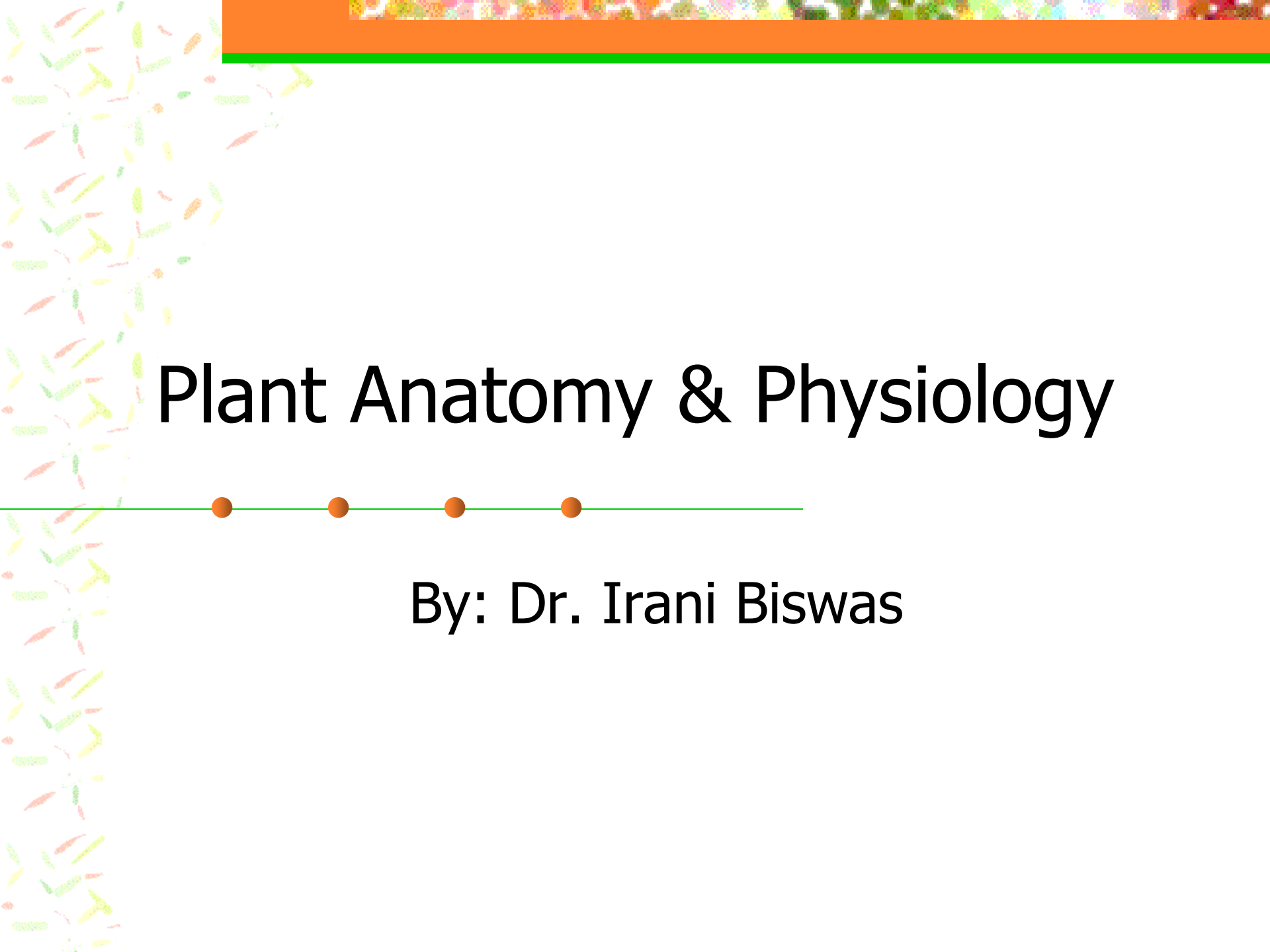


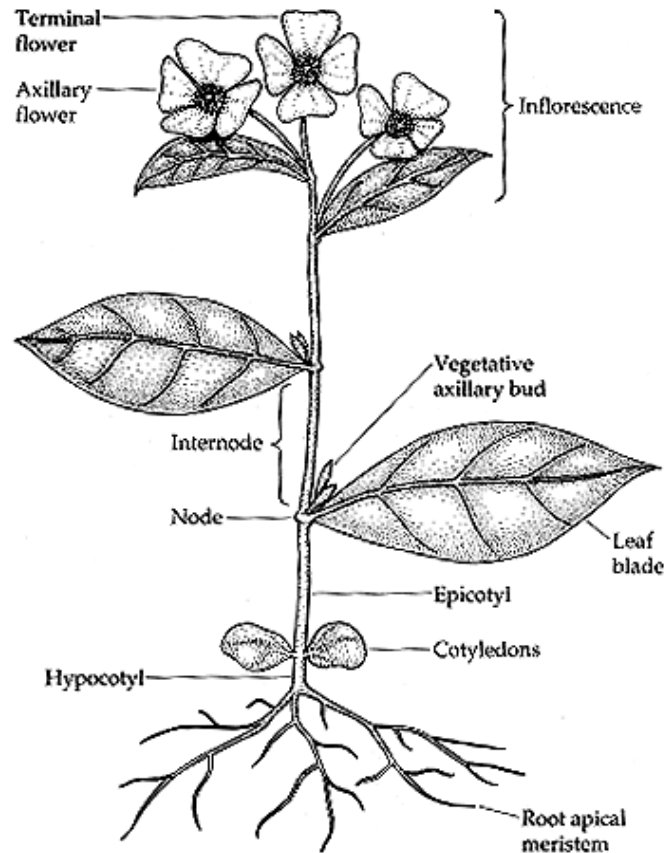


Plant Anatomy & Physiology

By: Dr. Irani Biswas

The Four Basic Parts of Plants

- Leaves
- Stems
- Roots
- Flowers



Leaves

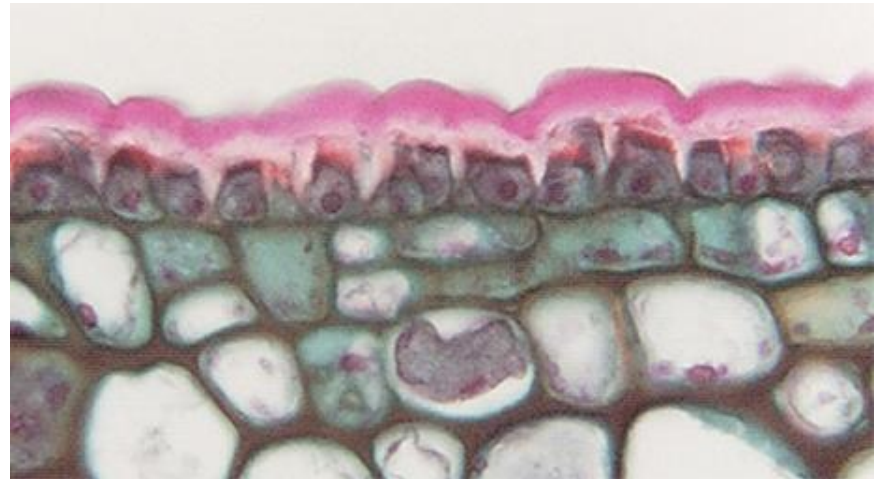
■ Functions

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

Tissues of the Leaf (Epidermis)

■ Cuticle

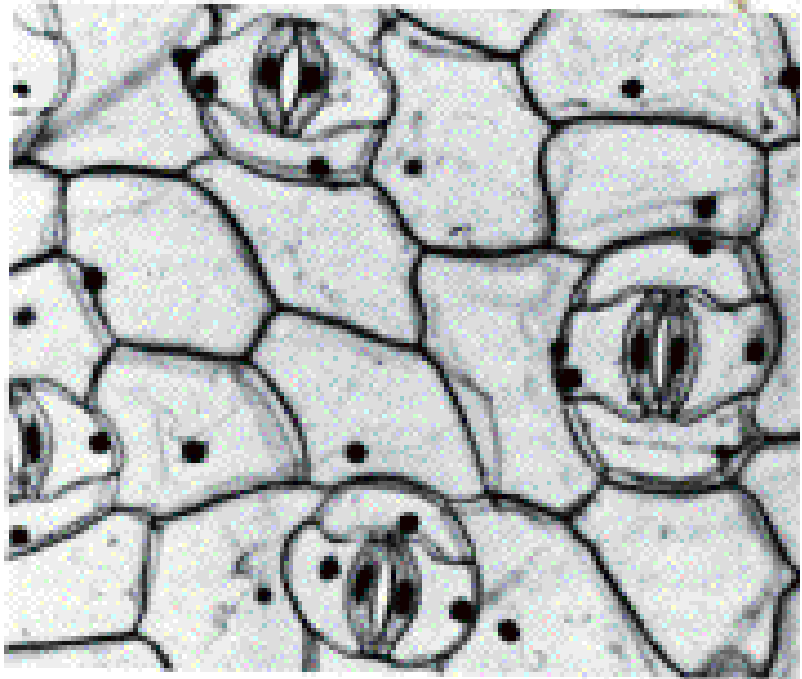
- Waxy substance that covers the leaves & stems
- Waterproof layer that keeps water in plants



