

CLASS – 11

BIOLOGY

Chapter – 2

BIOLOGICAL CLASSIFICATION

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Two kingdom classification

Introduced by *Carolus Linnaeus* in 1758 and classified organisms into two kingdoms:

1. Kingdom Plantae:

- Include those organisms which were stationary, photosynthetic, cell wall with cellulose and grow indefinitely.

Example: Green plants, mosses, fungi, lichens, and bacteria.

2. Kingdom Animalia:

- Include those organisms which could move, heterotrophic and do not have cell wall.

Example: all multicellular organisms and protozoa.

Major dispute in placement of some groups:

- *Euglena* (i.e. have features of both autotrophic and heterotrophic), **Slime moulds** (lack cell wall in vegetative stage and having in reproductive stage), **Fungi** (placed in photosynthetic in spite of they lack photosynthesis) etc.

Disadvantage:

1. **Prokaryote** (*bacteria and blue green algae*) and Eukaryote have been put together.
2. **Non-photosynthetic fungi** having chitin cell wall put together with **photosynthetic green plant** having cellulosic wall.

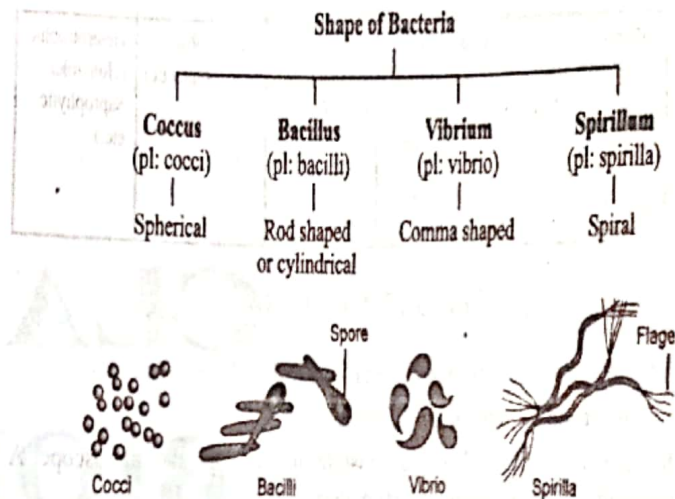
Five kingdom classification

- Proposed by Whittaker in 1969.
 - Based on the following criteria
1. Complexity of cell structure (Prokaryote and Eukaryote)
 2. Complexity of organism body (*Unicellular or Multicellular*)
 3. Mode of nutrition (Autotrophic or Heterotrophs)

Kingdom monera

- It has only **bacteria** as its members and most abundant on the earth.
- They are *unicellular, prokaryote, microscopic with rigid cell wall.*
- Also known as **decomposer** and **mineralisers** in the biosphere.
- Show diverse mode of nutrition like –
- Classify

- Classify into four categories on the basis of their shape:



Classification of Monera:

Archeobacteria

- They are **oldest or ancient bacteria** which survive under **extreme conditions** (i.e. **absence of O₂**, **high salt concentration**,

acidic pH, very high temperature like up to 100 degree Celsius).

- Contain cell wall which is made up of polysaccharides and protein.
- They classify into following subcategories on the basis of their habitat:

1. **Halophiles:** live in strong salt solution.
2. **Methanogens:** live in marshy area and produce methane gas, also found in gut of ruminant animals.
3. **Thermoacidophiles:** found in hot sulphur springs at high temperature of 80° C to 100° C.

Eubacteria

- It also referred as true bacteria and classified into two group:

1. Cynobacteria or blue green algae

- They are photosynthetic autotrophs (i.e. contain chlorophyll a), unicellular, colonial (i.e. surrounded by gelatinous sheath) or filamentous, marine or terrestrial algae.
- Some cynobacteria form bloom in polluted water and some fix atmospheric nitrogen by heterocysts.

Example: *Nostoc*, *Anabaena* (both fix atmospheric nitrogen), *Spirulina* (make protein rich food).

