Introduction

1. What is Botany?

Botany (means "herb, plant" from the Ancient Greek) is the science that specializes in the study of plants or vegetation, encompasses several fields that connect it to other life sciences.

There are more than 350,000 plant species, including over 240,000 species of flowering plants and millions of horticultural varieties. Botanists have identified plants by providing precise descriptions of their unique characteristics and then classifying them according to an orderly and coherent system.

2. History of Botany

In Antiquity, botany was a branch of medicine. Plants were studied and classified based on their uses and properties.

The philosopher Aristotle (384-322 BCE) wrote a *Treatise on Plants*, which has unfortunately been lost. His student Theophrastus (372-287 BCE) authored *History of Plants* in nine volumes, in which he classified plants according to their size: trees, shrubs, bushes, and herbs.

A Greek physician, Dioscorides (1st century CE), wrote a treatise called *De Materia Medica*, in which he classified plants into aromatic, edible, medicinal, and poisonous categories.

Pliny the Elder (23-79 CE), author of *Natural History* in 37 volumes, compiled the botanical knowledge of his time.

During the Middle Ages, botany was limited to the study of plants through ancient texts. To learn about a flower, one would not pick it in the fields but rather study it in books.

In the 16th century, botany began to flourish. Botanists described as many plants as possible by observing them in nature and classified them based on similarities and differences.

The 18th century was dominated by the work of Carl von Linné (1707-1778), through *Systema Naturae*, and the Jussieu family.

Modern systematics and phylogeny : The APG system (Angiosperm Phylogeny Group system) of plant classification is the first version of a modern, mostly molecular-based, system of plant taxonomy. Published in 1998 by the Angiosperm Phylogeny Group, it was replaced by the improved APG II in 2003, APG III system in 2009 and APG IV system in 2016.

General botany encompasses:

- **Taxonomy**: The science of describing, naming, and grouping living organisms into entities called taxa (families, genera, species, etc.) to classify them systematically.
- **Systematics**: The branch of botany focused on grouping plants into categories or systems based on morphological, cytological, biochemical, and molecular biology characteristics. Each systematic unit (order, family, genus, species) corresponds to a taxon.
- **Plant Morphology**: The study of the organs or structural parts of plants.
- **Plant Histology**: The study of plant tissues.
- **Plant Biology and Physiology**: The study of how plant organs and tissues function, including nutrition, respiration, interactions with the environment, growth, development, and reproduction (e.g., photosynthesis, nectar synthesis, fragrance and essential oil production).
- **Plant Biogeography**: The study of plant distribution across the globe and their environmental interactions, including plant pathology.
- **Phytochemistry**: The chemistry of plants, focusing on the structure, metabolism, and function of plant-derived substances, as well as methods for analyzing, purifying, and extracting natural compounds.
- **Applied botany** deals in particular with the use of plants in agriculture and forestry, horticulture, landscape management and environmental protection (medicinal plants in phytotherapy) and the selection and improvement of cultivated plants.

Classification, Taxonomy and Systematics:

Classification

Classification is the classification of living beings into more or less large groups, using well-chosen criteria (a criterion is a characteristic that living beings possess and that can be used to classify them). The disciplines involved in classification are **systematics** and **taxonomy**

Systematics

Systematics seeks to establish a description of species and organize them in relation to each other within a classification by focusing on the evolutionary relationships between species.

Taxonomy

Taxonomy deals with the attribution of names (nomenclature) and the construction of hierarchical systems.

Taxonomic hierarchy

Given the vast number of organisms, it is necessary to arrange and put in order the taxa (taxon) in a hierarchical system. (Taxa: is a conceptual entity, which is supposed to group together all living organisms, possessing in common certain well-defined taxonomic characteristics).

The main used taxa are **Kingdom, Division or Phylum, Class, Order, Family, Genus and Species**

The major groups in the classification of living organisms are distinguished as follows:

- **Monera**, which includes all prokaryotic organisms (bacteria), meaning they consist of a single cell without a nucleus.
- **Protists**, which include mostly unicellular eukaryotic organisms (that do not fit into the other kingdoms). Their cells have a nucleus.
- **Fungi**, which are eukaryotic, heterotrophic organisms with a cell wall.
- **Plants**, which are eukaryotic, autotrophic organisms with a cell wall.
- **Animals**, which are eukaryotic, heterotrophic organisms without a cell wall.

