**The Angiosperms**

I. Division Anthophyta (flowering seed plants)
  A. Characteristics
    1. Contains six times the number of species of all other plant groups combined: approximately 285,000 species; Earth's dominant plants
    2. Size varies from the small duckweed found on pond surfaces to shrubs, vines, herbs and tree-size
    3. Habitat greatly varies from deserts, mountains, polar regions, marsh and estuaries, to lakes and streams
    4. Majority are autotrophic with exceptions: Indian pipe plant that has little or no chlorophyll and is partially or wholly parasitic to the carnivorous but photosynthetic Venus flytrap (pitcher plants, sundews, flytraps)
    5. Life cycle varies from a month to 20 to 30 years to reach sexual maturity; some live for only a single growing season (annuals); other are perennials
    6. Crucial to the existence and economy of humans: food, clothing, lumber, fuel, beverages, drugs, and medicines (digitalis and codeine)
      a. cereal crops such as rice, wheat, corn, and barley
      b. valuable lumber such as oak, cherry, and walnut
      c. fibers like cotton and linen
      d. other products such as rubber, tobacco, coffee, chocolate and aromatic oils for perfumes
    7. Most distinctive feature of its member are the <u>flowers</u> (sexual reproductive organ)
  B. Evolution
    1. Not linked clearly to any other group
    2. Sprung up only once and suddenly and radiated rapidly into a variety of different forms
      a. Structural and molecular data possibly indicates the gnetophytes of the gymnosperms as the closest living relatives
    3. Found abundant in the fossil record of the Cretaceous period (70 million years ago) when the earth was drying and cooling, dinosaurs and most cycads were extinct, and mammals and angiosperms were beginning domination
    4. Great evolutionary success:
      a. more efficient vascular tissue and extensive root system
      b. leaves with large surface area for photosynthesis
      c. seedlings can survive with less light than gymnosperms
      d. speed in growth and reproduction
        1) presence of closed carpels (results in fruit surrounding seeds), double fertilization, and faster seed production increases reproductive success
      e. relationships with various animals for pollination and seed dispersal due to flower attraction
        1) helps to ensure cross-fertilization
      f. dominant sporophyte (GAMETIC): overall adaptability to new habitats and changing environments
  C. Angiosperms Distinguished from Gymnosperms
    1. Abundance and prominence of xylem vessel elements and phloem sieve tube members; most gymnosperms have only tracheids (smaller and acutely slanted at their cell wall endings) comprising their xylem; less efficient and specialized sieve cells comprise gymnosperm phloem.
    2. Formation of flowers and fruits; most species are monoecious (male and female parts on same flower) with some dioecious species
    3. Presence of sepals, petals, or both in angiosperms
    4. Formation of a pistil through which the pollen tube grows to reach the ovule and egg; in gymnosperms, the pollen lands on the ovule surface and the pollen tube must grow in directly; ovules develop into seeds while the ovary wall develops into the fruit in angiosperms
    5. Endosperm is triploid rather than haploid as in gymnosperms; triploid is formed as a result of <u>double fertilization</u> instead of prior to fertilization as in gymnosperms.
  D. Angiosperm classes:
    l. <u>Dicotyledons</u>: most vegetables, fruit and nut crops and angiospermous lumber trees (deciduous)
      a. Families include buttercup (<u>Ranunculus</u>), mustard, rose, maple,cactus, carnation, mint, pea and parsley.
        l) Rose family includes apple, pear, plum, cherry, apricot, peach, almond and strawberry

2. Monocotyledons: includes major agricultural crops as wheat, corn, and rice
    a. Families include the grasses, palms, Joshua tree, lilies, orchids and irises
3. Contrasting the two groups:
    a. Monocot's embryo has only one seed leaf or cotyledon functioning mainly as a digestive and absorptive organ rather than storage; dicots have two seed leaves functioning to store large deposits of starch to nourish the embryo until it is capable of photosynthesis.
    b. Endosperm is typically present in the monocot's mature seed and often absent from the dicot's mature seed (cotyledon's absorb and function in that respect)
    c. Monocot's leaves have parallel veins with smooth edges and plentiful stomata in both upper and lower layers of the leaf epidermis; dicot's leaves have branching veins with fan-like and net-like patterns, serrated edges, and most with stomata only in the lower epidermis; monocot's stem may also have stomata.
    d. Monocots usually lack cambium (lateral meristem) allowing for little or no secondary growth (diameter or girth); having primary growth only (length) due to apical meristem; only tree-like examples are palms and the Joshua Trees that have a special thickening meristem; dicot's have cambium present allowing for secondary growth besides primary growth capability
    e. Monocots are generally herbaceous: soft and nonwoody with only a few families (palms and bamboo) having woody parts; dicots are generally woody (due to lateral meristem)
    f. Monocot’s flower parts (petals, sepals, stamens, pistils) exist in threes or multiples of threes while dicots exist in fours or fives or their multiples
    g. Monocot's vascular bundles (xylem and phloem) are scattered throughout the stem with no clear distinction between the pith and cortex; dicot's bundle present as a discrete vascular ring separating cortex from the inner pith.
    h. Monocot's roots are typically fibrous and multiple with many star-shaped xylem and an area of pith in the root's center; dicot's roots consist usually of one or more primary tap roots and secondary roots containing a single star-shaped area of xylem surrounded by a distinct outer cortex.