

## UNIT I: BASICS OF ANIMAL CLASSIFICATION

### SEM-I ZOOA-CCI-I-TH;

#### Five Kingdom Concept of Classification of Whittaker, 1969:

Whittaker's Five Kingdom Classification brings evolutionary changes in classification system of organisms. Since the centuries, biologists are trying to classify organisms in different ways. Even, Greek philosopher and polymath Aristotle tried to classify organisms on the basis of their habitats, such as whether they lived on land, water, or air.

Then Carolus Linnaeus proposed a two-kingdom classification that contains only two kingdoms such as, *Plantae* and kingdom *Animalia*. This classification system did not last too long because this two-kingdom classification has many Limitations .

This two Kingdom classification can not differentiate between unicellular and multicellular, eukaryotes and prokaryotes, autotroph and heterotroph etc.

It's hard to keep each group together because each group has different variations. Such as, monera and protista contain both walled and wall-less organisms, photosynthetic and non-photosynthetic organisms, unicellular and filamentous or mycelial organisms.

All these confusions help in the development of a new mode of classification called the five-kingdom

classification or Whittaker's Five Kingdom Classification.

### Whittaker's Five Kingdom Classification:

- ❖ The five-kingdom classification was proposed by R.H. Whittaker in 1969 and was built on the work of two-kingdom classification.
- ❖ In Five Kingdom Classification, the organisms are classified based on several characteristics such as mode of nutrition, thallus organization, cell structure, phylogenetic relationships, and reproduction.
- ❖ It is the most common classification system of grouping organisms based on their simple distinctive characteristics.
- ❖ Whittaker's Five Kingdom was divided into five groups; Kingdom Animalia, Kingdom Plantae, Kingdom Fungi, Kingdom Protista, Kingdom Monera (Bacteria).
- ❖ Kingdoms are divided into various subgroups such as  
Kingdom →  
Phylum → Class → Order → Family  
→ Genus → Species.

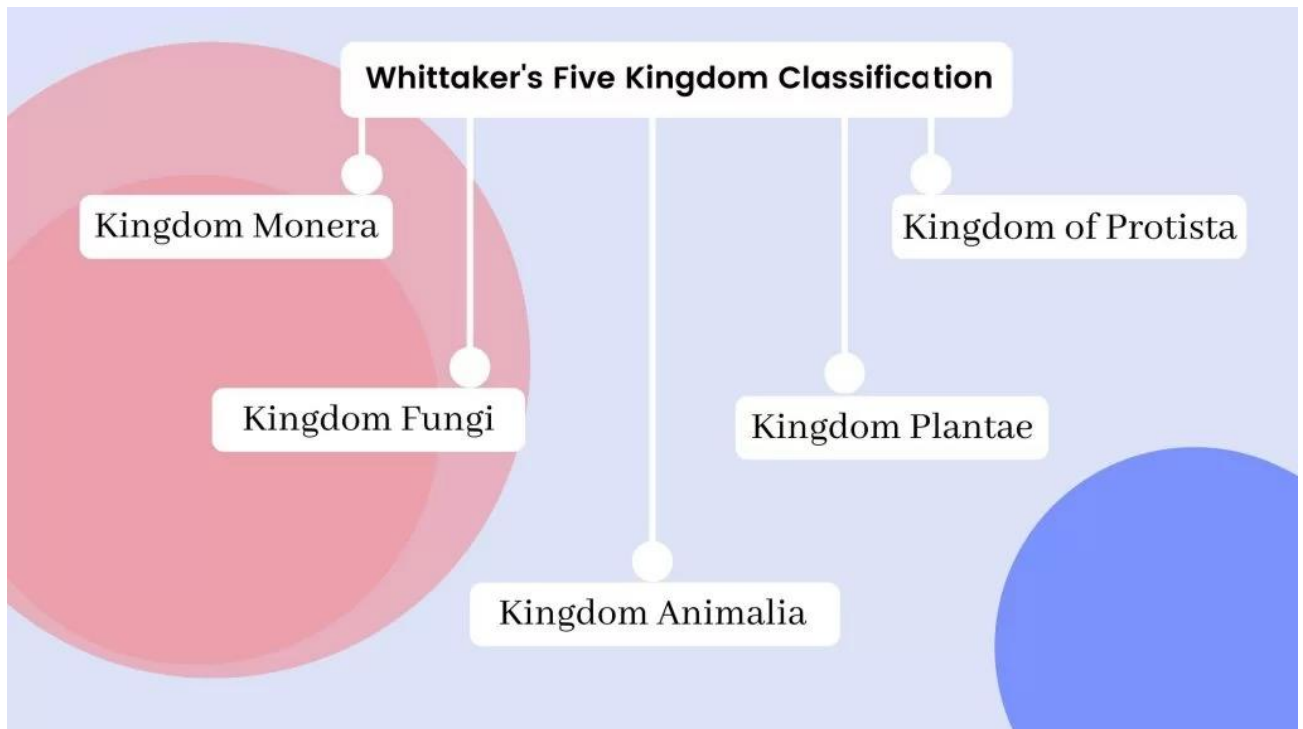
### Characteristics of the 5 Kingdoms:

