

CHAPTER 2

Plant Structures and Functions

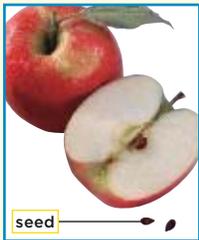
Vocabulary



spore a single cell that can develop into a new plant exactly like the plant that produced it



gymnosperm a seed plant that does not produce flowers



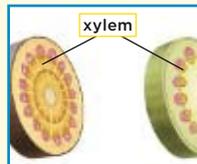
seed an undeveloped plant with stored food inside a protective coat



pollination the movement of pollen to the seed-making part of a flower



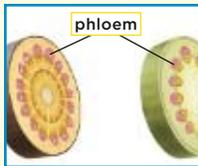
angiosperm a seed plant that produces flowers



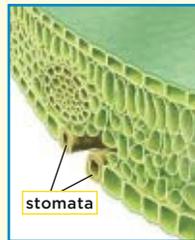
xylem tissue that moves water and minerals up from the roots



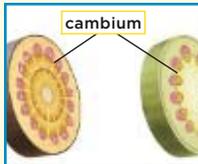
How do plants produce, transport, and use food?



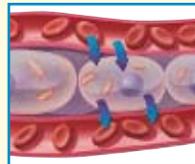
phloem tissue that moves food (sugar) from the leaves to other parts of a plant



stomata tiny holes in the bottom of a leaf that allow gases in and out



cambium a layer of cells that makes xylem and phloem



respiration (in cells) the release of energy from food



photosynthesis how a plant changes raw materials into food in the presence of sunlight



What are vascular plants?

Trees, bushes, grass, and plants with vegetables or fruits are all vascular plants. A vascular plant has special tissues that form thin tubes inside the plant. These tubes carry water and other materials up and down the plant.

These tubes connect the three main parts of a vascular plant:

roots Roots have several jobs:

- anchor plants to the ground
- take in water and minerals from the soil
- store food made by the plant (in some plants)

stems Stems have several jobs:

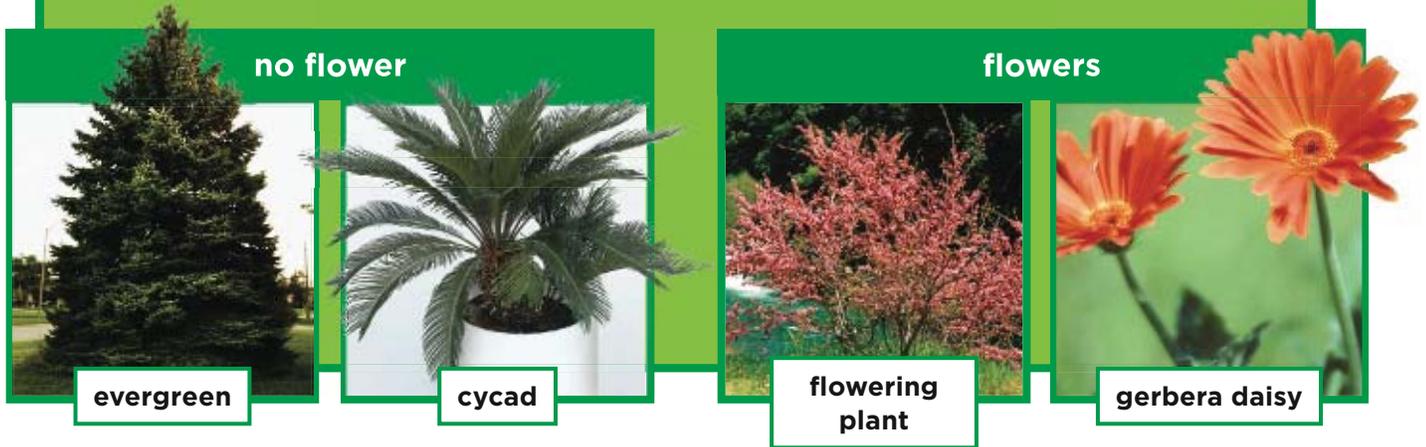
- support the plant above ground
- move materials from the roots to the leaves and from the leaves to the roots

leaves Leaves have one main job:

- make food for the plant

(which have roots, stems, and leaves)

seed plants



Classifying Vascular Plants

There are two ways vascular plants reproduce, that is, form offspring (more of their own kind).

seedless plants Plants such as ferns do not have seeds. They grow from spores (spawrz). A **spore** is a single cell that can develop into a new plant. The new plant is exactly like the plant that produced the spore.

seed plants Most familiar vascular plants make and grow from seeds. A **seed** contains an undeveloped plant and stored food inside a protective coat. Some seed plants produce flowers. Some do not.

Quick Check

Match each word with its description.

- | | |
|--------------|-------------------------------------------|
| 1. ___ root | a. undeveloped plant with food and a coat |
| 2. ___ leaf | b. part that takes in water and minerals |
| 3. ___ spore | c. part that makes food for a plant |
| 4. ___ seed | d. single cell that develops into a plant |

How are seedless and seed plants different?

Mosses, ferns, and horsetails are seedless plants. They grow from spores. Here is an example.

