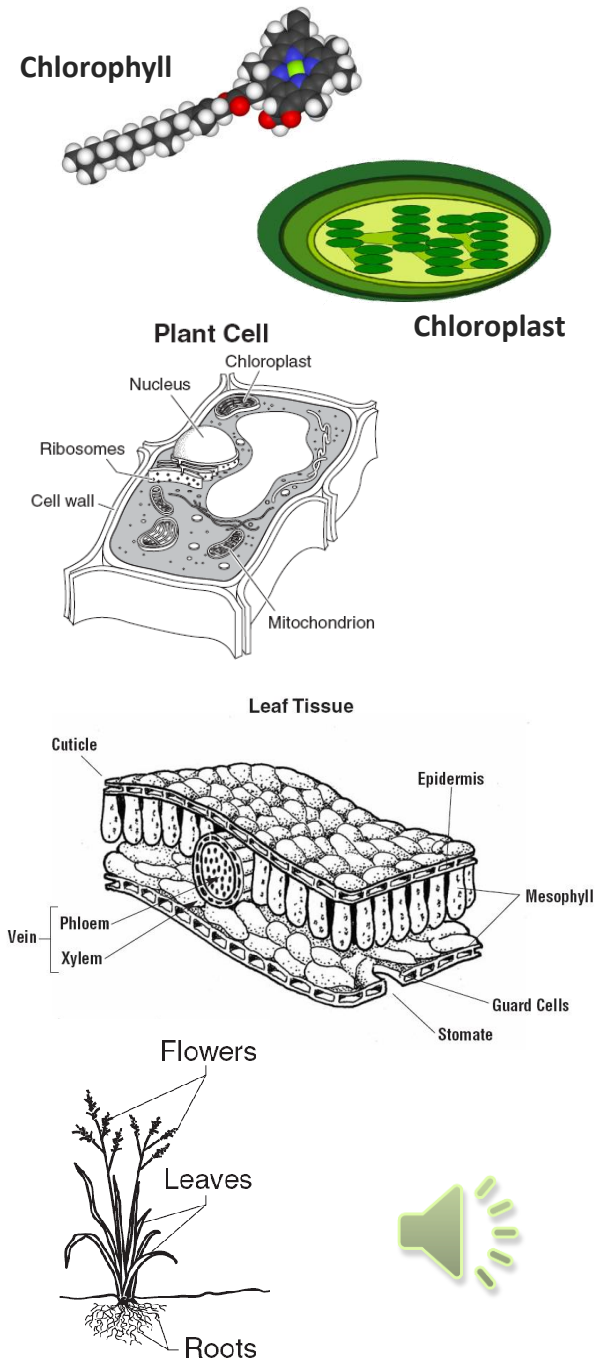
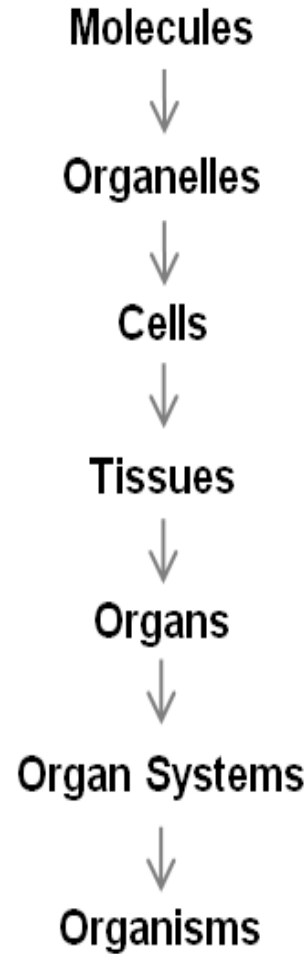


Diagram by Jeffrey Winterborne

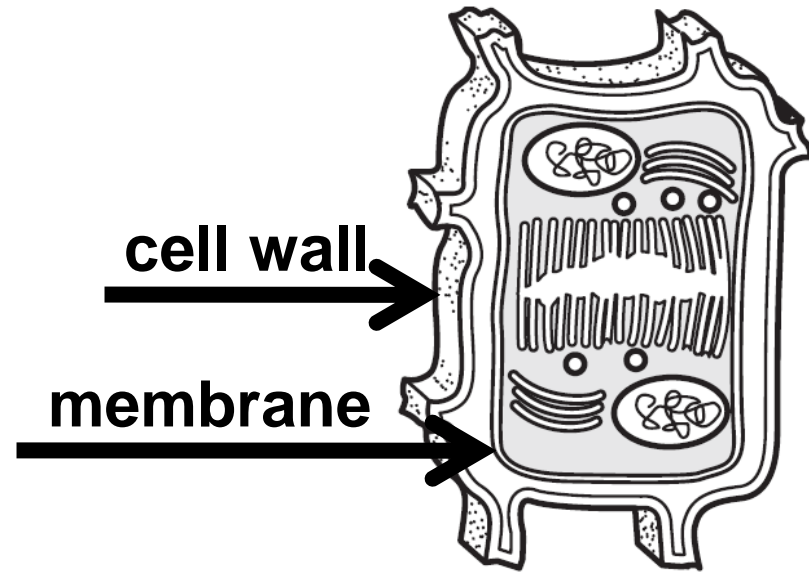
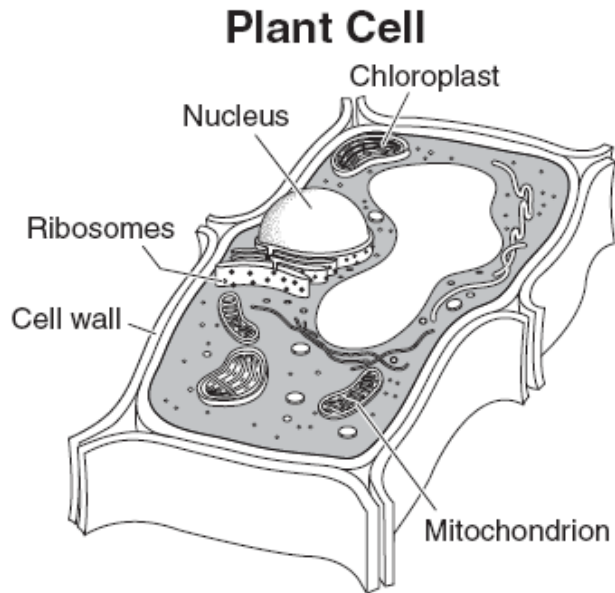
# Plant Systems

# Plant Organization

Plants contain all of the same levels of organization that animals do. These include *groups of specialized cells*, which we call *tissues*, organs and organ systems.



