Plant Structures

Root System vs. Shoot System

Shoot System

Root System

- **<u>Root System</u>**:
  - Part of the plant normally found below the ground.
  - Functions to anchor the plant to the ground.
  - Absorbs water + minerals from the ground + moves them to the stem.
  - Some are food storage sites for the plant.
    - Ex. carrot, sweet potato, beet, turnip (edible forms)

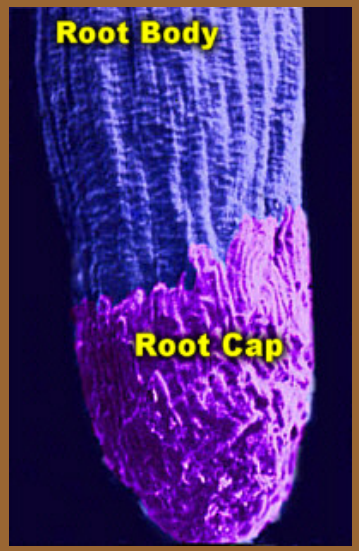
Shoot System (3 Parts)

- 1. **<u>Stems</u>**
  - Support leaves + lift them toward the sun.
  - Tissues of the stem transport water + minerals from the roots to the leaves and food from the leaves to the roots.
  - Green stems can photosynthesize.

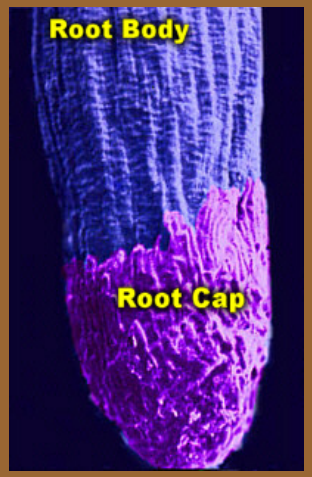
- 2. **Leaves**
  - Produce food.
  - Exchange gases between plant + leaves.
- 3. **Flowers**
  - Reproductive organs.
  - Produce seeds.

Roots

- 1. **Root Cap** – located at the very tip of the root.
  - Protects the growth point (**meristem**) of the root.
  - Secretes a slime that helps the root move through the soil.
  - Causes the root to grow downward.

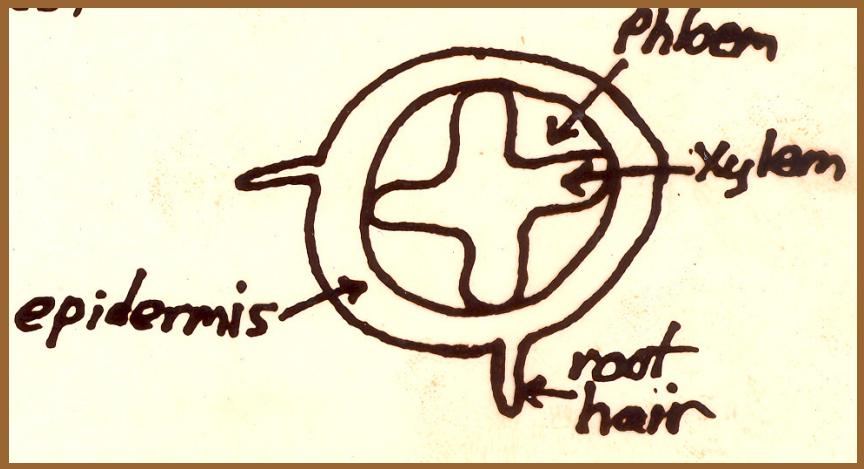


- 2. Region of Root Growth (root body)
  - Area at the tip of the root but behind the root cap.
  - Increases the root length + some width.
  - Replaces the root cap as it is damaged and worn off.



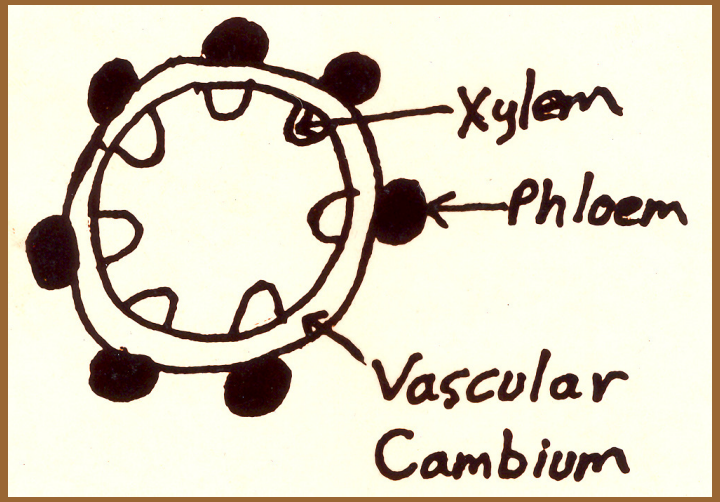
- 3. **Primary Tissues** (found in young roots)
  - A. Epidermis
    - Outer most cell layer
    - Absorbs water + minerals
    - Protects inner layers
    - May have root hairs projecting from it that help absorb water and anchor it.

