Web Activity: Comparing the Life Cycles of Plants

Figure 1 shows the major divisions of the kingdom Plantae. In this activity, you will compare the life cycles of these different classes of plants.

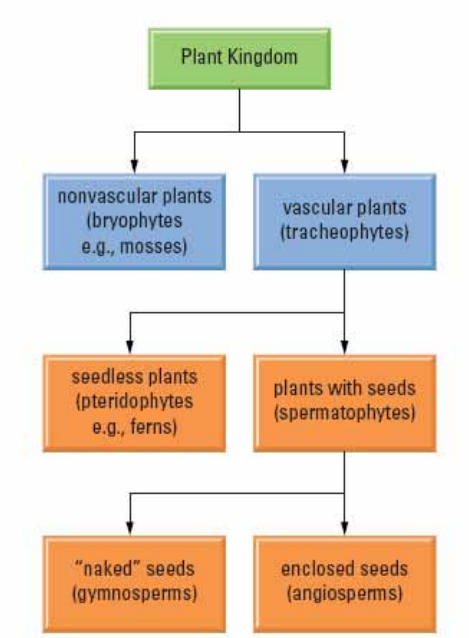

Figure 1
The major divisions of Kingdom Plantae

Alternation of Generations

The life cycle of a multi-cellular organism involves two types of cell division, mitosis and meiosis. During the life cycle of animals, diploid cells divide by mitosis produce more diploid cells. These are the somatic cells that make up the body of the organism. During meiosis, on the other hand, a specialized diploid parent cell gives rise to four haploid cells. These haploid cells are gametes (egg or sperm cells) that normally do not undergo further cell division. Each subsequent generation of animals will also be composed of diploid multicellular organisms.

In contrast, a single, complete life cycle of plants involves two generations of multicellular organisms, a haploid generation and a diploid generation. The haploid organism is composed of haploid cells, and the diploid organism is composed of diploid cells. The life cycle of a plant is therefore said to involve alternation of generations. As in an animal's life cycle, diploid plant cells may undergo mitosis to produce additional diploid somatic cells, and specialized diploid cells may divide by meiosis to produce haploid reproductive cells. However, unlike during an animal's life cycle, some haploid plant cells undergo mitosis and give rise to other haploid cells.

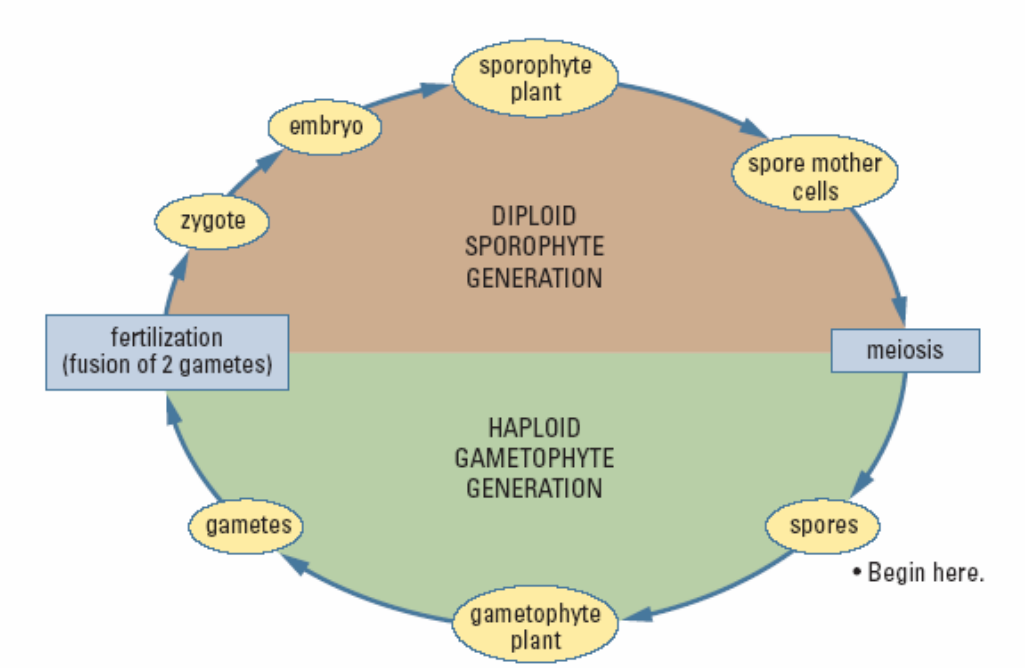

Figure 2
Generalized life cycle with alternation of generations: In reality, the two generations are not usually the same size nor do they last the same length of time. Since it is a cycle, there is no specific beginning or end. The labels here will apply to all other plant life cycles in this activity.