- On a fern, spores are found in spore cases on the underside of a fern leaf (a frond).
- When a spore case opens, many spores come out. Some fall to the ground. Some are carried by wind.
- Spores grow into new ferns, just like the parent fern, if they land in moist soil.

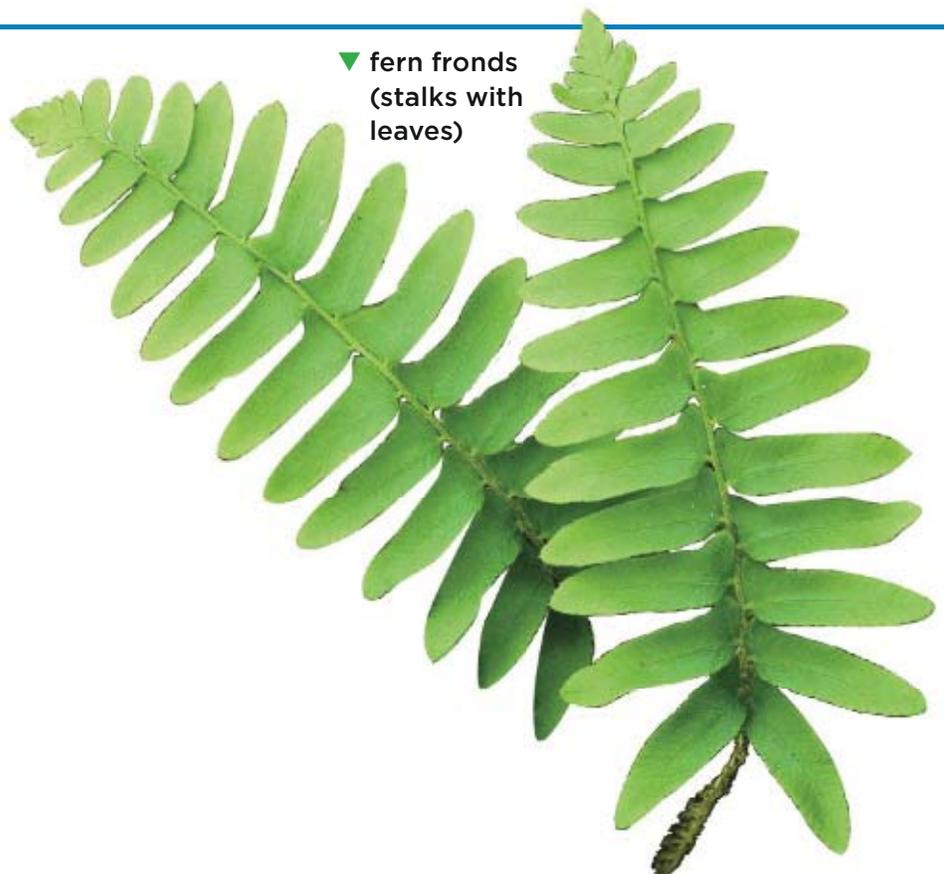
Grasses, trees, and flowering plants are seed plants.

- Seed plants produce two special kinds of cells: *male cells* and *female cells*.
- A seed forms when a male cell and a female cell join together into one cell.
- Inside a seed there is a new, undeveloped plant, as well as food. The new plant shares characteristics of the two cells that joined when the seed was made.

Spores and Seeds



- ▲ These spore cases are found on the bottom side of a fern frond. Each spore case contains thousands of spores.



▼ fern fronds (stalks with leaves)

Classifying Seed Plants

Most seed plants produce flowers. Some do not.

Seed plants that produce flowers are called **angiosperms** (AN•jee•uh•spurmz). There are over 235,000 kinds of angiosperms, from rose plants to orange trees.

Seed plants that do not produce flowers are called **gymnosperms** (JIM•nuh•spurmz). Gymnosperms produce seeds inside a cone. When the cone falls, the seeds are released.

Evergreens are gymnosperms. These trees lose their leaves slowly all year. When a leaf is lost, a new one grows back. So, these trees look green all year.