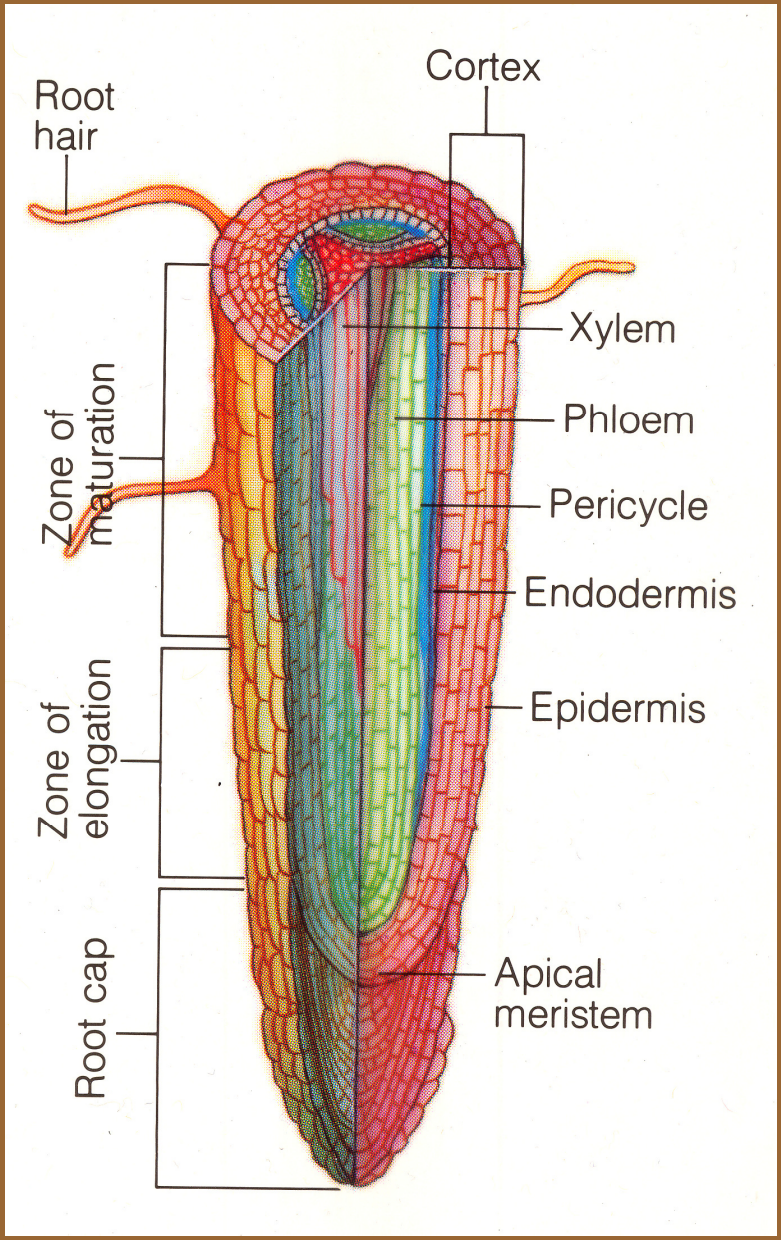
– B. Vascular Cylinder
  - Xylem composes the core of the cylinder.
  - Phloem composes the outer portion of the cylinder.

