

Botany: The scientific study of plants.

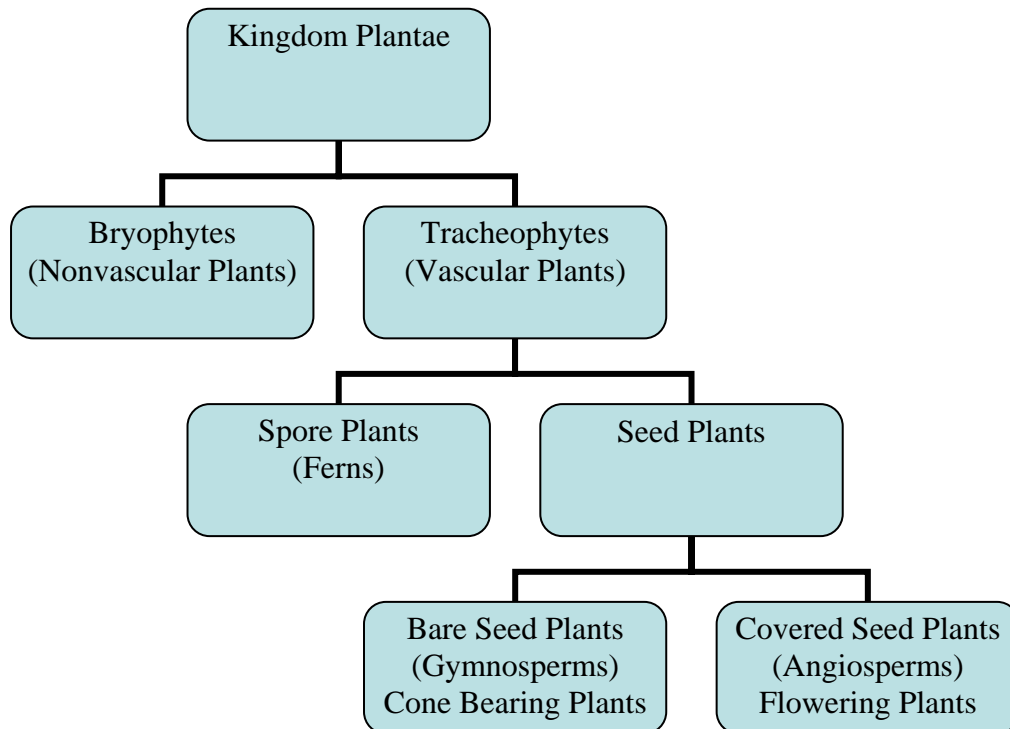
All plants are said to have a common ancestor; (ie.) it is thought that plants have evolved from an ancient group of green algae. Plants and green algae share a common evolutionary ancestry.

Characteristics of Plants

Plants have the following characteristics:

- They can undergo photosynthesis.
- They have the ability to absorb water and nutrients.
- They are able to conserve water and reduce the drying effect of air.
- They are able to exchange gases with the atmosphere.
- They have supporting tissues.
- They have conducting tissues (Xylem/Phloem)
- They are able to reproduce without water, but where sperm are able to swim.

Plant Classification



THE BRYOPHYTES

These are the **NONVASCULAR** plants. This means they DO NOT have any **vascular tissue**.

Vascular tissue: Tissue that transports water and food (glucose) throughout a plant.

Vascular tissue is made up of **xylem** and **phloem** cells.

Xylem carries water and minerals to the leaves of plants.

Phloem transports food (glucose) created in leaves throughout the plant.

Characteristics of the Bryophytes

They

- Are small plants that grow close to the ground.
- Grow best in areas where there is plenty of water.
- Lack true roots, stems, leaves.
- Require water for sexual reproduction.
- Dry out (desiccate) easily.
- Gametophyte (n)** is the dominant generation. (Dominant = one most often seen)
- Reproduction is by means of **Alternation of Generations**.

