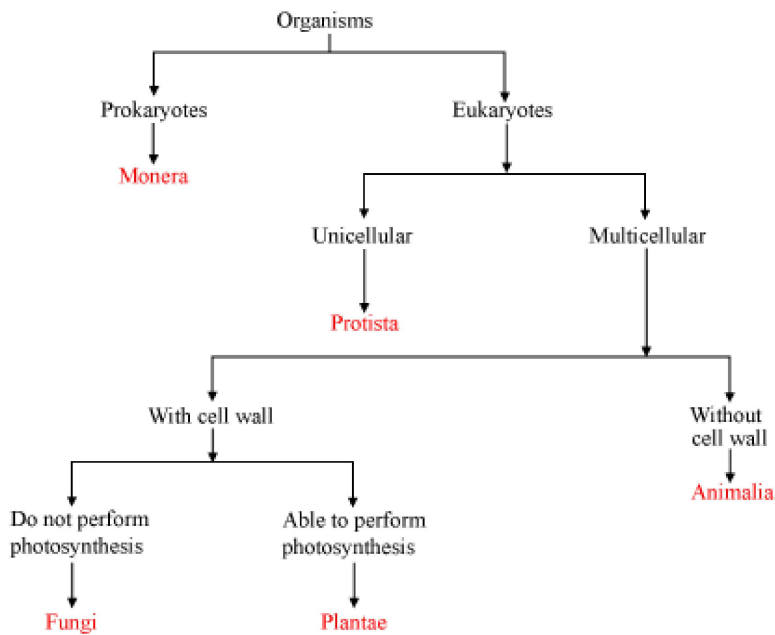


# 1. Diversity in Organisms

- **Diversity:** It refers to the variety and variability among living organisms from all sources including land, water, and other ecosystems.
- **Classification**
  - It refers to the identification, naming, and grouping of organisms into a formal system based on similarities in internal and external structures or evolutionary history
  - It helps in organising the diversity of life forms in detail.
  - **Characteristic** - A feature that helps identify or describe a person or a thing
  - There are certain characteristics that are considered more fundamental than others. These fundamental characteristics make broad divisions in living organisms.
- **Principles of classification**
  - **Nature of cell (Fundamental characteristic):** On the basis of the nature of cell, living organisms are classified as: **prokaryotes and eukaryotes**
  - **Cellularity:** On the basis of cellularity, organisms are classified as: **unicellular and multicellular**
  - **Mode of nutrition:** On the basis of mode of nutrition, organisms are classified as: **Autotrophs and heterotrophs**
- **Nomenclature**
  - The process to standardise the naming of a living organism is known as nomenclature.
  - The process of assigning a pre-existing taxon name to an individual organism is identification.
  - The system of providing a name with two components (Generic name and specific epithet) is known as **Binomial nomenclature**.
- **Binomial nomenclature was given by Carolus Linnaeus.**
  - The biological names are generally in Latin and written in italics (underlined when written by hand).  
Example: The biological name of mango is *Mangifera indica*.
  - The first word in a biological name (e.g. *Mangifera*) represents generic name, which always starts with capital letter while the second component (e.g. *indica*) represents the specific epithet that starts with a small letter.
- **IUBN** – International Code for Botanical Nomenclature and **IUZN** – International Code of Zoological Nomenclature are responsible for approving a scientific name and ensuring that this name has not been given to any other plant or animal.
- R.H. Whittaker (in 1969) proposed a five-kingdom classification of living organisms
- The five kingdoms proposed by Whittaker are: Monera, Protista, Fungi, Plantae, and Animalia



**Kingdom Monera:** It includes mainly bacteria, blue-green algae, or cyanobacteria

- **Important features of Monera:**

- Absence of well-defined nucleus or membrane-bound organelles- prokaryotic organisms.
- All of them are unicellular
- Can be autotrophic or heterotrophic

