

Introduction to Botany

Introduction to Botany

The scientific study of plants, their structure, function, growth, evolution, and uses.

1. What Is Botany?

- **Definition:** Branch of biology that focuses on all aspects of plant life.
- **Scope:** Includes algae, mosses, ferns, conifers, flowering plants, and plant-like organisms.
- **Goal:** Understand how plants work, how they interact with the environment, and how they can be applied in agriculture, medicine, industry, and conservation.

2. Major Subdisciplines

Subdiscipline	Focus	Typical Topics
Plant Anatomy	Internal structure of plant parts	Tissues (parenchyma, collenchyma, sclerenchyma), vascular bundles, leaf cross sections
Plant Physiology	Functions and processes	Photosynthesis, respiration, transpiration, hormone signaling
Plant Taxonomy & Systematics	Classification & evolutionary relationships	Linnaean hierarchy, phylogenetic trees, molecular markers
Ecology & Plant-Environment Interactions	Plant roles in ecosystems	Plant communities, succession, adaptations to stress
Plant Genetics & Breeding	Inheritance and improvement	Mendelian genetics, genome editing, hybridization
Economic Botany	Human uses of plants	Food crops, pharmaceuticals, timber, biofuels
Paleobotany	Fossil plants & plant evolution	Coal formation, early land plant colonization
Phytopathology	Plant diseases	Pathogen life cycles, disease management

Introduction to Botany

3. Basic Plant Organization

1. **Cell** – Plant cells have a rigid cell wall, chloroplasts, central vacuole, and plasmodesmata.
 2. **Tissue** – Groups of similar cells performing a common function (e.g., epidermis, ground tissue, vascular tissue).
 3. **Organ** – Collections of tissues forming roots, stems, leaves, flowers, fruits, and seeds.
 4. **Organ System** – Whole plant body; includes underground (root system) and above-ground (shoot system) components.
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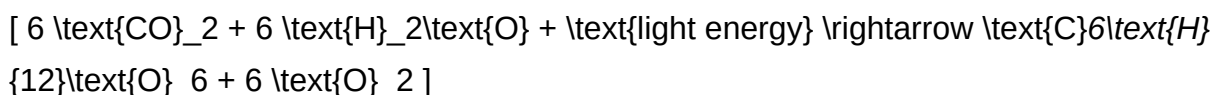
4. Life Cycle Overview

Phase	Description	Key Structures
Germination	Dormant seed → seedling	Radicle, plumule
Vegetative Growth	Production of leaves, stems, roots	Apical meristems
Reproductive Phase	Formation of flowers/cones → pollination	Gametophytes (male & female)
Fertilization	Fusion of gametes → zygote	Double fertilization (angiosperms)
Seed Development	Embryo maturation, storage tissue formation	Endosperm, seed coat
Dispersal	Spread of seeds or spores	Fruit, wind, animals

5. Photosynthesis – The Core Energy Process

1. **Light-dependent reactions** (thylakoid membranes)
 - Capture photons → split water → produce ATP & NADPH.
2. **Calvin Cycle** (stroma)
 - Use ATP & NADPH to fix CO₂ into triose phosphates → glucose.

Key Equation



Introduction to Botany

6. Plant Hormones (Phytohormones)

| Hormone |