

Kingdom Plantae (Plant Kingdom)

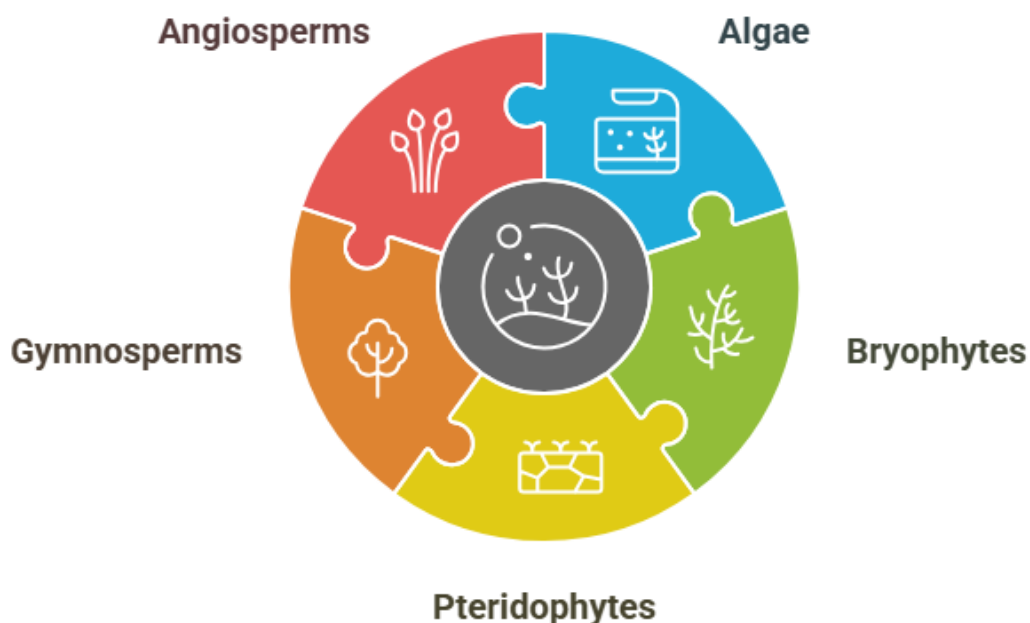
Kingdom Plantae (Plant Kingdom)

Definition of Kingdom Plantae

- **Kingdom Plantae** comprises all eukaryotic, multicellular, chlorophyll-containing autotrophic organisms, commonly referred to as **plants**.
- These organisms are characterized by:
 - The ability to synthesize their own food through photosynthesis
 - Cell walls made of cellulose
- This kingdom includes a wide variety of organisms ranging from simple algae to complex flowering plants.

Major Groups in Plant Kingdom

- The plant kingdom includes the following major groups:
 - Algae
 - Bryophytes
 - Pteridophytes
 - Gymnosperms
 - Angiosperms



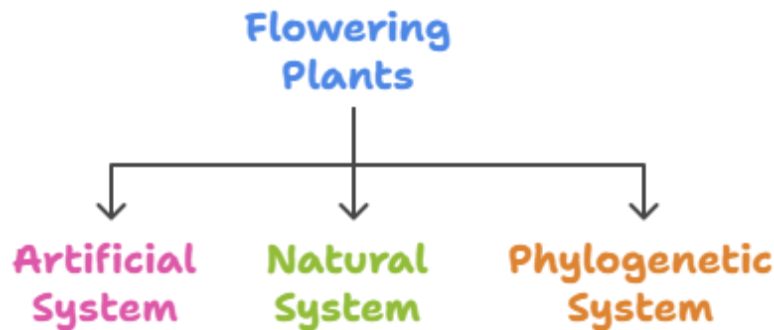
Evolution of Plant Classification Systems

- Over time, the classification of the plant kingdom has undergone refinement:
 - Organisms such as **fungi**, and members of Monera and Protista (despite having cell walls), have been excluded from Plantae.

- **Cyanobacteria** (*blue-green algae*) were once grouped with algae but are now classified under Monera due to fundamental differences.

Systems of Plant Classification

To categorize the vast diversity of flowering plants (**angiosperms**), various classification systems have been developed over the years.



A. Artificial System

- Based on superficial morphological traits, such as:
 - Habit (e.g., trees, herbs)
 - Color
 - Shape and number of leaves
 - Floral structures (especially the androecium)
- Proposed by **Carolus Linnaeus**
- **Limitations:**
 - Often separated closely related species.
 - Gave equal importance to vegetative and reproductive features, despite vegetative traits being more environmentally influenced.

