



## Introduction to

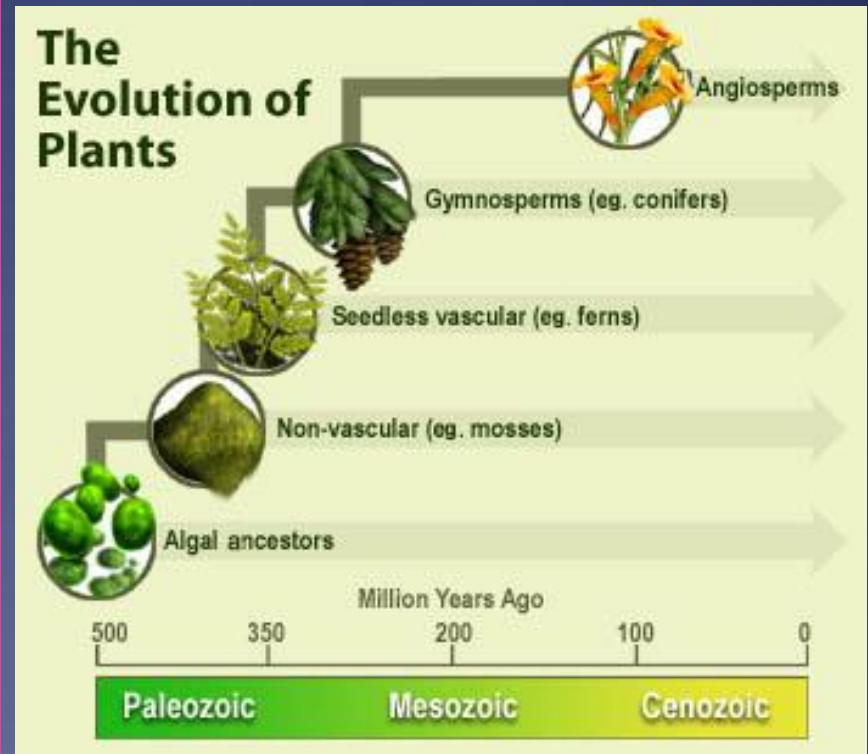
- Kingdom: Plantae
- Domain: Eukarya

# Plant Facts

- An acre of trees can remove about 13 tons of dust and gases every year
- Onions contain a mild antibiotic that fights infections, soothes burns, tames bee stings and relieves the itch of athletes foot
- Of the more than 260,000 different species of plants, the vast majority are flowering plants
- 84% of an apple and 96% of a cucumber is water
- A pineapple is a berry.

# Evolution of Plants

- One of the most important events in our planet's history was the origin of plant life
  - created conditions that allowed life to continue
  - paved the way for the evolution of higher organisms

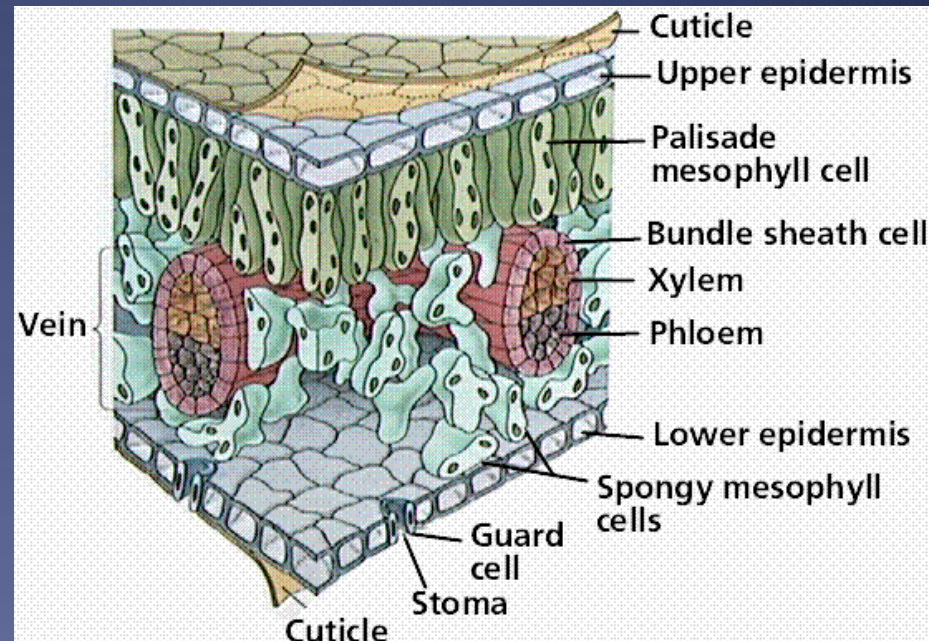


# Plant Overview

- Plants have three basic structures: roots, stems, and leaves.
- One important difference between plants and animals is that a plant can lose large parts of itself and still survive
  - an adaptation of plants to protect from herbivores
- Split into two groups (based on internal structure)
  - Vascular
  - Non-vascular