Bacteria

- They are microscopic, unicellular, cell wall made up of murine or peptidoglycan (i.e. protect against chemical and mechanical injury).
- Cytoplasm contain granule of food, lipid and glycogen and single circular DNA.

- Many of them have flagella while some have pilli or fimbriae (i.e. hair like projection on the surface).

- It could be autotrophic or heterotrophic-
- **Autotrophic bacteria** could be photoautotrophic (i.e. synthesis their food by photosynthesis) or chemosynthetic (i.e. oxidise various inorganic substances to produce energy).
- **Heterotrophic bacteria** could be Saprophytes (decomposer which play important role in recycling of nutrients), Symbionts (i.e. show symbiotic association like *Rhizobium* and leguminous plant) Parasites (live in or on the organism and cause damage).
- Reproduce by binary fission, spore formation and also show conjugation (in which DNA is transfer from one bacterium to other).

Kingdom protista

- It include single celled, microscopic eukaryote organism.
- They exhibit various lifestyle- Autotrophic plant like form are Protistan algae, Heterotrophic animal like forms are Protozoan protists, and Decomposer fungi like form include slime moulds.
- Show various mode of nutrition;

1. **Photosynthetic Autotrophs:** also know as chief producers in oceans and fresh water. Example: unicellular algae and diatoms and phytoplankton (i.e. have cell wall).

2. **Non-photosynthetic heterotrophs:** they show holozoic kind of nutrition., some also show parasitic and some are symbiont.

Example: zooplankton and protozoans.

- They reproduce asexually by binary fission and sexually by involving cell fusion and zygote formation.
- Protista also fill all three niches in ecosystem like producer, consumers and decomposers.

Example: *Diatom*, *Dinoflagellates*, *Euglena*, *Slime moulds*, *Amoeba*, *Paramecium*, *Plasmodium* etc.

Classification

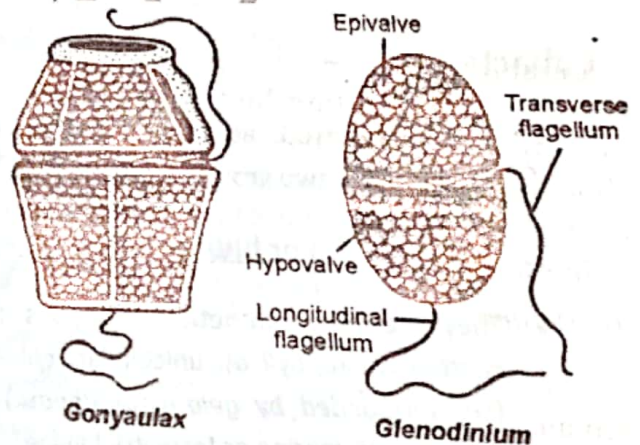
Chryophytes

- This group includes *diatom* and *golden brown algae*.
- It is basically *phytoplankton* (i.e. microscopic organism that floats passively in water currents).
- Found in *fresh water* and *marine water*.
- Diatoms have **cell wall** (i.e. form two thin overlapping shells) which has deposition of *silica* that accumulate over billions of years and form **diatomic earth** when the diatoms die.

Example: *Triceratium* (*diatom*), *chrysosphaerella* (*golden brown algae*).

Dinoflagellates

- They are unicellular, marine and photosynthetic organism.
- It consider next to diatom as producer in oceans.
- They appear in various colour due to presence of **pigment** which they contain and some are bioluminescent.
- It has two **unequal flagella** in which one lies longitudinally and other transversely in the furrow between the wall plates.



- It is very often that red dinoflagellates like *Gonyaulax* undergo rapid multiplication and form bloom which make appearance of sea as red and release **toxins** (i.e. kills marine animals including fish).

Example: *Gonyaulax*, *Glenodinium*

Euglenoids

- They are unicellular, free living and found in fresh water (i.e. *stagnant water*).
- They have **pellicle** (i.e. protein rich layer which is flexible and allow a change in shape).

- It contains **two flagella** in which one is short and one long (i.e. help in locomotion).



