Plant Anatomy & Physiology

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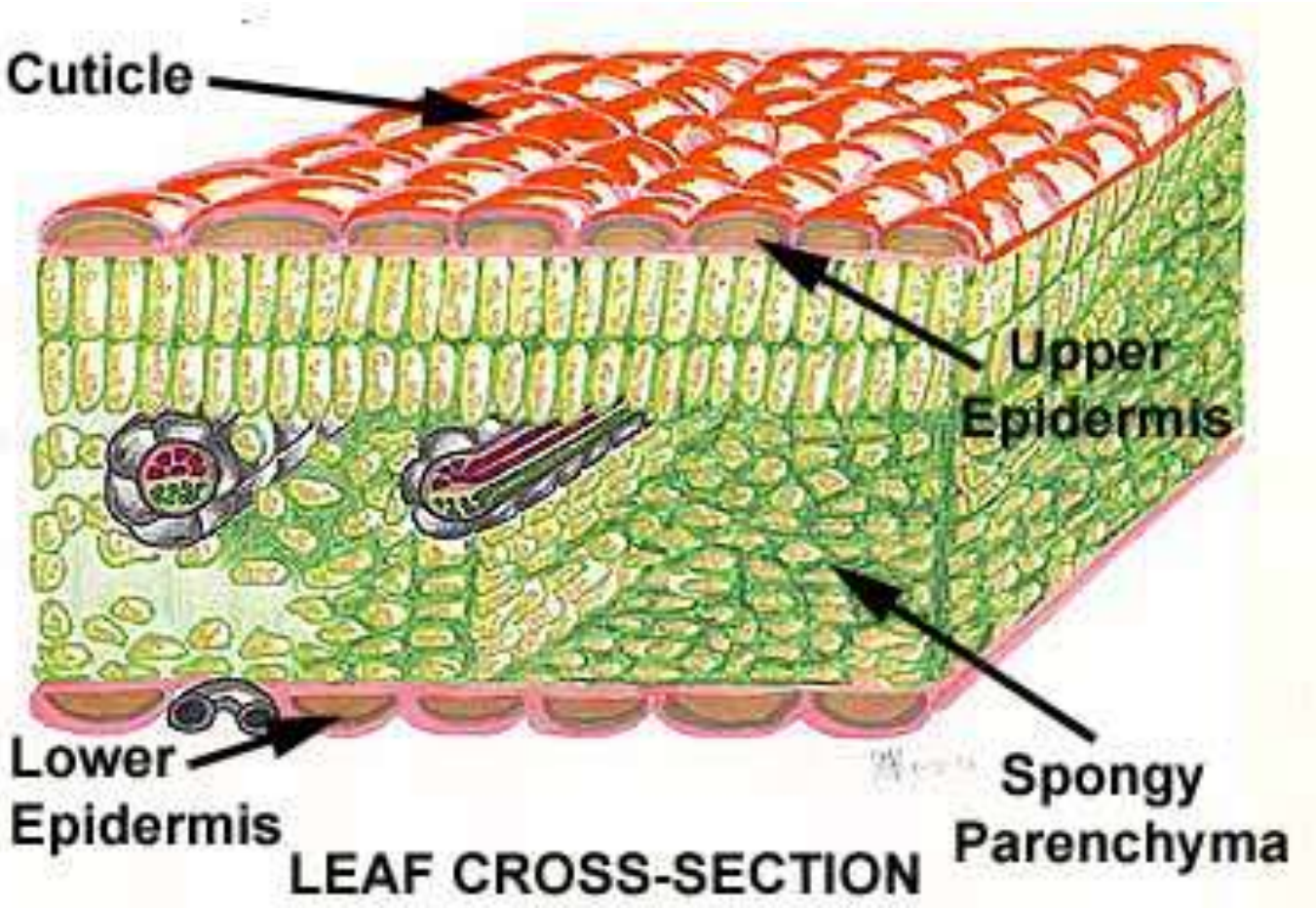
Leaves

- Functions
  - Make food through photosynthesis
  - Site of gas exchange
    - Respiration
    - Photosynthesis
  - Store food

Tissues of the Leaf

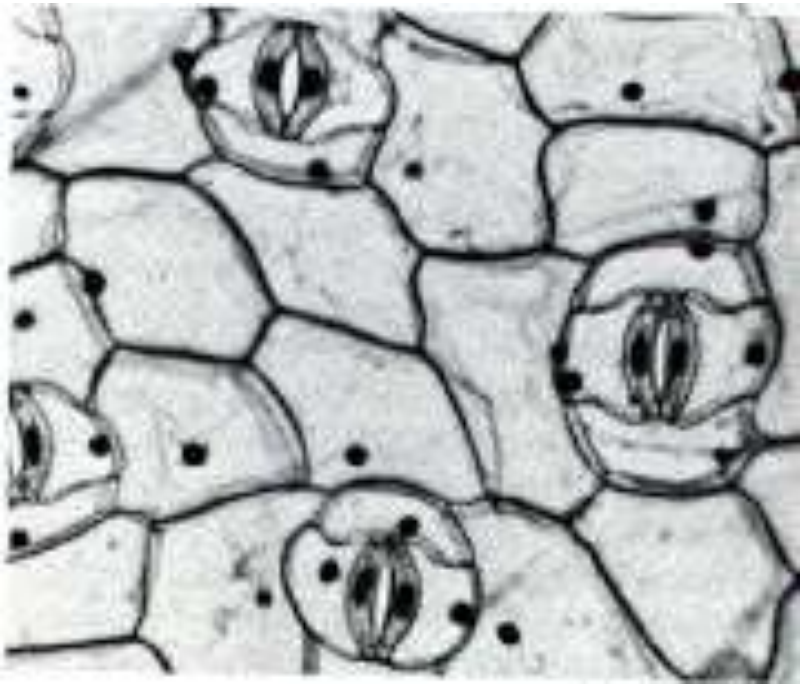


Tissues of the Leaf (Epidermis)

- Cuticle
  - Waxy substance that covers the leaves & stems
  - Waterproof layer that keeps water in plants

