Plants (Gymnosperms and Angiosperms) Part II

Chapter 27

Gymnosperms

- **Naked seed plants (*Gymnos* = naked, *sperma* = seed)**

Major reproductive adaptations:

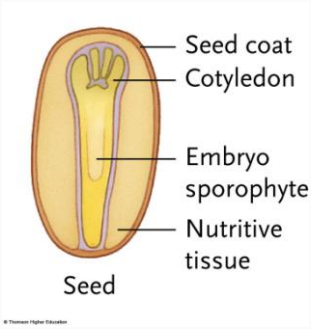
- Pollen grains produce nonmotile sperm
  - Pollination: Transfer of pollen to female reproductive parts; **no water is required!**
- Ovule
  - Sporophyte structure produces female gametophyte with egg
  - Connected to sporophyte by protective tissue

Progymnosperm *Archaeopteris*

Seeds

- Seed structure forms when ovule matures after sperm fertilization through pollination
  - Seed consists of:
    - Embryo sporophyte
    - Surrounding, nutritive tissues
    - Protective seed coat
- Seeds are major adaptations for uncertain environments
  - Long distance transport
  - Potential dormancy

Seed



Modern Gymnosperms

- Modern gymnosperms are all woody species

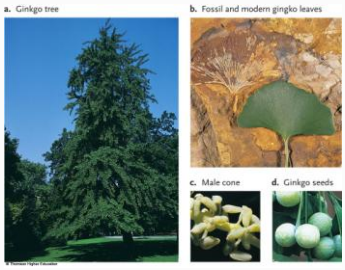
1. Cycads (Cycadophyta)
2. Ginkgoes (Ginkgophyta)
3. Gnetophytes (Gnetophyta)
4. Conifers (Coniferophyta)

Phylum Cycadophyta

- Cycads
  - Flourished during Mesozoic, now only in tropics and subtropics
  - Some have large, cone-shaped strobili

Phylum Ginkgophyta

- Ginkgoes: One living species, *Gingko biloba*



Phylum Gnetophyta

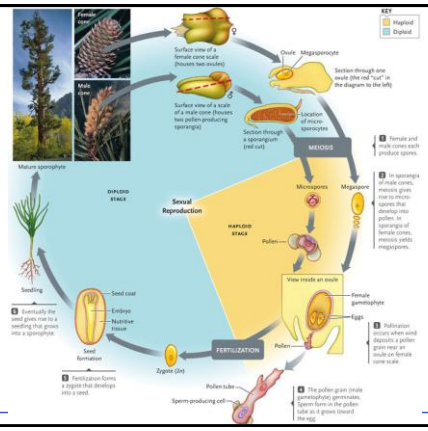
- Gnetophytes
  - Three genera (*Gnetum, Ephedra, Welwitschia*)
  - *Gnetum* and *Ephedra* both have **two-step fertilization** like angiosperms

Phylum Coniferophyta

- Conifers (cone bearers)
  - Pines, spruces, firs, hemlocks, junipers, cypresses, and redwoods
  - Woody reproductive cones
- Most are ***evergreen*** (shed some but not all leaves each year)
  - Adapted for aridity
  - Needle leaves
  - **Heterosporous** (male and female cones)
  - Many produce resin

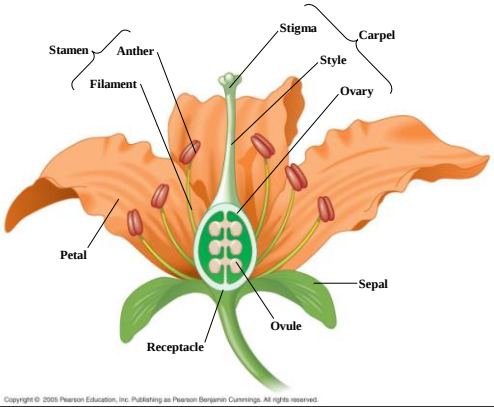
Conifer Life Cycle

- Haploid microspores develop in sporangia on male cones (strobili) from spore mother cells (**through meiosis**)
  - Microspores then **undergo mitosis** to become winged ***pollen grain (a male gametophyte)***
  - Males cones are typically small and delicate
- Haploid megaspores develop from spore mother cells in ovule
  - Only one of four megaspores survives
  - Develops into mature female gametophyte after pollination
- Pollen tube grows after pollination, stimulates egg production and delivers sperm



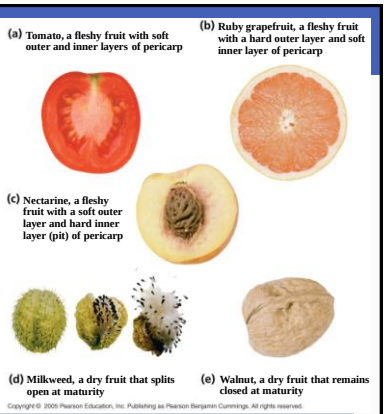
Angiosperms (Anthophyta)

- Assigned to the **Phylum Anthophyta**
- Flowering plants with "enclosed seeds"
  - Flowers contain carpels at their center
  - Carpels (specialized leaves) protects ovules (and seeds after fertilization)
  - Fruit structure surrounds and aids in the dispersal of seeds
- No current firm evidence for evolutionary origins