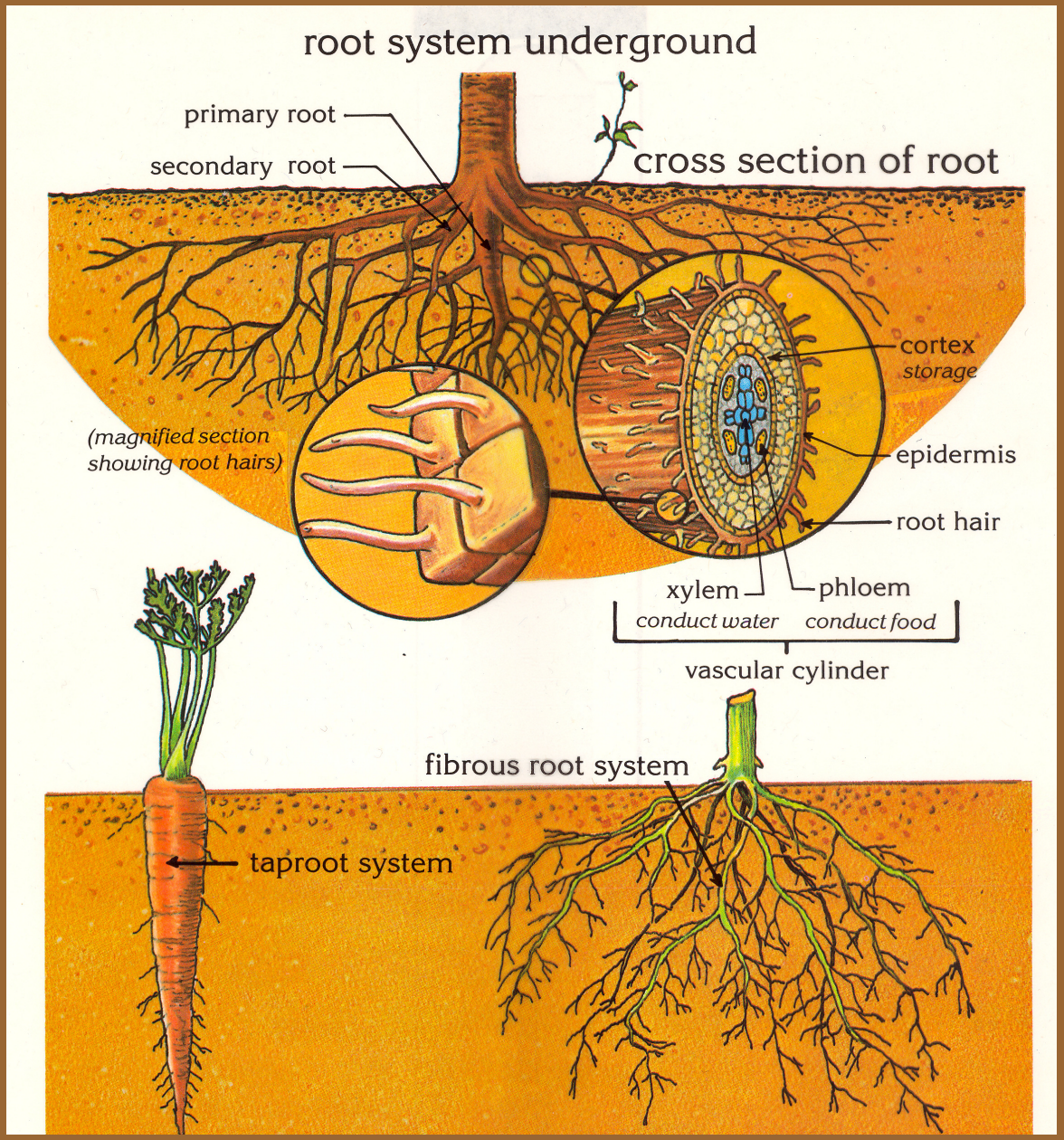


Secondary Root Structures (found in older roots)

- 4. Vascular Cambium
  - A meristem that forms between the xylem + the phloem.
  - Produces xylem on the inside + phloem on the outside which causes the root to grow in diameter.

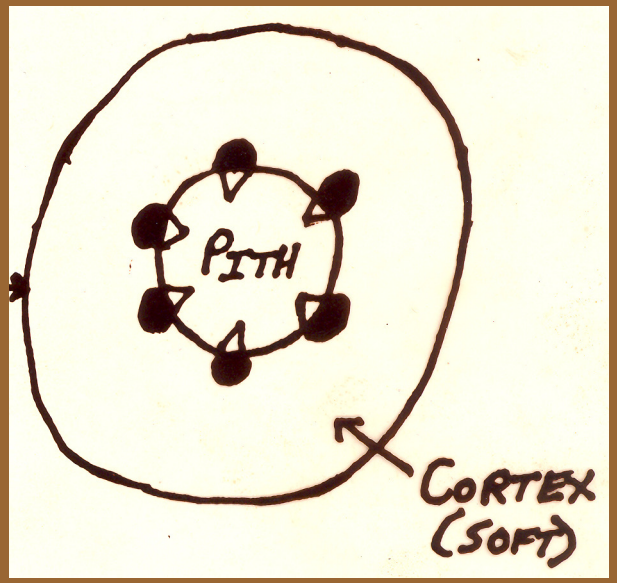



Root hair
Cortex
Xylem
Phloem
Pericycle
Endodermis
Epidermis
Apical meristem
Zone of maturation
Zone of elongation
Root cap


root system underground
primary root
secondary root
cross section of root
cortex
storage
(magnified section
showing root hairs)
epidermis
root hair
xylem
phloem
conduct water
conduct food
vascular cylinder
fibrous root system
taproot system

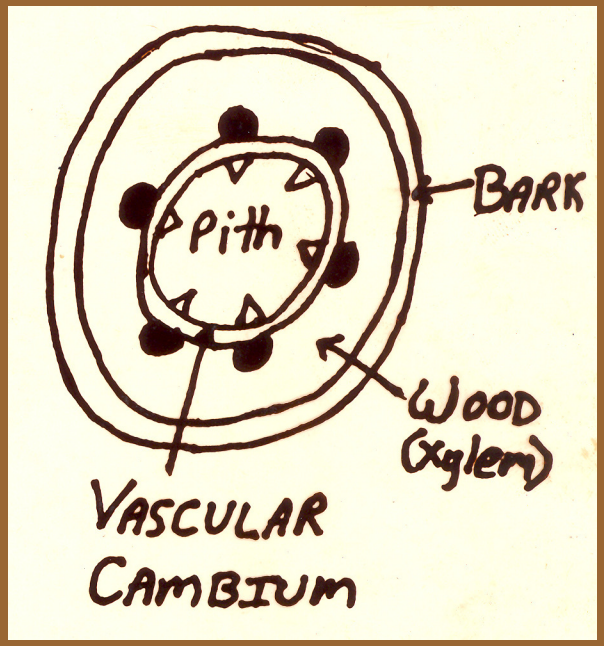
Stems

- Monocot (Herbaceous) vs. Dicot (Woody)
  - Difference in # and location of vascular tissues.
- A. Structures (Herbaceous), Ex. Grass
  - 1. Epidermis
    - Outermost layer
    - Protective layer
  - 2. Pith and Cortex
    - Pith-inner part of the stem.
    - Cortex-outer part of the stem.