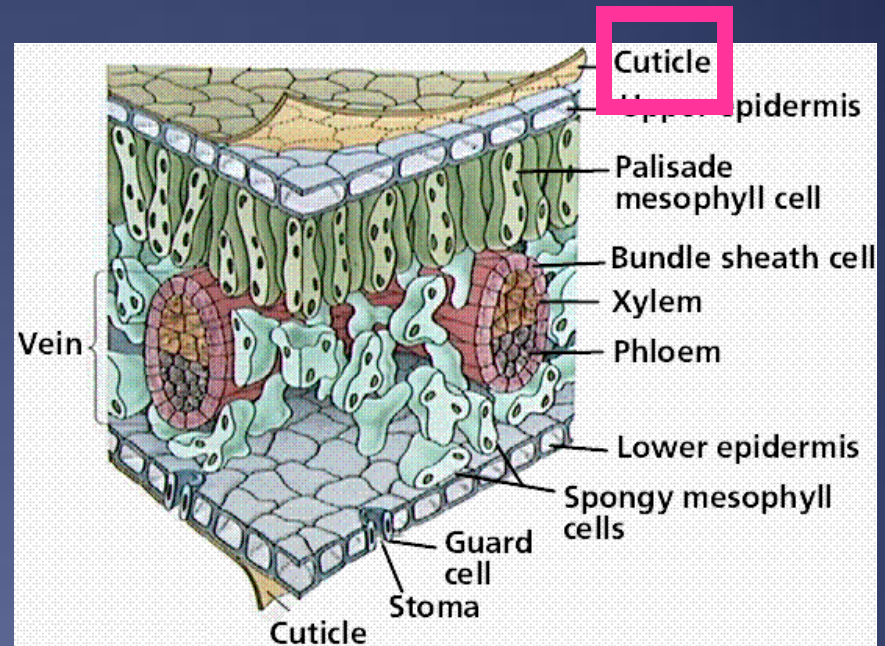
# Leaf

- Photosynthetic organ of the plant



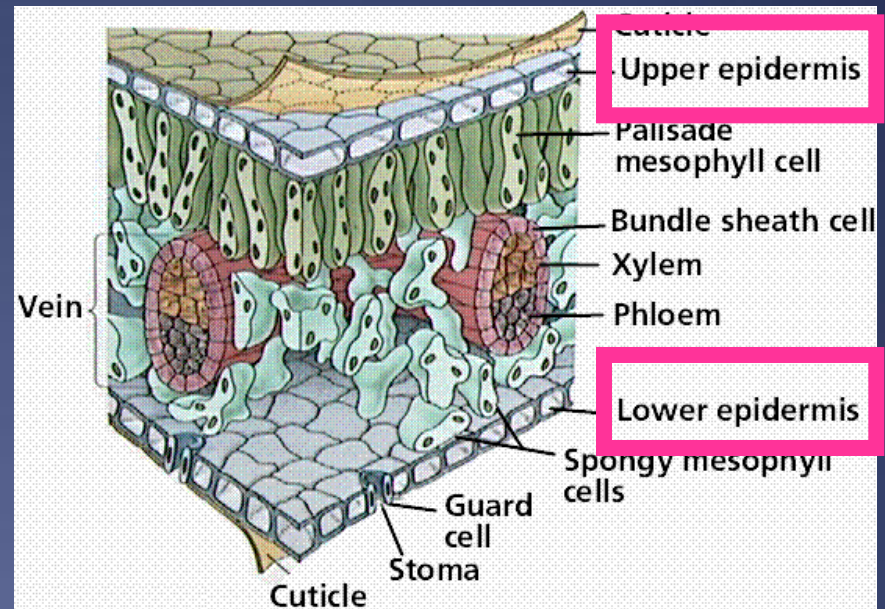
# Cuticle

- Thin waxy layer that covers leaf
- Prevents water loss
- Does not allow  $\text{CO}_2$  and  $\text{O}_2$  to pass through
- Plants that live entirely in the water do not have a cuticle.



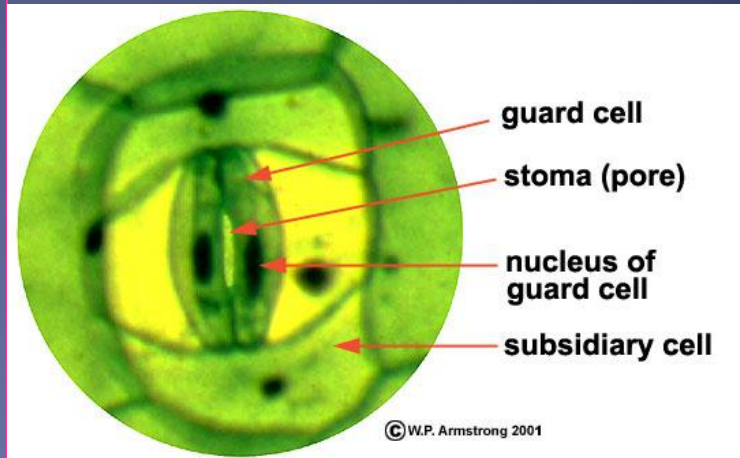
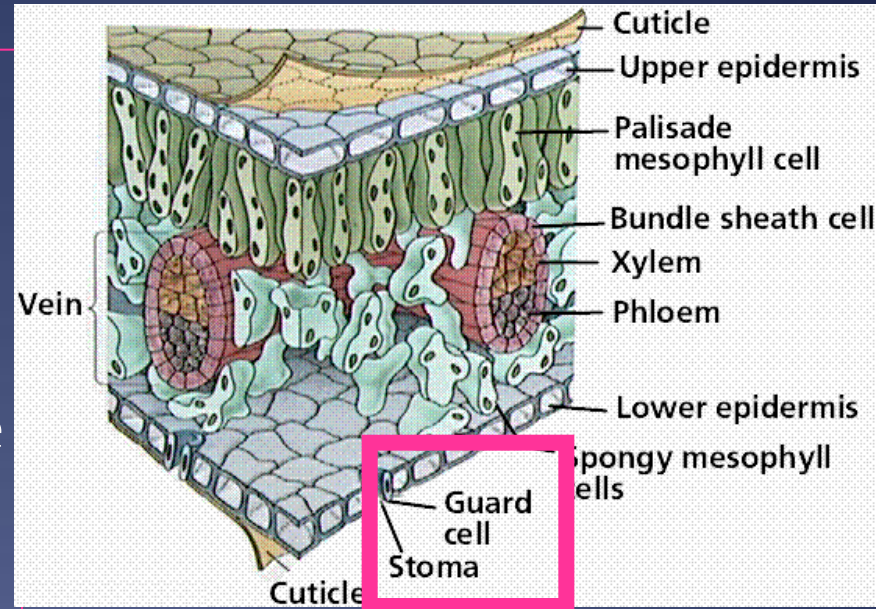
# Epidermis

- Directly under cuticle
- Tough cells that line the upper and lower layers of leaf
- Secretes the cuticle



# Stoma and Guard Cells

- Stoma: (plural stomata)
  - A pore where water vapor and other gases leave and enter the plant
  - Formed and regulated by two guard cells that regulate the opening and closing of the pore.
- Guard Cells
  - sausage-shaped cells that surround a stoma
  - change shape (as light and humidity change), causing the stoma to open and close.





# Chemistry of Guard Cells

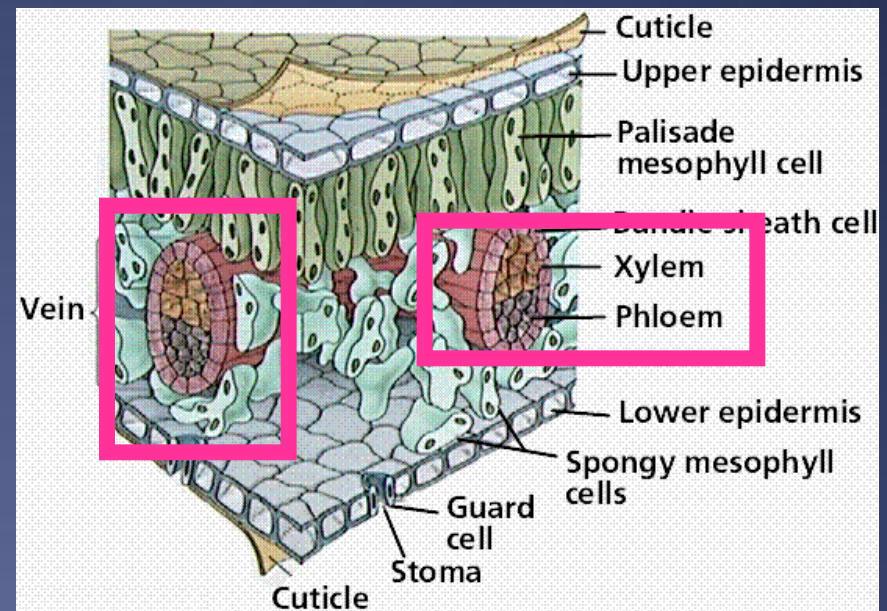
- Three environmental factors regulate guard cells
  - Light, [CO<sub>2</sub>], and water availability
- Light waves activate GC's causing ions to enter the cells. This ↑ concentration of ions inside the cell causes water to enter via **osmosis**.
- Guard cells swell and stoma open
  - CO<sub>2</sub> can diffuse into the leaf and enter the Calvin Cycle
  - O<sub>2</sub> (produced in photosynthesis) diffuses out open stoma
  - Plants also lose water vapor through stoma (cannot gain CO<sub>2</sub> without simultaneously losing water vapor = transpiration)
- ↓ **Water = Stoma closing**
- ↑ **Light or ↑ CO<sub>2</sub> = Stoma opening**