✓ Quick Check

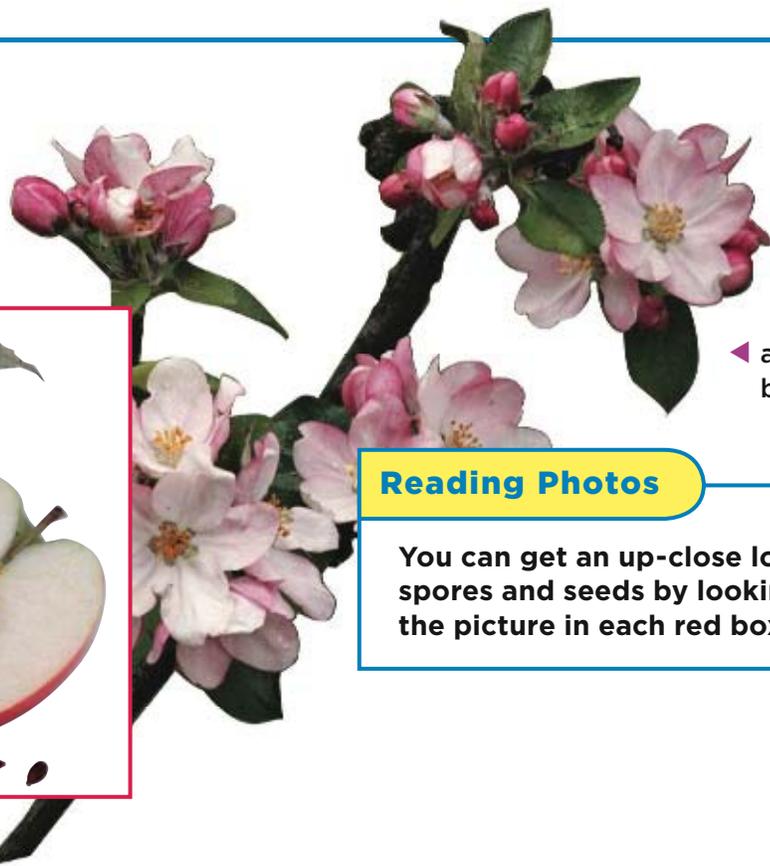
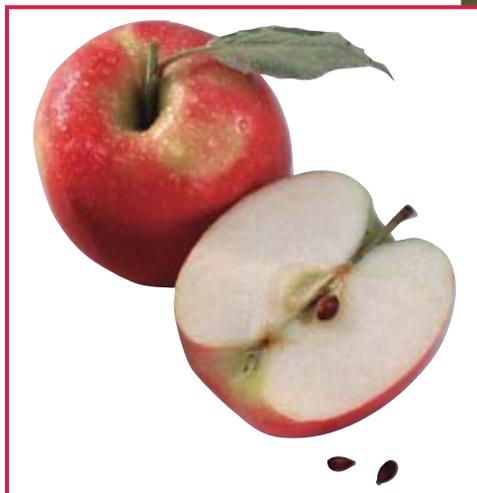
Fill in the diagram to show how you can classify vascular plants and then seed plants.

First Start with all vascular plants.

5. Next Classify vascular plants into _____ and _____.

6. Last Classify seed plants into _____ and _____.

▼ Apples are fruits that contain seeds. The seeds can be planted to grow new apple trees.



◀ apple tree branch

Reading Photos

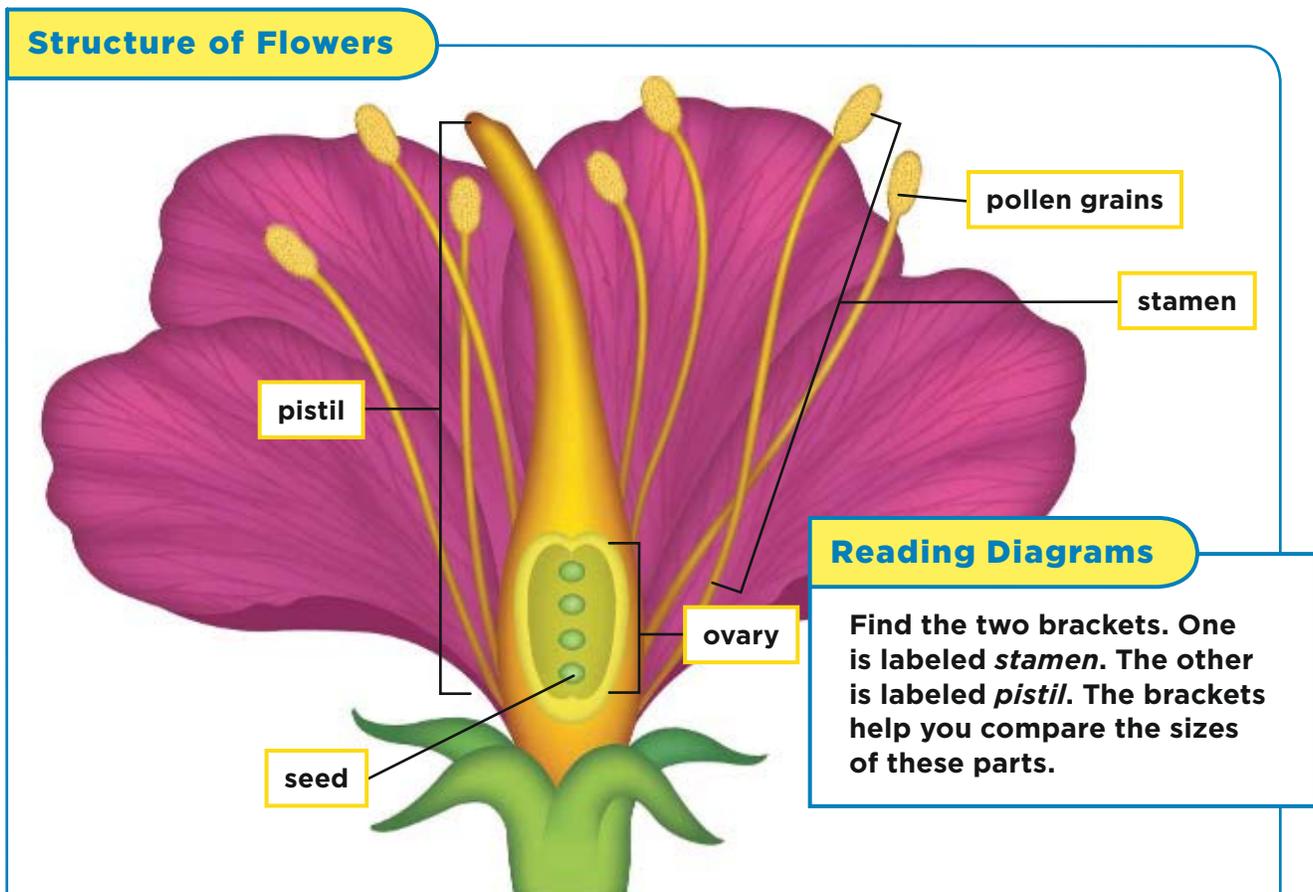
You can get an up-close look at spores and seeds by looking at the picture in each red box.

