

# **MODULE 8**

## **AIM**

The aim of this module is to enable the students to develop understanding of taxonomy and nomenclature.

## **CONTENTS AND OBJECTIVES**

- Taxonomy
- Which characteristics do scientists use to identify and classify organisms?
  - ✓ Classical characteristics
  - ✓ Molecular characteristics
- Taxonomic categories
- Three domains of life

# TAXONOMY AND NOMENCLATURE

## Taxonomy

- Taxonomy is the science of biological classification. It is simply the arrangement of organisms in orderly manner into bigger groups based on the characteristics shared by them.
- Taxonomy has three interrelated parts:
  1. Identification
  2. Classification
  3. Nomenclature
- Using morphological, behavioural, genetic and biochemical observations, taxonomists identify, describe and arrange the organisms into classifications.
- The knowledge of taxonomy is far from complete. In the 250 years of research, scientists have classified around 1.8 million species of plants, animals and microorganisms. However, the total number of species is unknown and has been estimated to be between 5 to 30 million.

## WHICH CHARACTERISTICS DO SCIENTISTS USE TO IDENTIFY AND CLASSIFY ORGANISMS?

- In order to identify and classify the organisms we need to study certain characteristics.
- The taxonomic characters to be studied are of two types:
  1. Classical characteristics

These include morphology, physiology and metabolism, ecology and genetic analysis.
  2. Molecular characteristics

Molecular characteristics include studying the amino acid composition, DNA sequence analysis, DNA composition, etc.

## CLASSICAL CHARACTERISTICS

### **Morphology**

É Morphology can be easily analyzed.  
É It includes the structural features like size, shape, etc.

### **Physiology and Metabolism**

É Organisms are classified on the basis of the nutrients they require for growth, energy sources, etc.

### **Ecology**

É Very closely related organisms differ in their ecological characteristics for eg- habitat, requirement for temperature and pH, etc

### **Genetic analysis**

É The study of exchange of genetic material between the is useful for the

## MOLECULAR CHARACTERISTICS

### **Sequence of DNA**

É Techniques are available by which scientists can sequence the DNA of organisms. This reveals relatedness between them.

### **DNA composition**

É Direct comparison of the GC content of organisms is a useful tool in taxonomy.

### **Amino acid sequence**

É Comparison of amino acid sequences of proteins from different organisms reveals its taxonomic relations.

## TAXONOMIC CATEGORIES

- Organisms are classified into hierarchical ranks or categories based on their observable characteristics.
- Every category is called as taxon. A taxon is the unit of classification.
- All the living organisms are classified into the following categories:

### Kingdom

É Kingdom is the highest taxonomic category

### Phylum

É It is a collection of similar classes

### Class

É One or more than one order makes a class

### Order

- One or more than one families constitute order

### Family

É It is defined as a collection of similar genera

### Genus

É It is defined as a group of similar species

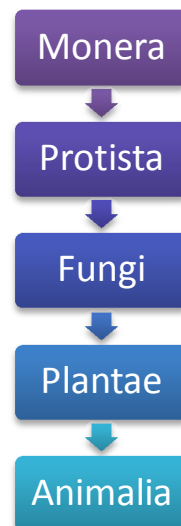
### Species

- Group of population which is similar in form, shape and reproductive features so that fertile sibling can be produced

## DIVISIONS OF LIFE

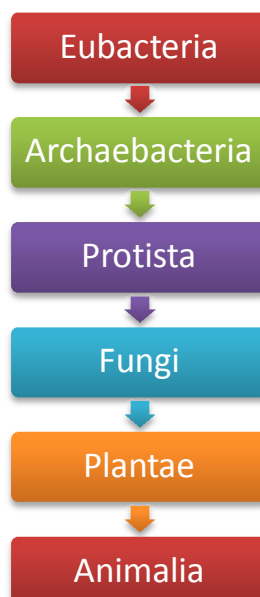
### 1. Five kingdom classification

This system was given by R. H. Whittaker in 1969. This system classified organisms into five kingdoms namely Monera, Protista, Fungi, Plantae and Animalia, on the basis of cell type, organization and means of acquiring nutrition.



