

## Study Guide - Kingdom Plantae

For our purposes here, we will consider plants as the multicellular eukaryotic organisms that are known as **autotrophs** (remember that word from our previous chapter - it means that they can produce their own food). They produce their food by **photosynthesis**. The algae, which are also able to produce their own food via photosynthesis, are not considered plants - remember we talked about them with the Kingdom Protista.

In this lesson we will cover the basic similarities of all plants, and then talk about the two main types of plants: the **nonvascular plants** (which have no specialized tissues for transporting fluids) and the **vascular plants** (which do have specialized tissues for transporting fluids).

Due to the amount of information again, we will present the information in outline form.



The Plants

### Characteristics

- **autotrophic** - produce own food via **photosynthesis**
- have two types of **chlorophyll (a & b)** to absorb the energy from the sun
- the life cycle of plants is interesting because they have a multicellular **haploid** and **diploid** phase. This is referred to as an **alternation of generations**. Remember that animals have a multicellular diploid phase and a single celled haploid phase. There are special names for the plants found in each phase:
  - the **sporophyte generation** is the diploid phase
  - the sporophytes go through meiosis and produce gametes
  - the **gametophyte generation** is the haploid phase
  - the haploid gametes come together in fertilization and form the sporophyte.
- egg cells produced in **archegonia**, sperm cells produced in **antheridia**



**Nonvascular plants** - mosses

#### **Characteristics**

- covered with a waxy **cuticle** to help them retain water
- no tissue to help in transport of fluids - so they cant retain water
- have no roots, stems or leaves - though there are leaf and stem-like parts
- some species have root-like parts called **rhizoids**
- the mosses must be in moist areas since they cant retain water
- The **gametophyte** is the dominant cycle in mosses it is the gametophyte generation that we see when we see a bed of moss.

#### **Vascular plants**

- there are three divisions of vascular plants: the **ferns**, the **gymnosperms** (like pine trees), and the **angiosperms** (the flowering plants). We will first identify basic characteristics in the vascular plants.





### Characteristics

- have specialized tissues that function in the distribution of fluids:
  - **xylem** - which carries the water and minerals upwards from the roots, this is what becomes wood. The annual rings you see when looking at a tree are formed from the xylem tissue.
  - **phloem** - which carries sugars and other nutrients from the leaves to other parts of the plant, this when combined with a tissue called **cork** becomes **bark**.
  - these tissues also serve as a support system in the plants and are the reason why some trees can grow very tall.
- the **dermal tissue** is for protecting the plant and generally covers the outside of the plant (except in trees and shrubs that have bark) and consists of the following:
  - the **epidermal layer** - with a waxy cuticle covering for protection
  - **guard cells** that surround the **stomata** (little openings in the dermal tissue that allow water, carbon dioxide, and oxygen in and out of the plant).
- growth tissue - known as **meristemic tissue** - plants grow where this tissue is. There are two types:
  - **apical meristem** - which is found at the tips of roots and stems and helps plants grow up from the ground, and helps the roots penetrate deeper in the soil.
  - **lateral meristem** - which is used for plants that grow larger and thicker
- the **roots**
  - the cells at the tip of the root are called the **root cap** - which provide protection
  - behind the cap is the **apical meristem** which provides the growth
  - many epidermal cells in the roots develop into **root hairs** in order to increase the surface area of the root system and help to obtain water.



- the **leaves**
  - have a **cuticle** that covers the epidermal layer to reduce the loss of water
  - under the epidermal layer are the **palisade cells** which contain **chloroplasts**
  - below the palisade cells is the **spongy mesophyll** - which is made of loosely packed cells that have chloroplasts.
  - again - the **xylem** tissue provides the nutrients and water to the leaves for photosynthesis and the **phloem** carries the products of photosynthesis to the rest of the plant.



**The ferns** - seedless vascular plants

#### Characteristics

- the leaves of the fern are called **fronds**
- ferns produce spores through meiosis that are stored in cases called **sori** on the under side of the fronds.
- the **sporophyte generation** dominates the life cycle of the ferns which is what we see



**The gymnosperms** - plants with unprotected seeds - the pine trees and other conifers

#### Characteristics

- seeds are not enclosed in female tissues - the word gymnosperm literally means **naked seed**
- largest and most well known of the gymnosperms are the **conifers** - cedars, pines, firs, and giant redwoods.
- the **sporophyte generation** dominates the life cycle



- the sporophyte (tree) produces male and female **cones** (like pine cones) which in turn produce gametophytes in the form of pollen for male cones and ovules (which contain two or three eggs) in the female cones. Fertilization takes place when pollen is released from the male cone and is carried by the wind and is trapped by the female cone. The sperm in the pollen fertilizes the eggs in the ovule - sooner or later the seed falls and germinates into a new pine tree.

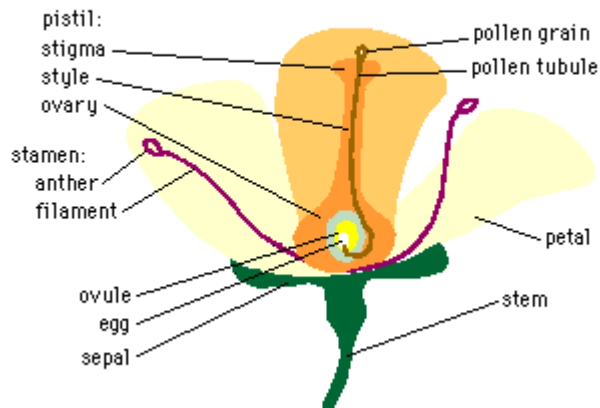


**The angiosperms** - plants with protected seeds - the flowering plants

#### Characteristics

- are the **most developed** and complex of the plant kingdom
- the word angiosperm literally means "**seed vessel**"
- the tissue that encloses the seed in the female plants is called the **endosperm**, which in some plants becomes the **fruit** - like tomatoes, beans, peas, apples, etc.
- the flower itself is made of different parts (please see the diagram):

## Parts of a Flower



- the **sepal** is a ring of adapted leaves that protect the flower when it is a bud, and help connect the petals.
- **petals** - colorful and are used to attract animals (especially insects) to pollinate. Contained within the petals are the reproductive organs:
  - the **stamen** - which is made of a stem-like **filament** and a knob-like **anther** - is where the haploid grains of pollen are produced.
  - the **pistil** - which consists of a sticky **stigma**, a **style** - which is a narrow stalk that connects the stigma to the **ovary**.
  - the **ovary** - which enclosed the **ovules**. In the ovary a **single mother cell** produces **four cells** - one of these becomes the gametophyte.
- fertilization occurs when **pollen** is carried from the anther and comes in contact with the **stigma**. The pollen grain releases sperm cells which travel down the pollen tubule to the ovary and fertilization occurs.
- the **sporophyte generation** is dominant in the angiosperms
- **germination** is another important stage in the life of the angiosperms. It requires the correct temperature, the right amount of light, and food. Gymnosperms are also classified in the way they store this food for germination.
  - plants known as **monocots** - store their food in one leaf called the **cotyledon**. Common monocots are grass, lilies, and irises.
  - other plants have two cotyledons and are called **dicots**. Common dicots are beans. For a little experiment take a bean and plant it in a small cup of soil. Keep it moist and in a relatively sunny place. When it sprouts you will see the two leaves that store the food for germination - these leaves are similar to the yolks of eggs that provide nutrients for the newly forming life.