B. Natural System

- Based on **natural affinities** among organisms.
- Considers both external and internal characteristics, including:
 - Ultrastructure
 - Anatomy
 - Embryology
 - Phytochemistry
- A major example: **George Bentham** and **Joseph Dalton Hooker's system**

C. Phylogenetic System

- Reflects evolutionary relationships among organisms.
- Assumes that organisms of the same taxon have a common ancestor.

- Incorporate evidence from:
 - Fossil records (when available)
 - Modern tools such as molecular biology and genetics

Modern Tools in Taxonomy

To further refine plant taxonomy, scientists now use the following modern approaches:

A. Numerical Taxonomy

- Involves quantitative assessment of numerous traits using computers.
- Assigns numbers and codes to characters.
- Each trait is given **equal importance**, allowing analysis of hundreds of characteristics simultaneously.

B. Cytotaxonomy

- Based on cytological features, including:
 - Chromosome number
 - Chromosome **structure and behavior**

C. Chemotaxonomy

- Relies on the **chemical composition** of plants.
- Helps in distinguishing species through their biochemical constituents, such as secondary metabolites.

Algae

General Characteristics

- Algae are chlorophyll-bearing, simple, thalloid, and autotrophic organisms.
- They are largely **aquatic**, found in both **freshwater** and **marine** environments.
- Additionally, they can inhabit:
 - Moist stones
 - Soils
 - Wood
- Some algae live in symbiotic associations:
 - With **fungi** (as lichens)
 - With **animals** (e.g., on sloth bears)

Structure and Diversity

- Algae show a wide range of **forms and sizes**:
 - Unicellular and colonial forms: e.g., *Volvox*
 - Filamentous forms: e.g., *Ulothrix*, *Spirogyra*
 - Massive plant bodies: Some marine forms like kelps can grow quite large.

Reproduction in Algae

Algae reproduce through:

A. Vegetative reproduction:

- By **fragmentation**
- Each fragment grows into a new thallus

B. Asexual reproduction:

- By various types of spores
- Most common: **Zoospores** (flagellated and motile)
- Zoospores germinate into new plants

C. Sexual reproduction:

- Through fusion of gametes, which may vary in structure:
 - **Isogamous**: Gametes are similar in size
 - May be flagellated (e.g., *Ulothrix*) or non-flagellated (e.g., *Spirogyra*)
 - **Anisogamous**: Gametes are dissimilar in size (e.g., *Eudorina*)

- **Oogamous:** A large, non-motile female gamete fuses with a smaller, motile male gamete (e.g., *Volvox*, *Fucus*)

Economic Importance of Algae

A. Ecological Role:

- Responsible for about half of the total **CO₂** fixation on Earth via photosynthesis
- Contribute to **increased** dissolved oxygen in aquatic ecosystems
- Act as **primary** producers of energy-rich compounds in aquatic food chains

B. Uses in Food Industry:

- Edible species: *Porphyra*, *Laminaria*, *Sargassum* (about 70 marine species used)

C. Industrial Applications:

- **Hydrocolloids** (water-holding substances):
 - Algin from brown algae
 - Carrageen from red algae
- **Agar:**
 - Derived from *Gelidium* and *Gracilaria*
 - Used in microbial culture media, ice-creams, and jellies

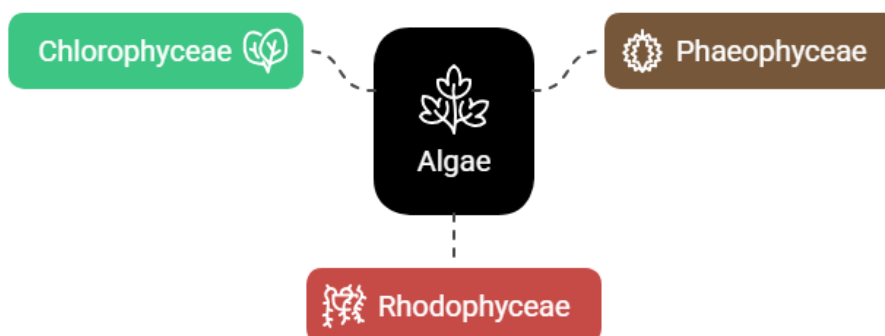
D. Nutritional Supplement:

- *Chlorella* (unicellular, protein-rich) is used as a food supplement, even by **space travelers**.

Classification of Algae

- Algae are primarily classified into three main classes based on their pigmentation, storage products, cell wall composition, and other characteristics:

1. **Chlorophyceae** – Green Algae
2. **Phaeophyceae** – Brown Algae
3. **Rhodophyceae** – Red Algae



Comparison of Algal Classes



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