Plant life cycles may seem complex, but they are all essentially the same. As you read about the life cycle of plants, follow the names and the direction of the arrows in **Figure 2**. Pay particular attention to whether the part is haploid or diploid. Since each stage leads to the next, there is no real start or end in a life cycle. For the purpose of this discussion, we will start with the spores.

A spore is a haploid (1*n*) reproductive cell, and is the first cell of the gametophyte generation. This is the stage in a plant's life cycle in which all cells have haploid nuclei. The spore divides by mitosis, eventually producing all the haploid cells that make up the body of the gametophyte plant. Specialized parts of the gametophyte plant divide and produce haploid gametes (egg and sperm cells), also by mitosis.

An egg cell and a sperm cell fuse and form a diploid (2*n*) zygote during fertilization. The zygote is the first cell of the sporophyte generation. This is the stage in a plant's life cycle in which cells have diploid nuclei. The zygote grows by mitosis to form the embryo and eventually the mature diploid sporophyte. Eventually, the mature sporophyte will produce spore mother cells by mitosis. These cells therefore are also diploid. The spore mother cells undergo meiosis to produce haploid spores. The spore mother cells are the last cells of the sporophyte generation.

During the life cycle of plants, fertilization and meiosis change the chromosome number between 1*n* and 2*n*, and enable the switch from the gametophyte generation to the sporophyte generation. When the union of the male and female gametes takes place during fertilization, more is happening than simply restoring the diploid chromosome number. Sexual reproduction is also taking place. The genetic material from both parents is combined in the zygote, giving rise to offspring with different

genotypes than the parent plants. This genetic diversity increases the ability of plants to adapt to changes in environmental conditions. Look closely at **Figure 2** again and identify where sexual reproduction occurs in the plant life cycle.

Life Cycle of Mosses

The full life cycles of mosses and other bryophytes involve an alternation of generations as shown in **Figure 3**. Follow **Figures 3** and **4** carefully as you read about the life cycle.

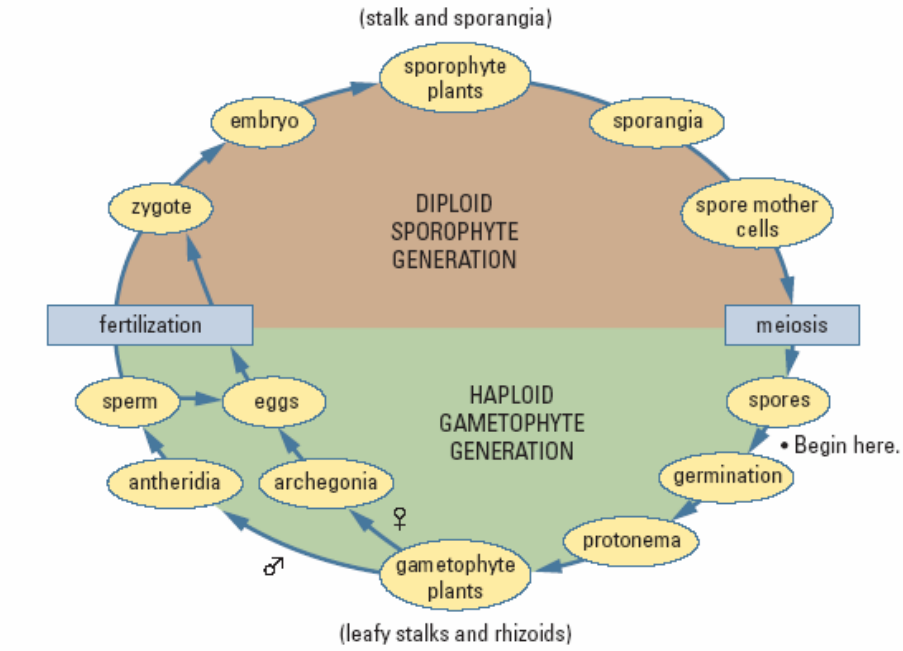

Figure 3
Alternation of generations of a moss. Starting with the spores at the right side of the diagram, follow the cycle clockwise and note the labels carefully as you read the detailed description.