- They act as **photosynthetic** (chlorophyll present) as well as **heterotrophic** (i.e. in deprived of sunlight).
- They reproduce **asexually by longitudinal binary fission** and by **cysts** during unfavorable conditions.

Example: *Euglena*.

Slime moulds

- They are **saprophytic** which move along decaying twigs and leaves engulfing the organic material.
- **During unfavorable condition** – they form **plasmodium** that contain thousands of nuclei which grow and spread over several feet and flow like amoeboid manner on the soil of forest or on dead leaves and stem.



- During unfavorable condition – plasmodium differentiate and form **fruiting bodies** which bear **spores** (i.e. possess true wall which make resistance and survive for many year under adverse conditions) at their tips.

Example: *Dictyostellum*.

Protozoans

- They are **heterotrophs** and live as **predators or parasites**.
- They are found in **all environment** and categories in four major groups.

1. *Amoeboid protozoans*
2. *Flagellated protozoans*
3. *Ciliated protozoans*
4. *Sporozoans*

Amoeboid protozoans:

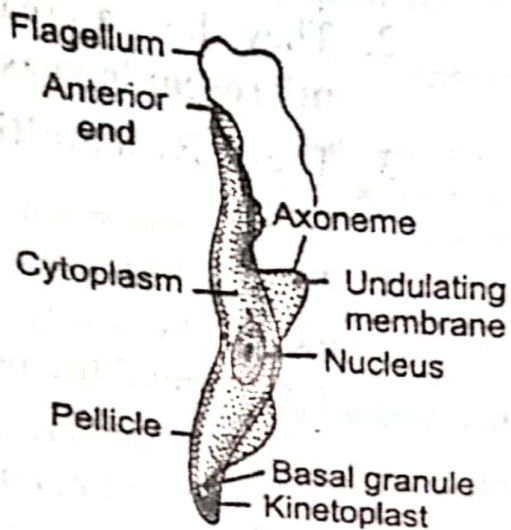
- **Habitat** – fresh water, sea water or moist soil.
- They do not have definite shape and have **pseudopodia** (i.e. help in locomotion and engulfing prey).
- Marine form (i.e. *Radiolaria*) has **silica shells** on their surface.



Example: *Amoeba* (fresh water form), *Entamoeba* (parasite that cause amoebic dysentery in man), *Radiolaria* (marine form).

Flagellated protozoans:

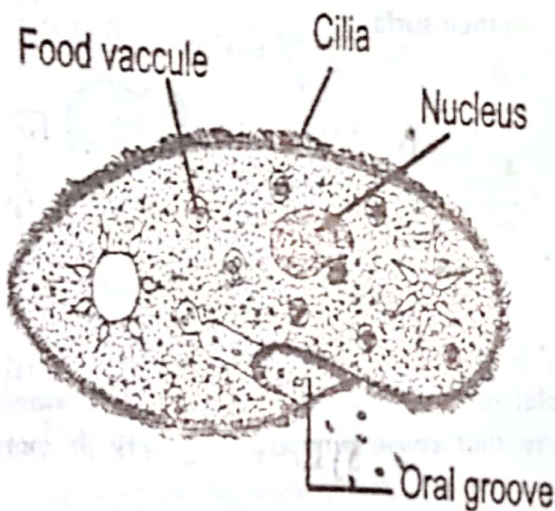
- They are **free living or parasitic**, have **pellicle** (i.e. semi rigid covering which provide flexibility), **flagella** (i.e. help in locomotion).



Example: *Trypanosoma* (cause sleeping sickness in man).

Ciliated protozoans:

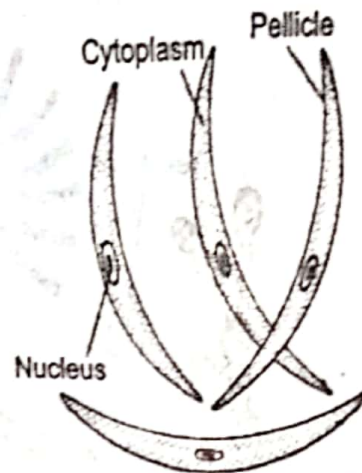
- All are *aquatic*, have *characteristic shape*, *cilia all over the body*.
- They have oral groove that called gullet.



