

**Master
Gardeners**

Basic Botany

2016 Master Gardener and Horticulture Training

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Topics we'll discuss in Chapter 1- Basic Botany

- **Plant life cycles**
- **Internal plant parts**
- **External plant parts**
- **Plant growth and development**
- **Environmental factors affecting growth**

DEFINITIONS...

➤ **Agriculture-**

➤ **Horticulture-**

➤ **Botany-**

DEFINITIONS...

- **Agriculture-** science of raising crops and livestock
- **Horticulture-** science of growing high value fruits, vegetables, flowers and landscape plants
- **Botany-** biology of plants

Why are plants important?

- **Primary source of food for humans and animals**
- **Provide fuel (biofuels, wood)**
- **Replenish the earth's oxygen supply**
- **Prevent soil and wind erosion**
- **Cool the atmosphere**
- **Provide habitat for wildlife**
- **Supply medicinal compounds**
- **Beautify our surroundings**

Monocots versus Dicots

Structure

Seed leaves

Vascular systems

Floral parts

Leaves

Monocots

one

Xylem and phloem
in bundles, dispersed

Usually in threes or
multiples of three

Often parallel-veined

Dicots

two

Xylem and phloem
form rings

Usually in multiples
of four and five

Generally net-veined

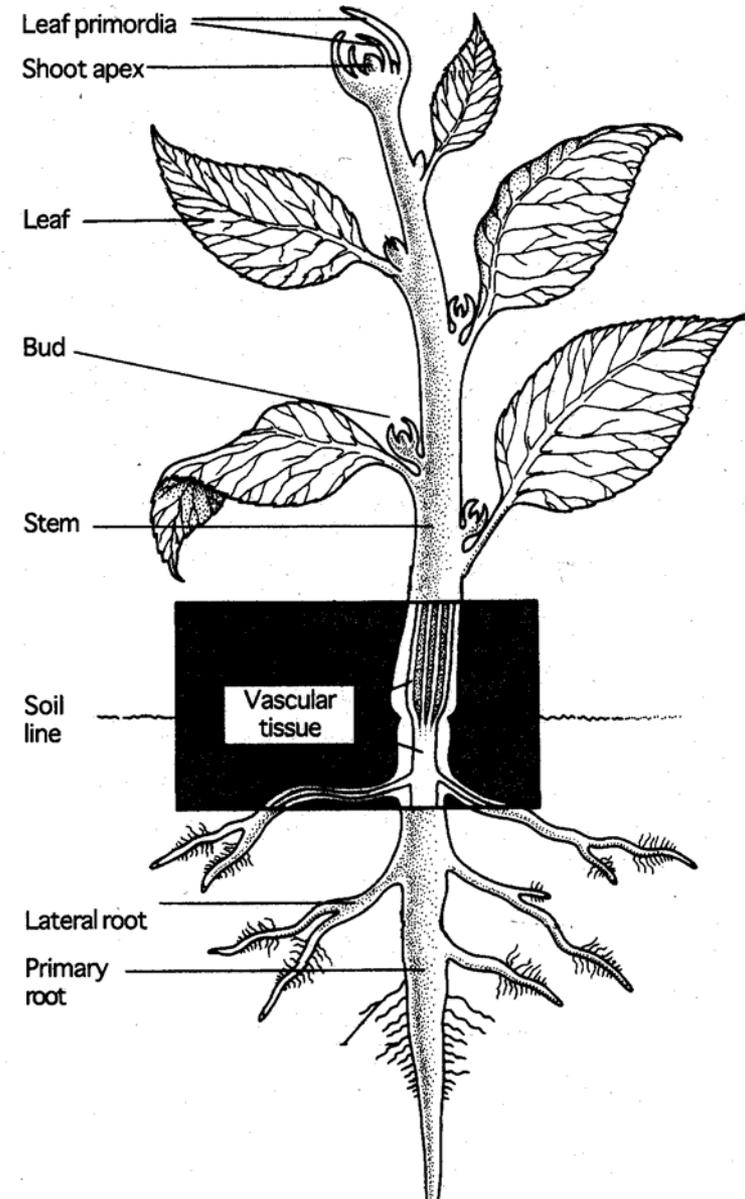
Plant Life Cycles

- **Annual-** completes life cycle in 1 year, either summer annuals or winter annuals. Example- zinnia
- **Biennial-** requires 2 years to complete life cycle. Can sometimes bolt and complete life cycle in 1 year. Examples- bull thistle, onion
- **Perennial-** live more than 2 years. Herbaceous and woody perennials. Examples- roses and shrubs

External Plant Parts

- **Roots-**

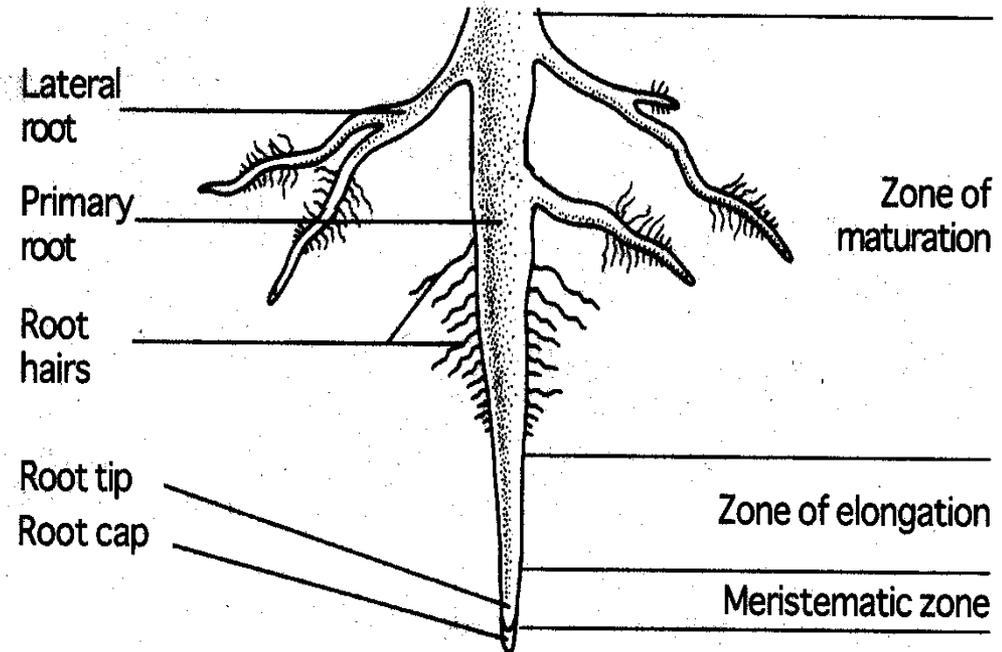
- Absorb nutrients and water
- Anchor plant
- Support the stem
- Store food



