PLANTS Kingdom

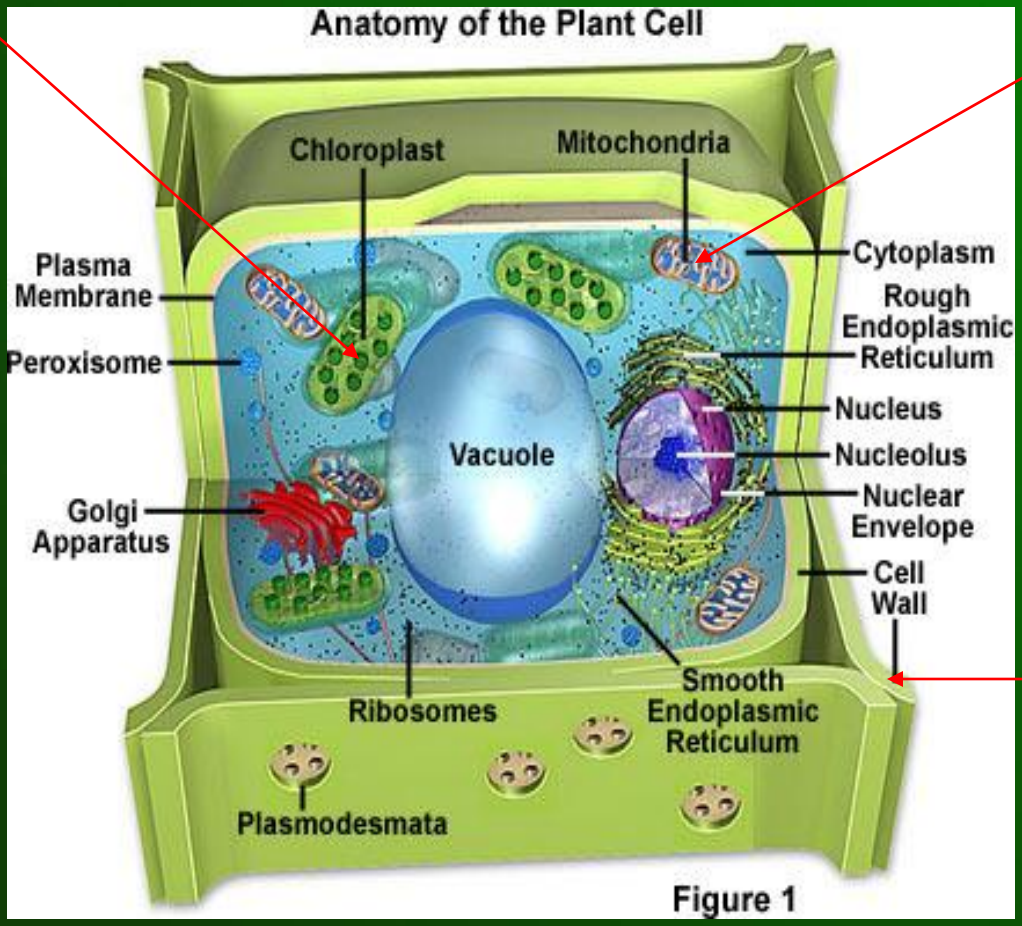
PLANTS

- Multicellular- made of many cells
- Eukaryotes- have nucleus & membrane bound organelles
- Cell Walls - made of cellulose
- Autotrophs/producers- make own energy through photosynthesis
- Stationary (sessile) : no mobility

Typical Plant Cell

PHOTOSYNTHESIS

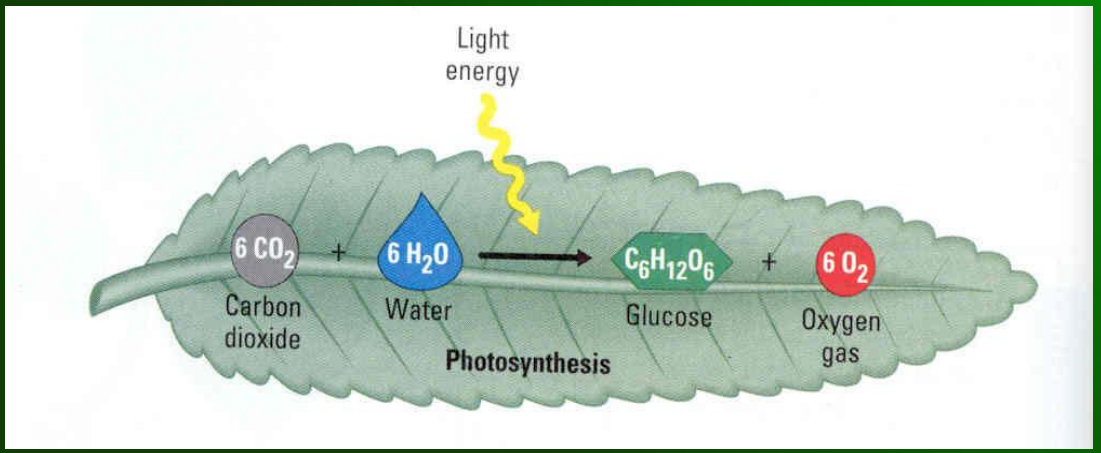
CELLULAR RESPIRATION

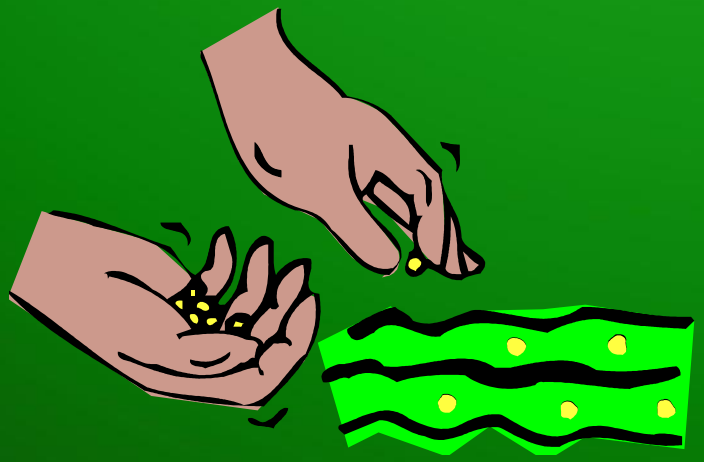


STRUCTURE & SUPPORT

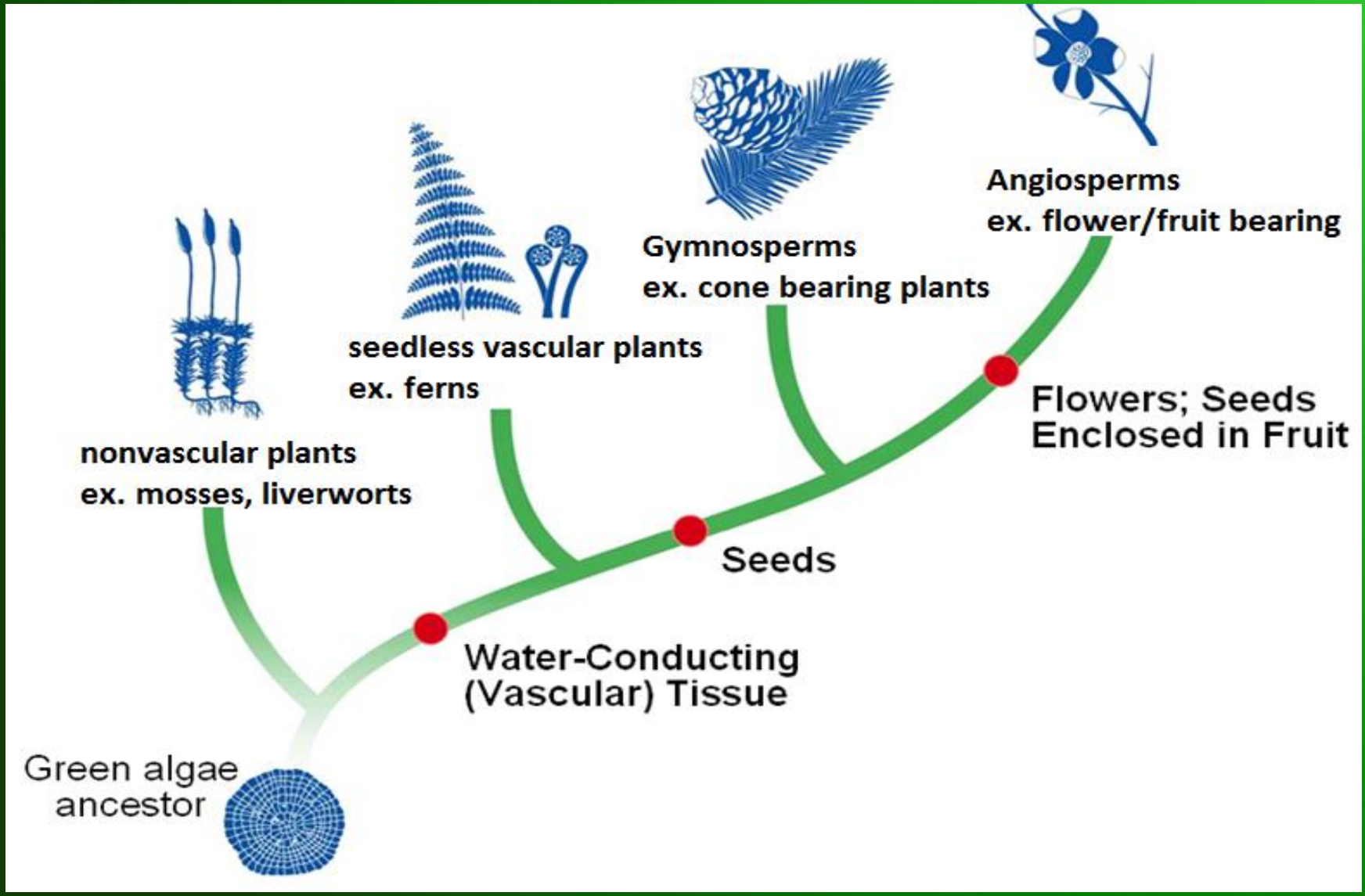
What do Plants Need?

- **sunlight**
- **water and minerals**
- **gas exchange (photosynthesis & cellular respiration)**
- **transport of water and nutrients throughout the plant body**





Classification of Plants



What is the ancestral species for all plants?