What do flowers do?

When you think of flowers, you may think of bright colors and sweet scents. Flowering plants use their flowers for reproduction, that is, making new plants. The diagram shows the parts of a flower:

- **stamen** The stamen (STAY•men) is the male part of a flower. It produces male cells called pollen grains.
- **pistil** The pistil (PIS•tuhl) is the female part of a flower. It produces female cells called egg cells.
- **ovary** The ovary (OH•vuh•ree) is the bottom part of the pistil. Egg cells are found in the ovary.

Seeds will form in the ovary. To learn how, follow the steps on the next page.



Seeds

Look back at the diagram as you follow the steps.

1. pollination Pollen grains collect on the top of a stamen. They are moved to the pistil of the same flower or another flower. **Pollination** (pol•uh•NAY•shuhn) is the movement of pollen grains from a stamen to a pistil. What moves the pollen grains?

- *wind*
- *insects and birds* are attracted to flowers by the colors and smells. They brush up against the stamens and pick up the pollen grains on their bodies. They drop the grains onto other flowers.

2. making a seed When a pollen grain reaches a pistil, it travels down into the ovary. A pollen and an egg cell can then join and form a seed. The ovary slowly enlarges, becoming a fruit with the seeds inside.

3. scattering seeds Seeds are then scattered by wind or animals.

If a seed reaches a place where the soil is moist and the temperature is just right, the new plant inside begins to grow.

Quick Check

Summarize the story of a seed.

7. First _____



8. Next _____



9. Last _____

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Lesson 2

Plant Transport Systems

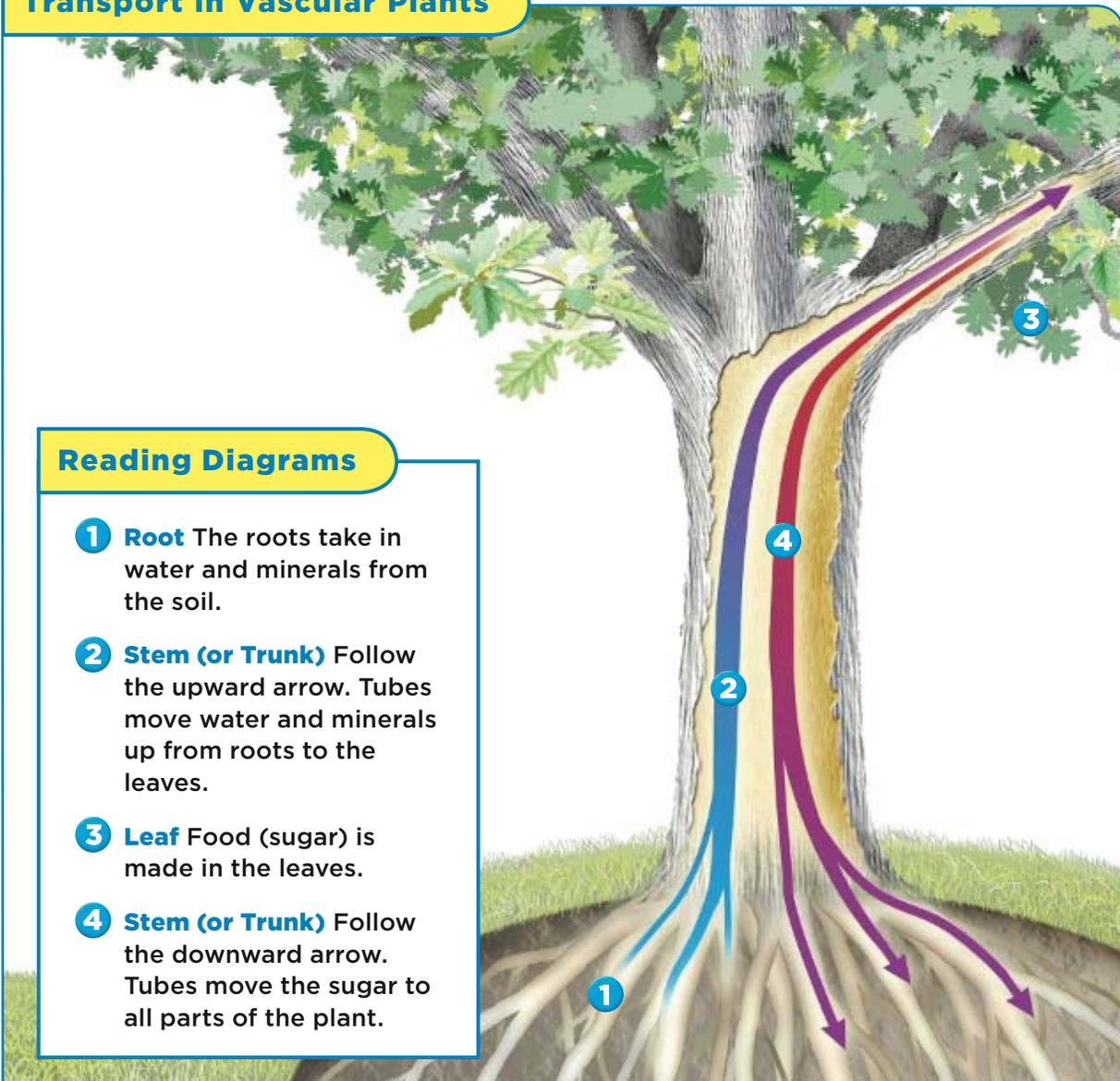
How do materials move in plants?