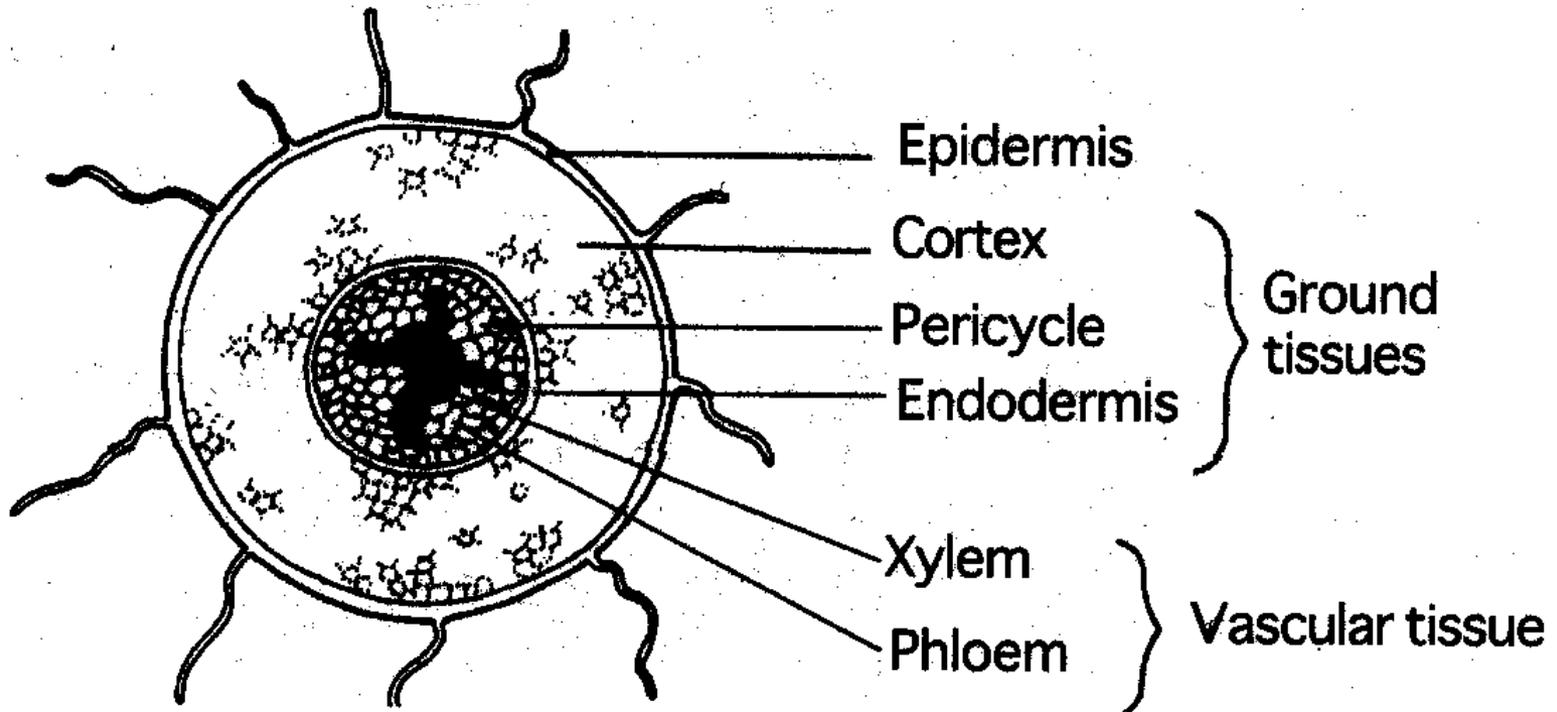
Root Structure

Three major parts

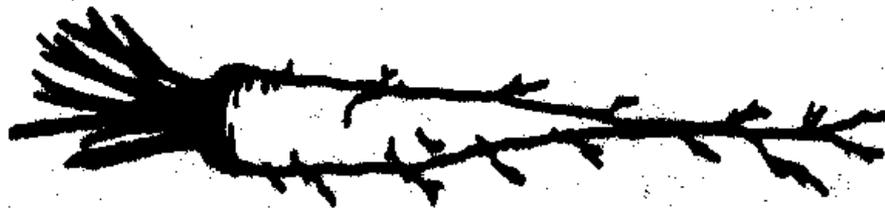
- **Meristematic zone-** cell division and growth
- **Zone of Elongation-** cells increase in size and push root through the soil
- **Zone of maturation-** directly beneath the stem; cells become tissues (epidermis, cortex or vascular tissue)



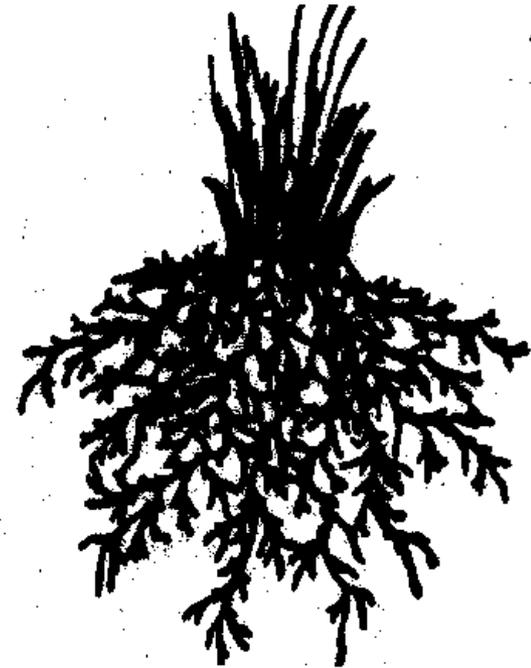
Cross section of a root



Primary root (taproot) versus lateral roots (fibrous root)



(a) Taproot



(b) Fibrous root

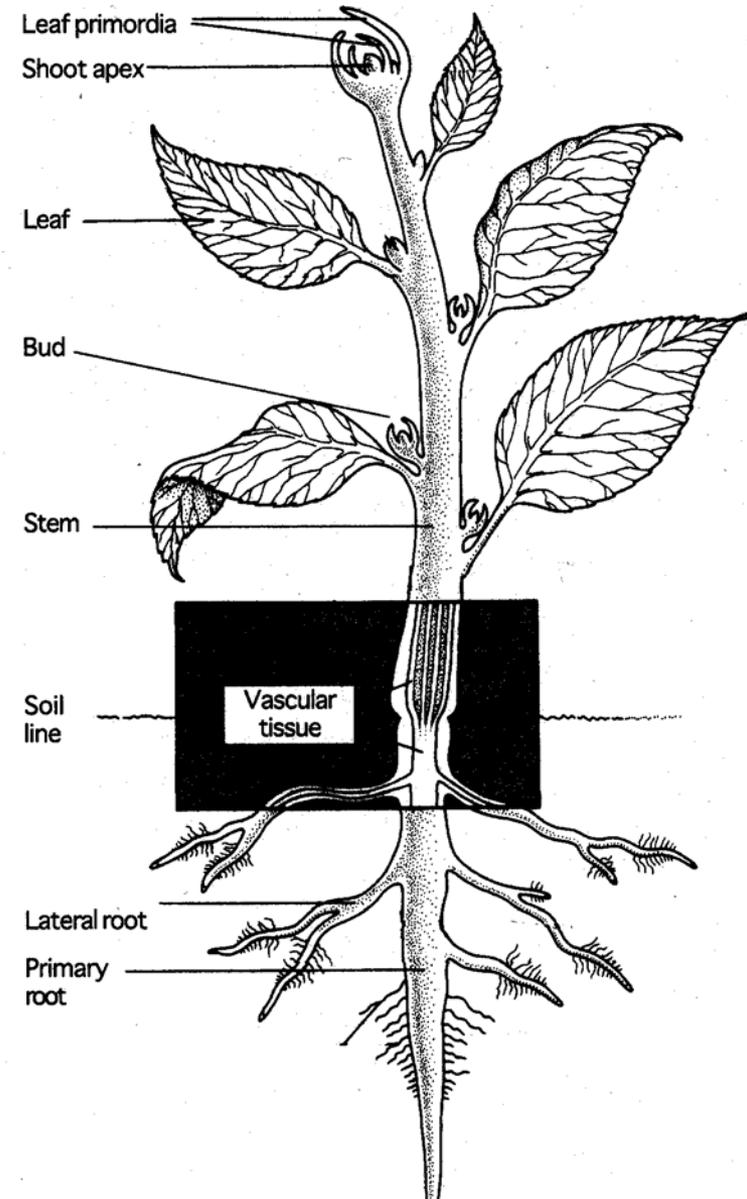
Factors important to root growth

- **Roots in water-saturated soil don't grow well and may die due to lack of oxygen.**
- **Roots penetrate deeper in loose, well-drained soil compared to heavy soils.**
- **Container plants have a restricted area for root growth, and are susceptible to cold damage due to lack of insulation.**
- **Roots grow laterally and may extend beyond a plant's dripline.**