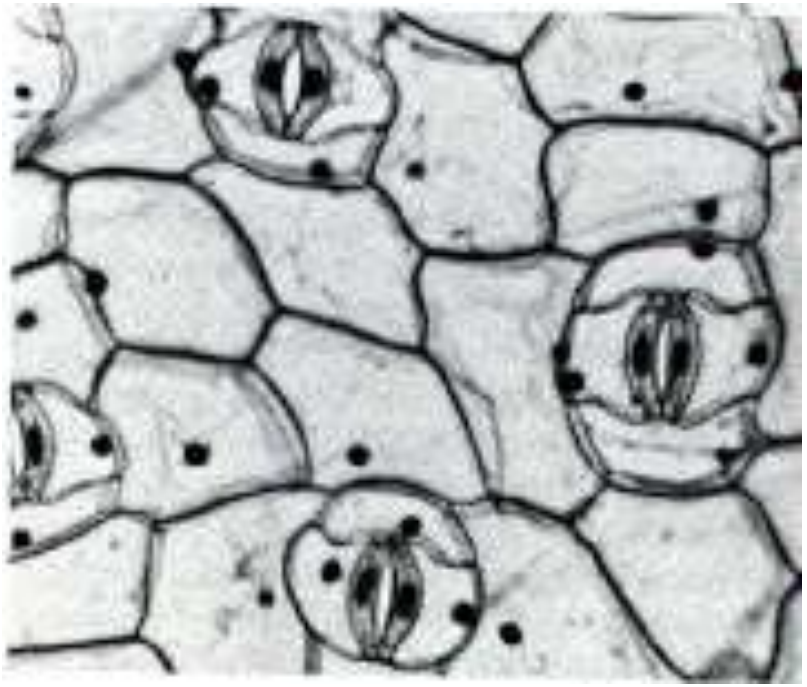
Tissues of the Leaf (Epidermis)

- Stomata
  - Openings in the epidermis mainly located on the underside of leaves
  - Exchange of gases



Tissues of the Leaf (Epidermis)

- Guard Cells
  - Two cells located on each side of stomata
  - Open and closes stomata

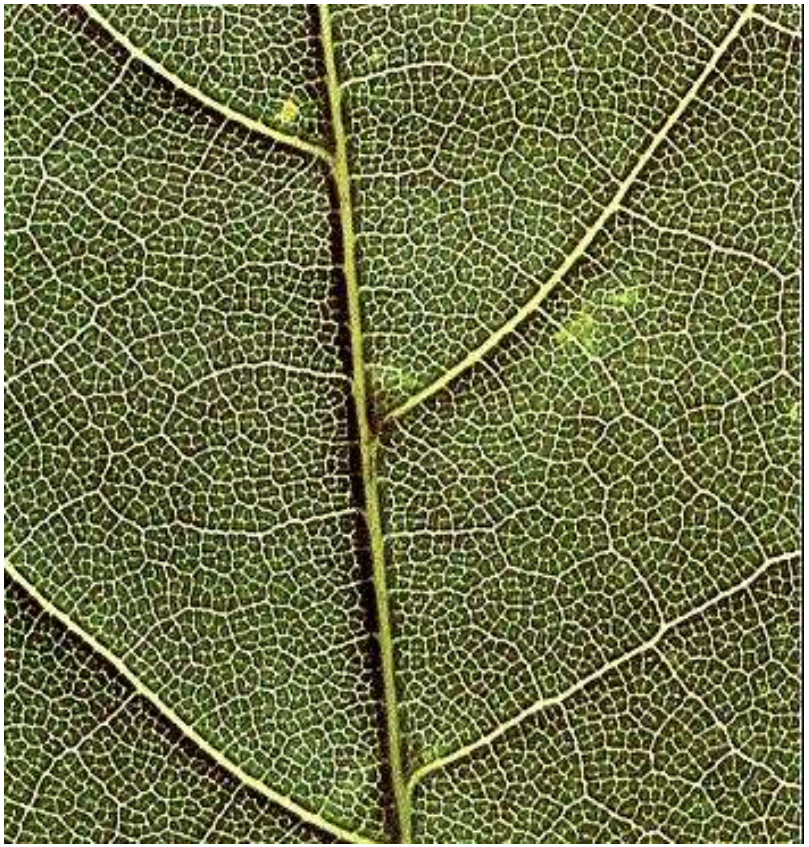


Tissues of the Leaf (Mesophyll Layer)

- Palisade mesophyll
  - Primary site of photosynthesis
- Spongy mesophyll
  - Contains air & chloroplasts
  - Site of photosynthesis and gas exchange

Tissues of the Leaf

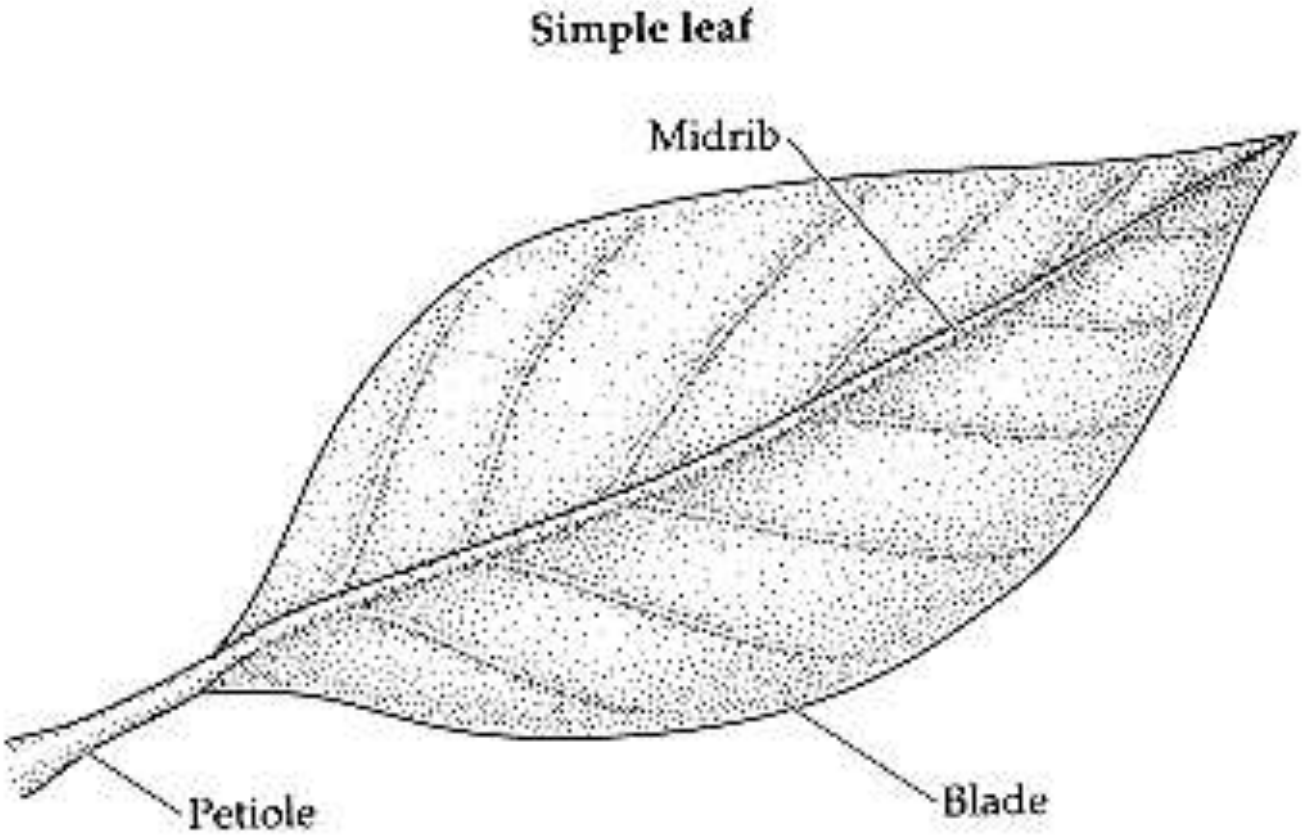
- Vascular Bundles
  - Called veins
  - In spongy mesophyll
  - Phloem moves food from leaf to the rest of the plant
  - Xylem moves water & minerals up to leaves from roots