In General

<http://www.tvdsb.on.ca/westmin/science/sbioac/plants/stoma.htm>

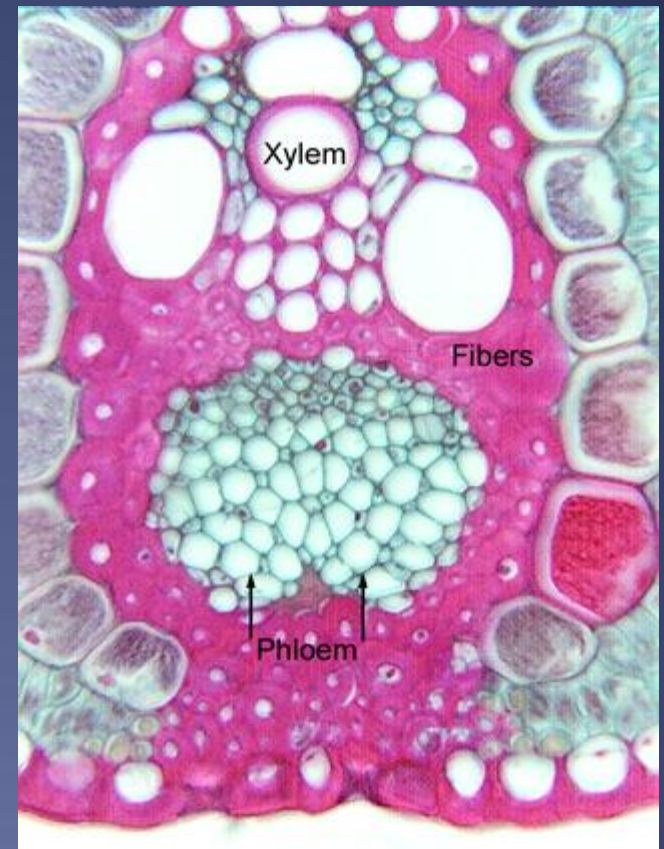
# Vascular Bundle (Veins)

- Extensions that run from tips of roots to tips of leaf
- Provide support for the leaf and transport both water and minerals and food
  - via xylem (ZIE luhm) and phloem (FLOH uhm)



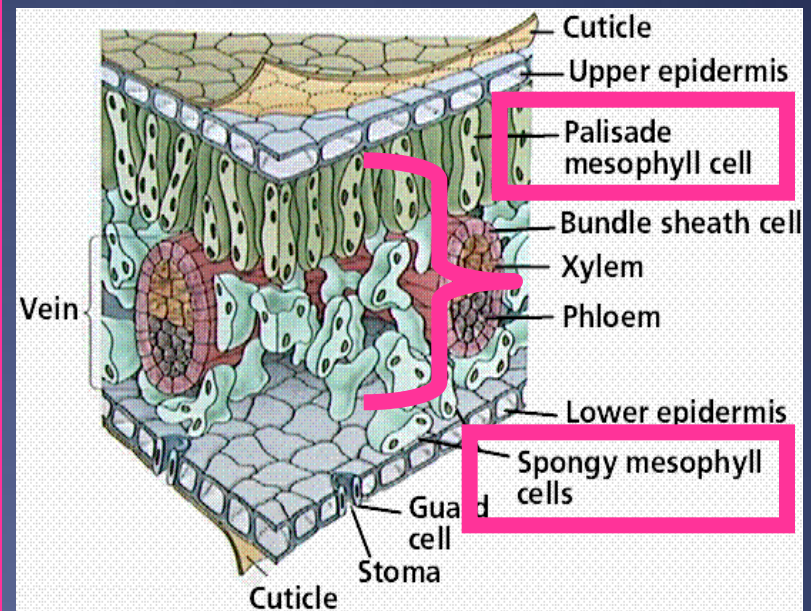
# Phloem and Xylem

- Outer layer of vein is surrounded by cells that create a circle around the phloem and xylem.
- Phloem
  - Transports sugar
- Xylem
  - Transports water and minerals



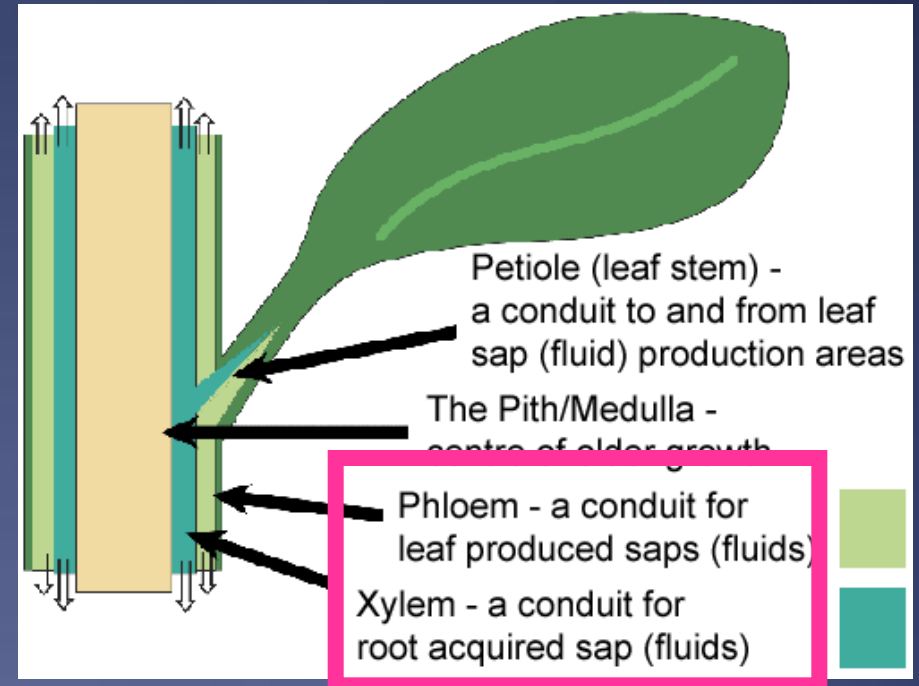
# Mesophyll

- Meso (Greek-middle)
- This is the middle layer
- Composed of 2 layers
  - Palisade mesophyll (outer middle)
    - Column like cells located under the upper epidermis
    - Contain most of the leaf's chlorophyll
  - Spongy mesophyll (filling)
    - Layer below the palisade mesophyll
    - Irregularly-shaped cells with many air spaces between the cells
    - Cells contain some chlorophyll