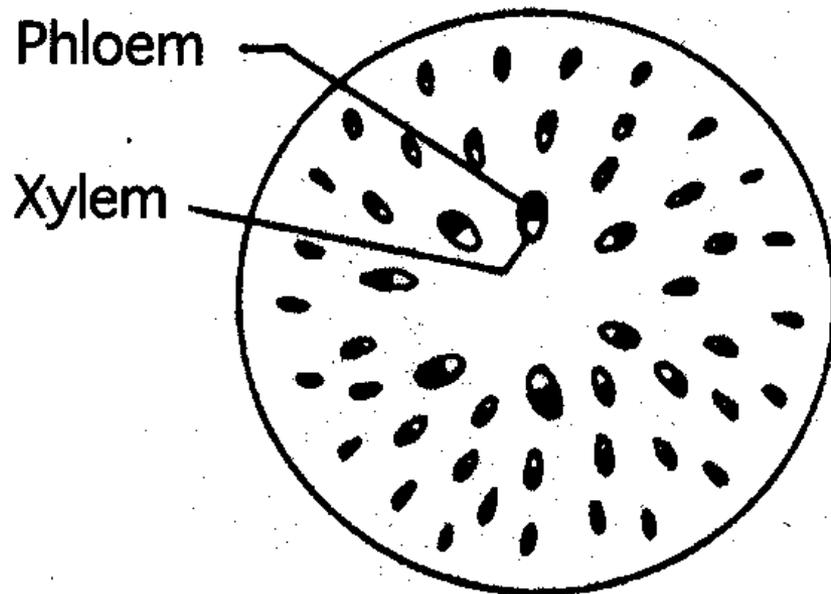
External Plant Parts

Stems-

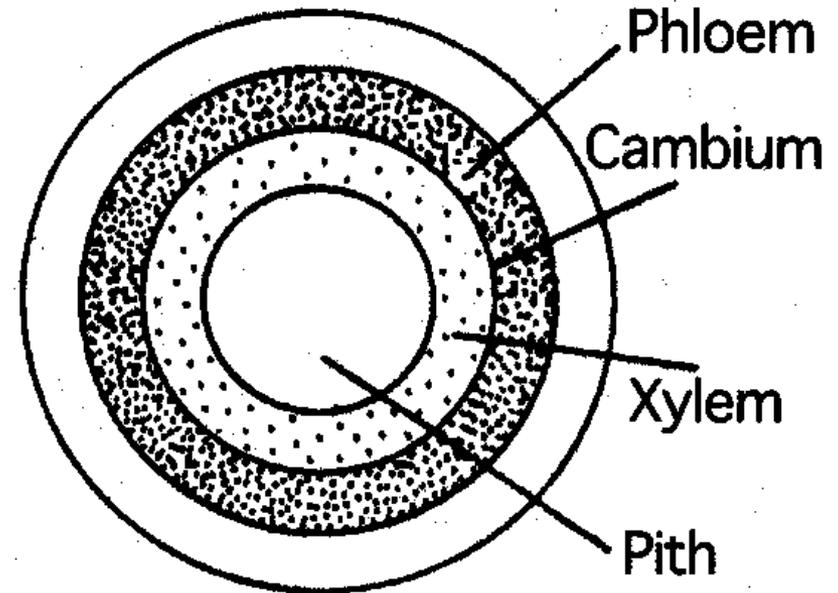
- Support buds and leaves
- Conduits for water (xylem tissue) and food (phloem tissue)