External Parts of the Leaf

- Petiole
  - Leaf stalk or part that connects the leaf to the stem.
- Blade
  - The large, flat part of a leaf.
- Midrib
  - The large center vein.

External Parts of the Leaf



Stems

- Functions
  - Movement of materials
    - Water & minerals from roots to leaves
    - Manufactured food from leaves to roots
  - Support leaves & reproductive structures
  - Food storage

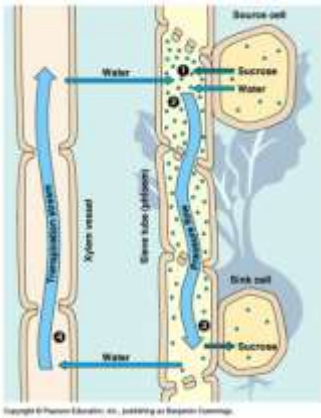
Internal Stem Structure

- Xylem
  - The tissue that transports water & nutrients up from roots to stems & leaves.
- Phloem
  - Tissue that transports food down from leaves to roots.
- Cambium
  - Thin, green, actively growing tissue located between bark & wood and produces all new stems cells.

Movement of Water

- **Uptake of water from soil**
- Water is absorbed by plants at their roots. (water diffuses from soil into the root).
- Minerals are dissolved within the water; these minerals are very important to the plants metabolic activities.
- Root hairs greatly enhance the surface area of roots thereby increasing the amount of water absorbed.
- The buildup of water within the roots exerts a ROOT PRESSURE, pushing the water from the xylem of roots, up into the xylem of the stem.
- **Movement of water up the xylem (within the 'shoot')**
- Water molecules stick together due to their cohesive properties (opposite charges in H2O attract one another).
- Water particles also are attracted to the sides of the wall of the xylem (adhesion).
- Water is drawn up the xylem of the stem due to the loss of water from the stomates of the plant (transpiration).
- **Transpiration/ Transpirational Pull**
- Transpiration involves the evaporation of water from the leaves of the plant.
- This evaporation exerts a pull on water molecules below; continuing to pull the water up the xylem. This is called Transpirational Pull.

Movement of Glucose (sugar)



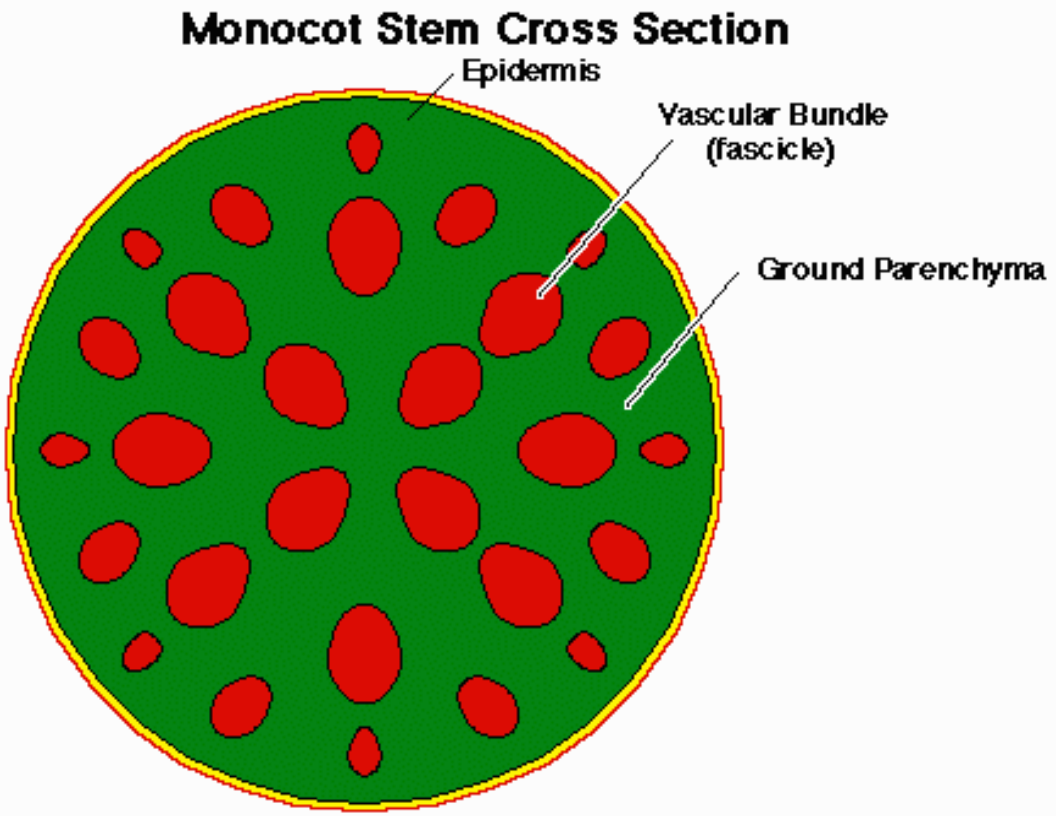
- Translocation involves the movement of sugars in plants. Once glucose (a monosaccharaide) is produced through photosynthesis, it links with another glucose to form sucrose (a disaccharide). Sucrose production in the leaves must travel through the phloem to be used for growth and metabolism. Sugar always moves from:
- SOURCE… to… SINK
- The SOURCE would generally be the leaf cells and the SINK would be the other parts of the plant in need of sugar for life activities or for storage. Keep in mind, however, that phloem can move sugar in both directions. So, when times are tough for a plant, it will call upon its stored food. It such a situation, the source may be the roots (where the food is stored) to where it is needed (sink).
- Steps:
- 1. Sucrose is actively transported into the phloem. Individual phloem cells are called sieve tube cells.
- 2. Water diffuses from xylem into phloem.
- 3. Pressure builds in sieve cell pushing the sucrose downward into the next sieve tube cell.
- 4. Sucrose will diffuse into those cells that are in need of carbohydrates.

