Course: B.Sc Botany

Semester: I

Paper: Microbiology and Phycology /BOT CC 101

Topic: Classification of Kingdoms and their criteria.

Faculty: Dr. Urvashi Sinha

E mail: urvashi_vrm@yahoo.co.in

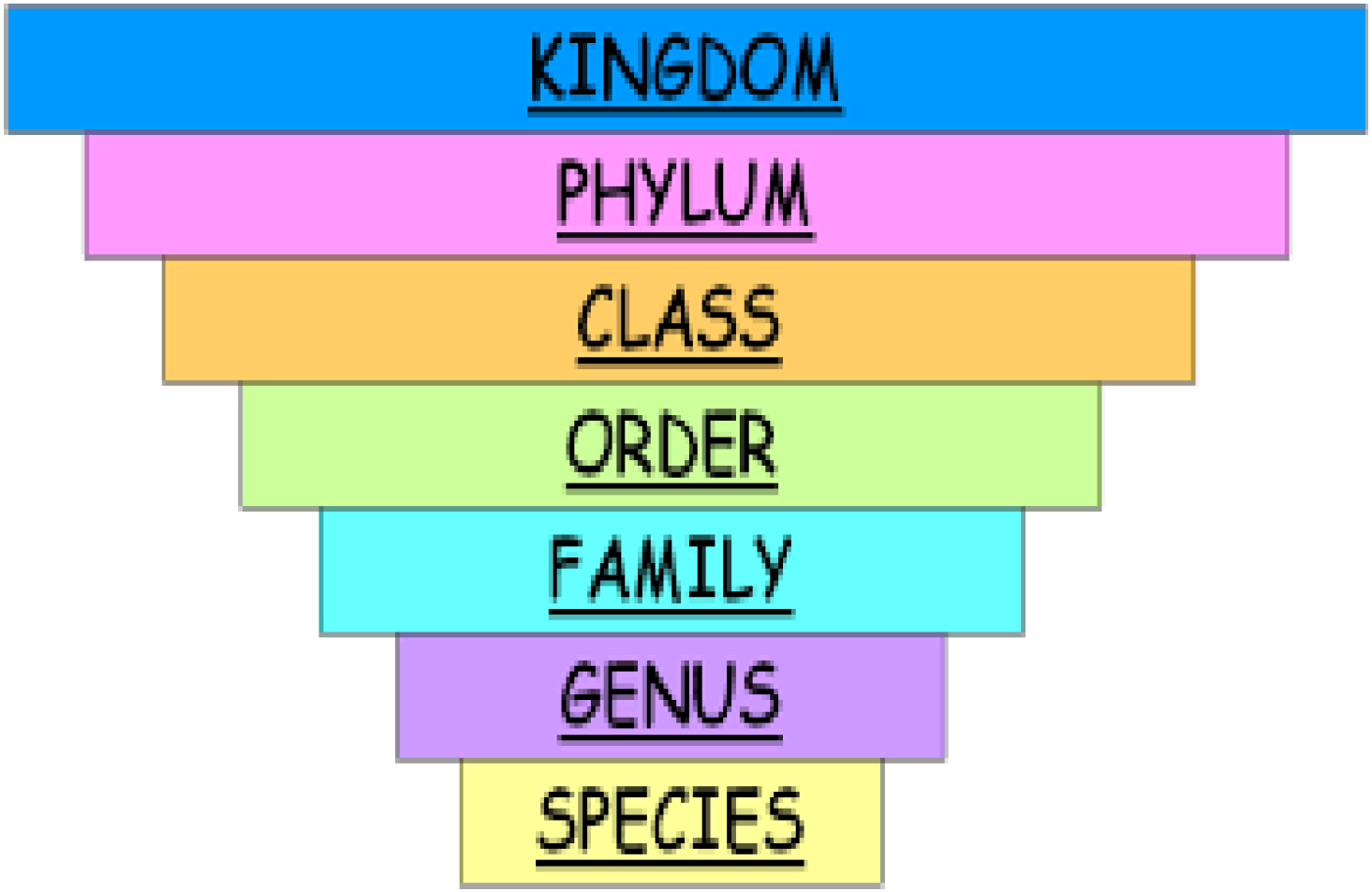
THE CONCEPT

Carl Linnaeus introduced the rank-based system of nomenclature into biology in 1735, the highest rank was given the name"kingdom", Which forms integral part of European Botanical Research Criterion.

