7th Life Science
Plant Processes
Chapter 13

13A – Functions of plants

Plants are supported by 2 related systems:

1. cell walls- cellulose
2. **turgor pressure** - water pressure inside a plant cells central vacuole; causes the stiffness of the plant cell.
   Turgor pressure supports most leaves and flower parts and many small plants.

Plants and Water

Plants contain larger amounts of water.
Most of the non-woody parts of plants are over 80% Water.
Plants require large amounts of water.

1 acre of rapidly growing corn - gives off 300,000 gal. of water
a single large oak tree - may release 300 gal. in 24 hrs.

Most plants get the water they need through their roots.

Three key events involved in transporting water

- entrance through the root
- transport through the exylem
- exit through the leaves

Parts of the Root

1. **Root cap**: the tip of the root is covered by the root cap. It is made up of dead, thick-walled cells which protect the delicate tissues of the root tip as it pushes through the soil
2. **Epidermis**: outermost tissue; one-cell-layer-thick covering tissue found on many areas of young or non-woody plant parts; it protects the root and -absorbs materials
3. **Root hairs**: it aids in absorbing water

Water-conducting System (located near the center of the root):

4. **Xylem**: has long, thick-walled cells which carry water and dissolved minerals upward (from roots up to stem and the leaves)
5. **Phloem**: has cell walls, slightly thinner then xylem; it carries water and dissolved foods downward

Xylem and phloem are usually arranged in fibrovascular bundles.
fibrovascular bundle - xylem and phloem surrounded by supporting tissues; found in non-woody plants

Transpiration pulls water up the plant.
Transpiration: the release of water from the leaves of plants by way of the stomata

The Covering of a Leaf

epidermis: the top and bottom layer
one cell layer in thickness
lacks chlorophyll
serves as protection
often secrets a waxy substance that forms a cuticle
usually transparent
lower epidermis: tiny openings called **stomata** (stoma, sing.)(or leaf pores) permit the exchange of gases between

atmosphere and spaces in leaf
main purpose - to allow air to move in and out of the leaves
may be very abundant (apple tree leaf - 47,000 stomata per square inch; oak tree – 100,000)
guard cells - two crescent-shaped cells around each stomata; open and close the stomata

The Inside of the Leaf

Between the upper and lower epidermis is the mesophyll.
It is in the mesophyll that most of the photosynthesis takes place.
It is structural tissue (called **parenchyma**)
Mesophyll is divided into two layers:

(1) **Palisade Mesophyll**
located toward the upper side of the leaf
consists of elongated, columnlike cells
there may be several layers of palisade mesophyll
abundance of chloroplasts which move in a circle

(2) **Spongy Mesophyll**
located toward the lower side of the leaf (sometimes sandwhiched in the middle)
consists of large, irregularly shaped cells separated by large air spaces
the air spaces form a system of passages throughout the leaf that permits air to come in contact with the individual cells

Veins (fibrovascular bundles)
run through the mesophyll
contain the vascular tissue (xylem and phloem)
the large veins of a leaf contain thick-walled strengthening **collenchyma** tissues around the vascular tissues

GAS EXCHANGE IN PLANTS

(1) The cycle of oxygen and carbon dioxide – takes place in green parts of plants
O_2 from photosynthesis
CO_2 from cellular respiration
(2) stomata – takes place in leaves
(3) lenticels – takes place in the woody parts of plants
lenticels: small openings in the woody parts of plants
(4) epidermis – takes place in underground parts
gases exchanged through the thin coverings; helped by burrowing of worms, insects, and other organisms (helps bring air; helps soil to drain)

Plants with roots always in H_2O and sometimes leaves - special networks of air tubes in fibrovascular bundles

What Plants Do With Glucose (the sugar they make)?

glucose - contains in a stored form the energy captured from the sun
Cells that carry on photosynthesis make more sugar than they need and they pass glucose along to other plant parts through the phloem.
Some glucose molecules are not used for energy but are hooked together to make cellulose.
Some glucose molecules are stored as starch (potatoes, wheat, bananas, corn) and some converts the glucose to lipids (corn oil, peanut oil, olive oil).

