Notes

Biology 103
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Topic: Plant Reproduction and Development **Reading:** Chapter 43

Note: If you have not take Biology 102, you should consult Chapter 11 to understand the processes of **mitosis** (normal cell division) and **meiosis** (reduction division). You should also understand the terms **haploid** and **diploid**. You can find notes to this chapter on the Biology 102 page of my website.

Main concepts:

- Plants reproduce both sexually (through union of pollen and ovule) and asexually (self-cloning by runners, offshoots, etc.).
- Sexual reproduction involves the alternation of generations: a life cycle with diploid and haploid phases (diploid = having two sets of chromosomes in each cell, one set from each parent; haploid = having only a single set of chromosomes in each cell).
  - Plants of any one species have two distinct forms: the haploid form (gametophyte) and diploid form (sporophyte).
  - Diploid sporophytes produce haploid spores through meiosis (reduction division).
  - Haploid gametophytes grow from the haploid spores. Gametophytes produce haploid gametes through mitosis.
- The two phases of the alternation of generations are most clear in ferns, where the gametophyte and sporophyte phases are independent organisms. In algaes (which are classified with the protists), the gametophyte phase is most prominent and the sporophyte is very reduced. In coniferous trees and the flowering plants, the sporophyte is most prominent, while the gametophyte is reduced to a few cells.
- Comparison of plant and animal reproduction:

	Plant reproduction	Animal reproduction
Life cycle	Alternation of generations in all plants	No alternation of generations
Gametes	Haploid gametes	Haploid gametes
Spores	Haploid spores	No spores
Gametes made by	Haploid gametophyte, by mitosis	Diploid organism, by meiosis
Spores made by	Diploid sporophyte, by meiosis	No spores

- In moss, ferns, and other non-flowering plants, male gametophytes make free-swimming sperm which swim through moisture (raindrops, dew) on the plant's surface to find the female gametophyte. This limits the size in plants if male and female plants are separate, and limits mixing of genes to close neighbors.
- In conifers and flowering plants, the male gametophhyte is inside the pollen grain, while the female gametophyte is inside of the embryo sac which is located in the cone or flower. This allows the male gamete to be carried long distances, allowing crossing of plants over wider areas.
- Flowering plants have evolved a wide range of flowers, some highly specialized, to assist reproduction. Wind-pollinated flowers are simple, and produce abundant dry pollen. Flowers pollinated by animals (insects, birds, others) have developed showy petals to attract pollinators, may offer rewards such as nectar, and often have sticky pollen.
- Flowers consist of four sets of parts: sepals, petals, stamens, and carpels. Flowers that have all of these parts are called complete. Those that do not have all four parts are incomplete. Flowers that have both male and female parts are called perfect, while those that are only male or only female are imperfect (and incomplete).
- When a pollen grain lands on the stigma of a female carpel, it grows a pollen tube. The sperm cells swum down the pollen tube to fertilize the ovule inside of the ovary.

- Seeds develop from fertilized ovules. The ovary swells to become a fruit. True fruits are swollen ovary walls. Some things we call “fruits” may derive from other parts of the flower. (For example, a strawberry is actually an enlarged pedicel, the part that holds up the flower. The individual “seeds” on the strawberry are the actual fruits.) A single fruit may have one seed (as in a peach) or multiple seeds (as in a pea pod).
- Fruits may have features that help aid seed dispersal such as tasty flesh, spines, parachute-like features, flotation devices, ore explosive fruits.
- A seed contains and embryonic plant and food (endosperm) to nourish the plant until it can photosynthesize. Endosperm may be starchy or oily. In dicots, both cotyledons contain endosperm. In monocots, the endosperm and the cotyledon are separate.

Common misconceptions:

- Kitchen definitions of “fruit” and “vegetable” are different from scientific definitions. In the kitchen, sweet things that can be made into desserts are termed “fruits,” while “vegetables” are plant parts that we eat that are not sweet.” In science, a “fruit” is a mature plant ovary containing seeds, while “vegetable” has no real meaning in science except to refer to plants in general (such as the old-fashioned term “the vegetable kingdom”). According to the scientific definition of “fruit,” all of the following are fruits: pea pods, green beans, cucumbers, pumpkins, zucchini, sunflower seeds, nuts, tomatoes, chili peppers. Rhubarb, however, is not a fruit.
- Many people have a very limited idea of what flowering plants are. “Flower” refers to the reproductive parts of flowering plants containing anthers, carpels, or both, and aren’t always showy and pretty. All of the following are flowering plants: grass, most broadleaf trees (except ginkgoes), rushes, sedges.
- Some students confuse pollination with fruit dispersal. Both may involve animals, but one is the process of moving pollen from one flower to another, while the other is scattering of mature fruits away from the parent plant.

Reading notes:

- Define: meiosis, mitosis, haploid, diploid, gametophyte, sporophyte.
- Sketch the alternation of generations in ferns. Label: sporophyte, gametophye, spore, gamete, fertilization, mitosis, meiosis.
- Describe why wind pollination is not efficient, and why insect pollination is more efficient.
- Sketch the parts of a complete flower and label all parts: sepal, petal, stamen, carpel, anther, filament, stigma, style, ovary.
- Name the parts of the pollen grain and the embryo sac.
- Describe the process of double fertilization in flowers. State what parts of the seed are produced by fertilization of the egg cell and the polar nuclei.
- State which parts of the flower grow into fruit and seeds.
- Describe the structure and location of endosperm and cotyledons in monocot and dicot seeds.
- Define seed dormancy, and describe why it is important in plant reproduction.
- Describe the process of seed germination.
- List some ways that flowers attract pollinators, and fruits are dispersed.

Useful websites:

- “Life Cycle of a Moss” http://www.sumanasinc.com/webcontent/anisamples/majorsbiology/moss.html includes an animation of the alternation of generations in moss plants.
- “Plant Life Cycles” http://intro.bio.umb.edu/111-112/112s99Lect/life-cycles.html includes simplified animations of moss, fern and angiosperm (flowering plant) life cycles.