1. Whittaker classified this five kingdom basis on their cell structure, mode of nutrition, mode of reproduction.

2. Mycoplasma, bacteria, actinomycetes and cyanobacteria, or blue-green algae comes under Kingdom Monera.
3. Protozoans, phytoplanktons, zooplanktons comes under Kingdom Monera Protista.
4. Molds, mushroom, and yeast comes under Kingdom Fungi.
5. Algae, Bryophytes, ferns, gymnosperms, Multicelled eukaryotes comes under Kingdom Plantae.
6. Sponges, Invertebrates, vertebrates ,Multicelled eukaryotes comes under Kingdom Animalia.

### Five Kingdom Classification Chart:

The five kingdoms are Protista, Fungi, Plantae, Animalia, and Monera, which are classified based on their cell structure, mode of nutrition, mode of reproduction and body organization. All these five Kingdoms are shown in bellow chart;



## Whittaker's Five Kingdom Classification – Five Kingdom Classification Chart

### Criteria for Five Kingdom Classification

1. Cell structure Complexity: prokaryotic and eukaryotic cells.
2. The complexity of body structure or structural organization: unicellular and multicellular.
3. Nutrition Mode: photo-autotrophy (Plantae), absorptive heterotrophy (fungi), and ingestive heterotrophy (Animalia).
4. Ecological lifestyle: producers (plantae), decomposers (fungi) and consumers (animalia).
5. Phylogenetic relationships: prokaryotes to eukaryotes, unicellular to multicellular organisms.

### Whittaker's Five Kingdom Classification:

## 1. Kingdom Monera

The kingdom Monera includes all prokaryotes—mycoplasma, bacteria, actinomycetes and cyanobacteria, or blue-green algae.

### Characteristics

#### Cell Structure:

- These are unicelled Prokaryotes and possess a cell wall.
- The cell wall is consist of amino acids and polysaccharides.
- These cells contain an envelope type of organization (the whole protoplast is covered by plasma membrane but internal compartmentalization is absent).
- These are Microscopic cells (0.1 to a few microns in length).
- In monera, the genetic material is not organized into a nucleus.
- They contain nake DNA (not associated with histone proteins).
- Membrane-bound cell organelles are absent.
- They don't have Mitotic spindle.

#### Movement:

- They use flagella (tubulin) for their movement.
- Flagella is formed of flagellin protein.

## Mode of Nutrition:

- They are heterotrophic and autotrophic.
- Most of the heterotrophs are parasitic or saprophytic and the autotrophs are chemosynthetic or photosynthetic (include both aerobes and anaerobes).
- Some of them have the ability to convert di-nitrogen into ammonia state.