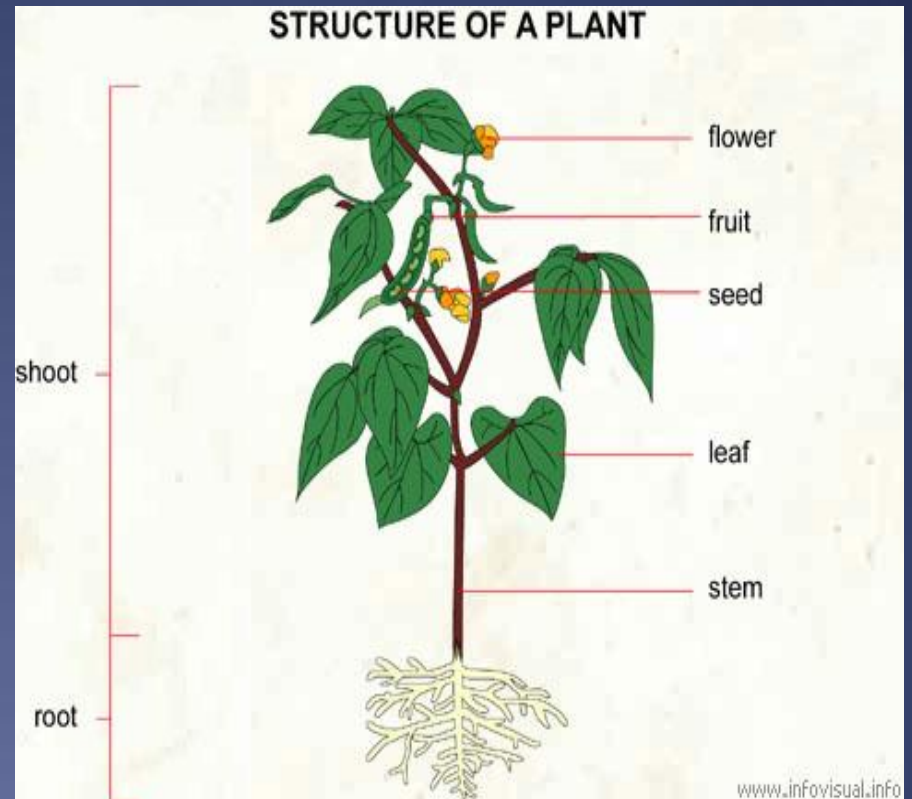
# Stem

- Support Plant
- Transport H<sub>2</sub>O through xylem
- Transport nutrients through phloem



# Shoot

- Part that grows mostly upward



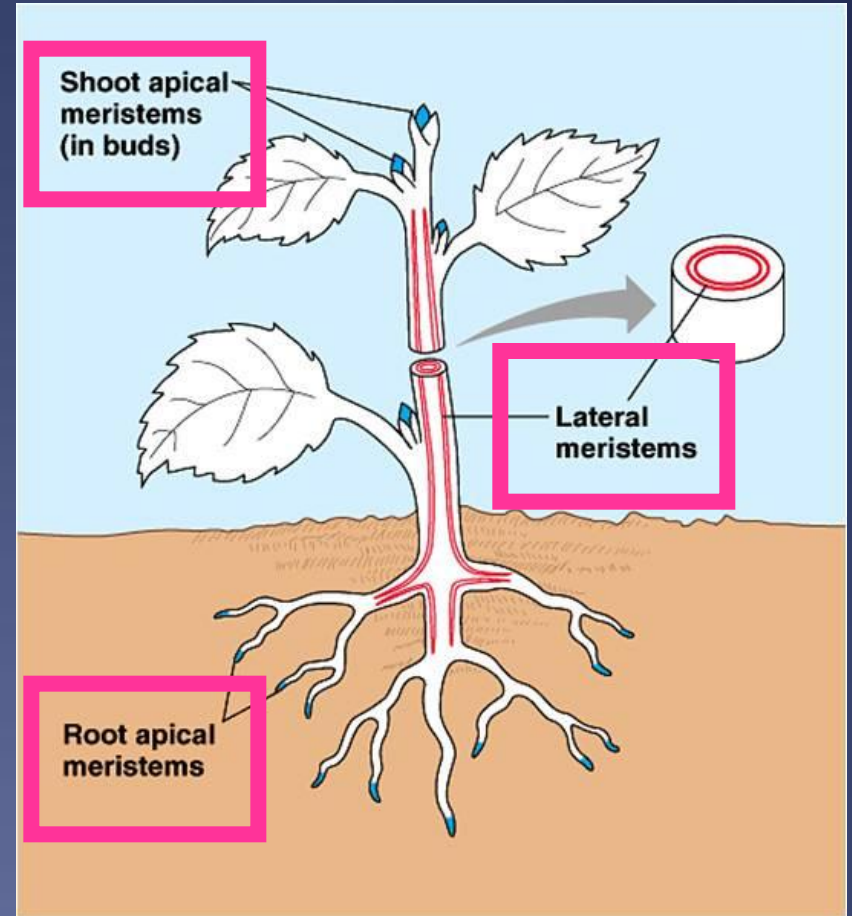
# Roots

- Part of plant that grows mostly downward
- Absorption of water and minerals
- Anchors plant
- Can enter into symbiosis with certain fungi to form mycorrhizas