Green algae (plant-like protista)

A. Nonvascular Plants

- Ex. Mosses, hornworts, liverworts
- Earliest to evolve to live on land
- Live close to the ground
- NO true stems or roots (use rhizoids) because they lack vascular tissue (xylem & phloem)
- They take in water by osmosis
- Water needed to reproduce

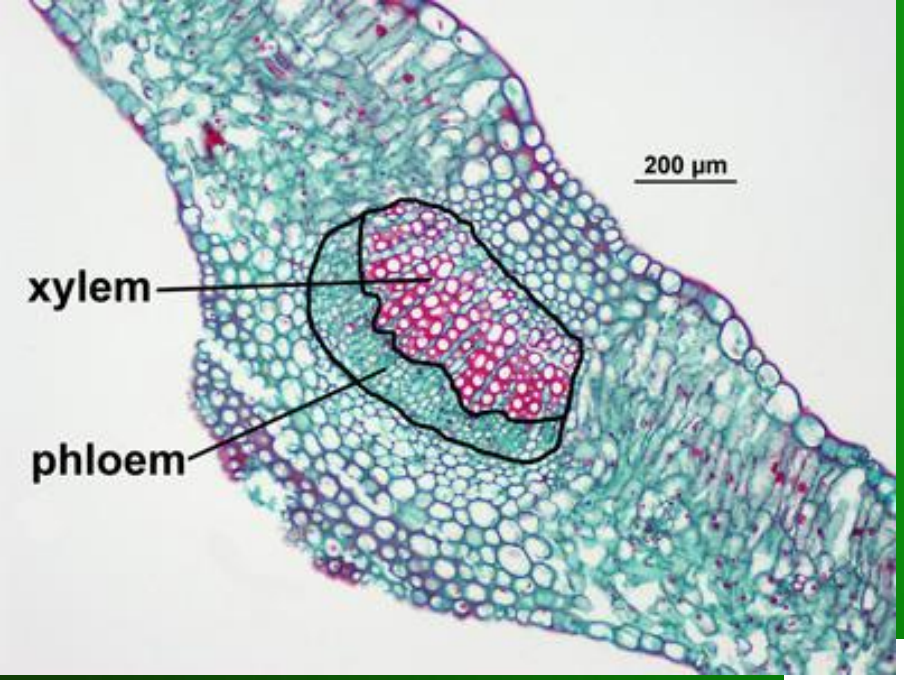
Mosses

Liverworts

Evolution of Vascular Tissue

- **Vascular tissue** is specialized to conduct water and nutrients throughout the plant.
- The first vascular plants contained **tracheids** which are cells specialized to conduct water. Tacheids make up xylem and phloem
- **Xylem** carries **water** from the roots to every part of a plant.
- **Phloem** transports solutions of **nutrients** and carbohydrates produced by photosynthesis.

Cross section of a leaf



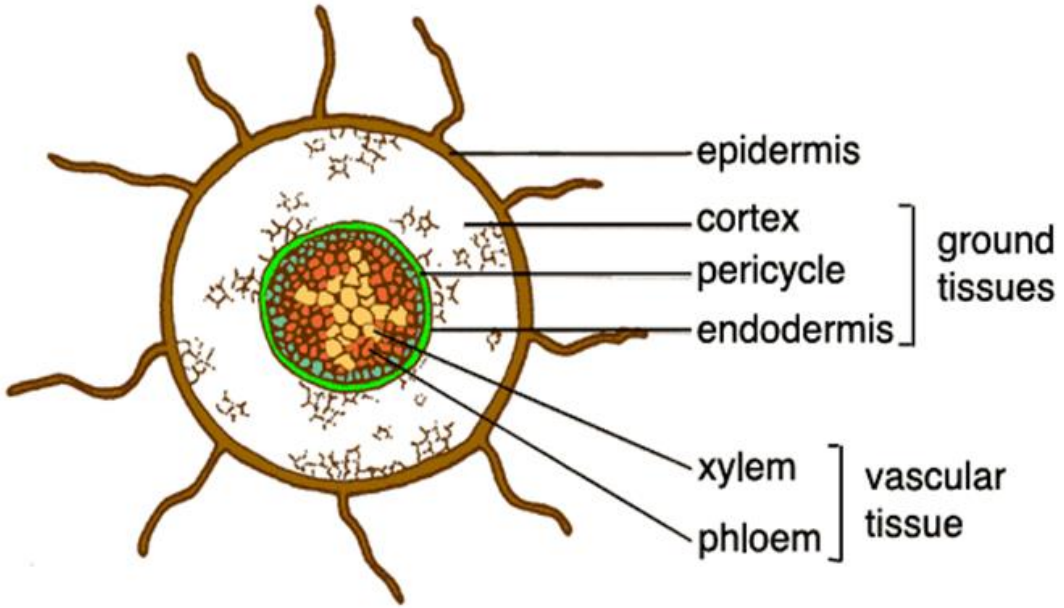
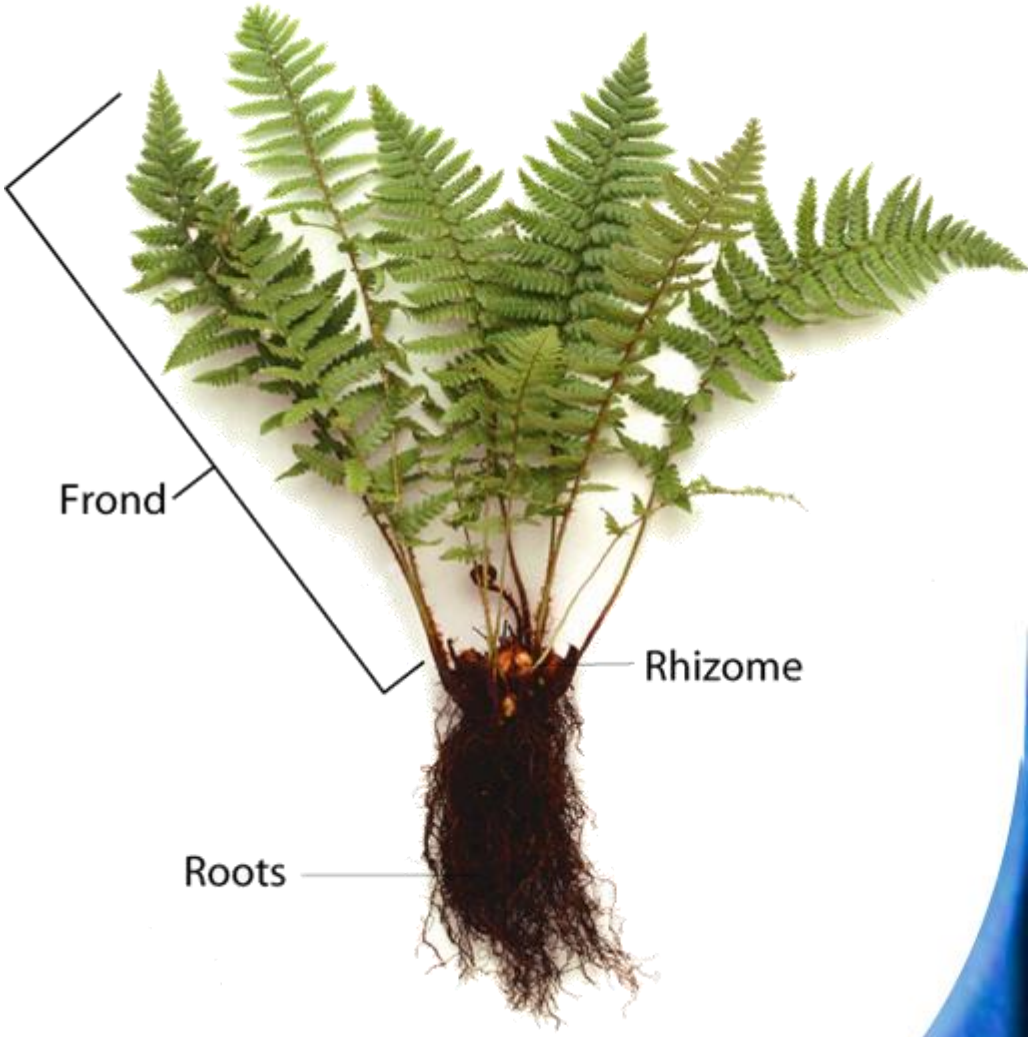


Figure 3. Cross section of a root

B. SEEDLESS VASCULAR PLANTS

- Example ferns
- Reproduce by spores NOT seeds
- Better adapted to live on land due to vascular tissue
- Ferns and their relatives have true roots, leaves, and stems.

Ferns have vascular tissues, strong roots, underground stems called **rhizomes**, and leaves called **fronds**.



SEEDED VASCULAR PLANTS

- Includes Gymnosperms and Angiosperms
- Contains vascular tissue (xylem/phloem)
- Produce seeds which allowed them to better survive on land

Adaptations that allow seed plants to reproduce without water include:

- flowers or cones
- The transfer of sperm by pollination
- the protection of embryos in seeds

C. Gymnosperms

- Contains vascular tissue (xylem/phloem)
- Seeds not enclosed inside a fruit “naked seeds”
- Cones seed-bearing structures ex. pine cones

Female Cone

Male Cone

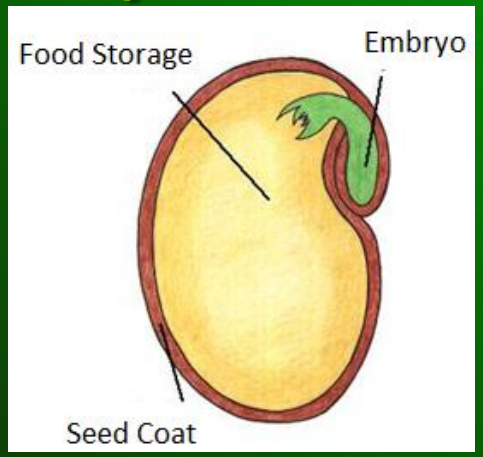
Pollen

- The male gametophyte is contained in a tiny structure called a **pollen grain**.
- The transfer of pollen from the male reproductive structure to the female reproductive structure is called **pollination.**

Pine Cone with naked seeds (not inside of protective fruit)

Seeds

- A **seed** is an embryo of a plant that is encased in a **protective covering** and surrounded by a **food supply**.
- The **seed coat** surrounds and protects the embryo and keeps contents of the seed from drying out.
- An **embryo** is an organism in its early stage of development.
- Plant seeds can stay in a state of dormancy (**not** growing)