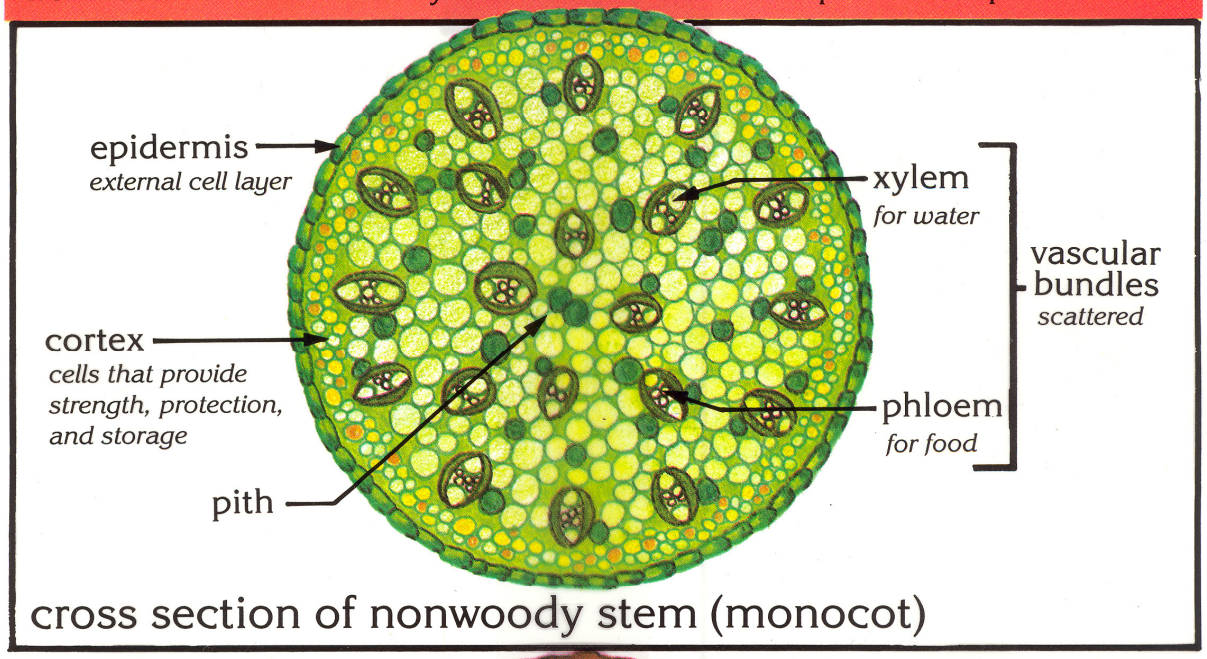
- 3. Vascular Cylinder
  - Region of xylem + phloem
  - Lies between the pith and the cortex.
- 4. Usually grow only in spring and summer.
  - Annuals (live for 1 growing season)
- 5. No taller than 6 feet.
  - Why?

- B. Structures (Woody), Ex. Oak tree
  - 1. Bark
    - Outermost layer.
    - Consists mostly of dead cork.
  - 2. Vascular cambium
    - Xylem on the inner edge.
    - Phloem on the outer edge.
  - 3. Pith + Wood
    - Pith—center of the stem.
    - Wood—composed mostly of xylem.
      - Very sturdy.
  - 4. Live for many growing seasons.
  - 5. May grow very tall.