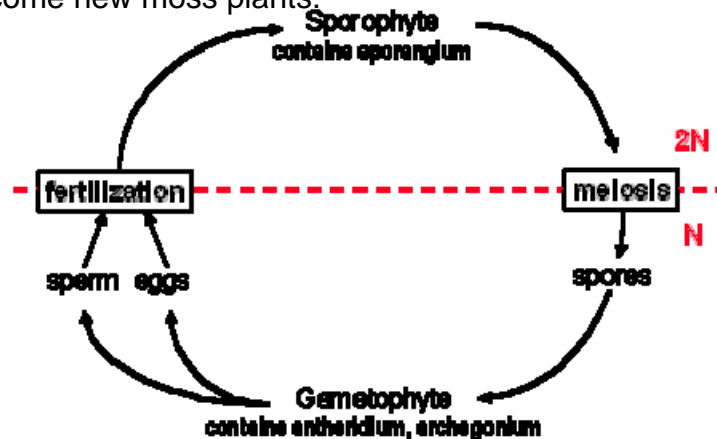
Examples of Bryophytes: 1. Mosses 2. Liverworts 3. Hornworts

Reproduction in Mosses – Alternation of Generations (See Page 170)

Stages of moss reproduction

1. Within the antheridium of a male moss, sperm (n) are created.
2. Sperm swim from the antheridium to the archegonium of a female moss containing an egg(n).
3. The egg is fertilized. A zygote (2n) forms.
4. The generation now becomes the **sporophyte generation (2n)**.
5. On top of a fertilized female plant grows a long stalk called a **sporangiophore**.
6. At the top of the sporangiophore grows a capsule called a **sporangium**.
7. Inside the sporangium are contained **spores**. The spores undergo **meiosis** to become haploid (n) spores.
8. When conditions are right, the sporangium breaks open and releases the spores. The **gametophyte generation** begins again.

9. The spores are carried back to the ground by wind, water etc where they become new moss plants.



Some Definitions

- A. **Gametophyte:** Structure that produces gametes. (Sperm and egg)
- B. **Sporophyte:** Structure that produces spores (2n).
- C. **Gametophyte Generation:** Time during the life of a moss where only males (n) and females (n) are present. These structures would produce gametes.
- D. **Sporophyte Generation(2n):** Time in the life cycle of a moss dominated by the presence of spores (2n). These structures will become new moss plants.
- E. **Antheridium:** Structure inside a male moss that produces and contains sperm.
- F. **Archegonium:** Structure inside a female moss containing eggs. This is also the site of fertilization in a moss.
- G. **Sporangiophore:** Stalk that grows out of a fertilized female moss plant. It holds up the sporangium.
- H. **Sporangium:** Capsule at the end of a sporangiophore that contains spores.
- I. **Spores:** reproductive structures (2n) that become new organisms.
- J. **Meiosis:** Process whereby the sporophyte generation (2n) is reduced to the gametophyte generation (n)

- K. **Alternation of Generations:** The switching between the gametophyte(n) and sporophyte(2n) generations during the life cycle of an organism.

THE TRACHEOPHYTES

These are the VASCULAR plants. This means that they have vascular (xylem and phloem) tissue.

Characteristics of Tracheophytes

- Have true roots, stems and leaves
- Are larger than bryophytes
- are able to live in areas with little water
- have vascular tissues (xylem and phloem)
- contain a cuticle (covering)
- Are able to reproduce **without** access to water.

Types of Tracheophytes

There are **two** types of Tracheophytes

- a. **Spore-producing plants** - these are the ferns and horsetails
- b. **Seed producing plants** - there are two types of these.
 - I) **Gymnosperms** – These are plants that have **bare seeds** or their seeds are exposed. Ex: The coniferous trees - spruce, pine, fir, hemlock
 - II) **Angiosperms** - These are plants that have seeds within **fruits**. Ex: roses, grass, tulips, oranges etc.