A tree may look still. However, materials are moving inside a tree. Vascular plants have tubes running through the roots, stems, and leaves. These tubes bring materials up to the leaves. The leaves make food (sugar). The sugar then is carried to the rest of the plant.

Transport in Vascular Plants

Reading Diagrams

- 1 Root** The roots take in water and minerals from the soil.
- 2 Stem (or Trunk)** Follow the upward arrow. Tubes move water and minerals up from roots to the leaves.
- 3 Leaf** Food (sugar) is made in the leaves.
- 4 Stem (or Trunk)** Follow the downward arrow. Tubes move the sugar to all parts of the plant.

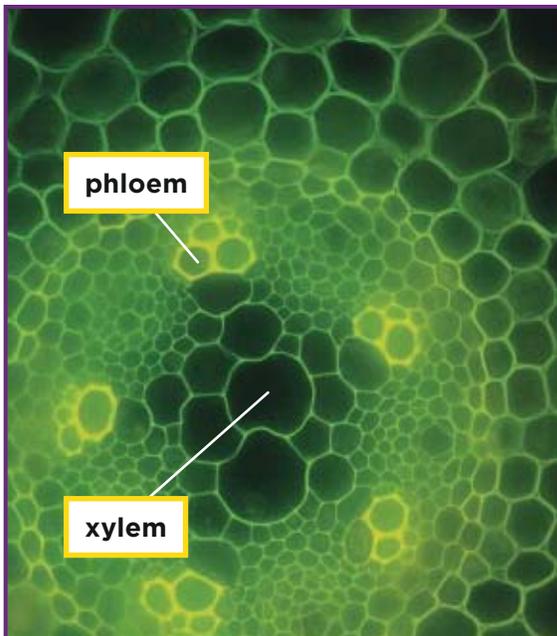


Roots

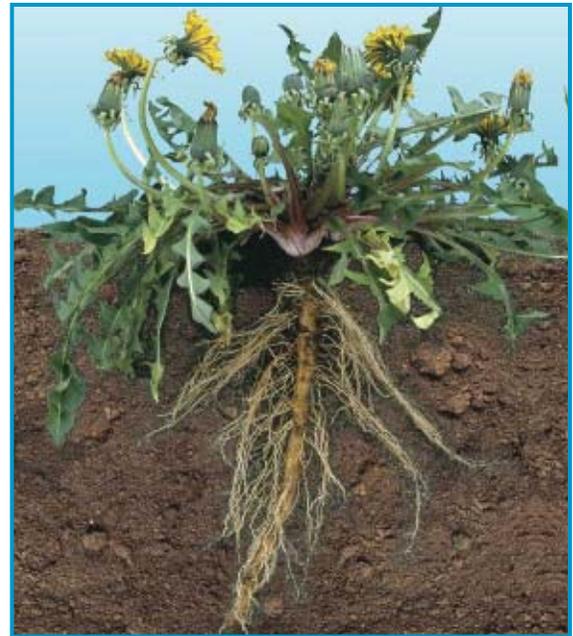
Inside a root, are tiny tubes made of vascular tissue. Toward the center, **xylem** (ZIGH•luhm) moves water and minerals up from the ground through the root to the stem.

Around the center, **phloem** (FLO•em) carries sugar from the leaves down the stem and into the root.

Roots come in many sizes and shapes. Carrots and beets have thick *taproots* that grow deep into the soil. Grasses have thin, *fibrous* roots. Corn plants have finger-like *prop* roots.



▲ This is what you see if you cut a thin slice across a buttercup root and look at it through a microscope.



▲ Dandelions have taproots. These roots can reach water deep in the ground.