Example: *Paramecium*

Sporozoans:

- It has mainly *parasitic protozoans* which have infectious spore like stage in their life cycle.



Example: *Plasmodium* (i.e. malaria parasite).

Kingdom Fungi

- It include heterotrophic and, *eukaryotic*, *multicellular organism (except yeast)*.
- They show great diversity of in morphology and habitat.
- Body consists of *hyphae* (i.e. *elongated filament*) which form *mycelium* (i.e. *network of hyphae*).
- Some fungi have *coenocytic hyphae* (i.e. continuous tube filed with multinucleated cytoplasm) while some have *septate hyphae* (i.e. hyphae have septae or cross wall).
- Cell wall is made up of *chitin* an *polysaccharides*.
- Mode of nutrition: *saprophytic*, *parasites* and *symbionts*.
- Reproduce by – Asexual through *budding*, *fission*, and *fragmentation and sporulation* (i.e. *conidia*, *sporangiospore* and *zoospore*) and by Sexual reproduction – through *spore* (i.e. *oospore* *ascospore* and *basidiospore*) which formed in distinct structure called *fruiting bodies*.]
- Sexual life cycle of fungi completed through the following 3 steps: *Plasmogamy* (i.e. *fusion of protoplasm of two motile or*

non-motile gametes), **karyogamy** (fusion of two nuclei) and **formation of zygote**.

Classification of fungi

Kingdom - Fungi				
	Phycomycetes Or Zygomycetes	Ascomycetes (sac fungi)	Basidiomycetes (club fungi)	Deuteromycetes (Imperfect fungi)
Morphology of mycelium	Non-septate hyphae	Septate hyphae	Septate hyphae	Septate and branched
Mode of spore formation	Sporangium	Conidia	Spore not found	Conidia
Kind of fruiting bodies	Zygosporangia	Ascospores	Basidiospores	No sexual phase

Phycomycetes or zygomycetes

(Conjugation fungi)

- Found in aquatic habitats on decaying wood in moist and damp places or obligate parasites on plants.
- Mycelium – **aseptate** and **coenocytic** (i.e. no cross wall and protoplast contain many nuclei).

- Asexual reproduction takes place by zoospore (i.e. motile) or **Aplanospores** (i.e. non motile) which produce **endogenously** (i.e. form inside the body) in the **sporangium**.
- They are also called **zygomycetes** due to formation of **diploid zygospore** (i.e. form by the fusion of two gametes) during sexual reproduction.
- Gamete could be **isogamous** (i.e. similar in morphology) or **anisogamous** (i.e. dissimilar in morphology).
- Zygospore have protective covering which can withstand extreme conditions and in favourable conditions its diploid nucleus undergoes meiosis and produce haploid hyphae.

Example: *Rhizopus* (bread mould), *Mucor* and *Albugo* (parasitic fungi on mustard) etc.

Ascomycetes

- It include **unicellular Yeast** (i.e. *Saccharomyces*) or **multicellular fungi** (*Penicillium*, blue green moulds) etc.
- Mode of nutrition – mainly **saprophytic** or **parasitic** and some are **decomposer** or **coprophilous** (i.e. growing on dung).
- Have **mycelium** which contain septate and branched hyphae (i.e. contain pores in septa through which nuclei can migrate).
- Asexual reproduction by **conidia** (i.e. Produce exogenously on the tip of hyphae called **conidiophores**).
- Sexual reproduction occurs through **ascospores** (i.e. produce endogenously in **asci**).

Example: *Saccharomyces* or yeast (unicellular fungi), *Penicillium*, *Aspergillus*, *Claviceps* (parasitic fungi); *Neurospora* (used in genetic experiments), *Morels* (edible fungi).