# Meristems

- Regions where plant cells are actively dividing.
- Root, Lateral, Shoot



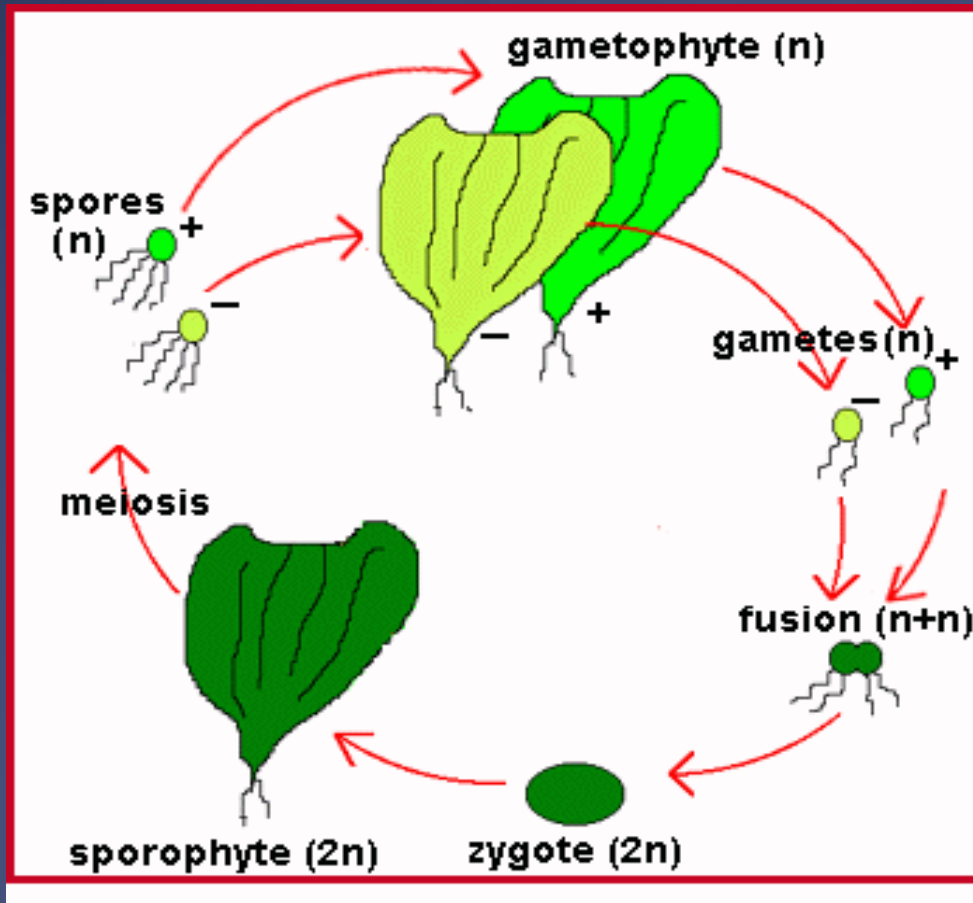




# Life Cycle and Classification of Plants

# Life Cycle

- A life cycle is a description of an organism as it passes from conception to production of progeny (offspring)
- Plants have an “**Alternation of Generations**”

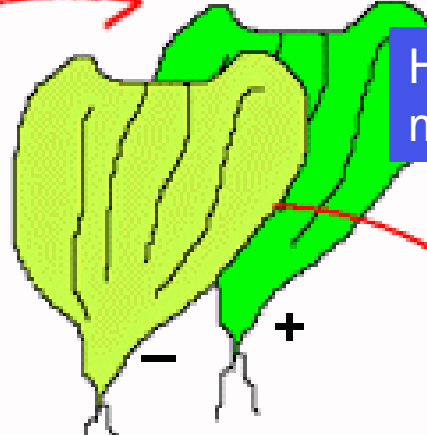
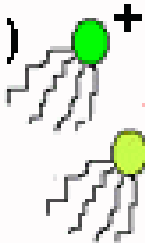


Individual spores grow and develop (mitosis) into gametophyte

gametophyte (n)

Haploid plant (gametophyte) makes gametes.

spores (n)



gametes (n)<sub>+</sub>



Label Your Picture

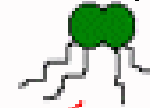
Sporophyte undergoes meiosis- produce spores (n)

meiosis



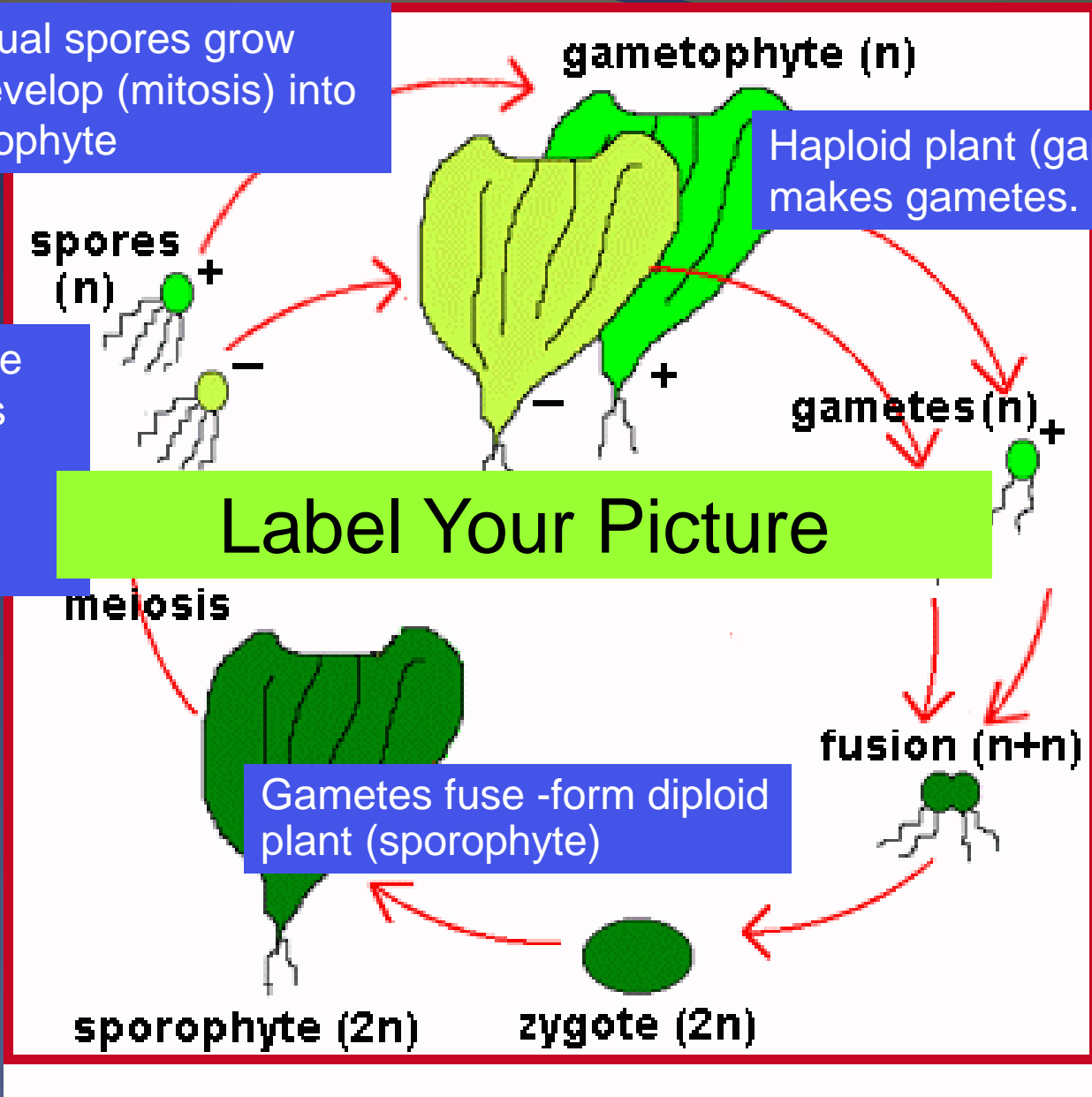
Gametes fuse -form diploid plant (sporophyte)

fusion (n+n)



sporophyte (2n)

zygote (2n)