Seed Dormancy

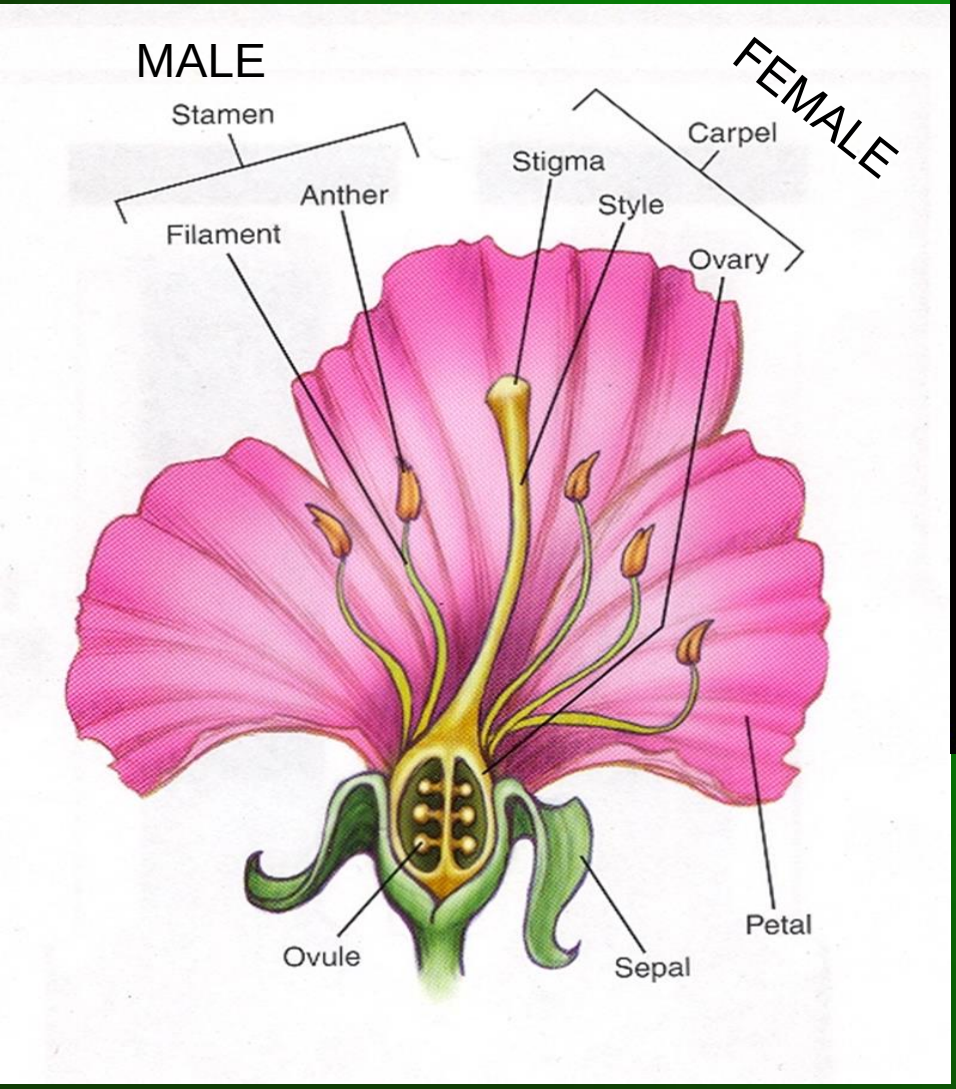
- Many seeds will not grow when they first mature.
- These seeds enter a period of dormancy, during which the embryo is alive but not growing.
- Environmental factors such as temperature and moisture can cause a seed to end dormancy and germinate.
- Germination – early growth stage of a plant

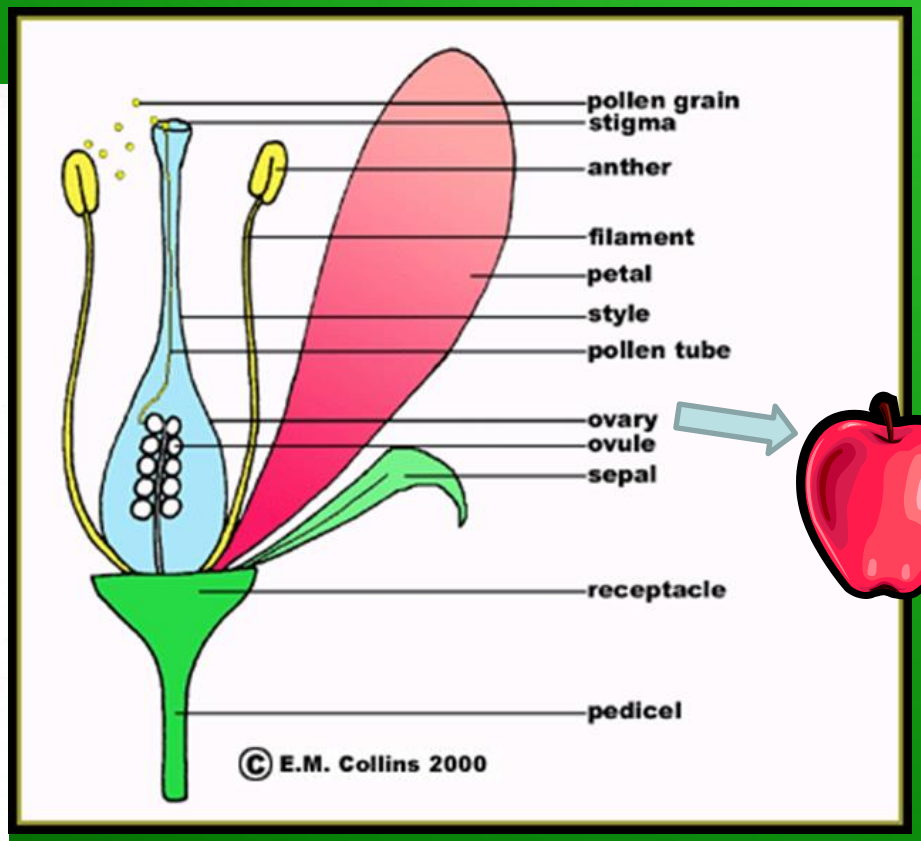
Seeds are dispersed (spread out) by wind, animals, and/or water.

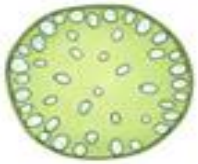
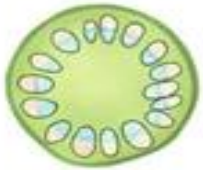
D. Angiosperms

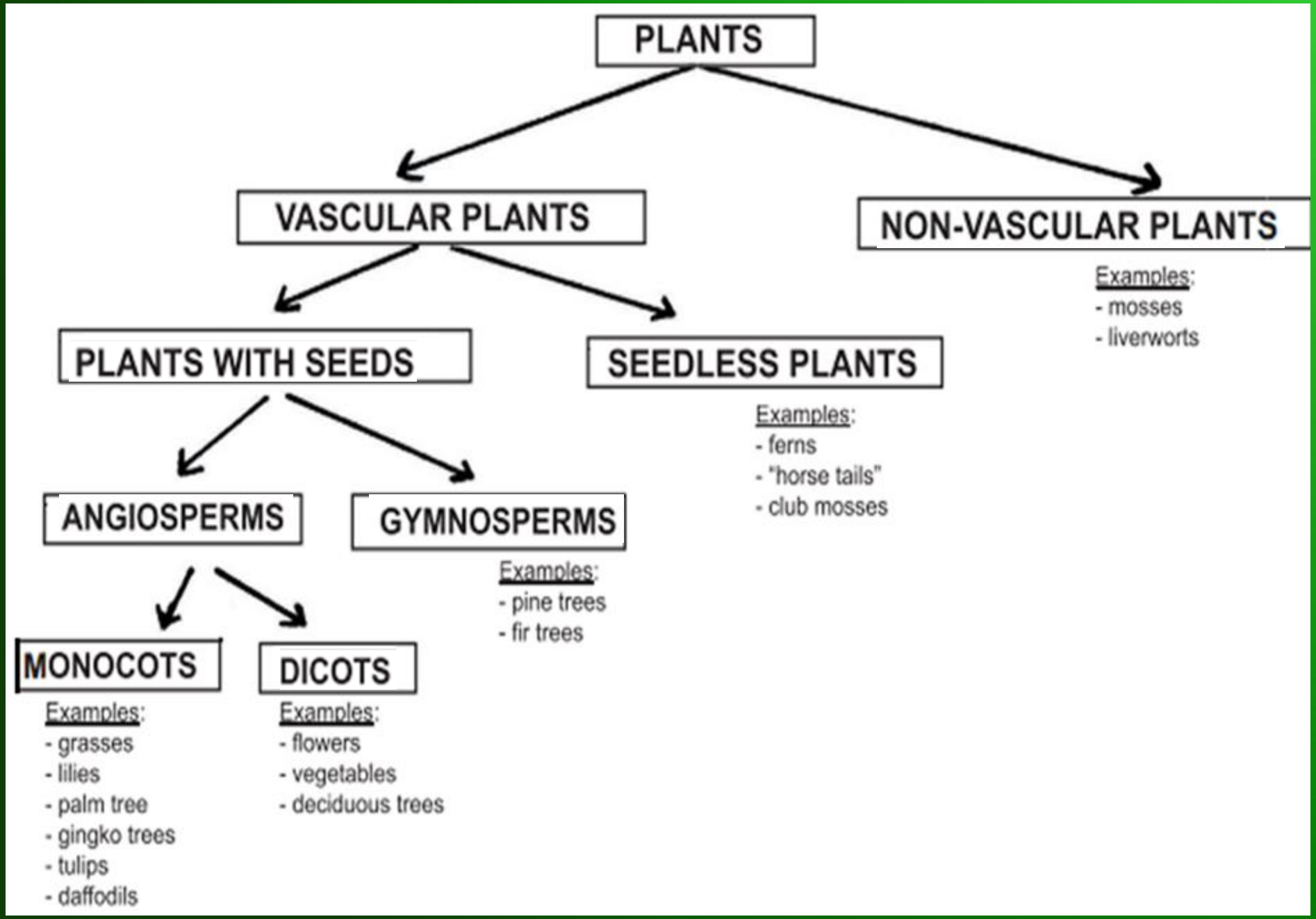
- The majority of plants alive today are flowering plants
- Contains vascular tissue (xylem/phloem)
- A flower or blossom is the reproductive structure
- Produce seeds enclosed in a ripened ovary which is a fruit
- Can be divided into monocots or dicots

Angiosperms: flowering plants





	Monocots	Dicots
Seeds	Single cotyledon 	Two cotyledons 
Leaves	Parallel veins 	Branched veins 
Flowers	Floral parts often in multiples of 3 	Floral parts often in multiples of 4 or 5 
Stems	Vascular bundles scattered throughout stem 	Vascular bundles arranged in a ring 
Roots	Fibrous roots 	Taproot 


PLANTS
VASCULAR PLANTS
NON-VASCULAR PLANTS
Examples:
- mosses
- liverworts
PLANTS WITH SEEDS
SEEDLESS PLANTS
Examples:
- ferns
- "horse tails"
- club mosses
ANGIOSPERMS
GYMNOSPERMS
Examples:
- pine trees
- fir trees
MONOCOTS
DICOTS
Examples:
- grasses
- lilies
- palm tree
- gingko trees
- tulips
- daffodils
Examples:
- flowers
- vegetables
- deciduous trees

What are the organ systems of a vascular plant?

- Root System

  This includes parts found underground

  ex: roots.

- Shoot System

  This includes parts found above ground

  ex: stems, leaves, flowers.

What are the organs of a vascular plant?

- Leaf

  This part makes food for the plant.

- Stem

  This part carries food and water through the plant.

- Root

  This part carries water from the soil to the plant.