----------Quiz 13A

Growth

Plants respond to their environment by the way they grow or do not grow.

Growth in plants can result in an increase in length, or an increase in thickness, or both.

vascular cambium is a growth region located between a plant's xylem and phloem
cork cambium produces new cork cells that protect the outside of a plant's stem

The special areas where growth is occurring in plants are called **meristems**. These areas are easily spotted under a microscope because the recently divided or dividing plant cells are smaller and more dense and have either larger nuclei or visible chromosomes. Meristems are these regions where many cells are undergoing cell division.

Meristems are located near the tips of stems and roots and between a plant's xylem and phloem.
apical meristems: those meristems at the tips of stems and roots.
lateral meristems: a region of cell division located parallel to the sides of a plant (responsible for growth in thickness; vascular cambium and cork cambium)

Hormones are one way a plant's growth is controlled. Hormones are chemical substances which are made by plants and which affect how plant tissue growth by stimulating plant cells to divide, to enlarge, or to stop growing.

auxin: a plant growth hormone produced in the growing tips of plants.

Other variables that affect a plant's growth: water, minerals, genetics, competition, temperature, etc.

13B – The Environment and Plant Responses

tropism – the growth responses of plants to their environment
a plant's directional growth response to a physical stimulus
the growth of plants in response to external stimuli such as light, gravity, or contact
positive: when the plant grows *toward* the stimulus
negative: when the plant grows *away from* the stimulus

types of tropism:

1. **phototropism** – light
   plant's response to light
   positive phototropism - turns toward light (stem and leaves)
   negative phototropism - away from light (roots)
2. **graviropism** – gravity
   plant's response to gravity
   positive geotropism - grows toward the pull of gravity (roots)
   negative geotropism - grows away from the pull of gravity (stem and leaves)
3. **thigmotropism** - touch
4. **chemotropism** - chemicals
5. **hydrotropism** - water

Plants and Light

Characteristics of light that are significant for plant growth:

1. Intensity
   etiolated - the condition of a
   plant when grown in the absence of light
   elongated stems with small, pale leaves

2. Duration
   duration - the length of daylight
   affects the photoperiodism of plants
   the chief factor affecting flowering

photoperiodism – the response of a plant to changes in the length of daylight
(the reponses of a plant to changes in light intensity and length of days)
It often determines whether or not a plant produces flowers.
Some plants can accurately measure the length of light and darkness to within minutes so they will flower at precisely the right time of year.

Short-day plants: plants that flower when exposed to less than 12 hours of sunlight
(bloom when the days are short and the nights are long)
examples: chrysanthemums, corn, strawberries, apples, soybeans, violets, ragweed
flower naturally out-of-doors in the early spring or in late summer and fall

Nurserymen can delay the natural blooming schedule by placing the chrysanthemums in a greenhouse and illuminating them for a short period of time during the night. The plants repond to this lighting arrangement just as they would to days consisting of long periods of sunlight. The flowering hormone is not formed, and the flowering of these plants is artificially delayed. When the nurserymen are ready for the chrysanthemums to flower (usually in Oct. or Nov. - in time for football season), they suspend the nightly periods of illumination. This same procedure has been used successfully with other short-day plants such as poinsettia, dahlia, and aster.

Long-day plants: require more than 12 hours of light
bloom with long periods of light and short periods of darkness
generally flower during late spring and summer
examples: clover, gladiolus, sunflowers, beets, lettuce, grains

Neutral-day plants: flower independently of a photoperiod
bloom whenever conditions like moisture and temperature are acceptable regardless of the amount of light or darkness
usually flower continuously if other conditions (temp., moisture, etc.) are favorable
examples: tomato, dandelion, hybrid roses, beans, zinnias, cotton

----------Quiz 13B