Observing God's World

Fourth Edition

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Cataloging Data
Observing God's world / Gregory Rickard . . .[et. al] — 4th edition
iv, 348 p. : col. ill.; 26 cm. (Abeka Book science series)
Includes index.
1. Science—study and teaching (Elementary) III. Abeka Book, Inc.
Library of Congress: Q161.2 I68 2010
Dewey System: 500

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1

Plentiful Plants

Have you ever considered how much of our lives is affected by plants? In the summer, we mow the grass; and in the fall, we spend days raking up huge piles of leaves. On cold winter evenings, we enjoy the warmth of a crackling wood fire; in the spring, we are thrilled with the beauty of the flowers blooming all around us.

God created plants in a wealth of shapes and sizes. Some are very beautiful; others have particularly fascinating designs or manners of growth. But above all else, God made plants to be useful. Many of the clothes we wear are made from cotton, a material made from plants. Wood is used in a variety of ways in the houses we build. The books we read are printed on paper, another plant product. And, of course, much of the food we eat comes from the roots, stems, leaves, or fruits of plants.

Warmth, clothing, building materials, transportation, and food are some of the most important uses for plants; but plants have many other uses that you may not be aware of. As a result of study throughout history, people have learned much about the possible uses of plants. You will learn more about how plants help us as you read this chapter.

1.1 Leaves: The Food Factories

When we look at a plant, we often notice its leaves first. Some plants have very large leaves that look like the ears of an elephant; others have bunches of tiny, needlelike leaves that shimmer in the sunlight. Because leaves have interesting smooth or jagged shapes, attractive colors, and a variety of arrangements on the stem, they give beauty to plants.

Working all the day long

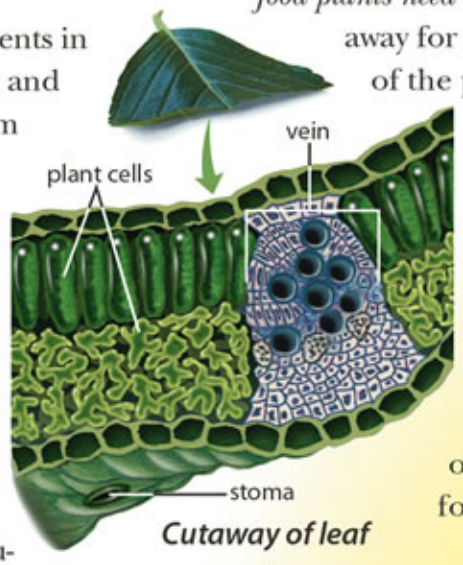
Essential leaves. Is adding variety and beauty to our world the only purpose for leaves? You might think so if you were to watch a leaf for several hours, or even days. It never does anything but hang from its plant. It never even moves, unless stirred by the wind. But that leaf is not as lazy as it seems.

Every leaf is a complex mechanism working to produce food for the plant by means of a chemical process called **photosynthesis** [fō′tō·sĭn′thĭ·sĭs]. Without the food produced by photosynthesis in the leaves, plants could not grow. And without plants, there would be no food for animals and people. *All life depends on plants because*

plants are the only living things that can make their own food. The next time you look at the unusual or beautiful leaves on a plant, remember that the job of photosynthesis, occurring unseen within the leaves day by day, is an essential part of God's plan for life on earth.

Leaves in action. Photosynthesis is carried out by tiny cells in the leaf, too small to be seen by the human eye. Let's look at an enlarged view of the inside of a typical leaf to help us understand how this important process works.

