# The Evolution of Seed Plants

(Vascular)

- Reproductive Adaptations
- Gymnosperms
- Angiosperms

AP Biology

Mrs. King

# Eukaryotic Kingdoms

**CHROMISTA**
- Kelps, diatoms, haptophytes

**FUNGI**
- Fungi

**METAZOA**
- Animals

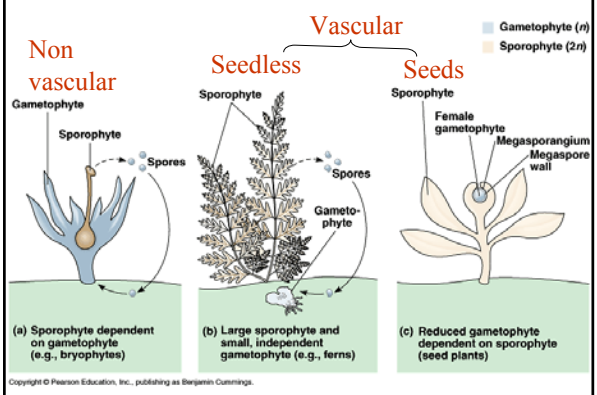
**PLANTAE**
- Plants

**PROTISTA**
- Protists

# Land Plants

- Plants began life in the seas and moved to land as competition for resources increased.
- The biggest problems a plant on land faces
  - supporting the plant body
  - absorbing and conserving water

Three variations on gametophyte/sporophyte relationships

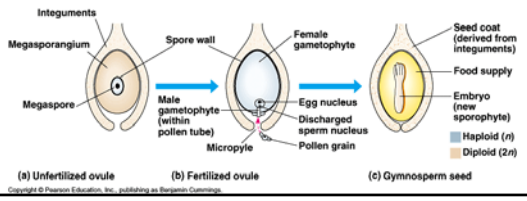





# Seed Plants

Heterospores

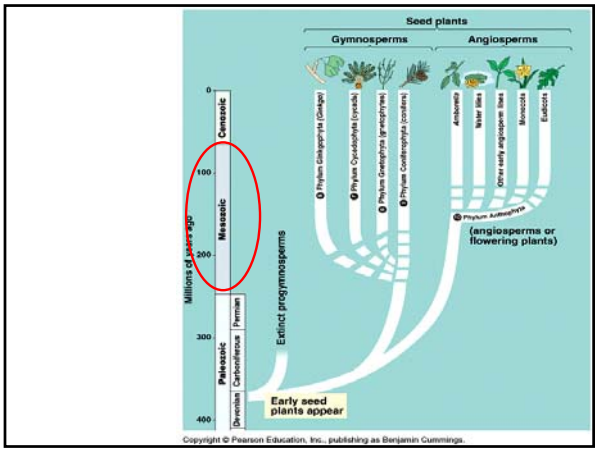
- Produce 2 types of sporangia
  - 2 types of spores
    - **Megasporangia** → megaspores →female gametophytes
    - **Microsporangia** → microspores → male gametophytes






# Reproductive Adaptations of Seed Plants

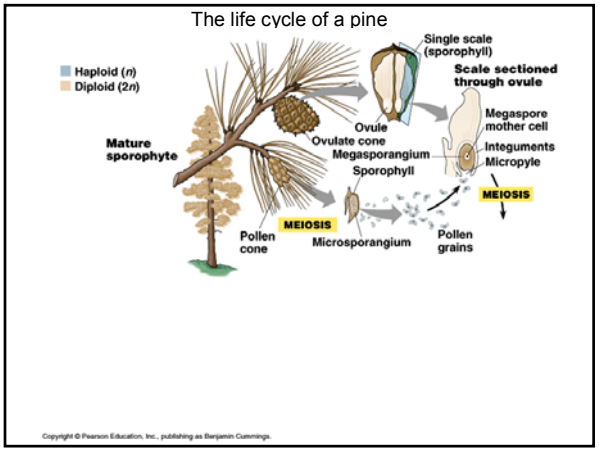
- Reduced gametophyte
  - retained within the sporophyte
- Origin of the seed
  - protected embryo and key dispersal structure
- Pollen
  - no longer a need for external water for fertilization



