marshy area (methanogens). They differ from other bacteria in having different cell wall structure (absence of peptidoglycan). Methanogens are present in the gut of several ruminant animals like cows and buffalo, which is responsible for production of biogas (methane) from dung of these animals.

Eubacteria – They are called as true bacteria. They contain rigid cell wall, if motile contain flagellum. Cyanobacteria or blue-green algae are gram positive photosynthetic bacteria. They contain chlorophyll a and carotenoids. They may be unicellular, colonial or filamentous, fresh water, marine or terrestrial. Some of them have specialized heterocyst cells to perform nitrogen fixation (Nostoc and Anabaena).

Chemosynthetic bacteria oxidize inorganic substances like nitrate, nitrite, ammonia etc. to produce energy and help in recycling of nitrogen, phosphorous, sulphur etc.

Heterotrophic bacteria are most abundant and act as decomposer. They are helpful in production of curd, antibiotic and fixing nitrogen in leguminous plants. Some of them are pathogenic and cause disease like cholera, typhoid, tetanus and citrus canker.



Mycoplasma – they are the simplest free living prokaryotes. They are also known as PPLO (Pleuropneumonia like organism). They lack cell wall and can survive without oxygen. They cause disease in plants and animals.

Protista- Kingdom Protista includes Chrysophytes, Dinoflagellates, Eugleoids, slime mould and Protozoans.

1. It includes all unicellular and colonial eukaryotes.
2. Most of them are aquatic forming plankton.
3. Mode of nutrition may be photosynthetic, saprophytic, parasitic or holozoic.
4. Flagella if present are 11 stranded with 9+2 arrangement of microtubules composed of tubulin.
5. Genetic material consists of 2 or more DNA molecules.
 - They includes diatoms and golden algae (desmids) found in fresh water as well as marine water.
 - In diatoms cell wall forms two thin overlapping cells which fit together as in soap box.
 - The siliceous indestructible cell wall pile up at the bottom of water reservoirs and form big heaps called **diatomaceous earth**. It may extend for hundred meter and used for polishing, filtration of oil and syrups. They are chief producer in oceans.
 - They are basically unicellular, motile, biflagellate and photosynthetic protists.
 - Predominate colour is golden brown but yellow, green, red and even blue also exists.
 - Some Dinoflagellates like *Gymnodinium* and *Gonyaulax* grow in large number in the sea and make the water look red and cause the so called “**red tide**”.
 - They are Euglena like unicellular flagellates which possess pellicle instead of cell wall which make their body flexible.
 - They have two flagella, one short and other long.
 - They are photosynthetic in presence of sunlight and act as predators in absence of sunlight.
 - Example- *Euglena*, *Peranema*.

Slime Moulds

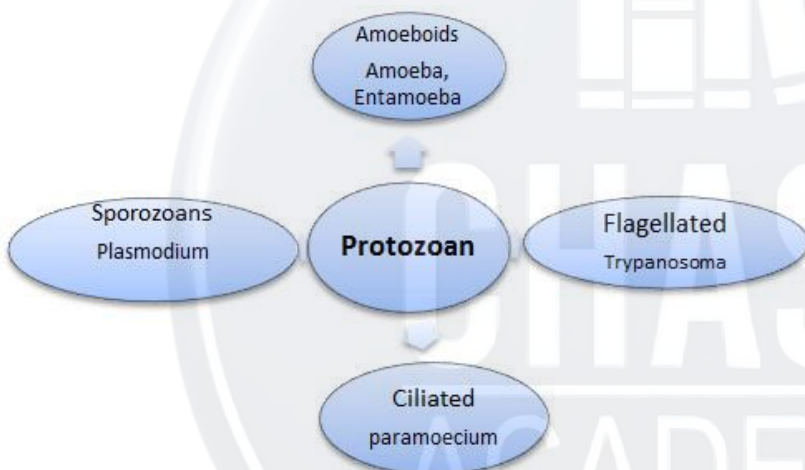
- They are saprophytic protists and feeds on decaying twigs and leaves.
- Under favorable condition, they form an aggregation called plasmodium which

produce fruiting bodies bearing spores.

- The cell wall of spores contain cellulose.
- The spores are dispersed by air currents.
- Example- *Physarum*, *Fuligo*.

Protozoans

- All protozoans are heterotrophs and live as predators or parasites.
- They are considered as primitive relatives of animals.
- Amoeboids move and capture food by pseudopodia. Some are parasitic also.
- Flagellated protozoans are free-living or parasitic. They have flagella.
- Ciliated protozoans are aquatic and have cilia all over the body for movement.
- Sporozoans includes organism that have infectious spore like stage in their life cycle.