- Flower (angiosperms)

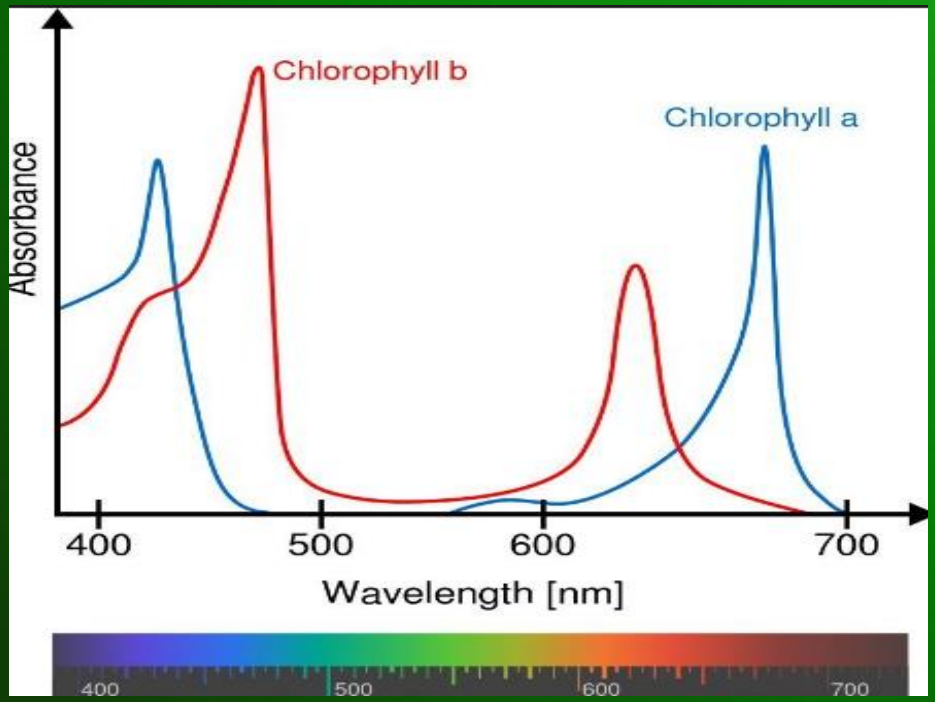
  This part makes seeds.

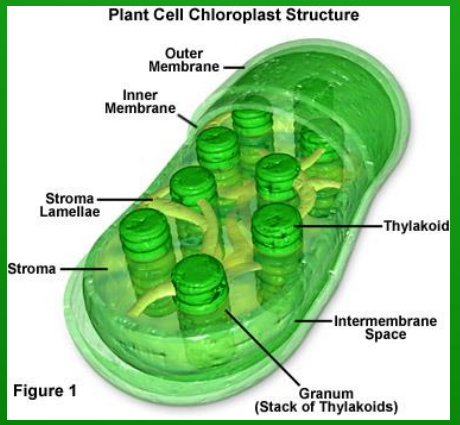
Leaves

- Where photosynthesis takes place and glucose (sugar) energy is made
- Chloroplast: Cell organelle where photosynthesis occurs
- Green pigments called chlorophyll *a/b* absorbs light.

What color(s) is best absorb by plants?

Least?





Cuticle

- Waxy covering on top of the leaf that helps prevent transpiration (water loss)

Veins

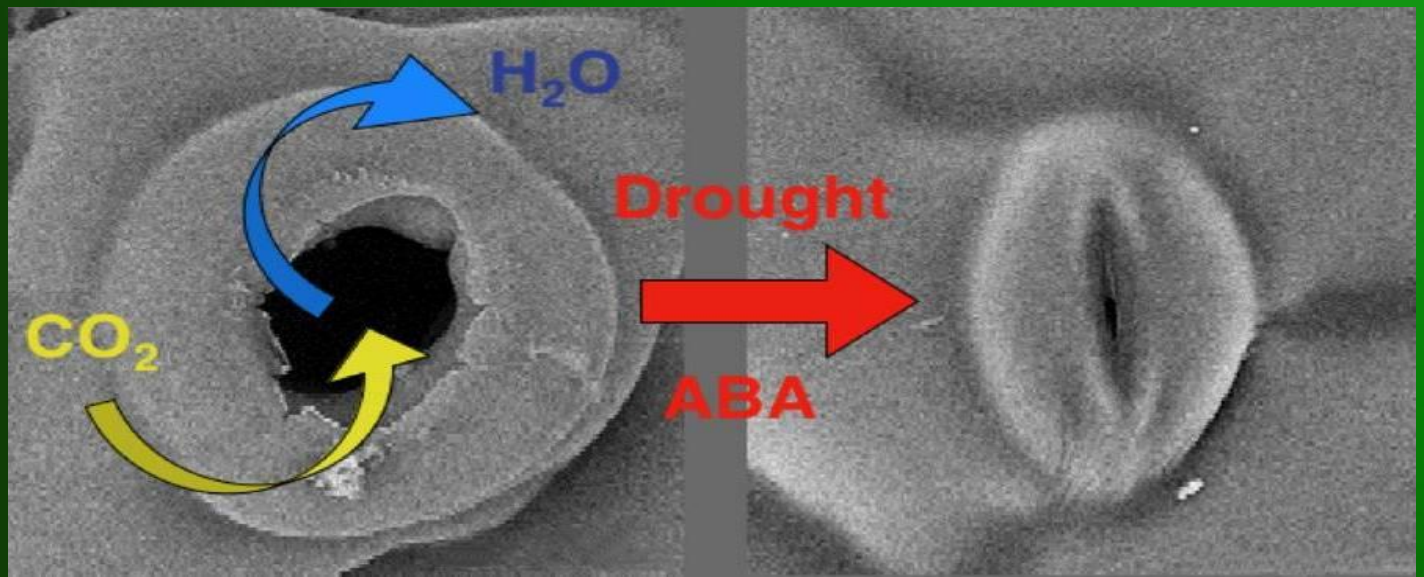
- Transport water from roots & nutrients/ food that was made in leaves to other parts of plant

- Made of xylem and phloem cells which can be called vascular tissue

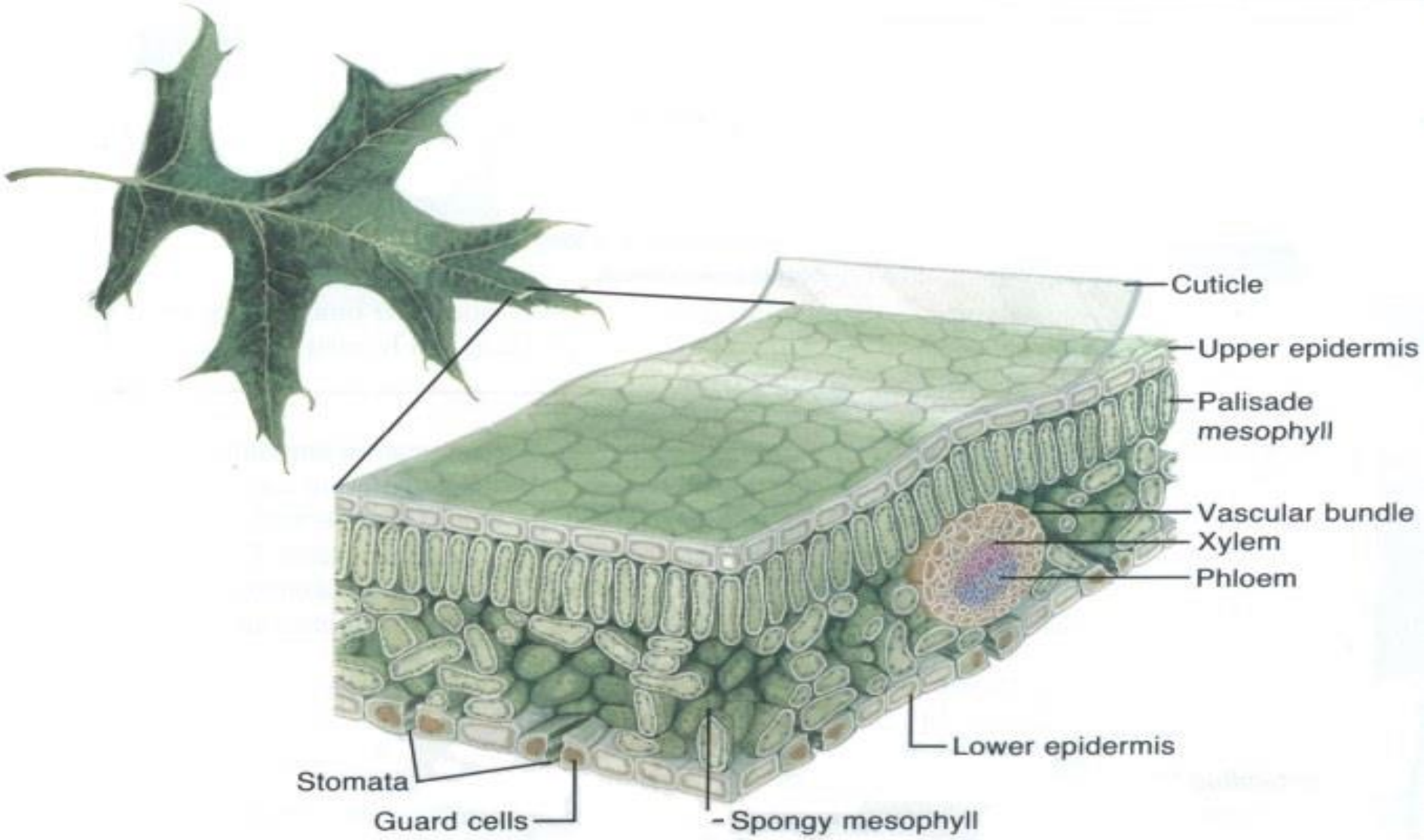
*remember not all plants have vascular tissue

Stomata- Openings on the bottom of the leaf

- Allows carbon dioxide IN, Allows oxygen to go OUT
- Water is lost through these openings (transpiration)
- Guard cells opens and closes the stomata to prevent transpiration

