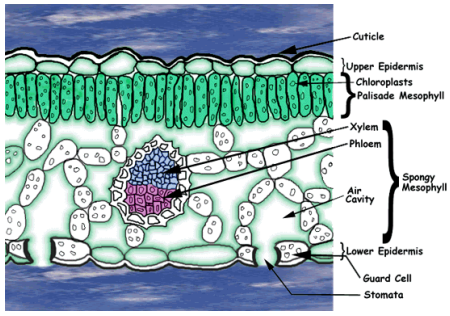
Kingdom Plantae

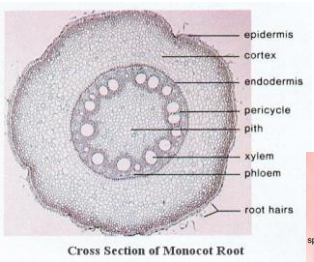
The Kingdom of Plants

- Defined as a group of organisms that share a common green-alga ancestor (similar to modern *Chara)*
- mostly photosynthetic (photoautotroph)
- multicellular; cell wall with cellulose
- Protection of embryos
- Adaptations to land life: desiccation
  - cuticle = waxy layer on leave surfaces; reduces water loss but restricts gas (CO_2) uptake
  - stromata: mouth-shaped openings, mostly on underside of leaves, helps in gas exchange

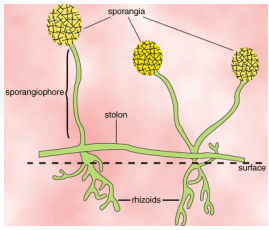


Adaptations to Life on Land

- Plants evolved in the water; plants that have colonized the land show different degrees of adaptation to life on land, such as:
- vascular tissue: tissue that transports water throughout a plant (through roots and stem)
- pollen: a reduced male gametophyte that can be transported from plant to plant without water, rather than having sperm that must swim to an egg in water
- seeds: developing zygotes inside of structures to nourish and protect them
- The presence fruit surrounding the seed

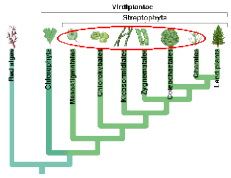


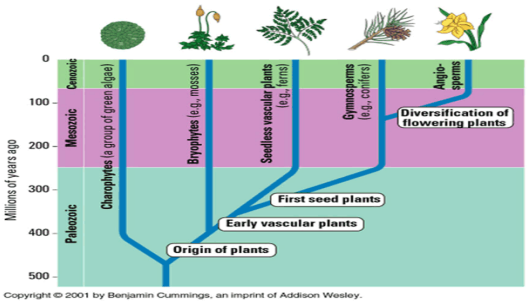
Cross Section of Monocot Root

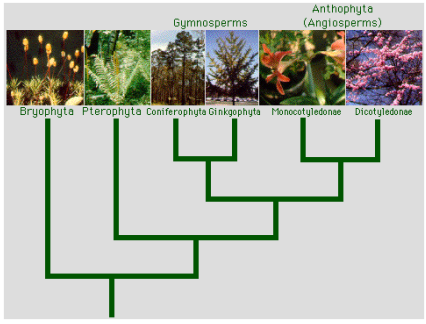


Origin and Groups of Plants

- 4 major groups of plants:
  - nonvascular plants: mosses and liverworts; have no water-conducting xylem and food-conducting phloem yet
  - seedless vascular plants: ferns and horsetails
  - Gymnosperms: seeds that protect embryo; flowerless
  - Angiosperms: flowering plants; seeds protect embryo
- Only Gymnosperms and Angiosperms are monophyletic





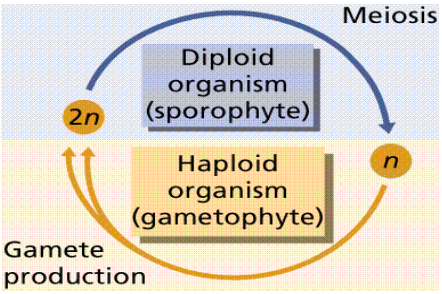


Some terminology

- sex cells or gametes are **haploid**, meaning that they contain only half the number of chromosomes.
- When two sex cells are fused, they form a **zygote**. The zygote contains two copies of chromosomes (from each sex cell) and is therefore called a **diploid** cell.
- A haploid cell is noted by the letter (n) and a diploid cell is noted by (2n). When we refer to an organisms **ploidy** we are referring to its number of chromosomes (diploid (2n) or haplod(n))

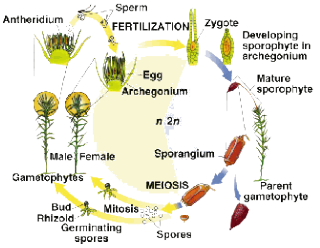
Some Terminology:

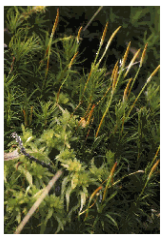
- **Spore:** a reproductive structure, usually single celled that is capable of growing into a new individual.
- **Sporophyte:** a diploid organism that produces haploid spores in an alternation of generation lifecycle
- **Gametophyte:** a haploid organism that produces haploid sex cells.