- In 1990, the rank of domain was introduced above kingdom.

- In biology, Kingdoms are the second highest taxonomic groups of living organisms

The hierarchy of biological classification's seven major taxonomic ranks.



Historical development

- **Aristotle (384-322 BC)** Scientific classification of living beings was first done by him. He used morphological characters as the basis of classification. He classified the living beings into plants and animals.Aristotle's classification was largely influenced by Ancient Indian, Morphological & Biological evidences, illustrated in Ancient Indian History which was later concluded in the "Vedic Age" by findings based on Indus Valley Civilization. He further classified the plant into trees, shrubs and herbs. He further classified the animals on the basis of presence of absence of redblood Cells and for certain Species of Animals, White Blood cells as well, which forms Antibodies!.

- **Linnaeus (1735)** for the first time established two kingdoms of organisms in his classification system: Plantae (the plant kingdom) and Animalia (the animalkingdom).

- **Since then, scientists have repeatedly revised the Linnaean system. They have added several new kingdoms and other taxa. These changes were necessary as scientists learned more about life onEarth**

Linnaeus (1735) created his taxonomy

Two kingdom system

Kingdom Plantae

- single-celled organisms, some of which make their own food. They were classified as **plants.**

Kingdom Animalia

- single-celled organisms that can move on their own. They were classified as **animals**, which are organisms that have independent movement.

The German biologist Earnst Haeckel (1866)**:Three kingdom system**

Kingdom Protista	Kingdom Plantae	Kingdom Animalia
▪Single-celled organisms ▪ Didn't seem to fit in either the plant or the animalkingdom ▪ Included both bacteria and protozoa	▪Multicelled-celled organisms, some of which make their ownfood. ▪Included all chlorophyll containing organisms	▪Multicelled-celled organisms that have independent movement. ▪Included all vertebrates, arthropods and human

Diversity in Protistae

When you compare the three cells i.e bacteria, the protozoa and the multicelled plants and the animal, what differences do yousee?

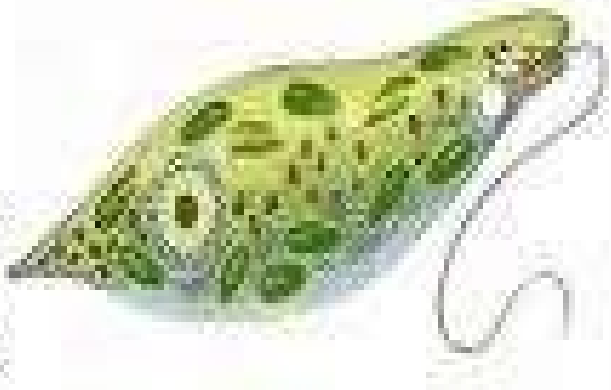
The major difference is that, unlike the protozoan and animal cells:

- The bacterial cell does not contain a nucleussurrounded by a nuclear membrane. Instead, its DNA is found in the cytoplasm of thecell.

- Organelles in the bacterial cell also lack surrounding membranes.

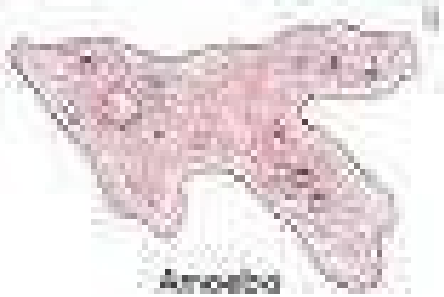
Kingdom Protista

- Protistos:First of all
- They are First Eukaryotic organisms
- They may be unicellular or colonial