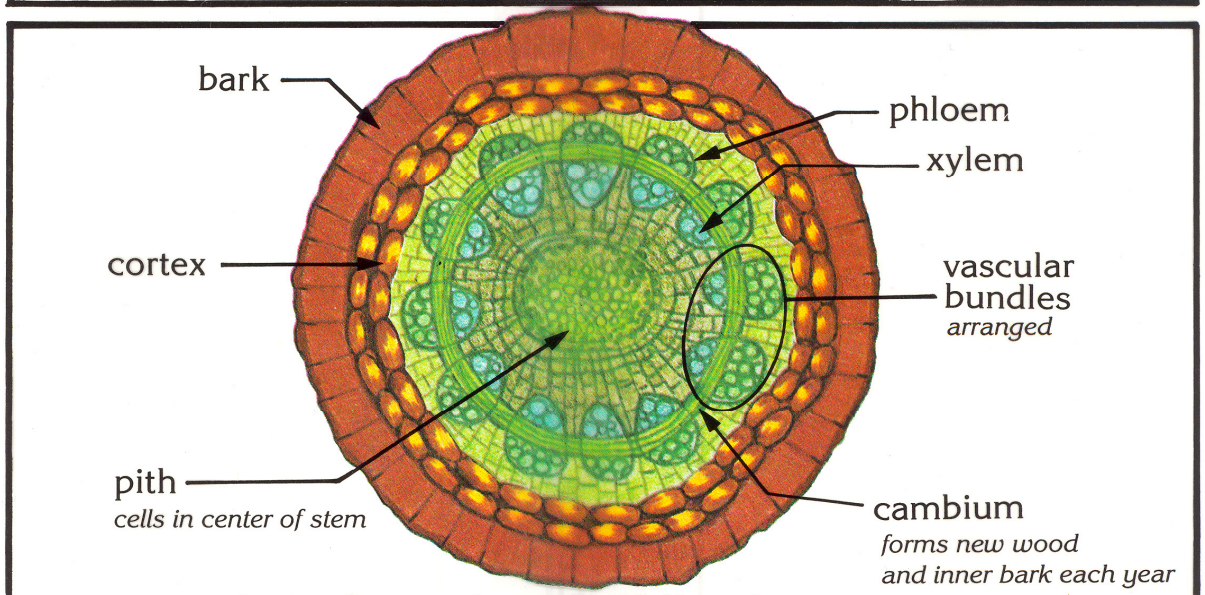


Stems

Stems support the leaves and flowers of plants. Stems carry water and minerals from roots to leaves and carry food from leaves to other parts of the plant.



cross section of nonwoody stem (monocot)

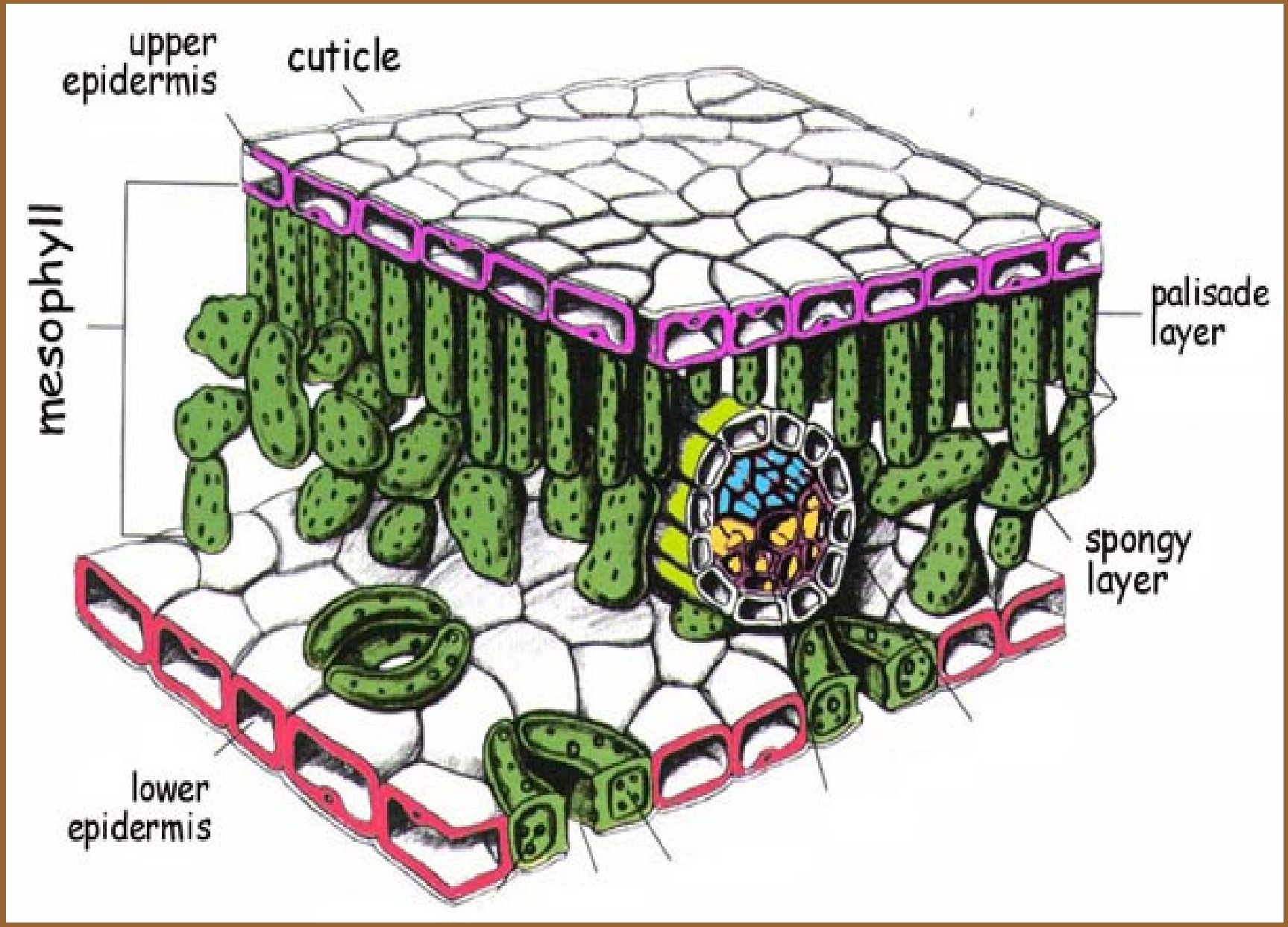


cross section of woody stem (dicot)