Internal Stem Structure

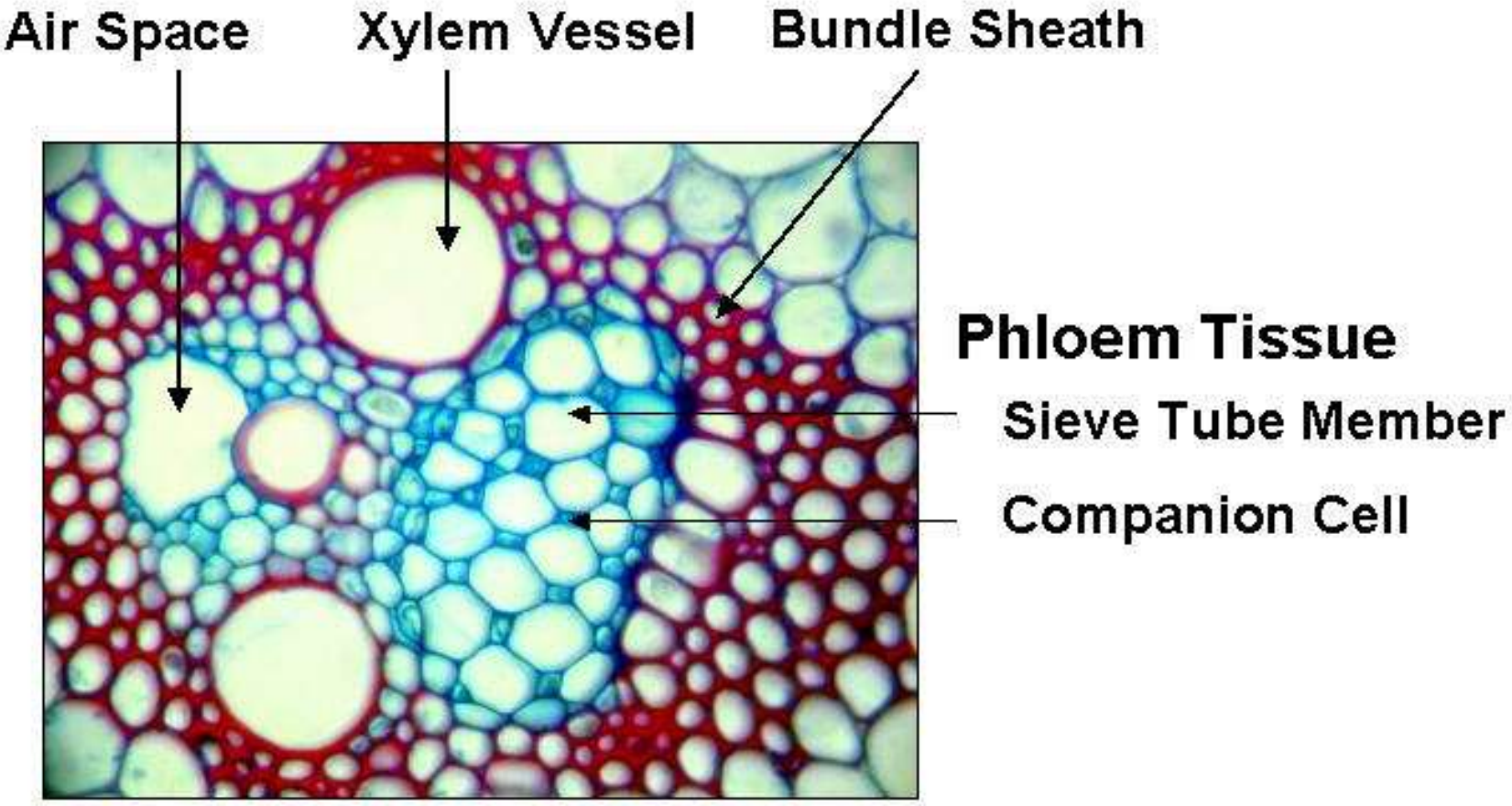
- Bark
  - Old, inactive phloem.
- Heartwood
  - Old, inactive xylem.
- Sapwood
  - New, active xylem.

Internal Stem Structure (Monocots)

- Vascular bundles contain both xylem & phloem.
- Examples:
  - Grasses
  - Corn

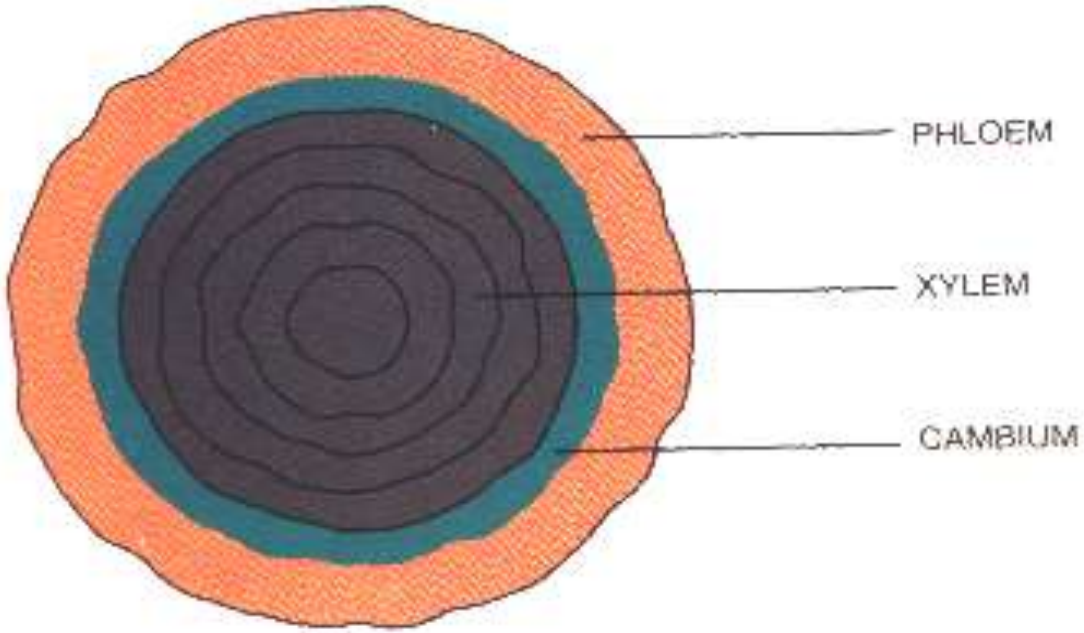


Monocot Stems (Vascular Bundle)