# Examples

Non-vascular have dominant gametophyte generation

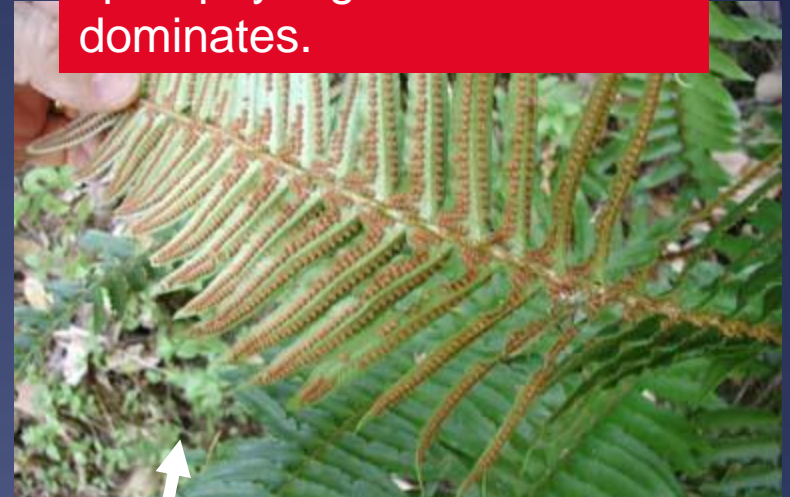


Spores

Gametes

Familiar green moss plant is gametophyte, while the long-stalked spore capsules growing from it are sporophyte.

In vascular plants, the sporophyte generation dominates.



Fern plants commonly seen are the sporophytes: it is the gametophyte stage that is small and often overlooked.



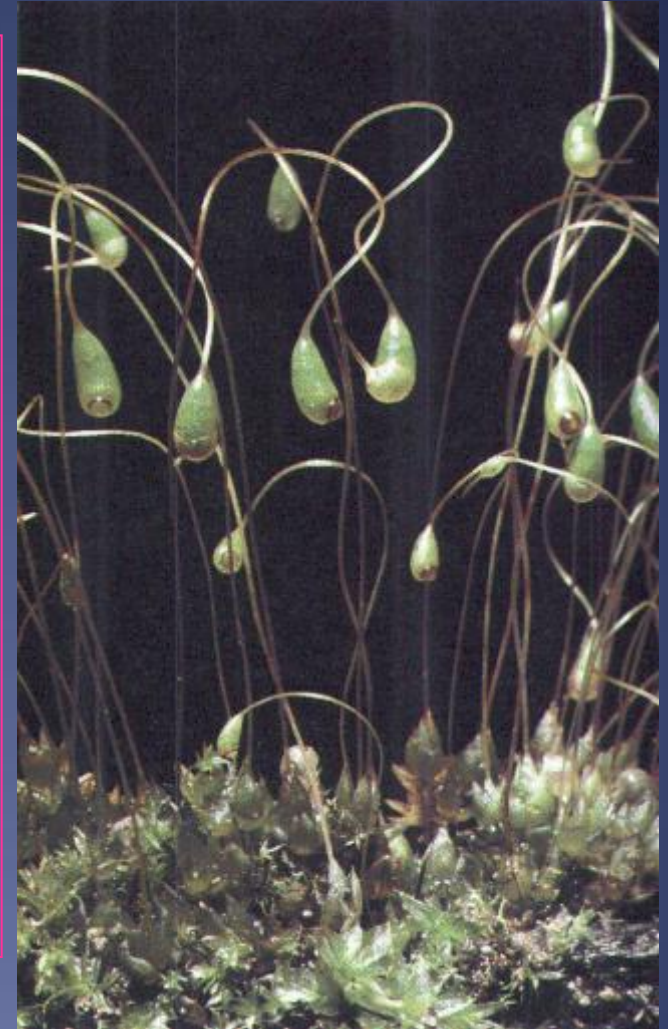
# Classifying Plants

## Vascular or Nonvascular



# Nonvascular Plants

- Lack true roots, stems, and leaves
- Need Moisture
  - Water required for sexual reproduction. Egg/sperm form in diff structures
- Small and Simple
  - Water and nutrients are transported mainly by osmosis and diffusion. These processes can only carry items small distances
- No vessels



# Non-Vascular Plants

- Larger Gametophyte
  - Gametophytes of NV plants are larger and more noticeable than the sporophytes.
  - Sporophytes grow on gametophytes



# Three Phyla of Nonvascular Plants

Hornwort

Phylum: Anthoceroophyta



Mosses

Phylum: Bryophyta

Liverwort

Phylum: Hepatophyta





# Vascular Plants

- Vascular
  - Vessels to transport food and water (phloem and xylem)
  - Roots, stems, and leaves
  - Seeds and no seeds



# Seedless Vascular Plants

- Vascular System
- Larger Sporophyte
  - Easier for wind to carry spores
  - Water needed for fertilization in sporophyte generation
- Drought-Resistant Spores
  - Spores have thickened walls