Leaves

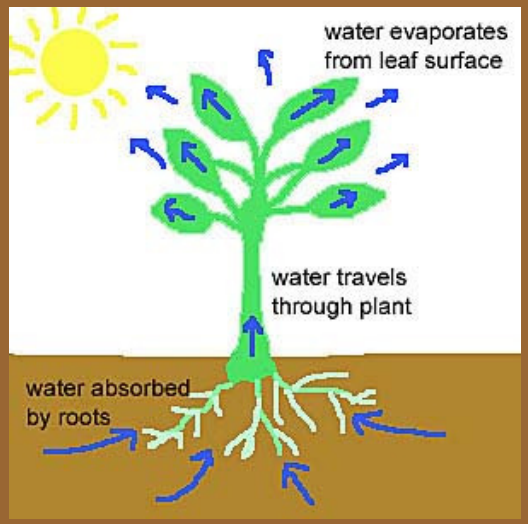
- A. Structures
  - 1. **Epidermis** (upper + lower)
    - A. Outer most layer that is covered by the waxy **cuticle**.
    - B. has openings called **stomata** that are pores that regulate the passage of gases and water vapor to and from a leaf.
      - Capable of opening and closing (**Guard Cells** control this)
      - Horizontal leaves have stomata on the bottom.

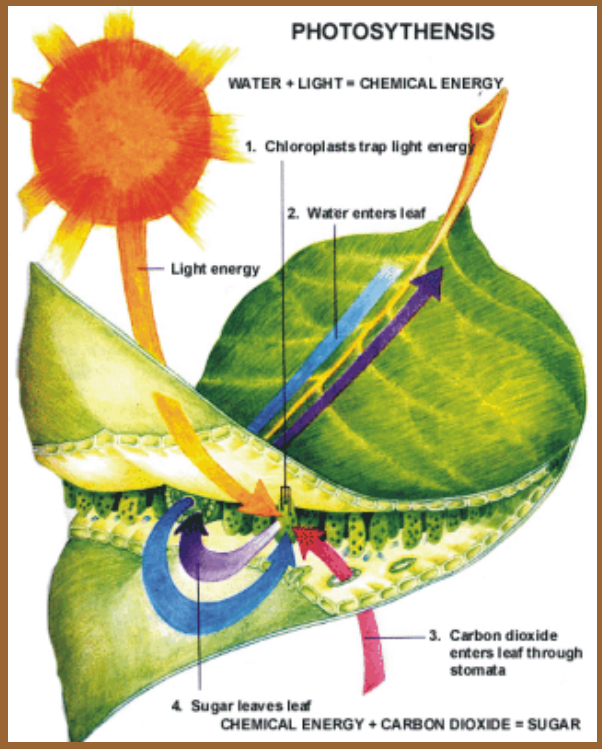
- 2. **Mesophyll**
  - A. Middle layer of the leaf.
  - B. 2 cell layers thick.
    - Top cell layer "**palisade layer**", closest to the upper leaf surface. This layer has elongated cells that are tightly packed + contain many chloroplasts.
    - Bottom cell layer "**spongy layer**", has loosely packed cells with many air spaces + a few chloroplasts.


upper epidermis
cuticle
mesophyll
palisade layer
spongy layer
lower epidermis

– 3. Leaf Veins
  - A. Enter the leaf through the petiole.
  - B. Xylem on upper side of vein.
    Phloem on lower side of vein.

- B. Functions of Leaves
  - 1. Produce food through photosynthesis.
  - 2. Release oxygen and take in carbon dioxide.
  - 3. Release water vapor.



