

## What is a Plant?

- Multicellular
- Eukaryotic
- Autotrophic (photosynthesis)
- Has cell walls containing cellulose
- Lack mobility (sessile)
- Display "Alternation of Generations" in their life cycle

## Plant Life Cycle – Alternation of Generations

- The lives of plants consist of two alternating stages, or generations: a gametophyte generation and a sporophyte generation.
- One generation is dominant over the other. This means that it is larger and lasts longer.

(c) Alternation of generations

The diagram shows a cycle starting with a Diploid plant. It undergoes MEIOSIS to produce Haploid cells. These cells undergo MITOSIS to form a Haploid gametophyte. The gametophyte produces Haploid gametes, which fuse during FERTILIZATION to form a Diploid zygote. The zygote undergoes MITOSIS to become a Diploid cell, which then grows into a Diploid plant.

## Plant Life Cycle

- The stage that produces gametes (sperm and eggs) is the **Gametophyte** generation. It is haploid.
- The stage that produces spores is the **Sporophyte** generation. It is diploid.
- In most plants, the diploid sporophyte generation is dominant. In mosses, the gametophyte dominates.

The diagram shows the life cycle with numbered steps: 1. Gametophyte (n) produces Sperm and Egg. 2. Gamete fusion results in a Zygote (2n). 3. Embryo develops into a Sporophyte (2n). 4. Spore mother cell undergoes Meiosis to produce Spores (n). 5. Spores germinate into a new Gametophyte (n).

## What did they evolve from?

- Green Algae
- Similarities
  - contain chlorophyll
  - have cell walls made of cellulose
  - store energy as starch

The diagram shows the same phylogenetic tree as in the first slide, highlighting the evolutionary path from Ancestral Green Alga to various plant groups.

## Original Habitat

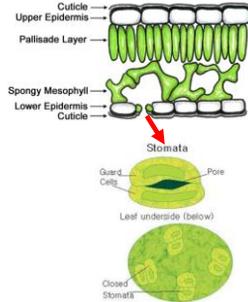
- The simplest plants live surrounded by water because water satisfies many of their needs:
  - prevents cells from drying out
  - gives structural support
  - provides nutrients
  - helps with reproduction (spore dispersal and meeting of sex cells)
- With time, plants adapted to live on land

## Adaptations for Land

### Structures for retaining moisture

Cuticle = waxy coating on the outer surface of a plant

Stomata = openings in the outer layer of leaves & some stems which regulate water loss and allow gas exchange for photosynthesis

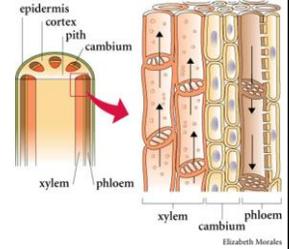


## Adaptations for Land

### Transport System

Vascular tissue to move nutrients and water throughout the plant

Also provides structure and support for the plant



## Adaptations for Land

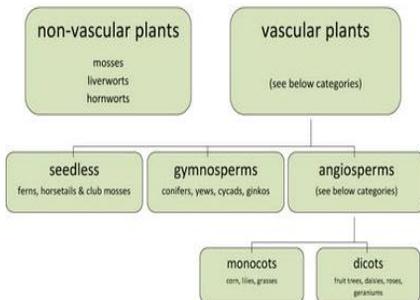
### Reproductive Strategies

adaptations that allow gametes to meet without water



## How are Plants Classified?

No phyla, rather plants are organized into 12 divisions.



## Non-Vascular Plants



Are known as Bryophytes  
Include mosses, liverworts, & hornworts

- No transport system  
- no vascular "tubes" to transport water & nutrients so must live in moist habitats
- Small size  
- no support from vascular tissues

## Non-Vascular Plants



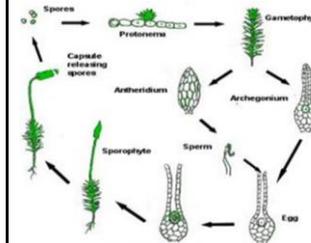
- Do not have true roots, stems and leaves
  - Have root-like rhizoids which anchor the plant and absorb nutrients
  - Absorb water through cell walls of leaf-like structures; water moves via osmosis.



- Depend on water for reproduction
  - water is needed for the sperm to swim to the egg

## Non-Vascular Plants - Reproduction

- Mosses display Alternation of Generations with the Gametophyte stage being dominant & the sporophyte stage being dependent on it



- Spores produced by a capsule (sporophyte)
- A spore grows into a leafy moss gametophyte plant
- The gametophyte produces sperm which must swim to fertilize the egg

## Vascular Plants

- Are known as Tracheophytes
  - Are true terrestrial plants
- Contain vascular tissue
    - xylem transports water
    - phloem transports food and nutrients
    - run continuously through out the plant body



## Vascular Plants

- Larger size
  - vascular tissues provide support against gravity
- Cuticle
  - reduces water evaporation from leaves and some stems



## Seedless Plants

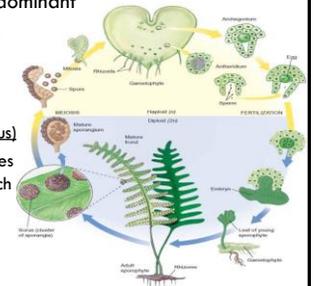
- Belong to the Class Filicineae
- Includes Ferns, horsetails, and club mosses
- Have vascular tissue, but have a rhizome underground instead of a stem and leafy fronds
- Are the most primitive Tracheophytes because they are still dependent on water for reproduction



## Seedless Plants - Reproduction

- Ferns display Alternation of Generations with the Sporophyte stage being dominant

- Spores are produced in sori on the underside of fronds (sporophyte)
- A spore grows into a heart-shaped gametophyte (prothallus)
- The prothallus produces gametes that fuse to form a zygote which grows into a frond.
- Water is necessary for fertilization.