Organization of the Plant Kingdom

The classification of plants is based on several cytological, anatomical, and morphological criteria. Traditionally, the plant kingdom is divided into two major groups based on the structural organization of the plant: the presence of a Thallus or a Cormus. Thus, we distinguish: Thallophytes and Cormophytes

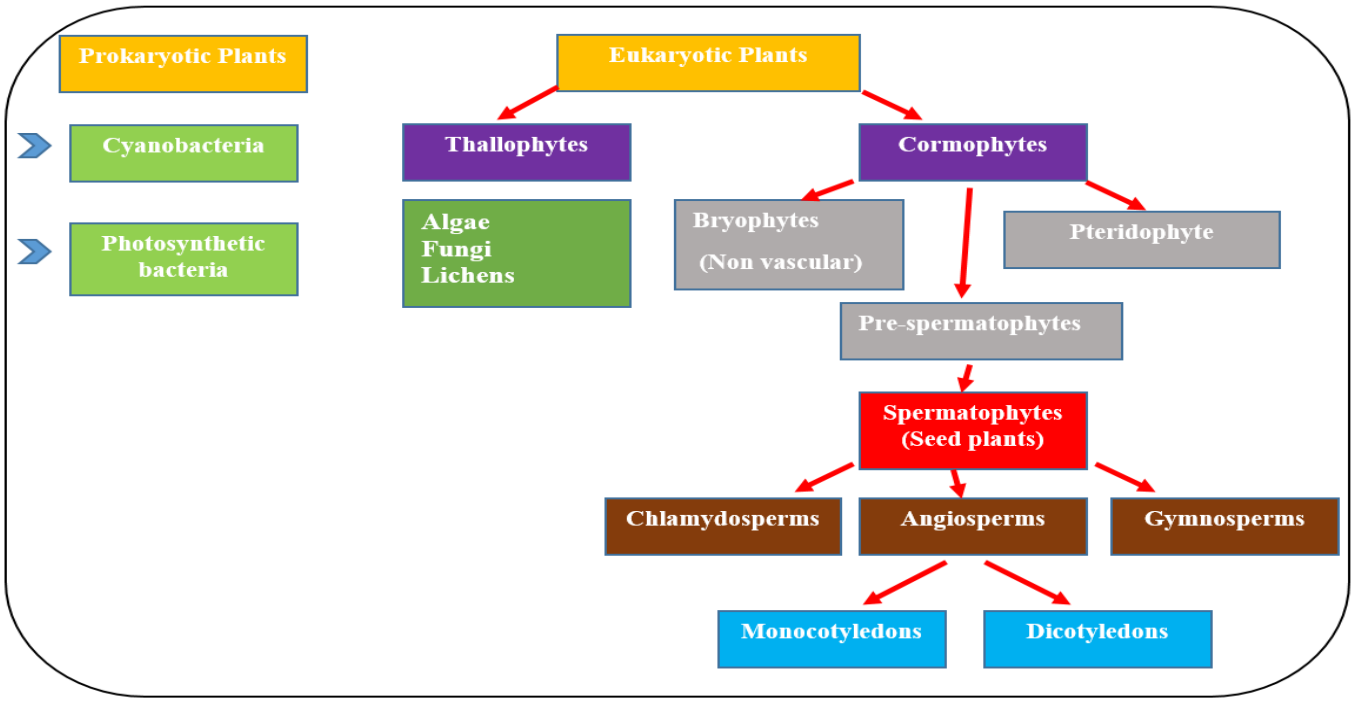
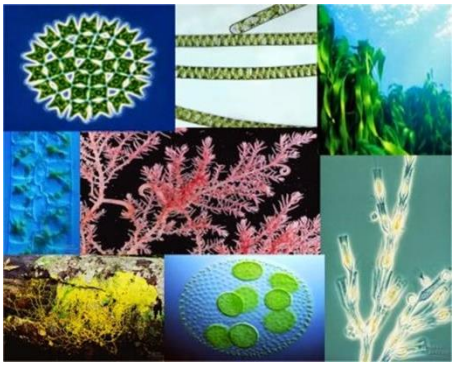


Figure : Plant Kingdom

Thallophytes

Thallophytes correspond to so-called lower plants (primitive plants consisting of a single body called a thallus with a very simple structure). Examples include algae, fungi, lichens. The thallus is composed of similar cells without physiological differentiation, where no roots, stems, leaves, or conducting vessels can be distinguished. Depending on the species, some thallophytes are unicellular, such as cyanobacteria (blue-green algae), while others are multicellular with complex structures, such as fungi and yeasts. To reproduce, thallophyte organisms can either produce spores or gametes or duplicate through vegetative propagation**.**