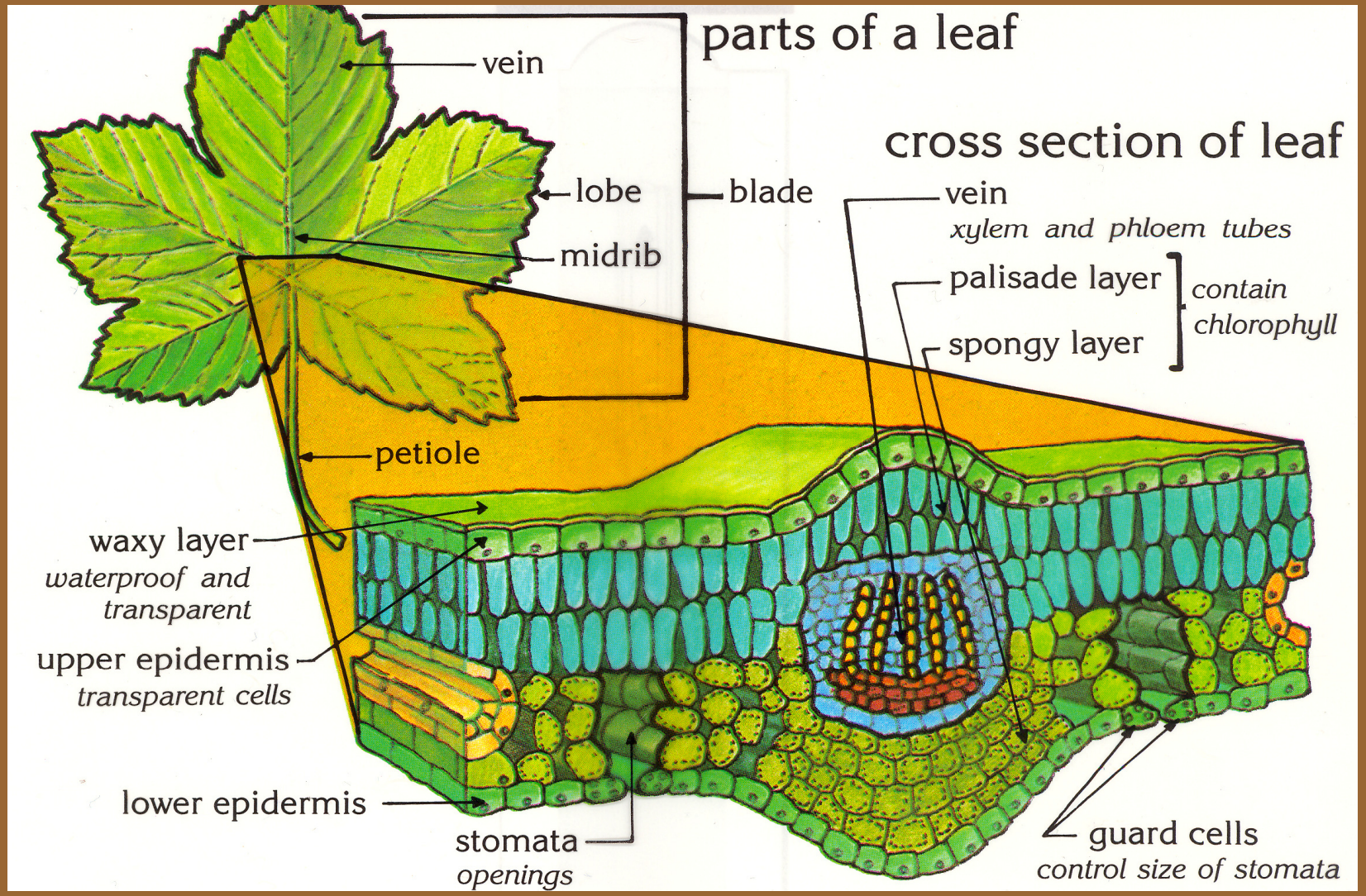


- C. **Specialized Leaves**
  - 1. **Needles** of conifers.
  - 2. **Spines** of cactus.
    - Small to prevent too much water loss.
    - Protects the plant from being eaten.

– 3. **<u>Tendrils</u>**

- Leaves that wrap around objects + help plants climb.
- Ex. pea plants, morning glories, cucumbers

- 4. Leaves of Carnivorous plants
  - Adapted to capture + digest insects.
  - Need certain minerals that the environment can't provide.
  - Ex. Venus flytrap, Pitcher plant, sundews


parts of a leaf
vein
lobe
midrib
blade
petiole
cross section of leaf
vein
xylem and phloem tubes
palisade layer
spongy layer
contain chlorophyll
waxy layer
waterproof and transparent
upper epidermis
transparent cells
lower epidermis
stomata
openings
guard cells
control size of stomata

Flowers

- The reproductive structures of angiosperms.
- A. **Structures**
  - 1. **Receptacle**
    - The swollen tip of the stem where a flower is produced.

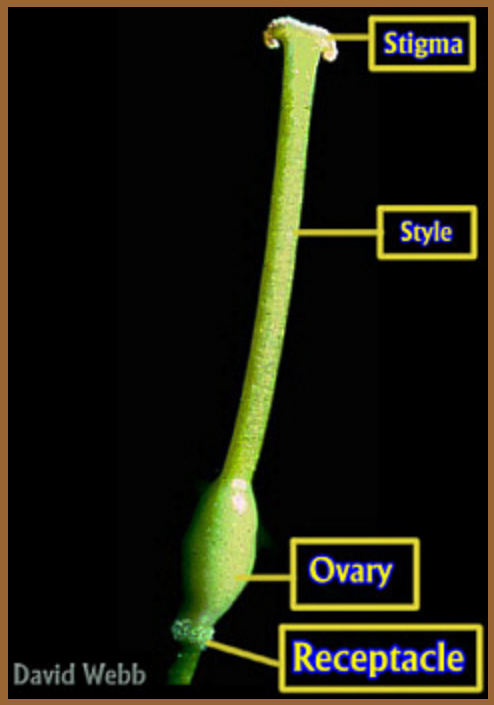
– 2. **Sepals**
  - Outer most green flower parts.
  - Cover and protect the flower bud.