**Kingdom Protista:** It Includes protozoans such as, *Amoeba*, *Paramecium*, diatoms etc

- **Important features of protista:**

- Unicellular, eukaryotic organism
- Can be autotrophic or heterotrophic

**Kingdom Fungi:** Commonly known fungi are *Yeast*, mushroom, *Penicillium*, *Aspergillus*, etc.

- **Important features of fungi:**

- Multicellular eukaryotic organisms
- Always heterotrophic (saprophytes)
- Cell wall made of chitin

## Kingdom Plantae

- **Important features of Plantae:**

- Multicellular eukaryotic organisms
- Most of the plants contain chlorophyll. Hence, they are autotrophic
- Cell wall is made of cellulose

## Kingdom Animalia

- **Important features of Animalia:**

- Multicellular eukaryotic organisms
- Chloroplast is absent. Hence, they have heterotrophic mode of nutrition
- Cell wall is absent

## Classification

- The process of grouping living organisms into convenient categories based on simple characters is known as classification.

### **1. Two kingdom classification**

- Carolus Linnaeus divided all living things into two kingdoms- Plantae and Animalia.

### **2. Five kingdom classification**

- R.H. Whittaker divided all living things into five kingdoms- Monera, Protista, Fungi, Plantae, and Animalia.
- The main criteria for classification included
  - cell structure
  - thallus organisation
  - mode of nutrition
  - reproduction
  - phylogenetic relationship (evolutionary relationship)

## **Kingdom Monera**

- It includes all prokaryotes. Bacteria are the sole members of this kingdom.
- They have autotrophic (photosynthetic or chemosynthetic) or heterotrophic mode of nutrition.
- Bacteria can be classified into four categories based on their shapes.
  - Spirillum – spiral-shaped
  - Coccus – spherical-shaped
  - Bacillus – rod-shaped
  - Vibrium – comma-shaped

### **1. Archaeobacteria**

- It includes halophiles, which are found in extreme salty areas; thermoacidophiles, which are found in hot springs; and methanogens, which are found in marshy areas.
- Methanogens are found in the gut of ruminants and are used for the production of biogas from cow dung.

### **2. Eubacteria (also known as true bacteria)**

- It includes blue-green algae (cyanobacteria) such as *Nostoc*, *Anabaena*, etc.
- Photosynthetic bacteria contain chlorophyll *a*. Chemosynthetic bacteria oxidise various inorganic compounds and use the released energy for their ATP production.
- They have rigid cell wall and flagellum (if motile) for locomotion.

- They have specialised cells known as heterocysts, which are involved in nitrogen fixation.
- Bacteria reproduce mainly by binary fission. Spore formation and primitive type of DNA transfer techniques from one bacterium to another are also seen for reproduction.
- Mycoplasma is the smallest cell that can survive in the absence of oxygen and completely lacks a cell wall. Many of them are pathogenic to plants and animals.

## **Viruses**

- Viruses are living only when found in living organisms.
- Viruses are non-cellular organisms having either DNA or RNA as the genetic material and a protein coat.
- W.M. Stanley showed that virus can be crystallized.
- Viruses that infect bacteria are called bacteriophages.
- A bacteriophage consists of head, tail, sheath, and tail fibres.

## **Viroids and lichens**

- Viroids are infectious agents, smaller than viruses having free RNA. These lack protein coat.
- Discovered by T.O. Diener
- Lichens are symbiotic associations of algae and fungi.
  - The algal component in lichen is referred to as phycobiont while fungal component is referred to as mycobiont.
  - Lichens are good pollution indicators.

## **Kingdom Protista**

- It includes all unicellular eukaryotes.
- They have autotrophic or heterotrophic mode of nutrition.
- Have well-defined nucleus and membrane-bound organelles
- Reproduce asexually and sexually by a process of cell fusion and zygote formation
- Classes of kingdom Protista-

### **1. Chrysophytes**

- This group includes diatoms and desmids (golden algae).
- The deposition of cell walls of diatoms in their habitat is known as diatomaceous earth.
- The soil of diatomaceous earth is gritty. Therefore, it is used in polishing, filtrations of oils and syrups.
- Diatoms form the chief producers in the oceans.