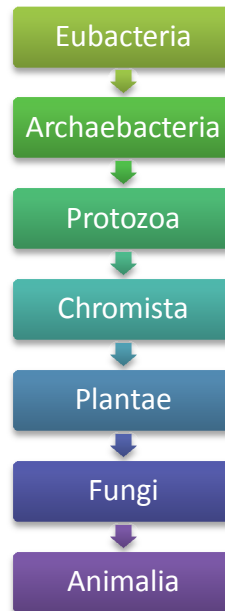
### 2. Six kingdom classification

This system of classification was introduced by Carl Woese. The system divided prokaryotes (Monera) into Eubacteria and Archaeobacteria. The six kingdoms are Eubacteria, Archaeobacteria, Protista, fungi, Plantae and Animalia.



### 3. Eight kingdom classification

It is also called as Cavalier-Smith's system of classification. This system was given by Cavalier-Smith. The eight kingdoms were Eubacteria, Archaeobacteria, Protozoa, Chromista, Plantae, Fungi and Animalia.



### THREE DOMAINS

- The three domain system is a biological classification system.
- It was introduced by Carl Woese in 1977.
- This system divides the living organisms into Archaea, Bacteria and Eukarya.
- A domain is taxonomically at a higher level than kingdom.
- Domain Eukarya has been further divided into four kingdoms- Plantae, Animalia, Fungi and Protista.

### Domain Archaea

- They mostly thrive in extreme and harsh environment and hence are also named as extremophiles.
- Archaeobacteria are divided into three categories based on their habitats:
  1. Methanogens- Produce methane as a metabolic byproduct and are obligate anaerobes.
  2. Halophiles- These bacteria occur in salt rich substrata (2.5-5.0M) Eg- Salt marshes.

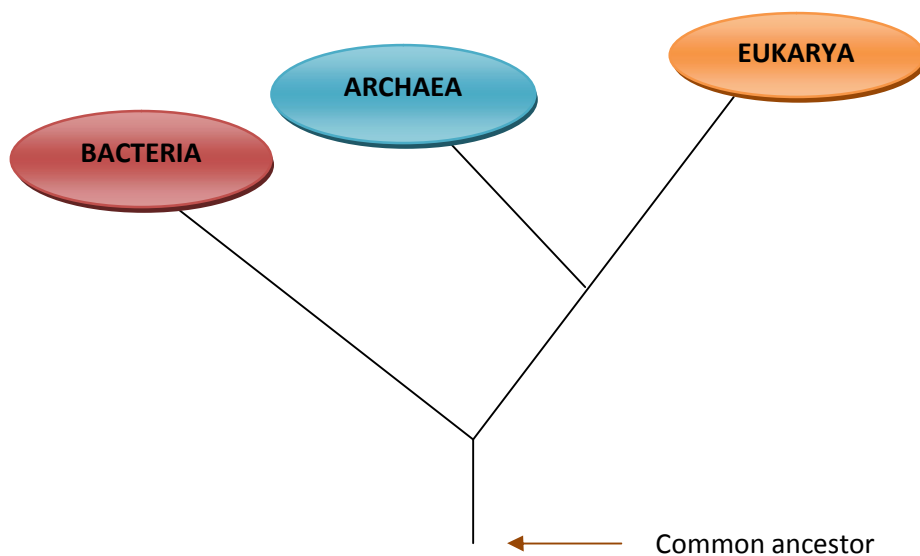
3. Thermoacidophiles- Thrive in highly acidic(pH- 2 to 3), sulphur-rich, high temperature environments.

### Domain Bacteria

- Eubacteria are categorically the most abundant organisms on Earth.
- They are highly diverse and play critical roles in carbon and sulphur cycling.
- Many of these bacteria are also responsible to causing a wide variety of diseases in higher organisms.

### Domain Eukarya

- This domain consists of four kingdoms. Out of these, only kingdom protista has unicellular organisms.
- We can differentiate Eukaryotes from prokaryotes on the basis of multicellularity and sexuality.



**The phylogenetic tree of life**