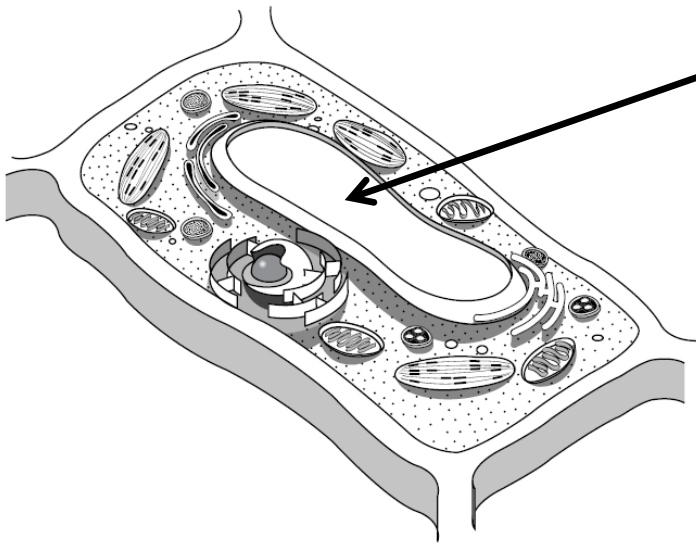
# Plant Cells



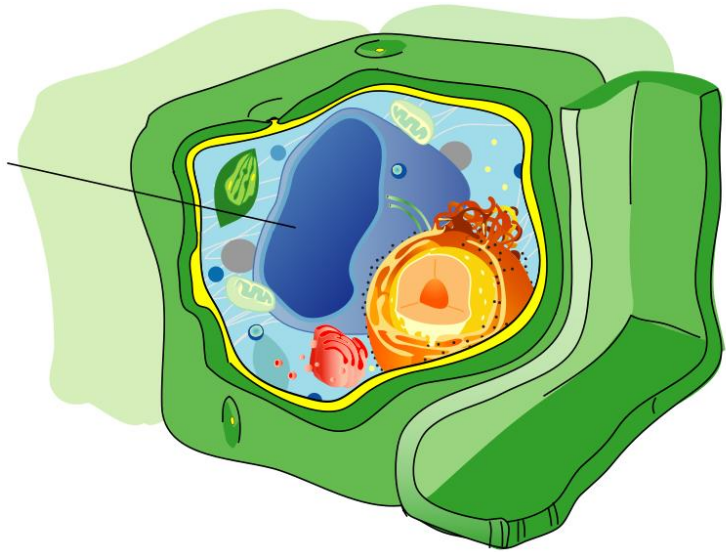
Plant cells have several important organelles. One of these is a **cell wall** made of the molecule **cellulose**. This provides the cell with protection and structural support.

# Plant Cells

**Vacuoles** are organelles that *store water and nutrients*. Plants have a very large **central vacuole** that stores a large amount of water and keeps the cell stiff and rigid.



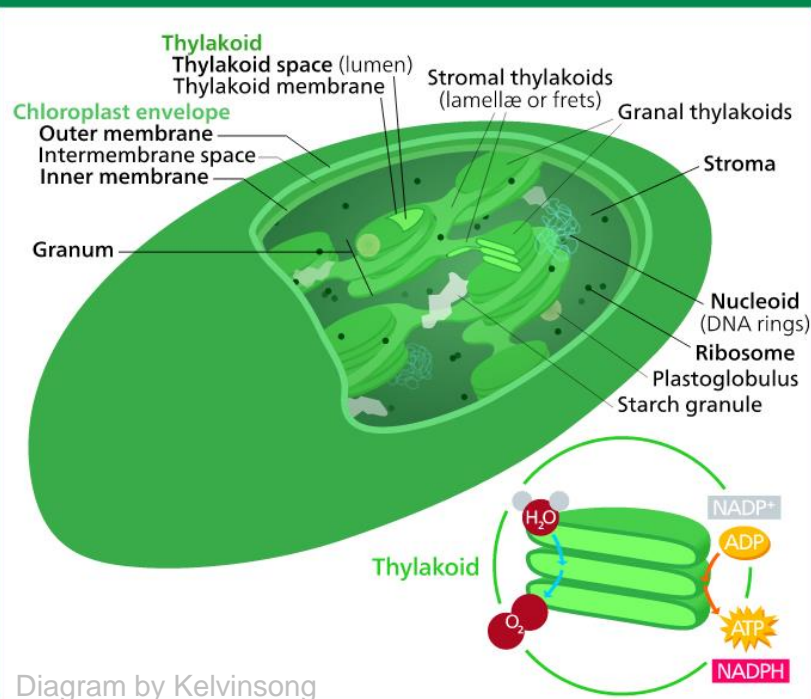
**Central  
Vacuole**



# Plant Cells

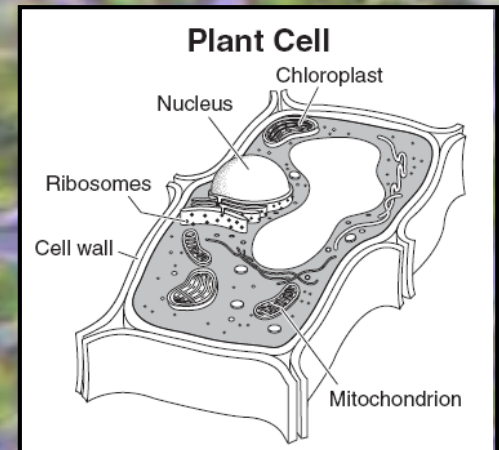
**Chloroplasts** are the organelles in plants that allow them to *make their own food* by performing **photosynthesis**. Chloroplasts contain the molecule *chlorophyll* which absorbs **sunlight**.

the chloroplast



*chloro- means green*

Photo by Thomas Dreps



# *Root System*

1. The plant's root system is responsible for **absorbing water and nutrients** for the plant.



Texas  
Bright **Lawn Fertilizer**

**10-4-6**

Guaranteed Analysis

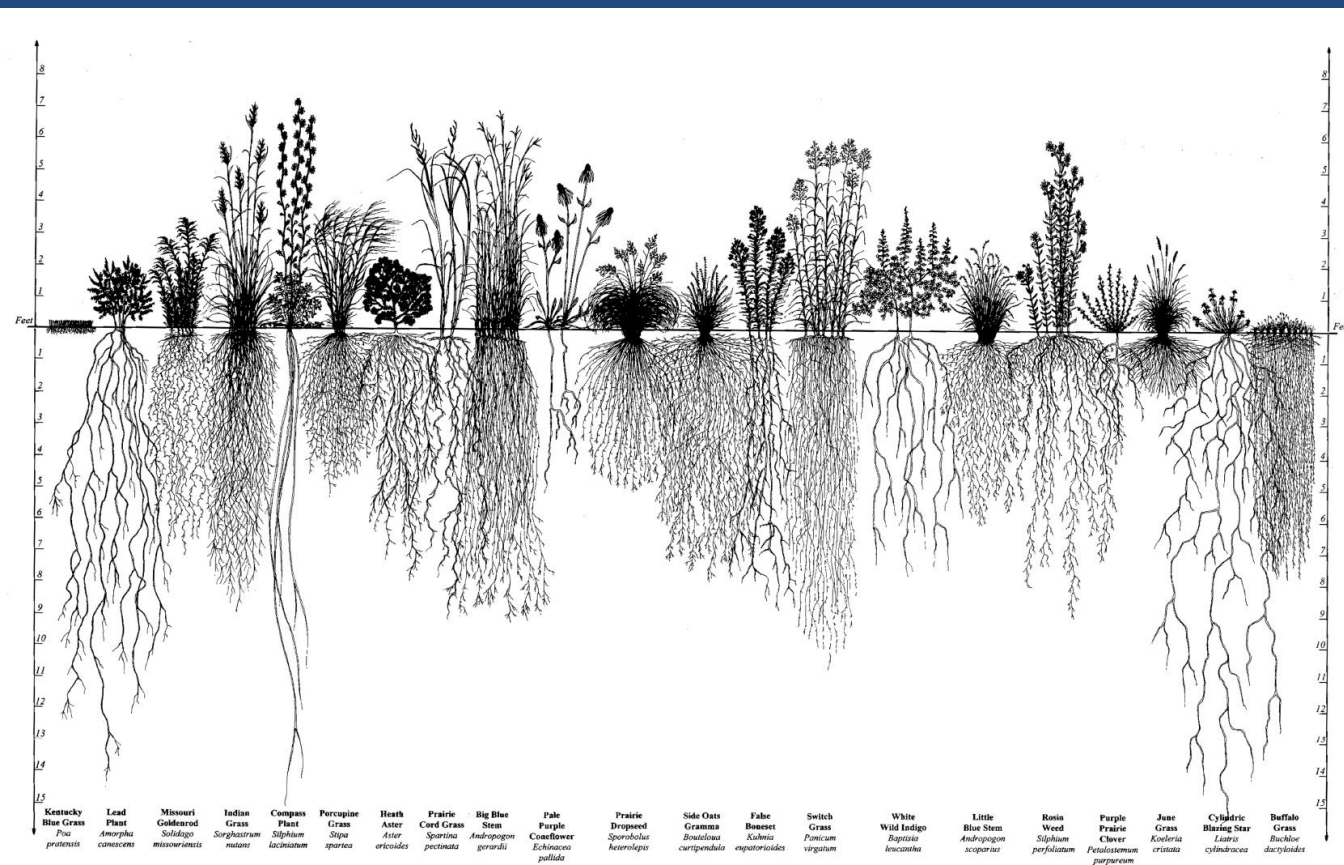
Total Nitrogen (N) .....	10.0%
Water-insoluble nitrogen .....	1.6%
Nitrogen from ammonia .....	3.1%
Nitrogen from urea .....	5.5%
Available Phosphoric Acid (H <sub>3</sub> PO <sub>4</sub> ) .....	4.0%
Soluble Potash (K <sub>2</sub> CO <sub>3</sub> ) .....	6.0%
Iron (Fe) .....	0.2%