Basidiomycetes (club fungi)

- Grow in soil, on logs and tree stump and living plant bodies as parasite in the form of rust and smuts.
- Mycelium is branched septate.
- **Asexual reproduction absent** but **vegetative reproduction** takes place by **fragmentation**.
- **Sexual reproduction** occurs by fusion of two different strains of haploid mycelium (i.e. dikaryotic mycelium).

Dikaryotic mycelium

Basidiocarp

Basidium

Meiosis

Basidiospores (n)

- **Basidiospore** produce **exogenously** on the **basidium**.

Example: *Agaricus* (mushrooms), *Ustilago* (smut, a parasitic fungus), *Puccinia* (rust fungus, a parasitic fungus).

- They are known as **imperfect fungi** (because only asexual and vegetative phase of fungi known while sexual phase has not been observed so far).
- Reproduce only through **asexually** – by **conidia**.
- Mycelium is septate and branched.
- **Mode of nutrition** – some are saprophytic, some parasitic while large number are decomposer (i.e. help in recycling of minerals).

Example: *Alternaria*, *Colletotrichum*, *Trichoderma*.

Kingdom Plantae

- It includes **eukaryotic, photosynthetic** plants.
- Cell wall made up of **cellulose**.
- They are **immotile** and show various modes of nutrition:
 1. **Autotrophic**
 2. **Heterotrophic** – like
 - a) **Parasitic** (live on another plant) e.g. *cuscuta*
 - b) **Insectivorous** (i.e. trap and digest insects) e.g. Pitcher plant
 - c) **Symbiotic** (live in association with nitrogen fixing bacteria or fungi) e.g. leguminous plants.
- **Life cycle exhibits alternation of generation** which have two distinct phases – **saprophytic phase (diploid)** and **gametophytic phase (haploid)**.
- It has major groups like – **Algae**, **Bryophytes**, **Pteridophytes**, **Gymnosperms**, **Angiosperms**.

Deuteromycetes (imperfect fungi)

Kingdom animalia

- It include *multicellular*, do not have cell walls.
- Generally *motile except sponges*.
- They are *heterotrophic* and show variation in nutrition like -

1. Free living and holozoic form o nutrition (include ingestion, digestion, absorption, assimilation and egestion).

2. Parasitic

3. Symbiotic

- Follow a definite pattern of growth and development.
- It is basic *consumer* on earth.
- Sexual reproduction by *fusion of gamete* which followed by embryological development.

Viruses

- They cannot be term as prokaryotes or eukaryotes because they do not have a cellular structure.
- They contain *heredity material* (i.e. DNA or RNA forming the core) which enclosed in *capsid* (i.e. protein coat).
- They *exhibit properties of both living and non living* because they do not have metabolic activity they use of the host metabolism and when remove from the body it can stored as a crystal.
- They are smallest living organism (i.e. 20nm to 303nm).
- It contains DNA or RNA as a genetic material and *no virus contain both DNA and RNA*.

Example: *Influenza and small pox virus* – contain DNA; *bacteriophage* – contains double –strand DNA; *hepatitis B, herpes virus* contain single or

double strand RNA; *tobacco mosale virus* contain single strand RNA etc.

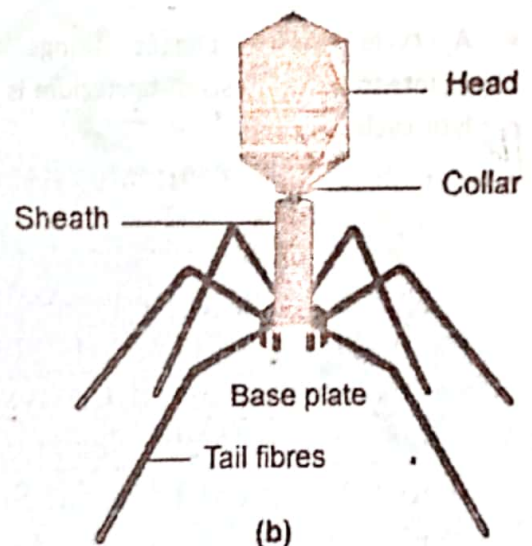
- Viruses are specific for host like bacteriophages infect bacterial cells, plant viruses – infect plant cells and animal viruses infect animal cells.