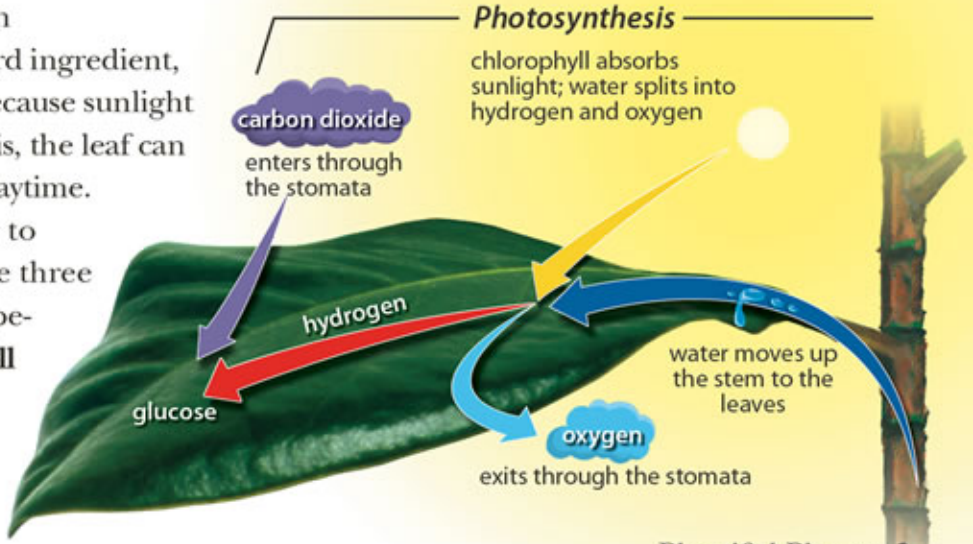
A leaf needs three ingredients in order to do its work: *water, air,* and *light.* The plant gets *water* from the ground and transports it to the leaf through the roots and stem. *Air* enters the leaf through holes or pores called **stomata** [stō′mə·tə: "little mouths"], located on the underside of the leaf. Each **stoma** (singular of *stomata*) is so extremely small that there may be tens of thousands of them in a leaf section the size of a quarter. The third ingredient, *light,* comes from the sun. Because sunlight is necessary for photosynthesis, the leaf can do its work only during the daytime.



Cutaway of leaf

Photosynthesis. In order to manufacture food from these three ingredients, the leaf uses a special tool known as **chlorophyll** [klôr′ə·fĭl], the *pigment,* or coloring, that makes plants green. As sunlight enters the leaf, some of its energy is absorbed by tiny packages of chlorophyll called **chloroplasts** [klôr′ə·plăsts], contained in the cells of the leaf. The energy of the sun splits the water, provided by the roots and stems, into simpler chemicals called *hydrogen* and *oxygen.* The oxygen (a gas) is released through the stomata into the air, where it is available to be breathed by people and animals. The hydrogen is combined with carbon dioxide (a gas taken from the air) to form a type of sugar called **glucose**—*the food plants need to live.* The glucose is shipped away for storage or used in other parts of the plant.

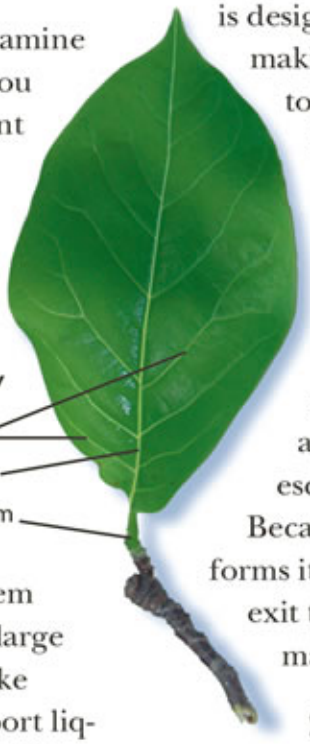
Besides photosynthesis, another important job of leaves is to construct chemicals, such as **proteins** and **vitamins,** that the plant needs for nourishment. Whenever we eat vegetables, our bodies make use of these proteins and vitamins for our own nourishment.