**Reproduction:** They reproduced by Asexually.

## Example

Examples of Monera include Archaea and Bacteria.

## 2. Kingdom of Protista

The kingdom Protista includes all eukaryotic cells – protozoans, phytoplanktons, zooplanktons.

## Characteristics

### Cell Structure:

- They are unicellular eukaryotic cells.
- They have well organized Genetic material in the form of nucleus.
- The DNA is associated with histone proteins
- Their cellular organization is of two envelope types, such as besides the plasma membrane, internal membranes occur around certain organelles.

### Movement:

- They use flagella, cilia for their movement.
- Flagella are 11 stranded with a 9 + 2 organization of microtubules that consist of a protein called tubulin.

### Mode of Nutrition:

- Their mode of nutrition is absorption and photosynthesis.
- Euglena-like organisms have a dual mode of nutrition, holophytic or photosynthetic in light and holozoic in absence of light or presence of abundant organic matter.

### Reproduction:

- They reproduced by both Asexually and sexually.
- They lack the embryo stage.
- The tissue system is absent in Protista kingdom.

### Example

Examples of protists include the organism known as Plasmodium (which causes malaria), *Amoeba*, and *Euglena*.

### Protista Subgroups:

The Protista kingdom is subdivided into several groups such as:

#### Protozoans

These are heterotrophs in nature and live as parasites or predators.

## Dinoflagellates

- These are photosynthetic in nature and marine.
- They are responsible for the formations of red, blue, brown, green, or yellow color in marine.
- These colors are formed by their pigments in cells.

## Euglenoids

- They are mostly found in freshwater habitation in motionless water.
- They contain a protein-rich layer called pellicle, instead of cell wall

## Chrysophytes

- They are mainly found in marine and freshwater habitats.
- The Chrysophytes include the golden algae (desmids) and diatoms.

## Slime Moulds

- They are saprophytic in nature.
- These are moves along putrefying leaves and twigs.
- They get their nutrients from organic material.
- These are form an accumulation Under a favorable environment, which is called Plasmodial slime molds.

The Kingdom Protista does not seem to be a natural group due to:

- Dinoflagellates are referred to as mesokaryotic, they are not eukaryotes.
- Among all Protista kingdoms, Slime molds are quite distinct.
- The Kingdom Protista has several evolutionary lines.
- Protists have different modes of form, structure, and life.
- A distinction of unicellular protist algae and green algae included in Volvocales is not valid.

### 3. Kingdom Fungi

The molds, mushroom, and yeast, etc fall under this kingdom.

#### Characteristics

#### Cell Structure:

- They are multicelled eukaryotes.
- They contain a chitinous cell wall and non-cellulosic polysaccharides. Sometimes Cellulose also occurs.
- Their body is filamentous and is called mycelium.
- They have unicellular or multinucleate Hyphae.
- They contain a small nuclei and show intranuclear spindles.
- Golgi bodies are unicisternal (In most cases).
- Their cellular organisation is two envelope types.

#### Movement:

- They are non-motile.
- Mode of Nutrition:
- Most of them are heterotrophic, absorptive, saprobic.

### Reproduction:

- They reproduced by both asexually and sexually.
- They lack the Tissue differentiation.
- They store their food in glycogen and fat.

Example:

Example of a useful fungus is Penicillium.

## 4. Kingdom Plantae

- The Kingdom Plantae includes Algae, Bryophytes, ferns, gymnosperms, Multicelled eukaryotes.
- Plants are restricted to land, sea-shores and fresh water reservoirs, and some of them are fixed or free floating.

### Characteristics

#### Cell Structure:

- They are multicellular eukaryotic cell.
- Their body form is less regular
- They contain cellulosic cell walls.
- They have plastids.

#### Movement:

- They are non-motile.

- Mode of Nutrition:
- They are autotrophic.