Structure of viruses

- Viruses do not have cellular structure and the contain a *core* (i.e. made up genetic material which could be either DNA or RNA) which surrounded and protected by *capsid* (i.e. protein coat).

Some viruses like *influenza and herpes viruses* have additional membranous envelop which's made up of lipoproteins.

- In general the viruses that infect plant contain *single strand RNA* and that infect animal contain *either single strand or double strand RNA or double strand DNA* and bacteriophage generally have *double strand DNA*.



- Protein coat or *capsid* is made up of *capsomeres* (i.e. subunit of capsid) which

arranged in **helical or polyhedral** geometric form.

Disease caused by virus

- Disease in human: *mumps, small pox, chicken pox, herpes, influenza, swine flu, common cold, AIDS.*
- Diseases in plant: *mosaic pattern on leaves, leaf rolling and curling, yellowing and vein clearing, dwarfing and stunted growth.*

Life cycle of viruses

- The regulation of gene decides whether the virus is going to follow a lytic or lysogenic cycle.
- In **lytic** – it undergo replication and produce more phages while in **lysogenic** – it may remain temperate and give rise to a prophage as its DNA integrate with the bacteria DNA.

Lytic cycle:

- A cycle where phages brings about disintegration or lysis of bacterium is called lytic cycle.

The bacteriophage get attached to the bacterium by its tail fiber which get contract and produce lysozyme enzyme (i.e. create a pore in cell wall and phage DNA injected into the bacterial cell).



The phage DNA coded for the phage enzyme by using the host mechanism and produce nuclease enzyme that breakdown the host DNA but fail to harm phage DNA (i.e. the phage DNA modified cytosine residues which resistant to nuclease attack)



Phage DNA replicate itself and code for new proteins which surround the phage DNA.



Lysozyme is made by the phage DNA which lysis the bacterial cell and release the phages.

Lysogenic cycle:

- In some cases phage DNA may inject its DNA into a bacterial cells but do not cause production of more phage particles because phage DNA which integrated in bacterial DNA does not exert any influence over the bacterial cell
- In this the temperate phage of virus (i.e. **prophage or provirus**) produce a **repressor protein** which keep the phage gene in **repressed stage** and keep phage DNA to multiply after generation to generation without causing any damage.
- Such bacterial cell that carries potential seeds of destruction by carrying prophage is called **lysogenic cell** and the phenomenon by which phage DNA become a part of host cell called **lysogeny**.

Retroviruses and reverse transcriptase

- Retrovirus contains oncogene and cause infected cells to become cancerous.

Example: *hepatitis B virus, herpes virus, AIDS virus and papilloma virus.*

- Retrovirus contains **RNA as genetic material** but all RNA viruses are not retroviruses.
- They have **ability to making RNA copy of themselves** which can recombined to make double stranded DNA (viz. is disintegrate randomly into the chromosome of host DNA).
- They carry the **gene for reverse transcription** which copying the RNA into DNA by enzyme **RNA-dependent DNA polymerase** or **reverse transcriptase**.

Home work – make notes on the viroids

Lichens

- It composed of **symbiotic association** of the **fungus** and **algae** or **cynobacterium**.
- The body of lichens (small and does not resemble the either partner) consist of **mass of fungal hyphae** in which **algal cells** are scattered.
- In this symbiotic association **fungus** absorb **minerals and water** from the surface and **algae** in turn **prepare food by photosynthesis**.
- Lichens can be seen as **grayish-green growth** on barren rock, bark of tree or ground.
- Lichens crumble the rock surface and produce **rich organic matter** in soil.
- Reproduction occurs by **fragmentation** of their thallus body generally.
- **Economic importance:** of lichens are: **make food for reindeer and caribou in the tundra region**, **yield pigments including pH indicator and litmus**, **being the soil formation and also used as pollutant monitors**.