Vascular Systems of stems



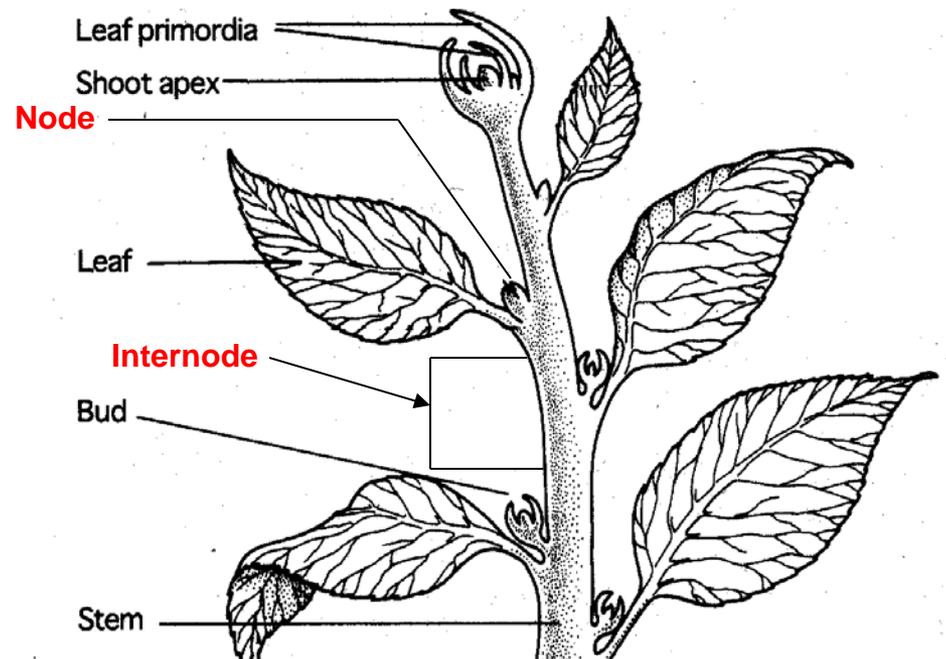
(a) Monocot



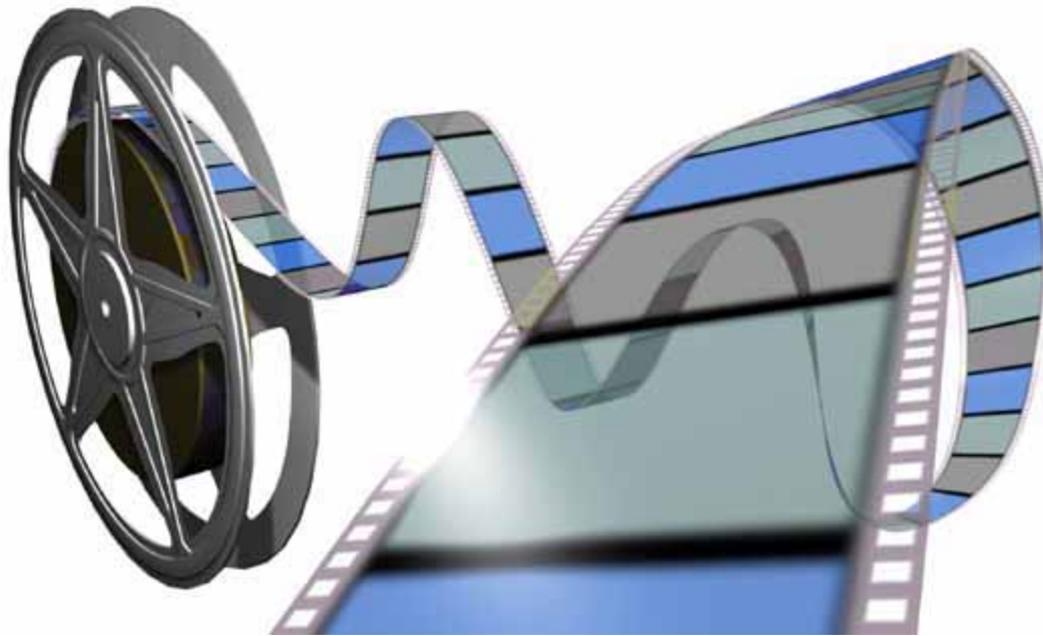
(b) Dicot

Nodes and Internodes

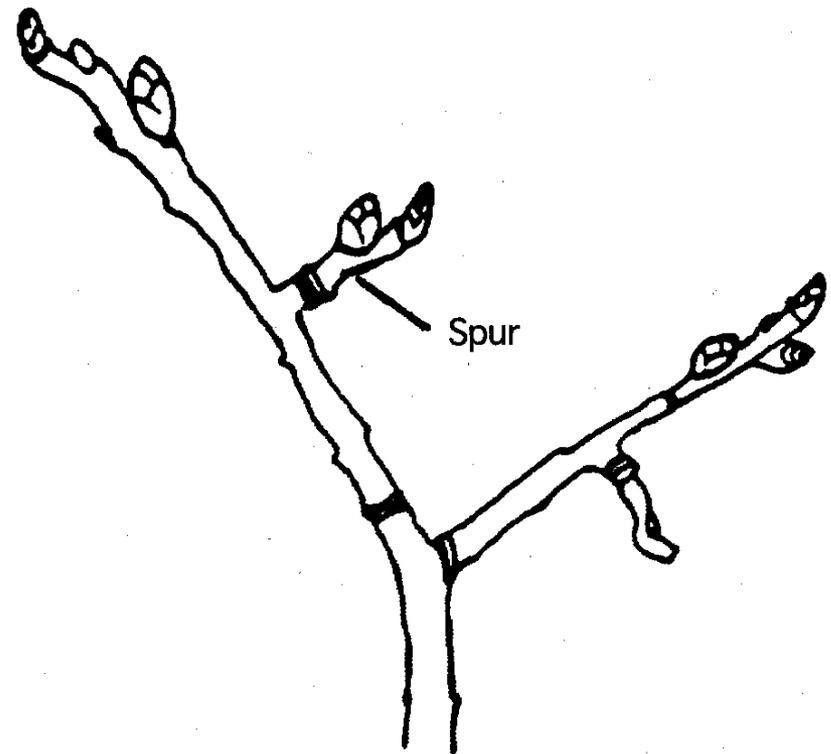
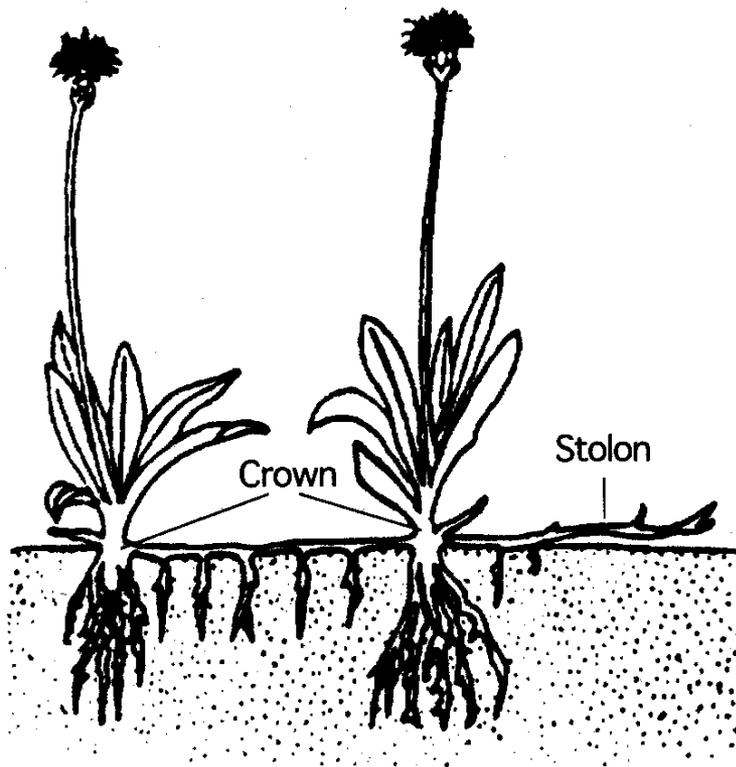
- **Node**- an area on stem where buds (leaf or flower) are located.
- **Factors affecting internode length include**- soil fertility, lack of light, season of the year, plant growth regulators, herbicides, requirements for the stem's energy.



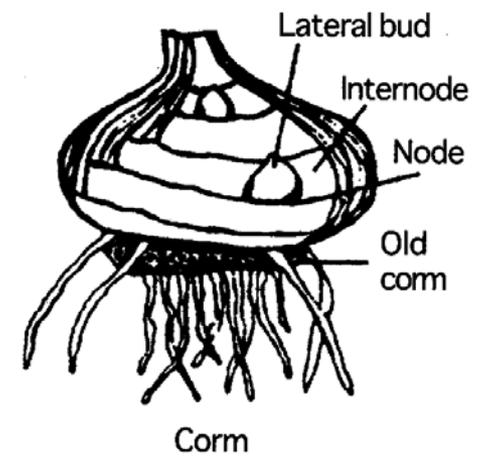
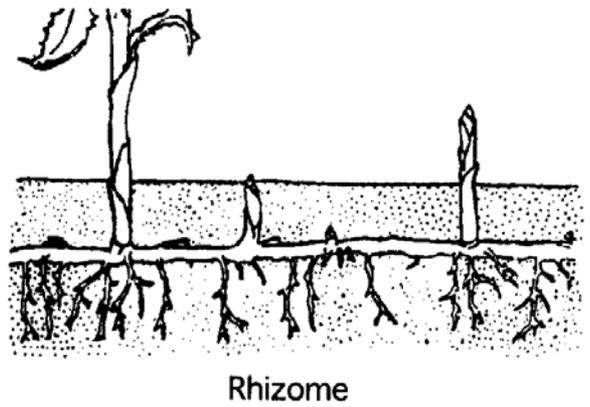
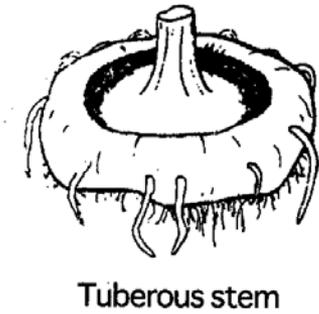
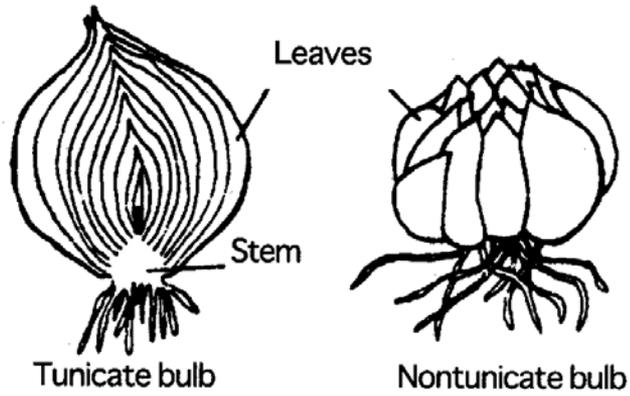
TWIG GROWTH VIDEO- Botany Module