A look at leaf anatomy

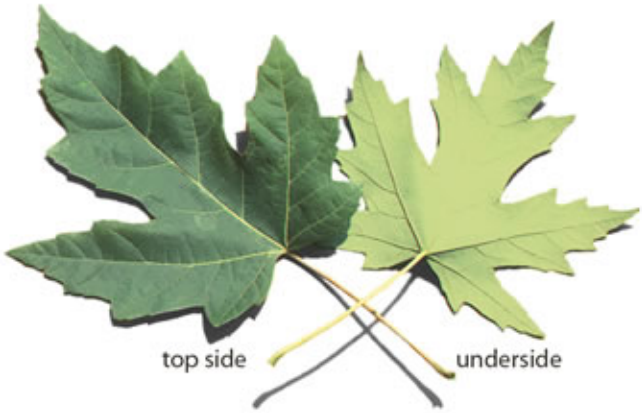
Take a close look at a leaf growing on a tree or a bush. Notice its color. How does the color of the top surface compare with that of the bottom? Is the leaf all one color? Is it green, or yellow, or red? Observe its shape. Is it rounded or pointed at the tip? Is the edge jagged or smooth? Feel the texture of its surface. Is it smooth, or furry, or rough? Does the bottom feel different from the top? Look around your yard for leaves with other shapes, colors, and textures.

A strong skeleton. Carefully examine the structure of one of the leaves you found. The leaf is joined to its plant by a **stem.** The stem is strong yet flexible, so that even in violent storms the leaf is not torn away. The stem also contains many conducting channels or tubes. Some of these tubes bring water and minerals to the leaf, and others take food from the leaf to the rest of the plant.



Leaf anatomy

Spreading outward from the stem and across the leaf is a network of large and small **veins.** These veins are like strong pipes serving both to transport liquids and to reinforce the structure of the thin, fragile leaf. Examine the pattern of the veins on your leaf. Do they run side by side lengthwise along the leaf, or do they branch out from both sides of a central vein? On many leaves, all the smaller veins are joined to one especially large vein, called the **midrib,** that runs straight up the middle of the leaf.



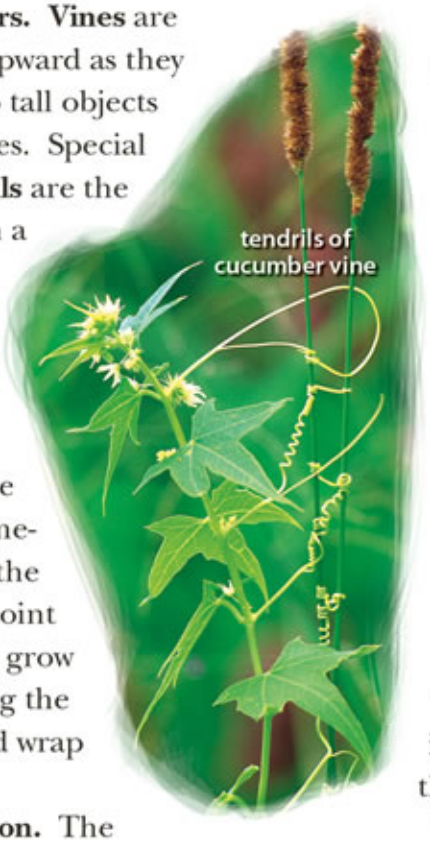
A green complexion. You should also notice that the top of the leaf looks different from the underside. The leaf is designed so that most of its food-making cells are arranged close to its top surface, the side that is turned toward the sunlight. Since most of the chlorophyll is near the top, the top of the leaf is usually greener than the bottom.

A smooth skin. Most leaves feel very smooth. The waxy covering that coats the skin of a leaf and prevents water from escaping is called the **cuticle.** Because the cuticle faithfully performs its job, materials can enter and exit the leaf only through the stomata or the stem.