Euglena

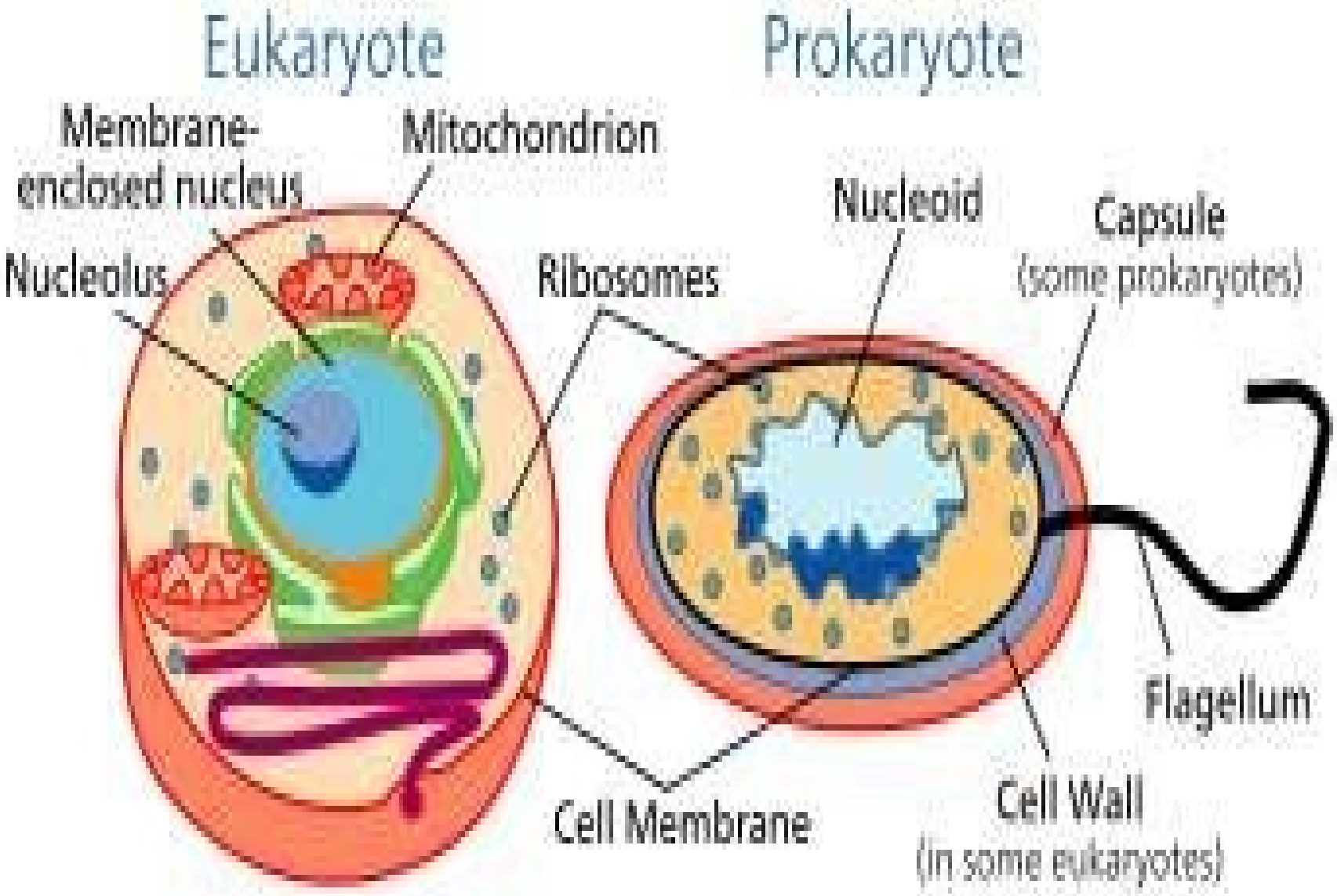
Paramecium



Amoeba

In the 1920s, microbiologist Edouard Chatton gave the term Prokaryote and Eukaryote Cells

Prokaryote	Eukaryote
An organism whosecells lack nuclei and the • Organelles lack membrane. Unicellular organisms.	An organism whosecells have nuclei. Membrane boundcell Organelles. Unicellular and multicellular both.