Specialized above-ground stems



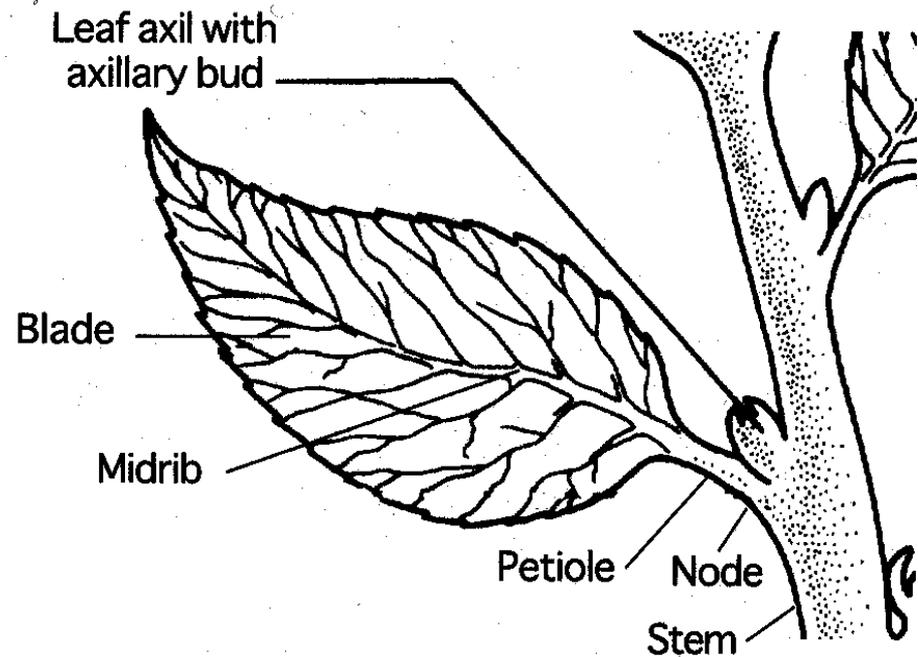
Specialized below-ground stems



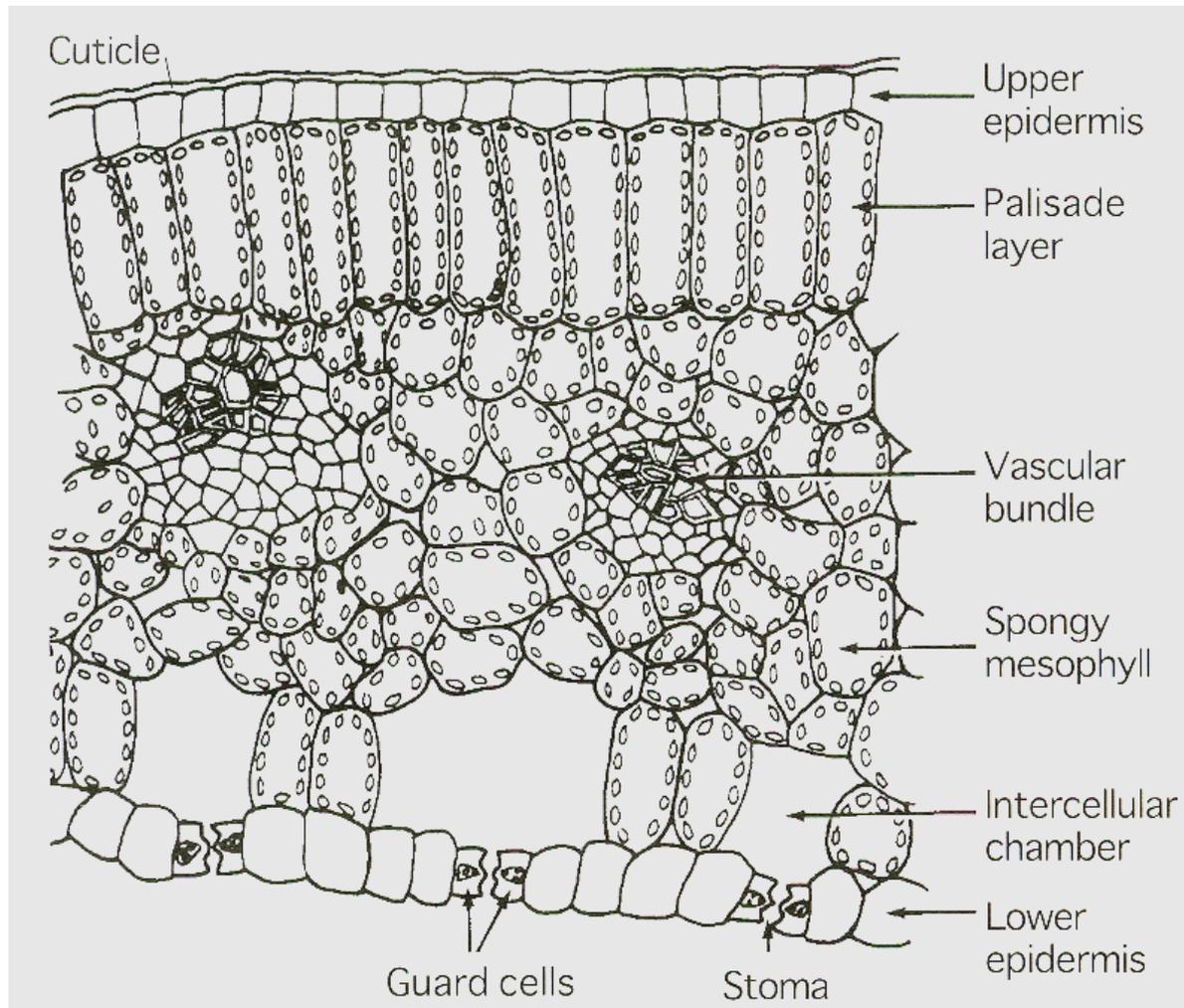
External Plant Parts

• Leaves-

- Principal function is to absorb sunlight and manufacture plant sugars through photosynthesis.
- Leaves are flattened to maximize light absorption.



Leaf cross section

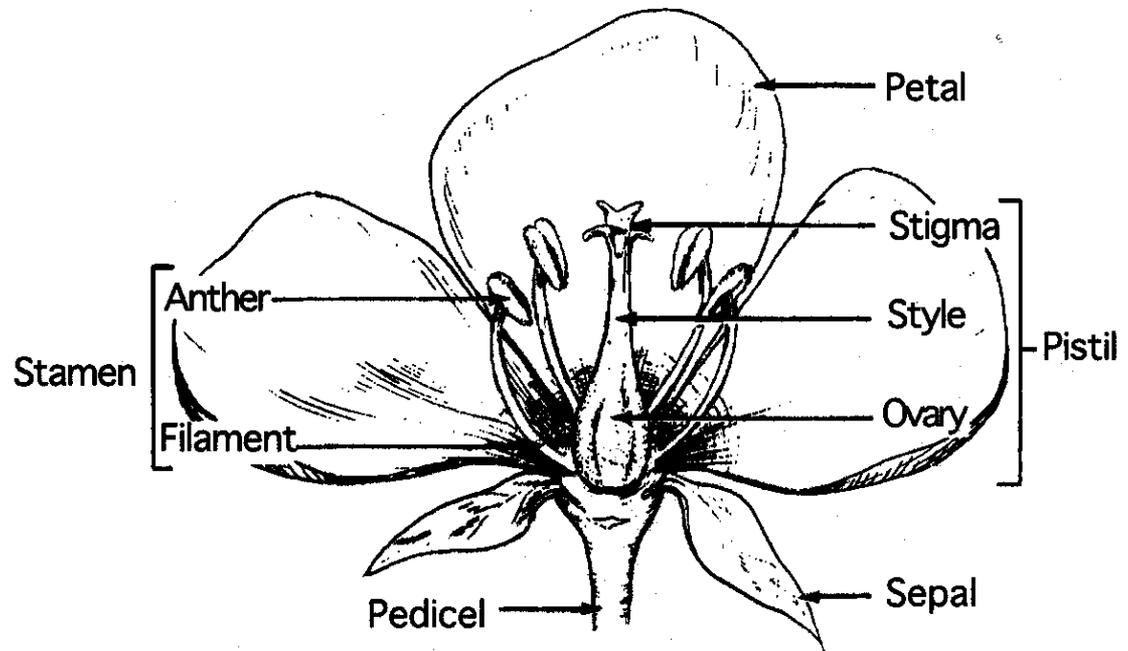


Types of Leaves

- **Foliage leaves-** for photosynthesis
- **Scale leaves-** found on rhizomes and buds
- **Seed leaves (cotyledons)-** found on embryonic plants
- **Spines and tendrils**
- **Storage leaves-** on bulbous plants and succulents
- **Bracts-** brightly colored, on dogwoods and poinsettias

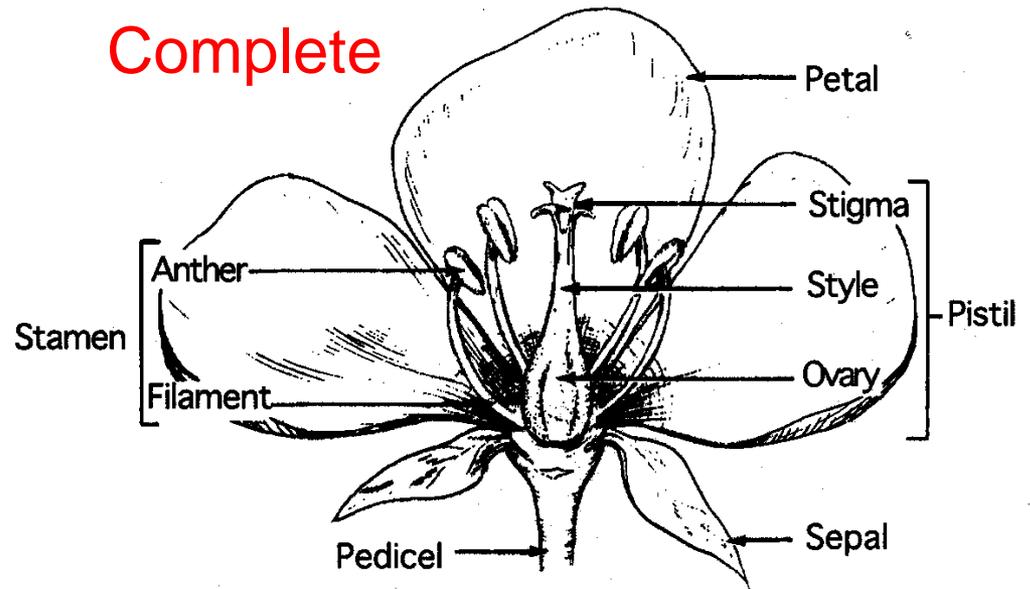
Parts of a flower

- **Stamen**- male reproductive organ, anther and filament
- **Pistil**- female reproductive organ, stigma, style and ovary
- **Sepals (calyx)**
- **Petals (corolla)**