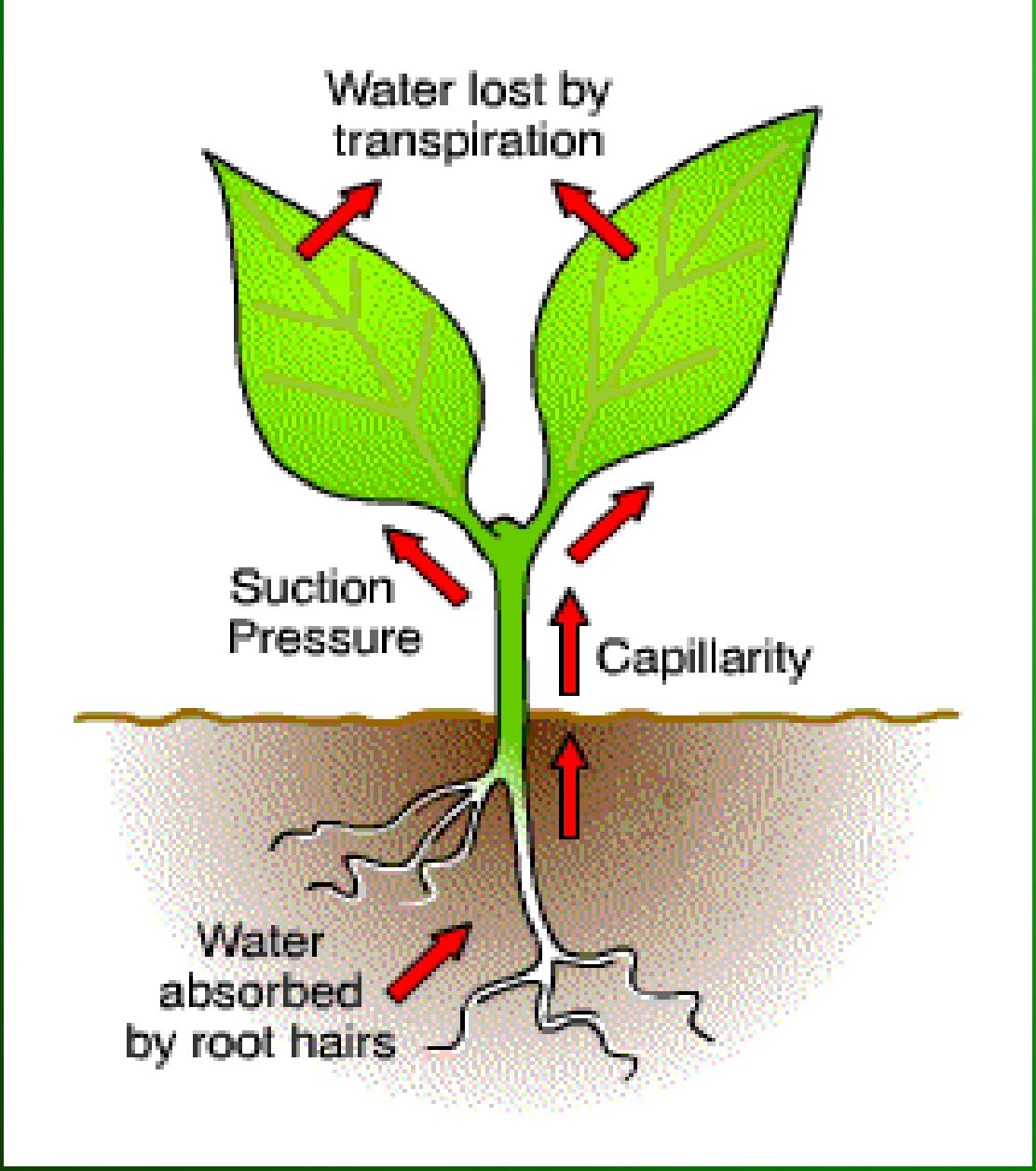


Leaf Anatomy



TRANSPIRATION

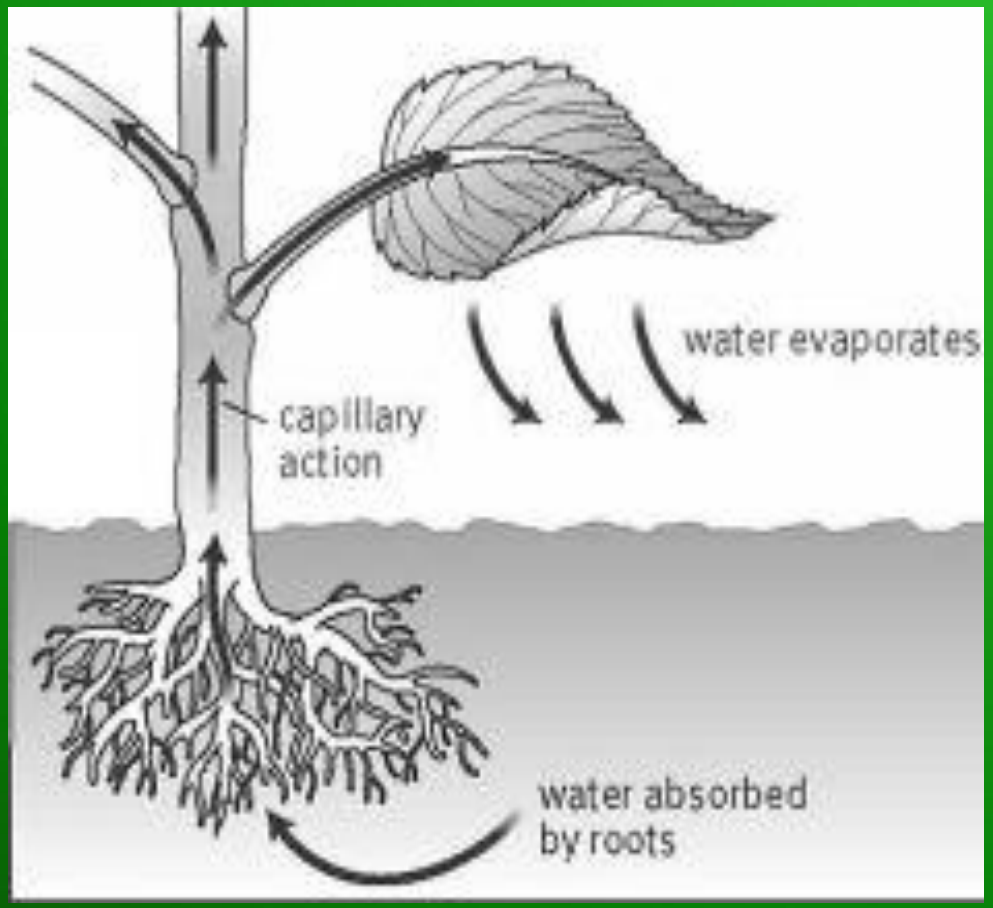
- Loss of water from a plant through the stomata
- Helps **pull** **water** & required **nutrients** up stem from roots.
- Part of the **water** **cycle**, trees transpire water back into the atmosphere.
- Usually occurs during the day when there is a lot of heat
- Will also occur if a plant has to remove extra water (maintain homeostasis)



Transpiration is the #1 driving force for pulling water up stems from roots.

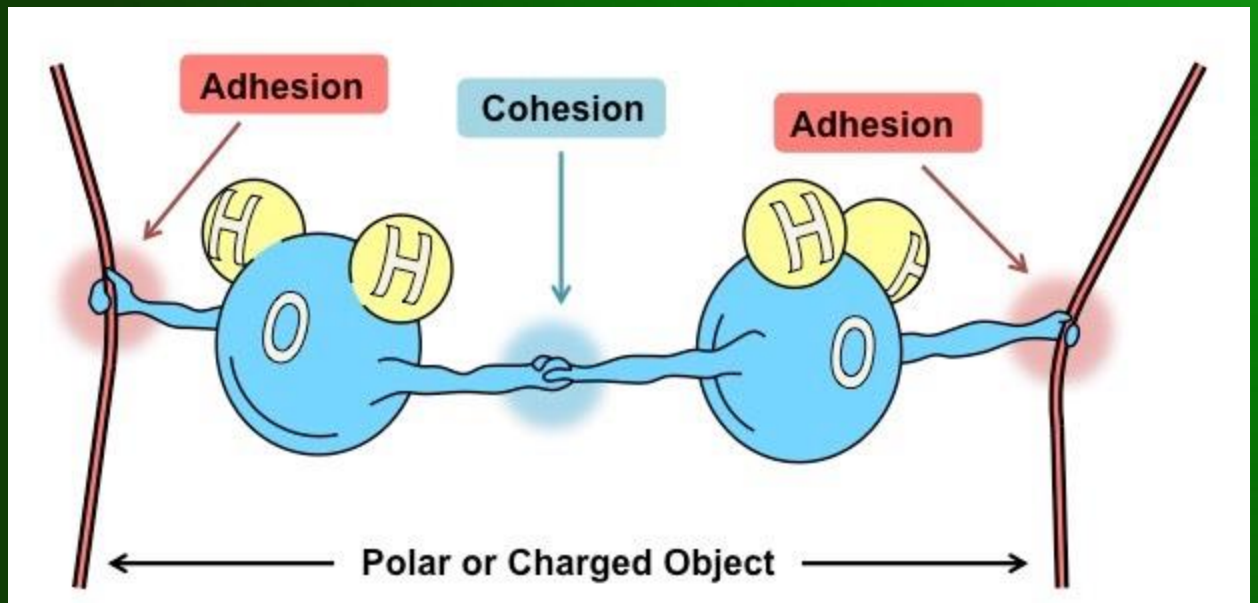
Water Pressure

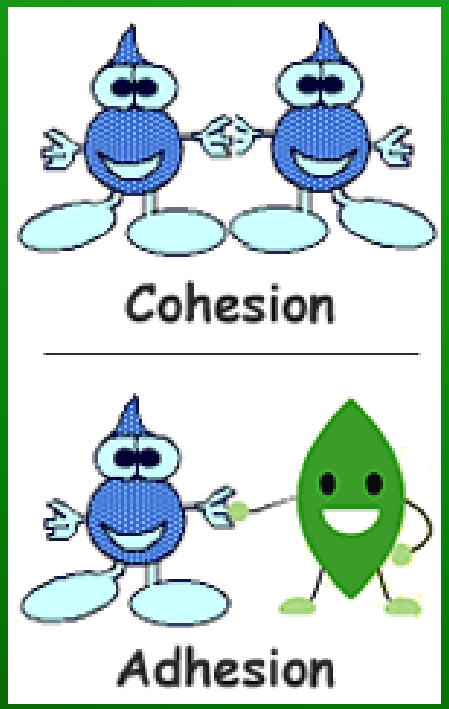
The combination of root pressure, capillary action, and transpiration provides enough force to move water through the xylem tissue of even the tallest plant.



Water Pressure

- **Cohesion** is the attraction of molecules of the same substance to each other.
- **Adhesion** is the attraction between unlike substances. (hydrogen bonds)
- The tendency of water to rise in a thin tube is called **capillary action**.





Wilting of a plant results from the loss of water.

Leaf Adaptations

Rainforest plants will need broad big leaves to increase amount of light absorbed, guard cells will keep stomata will stay open to drain out excess water

Desert plants have narrow, spikey leaves with thicker cuticles (waxy covering) and less stomata which mainly will stay closed during the day

Stem

- produce leaves, branches and flowers
- hold leaves up to the sunlight
- transport substances between roots and leaves (vascular)
- have adaptations for extra storage of nutrients and/or water ex. Tuber, bulbs

pleated stems for water

Tuber stems for storage

(potato)

Annual Wood Rings = layers of **xylem**

- Each pair of light & dark rings = **one** year's growth.
- **Thin rings**: weather conditions were not favorable
- **Thick rings**: weather conditions were favorable.