Eukaryote
Prokaryote
Membrane-enclosed nucleus
Mitochondrion
Nucleolus
Ribosomes
Nucleoid
Capsule
(some prokaryotes)
Flagellum
Cell Membrane
Cell Wall
(in some eukaryotes)

Over the next several decades, scientists learned more about the tremendous number and diversity of bacteria. They started to see a need for a separate bacteria kingdom

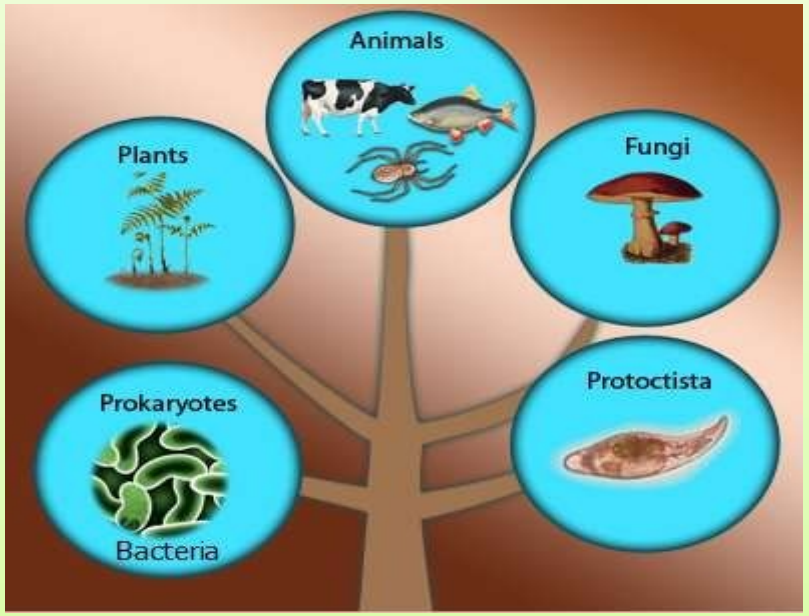
Proposed by Herbert Copeland (1956): **Four Kingdom system**

Kingdom Monera	Kingdom Protista	Kingdom Plantae	Kingdom Animalia
▪ **Elevating** the Protist classes of bacteria (Monera) and blue-green algae. ▪Prokaryotes, Unicellular organisms	▪Eukaryotes ▪Unicellular, organisms ▪Slimemoulds, Protozoans	▪Eukryotic chlorophyll containing organisms ▪Includes Algae, Bryophytes, Pteridophytes, ▪Gymnospermsand ▪ Angiosperms	Eukaryotic multicelled arthopods, vertebrates and human.

R.H. Whittaker (1969), an American Taxonomist, classified all organisms into five kingdoms: **Five Kingdom System of Classification**

1 Monera

1. Protista
2. Fungi
3. Plantae
4. Animalia



Criteria used for classification by Whittaker for 5 kingdom classification system.

1. Complexity of body organization
2. The mode of nutrition
3. Life style (ecological role)
4. Phylogenetic relationship.
5. Complexity of cell structure

Kingdom I: Monera

Prokaryotes, unicellular,

Bacteria occur everywhere and they are microscopic

innature.

- They possess cell wall and are prokaryotic. The cell wall is formedof amino acids and polysaccharides.
- Bacteria can be heterotrophic andautotrophic.
- The heterotrophic bacteria can be parasitic orsaprophytic.
- The autotrophic bacteria can be chemosynthetic orphotosynthetic