The most important nutrients for plants to absorb are **nitrogen (N)**, **phosphorous (P)** and **potassium (K)**. Fertilizers even contain an *N-P-K rating* on their bags to show how much of each nutrient is present.

# Root System

2. The roots also **anchor** the plant. This is usually in the ground, but some plants, like the vine shown below, grow on other surfaces.





# Root System

3. Another main function of the root system is to **store energy** for the plant. These storage organs are usually found in the form of **taproots** or **root vegetables**.

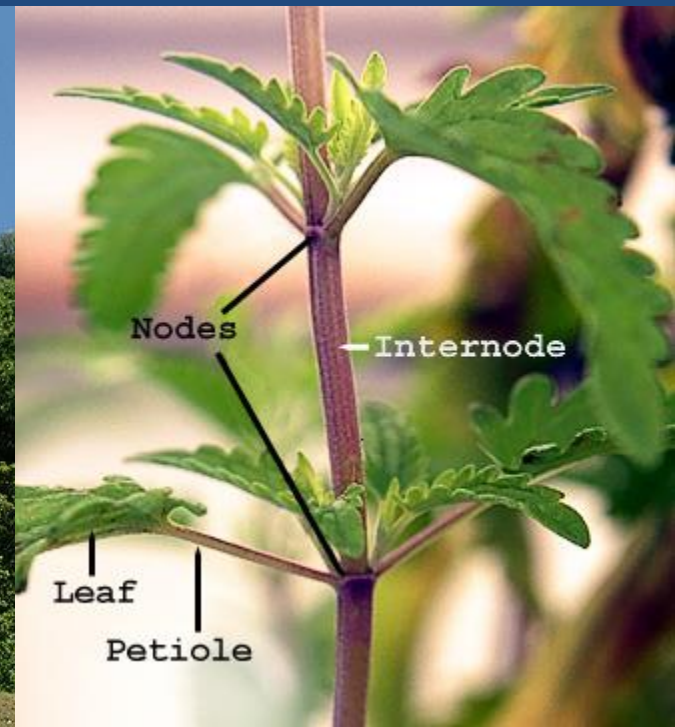


Photo by Miya



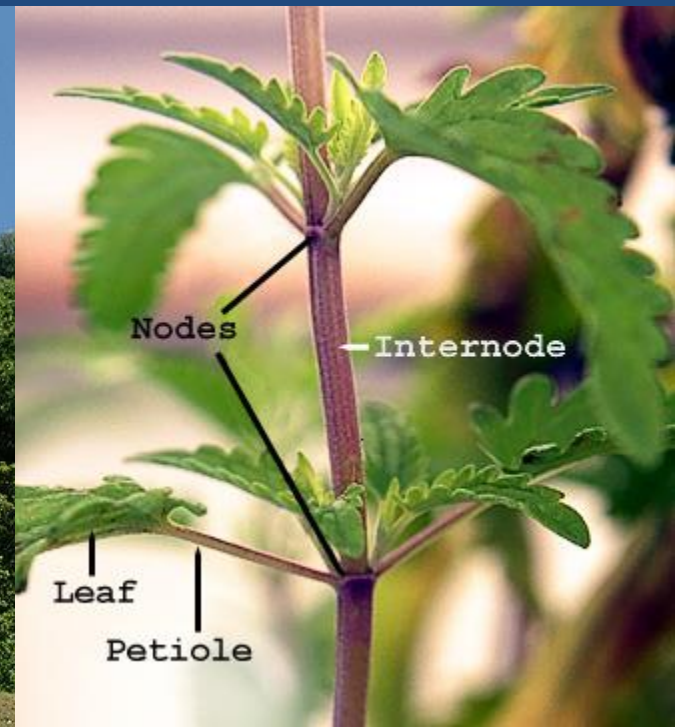
# Shoot System

Everything *above the ground* is part of the **shoot system**. A new plant growth is known as a **shoot**. The shoot system includes stems, leaves, and flowers/cones.



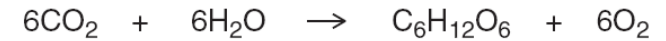
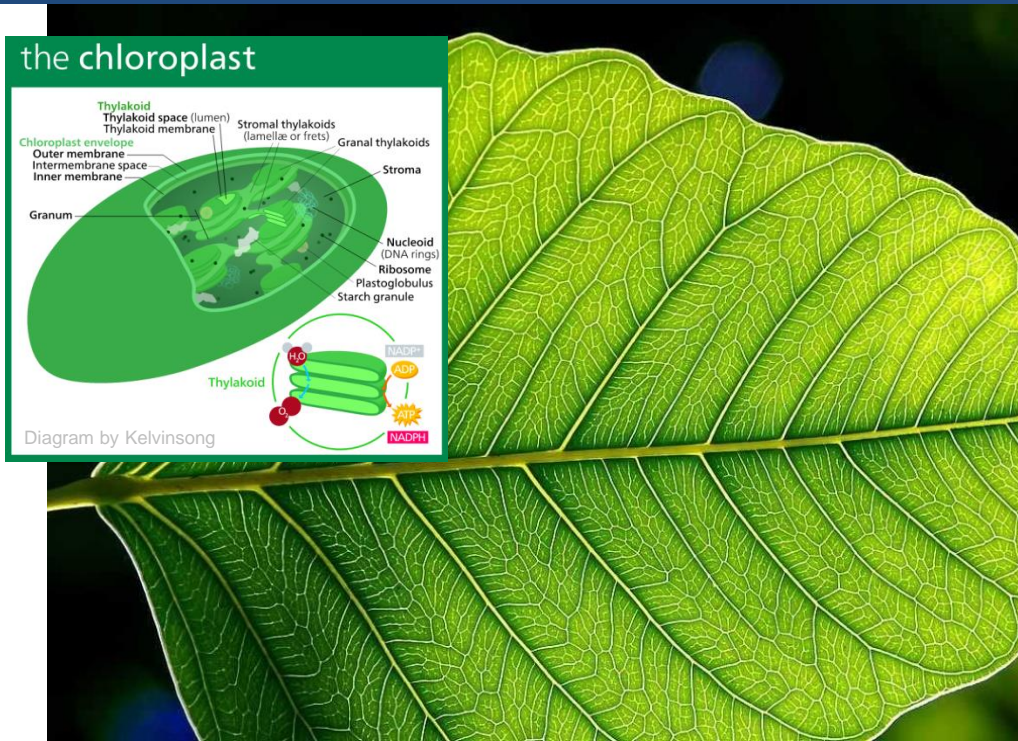
# Shoot System

1. One of the main jobs of the shoot system is to **provide support** to the plant. Stems provide leaves and flowers with support and allow the plant to grow upwards.