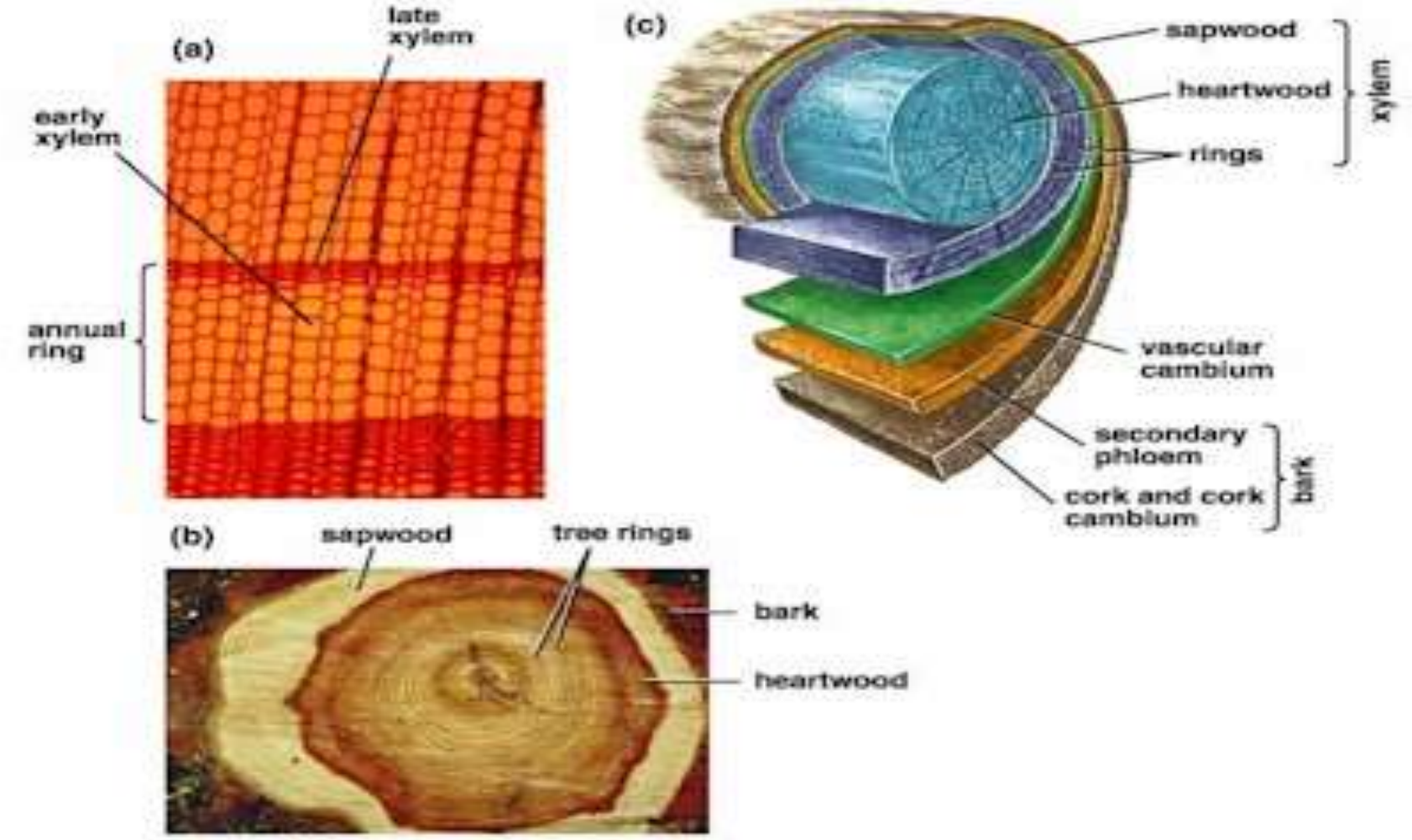


Internal Stem Structure (Dicots)

- Plant stems have xylem & phloem separated by the cambium.
- Example:
  - Trees



Internal Stem Structure (Dicots)

