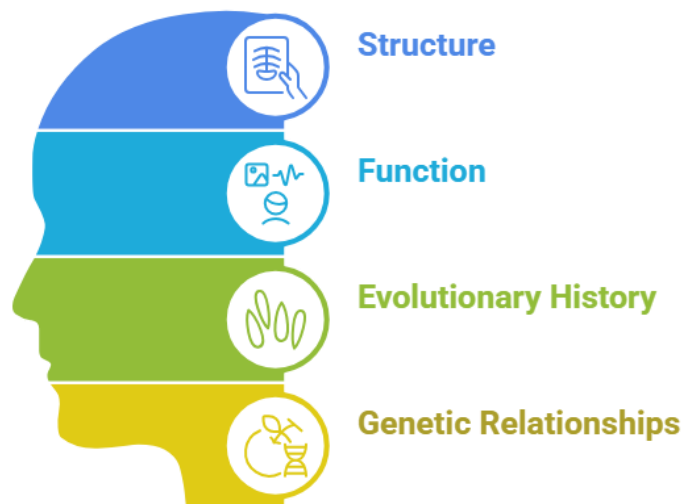


Biological Classification

What is Biological Classification?

Definition:

- Biological classification is the systematic arrangement of living organisms into groups or categories based on shared characteristics
- **These characteristics include:**
 - Structure
 - Function
 - Evolutionary history
 - Genetic relationships



Early Efforts in Classification:

- Since ancient times, humans have made efforts to classify living organisms.
- Early classification was:
 - **Instinctive**, not scientific
 - Based on practical needs, such as:
 - Identifying organisms for food
 - Using organisms for shelter
 - Utilizing organisms for clothing
- These early systems lacked a scientific basis and were limited in scope.

Aristotle's Contribution

- Aristotle was the first to attempt a systematic classification of living organisms.
- He classified organisms based on simple morphological features:

- **Plants** were divided into:
 - Trees
 - Shrubs
 - Herbs
- **Animals** were classified into:
 - Those with red blood
 - Those without red blood

Linnaeus and the Two Kingdom System

- Carl Linnaeus introduced the Two Kingdom Classification:
 - **Kingdom Plantae** – all plants
 - **Kingdom Animalia** – all animals

Limitations of the Two Kingdom System

- This system was simple and easy to understand, but it had several limitations:
 - No distinction between:
 - Prokaryotes and eukaryotes
 - Unicellular and multicellular organisms
 - Photosynthetic organisms (e.g., green algae) and non-photosynthetic organisms (e.g., fungi)
- As a result, many organisms could not be accurately placed into either kingdom, making the system **inadequate**.

Need for a More Advanced Classification System

- With advancements in science and technology, a more comprehensive approach to classification became necessary.
- Additional **criteria** were introduced for more accurate grouping, including:
 - Cell structure
 - Nature of the cell wall
 - Mode of nutrition
 - Habitat
 - Methods of reproduction
 - Evolutionary relationships

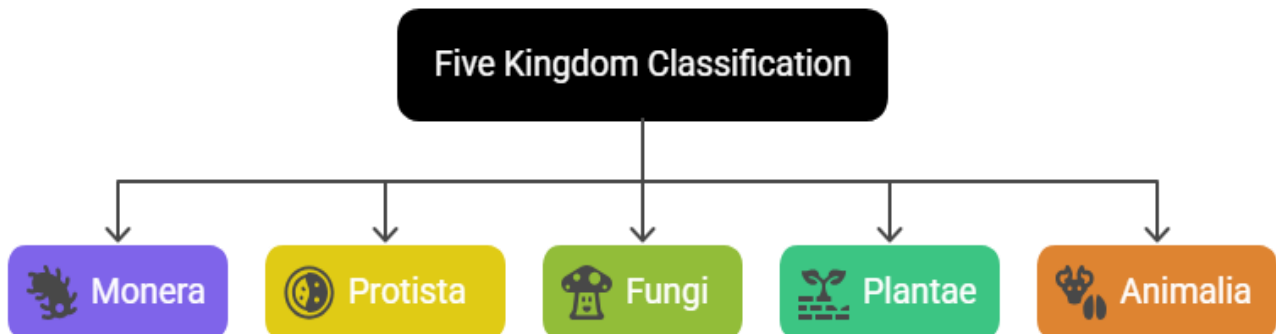
Evolution of Classification Systems

- Over time, classification systems have undergone significant changes to reflect improved scientific understanding.