### Reproduction:

- They reproduced by both asexually and sexually.
- Spores are present in lower plants.
- The embryo stage is absent in the algal
- Their food reserve is usually starch and fat.

### Example:

Examples of plants are mosses, ferns, conifers and flowering plants.

## 5. Kingdom Animalia

The Kingdom Animalia includes Sponges, Invertebrates, vertebrates, Multicelled eukaryotes.

### Characteristics

#### Cell Structure:

- These are multicellular eukaryotes.
- They lack cell walls.
- Plastid is absent.
- Their Body form is regular.
- They have internal organs.
- Centrioles present in the cells.

#### Movement:

- They are highly-motile.
- Mode of Nutrition:

- Their mode of nutrition is heterotrophic.

### Reproduction:

- They reproduced by both asexually and sexually.
- Their food reserve is usually starch and fat.
- Their Response to stimuli is quick.
- They have Embryo stage.

### Example:

Examples of Animalia are Porifera (sponges), Cnidaria (jellyfish), Nematoda (nematode worms), Platyhelminthes (flatworms), Annelidas (segmented worms), Mollusca (Snails and Squid), Echinodermata (starfish), Arthropoda (Insects and Crustaceans), Chordata (includes all the vertebrates: fish, amphibians, reptiles, birds, mammals)

# WHITTAKER'S FIVE KINGDOM

1

## KINGDOM MONERA

The kingdom Monera includes all prokaryotes—mycoplasma, bacteria, actinomycetes and cyanobacteria, or blue-green algae.

## KINGDOM PROTISTA

The kingdom Protista includes all eukaryotic cells - protozoans, phytoplanktons, zooplanktons.

2

3

## KINGDOM FUNGI

The molds, mushroom, and yeast, etc fall under this kingdom.

## KINGDOM PLANTAE

The Kingdom Plantae includes Algae, Bryophytes, ferns, gymnosperms, Multicelled eukaryotes. Plants are restricted to land, sea-shores and fresh water reservoirs, and some of them are fixed or free floating.

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## KINGDOM ANIMALIA

The Kingdom Animalia includes Sponges, Invertebrates, vertebrates, Multicelled eukaryotes.



## Advantage of Whittaker's Five Kingdom:

1. The first and most important advantage is, this five-kingdom classification differentiates the prokaryotes into a separate kingdom called monera. Because the prokaryotes are differ from their genetic, cellular, reproductive, and physiological organization.
2. Whittaker's Five Kingdom classification separates the fungi into a separate kingdom, which separates them from plants. The fungi has distinct biochemical, physiological and structural organization.
3. There were present several unicellular eukaryotes that had been included both amongst plants and animals, which creates a big problem. This classification separates the unicellular eukaryotes into the kingdom Protista, this helps us to distinguish them separately.
4. The 5 kingdom classification relies on ranges of organization and nutrition which developed very early and have become established in later groups which might be present in the present day.
5. In five kingdom classification, the plant and animal and plant kingdoms are more homogeneous as compared to two-kingdom classification.

6. The Whittaker's Five Kingdom classification bring out the phylogenetic relationships even between the primitive forms.

### Limitations of Whittaker's Five Kingdom:

1. This Five Kingdom classification can not differentiate between unicellular and multicellular algae, because Whittaker doesn't include the unicellular green algae in the kingdom Protista.
2. Viruses are not included in this Five Kingdom classification.
3. Archaeobacteria differ in their structure, composition, and physiology from bacteria.
4. It's hard to keep each group together because each group has different variations. Such as, monera and protista contain both walled and wall-less organisms, photosynthetic and non-photosynthetic organisms, unicellular and filamentous or mycelial organisms.
5. Mycoplasmas are placed along with prokaryotes, but they are different from bacteria.
6. Some biologists do not agree that algae and protozoa belonged to the same kingdom.
7. This five kingdom classification does not include the symbiotic associations. For example, lichens are a symbiotic association between fungi and algae.