Tissues of the Leaf (Epidermis)

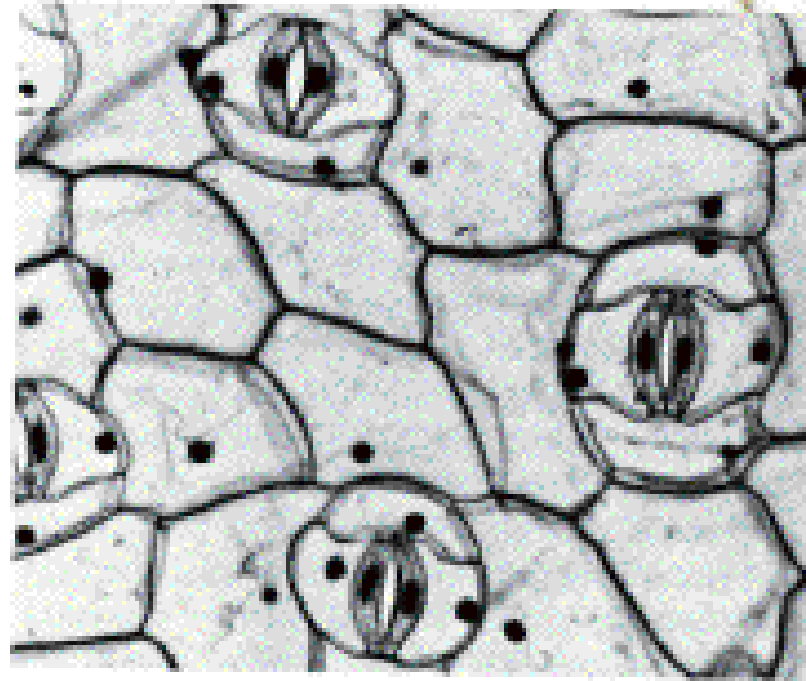
■ Stomata

- 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

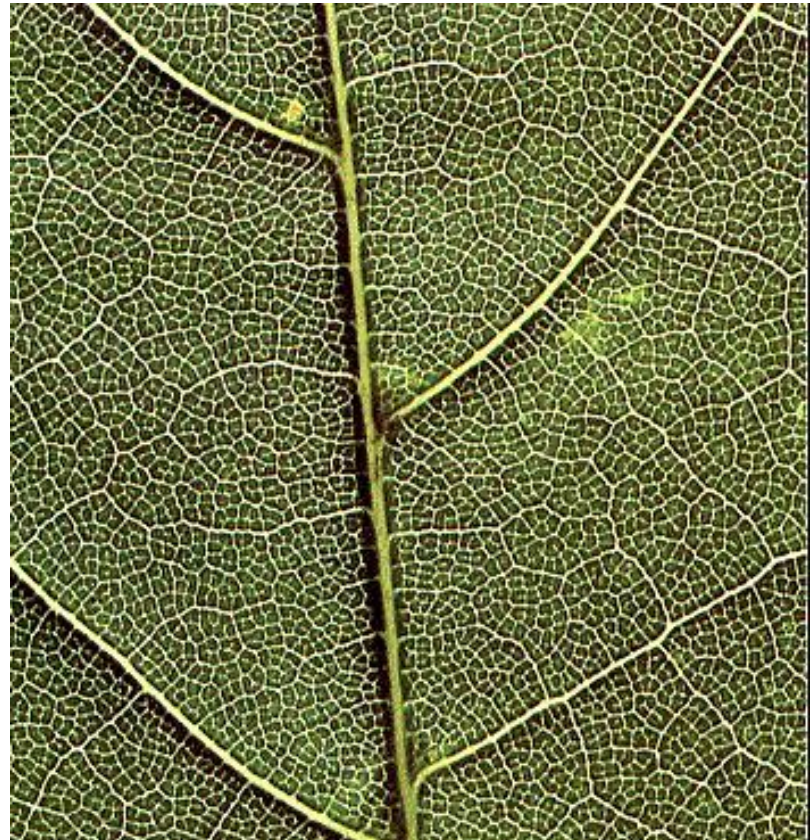


Tissues of the Leaf (Mesophyll Layer)

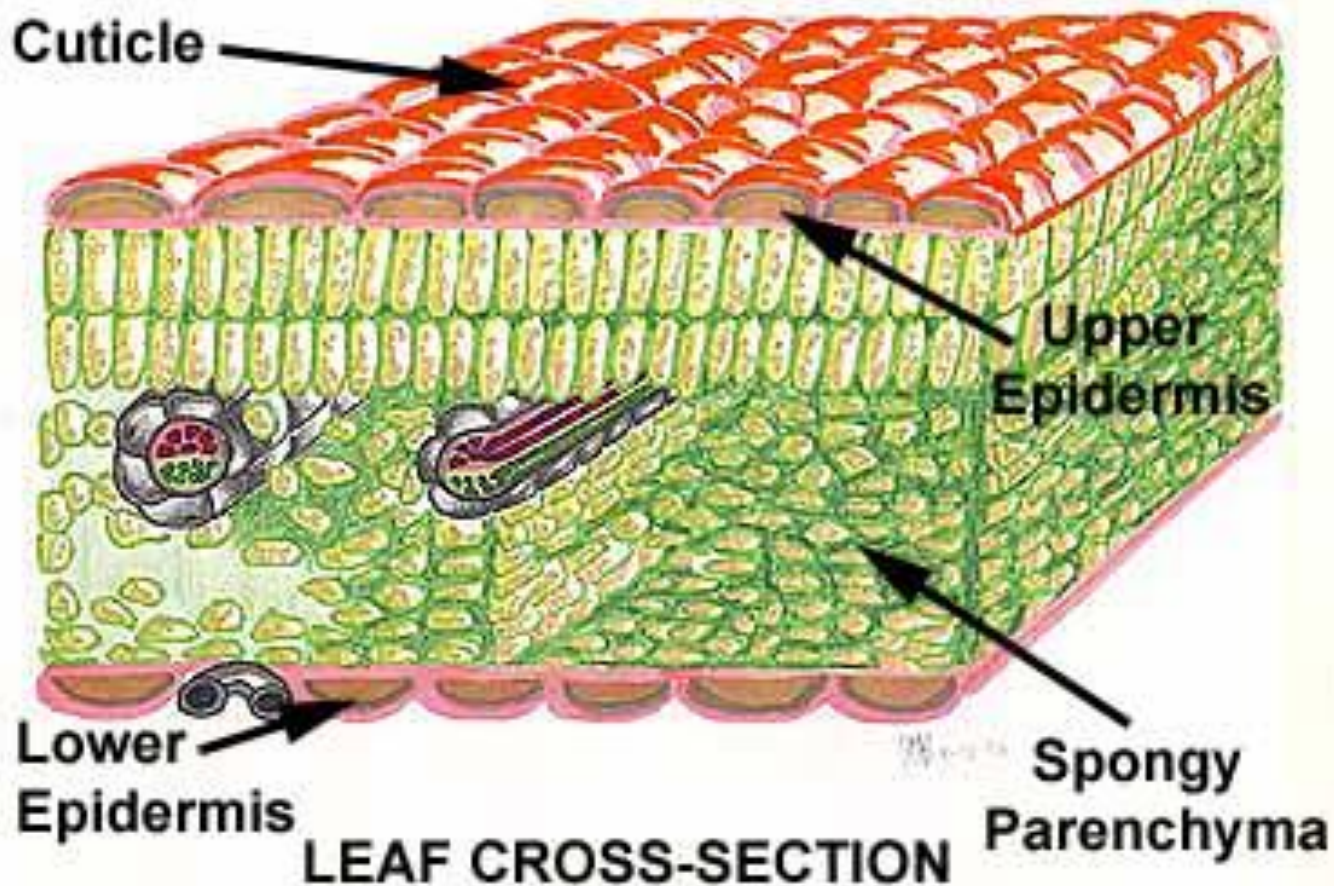
- Palisade mesophyll
 - Primary site of photosynthesis
- Spongy mesophyll
 - Contains air & chloroplasts
 - Site of photosynthesis and gas exchange

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



Tissues of the Leaf



External Parts of the Leaf



■ Petiole

- Leaf stalk or part that connects the leaf to the stem.