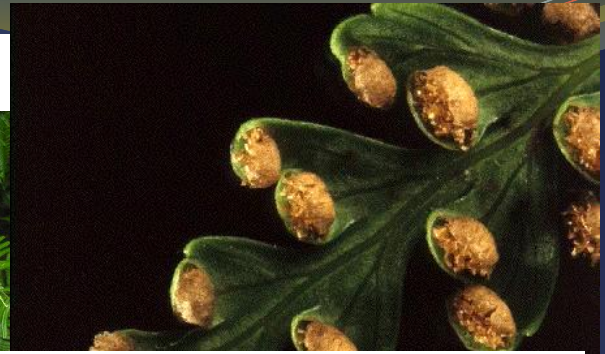
Whisk Fern

Spores

# Types of Seedless Vascular Plants



Fern

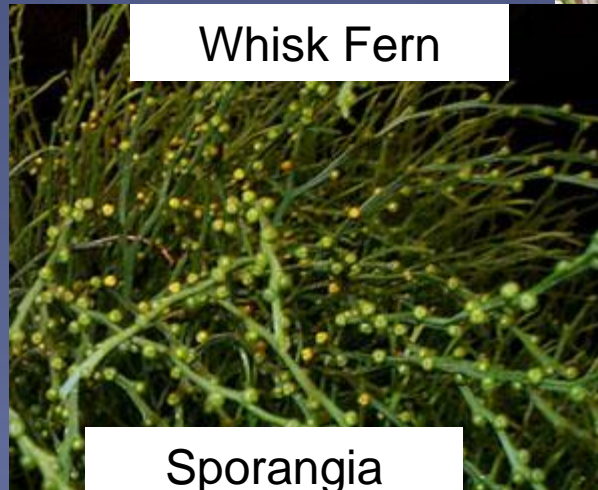


Sporangia on underside  
Gametophytes are flattened



Horsetail

Spores grow in  
cones



Whisk Fern

Sporangia  
contain spores



Club Moss

Spores grow in  
cones

# Seeded Vascular Plants

Gymnosperms



Angiosperm



# Gymnosperms

- Gymnos (Greek-naked) and sperma (seed)

## Key Features

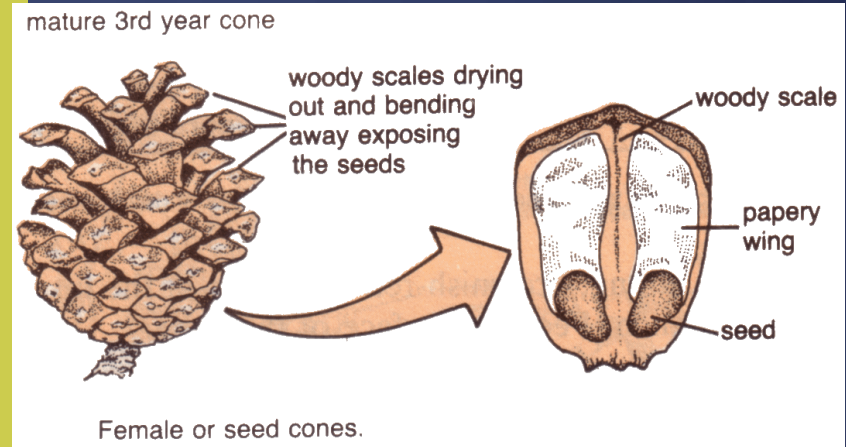
- Seeded plants whose seeds do not develop within a sealed container (fruit).
- Very Successful
- Why would a seeded plant be more successful than one that is not?
  - Seeds protect the plant embryo, provide nutrients, permit survival during harsh times.
- 4 Groups
  - Conifers, Cycads (si'kads) , Ginkgo, and Gnetophyte

# Gymnosperms

## Conifer



- Most Successful Gymnosperms
- Needle-like or reduced (scale) leaves
- Small leaf reduces water loss
- Some over 5000 y.o
- Cool, dry regions



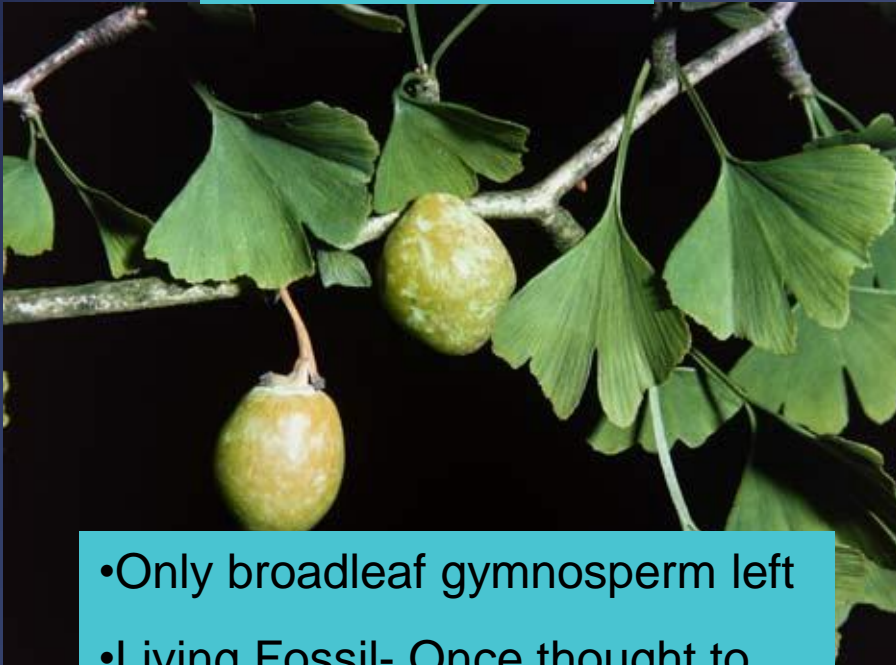
## Cycad



- Short stems and palmlike leaves
- Male (pollen) and Female (seeds) types
- Tropics

# Gymnosperms cont...

Ginkgo



- Only broadleaf gymnosperm left
- Living Fossil- Once thought to be extinct
- Ginkgo Biloba (memory or concentration enhancer)

Gnetophyte:

Ephedra



- Diverse group of trees, shrubs, and vines
- Produce pollen and seeds in cones that resemble flowers.
- Ephedra used for treatment of asthma
- Stimulant which constricts blood vessels and increases blood pressure and heart rate.

# Angiosperms

- Angiosperm (case) Sperm (seed)