How old is this tree? ~19

Which letter represents growth during a rainy season? A

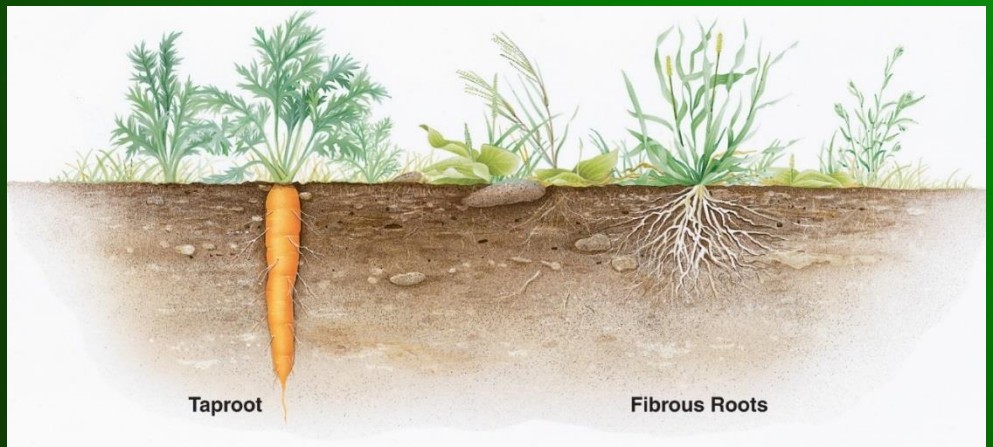
What could have caused the scarring marked by letter C?
Fire or animal

Roots

- Underground organs that absorb water and minerals
- anchors and keeps the plant in place
- 2 main types: tap root and fibrous roots

  a. Tap roots: one main root follows water deep underground

  b. Fibrous roots: many roots spread out and follows water close to the surface

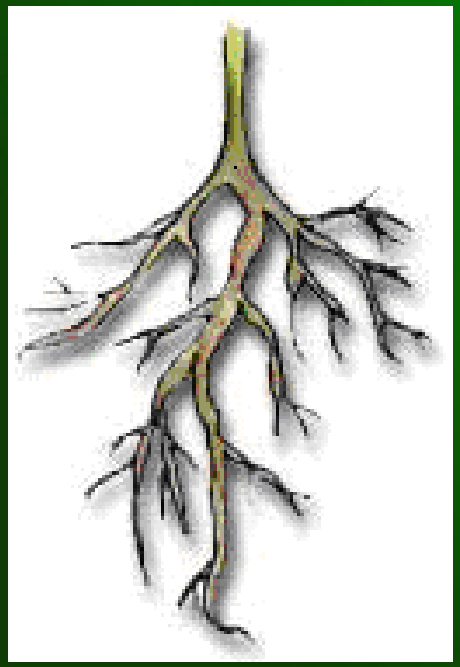


Tap root vs. Fibrous root *Think!

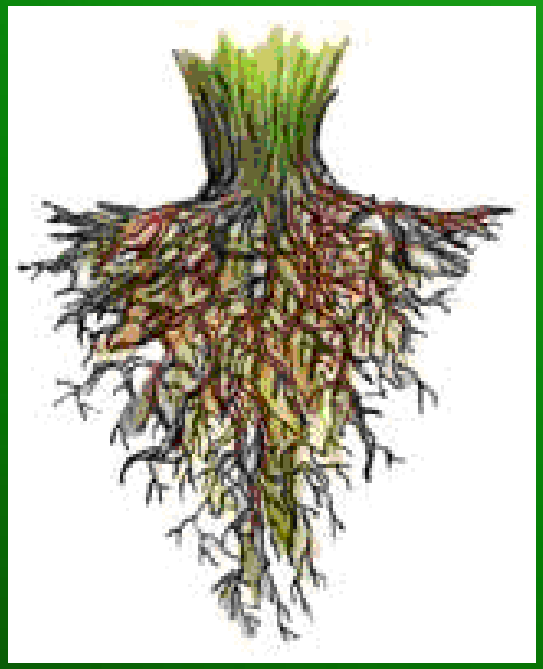
Which root would be better if water was only found deep underground?

Which root would be better if it rain only for short periods of time and the sun quickly dries up the water?

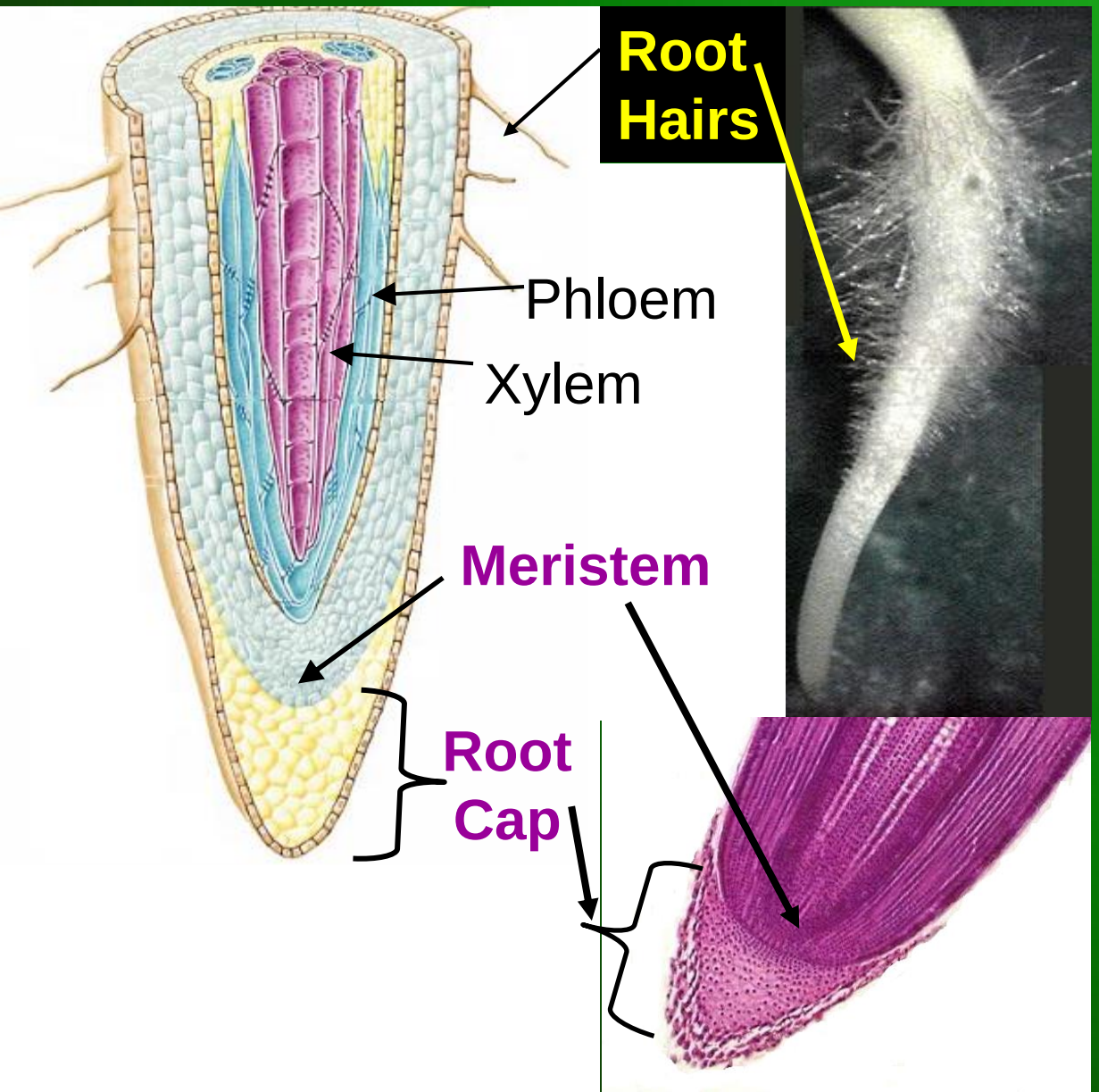
A



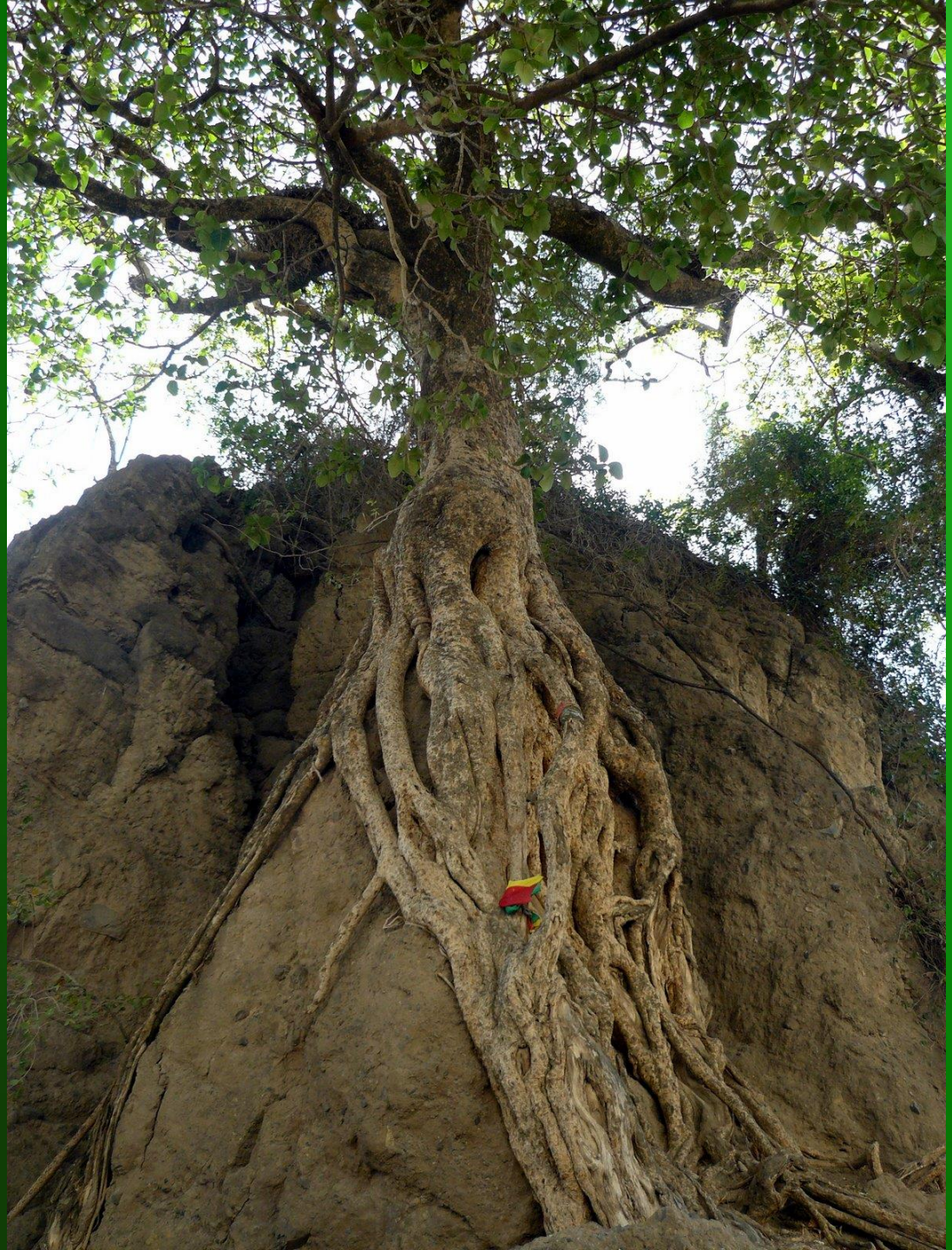
B



The Structure of a Root



1. **Root Hairs:** increase surface **area** for water & mineral absorption
2. **Meristem**: region where **new cells** are produced (mitosis)
3. **Root Cap: protects** tip of growing root



