**UNIT-I**

**Classification of Microorganisms**

* Microorganisms or microbes are microscopic organisms .
* Mcroorganisms are divided into seven types: bacteria, archaea, protozoa, algae, fungi, viruses, and multicellular animal parasites ( helminths ).
* Each type has a characteristic cellular composition, morphology, mean of locomotion, and reproduction.
* Microorganisms are beneficial in producing oxygen, decomposing organic material, providing nutrients for plants, and maintaining human health, but some can be pathogenic and cause diseases in plants and humans.
* **The microoranisms are classified in the following ways:**
* 1.Based on plants and animals
* 2.Based on cellularity
* 3.Based on the type of nuclear materials
* 4.Five Kingdom concept
* 5. Eight Kingdom concept
* 6.Three domain system

1. **Based on plants and animals**

* Aristotle (4th century BC) – classified living organisms into two kingdoms, namely Plantae and Animalia.
* Plantae includes algae, fungi, bacteria and other pants.
* Animalia includes all animals including Protozoa.

**2. Based on cellularity**

* Microbes are classified into three categories.
* 1.Non-cellular – microbes have no cells. Eg. Viruses – living chemicals.

2.Unicellular - single cell Eg. Protozoa, bacteria, some algae and some fungi

3. Multicellular – many cells Eg. Fungi, algae etc.

**3. Based on the type of nuclear materials**

- microbes are classified into two groups based on the nature of nucleus. They are:

1. Prokaryotes

2. Eukaryotes

1. **Prokaryotes**–

1. The organisms which do not contain a nucleus are called Prokaryotes.

2. The nuclear materials remain scattered in the cytoplasm.

3. No nuclear membrane – nucleoid or incipient nucleus.

4. The cell containing a nucleoid is called a Prokaryotic cell.

5. In prokayotic cells, the ribosome is 70S, chromosome is circular in shape, cell organelles like mitochondria, Golgi apparatus, lysosomes etc. are absent.

* + - Eg. Bacteria.

**2. Eukaryotes**

1.The organisms which contain a true nucleus are called Eukaryotes.

2.The ribosome is 80S, chromosome is not circular in shape, cell organelles like mitochondria, Golgi apparatus, lysosomes etc. are present.

Eg. Protozoa, algae, fungi and all animals .

**4. Five Kingdom concept**

* Whittaker proposed has five kingdoms: Monera, Protista, Fungi, Plantae and Animalia, and is widely used.
* These groups are formed on the basis of their cell structure, mode and source of nutrition and body organisation.
* The important characteristics of the five kingdoms of Whittaker are as follows:
* **1. Monera**
* These organisms do not have a **defined nucleus or organelles**, not do any of them show multi-cellular body designs.
* On the other hand, they **show diversity**based on many other **characteristics**. Some of them have cell walls while some do not.
* The mode of nutrition of organisms in this group can be either by synthesising their own food (autotrophic) or getting it from the environment (heterotrophic).
* This group includes bacteria, blue-green algae or cyanobacteria, and mycoplasma.

**2.Protista** This group includes many kinds of **unicellular eukaryotic organisms**. Some of these organisms use appendages, such as hair-like cilia or whip-like flagella for moving around.   
Their mode of nutrition can be **autotrophic or heterotrophic**. Examples are unicellular algae, diatoms and protozoans.

**3.Fungi**

- These are **heterotrophic eukaryotic organisms**. They use decaying organic material as food and are therefore called saprophytes.

- Many of them have the capacity to become multicellular organisms at certain stages in their lives.

- They have cell-walls made of a tough complex sugar called chitin. Examples are yeast and mushrooms.

- Some fungal species live in permanent mutually dependent relationships with bluegreen algae (or cyanobacteria). Such relationships are called **symbiotic**. These symbiobic life forms are called **lichens**.

**4. Plantae**

- These are **multicellular eukaryotes** with cell walls. They are autotrophs and use chlorophyll for photosynthesis.

- Thus, all plants are included in this group. Since plants and animals are most visible forms of the diversity of life around us.

**5. Animalia**

- These include all organisms which are multicellular eukaryotes without cell walls. They are heterotrophs.

- .Ingestive mode of nutrition

**5. Eight kingdom concept**

* Cavalier-Smith (1987) – divides the microbes into two empires

Having eight kingdoms,

Two empire – Bacteria and Eukaryota

I. Bacteria

1.Eubacteria – all true bacteria

2.Archaebacteria - all filamentous bacteria

II. Eukaryota – divided into six kingdoms

1. Archezoa – all microscopic animals feeding on archaebacteria
2. Protozoa – unicellula r animals
3. Chromista – photosynthetic organisms – having chloroplast in the lumen of ER. Eg. Diatoms, cryptomonads and brown algae.
4. Plantae – all photosynthetic plants and algae
5. Fungi – eukaryotic multicellular organisms having absorptive mode of nutrition.
6. Animalia – multicellular animals having ingestive mode of nutrition.

**6. Three domain system**

* Woese, Kandler and Wheelis (1990).
* It is based on the comparative analysis of ribosomal RNA in various organisms.
* It is a phylogenetic system.
* The system divides the living being into three domains. They are

1.Bacteria

It includes unicellular or filamentous prokaryotes. They have diacyl glycerol diester and eukaryotic type rRNA in the cell.

It is further divided into

Aquifex

Thermatogales

Flavobacteria

Cyanobacteria

Purple bacteria

Gram positive bacteria

Green non sulphur bacteria

* 2.Archaea
* This domain includes organisms having isopyrenoid glycerol diester in the cell membrane and archaebacterial rRNAs in the cells.
* It is divided into the following groups:
* Halophiles thermococcus
* Methanococcus thermoproteus
* Methanosarcina pyrodictium

Methanobacterium

* 3. Eukaryota
* This domain includes organisms having glycerol fatty acyldiester in the cell membrane and Eukaryotic rRNAs in the cells.
* It includes the following groups:
* Entamoeba flagellates
* Slime molds trichomonads
* Fungi
* Diplomonads