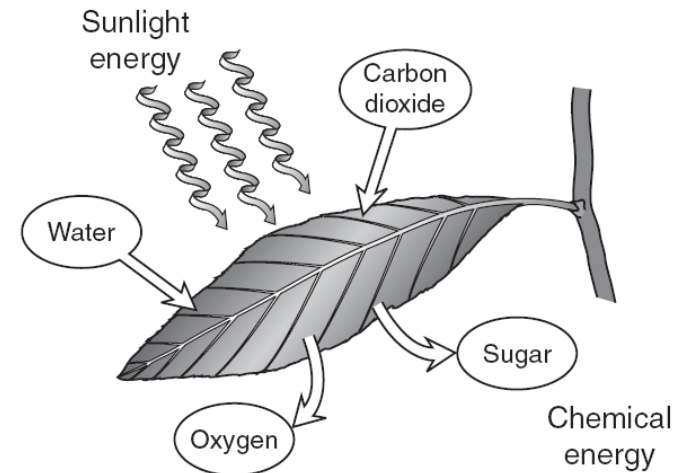


# Shoot System

2. Leaves are responsible for *producing the plant's food*. Plants produce their own **glucose** during *photosynthesis* using **carbon dioxide**, **water**, and **energy** from the **sun**.



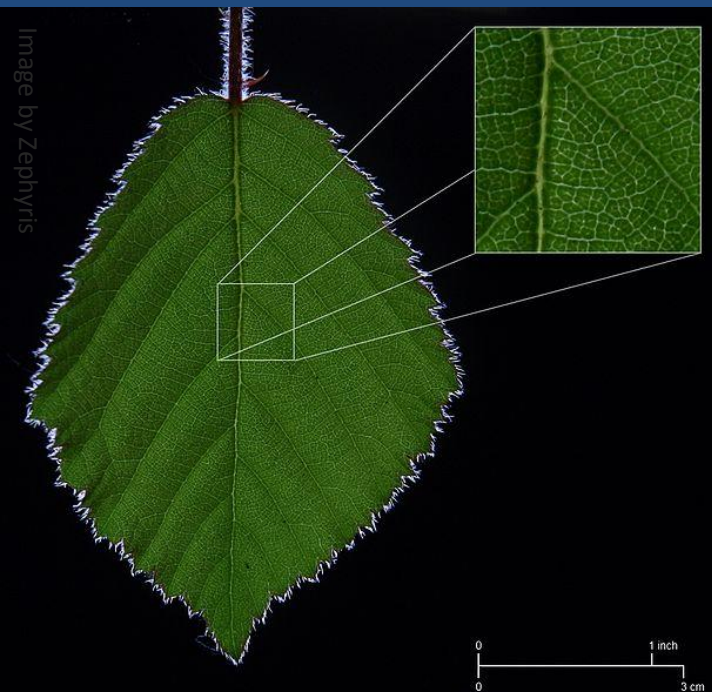
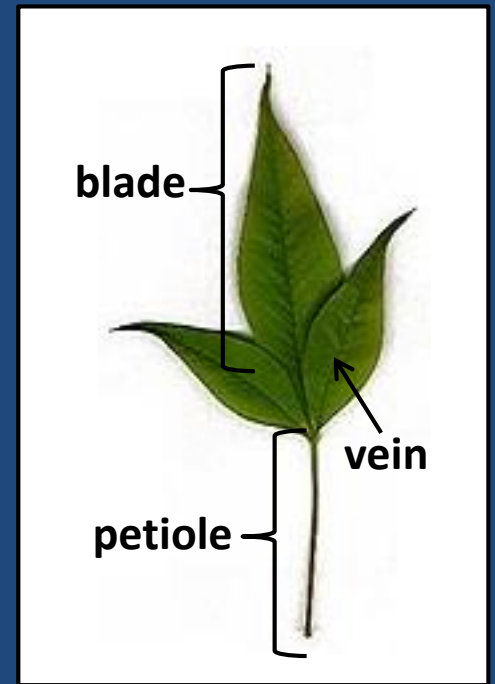
Sunlight energy  $\rightarrow$  Chemical energy



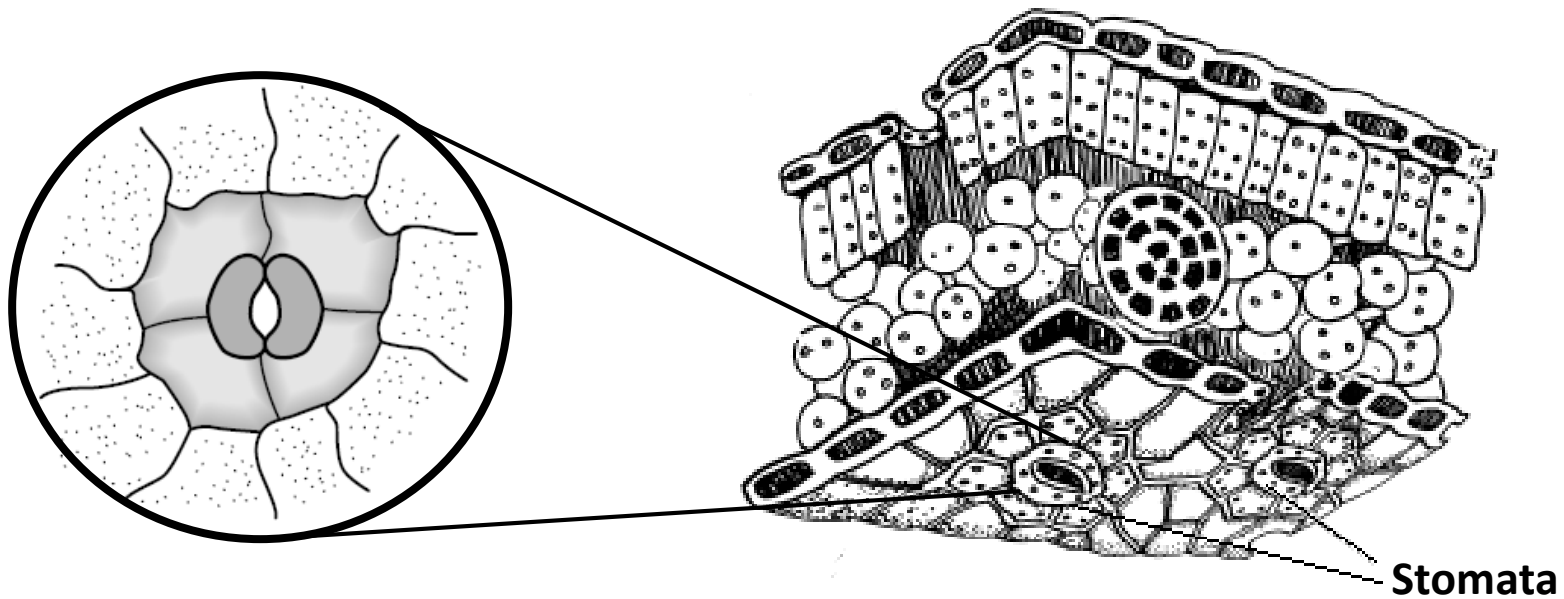
1. The flat, broad surface of the leaf is known as the **blade**.