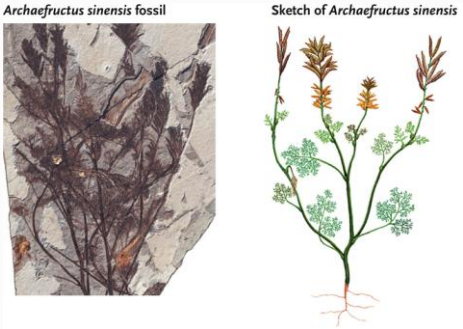
Fruits

- **A fruit typically consists of a mature ovary but can also include other flower parts**
- **Fruits protect seeds and aid in their dispersal**
- **Mature fruits can be either fleshy or dry**



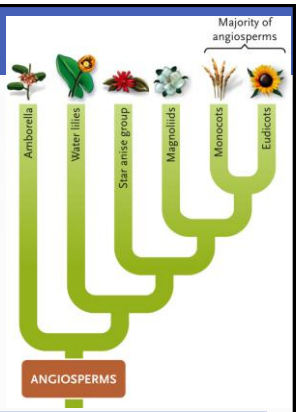
Flowering Plants

Fossil *Archaefructus sinensis*

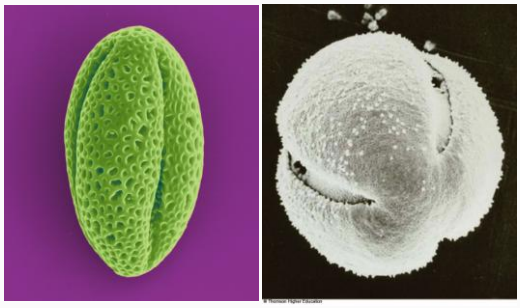


Phylum Anthophyta Phylogenetic Tree

- Monocots (single cotyledon)
- Eudicots (2 cotyledons, 3 grooved pollen grains)
- Magnoliids
- Basal angiosperms
  - Star anise
  - Water lilies
  - *Amborella*



Eudicot Pollen (examples)



Basal Angiosperm Clades

A. Southern magnolia *(Magnolia grandiflora)*, a magnoliid

B. Star anise *(Illicium floridanum)*

Basal Angiosperm Clades

C. Yellow pond lily *(Nuphar polysepala)*, a water lily

D. *Amborella*

Monocots

A. Representative monocots

Wheat *(Triticum)*

Tulips *(Tulipa)*

Eastern prairie fringed orchid *(Platanthera leucophaea)*

Eudicots

B. Representative eudicots

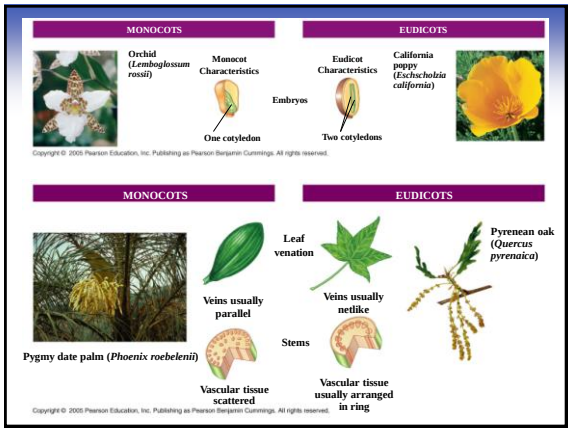
Rose *(Rosa)*

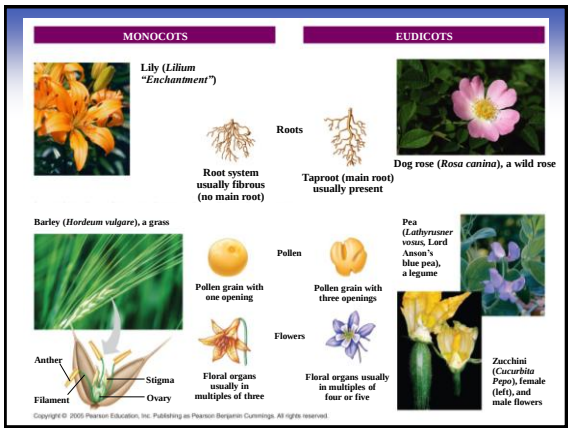
Yellow bush lupine *(Lupinus arboreus)*

Eudicots

Cherry *(Prunus)*

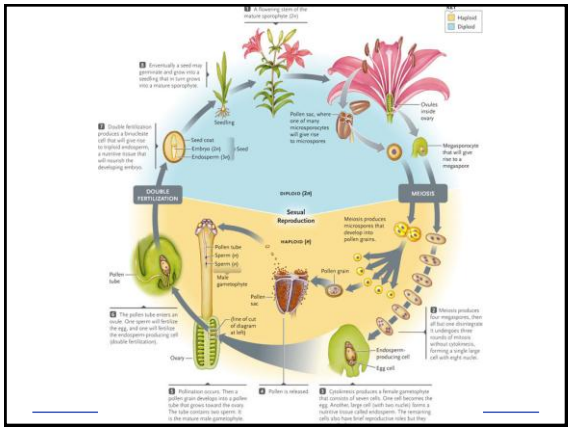
Claret cup cactus *(Echinocereus triglochidratus)*





Angiosperm Adaptations

- **Efficient transport**
  - Vessel elements (more efficient than tracheids)
  - More efficient phloem
- **Double fertilization**
  - Produces embryo and endosperm
- **Ovary** protects **ovule**
  - Ovary develops from carpel and **turns into fruit**



Coevolution with Animal Pollinators

- Many angiosperms have specific pollinators instead of just air currents
- Pollinators undergo coevolution with angiosperms
  - Heritable change in one affects other
- Highly specific flowers for pollinators
  - Bats, bees, beetles, moths, birds etc.

Coevolution with Animal Pollinators