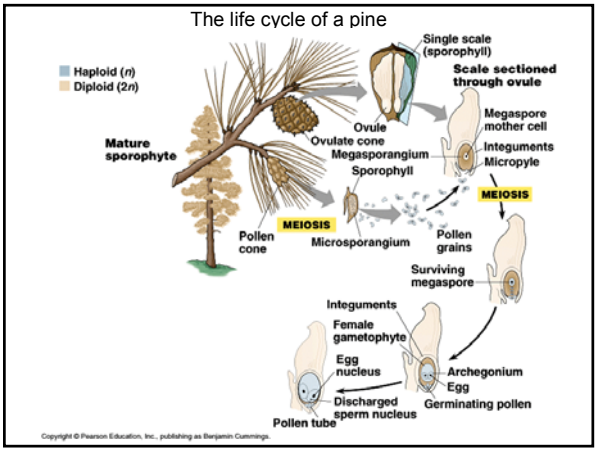

# Gymnosperms

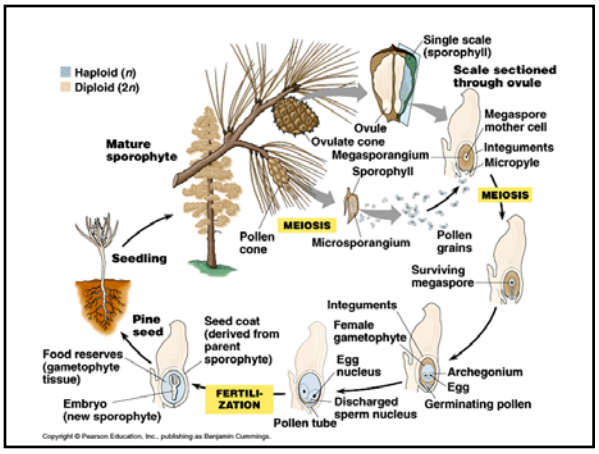
- Evolved during Mesozoic era
  - "naked seed"
- Conifers are largest division
- Characterized by
  - Thick cuticle
  - Recessed stomata
  - Long, thin leaves (needles)

The life cycle of a pine




The life cycle of a pine




# Role of "Cones"

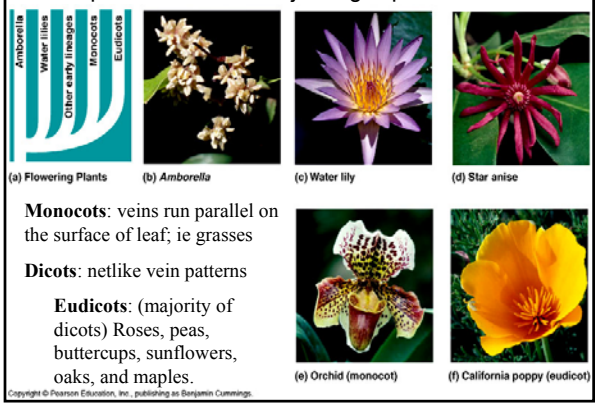
Two types:

- Pollinate cone - male
  - pollen producing
  - contains microgametophyte
  - seasonal
- Ovulate cone - female
  - contains megagametophyte

# Angiosperms

- Flowering plants
- Monocots and dicots
- Many dependent upon insects for pollen dispersal
- Flower-key reproductive adaptation, many variations
- Importance of fruit

## Representatives of major angiosperm clades

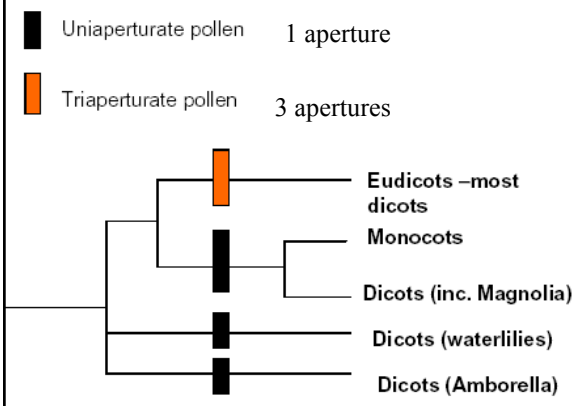



**Monocots**: veins run parallel on the surface of leaf; ie grasses

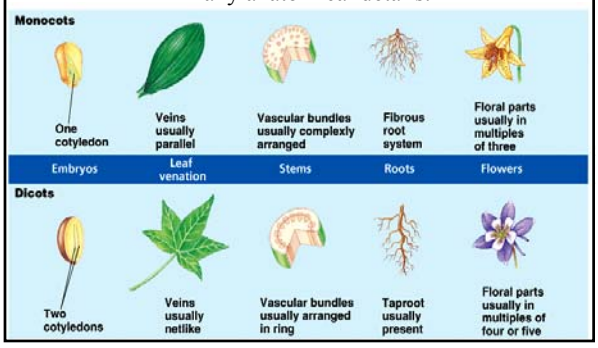
**Dicots**: netlike vein patterns

**Eudicots**: (majority of dicots) Roses, peas, buttercups, sunflowers, oaks, and maples.





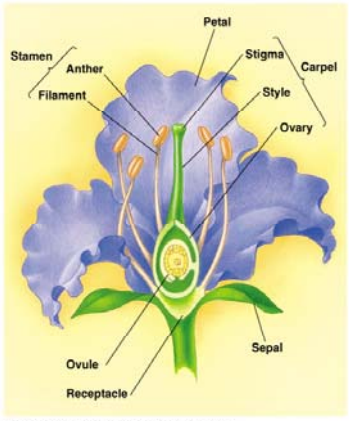

Although all angiosperms have a number of features in common, the monocots and dicots differ in many anatomical details.