2. The leaf stem is known as the **petiole**.

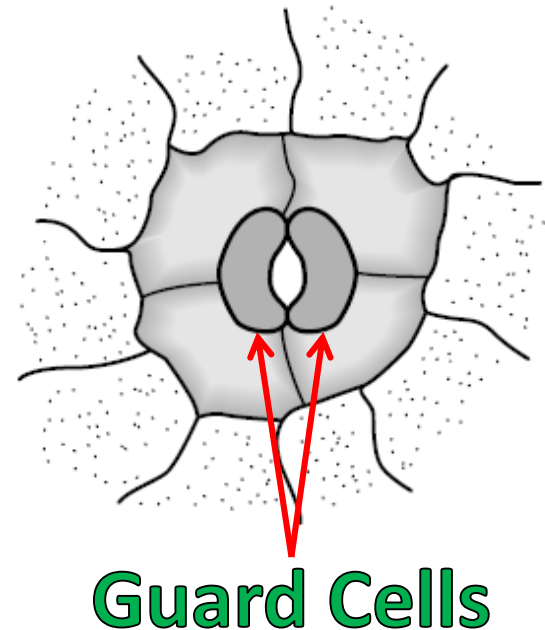
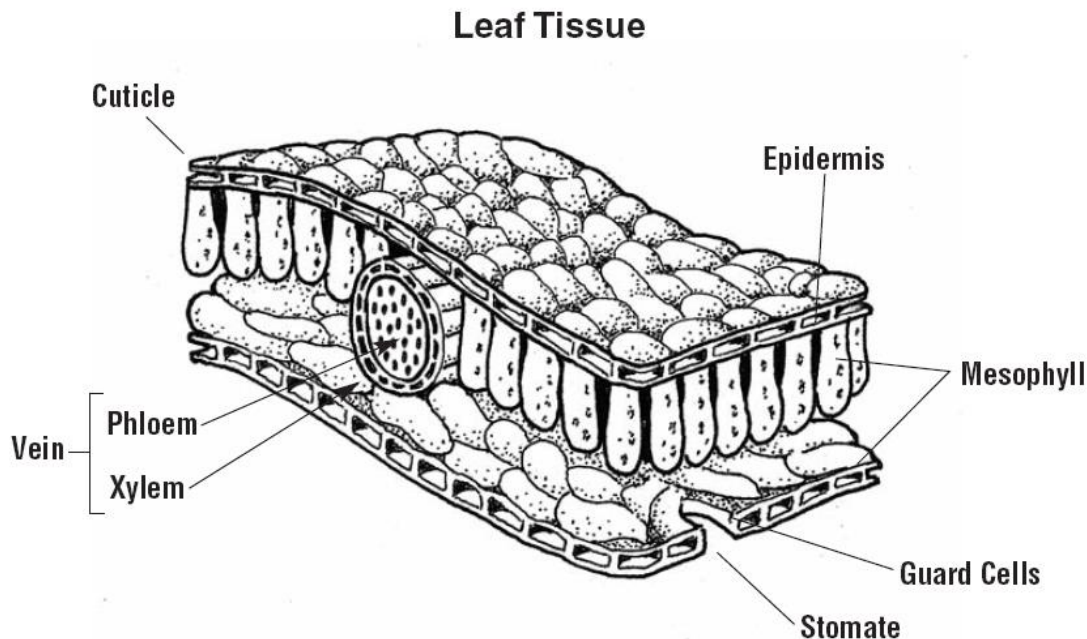
3. Each leaf contains **veins** which transport water and nutrients into and out of the leaf.



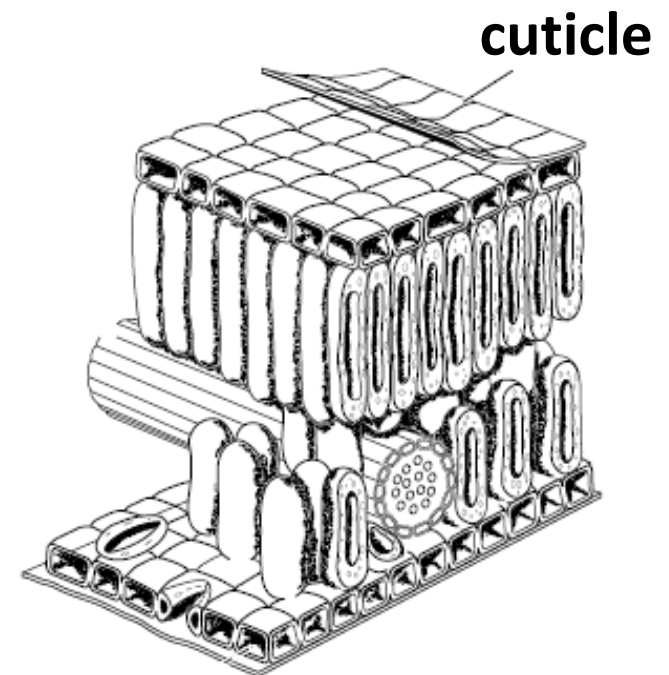
The leaf also contains tiny pores that allow gases to enter and exit the leaf. These tiny holes are known as **stomata**.  $\text{CO}_2$ ,  $\text{O}_2$ , and  $\text{H}_2\text{O}$  vapor all enter and exit the leaves through a stoma.



The cells around a stoma are known as **guard cells**. These cells control the size of the pore, and they can close the stoma to conserve water or open it to bring in more carbon dioxide.



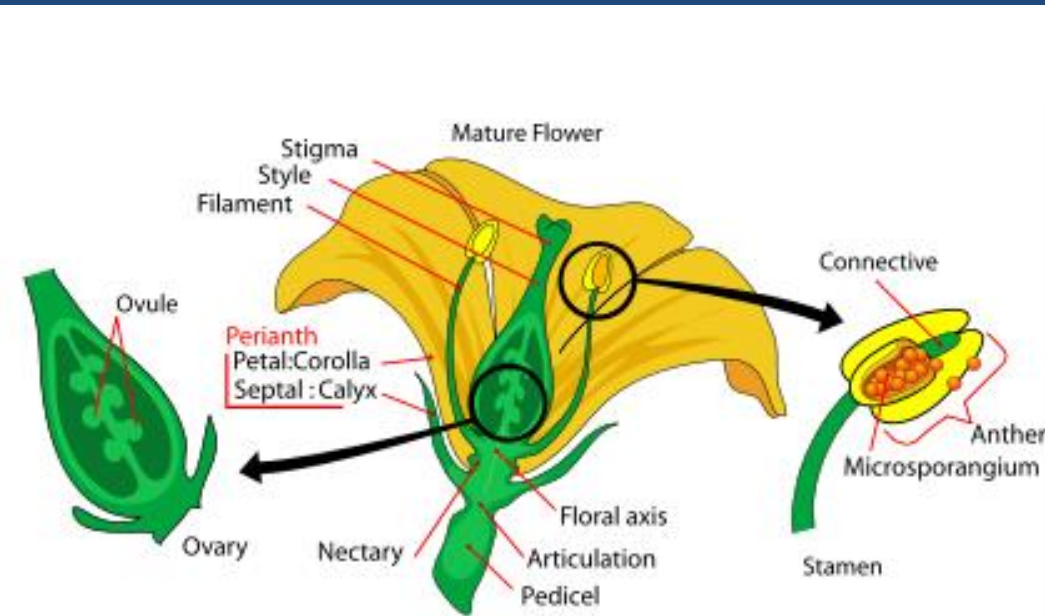
The leaves also have a waxy covering known as a **cuticle**. The waxy coating does not allow water to pass through. This minimizes the amount of water that is allowed to evaporate from the leaves.