Fungi



Algae

Lichen

Cormophytes

Are plant organisms that have stems, leaves, and roots, contrasting with thallophytes. Their emergence enabled the colonization of land by plants and the diversification of plant life. This group consists of higher plants with chlorophyll, where starch is stored in plastids. They are always multicellular organisms, and their eukaryotic cells are organized into tissues, which in turn form organs much more complex than a thallus, called a cormus, hence the name cormophyte. There is a wide variety of cormi, ranging in size from one millimeter for duckweed to 100 meters for a sequoia. Cormophytes are divided into several phyla:

Bryophytes

They are also called mosses, with approximately 25,000 species existing worldwide. Bryophytes are plants composed of structures resembling "stems" and "leaves", but they lack true roots, having only filamentous rhizoids instead. They do not possess true conducting vessels or woody tissues**,** only elongated cells in certain moss stems.Bryophytes inhabit various environments**,** with most thriving in humid areas such as forest understories, riverbanks, and rooftops. They are small terrestrial plants**,** only a few centimeters long,

and are chlorophyllous (autotrophic)**.** The presence of water is crucial for their biological cycle, as their gametes are aquatic**.**

Pteridophytes

These are vascular plants (ferns). They have a root system and a conducting system**,** but they do not produce flowers or seeds**.** More than 10000 species are recorded in this plant group. Pteridophytes are cryptogams**,** meaning they reproduce without seeds or flowers**.** They reproduce through spores in an aquatic environment**.**

Figure : Pteridophytes

Pre-Spermatophytes

This is an intermediate group between pteridophytes and spermatophytes. They appeared 400 million years ago. Over time, this group declined, giving way to spermatophytes (seed plants). Today, only about a hundred species remain, considered living fossils, which allow scientists to study the organization and evolution of this group.

Spermatophytes (Phanerogams)

Flowering plants or phanerogams are plants made up of two parts: the reproductive elements and the perianth or protective elements, which are composed of different parts called floral parts, hence the name spermatophytes (from Greek, sperma: seed; phytes: plant). There are three sub-division distinguished:

Gymnosperms

The term "gymnosperms" comes from the Greek word (gymnos: naked and sperma: seed). These are plants with reduced flowers consisting only of reproductive organs and naked seeds (gymnosperms are seed-bearing plants). Most gymnosperms are trees that form large forests. There are approximately 700 species, spread across 07 classes. The most important class is that of conifers, which includes around 550 species.

Chlamydosperms

(Chlamydos: covering; sperma: seed) These plants are isolated in the current flora and are considered intermediates between gymnosperms and angiosperms.

Angiosperms

Angiosperms include flowering plants. Their reproductive organs are condensed into an organ called the flower, which is well-defined, and their fertilized seeds are enclosed within a fruit. They are characterized by the appearance of a structure called the ovary, which protects the ovules. Thus, "angiosperm" means in Greek "seed in a container," in contrast to gymnosperms (naked seed). Angiosperms represent the largest portion of terrestrial plant species, with 250,000 to 300,000 species. Angiosperms include both **Dicotyledons** and **Monocotyledons**.

Rules of botanical Nomenclature

The International Code of Botanical Nomenclature (ICBN) is adopted by all botanists around the world for the naming protocol. This code makes sure that each plant gets a specific name and that name is globally identified.

The naming follows certain conventions :

1. All the scientific names of organisms are usually Latin. Hence, they are written in italics.
2. There exist two parts of a name. The first word identifies the genus and the second word identifies the species.
3. When the names are handwritten, they are underlined or italicized if typed. This is done to specify its Latin origin.
4. The name of the genus starts with a capital letter and the name of the species starts with a small letter.

5. Name of the scientist should be written in short letter after the specific name.

Some botanists have widely recognized abbreviations:

- **L.** – Carl Linnaeus
- **DC.** – Augustin Pyramus de Candolle
- **Engl.** – Adolf Engler

Main taxonomic ranks and their corresponding suffixes:

Taxonomic Rank	Standard Suffix	Example
Kingdom	*(no standard suffix)*	*Plantae*
Phylum (Division)	**-phyta**	*Magnoliophyta*
Class	**-opsida**	*Liliopsida*
Order	**-ales**	*Rosales*
Family	**-aceae**	*Fabaceae*
Genus	*(no standard suffix)*	*Rosa*
Species	*(binomial, no fixed suffix)*	*Rosa canina*