Vegetative Propagation – Asexual Reproduction

Grafting

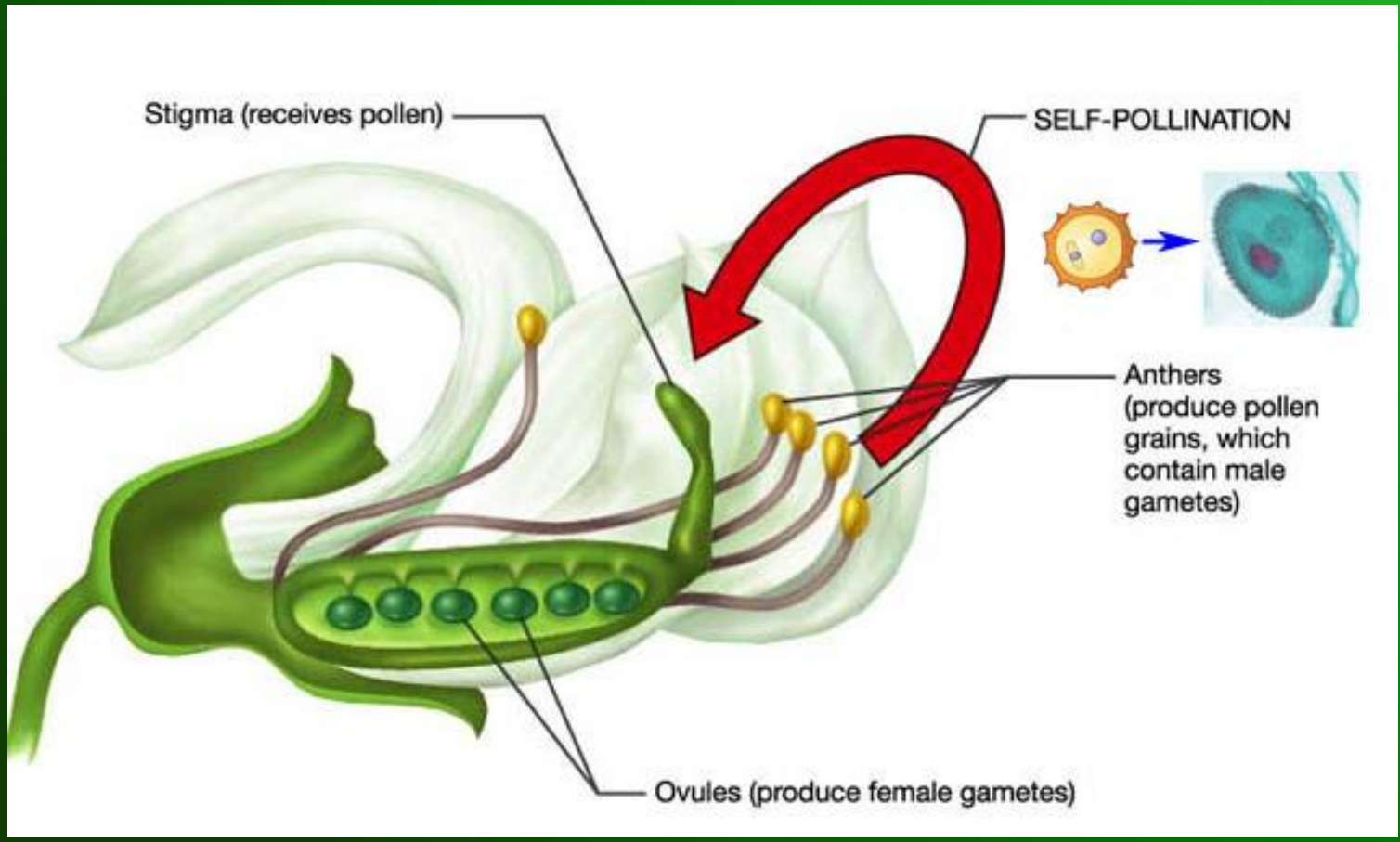
Cutting

Budding

Pollination- The transfer of pollen to a stigma, ovule, flower, or plant to allow fertilization

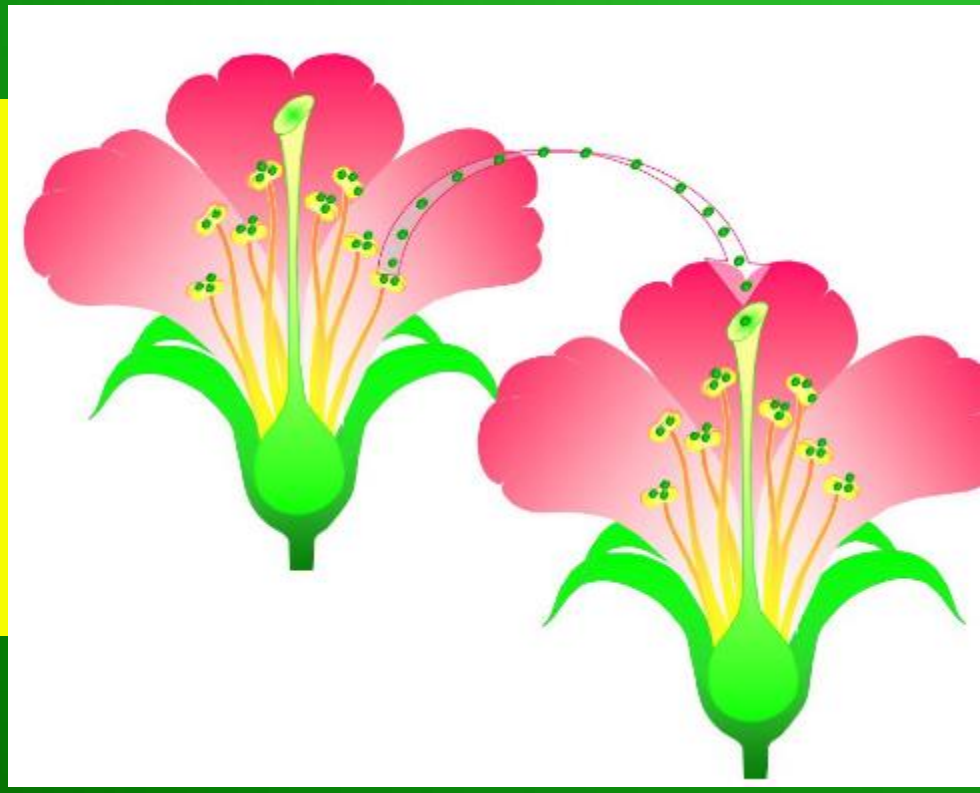
Self Pollination

Pollen grains from the anther to the stigma of either the same or genetically similar flower



Cross Pollination

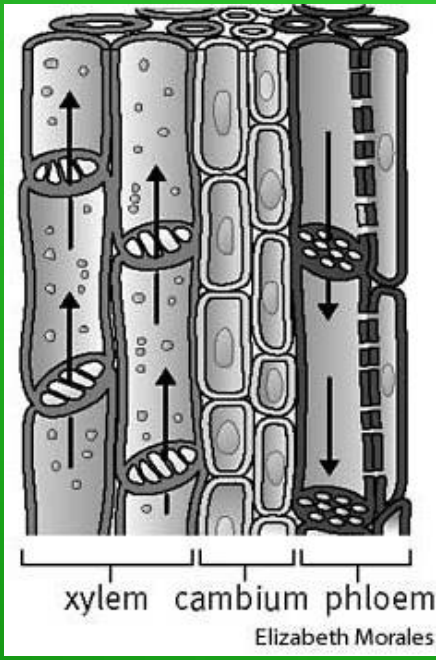
The transport of pollen from a single plant to a different plant by insects or the wind.

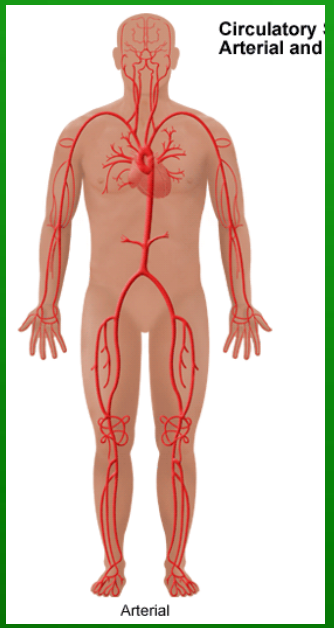


Plant Response

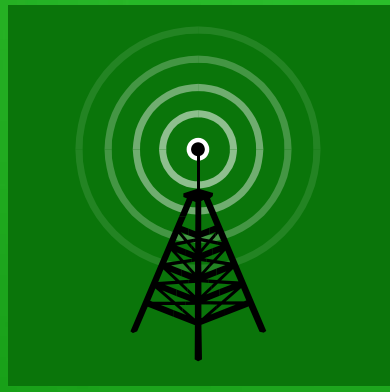
Relating plants to humans:

- Reproduction: reproductive systems, meiosis and male/female gametes coming together to fertilize!
- Transport: vascular system/cardiovascular system, transport of water and minerals in and out of cells
- Response: hormones control things!



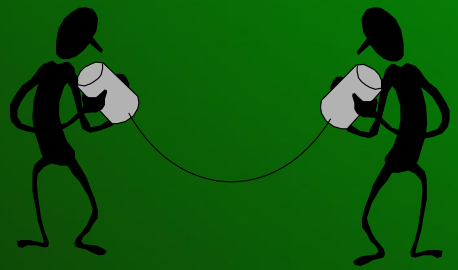


Plant Hormones:



Hormones signal things to happen for plants, just like humans:

- Promotes and inhibits cell division
- Growth of roots, seeds, fruits, flowers and stems!
- This is a communication system to maintain HOMEOSTASIS!