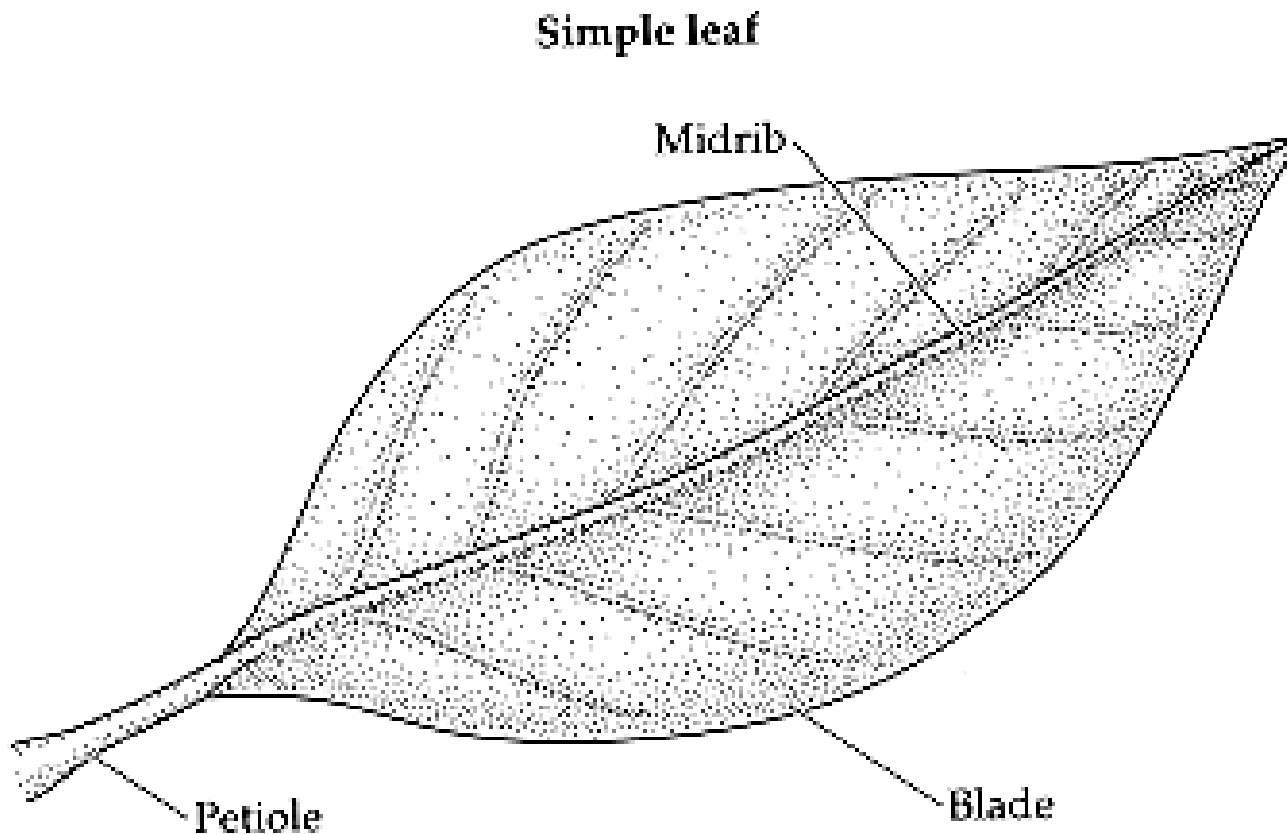
■ Blade

- The large, flat part of a leaf.

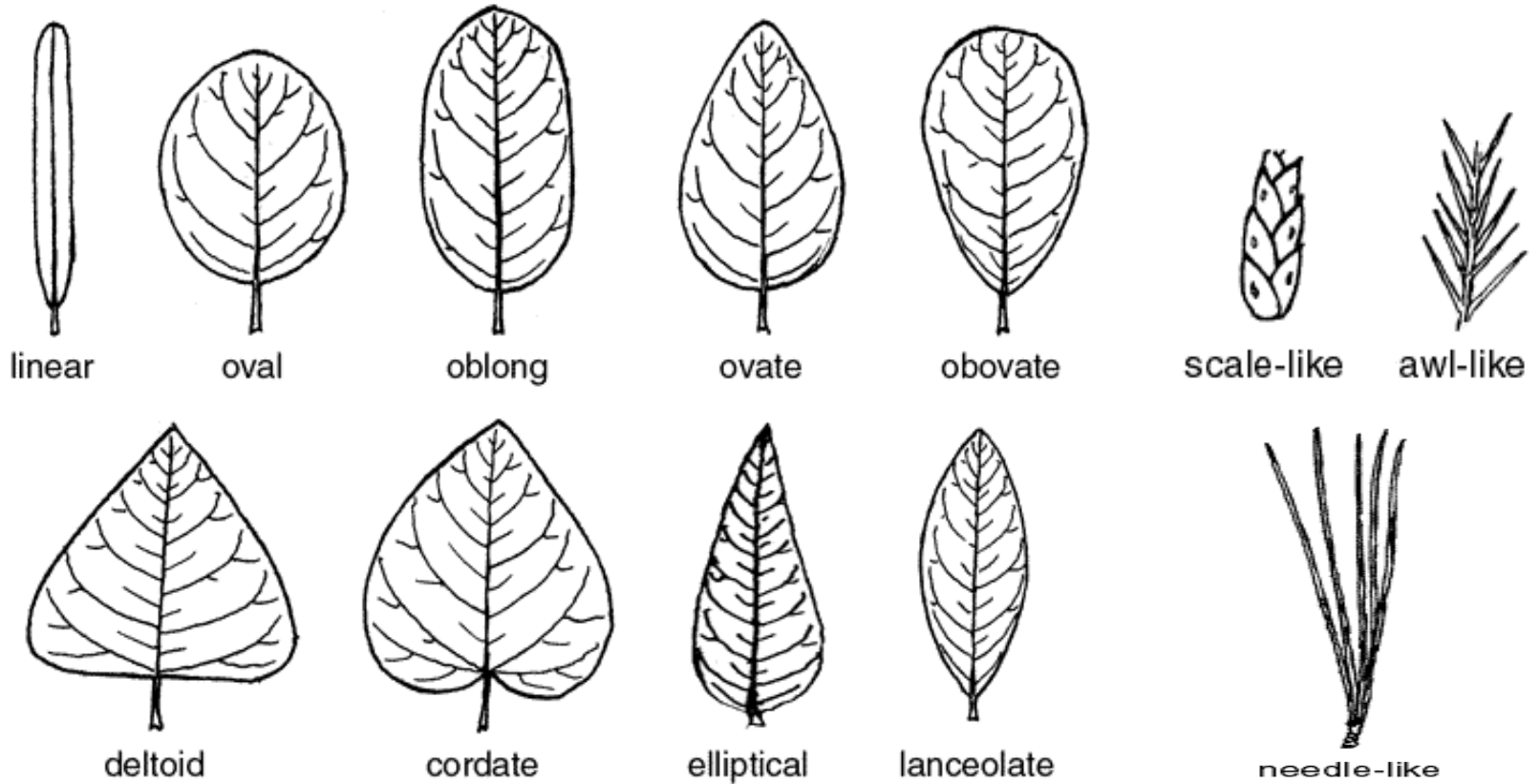
■ Midrib

- The large center vein.