Special leaves

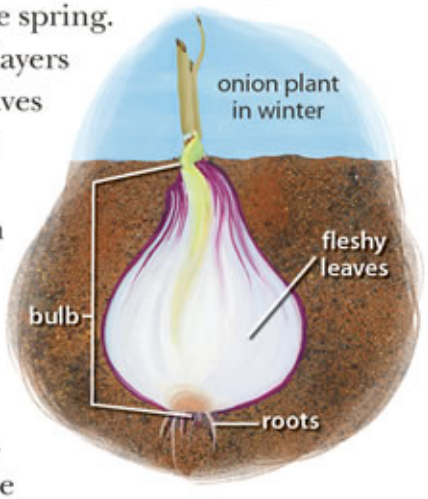
God has given some leaves special jobs to do. These unusual leaves have structures so unique that you might not recognize them as leaves at all. A *special leaf,* sometimes called a **modified leaf,** is *one that has a special design for a special task.* Some of these leaves include tendrils, spines, fleshy storage leaves, and the trapping leaves of insect-eating plants.

Twining climbers. **Vines** are plants that climb upward as they grow by clinging to tall objects such as walls or trees. Special leaves called **tendrils** are the "hands" with which a vine grasps a support structure. A tendril is designed to coil around any object it happens to touch. When the tendril touches something, the cells on the side opposite the point of contact begin to grow very rapidly, causing the tendril to bend and wrap around the object.



Prickly protection. The **spines** of cactuses are special leaves that contain no chlorophyll. Their function is to protect the water-storing stem of the cactus plant. This plant grows in hot, dry regions, where animals would destroy the cactus to get at its water if God had not given the plant special sharp spines for protection. These spines discourage animals from eating the cactus.

Tasty storage space. The leaves of some plants, such as the onion, grow partially below the ground. In the winter, the upper tubular leaves of the onion die, but the fleshy bases of the leaves remain in the earth, wrapped around the tiny plant to insulate it from the cold ground and to nourish the plant when it begins to grow again in the spring. The many layers of lower leaves that remain below the ground form a **bulb.** This bulb is the onion that we eat.



Insect eaters. Plants such as the Venus's-flytrap, bladderwort, pitcher plant, and sundew have unusual leaves that can trap and digest small insects. Because of their unusual diet, these plants are called **insectivorous** [ĭn′sĕk·tĭv′ər·əs: insect-eating] **plants.** Insectivorous plants contain chlorophyll for manufacturing their own food, but they also obtain some food from the bodies of their victims.

The leaves of the **Venus's-flytrap** are hinged so that they can close like the jaws of a steel trap. An insect that crawls into the flytrap's leaf touches tiny trigger hairs that cause the two halves of the leaf to slam together. In order to prevent the leaf from closing at a false alarm, God has designed the trigger hairs in such a way that the leaf closes only if a hair is touched two times in

a row, or if two hairs are touched at least one time each. When the trapped insect has been digested, the leaf opens and waits for its next meal to happen along.

Another insect-eating plant with trigger hairs is the **bladderwort.** This underwater plant has hollow, bladder-like leaves filled with water. When an unsuspecting insect or small crustacean bumps into one of the hairs positioned at the bladder's opening, the leaf suddenly expands. The creature finds itself caught in an inescapable current as water is sucked into the expanding leaf. After digesting its victim, the leaf shrinks down to set the trap again.

The **pitcher plant** attracts insects with its bright colors and the aroma of its honeylike nectar. When an insect lands on the rim of the slippery pitcher leaf, it slides helplessly down past many tiny hairs. These hairs point downward, allowing the insect to "drop in" but not to crawl out. After the insect dies, it is slowly digested in a liquid at the bottom of the pitcher.

Insects are attracted to the **sundew** by the plant's glistening bait—its sticky "dewdrops." When an insect crawls over the sundew plant, it steps into the dewdrops and gets stuck. The leaf's long hairs or tentacles then close over the insect to prevent its escape, and juices in the tentacles digest the insect.