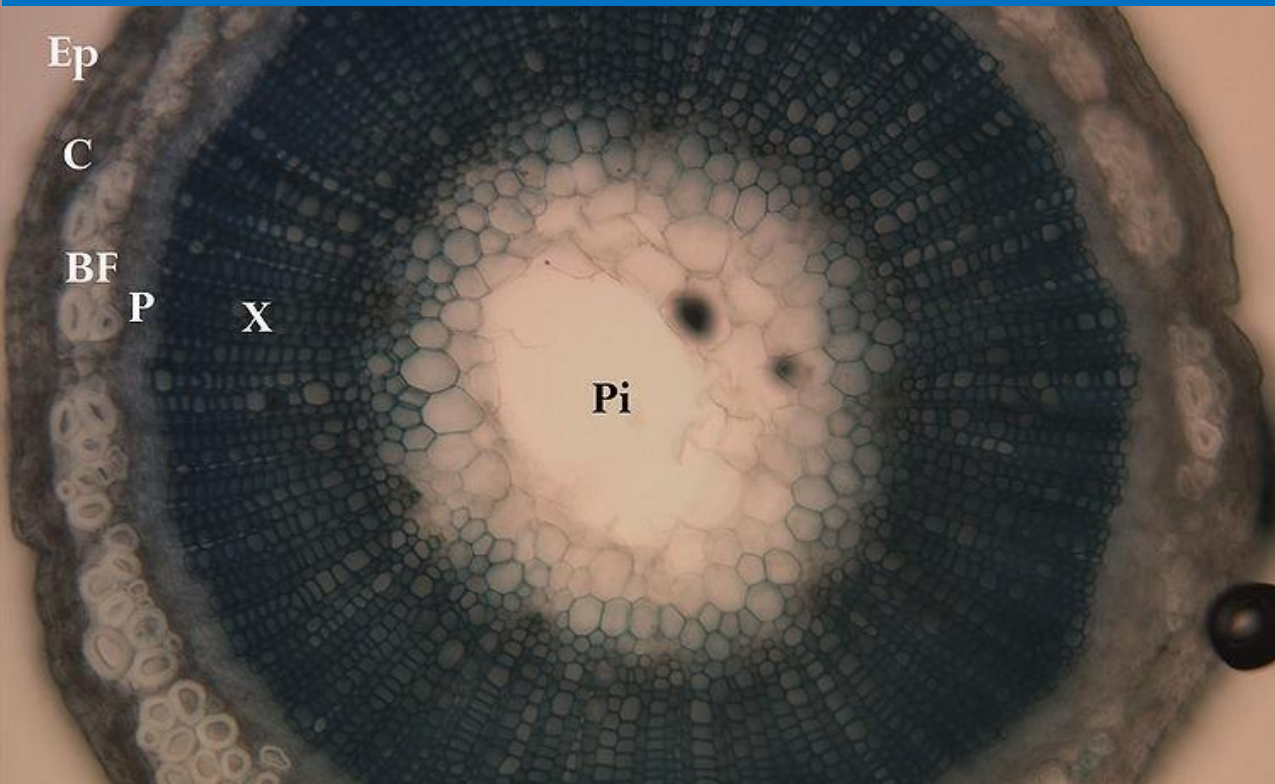


# Shoot System

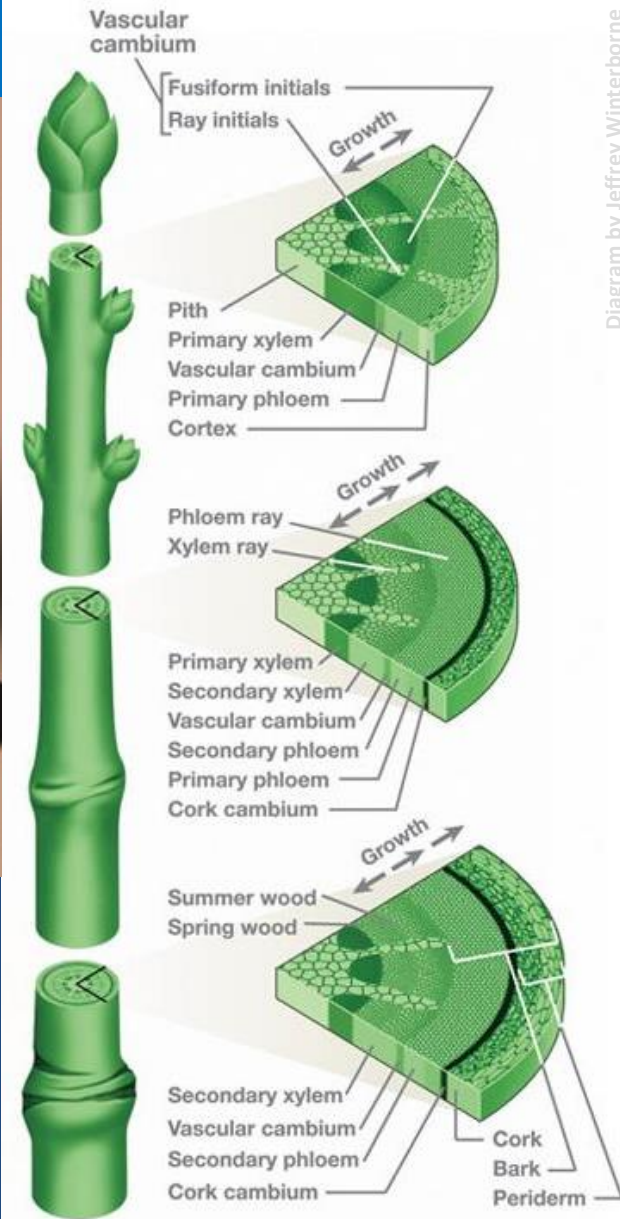
3. The shoot system also contains the **flowers** or **cones**. These are the **reproductive organs** that are used to produce seeds for the plant.