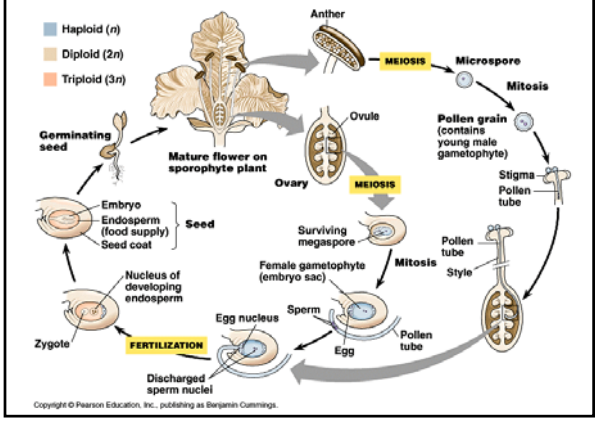

| MONOCOTS | DICOTS |
|---|---|
| • Embryo with single cotyledon | • Embryo with two cotyledons |
| • Pollen with single furrow or pore | • Pollen with three furrows or pores |
| • Flower parts in multiples of three | • Flower parts in multiples of four or five |
| • Major leaf veins parallel | • Major leaf veins reticulated |
| • Stem vacular bundles scattered | • Stem vascular bundles in a ring |
| • Roots are adventitious | • Roots develop from radicle |
| • Secondary growth absent | • Secondary growth often present |

# Flower

- Evolved from modified leaves
- Four evolutionary trends
  - Number of parts have become reduced
  - Parts fused
  - Radial→bilateral symmetry
  - Position of ovary changed









(1) The anthers of the flower produce (2) microspores that form (3) male gametophytes (pollen).

(4) Ovules produce megaspores that form (5) female gametophytes (embryo sacs).

(6) After its release from the anther, pollen is carried to the sticky stigma of a carpal.

- Although some flowers self-pollinate, most have mechanisms that ensure **cross-pollination**, transferring pollen from flowers of one plant to flowers of another plant of the same species.
- The pollen grain germinates (begins growing) from the stigma toward the ovary.

- When the pollen tube reaches the micropyle, a pore in the integuments of the ovule, it discharges two sperm cells into the female gametophyte.

(7) In a process known as **double fertilization**, one sperm unites with the egg to form a diploid zygote and the other fuses with two nuclei in the large center cell of the female gametophyte.

(8) The zygote develops into a sporophyte embryo packaged with food and surrounded by a seed coat.

- The embryo has a rudimentary root and one or two seed leaves, the **cotyledons**.
  - Monocots have one seed leaf and dicots have two.

- Monocots store most of the food for the developing embryo in **endosperm** which develops as a triploid tissue in the center of the embryo sac.
  - Beans and many dicots transfer most of the nutrients from the endosperm to the developing cotyledons.
- One hypothesis for the function of double fertilization is that it synchronizes the development of food storage in the seed with development of the embryo.
  - Double fertilization may prevent flowers from squandering nutrients on infertile ovules.

Flower-pollinator relationships: Scottish broom flower and honeybee (left), hummingbird (top right), baobab tree and bat (bottom right)

## Pollen Grains

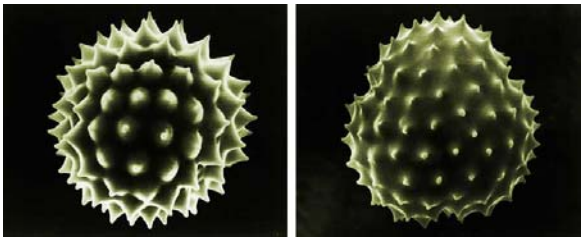
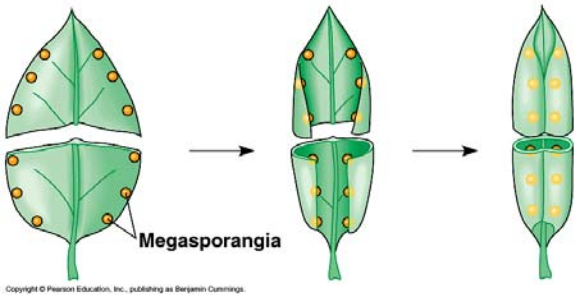
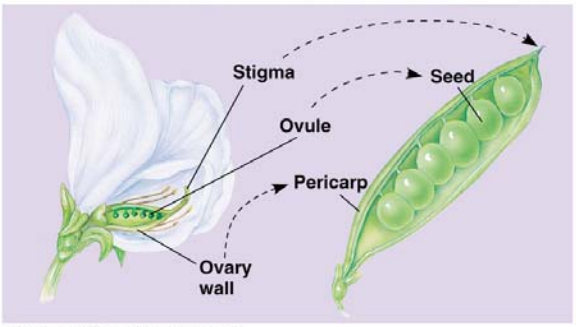


Figure 30.14 Hypothesis for the origin of the carpel from a reproductive leaf (sporophyll)






Relationship between a pea flower and a fruit (pea pod)






## Seed and Fruit

The seed contains:
- Embryo
- Cotyledon(s)
- Seed coat

Function:
- Dispersal
- Protection
- Dormancy?

Functions of the fruit:
- Protection?
- Dispersal?