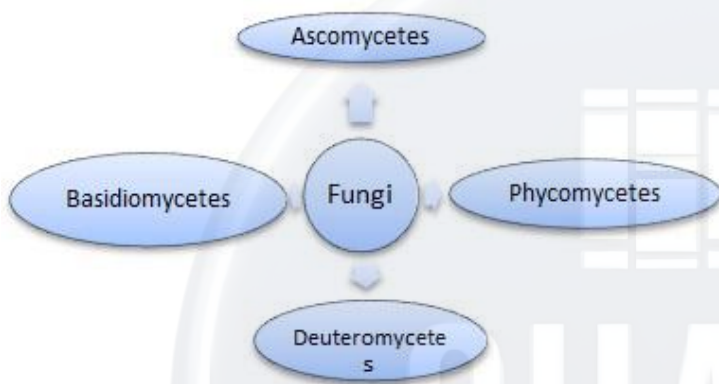
Kingdom Fungi–

- They are achlorophyllous, heterotrophic, spore forming, non-vesicular eukaryotic organisms.
- Cell wall is made up of chitin or fungal cellulose.
- Reserved food is glycogen.
- Mode of nutrition is saprophytic, parasitic or symbiotic.
- Reproduction may be vegetative (fragmentation, fission or budding), asexual (conidia, sporangiospores or zoospores) or sexual reproduction by oospores, ascospore and basidiospores.
- Sexual cycles involves the following steps-

1. Plasmogamy, fusion of male and female gametes.
2. Karyogamy, fusion of two nuclei.
3. Meiosis in zygote to produce haploid spores.

Phycomycetes-

- They are found in aquatic habitat and on decaying wood in moist and damp places.
- The mycelium is aseptate and coenocytic.
- Asexual reproduction by zoospores (motile) or aplanospores (non-motile).
- Example- Mucus, Rhizopus, Albugo etc.



Ascomycetes (The sac fungi)

- They are saprophytic, decomposers, parasitic or coprophilous (growing on dung).
- Mycelium is branched and septate and asexual spores are conidia.
- Sexual spores are called ascospores produced inside the fruiting body called ascocarps.

Example- *Neurospora*, *Asperigillus*, *Claviceps* etc.

Basidiomycetes (The club fungi)

- The mycelium is branched and septate.
- Vegetative reproduction is by fragmentation. Asexual spores are not found. Sexual reproduction is by two vegetative or somatic cells forming basidium.
- Basidiospores are produced in basidium by developing a fruiting body called basidiocarps.
- Example- *Agaricus*, *Ustilago*, *Puccinia*.

Deuteromycetes (The fungi imperfect)

- Only vegetative and asexual phase is known.
- Mycelium is septate and branched. Some members are saprophytes or parasites.
- Example- *Alternaria*, *Trichoderma*, *Colletotrichu*.

Kingdom Plantae

1. Eukaryotic, chlorophyll bearing organism.
2. Life cycle is divided into diploid saprophytic and haploid gametophytic, which alternate with each other.
3. Kingdom Plantae includes Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

Kingdom Animalia

1. Heterotrophic, eukaryotic organisms that are multicellular and cell wall is absent in the cell.
2. Mode of nutrition is holozoic and reserve food is glycogen or fats.
3. Sexual reproduction is by copulation between male and female followed by embryological development.

Virus, Viroids and Lichens

Five kingdom system of classification do not includes Virus, Viroids and Lichens.

- Viruses are non-cellular organisms having inert crystalline structure outside the living. When they enter the living cell, they take over the machinery of living cell to replicate themselves.
- D.J.Ivanowsky recognized certain microbes as causal organism of mosaic disease of tobacco.
- In addition to proteins, viruses also contain genetic material that could be DNA or RNA. In general, virus that infect plants have single stranded RNA and virus that infect animals have double stranded DNA.
- Some common diseases caused by virus are common cold, influenza, AIDS, small pox, leaf rolling and curling.
- Bacteria feeding virus are called Bacteriophage. They are usually double stranded

DNA viruses.

- The protein coat called capsid is made of small subunits called capsomeres, protects the nucleic acid. These capsomeres are arranged in helical or polyhedral geometric forms.
- Viroids are discovered by T.O.Diener as new infectious agent smaller than virus causing potato spindle tuber disease. They are free RNA without protein coat.

Lichens are symbiotic association between algae and fungi. The algal part is called **Phycobiont** and fungal parts are called **Mycobiont**. They are good pollution indicator as they do not grow in polluted area.