# Vascular Tissue

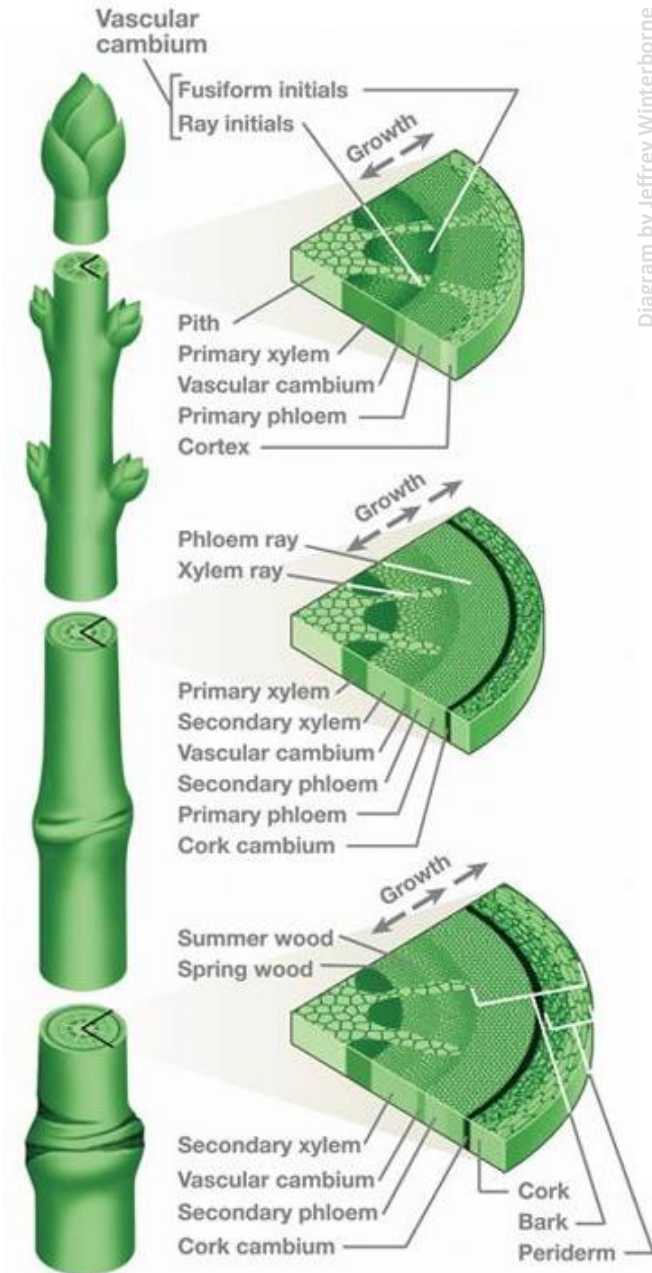
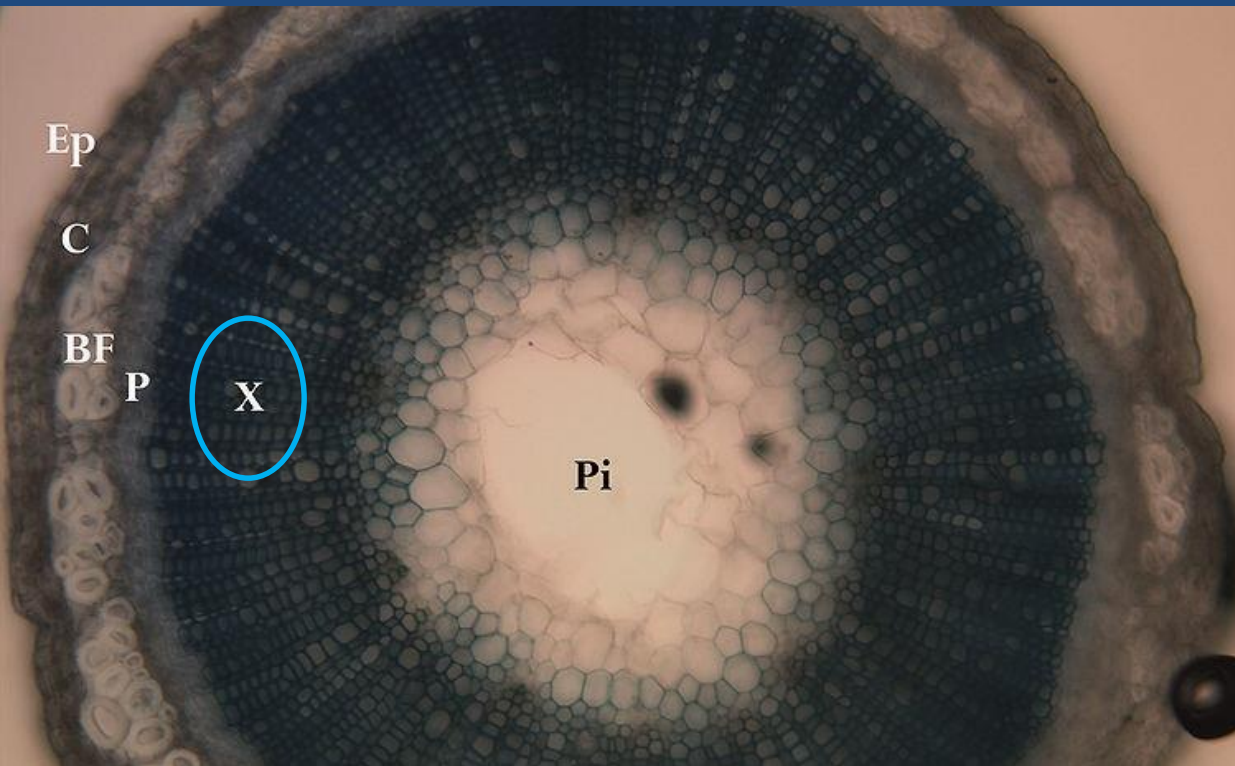