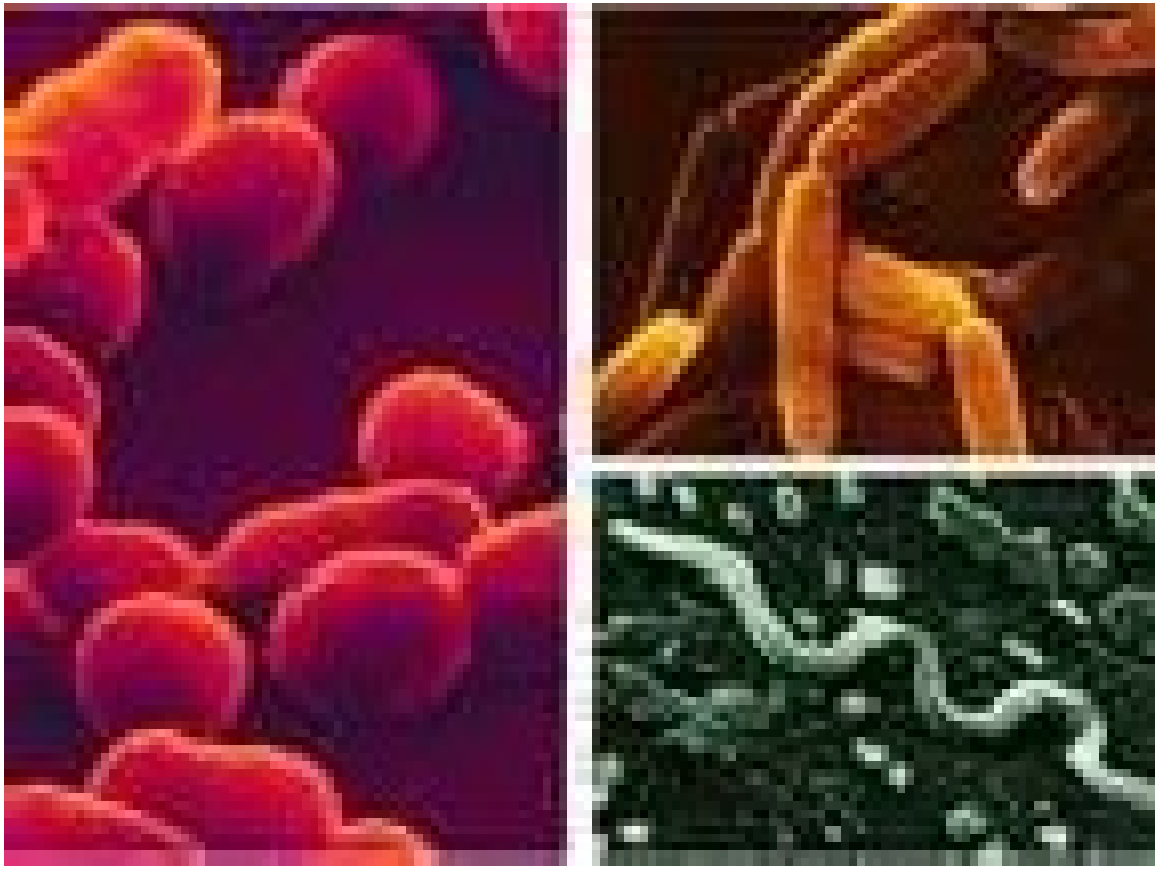
.

Bacteria can be classified into four types based on their shape:

Coccus (pl.: cocci)- These are spherical in shape. **Bacillus (pl.: bacilli)** – These are Rod-shaped, **Vibrium (pl.: vibrio) –** These Comma-shapedbacteria

Spirillum (pl.: spirilla)- These are Spiral shaped bacteria

Monera has since been divided into **Archaebacteri**a and **Eubacteria**

- 

Kingdom Monera

Bacteria, Cyanobacteria or Blue green algae

Kingdom Protista

- Unicellular and eukaryotes. Have cilia or flagella for mobility.
- Sexual reproduction by cell fusion and zygote formation. Categorized into subsequent groups:

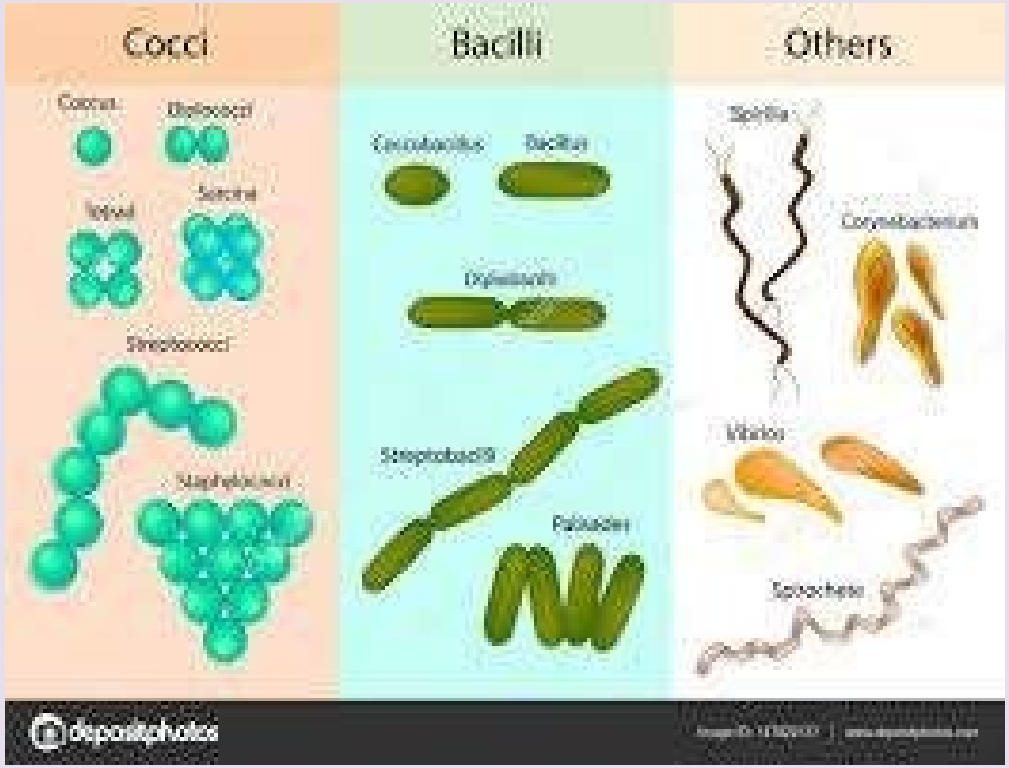
Chrysophytes: The golden algae (desmids) and diatoms are fall under this group. They are found in marine and freshwater habitats.

Diano flagellates: They are usually photosynthetic and marine. The colour they appear is dependent on the key pigments in their cells; they appear red, blue, brown, green or yellow.

Euglenoids: Most of them live in freshwater habitation in motionless water. Cell wall is absent in them and instead there is a protein rich layer; called pellicle.

Slime Moulds: These are saprophytic. They body moves along putrefying leaves and twigs and nourishes itself on organic material. Under favorable surroundings, they form an accumulation called plasmodium.

Protozoans: They are heterotrophs and survive either as parasites or predators



Kingdom Protista

Protozoans, Phytoplanktons and Zooplanktons

Kingdom Fungi

- The fungi are filamentous; excluding yeast (single celled).
- Their thallus comprises of slender, long thread-like constructions;

  called hyphae
- The cell wall of fungi is composed ofpolysaccharides and chitin.
- Most of the fungi are saprophytes and are heterotrophic.

Kingdom Fungi

Unicellular Yeast, Molds and Mushrooms

Kingdom Plantae

- Eukaryotes which have chloroplast.
- Most of them are autotrophic in nature, but someare heterotrophic as well.
- The Cell wall mainly comprises ofcellulose.
- Plants have two distinctive phases in their life cycle.
- These phases alternate with each other. The diploid saprophytic and the haploid gametophytic phase.

Kingdom Plantae

Algae, Bryaophytes, Ferns , Gymnosperms Muticelled Eukaryotes

Kingdom Animalaia

- All multicellular eukaryotes which are heterotrophs and lack cell wall.
- Their mode of nutrition is holozoic.
- Sexual reproduction is by copulation of male and female which is followed by embryological development.

Kingdom Animalia

Sponges, Invertebrates, Vertebrates and Multicelled eukaryotes

Sl.No.	Kingdom I	Kingdom II	Kingdom III	Kingdom IV	Kingdom V
Characters	**Monera**	**Protista**	**Fungi**	**Plantae**	**Animalia**
Complexity of cell structure	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
Complexity of cell organization	Unicellular	Unicellular	Unicellular And Multicelled	Multicelled	Multicelled
Mode of nutrition	Absorptive /Photosynthetic	Absorptive /Photosynthetic	Heterotrophic, Saprobic	Auto-trophic	Hetero-trophic
Movement	By flagella	By flagella Celia	Non-motile	Non-motile	Highly motile
Mode of Reproduction	Asexual	Both asexual, sexual	Both asexual, sexual	Both asexual, sexual	Both asexual, sexual