External Parts of the Leaf



Leaf Forms



Leaf Margins



entire



undulate



finely
serrate



coarsely
serrate



doubly
serrate



crenate



lobed

Leaf Tips



acute



acuminate



bristle-tipped



truncate



obtuse

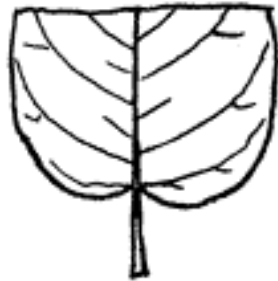
Leaf Bases



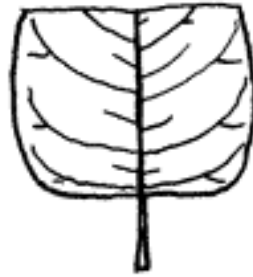
cuneate



obtuse



cordate

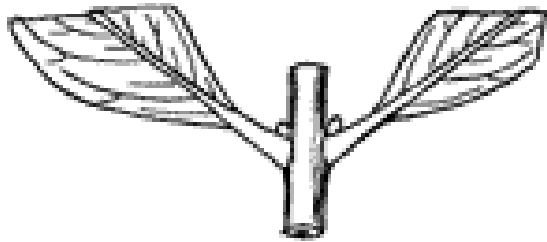


truncate

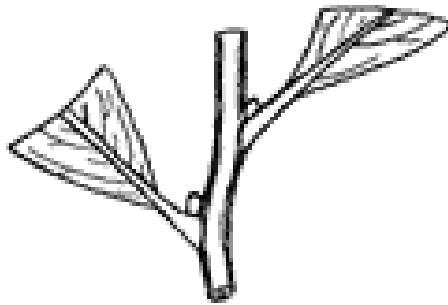


oblique

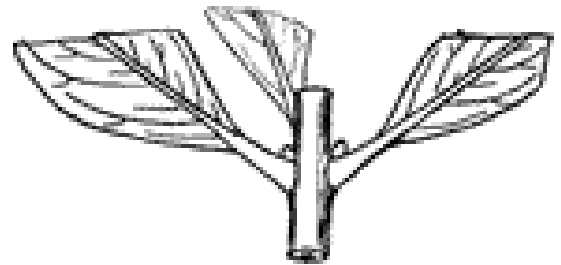
Leaf Arrangements (Simple)



opposite

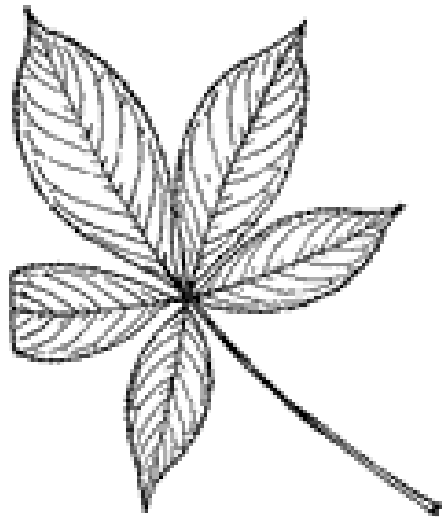


alternate

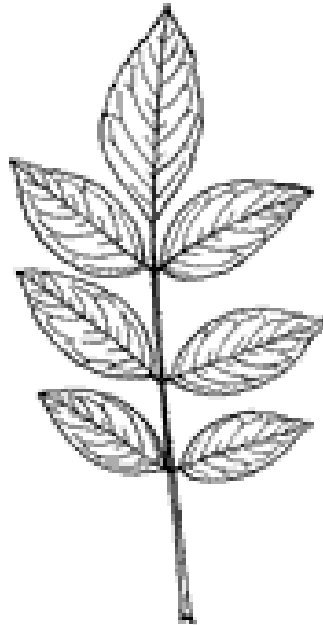


whorled

Leaf Arrangements (Compound)



palmately
compound



pinnately
compound



Bi-Pinnately Compound Leaf

Leaf Crops



Stems



■ Functions

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

External Stem Structure

- Lenticels

- Breathing pores.

- Bud Scale Scars

- Show where terminal buds have been located.

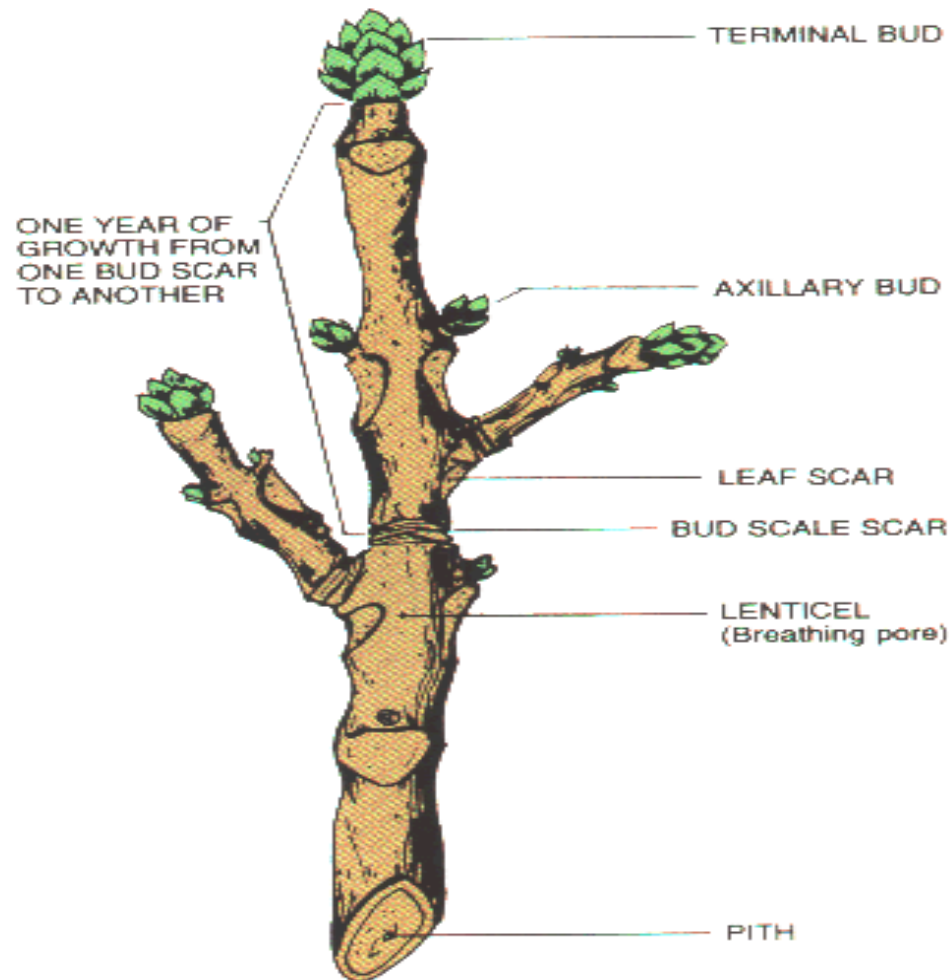
- Leaf Scars

- Show where leaves were attached.

External Stem Structure

- Terminal Bud
 - Bud on the end of the stem.
- Axillary Lateral Bud
 - Bud on the side of the stem.

External Stem Structure



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

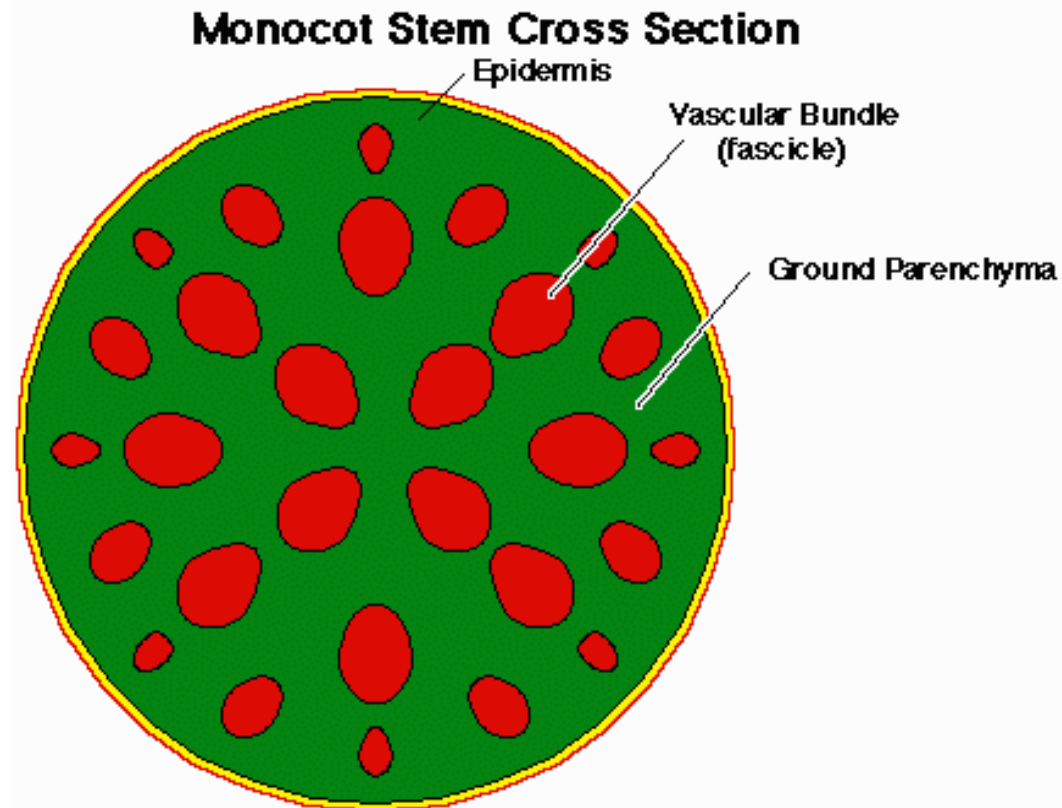
- Thin, green, actively growing tissue located between bark & wood and produces all new stem cells.