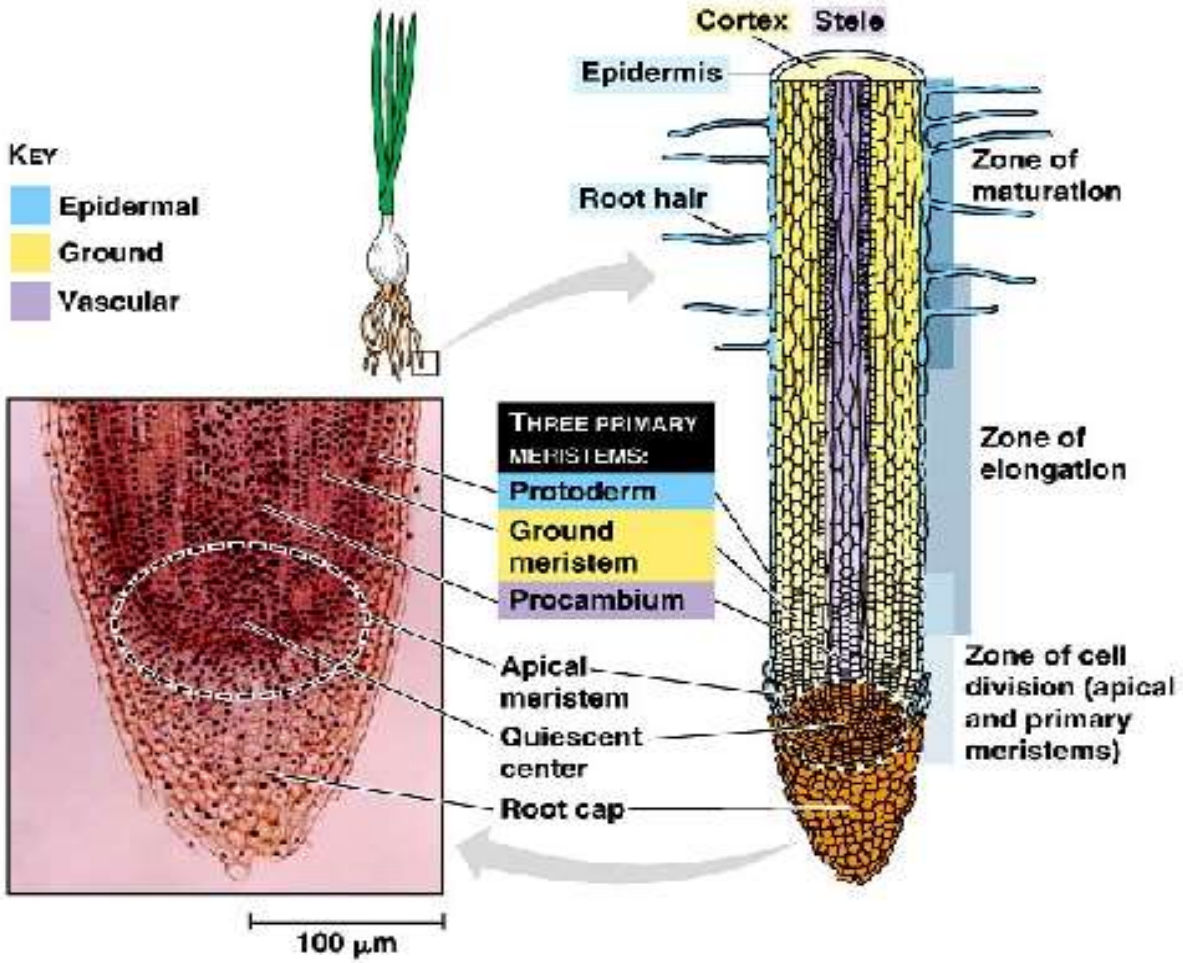


Roots

- Functions
  - Anchor the plant
  - Absorb water & minerals
  - Store food
  - Propagate or reproduce some plants

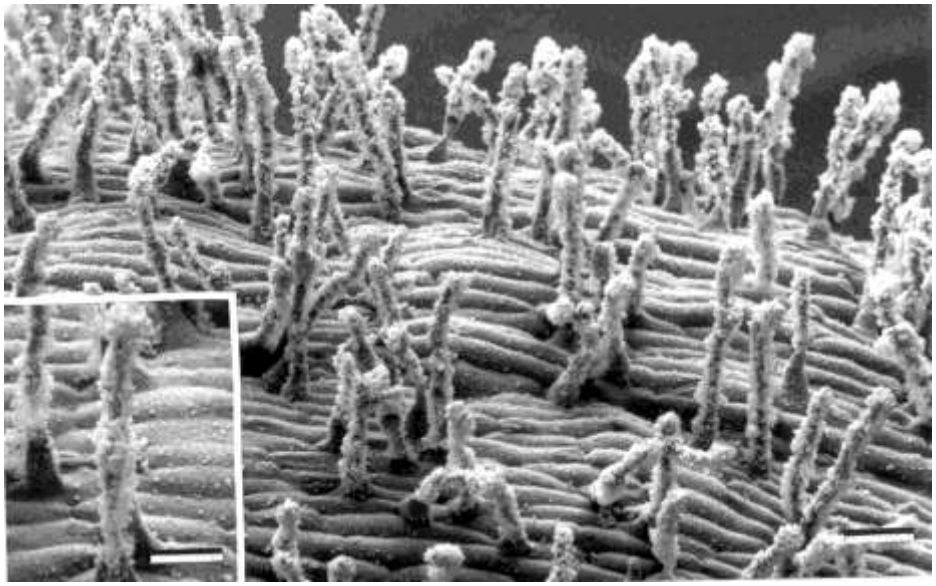
External Parts of Roots

- Root Cap
  - Indicates growth of new cells.



External Parts of Roots

- Root Hairs
  - Tiny one celled hair-like extensions of the epidermal cells located near the tips of roots.
  - Increase surface area.
  - Absorb water & minerals.



Internal Parts of Roots

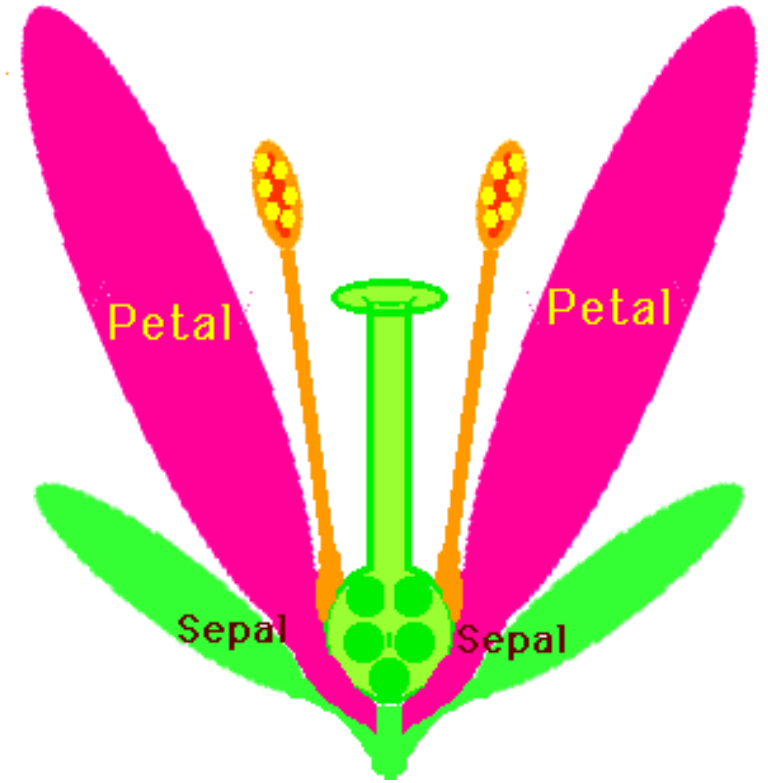
- Much like those of stems with phloem, cambium and xylem layers.
- Phloem
  - The outer layer.
  - Carries food down the plant.
- Xylem
  - The inner layer.
  - Carries water & minerals up to the stem.

Flowers

- Function
  - Contain the sexual organs for the plant.
  - Produces fruit, which protects, nourishes and carries seeds.
  - Attracts insects for pollination.