Quick Check

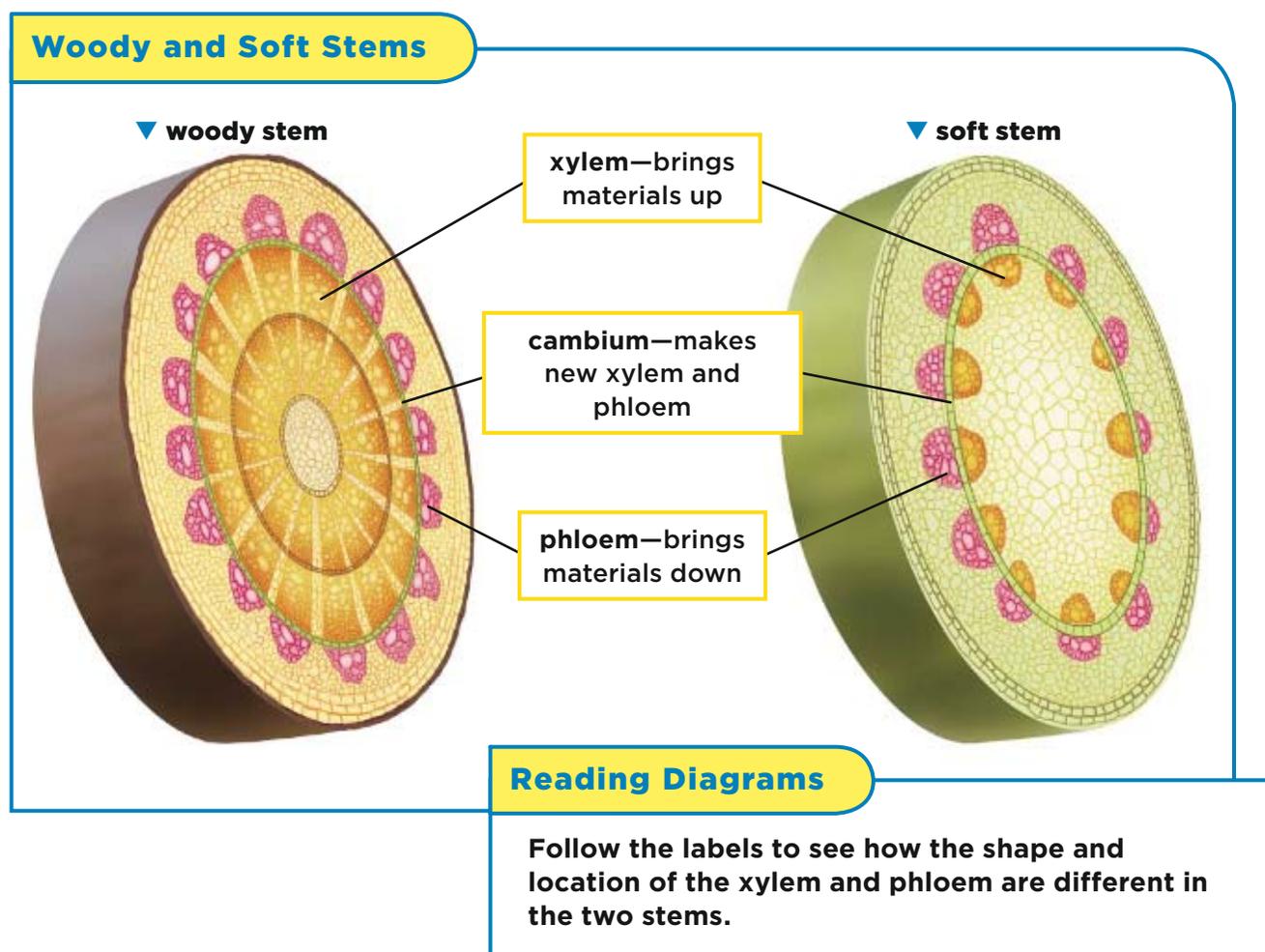
10. How does water from the ground get all the way up to a leaf?

11. Why are two kinds of tubes needed in a plant?

What is the transport system made of?

You saw that a root has two kinds of tubes made from vascular tissue, xylem and phloem. They continue up from the root all the way through the stem.

In different kinds of stems, the xylem and phloem are arranged differently. See the diagram. There is a layer of cells called cambium (KAM•be•uhm) in both stems. **Cambium** is where new cells of xylem and phloem are made.



Tree Rings

A tree stump gives you a view of the outside and inside of a woody stem, a tree trunk.

- **bark** Along the outside is a layer of bark. Bark protects the trunk.
- **phloem** Just inside the bark is a layer of phloem.
- **xylem** Inside the phloem are rings. The rings are layers of xylem.

A ring of xylem grows every year. So by counting the rings you can tell the age of the tree. Start from the inside, the oldest part. Each ring has two parts.

- **light part** The lighter part grows in the spring when water is usually plentiful.
- **dark part** The dark part grows in the fall when there is less rain.