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

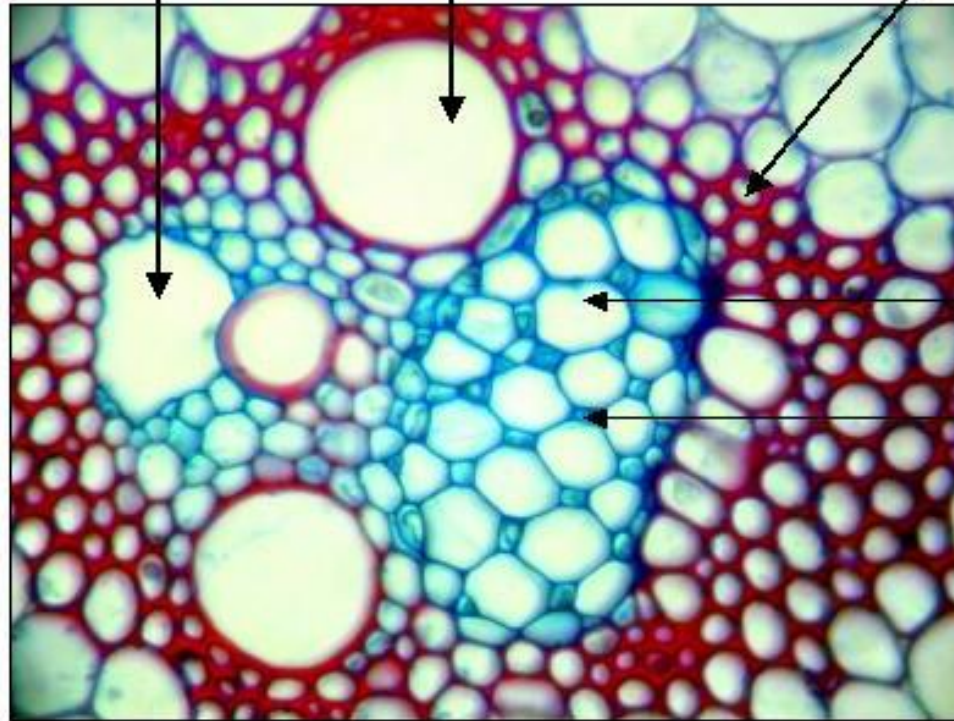


Monocot Stems (Vascular Bundle)

Air Space

Xylem Vessel

Bundle Sheath



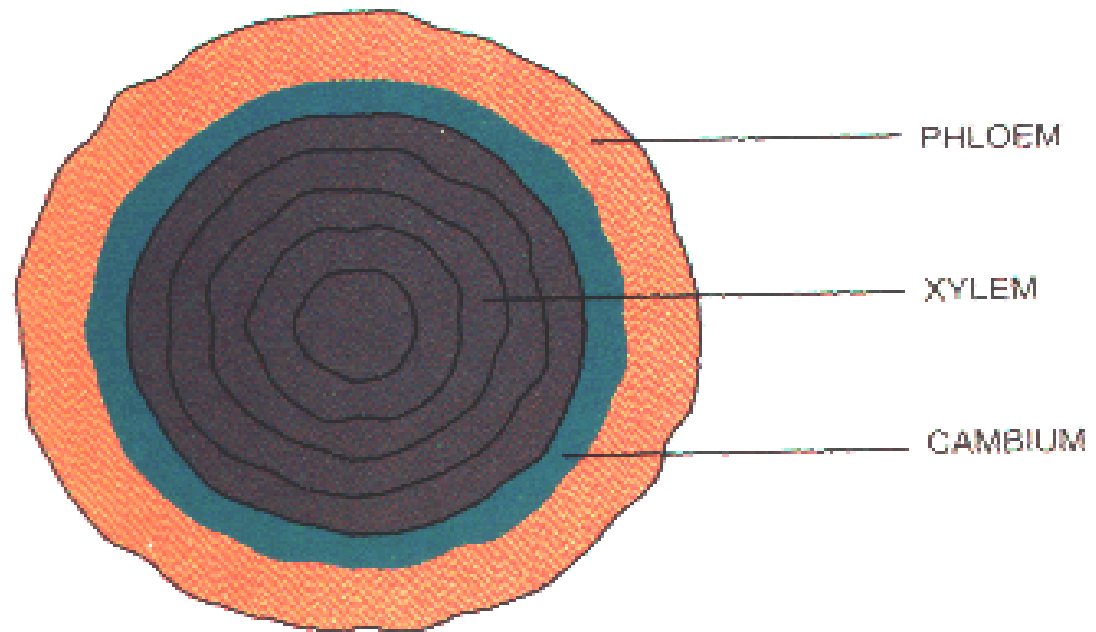
Phloem Tissue

Sieve Tube Member

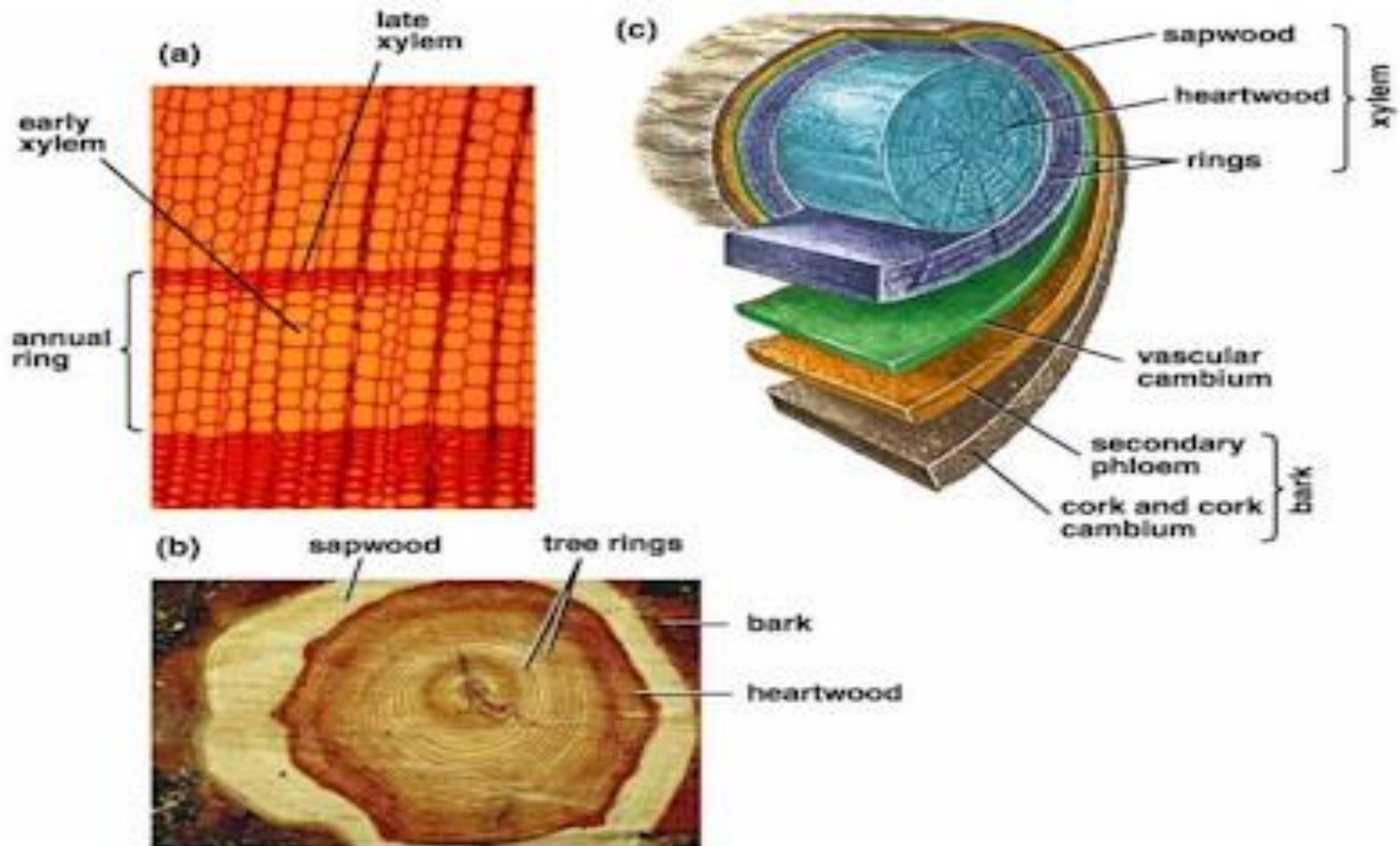
Companion Cell

Internal Stem Structure (Dicots)