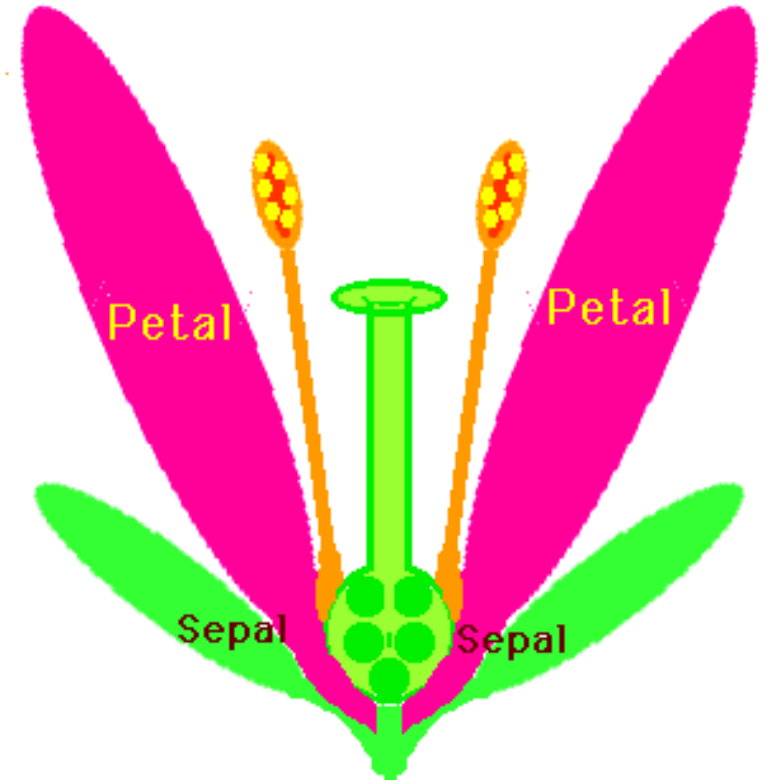
Parts of the Flower

- Sepals
  - Outer covering of the flower bud.
  - Protects the stamens and pistils when flower is in bud stage.
  - Collectively known as the calyx.



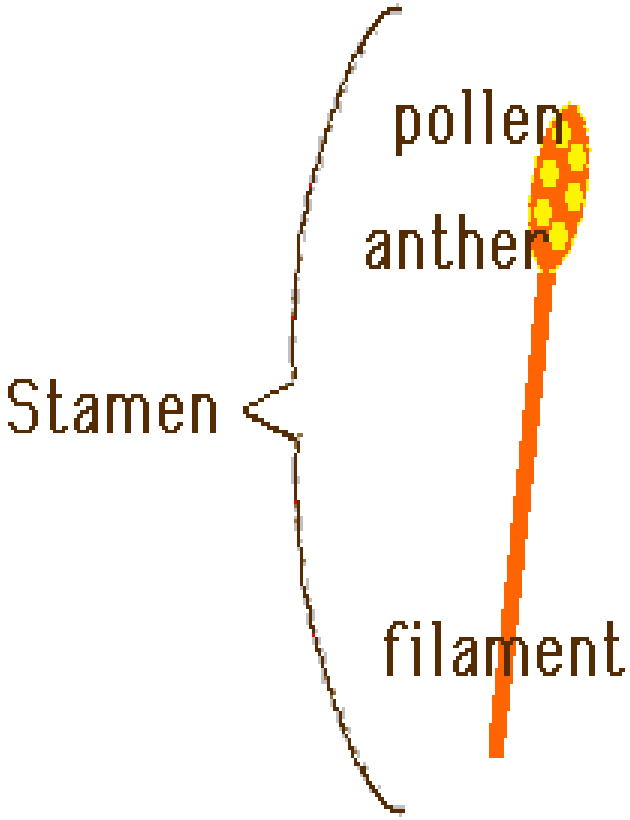
Parts of the Flower

- Petals
  - Brightly colored
  - Protects stamen & pistils.
  - Attracts pollinating insects.
  - Collectively called the corolla.



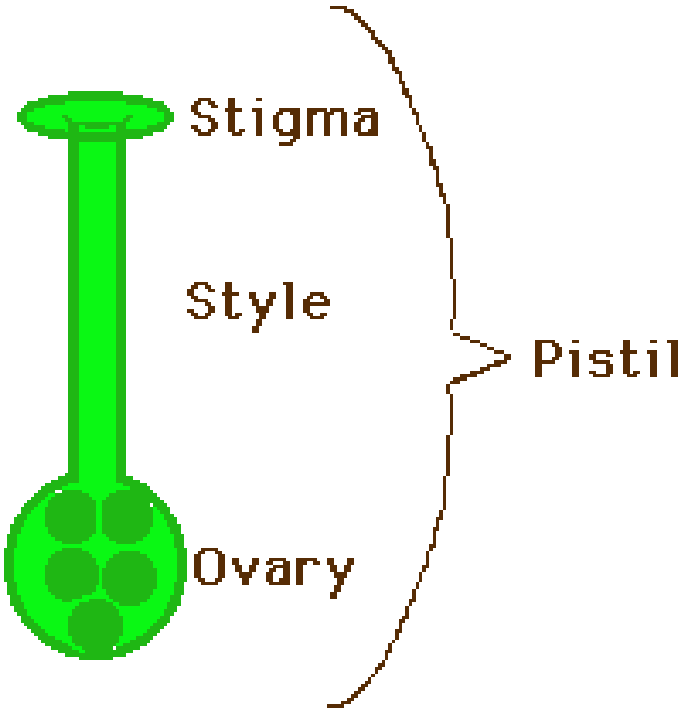
Parts of the Flower (Stamen)

- Male reproductive part
  - Anther
    - Produces pollen
  - Filament
    - Supports the anther



Parts of the Flower (Pistil)

