Unit 8 Study Guide

Plants are multicellular, photosynthetic eukaryotes. Unlike animal cell, plants have chloroplasts and cell walls made of cellulose (a carbohydrate polymer). Plant cells still contain mitochondria for cellular respiration, and these mitochondria consume oxygen to burn sugars for ATP and NADH.

Basic plant structures are Roots, Stems, and Leaves. These structures are made of three basic tissue types: 1) dermal tissue; 2) vascular tissue (xylem and phloem); 3) ground tissue (parenchyma, schlerenchyma, collenchyma).

Xylem transports water and minerals upward from the roots to the stem and leaves. Phloem transports sugars from photosynthesis downward to the stem and roots.

Moving water into roots requires the active transport of minerals and ions from soil. This makes the inside of the root hypertonic to the soil, so water follows by osmosis (passive transport).

The Casperian Strip forces water to move through the cells instead of in between root cells. Therefore root cells can control the movement of water and prevent backflow.

Water moves up the xylem in a process known as Transpiration. Adhesion makes water molecules stick to the side of sieve tube cells, and cohesion makes water molecules stick to each other. By themselves adhesion and cohesion would not be strong enough to move water all the way up a stem against the force of gravity, but water also evaporates out of the leaves through the stomata (holes that guard cells can open and close). The evaporation of water out the stomata creates negative pressure that further sucks water up the xylem.

Gasses like carbon dioxide and oxygen can move through the stomata in addition to water. Generally, guard cells open a stoma during the day for photosynthesis so carbon dioxide can enter the leaf and the mesophyll. At night, guard cells close a stoma to prevent additional loss of water when photosynthesis does not occur. In hot, dry climates, some plants have evolved to open their stoma at night to store carbon dioxide for later use during the day. This prevents excessive loss of water during photosynthesis.

Mosses (bryophytes) lack vascular tissue and require water for fertilization to occur. The moss you are familiar with is the gametophyte stage of the lifecycle. It is haploid and produces sperm and ova by mitosis. Fertilization forms the diploid sporophyte, which produces spores by meiosis. The haploid spores grow into a free-living, multicellular gametophyte.

Ferns still require water for fertilization, but do have vascular tissue. Additionally, the fern lifecycle is dominated by the diploid sporophyte stage. The sporophyte makes spores

which grow into very small, multicellular gametophytes. The haploid gametophyte again produces sperm and ova by mitosis, which can fertilize to make a new sporophyte.

Gymnosperms were the first seed producing plants, but the seeds lack a surrounding fruit. The cones of a gymnosperm can be male or female, and produce pollen grains or ova. Because gymnosperms produce pollen they do not require water for fertilization.

Angiosperms are the flowering, seed producing plants. Angiosperm seeds are surrounded by a triploid (3n) fruit that is famously formed by double fertilization. Flowers are hermaphroditic structures that attract pollinators like insects, birds, and some mammals. Coevolution with pollinators has made the angiosperms the most successful and widespread of all the plant groups.

Angiosperm reproduction begins with the production of spores by the female (2n) megasporangium and male (2n) microsporangium. The spores are produced by meiosis and are haploid. Only one out of four megaspores survives to form the female (1n) multicellular gametophyte, in contrast to the four microspores produced by a single microsporocyte. When a pollen grain containing a microspore lands on the stigma of a flower, a pollen tube grows down to the female gametophyte. The microscope divides by mitosis into two sperm. One sperm fertilizes an ova and develops into the diploid seed embryo. The other sperm fertilizes two antipodal nuclei and forms the (3n) triploid endosperm tissue. The mature fertilized ovary, with its (2n) seed surrounded by the (3n) endosperm is called a fruit.