## Key Features

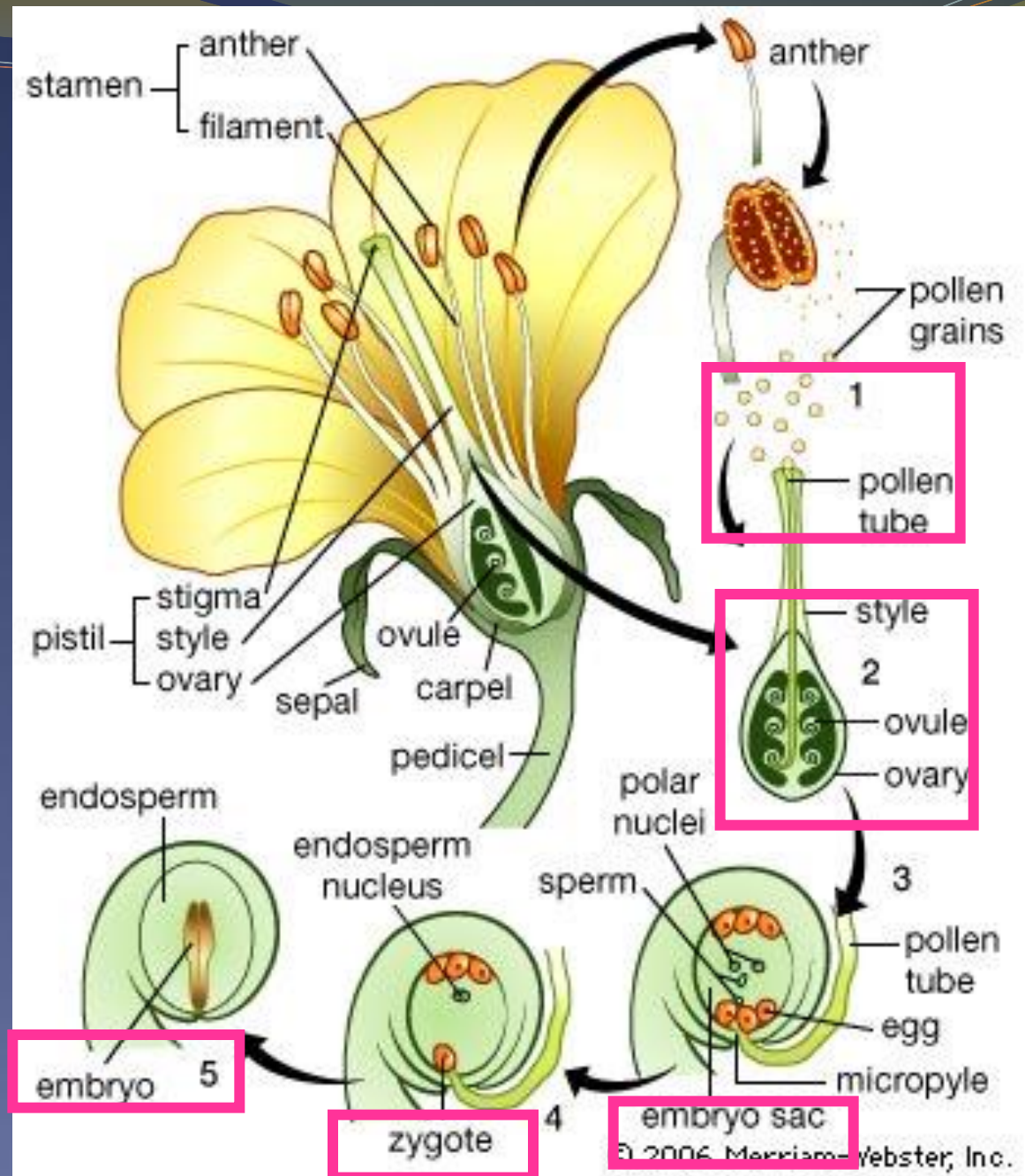
- Produce seeds that develop enclosed within a specialized structure called a fruit
- Flowers
- Fruits
- Endosperm





# Angiosperm Life Cycle

Highlight on your picture



# Flowers

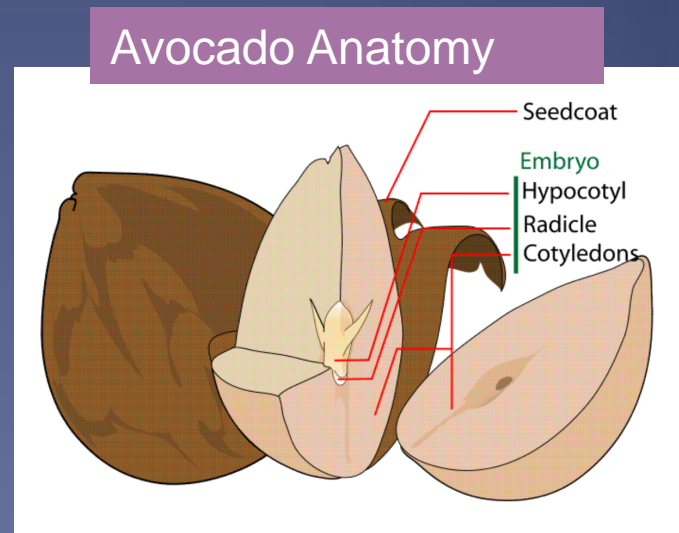
- Male and female gametophytes develop inside flowers
- Allow more efficient pollination than cones
- Allows sperm to travel w/o water
- Angiosperms can have adaptations to ↑ chance of pollination
  - Strongly scented to attract pollen carriers
  - Some are self-pollinators (peas)
  - Small flowers for wind (grass, oak)

# Fruits

- Promotes seed dispersal
- Develop from flower
- Animals eat fruit...seeds passed through digestion system
- Other seeds can float on wind/water
- Provide some protection for seed

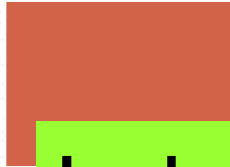
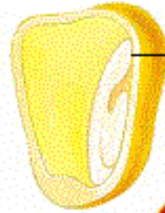
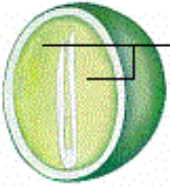
# Endosperm

- Angiosperm seeds have a storage of food called endosperm
- Endosperm usually absorbed by embryo before seeds mature

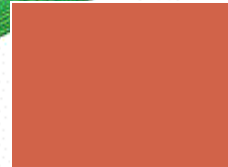


Cotyledon- usually first leaf of seedling

# 2 Types of Angiosperms

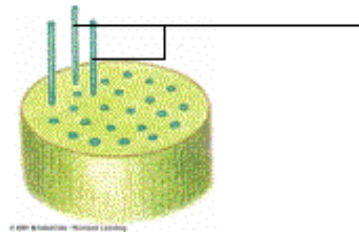
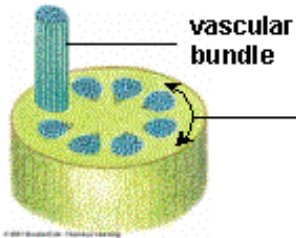


Label Your Picture



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DICOTS

MONOCOTS

# Familiar Monocots

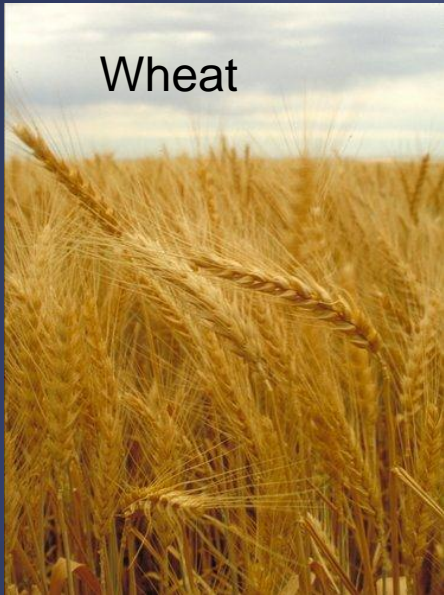
Iris



Corn



Wheat



Grass



Lily



# Familiar Dicots