## Seed Plants

□ Include Gymnosperms and Angiosperms

1. Have an improved vascular system with true roots, stems & leaves
2. Do not depend on water for reproduction
3. Produce seeds
  - a seed is a plant embryo



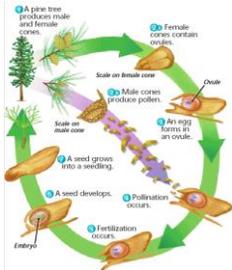
## Gymnosperms



- Gymnosperms have "naked" seeds usually protected by cones.
- They include evergreens, junipers, cedars
- Adaptations of Gymnosperms
  1. Thin, needle-like leaves
    - = retains moisture
  2. No water needed for reproduction
    - = allows diversity of habitats

## Gymnosperms – Reproduction

□ Gymnosperms display Alternation of Generations with the Sporophyte stage being dominant



- The sporophyte (tree) produces male and female cones.
- After pollination and fertilization, the zygote will develop into a naked seed attached a scale of a female cone.
- Most cones you find on the ground have lost their seeds.

## Angiosperms

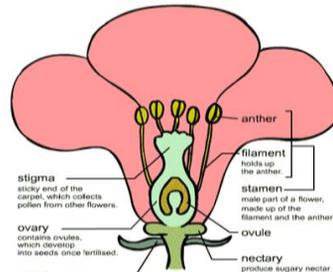
- Angiosperms are flowering plants whose seeds are produced and protected within fruit.
- Further divided into monocots and dicots.



MONOCOTS	DICOTS
<p>one cotyledon</p>	<p>two cotyledons</p>
<p>floral parts in threes</p>	<p>floral parts in fours or fives</p>
<p>parallel leaf veins</p>	<p>netlike leaf veins</p>
<p>pollen grain has one pore or furrow</p>	<p>pollen grain has three pores or furrows</p>
<p>vascular bundles throughout stem's ground tissue</p>	<p>stem's vascular bundles arranged in a ring</p>

## Angiosperms -- Reproduction

- A flower is the gametophyte reproductive structure of a plant



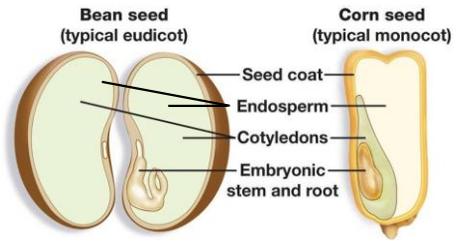
## Angiosperms -- Reproduction

- **Pollen** is produced by the stamen.
- Pollen moves away from the plant via **pollinators** (wind, birds, bees)
- The pollen lands on the pistil of another plant and fertilizes the eggs within the **ovary**
- The flower petals fall off, the ovary develops into a **fruit** that encloses the seeds
- Fruits are dispersed in a variety of ways (**wind, water, animals, mechanical**)
- Fruits are not always edible, anything with a seed inside can be considered a fruit (**helicopters, acorns, dandelions**)

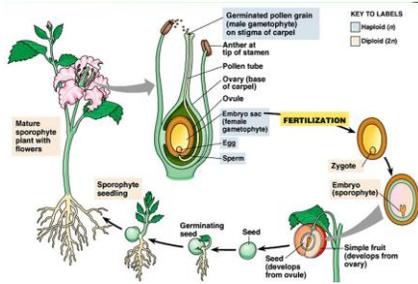
<https://www.youtube.com/watch?v=X7LW5W68Geg>

## Angiosperms -- Reproduction

- Each seed is composed of the plant embryo and a food source called the **endosperm**



## Angiosperms -- Reproduction



## Angiosperms -- Reproduction

- Many plants can clone themselves, a process called **vegetative propagation**
- = use organs of the sporophyte stage (roots, stems, leaves) to produce a new plant
- result in plants that are genetically identical to the parent plant = **clones**

## Angiosperms -- Reproduction

**Cutting** – A part of stem is cut and the cut end grows into new plant when placed in moist soil  
e.g. mango, guava, litchi, lemon, rose



**Layering** – The stem of a plant is bent down until it touches the soil. The stem is then cut once it develops roots and grows into a new plant e.g. lemon, rose, jasmine



**Grafting** – The stem of a plant is cut and then fitted on another strong plant and covered with grafting wax.  
e.g. apples, oranges, water melon, ornamental plants



**Tissue culture** - A collection of techniques used to maintain or grow plant cells, tissues or organs under sterile conditions on a nutrient culture medium of known composition



- Angiosperms display Alternation of Generations with the **Sporophyte** stage being dominant

## A sporophyte has the following characteristics:

- Spore
- Egg and sperm
- Haploid
- Diploid

Which stage is dominate in gymnosperms?

- Sporophyte
- Gametophyte
- Both of the above
- None of the above

Which stage does the zygote belong to?

- Gametophyte
- Sporophyte
- Gymnosperm
- Angiosperm

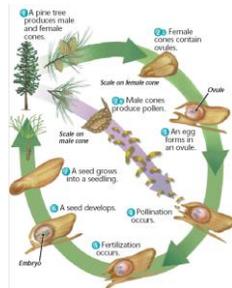
Fruits are essentially

- Plant ovaries
- Seed bearing structures
- Roots
- Stems
- Congratulations! You have been eating plant ovaries!

An orange tree branch is cut and then attached to another tree. This would be an example of \_\_\_\_\_.

1. vegetative propagation
2. grafting
3. layering
4. cutting

- <https://voitbio2013.wordpress.com/plant-reproduction/sexual-reproduction/>



Today's Agenda

- Did you know?
- Notes
- Practice