Counting tree rings gives you the age of a tree. The oldest living tree is a bristlecone pine in California. It is 4,767 years old. ▼



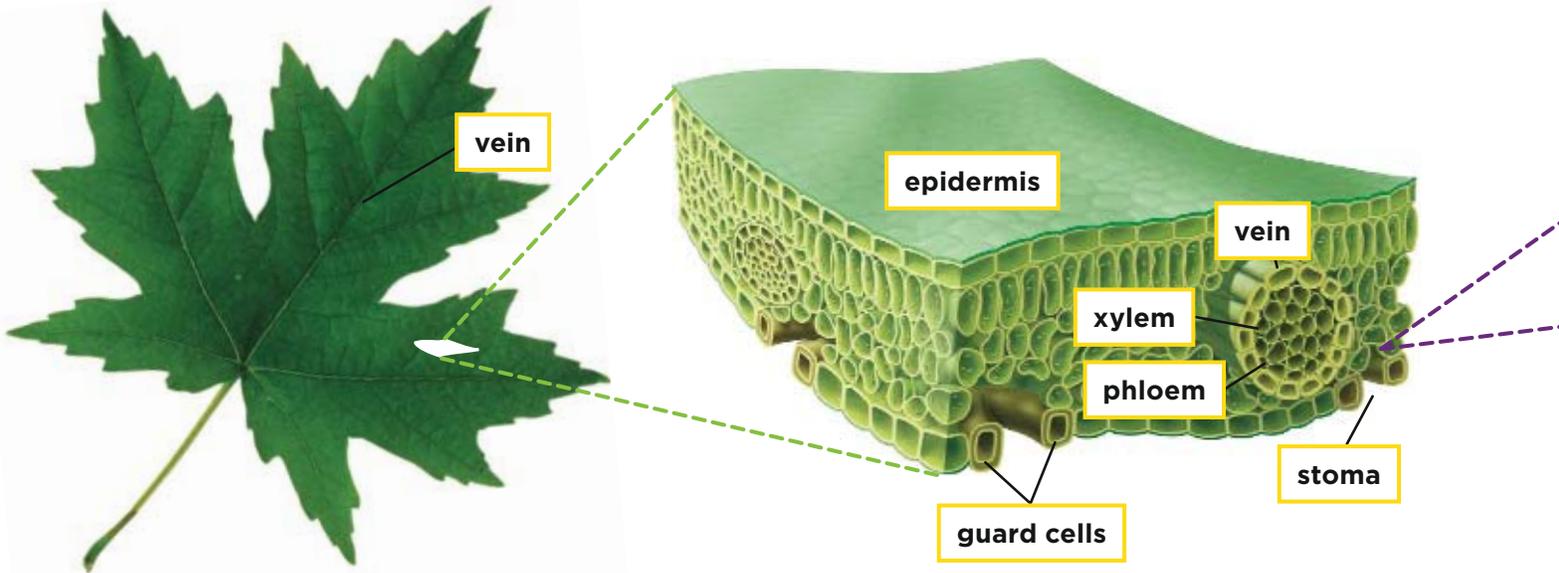
✓ Quick Check

What happens in a stem? Give a cause or effect in each row.

Cause	→	Effect
Xylem dries up and dies.	→	12. _____
13. _____	→	Sugar cannot move down the stem.
14. _____	→	A thick ring grows in the spring.