Flower Terms

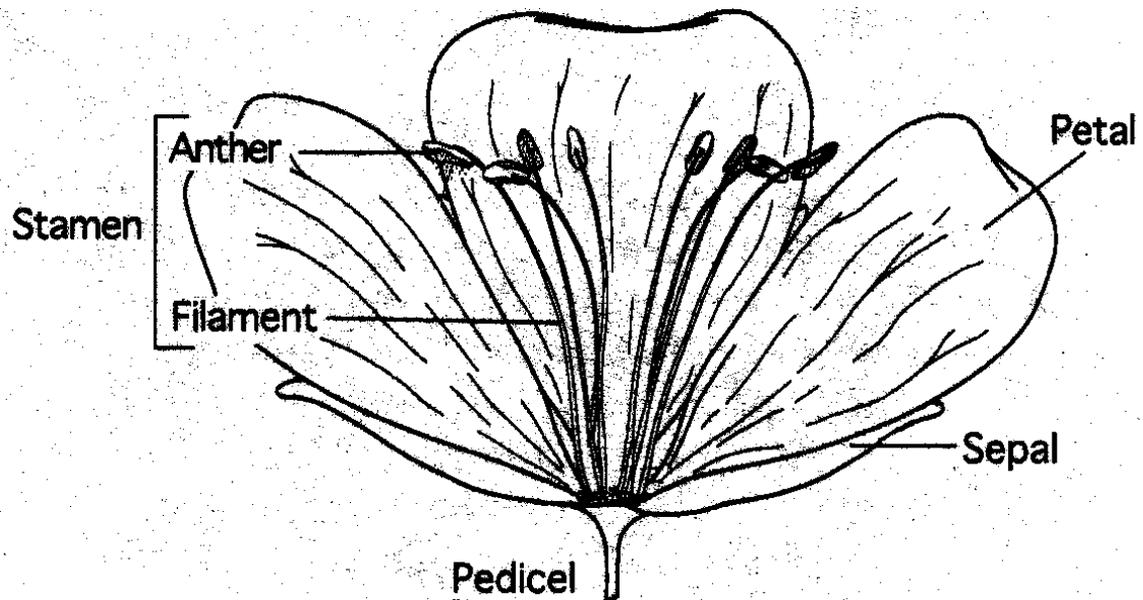
- **Complete**- has all four parts (rose)



Flower Terms

- **Incomplete**- missing one or more parts

Incomplete



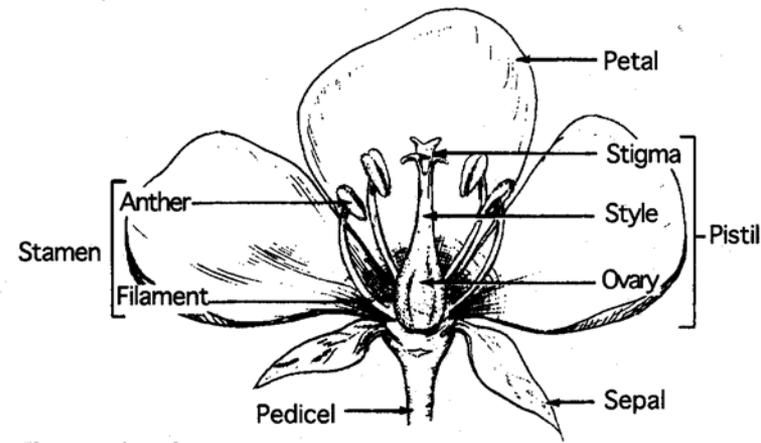
Flower Terms

- **Complete-** has all four parts (rose)
- **Incomplete-** missing one or more parts
- **Perfect-** has both male and female parts on same flower
- **Imperfect-** either pistil or stamen is missing
- **Monoecious plants-** have separate male and female flowers on the same plant (corn)
- **Dioecious plants-** have separate male and female plants (holly)

How do seeds form?

The Birds and the Bees!

- **Pollination**- the transfer of pollen from an anther to a stigma
- **Fertilization**- union of a male sperm nucleus from a pollen grain with a female egg
- **Cross-fertilization**- combines genetic material from two different parents; increases genetic diversity

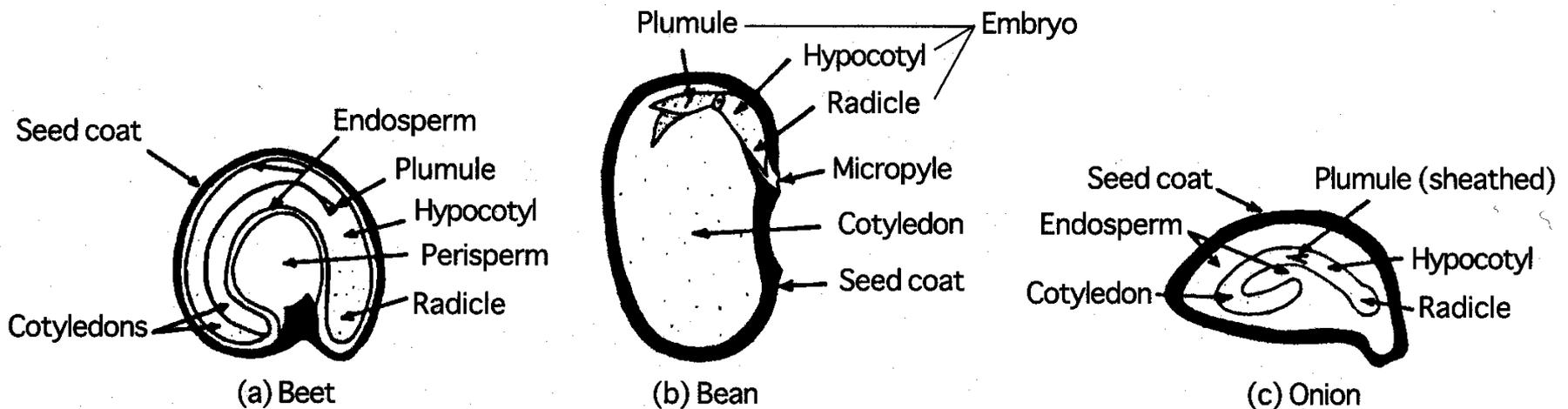


LILLY PARTS VIDEO- Botany Module



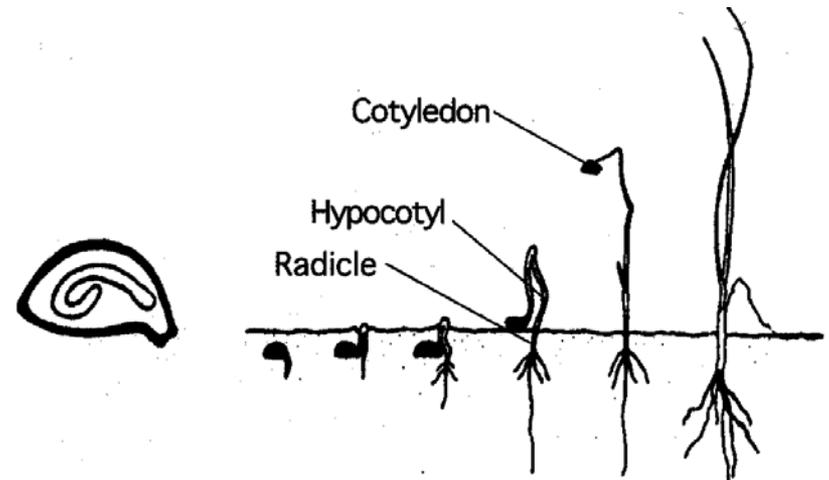
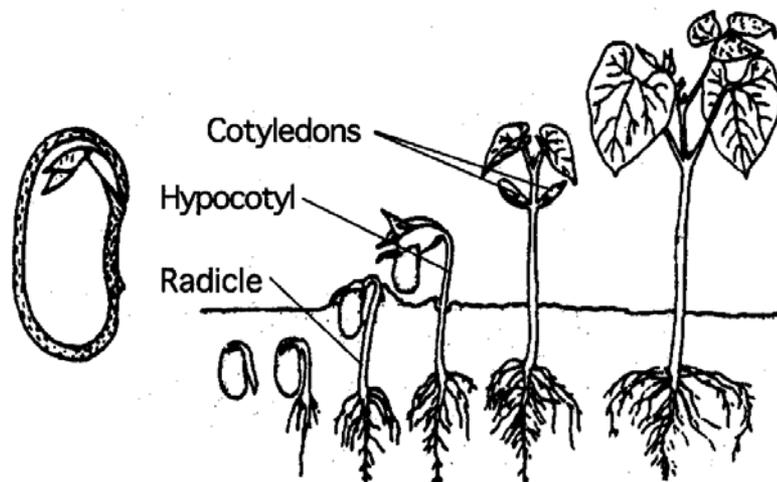
Parts of a seed

