

## 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 plant (the gametophyte). The gametophyte produces Haploid gametes. These gametes undergo Fertilization to form a Diploid cell, which then undergoes Mitosis to form 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 starting with a Haploid Gametophyte (n). It produces Spores (n) through Meiosis. The spores undergo Mitosis to form a Haploid plant. The plant produces Egg (n) and Sperm (n). Gamete fusion results in a Diploid Zygote (2n). The zygote undergoes Mitosis to form a Diploid Embryo (2n), which then grows into a Diploid Sporophyte (2n). The sporophyte produces Spore mother cells (2n) through Meiosis, which then undergo Meiosis to produce Spores (n). The spores undergo Mitosis to form a Haploid plant, completing the cycle.

## What did they evolve from?

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

The diagram illustrates the evolutionary relationships between different plant groups. It starts with Ancestral Green Alga on the left. A branch leads to Nonvascular plants, which includes Mosses, liverworts, and hornworts. Another branch leads to Vascular plants, which is further divided into Nonseed plants (Ferns and Conifers) and Seed plants (Flowering plants). Key evolutionary milestones are marked: First vascular plants, First seed plants, and First flowering plants.

## Original Habitat

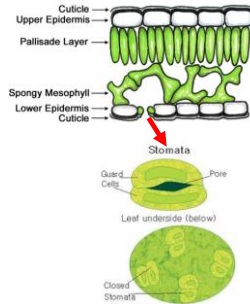
- The simplest plants live surrounded by water because water satisfies many of their needs:
  - prevents cells from drying out
  - gives structural support
  - provides nutrients
  - helps with reproduction (spore dispersal and meeting of sex cells)
- With time, plants adapted to live on land

## 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

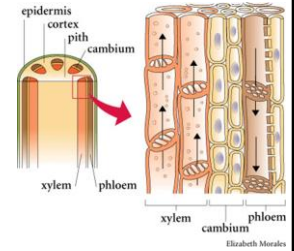


## Adaptations for Land

### □ Transport System

➤ Vascular tissue to move nutrients and water throughout the plant

➤ Also provides structure and support for the plant



## Adaptations for Land

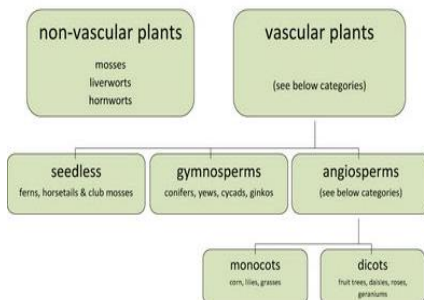
### □ Reproductive Strategies

➤ 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

1. No transport system

- no vascular "tubes" to transport water & nutrients so must live in moist habitats

2. Small size

- no support from vascular tissues

## Non-Vascular Plants



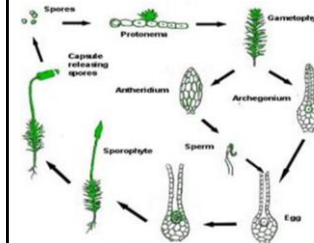
- Do not have true roots, stems and leaves
  - Have root-like rhizoids which anchor the plant and absorb nutrients
  - Absorb water through cell walls of leaf-like structures; water moves via osmosis.



- 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

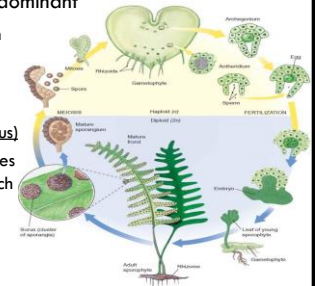
- Belong to the Class Filicineae
- Includes Ferns, horsetails, and club mosses
- Have vascular tissue, but have a rhizome underground instead of a stem and leafy fronds
- Are the most primitive Tracheophytes because they are still dependent on water for reproduction



## 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



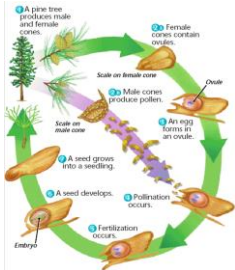
## Gymnosperms



- 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

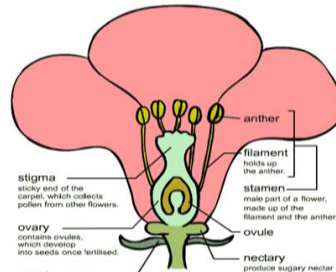
- Angiosperms are flowering plants whose seeds are produced and protected within fruit.
- Further divided into monocots and dicots.



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



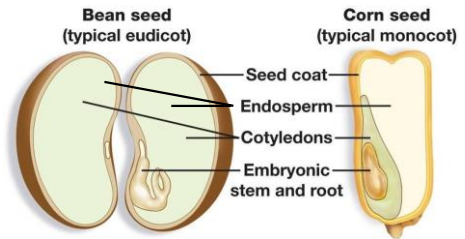
## Angiosperms -- Reproduction

- **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**)

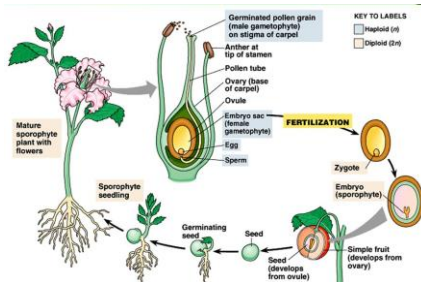
<https://www.youtube.com/watch?v=X7LW5W68Gag>

## Angiosperms -- Reproduction

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



## Angiosperms -- Reproduction

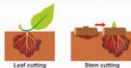


## Angiosperms -- Reproduction

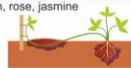
- Many plants can clone themselves, a process called **vegetative propagation**
  - = use organs of the sporophyte stage (roots, stems, leaves) to produce a new plant
  - result in plants that are genetically identical to the parent plant = **clones**

## Angiosperms -- Reproduction

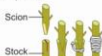
**Cutting** – A part of stem is cut and the cut end grows into new plant when placed in moist soil  
e.g. mango, guava, litchi, lemon, rose



**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

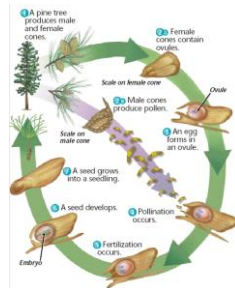
### Fruits are essentially

- 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

