April 2007: 30 Days of Green

SUNDAY MONDAY TUESDAY WEDNESDAY THURSDAY FRIDAY SATURDAY

April is National Garden Month® — When you garden, you GROW!

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April 21
Leave It to Leaves

All life on earth depends upon the ability of plants to make their own food through photosynthesis.

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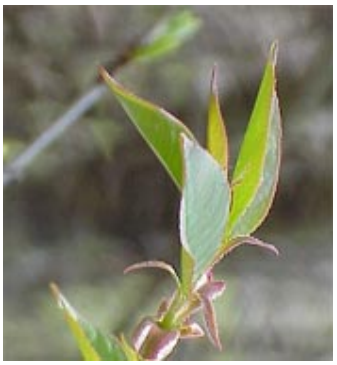

background

Plants possess the unique ability to make their own food through a process known as photosynthesis. Believe it or not, this characteristic sustains all life on earth! How does it work? It is a complex process, but essentially it comes down to this: Light fuels a chemical reaction that combines CO_2 from the air with water molecules (H_2O) to form carbohydrates, such as sugars and starches. All this takes place within chlorophyll molecules, the green pigment contained in plant tissues.

Leaves are the primary sites for photosynthesis, and though leaves take many forms, from pine needles to huge, fan-like fronds, they've all evolved within the constraints of their environment to be very efficient at the task. Each plant uses leaves to maximize the overall surface where chlorophyll can intercept light. Leaves also have pores (stomata) that open and close to let in CO_2 and limit water loss, and veins through which water and the products of photosynthesis are shuttled to the rest of the plant.

Photosynthesis takes place in two phases. During the first phase, chlorophyll captures light energy. The plant uses this energy to split water molecules that have arrived from the roots into hydrogen and oxygen. Meanwhile, carbon dioxide is entering leaves via tiny stomata.

In the second phase, the hydrogen freed from the water molecules combines with the carbon dioxide to form glucose. The oxygen left over from the water molecules is released into the atmosphere through the stomata – and this is what allows all animals, including us, to breathe!

Chlorophyll is what makes leaves green. Leaves contain other pigment colors, too, but they're usually outnumbered – and masked – by chlorophyll. In temperate areas of the world (where winters are cold) the longer nights of fall trigger a chemical response to prepare plants for dormancy. This reaction cuts off the flow of nutrients to the leaves, causing chlorophyll to break down, and the other pigments that have been hidden by it are revealed. The yellow and orange pigments are carotenoids. The red pigment, anthocyanin, is formed when sugars trapped in the leaves are exposed to cold night temperatures.

activity

Light Matters

Conduct experiments to investigate the importance of light for photosynthesis. Depending on resources available, you can either grow potted plants in environments with different amounts of light (ranging from no light in a closet to full sunlight outdoors).

Alternatively, you can devise ways to block light from leaves on outdoor plants using materials such as card stock, cardboard, or aluminum foil. (Note: Some materials can capture heat. To avoid burning leaves, don't use aluminum foil or other heat-retaining material in hot environments.)

Make daily observations of plants and note changes. Measure growth and describe leaf color. One way to record leaf color is to obtain paint sample cards with varying colors of green to use to compare with the leaves.

Leaf Pigment Chromatography

Your students can uncover "hidden" colors in leaves through a process called chromatography. Start by inviting them to collect and keep track of leaves from different types of trees and locations (e.g., shade and sun). Next, have them crush the leaves and put each type in a test tube or small, lidded glass jar. Carefully add enough of the solvent acetone (you can use nail polish remover) to create a milkshake consistency (for a test tube, this will be about 2 cm). Cover and let the mixtures sit for 24 hours. (Pigment molecules dissolve in acetone.) Make narrow strips from the middle of a coffee filter, then place one end in each solution and let it sit overnight.

Remove the strips and let them dry, making sure they don't get mixed up. (The solvent carries pigments up the strip, but some will "drop out" of the solution sooner than others. Because each pigment has a characteristic rate of movement, they will separate from each other on the strip, typically as green, yellow, and light orange bands.)

What happens to the leaves exposed to less light? How does light affect overall plant growth? Why do you think this happens? What happens if you place light-deprived plants back into full light?