- **Embryo**- miniature plant in an arrested state of development
- **Endosperm**- food source for young plant
- **Seed Coat**- protects embryo from disease, insects and early germination



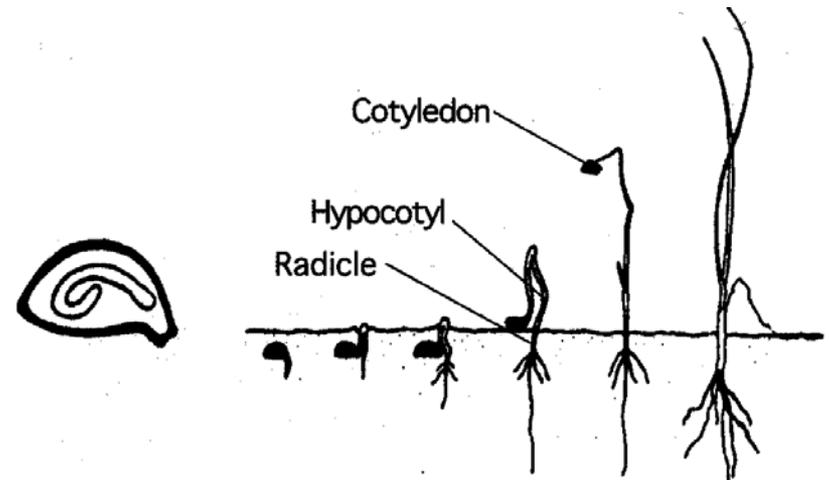
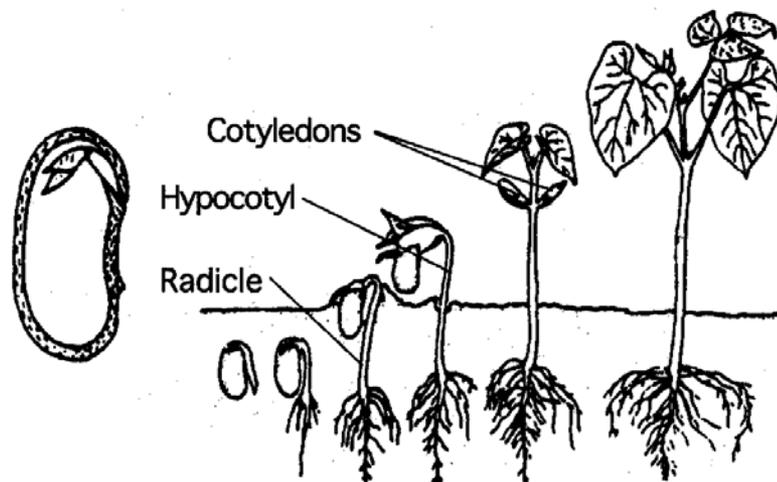
Germination

- Process whereby a seed embryo goes from a dormant to an active growing state.
- Germination requires water being absorbed through seed coat, oxygen, favorable temperature and sometimes light.



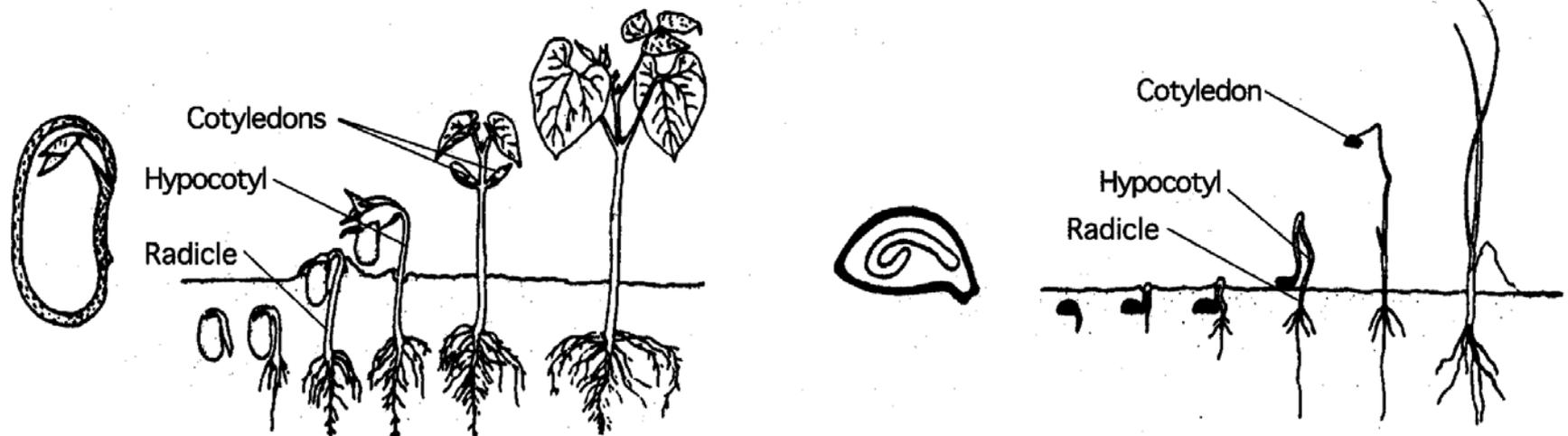
Germination

- Plants have evolved many mechanisms to ensure their survival.
- **Embryo Dormancy**- seeds must go through a chilling period before germinating. Common in ornamentals; Stratification is used to break dormancy.



Germination

- **Seed Coat Dormancy**- a hard seed coat does not allow water to penetrate. Scarification is used to soften seed coat (fire, digestion by an animal, sulfuric acid).



Other factors affecting germination

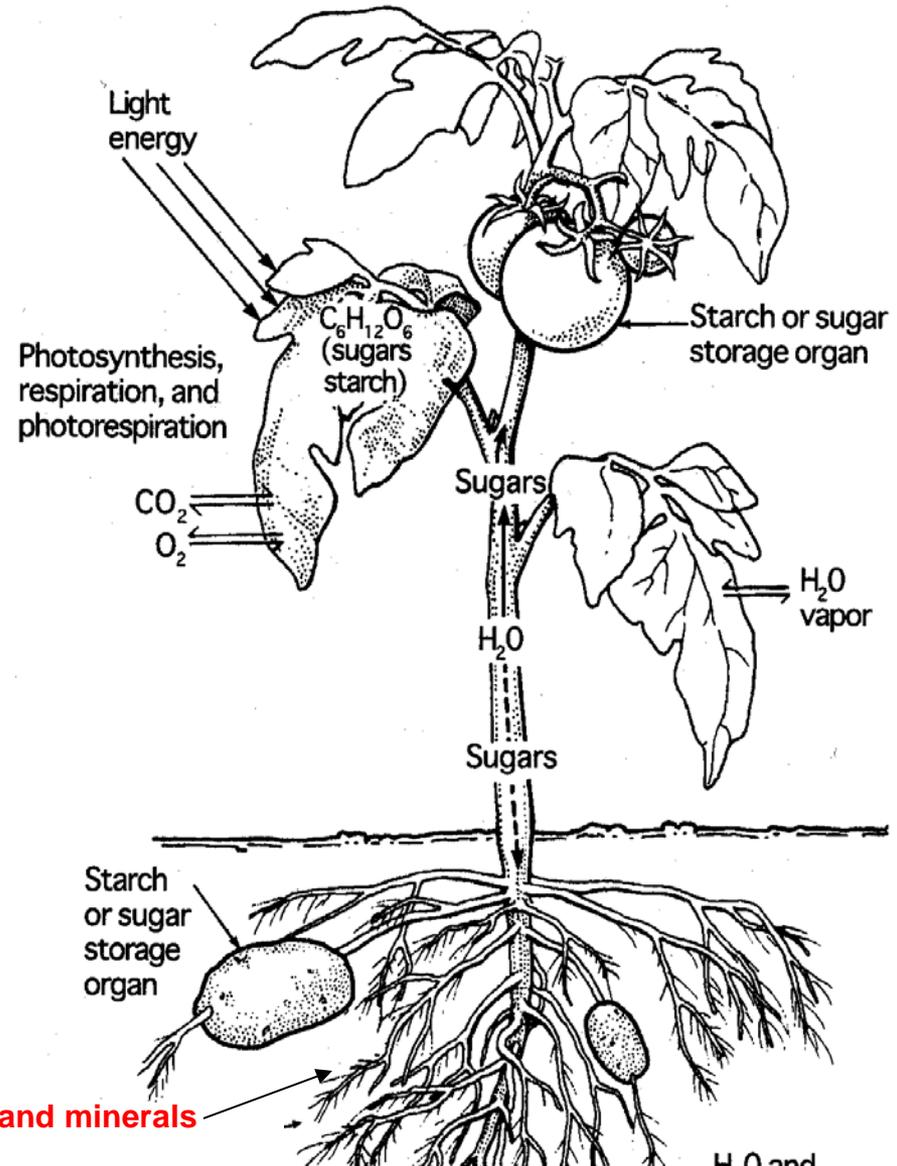
- A seed's age affects viability and seedling vigor.
- Seeds must be planted at the correct depth.
- Seeds need continual moisture, however, over-watering may promote rot and diseases.
- Many weed seeds are able to germinate at less than optimal conditions.