**Vascular tissue** runs throughout the plant. It is responsible for *distributing water and nutrients.*



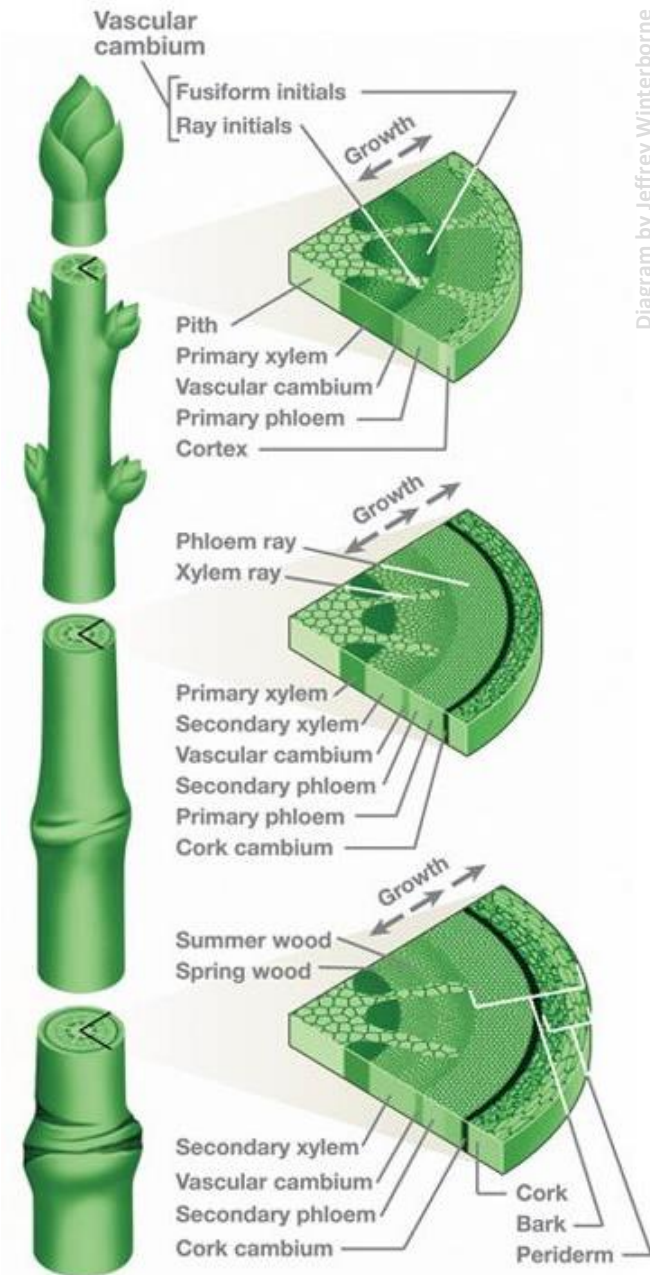
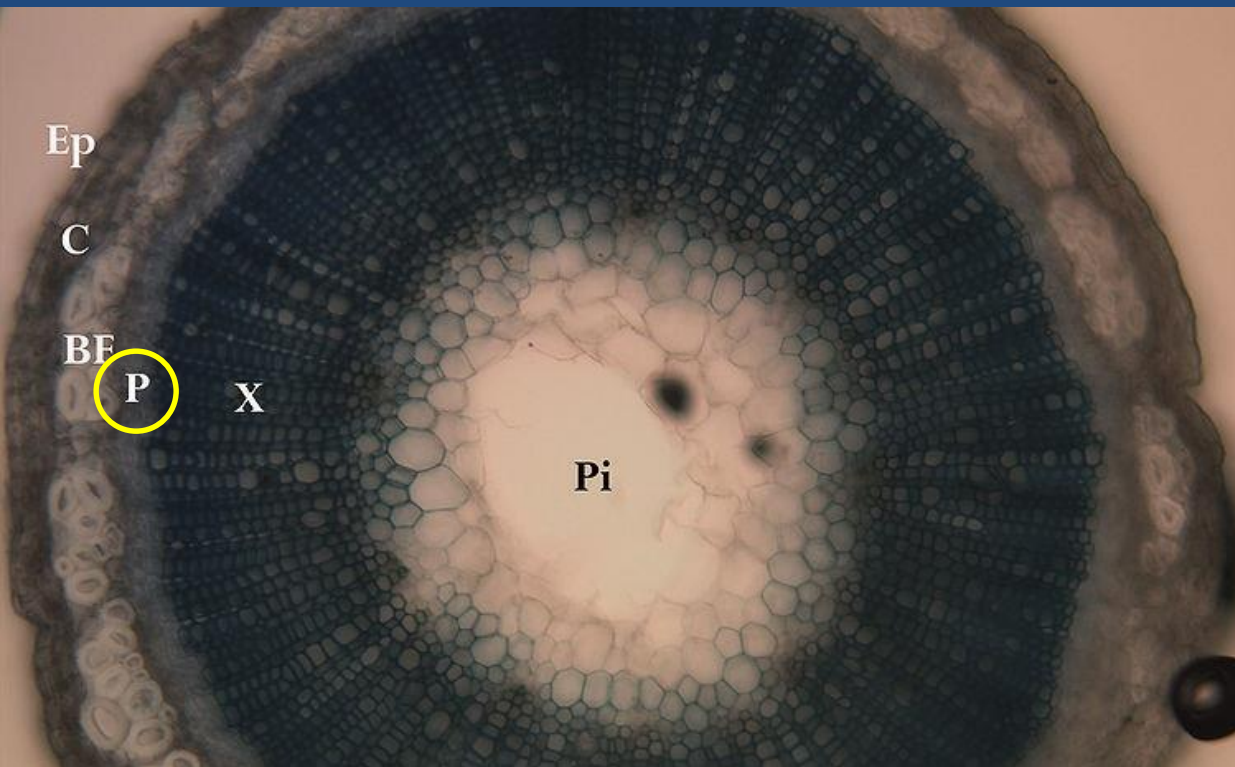
# Vascular Tissue

Xylem is the vascular tissue that carries water throughout the plant.



# Vascular Tissue

**Phloem** is the vascular tissue that carries *organic nutrients*, like **sugars**, through the plant.



# *Vascular Tissue*

The fluid that travels through the vascular tissue of plants is called **sap**. This fluid contains the water, minerals and sugars that are needed by every cell in the plant.



**Sap is used as a food source by many insects and other animals. Syrup is a form of purified sap.**

# Vascular Tissue

Plants can also distribute **hormones** through their vascular tissue. One important hormone, **auxin**, controls how plants respond to *external stimuli*.

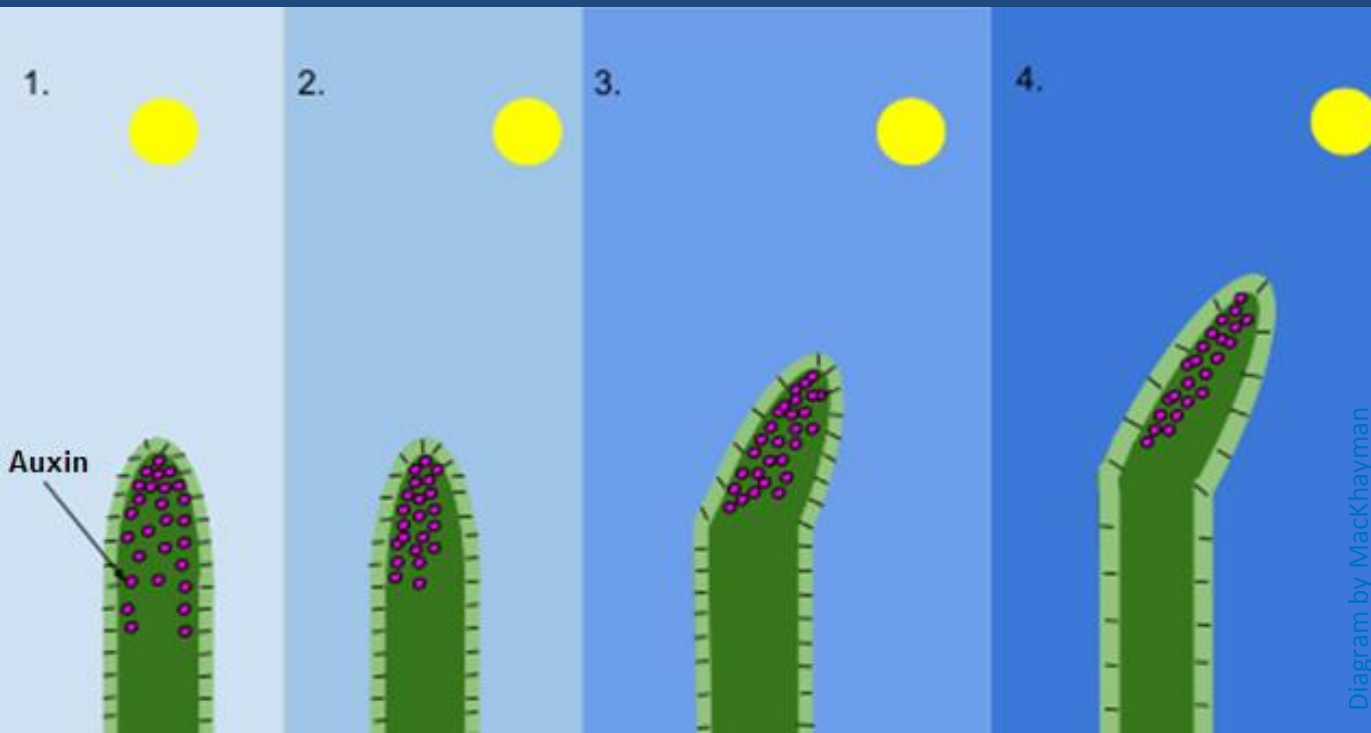


Diagram by Mackhayman



Photo by Marco Roepers