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



Internal Stem Structure (Dicots)



Specialized Types of Stems

- Corm

- Underground
- Solid, fleshy, scale covered
- Examples
 - Gladiolus
 - Crocus



Specialized Types of Stems

■ Bulb

- Layers of fleshy scales that overlap each other
- Underground stem
- Examples
 - Tulips
 - Lilies
 - Onions

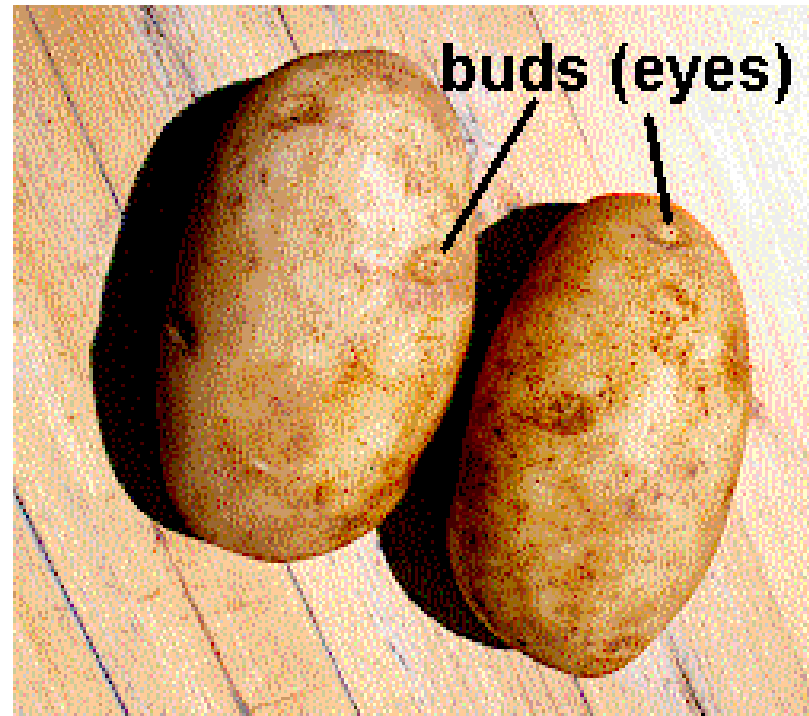


Onion

Specialized Types of Stems

■ Tubers

- Food Storage Area
- Short, thick underground stem
- Examples
 - Potato
 - Caladium



Specialized Types of Stems

- Crown

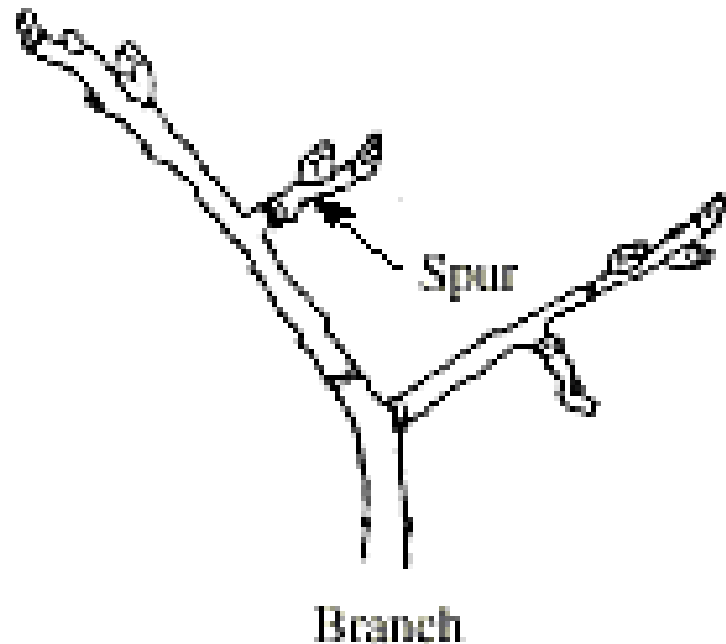
- Closely grouped stems or plantlets
- Just above or below ground
- Examples
 - African violet
 - Ferns



Specialized Types of Stems

■ Spurs

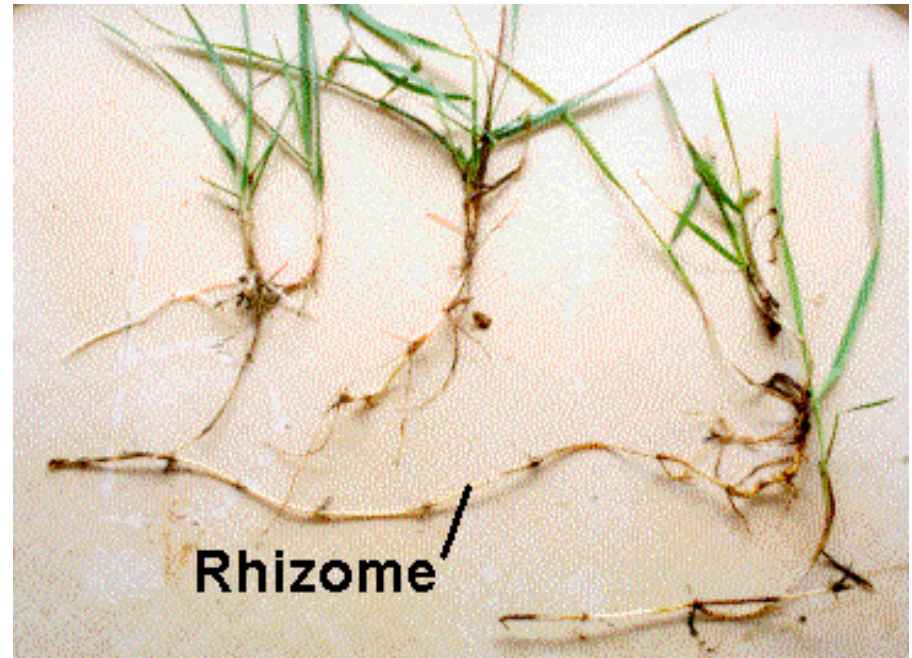
- Short stems found on woody limbs adapted for increased fruit production
- Examples
 - Apple
 - Pear



Specialized Types of Stems

■ Rhizomes

- Underground stems that produce roots on the lower surface and extend leaves and flower shoots above ground
- Examples
 - Iris
 - Lily of the Valley



Specialized Types of Stems

■ Stolons

- Stem that grows horizontally above the soil surface
- Examples
 - Strawberries
 - Airplane Plant



Stem Crops



Roots



■ Functions

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

Different Types of Roots

■ Tap Root

- One main root, no nodes
- Continuation of the primary root
- Ideal for anchorage
- Penetration is greater for water
- Storage area for food



Different Types of Roots

■ Fibrous Root

- Many finely branched secondary roots
- Shallow roots cover a large area
 - More efficient absorption of water & minerals
 - Roots hold the soil to prevent erosion



Different Types of Roots

- Aerial Roots

- Clinging air roots

- Short roots that grow horizontally from the stems
- Roots that fasten the plant to a support