APPLE VIDEO- Botany Module



Plant Growth and Development

- **Photosynthesis-** The plants' ability to make its own food. During PHS, carbon dioxide and water (in the presence of sunlight) are converted into food (sugar, starch) and oxygen is given off.



Key factors affecting photosynthesis

- **Light-** PHS generally increases as sunlight increases
- **Carbon dioxide-** can be limiting in greenhouses
- **Temperature-** generally 65 to 85 degrees optimum
- **Water**

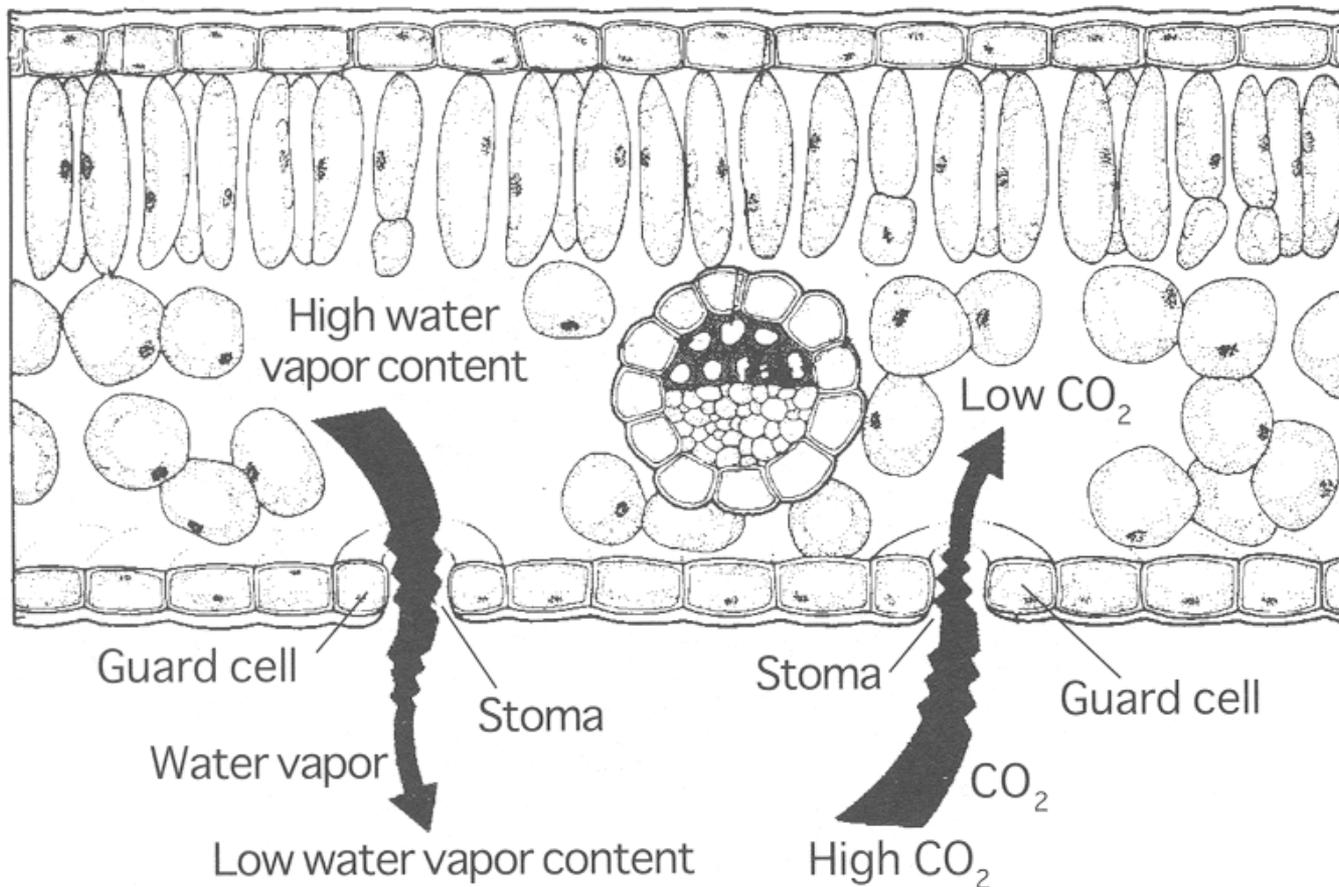
Respiration

- **Respiration is a breaking down process that releases energy for a plant (oxidation).**
- **Sugars/starches, in the presence of oxygen, are broken down into water and carbon dioxide. Energy is released for the plant.**
- **Since no light is required, respiration can occur both day and night in the plant.**

Transpiration

- **Transpiration is water loss via the leaf's stomata.**
- **The transpiration stream is responsible for:**
 - Transporting minerals from the soil throughout the plant.**
 - Cooling the plant through evaporation.**
 - Moving sugars and plant chemicals.**
 - Maintaining cell firmness**

Stomata and leaf transpiration



Environmental factors affecting plant growth

- **Light-** refers to quantity (intensity) of light, quality (blue and red wavelengths) and duration (short-day versus long-day plants).
- **Temperature-** affects plant hardiness, dormancy, germinations and overall growth of a plant.
- **Water and Humidity**
- **Plant Nutrition**

Plant Nutrition

- **Plants need 16 elements for normal growth.**
- **Carbon, Hydrogen and Oxygen are found in water and air.**
- **Primary nutrients needed in large amounts are Nitrogen, Phosphorus and Potassium (N-P-K).**
- **Secondary nutrients are needed in moderate amounts are Calcium, Magnesium and Sulfur.**
- **The seven micronutrients (trace elements) are Iron, Boron, Zinc, Copper, Manganese, Molybdenum and Chlorine.**



Plant Hardiness Zone Map

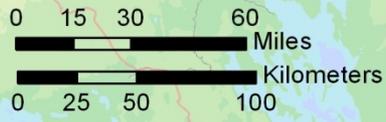
Washington

Average Annual Extreme Minimum Temperature 1976-2005

Temp (F)	Zone	Temp (C)
-30 to -25	4a	-34.4 to -31.7
-25 to -20	4b	-31.7 to -28.9
-20 to -15	5a	-28.9 to -26.1
-15 to -10	5b	-26.1 to -23.3
-10 to -5	6a	-23.3 to -20.6
-5 to 0	6b	-20.6 to -17.8
0 to 5	7a	-17.8 to -15
5 to 10	7b	-15 to -12.2
10 to 15	8a	-12.2 to -9.4
15 to 20	8b	-9.4 to -6.7
20 to 25	9a	-6.7 to -3.9



Mapping by the PRISM Climate Group Oregon State University





Plant Hardiness Zone Map

Idaho

Average Annual Extreme Minimum Temperature 1976-2005

Temp (F)	Zone	Temp (C)	Temp (F)	Zone	Temp (C)
-35 to -30	3b	-37.2 to -34.4	-10 to -5	6a	-23.3 to -20.6
-30 to -25	4a	-34.4 to -31.7	-5 to 0	6b	-20.6 to -17.8
-25 to -20	4b	-31.7 to -28.9	0 to 5	7a	-17.8 to -15
-20 to -15	5a	-28.9 to -26.1	5 to 10	7b	-15 to -12.2
-15 to -10	5b	-26.1 to -23.3			