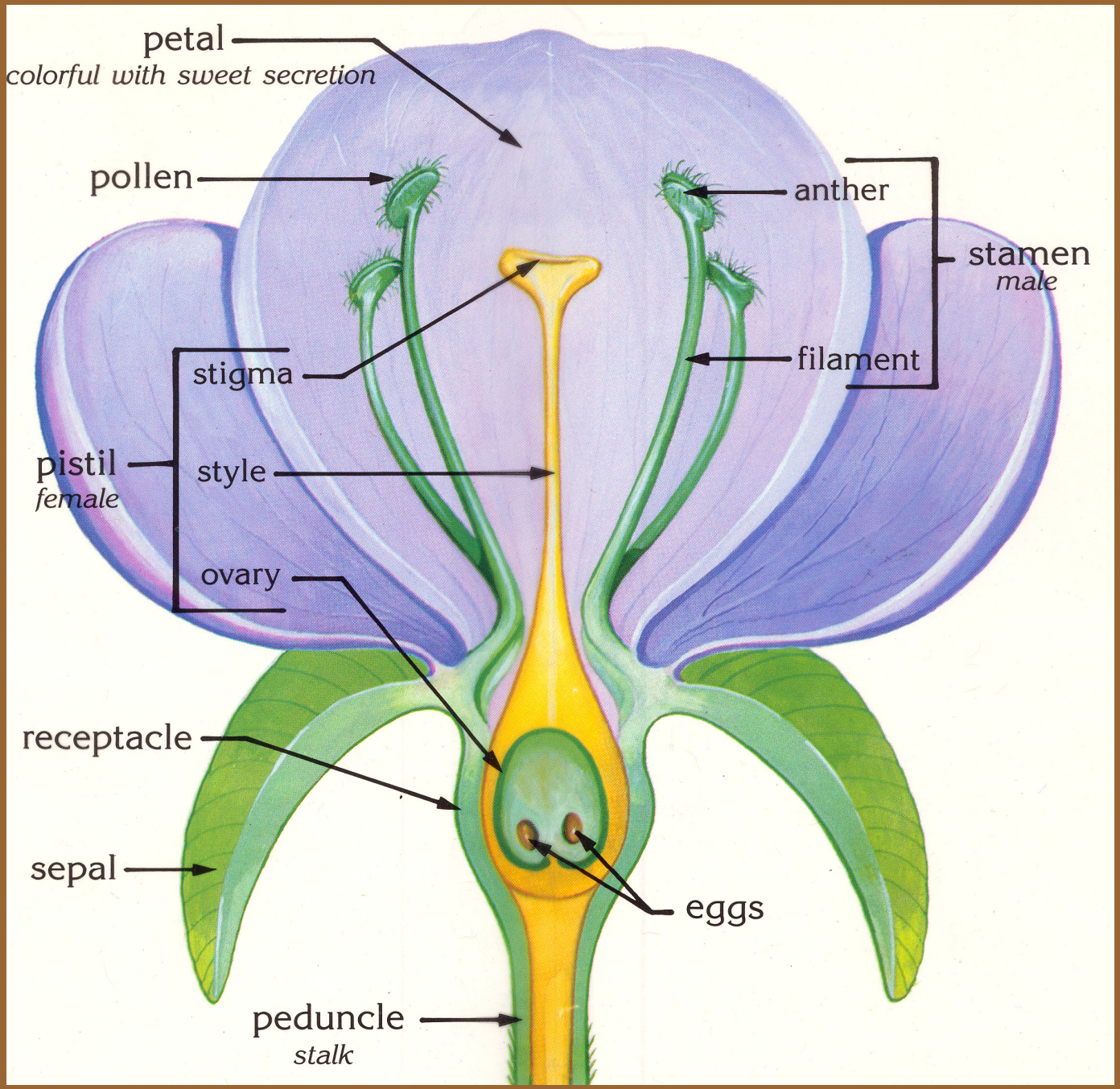
– 3. **Petals**
  - Brightly colored flower structures.
  - Function to attract insects.

– 4. **Stamen**

- The male reproductive organ.
- Consists of 2 parts:
  - **Anther**—top capsule where pollen (male gamete) is produced + released.
  - **Filament**—stalk that holds the anther up.

– 5. Pistil
  - The female reproductive organ.
  - Consists of 3 parts:
    – **Stigma**—top of the pistil that collects pollen grains.
    – **Style**—tube that pollen travels down to reach the egg.
    – **Ovary**—swollen area that contains the eggs.




petal
colorful with sweet secretion
pollen
anther
stamen
male
filament
stigma
pistil
female
style
ovary
receptacle
sepal
eggs
peduncle
stalk

- B. **Pollination**
  - Transfer of pollen from stamen to pistil (sticks to the stigma).
  - Fertilization occurs when the pollen travels from the stigma down the style + into the ovary of the egg.

1. **Self pollination**
   - Stamen + stigma on same flower.
2. **Cross pollination**
   - Stamen + stigma on different flowers of different plants.

After fertilization, a seed will form.

3. Pollination is dependent on:
   - A. The wind to carry the pollen.
   - B. Animals—mainly birds, bats, and insects

Attracted to the bright colors of the petals.

Attracted to the nectar (sweet sugar reward).

Pollen sticks to body when animal comes to feed on nectar.

When animal travels to another flower, pollen falls off.

4. Animals also important for seed dispersal.
   - Seeds stick to fur.
   - Animals like to eat fruits that surround seeds.
     – Seeds are also consumed and pass through their digestive systems unharmed.