- Absorptive air roots

- Absorb moisture from the air



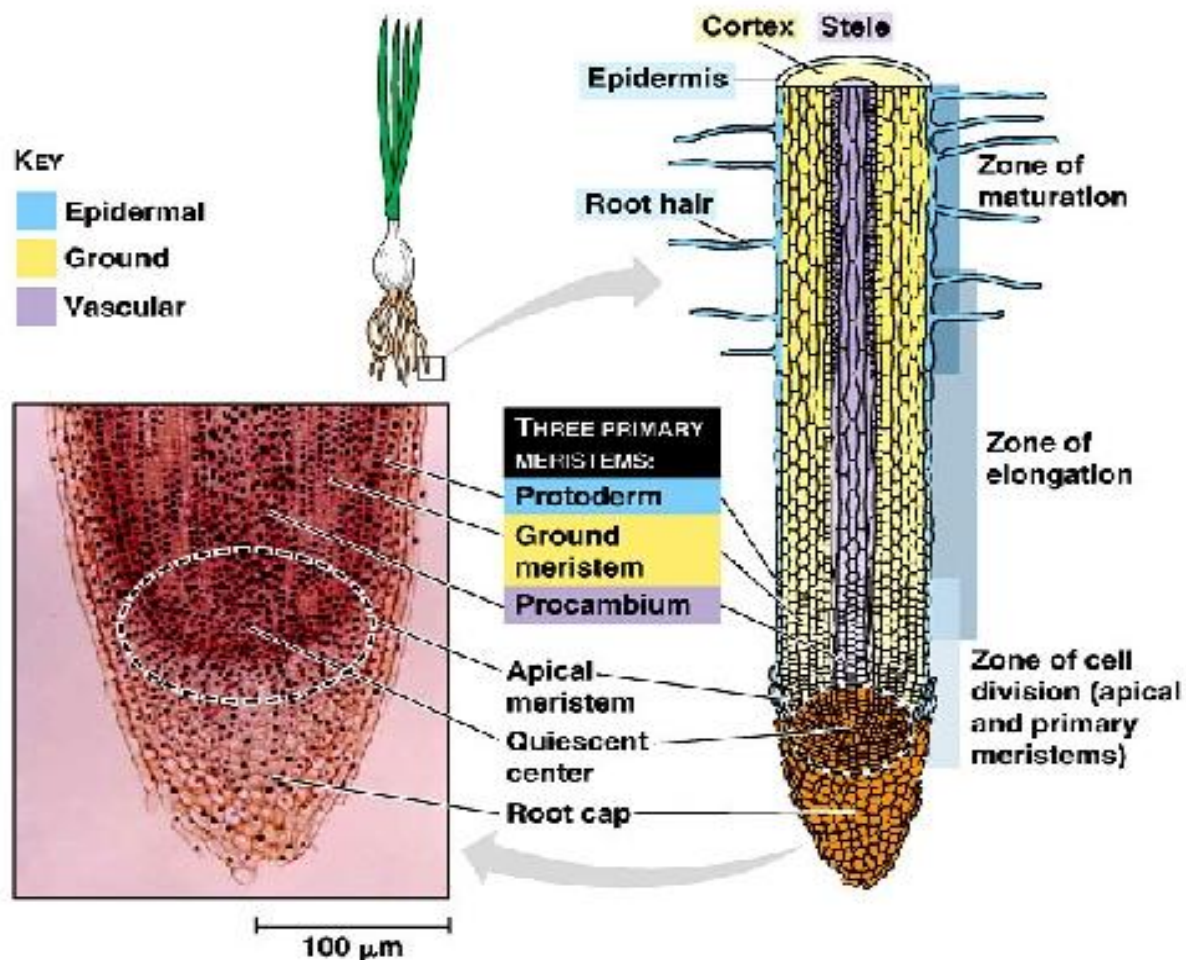
Different Types of Roots

- Adventitious Roots
 - Develop in places other than nodes
 - Form on cuttings & rhizomes



External Parts of Roots

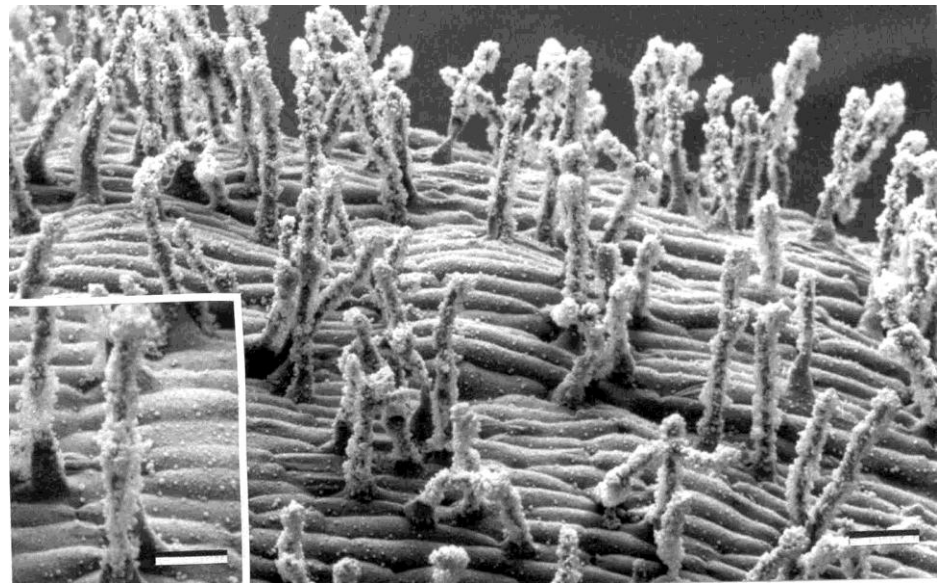
- Root Cap
 - Indicates growth of new cells.



External Parts of Roots

■ Root Hairs

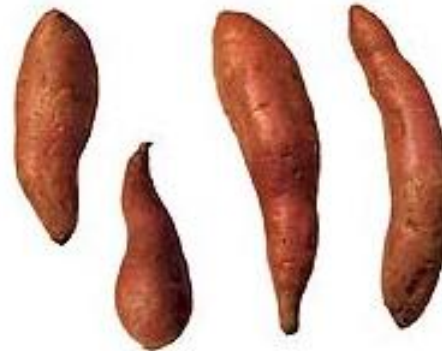
- Tiny one celled hair-like extensions of the epidermal cells located near the tips of roots.
- Increase surface area.
- Absorb water & minerals.



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.

Root Crops



Flowers

■ Function

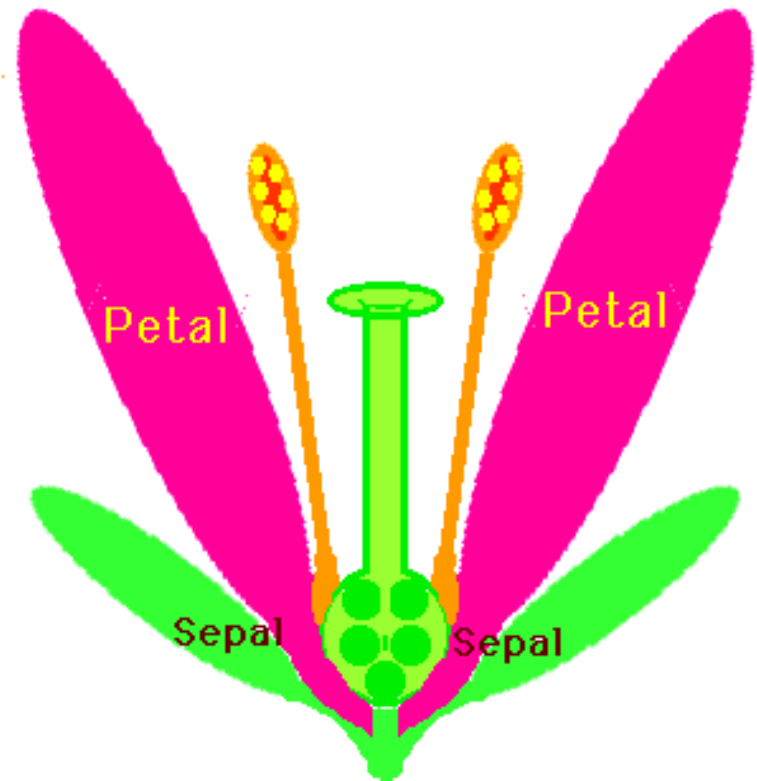
- Contain the sexual organs for the plant.
- Produces fruit, which protects, nourishes and carries seeds.
- Attracts insects for pollination.



Parts of the Flower

■ Sepals

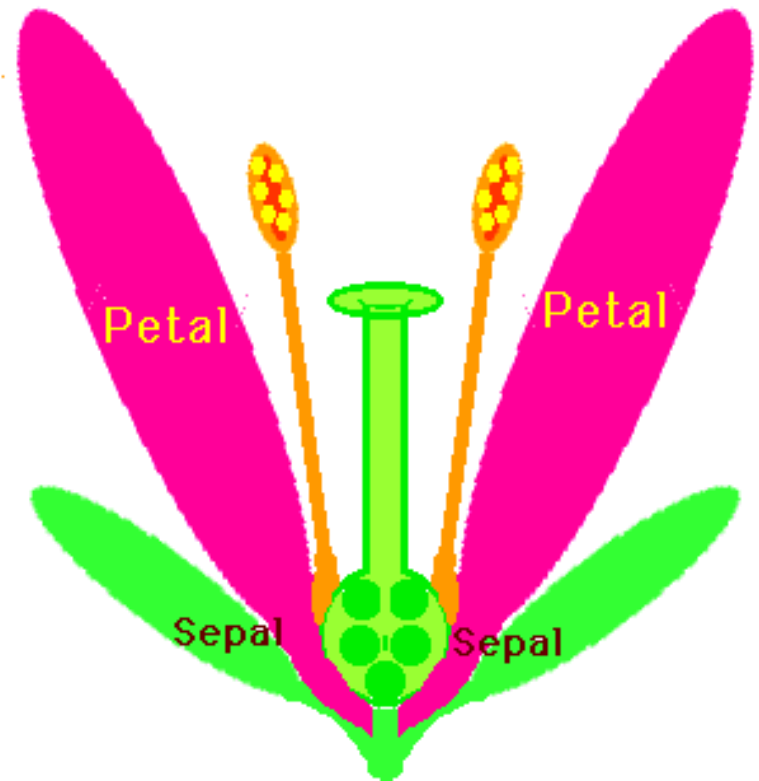
- Outer covering of the flower bud.
- Protects the stamens and pistils when flower is in bud stage.
- Collectively known as the calyx.