## 2. Dinoflagellates

- This group includes red dinoflagellates such as *Gonyaulax*.
- These are mostly marine and photosynthetic.
- They make the sea appear red, forming red tides. The toxins released by them are harmful to marine animals.

## 3. Euglenoids

- It includes fresh water organisms such as *Euglena*.
- These organisms have both autotrophic (in presence of sunlight) and heterotrophic (in absence of sunlight) mode of nutrition.
- The outer layers of these organisms are made up of pellicle, which makes the body more flexible.
- These possess two flagella for locomotion and engulfing food.
- *Euglena* is called the connecting link between plants and animals as it possesses characteristics of both plants and animals.

## 4. Slime moulds

- This group includes saprophytic protists. They feed upon decaying parts of plants.
- Under favourable conditions, slime moulds form plasmodium.
- During unfavourable conditions, plasmodium gets differentiated and forms fruiting bodies bearing spores at their tips.

## 5. Protozoans

- They have heterotrophic mode of nutrition.
- They include four major groups of protozoans:
  - Amoeboid protozoans - Examples include *Amoeba*, *Entamoeba*.
  - Flagellated protozoans - Example includes *Trypanosoma*.
  - Ciliated protozoans - Example includes *Paramecium*.
  - Sporozoans - Example includes *Plasmodium* (malarial parasite).

## Kingdom Fungi

- It includes eukaryotes with cell wall (made of chitin), which have heterotrophic mode of nutrition.
- They may be saprophytic, parasitic, or symbiotic.
- Their body consists of long slender thread-like structures called hyphae. The network of hyphae is called mycelium.
- The symbiotic association of fungi and algae is known as lichens.

- The fungi living in symbiotic association with roots of higher plants are known as mycorrhiza.
- Fungi reproduce asexually through spores called conidia, sporangiospores, or zoospores.
- Fungi reproduce sexually through oospores, ascospores, and basidiospores.
- The sexual cycle involves three steps:  
Plasmogamy (fusion of protoplasm) → Karyogamy (Fusion of nuclei) → Meiosis in zygote, which leads to production of haploid spores

## **Four classes of kingdom fungi:**

### **1. Phycomycetes**

- Mycelium is aseptate and coenocytic.
- Asexual reproduction through zoospores or aplanospores
- Sexual reproduction - isogamous, anisogamous, or oogamous
- Examples include *Rhizopus*, *Mucor*, and *Albugo*.

### **2. Ascomycetes (sac fungi)**

- They are saprophytic, decomposers, parasitic, or coprophilous.
- Mycelium is branched and septate.
- Asexual reproduction through Conidia
- Sexual reproduction through asci
- Examples include *Aspergillus*, *Claviceps*, and *Neurospora*.

### **3. Basidiomycetes (club fungi)**

- Mycelium is branched and septate.
- Asexual reproduction is normally absent, but it reproduces vegetatively through fragmentation.
- Sexual reproduction is through basidia.
- Examples include *Agaricus*, *Puccinia*, and *Ustilago*.

### **4. Deuteromycetes (known as imperfect fungi)**

- Mycelium is branched and septate.
- Asexual reproduction through conidia
- Sexual reproduction absent
- Examples include *Alternaria*, *Colletotrichum*, and *Trichoderma*.

## **Kingdom Plantae**

- It includes all eukaryotic chlorophyll-containing organisms known as plants.
- They have autotrophic mode of reproduction.
- Cell wall is made up of cellulose.
- It exhibits the phenomenon of alternation of generation. The diploid sporophytic phase alternates with haploid gametophytic phase.
- Few members such as Venus fly trap and *Cuscuta* are heterotrophic.

## **Kingdom Animalia**

- It includes eukaryotic multicellular organisms without cell wall and having heterotrophic mode of nutrition.
- They directly or indirectly depend on plants for food.