Plant hormones:

A Summary of Plant Hormones

Hormone	Some of the Effects	Where Found
Auxins	Promote cell elongation and apical dominance; stimulate growth of new roots	Produced in shoot apical meristem and transported elsewhere
Cytokinins	Stimulate cell division; affect root growth and differentiation; may work in opposition to auxins	Growing roots
Gibberellins	Stimulate growth; influence various developmental processes; promote germination	Meristems of shoot, root, and seed embryo
Abscisic acid	Inhibits cell division; promotes seed dormancy	Terminal buds; seeds
Ethylene	Stimulates fruits to ripen; causes plants to seal off and drop unnecessary organs, such as leaves in autumn	Fruit tissues; aging leaves and flowers

Plant Response:

- **Phototropism:**

Plant responds to light stimulus using hormone auxin by growing towards the light source.

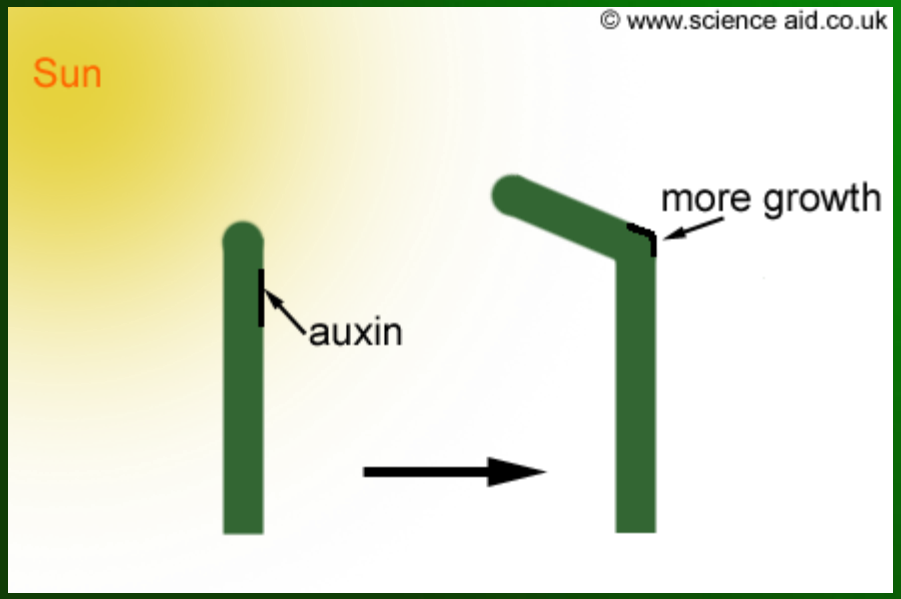
- **Geotropism:**

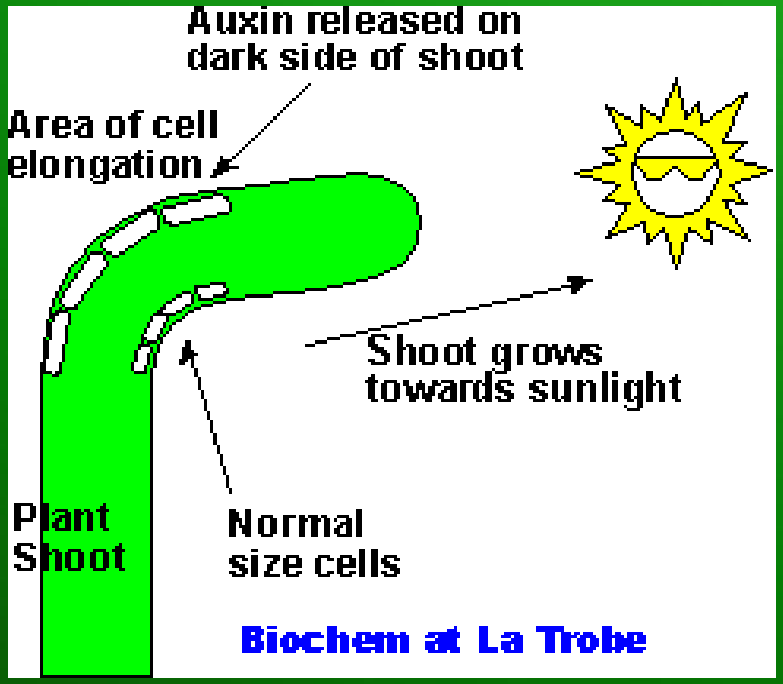
Plant responds to gravity by roots growing down and leaves/stems growing up.

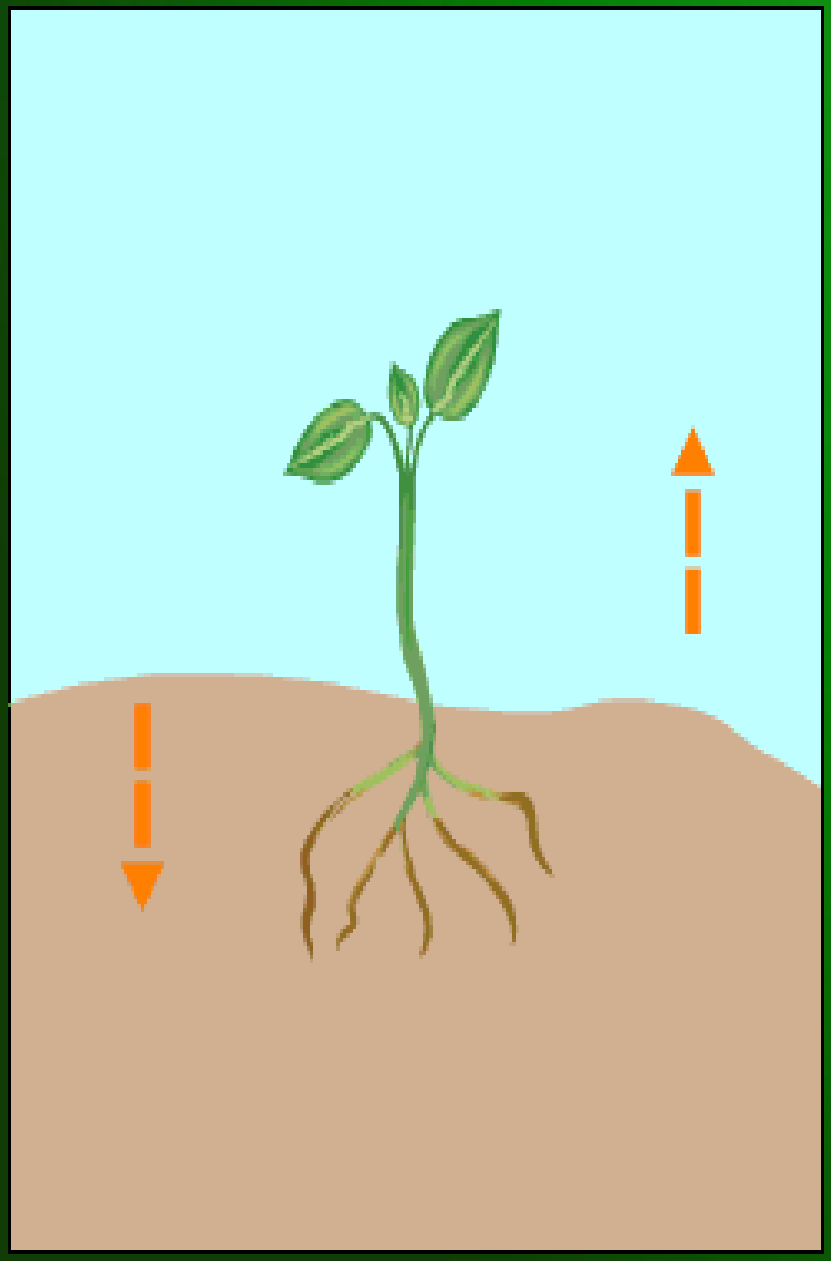
- **Thigmatropsim:**

Plants respond to touch or physical contact.

PHOTOTROPISM: hormone (AUXIN) causes the cells on that side to elongate toward LIGHT







GRAVITROPISM:

hormone auxin controls how plants respond to of gravity

Causes shoots to go against gravity and roots to go towards soil (ground)

PLAY!

Plants respond to touch (THIGMOTROPISM)

PLAY!

Hormone ETHYLENE stimulates fruit to ripen

Plant produced Ethylene – fruit ripens naturally on vine

Fruit can be picked green & treated with synthetic ethylene before delivered to market to produce ripe color

Plant Adaptations

Deciduous plants (those that lose their leaves in winter) prepare for winter dormancy by

- Turning off photosynthetic pathways
- Transporting materials from leaves to roots
- Sealing leaves off from the rest of the plant

Plants that live in the desert have adaptations that include:

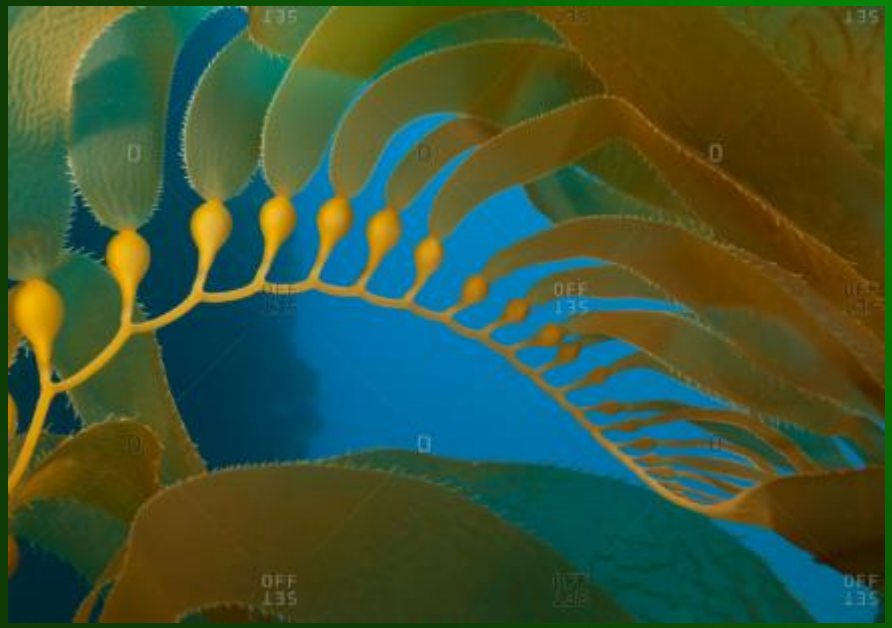
- Extensive roots
- Reduced leaves, less stomata
- Thick stems to store water

Stem

Leaves

Aquatic plants

- To take in sufficient oxygen, many aquatic plant have tissues with large air filled spaces through which oxygen can diffuse.



Commensalistic plants

- An epiphyte plant is not rooted in soil but instead grow directly on the bodies of other plants.
- Epiphytes gather their own moisture, generally from rainfall, and produce their own food so do not harm nor help the other plant.

MISTLETOE is a PARASITIC plant that is found in Texas

CARNIVOROUS PLANTS (yes, they also do photosynthesis) INCLUDE:

- Venus' flytrap

- Pitcher plants

- Sundews

Grow in areas where soil are <u>lacking</u> <u>nitrogen</u> or minerals