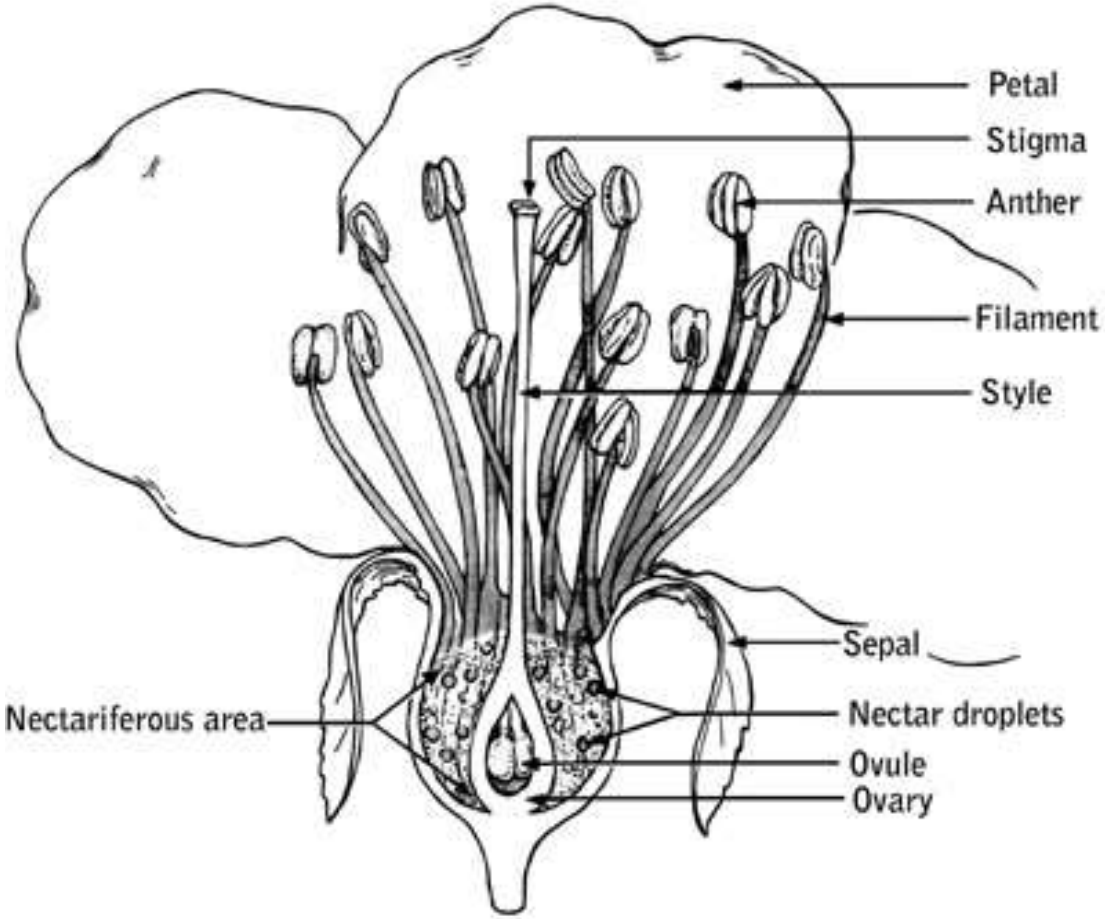
- Female reproductive part
  - Ovary
    - Enlarged portion at base of pistil
    - Produces ovules which develop into seeds
  - Stigma
    - Holds the pollen grains



Parts of the Flower (Pistil)

- Style
  - Connects the stigma with the ovary
  - Supports the stigma so that it can be pollinated

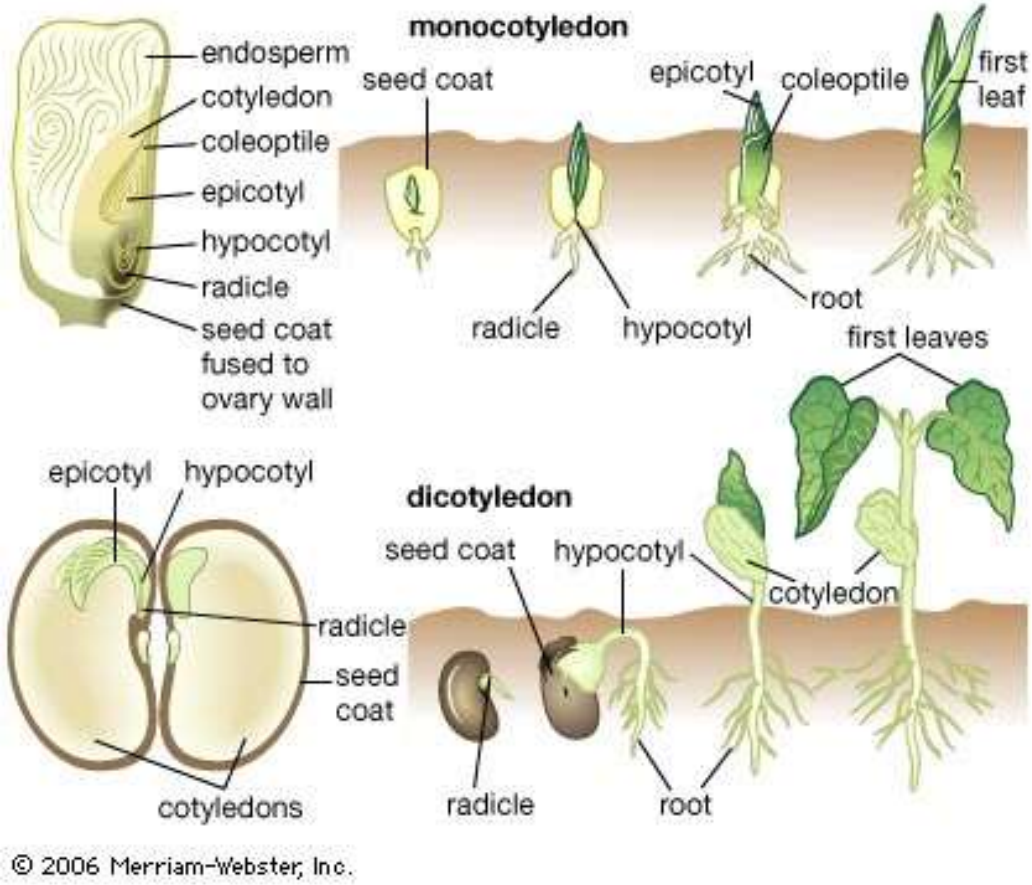
Parts of the Flower



Importance of Flowers

- Important in florist & nursery businesses.
- Many plants are grown solely for their flowers.
- Plants have flowers to attract insects for pollination, but people grow them for beauty & economic value.

Seeds


endosperm
cotyledon
coleoptile
epicotyl
hypocotyl
radicle
seed coat fused to ovary wall
monocotyledon
seed coat
epicotyl
coleoptile
first leaf
root
radicle
hypocotyl
first leaves
epicotyl
hypocotyl
dicotyledon
seed coat
hypocotyl
cotyledon
radicle
seed coat
cotyledons
radicle
root
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Seeds

Seed Coat: Protective covering around the seed
*Epicotyl: Develops into the leaves of the plant.
*Hypocotyl: Develops into the stem of the plant.
Cotyledon: Stored food for the embryo.
*Radicle: Develops into the root system of the plant.

**Make up the embryo.*

Tropisms (+ and -)

Gravitropism: a response of a plant to gravity

Phototropism: a response of a plant to light

Thigmotropism: a response of a plant to touch

Hydrotropism: a response of a plant to water

Plant Hormones

Hormone	Where Produced/Found in Plant	Major Functions
Auxin	Developing seeds and fruits contain high levels of auxin, young leaves are the primary site of auxin synthesis	Stimulates stem elongation, regulates development of fruit, functions in phototropism and gravitropism
Cytokinins	Synthesized primarily in roots and transported to other organs	Regulate cell division
Gibberellins	Young leaves and developing seeds are the primary sites of production	Stimulate stem elongation, regulate fruit growth, seed development
Abscisic acid	Found in every major organ and living tissue	Inhibits growth
Ethylene	Found in almost all areas of the plant	Promotes ripening of fruit