The Spore Producing Tracheophytes

Characteristics of the Spore Producing Tracheophytes

- Have vascular tissue
- Have true roots, stems, and leaves
- Thicker cuticle than Bryophytes
- No seeds but spores
- Sporophyte generation is dominant.
- Gametophyte generation still dependent on water for reproduction
- Both sex organs on one gametophyte

Reproduction in the Ferns

1. Male Antheridium produces sperm.
2. Sperm swims to female Archegonium to fertilize egg. *Note: Water is needed for this to occur.*
3. Fertilization occurs. A zygote (fertilized egg) results. The Zygote is Diploid (2n)
4. The Sporophyte (fern plant) begins to grow.
5. Spores are produced by Meiosis in little sacs called sporangia located in clusters called *Sori*. The Spores contain the Haploid (n) chromosome number.
6. The sporangium breaks open releasing spores.
7. Individual spores produce a *Prothallium* that contains both male and female gametophytes.

Definitions

- | | | |
|----|-----------------------|--|
| a. | <i>Antheridium</i> -- | Male reproductive structure in a fern. This structure creates sperm. |
| b. | <i>Archegonium</i> -- | Female reproductive structure in a fern. This structure creates eggs. |
| c. | <i>Prothallium</i> -- | Heart shaped reproductive structure in ferns that contains both the male portion (Antheridium) and female portion (Archegonium). |
| d. | <i>Sori</i> -- | Tiny sacs on the underside of fern leaves that contain spores. |
| e. | <i>Fron</i> d -- | The leaf of a fern plant. |

The Seed Producing Tracheophytes

These are the plants that produce seeds.

There are two types of Tracheophytes:

- a. Gymnosperms
- b. Angiosperms

Characteristics of Seed Producing Tracheophytes

- Both have **no need for water for reproduction** and have true leaves, stems and roots. (Needles are leaves).
- In both, the **sporophyte is dominant** (the plant is the sporophyte). The gametophytes are microscopic.

Seed: ***A complex structure containing an embryo, food and tough waterproof coating.***

The Gymnosperms

- These are plants with **CONES** or **Naked Seeds**.
- Conifers (Spruce, Pine and Fir Trees)** are gymnosperms.
- Their seeds are in the female cones while **pollen** (contains sperm) comes from the male cones.

Reproduction in Gymnosperms

- a. Pollen from a male cone moves by air, insect etc. to a female cone.
- b. Within the female cone, fertilization takes place.
- c. A zygote is formed.
- d. The zygote produces a seed.
- e. The seed develops and grows into a new plant (sporophyte).

The Angiosperms

Characteristics of the Angiosperms

- ❑ These are the flowering plants: the reproductive structures are located within the flower.
- ❑ These plants have Seeds that are 'Covered'.
- ❑ Male and female sex organs are in close proximity and are often placed to take advantage of wind or insects.

Types of Flowers

Perfect Flowers

Flowers that have both male and female parts (Stamen and Pistil)

Imperfect Flowers

Flowers that have either male or female parts (Stamen OR Pistil)

Flower Structure

Pistil

Female portion of the flower. Contains the *Stigma, Style and Ovary*.

Stigma – “Sticky” top of the carpel that receives pollen.

Style – Stalk that supports the stigma.

Ovary – Swollen base of the carpel that contains ovules.

Stamen

Male portion of the flower. Contains the *Anther* and *Filament*.

Anther – Structure containing “pollen”

Filament – Stalk holding up the anther.

Petals

Colourful structures to help attract pollinators.

Sepals

Leafy structures that surround the flower. Used for protection.

Fertilization/Reproduction in the Flowering Plants

1. When a pollen grain lands on a stigma it divides into **TWO** Sperm Nuclei.
2. Next, a pollen tube forms.
3. The pollen tube grows down through the style to the ovary.
4. The sperm nuclei move down the pollen tube to enter the ovule.
5. One sperm nucleus fuses with the egg to form a zygote (2N).
6. The other fuses with two polar nuclei to form a cell that becomes the **endosperm(3N)** (Food Source)
7. This is known as double fertilization

Definitions:

- a. Ovule → Space within an ovary of a flower that contains an egg and 2 polar nuclei. ***The ovule becomes the SEED in a plant.***
- b. Pollen → Male Reproductive cell. Has a tough outer coating and two nuclei within it.
- c. Endosperm → A 3n structure within the ovule of a plant created when a sperm nucleus fuses with two polar nuclei. The endosperm is a **food source** for the developing zygote in a seed.
- d. Pollen Tube → Tube that grows down through the style from the stigma to the ovary. It is a passageway for sperm to meet the egg within the ovule.
- e. Double Fertilization → This is 2 different fertilizations that occur within the ovule of a flower. One sperm fertilizes an egg while the other fertilizes the polar nuclei.
- f. Fruit → The swollen ovary of a plant. The ovary surrounds the seed and protects it. Fruits may be fleshy such as in oranges or apples or may be dry such as is the case with peanuts etc.

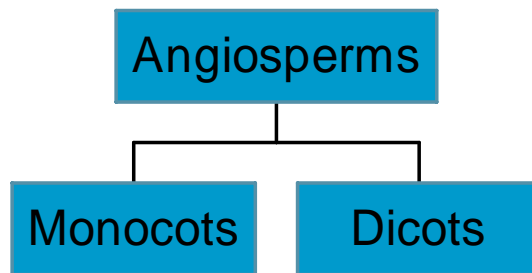
The angiosperms number more than any other type of plant on earth.

Q. Why do the angiosperms number more than any other plant on earth?

A. The reasons are:

- ▶ Animals/wind helps them pollinate and thus reproduce.
- ▶ The seeds are well protected within a fruit, thus the danger of death/destruction is minimized.
- ▶ Fruits aid with seed dispersal.
- ▶ Brightly coloured flowers help attract animal pollinators (bees). Gymnosperms do not have this feature.
- ▶ Specialized cells within angiosperms protect them from heat, cold and drought.

Types of Angiosperms



This division is based upon the number of Seed Leaves called Cotyledons.
Mono = one Di = two

Monocots .vs. Dicots

	# Seed Leaves (Cotyledons)	Veins in Leaves	Vascular Bundles in Stems	Flower Parts
Monocots	One	Parallel	Scattered	Multiples of 3
Dicots	Two	Branched	Arranged in a ring	Multiples of 4 and 5

Table 2: Plants Worksheet

Characteristics	Bryophyta	Tracheophyta		
		Ferns and fern allies	Gymnosperms	Angiosperms
Vascular vs nonvascular	<p><i>nonvascular</i></p> <p><i>lack true roots, stems and leaves</i></p> <p><i>small in size</i></p> <p><i>transport through diffusion</i></p> <p><i>no internal support</i></p>	<p><i>vascular tissue provides support and aids in transport</i></p> <p><i>possess true roots, stems and leaves</i></p>	<p><i>vascular tissue provides support and aids in transport</i></p> <p><i>possess true roots, stems and leaves</i></p>	<p><i>vascular tissue provides support and aids in transport</i></p> <p><i>possess true roots, stems and leaves</i></p>
Dependency on water	<i>yes, for movement of sperm</i>	<i>yes, for movement of sperm</i>	<i>no</i>	<i>no</i>
Dominant generation	<i>gametophyte</i>	<i>sporophyte</i>	<i>sporophyte</i>	<i>sporophyte</i>
Reproduction	<p><i>depends on water for movement of sperm to egg</i></p> <p><i>no protection of egg</i></p>	<p><i>depends on water for movement of sperm to egg</i></p> <p><i>no protection of egg</i></p>	<p><i>wind and insects are used to move sperm to egg</i></p> <p><i>seed is produced in a cone that is not covered by a fruit</i></p>	<p><i>wind and insects are used to move sperm to egg</i></p> <p><i>seed is produced in a flower that is covered by a fruit</i></p>
Examples	<i>mosses, liverworts and hornworts</i>	<i>ferns, whisk ferns, club mosses, horsetails</i>	<i>evergreens/conifers</i>	<i>deciduous trees, heaths, roses, peas, magnolias, dandelions</i>