

Big Picture

Plants are multicellular eukaryotes with cell walls made of cellulose. Plants are essential to our environment because they provide oxygen and take in carbon dioxide, create habitats for animals, and supply food for almost every living organism on Earth. Plants use photosynthesis to produce energy for themselves and other living things. Plants evolved from stoneworts, which reproduced by releasing spores, into species more capable of dispersing their seeds.

Key Terms

Plants: Multicellular eukaryotes with cell walls made of cellulose.

Alternation of Generations: Change back and forth from one generation to the next between haploid and diploid stages in the life cycle of plants.

Haploid: Having only one chromosome of each type.

Diploid: Having two of each type of chromosome (twice the amount of chromosomes in haploids).

Gametophyte: Haploid individual produced through asexual reproduction with spores.

Sporophyte: Diploid individual produced through fertilization of gametes (reproductive cells).

Spore: Reproductive structure adapted for dispersal and surviving extended periods of time in unfavorable conditions.

Vegetative Reproduction: Reproduction through stems, roots, or leaves.

Stonewort: An aquatic algae that is similar to the ancestor many early plants evolved from.

Rhizoid: Hair-like structure in a nonvascular plant that absorbs water and minerals and anchors the plant to a surface.

Vascular Tissue: Type of tissue in plants that transports fluids through the plant.

Lignin: Tough, hydrophobic carbohydrate molecule that stiffens and waterproofs vascular tissues of plants.

Seed: Contains an embryo and a food supply enclosed within a tough coating.

Germination: Early growth and development of a plant embryo in a seed.

Gymnosperm: Type of seed plant that produces bare seeds in cones.

Cone: Structure consisting of scales that bear naked seeds in the type of seed plants called gymnosperms.

Angiosperm: A seed plant that buds flowers.

Flower: A structure in angiosperms that consists of both male and female reproductive structures.

Weeds: Plants that grow where people do not want them, such as in fields or in gardens.

What are Plants?

Plants are:

- Multicellular eukaryotes
- Cells have chloroplasts
- Cell walls made of cellulose
- Have specialized reproductive systems
- Make food and grow by photosynthesis
 - Requires water, sunlight, and carbon dioxide to produce energy

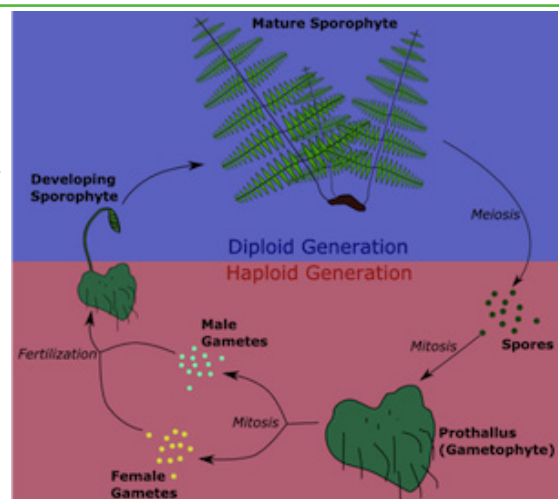
Life Cycle of Plants

All plants undergo **alternation of generations**.

- Allows for both asexual reproduction (**haploid** generation) and sexual reproduction (**diploid** generation).
- Early plants reproduce with **spores** and spend most of the life cycle as haploid **gametophytes**. Spores require little energy and matter to produce, and they grow into new individuals without the need for fertilization.
- Modern plants reproduce with gametes using pollen and seeds and spend most of the life cycle as diploid **sporophytes**.
- The asexual method of reproduction for modern plants is called **vegetative reproduction**.

Figure: Alternation of generations between haploid and diploid generations.

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PLANT KINGDOM CONT.

Evolution of Plants

1. Earliest plants most likely resemble **stonewort**, a type of aquatic algae. They have stiff stems and **rhizoids** that act as roots. They have distinct male and female reproductive structures.
2. Plants moved on land as early as 700 million years ago. They were small and low to the ground.
3. To deal with dry land, plants evolved **vascular tissues** that form a "plumbing system" that carries water and minerals from the soil to the leaves for photosynthesis. They also carry the food (sugar dissolved in water) from the photosynthetic cells to other cells in the plant. These tissues allowed the plants to grow large and endure periods of drought in hard land environments. Other adaptations include:
 - **Lignin**: A tough carbohydrate molecule that is "water fearing," or hydrophobic. Lignin adds support to the vascular tissues in the stem. By waterproofing them, it makes them more efficient at transporting fluids.
 - Roots that can penetrate soil and rock, absorb water and minerals, and anchor the plant.
 - Leaves with a lot of chloroplasts.
4. Plants then evolved to have **seeds**. The tough coating of the seed protects and nourishes the embryo (a zygote that has already begun development). The growth of the plant inside the seed is called **germination**. This increases the chances for the embryo to survive in tough conditions.
5. Different types of seed plants emerge.
 - **Gymnosperms** produce exposed seeds in **cones**. Cones are made up of overlapping scales, which are modified leaves.
 - **Angiosperms** are flowering plants. The male and female reproductive structures are both found in the **flowers**.

Classification of Living Plants

Major Division	Types of Plants	Number of Living Species	Description
Nonvascular Plants	Liverworts	7,000	lack leaves, roots, and stems; grow low to the ground; reproduce with spores; need a moist habitat
	Hornworts	150	lack leaves, roots, and stems; taller than liverworts but still grow low to the ground; long and pointed sporophytes; reproduce with spores; need a moist habitat
	Mosses	10,000	lack leaves, roots, and stems; grow low to the ground; reproduce with spores; need a moist habitat; grow in dense clumps; most similar to vascular plants and have root-like, leaf-like, and stem-like structures
Vascular Plants	Clubmosses	1,200	roots and tiny leaves; lack stems; grow low to the ground; reproduce with spores; need a moist habitat
	Ferns	11,000	large leaves in fronds; stiff stems; tall growing; reproduce with spores; need a moist habitat
	Ginkgoes	1	only one living species; reproduce with seeds and pollen
	Cycads	160	trees with stout trunks and fern-like leaves; reproduce with seeds and pollen; produce seeds in brightly-colored cones
	Conifers	700	most are trees with needle-like leaves, such as pines; reproduce with seeds and pollen; produce seeds in cone
	Gnetae	70	trees with wooden trunks; adaptations to dryness; reproduce with seeds and pollen; produce seeds in cones
	Flowering Plants	258,650	tremendous diversity; reproduce with seeds and pollen; produce seeds in the ovaries of flowers; ovaries might grow into fruits, which helps dispersal of seeds

Importance of Plants

- Supply food to nearly all terrestrial organisms
- Produce oxygen and absorb carbon dioxide
 - Oxygen is essential for cellular respiration
 - By using carbon dioxide, plants help reduce the greenhouse effect and global warming
- Recycle matter in biogeochemical cycles (example: transpiration, nitrogen fixation)
- Provide many products for human use
- Create habitats for many organisms
- **Weeds** are nuisances because they take up space and resources, hindering the growth of desirable plants.