Parts of the Flower

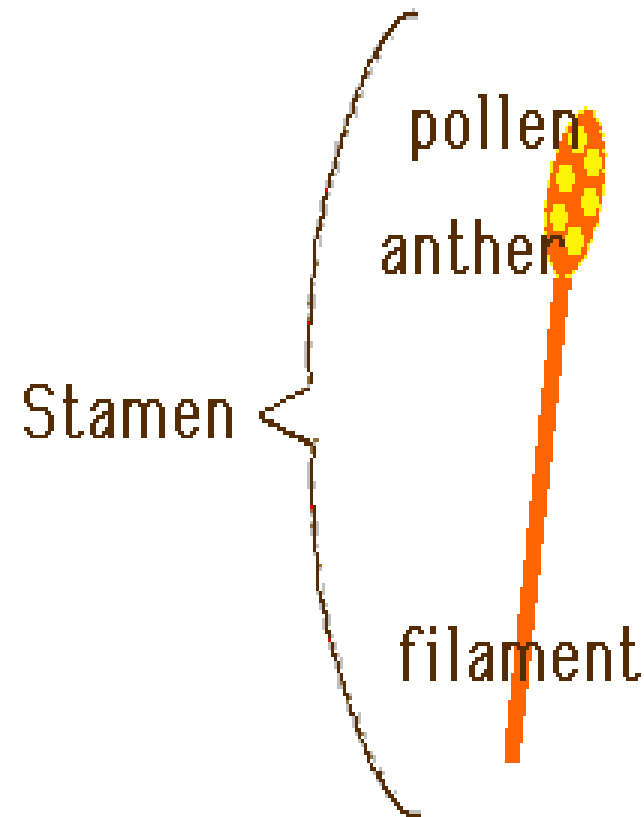
■ Petals

- 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)

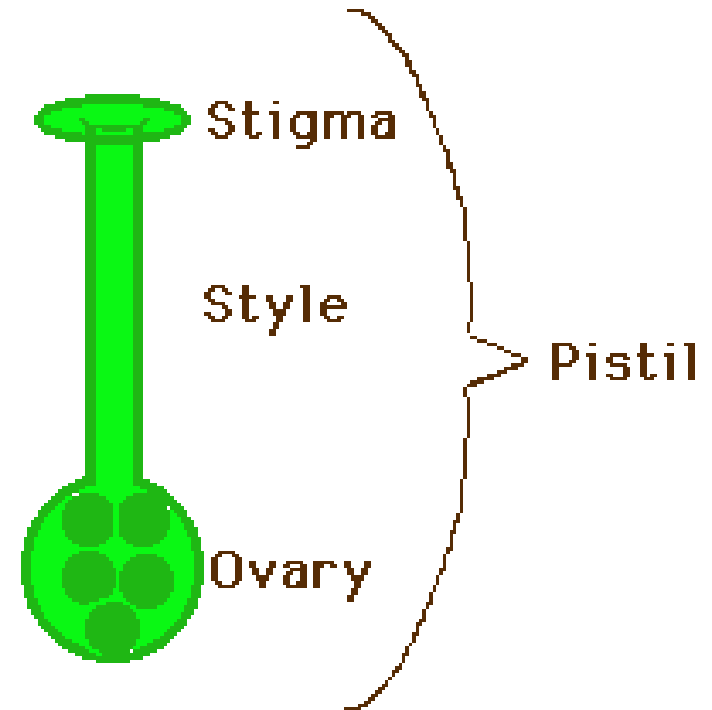
- Female reproductive part

- Ovary

- Enlarged portion at base of pistil
- Produces ovules which develop into seeds

- Stigma

- Holds the pollen grains



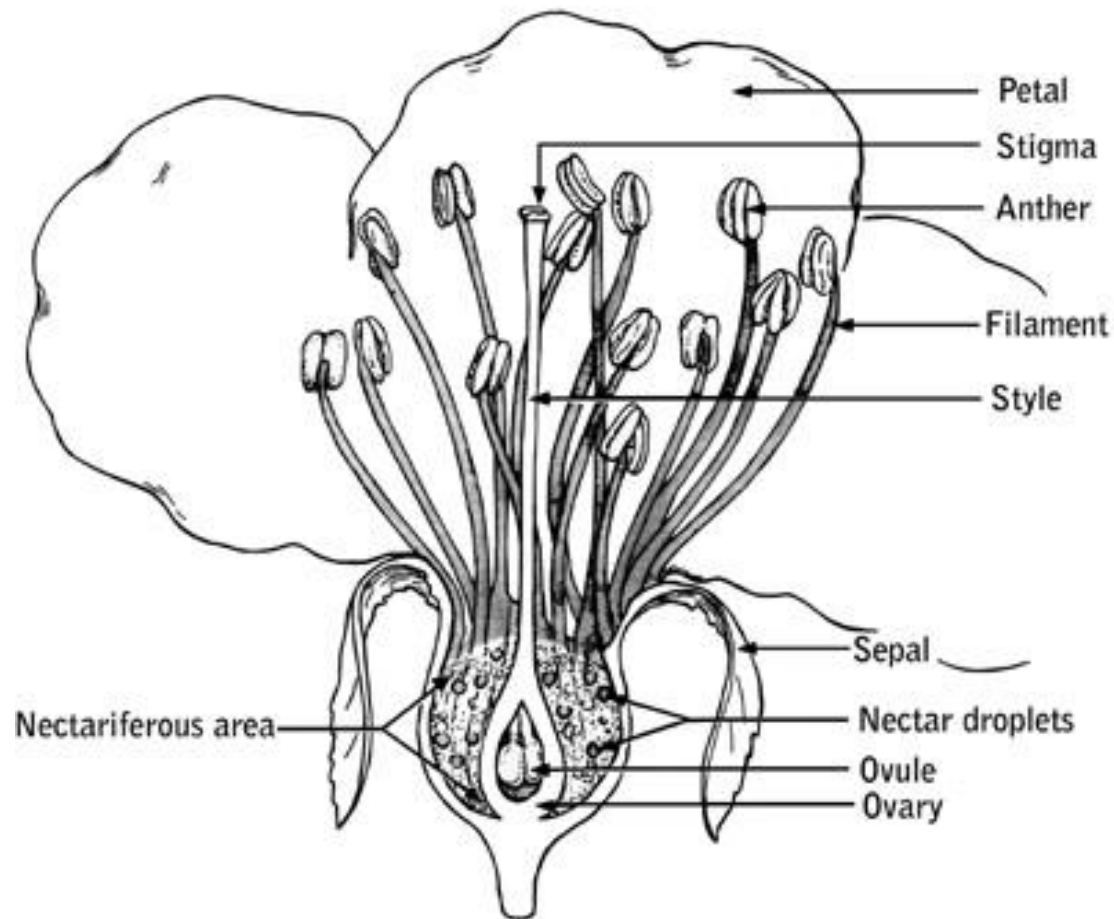
Parts of the Flower (Pistil)



■ Style

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

Parts of the Flower



Imperfect Flower

- Male or female reproductive organs, but not both.
- Example:
 - A male flower has sepals, petals, and stamen, but no pistils.
 - A female flower has sepals, petals, and pistils, but no stamen.



Perfect Flowers

- Contains both male and female reproductive structures.



Incomplete Flowers

- Missing one of the four major parts of the flower.
 - Stamen
 - Pistil
 - Sepal
 - Petal



Complete Flowers

- Contains male and female reproductive organs along with petals and sepals.



Flowers

- Imperfect flowers are always incomplete but.....
- Perfect flowers are not always complete and.....
- Complete flowers are always perfect.



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.

Important Flower Crops