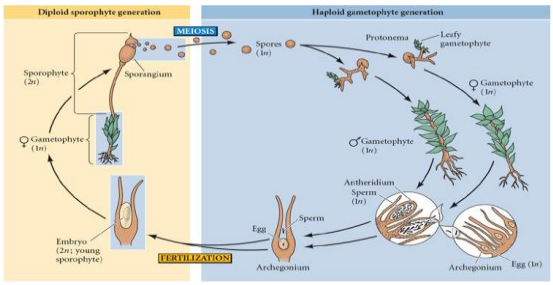
Mosses (Bryophyta)

- Small, photosynthetic plants with leaf-like structures
- "Leaves" are only 1 cell layer thick and lack vascular system
- Anchored by rhizoids; water uptake, less efficient than true roots
- Gametophytes produce ♂ antheridia and ♀ archegonia
- Sperms swim with flagella to egg cell in archegonium; need water





Moss: Bryophyte Lifecycle

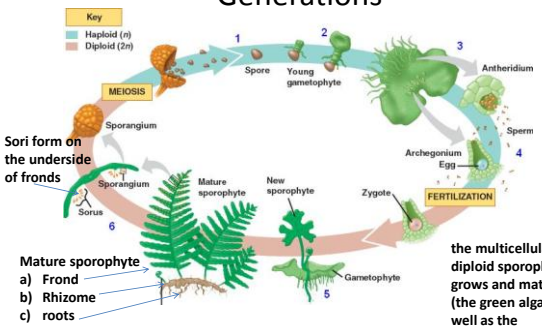


Archegonium: specialized structure on the gametophyte that produces eggs
Antheridium: specialized structure on a gametophyte that produces sperm
Sporangium: Structure in which spores are produced

Ferns & Horsetails (Pterophyta)

- Three major groups of seedless vascular plants:
  - Whisk ferns: tropical and subtropical; no leaves or roots; gametophyte colorless, lives parasitic with fungi
  - Horsetails: in moist forests, on lake and pond shores, swamps photosynthetic stems and colorless sporophyte stems
  - Ferns: most abundant seedless vascular plants; worldwide distribution, but 75% of species in the tropics; small to tree-size

Fern Lifecycle: Alternation of Generations



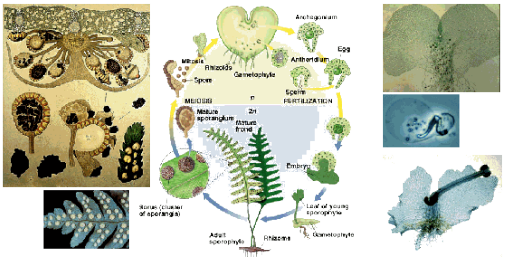
Sori form on the underside of fronds

Mature sporophyte
a) Frond
b) Rhizome
c) roots

the multicellular diploid sporophyte grows and matures (the green algae) as well as the multicellular haploid gametophytes.

Fern Life Cycle

- Sporophytes tall, produce sporangia in sori on underside of leaves
- Gametophyte small (nickel-size), photosynthetic; produces ♂ antheridia and ♀ archegonia in different regions of thallus
- Sperm swims with flagella to egg cell in archegonium; needs water



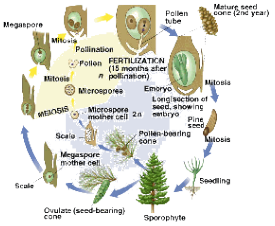
Seed Plants

- Gymnosperms and Angiosperms
- Produce two gametophytes: male and female
- Gametophytes consist of only few cells
- Seeds: Embryo is protected by layer of sporophyte tissue = ovule
- Sporophyte tissue hardens: protect seeds from water loss, heat, grazing
- Seeds provide means for distribution and resting stage to overcome unfavorable conditions (drought, freezing during winter, etc.)
- Pollen = male gametophytes; whole gametophyte moves towards female gametophyte for pollination/fertilization

Angiosperm Lifecycle

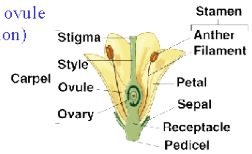
Gymnosperms - Conifers

- Ovule is not completely surrounded by sporophyte tissue
- Conifers - most familiar gymnosperms (pines, redwoods, cedar)
- Tree = sporophyte; ♀ cone upper branches, ♂ cones lower branches
- 2 ♀ ovules at each base of ♀ cone leave (becomes woody); take two or more years to mature
- Pollen tube grows out of pollen (♂ gametophyte), digests ovule tissue, reaches archegonium after 15 months, and releases 2 sperms

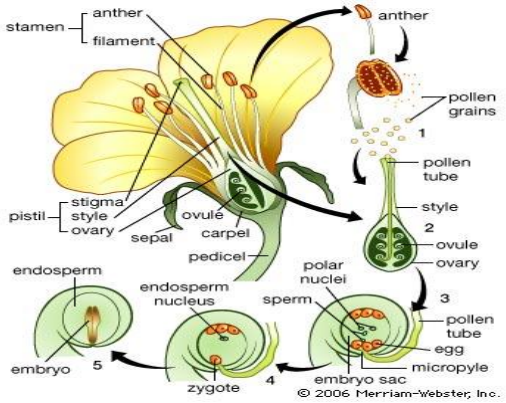


Angiosperms - The Flower

- Modified stems carrying modified leaves
- Pedicel: end widened to receptacle, carries flower
- Whorls: circles of inner flower parts; multiple of 3 or 5
- Sepals: outer ring, mostly green
- Petals: colored, 3-5, may be missing
- Stamens: ♂ anther on filament
- Carpel (one or more): contains ♀ ovule and ovary; top = stigma (pollination)



Angiosperm Lifecycle



Angiosperms - Two Groups

- Eudicots: two cotyledons ("seed leaves"); leaves with network of veins; flower parts in multiple of 4 or 5; most flowering plants
- Monocots: one cotyledon; leaves with parallel veins; flower parts in 3 or multiple of 3; grasses, lilies & tulips, palms, orchids; considered evolutionary younger