- While the **Plant** and **Animal kingdoms** have remained constant across systems, the organisms included in them have changed.
- **Additionally:**
 - The number and nature of kingdoms have expanded.
 - Scientists have proposed new kingdoms to accommodate organisms that did not fit into the traditional two-kingdom system.
 - These changes reflect a deeper understanding of biodiversity and evolutionary relationships among organisms.

The Five Kingdom Classification

- In 1969, **R.H. Whittaker** proposed a comprehensive system of classification that divided organisms into five distinct kingdoms:
 1. Monera
 2. Protista
 3. Fungi
 4. Plantae
 5. Animalia



Criteria Used for Classification

- Whittaker based his classification on the following criteria:
 - **Cell Structure:** Prokaryotic or Eukaryotic
 - **Body Organization:** Unicellular, Colonial, or Multicellular
 - **Mode of Nutrition:** Autotrophic or Heterotrophic
 - **Reproduction:** Asexual or Sexual
 - **Phylogenetic Relationships:** Evolutionary history and

Characteristics of the Five Kingdoms

Characters	Monera	Protista	Fungi	Plantae	Animalia
Cell type	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic

Cell wall	Noncellulosic (Polysaccharide + amino acid)	<i>Present in some</i>	Present with chitin	Present (cellulose)	Absent
Nuclear membrane	Absent	Present	Present	Present	Present
Body organization	Cellular	Cellular	Multicellular / loose tissue	Tissue / organ	Tissue / organ / organ system
Mode of nutrition	Autotrophic (chemosynthetic and photosynthetic) and Heterotrophic (saprophytic / parasitic)	Autotrophic (Photosynthetic) and Heterotrophic	Heterotrophic (Saprophytic / Parasitic)	Autotrophic (Photosynthetic)	Heterotrophic (Holozoic / Saprophytic etc.)

Need for a New Classification System

- Earlier classification systems grouped a wide variety of organisms into the Kingdom Plantae, primarily based on the presence of a **cell wall**.
- This **kingdom** included:
 - Bacteria
 - Blue-green algae (Cyanobacteria)
 - Fungi
 - Mosses
 - Ferns
 - Gymnosperms
 - Angiosperms
- This approach led to several **inconsistencies** and **inaccuracies** in classification.
- It overlooked critical differences among organisms, especially in terms of cell structure, mode of nutrition, and body organization.

Major Inconsistencies in the Earlier System

Prokaryotic vs Eukaryotic:

- Bacteria and cyanobacteria are **prokaryotic**.
- Fungi and plants are **eukaryotic**.

Unicellular vs Multicellular Organization:

- Chlamydomonas is a unicellular organism.
- Spirogyra is multicellular.
- Despite this difference, both were grouped under **Algae**, which created confusion regarding their biological complexity.

Autotrophic vs Heterotrophic Nutrition:

- Green plants are **autotrophic**.
- Fungi are **heterotrophic**, and their cell walls are made of chitin, unlike the cellulose walls of plants.

Revised Groupings in Whittaker's Classification

- To resolve these inconsistencies, Whittaker introduced a more logical grouping:
 - **Kingdom Monera:** All prokaryotic organisms
 - **Kingdom Protista:** All unicellular eukaryotic organisms
 - Included both autotrophic forms (*Chlamydomonas*, *Chlorella*) and heterotrophic forms (*Amoeba*, *Paramecium*)
 - **Kingdom Fungi:** All heterotrophic eukaryotic organisms with chitinous cell walls
 - **Kingdom Plantae:** Multicellular, autotrophic eukaryotes with cellulose in their walls
 - **Kingdom Animalia:** Multicellular, heterotrophic eukaryotes without cell walls

Evolution of Classification – The Three-Domain System

- With advances in molecular biology, a new system known as the Three-Domain System was introduced.
- It divided Kingdom Monera into two separate domains:
 1. **Bacteria**
 2. **Archaea**
- The remaining kingdoms—Protista, Fungi, Plantae, and Animalia—are grouped under the **third** domain:
 3. **Eukarya**
- This leads to a **Six Kingdom Classification**.

Importance of Evolving Classification Systems

- Classification systems continue to evolve as scientific understanding improves. Modern systems aim to reflect:
 - Morphological characteristics
 - Physiological and reproductive traits
 - Phylogenetic (evolutionary) relationships



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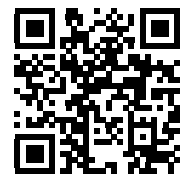


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