Lesson 3 Photosynthesis and Respiration

Parts of a Leaf

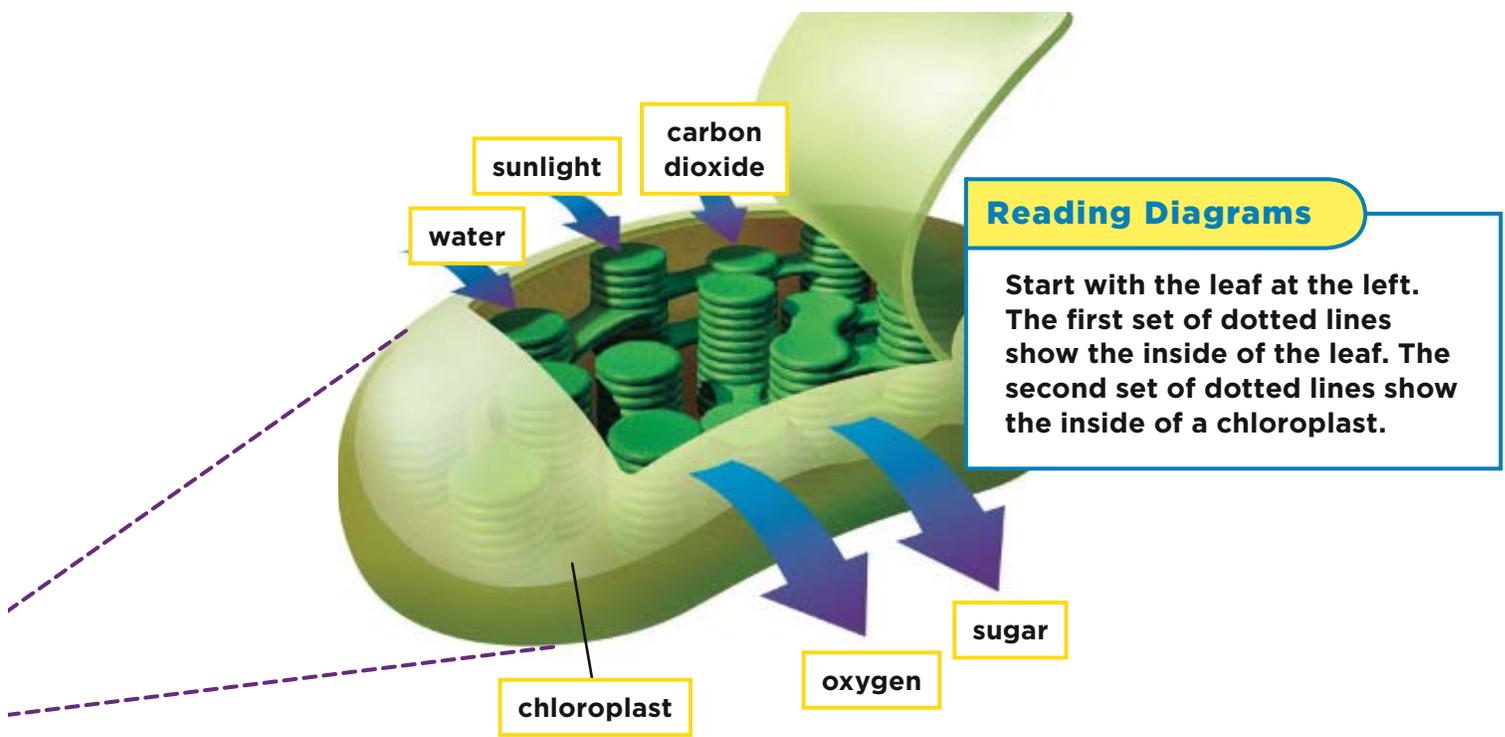


What do leaves do?

A leaf is a factory that makes food (sugar). To make food, a leaf needs two raw materials: water and carbon dioxide.

Look at the diagram to see how a leaf gets these two raw materials:

- **veins** A plant takes in water from the soil. The water travels up the xylem through the roots and the stem. The xylem goes into a leaf through narrow veins. Water enters the leaf through the xylem.
- **stomata** **Stomata** (STOH•muh•tuh) are tiny holes in the bottom of a leaf or stem. (The word for one hole is *stoma*.) The stomata are surrounded by guard cells. When the guard cells open the stomata, carbon dioxide comes in. Guard cells can close the stomata to keep a plant from drying up.



Food Making

Here is an outline of the food-making process, **photosynthesis** (foh•tuh•SIN•thuh•sis),

- **where it happens** Food is made in cells just under the epidermis (ep•i•DUR•mis). The epidermis is the outermost layer of a leaf. (It is also made in cells of some stems.) Food is made in chloroplasts. Chloroplasts are cell parts with a green substance that traps sunlight.
- **what happens** Carbon dioxide and water enter the chloroplasts. In the presence of sunlight, these two raw materials combine. They form sugar and oxygen.

carbon dioxide + water + energy → sugar + oxygen

- **after it happens** Phloem carries the food to all parts of the plant. Oxygen goes out the stomata.

✓ Quick Check

Cross out the word that does not belong in each row

15. Parts of a leaf: vein root epidermis

16. Raw materials: sugar water carbon dioxide

17. What a leaf makes: energy oxygen sugar

What is a cycle in plants and animals?

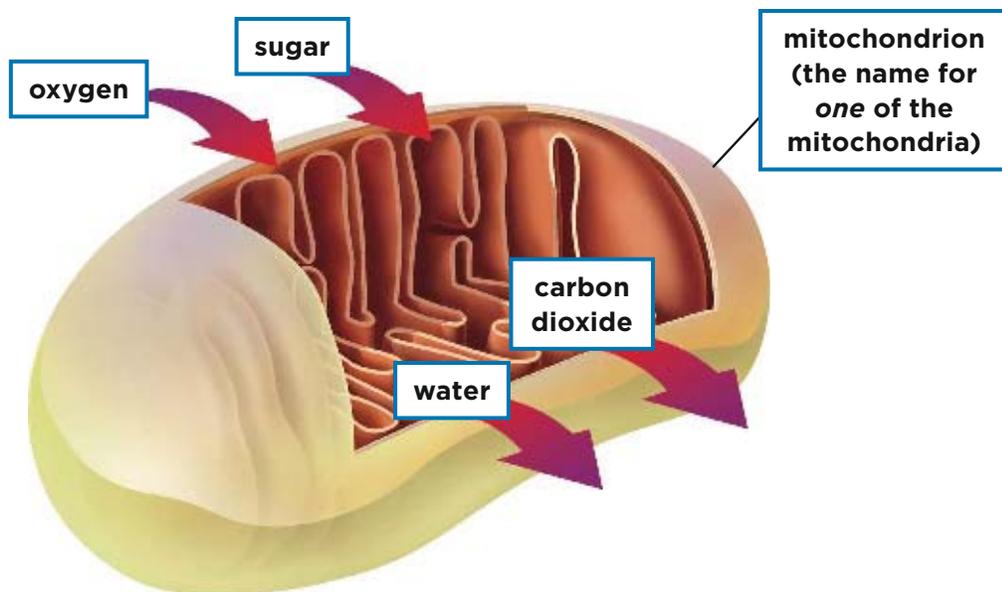
In photosynthesis, a plant makes food (sugar) and oxygen. These two products are used by the plant, and also by animals.

- **sugar (food)** The food has energy stored in it. Animals that eat plants take in the food with its stored energy. Other animals that eat plant-eaters also get the food and stored energy.
- **oxygen** Plants and animals use oxygen for the process of respiration (res•puh•RAY•shuhn) in cells. **Respiration** in cells is the release of energy from food.

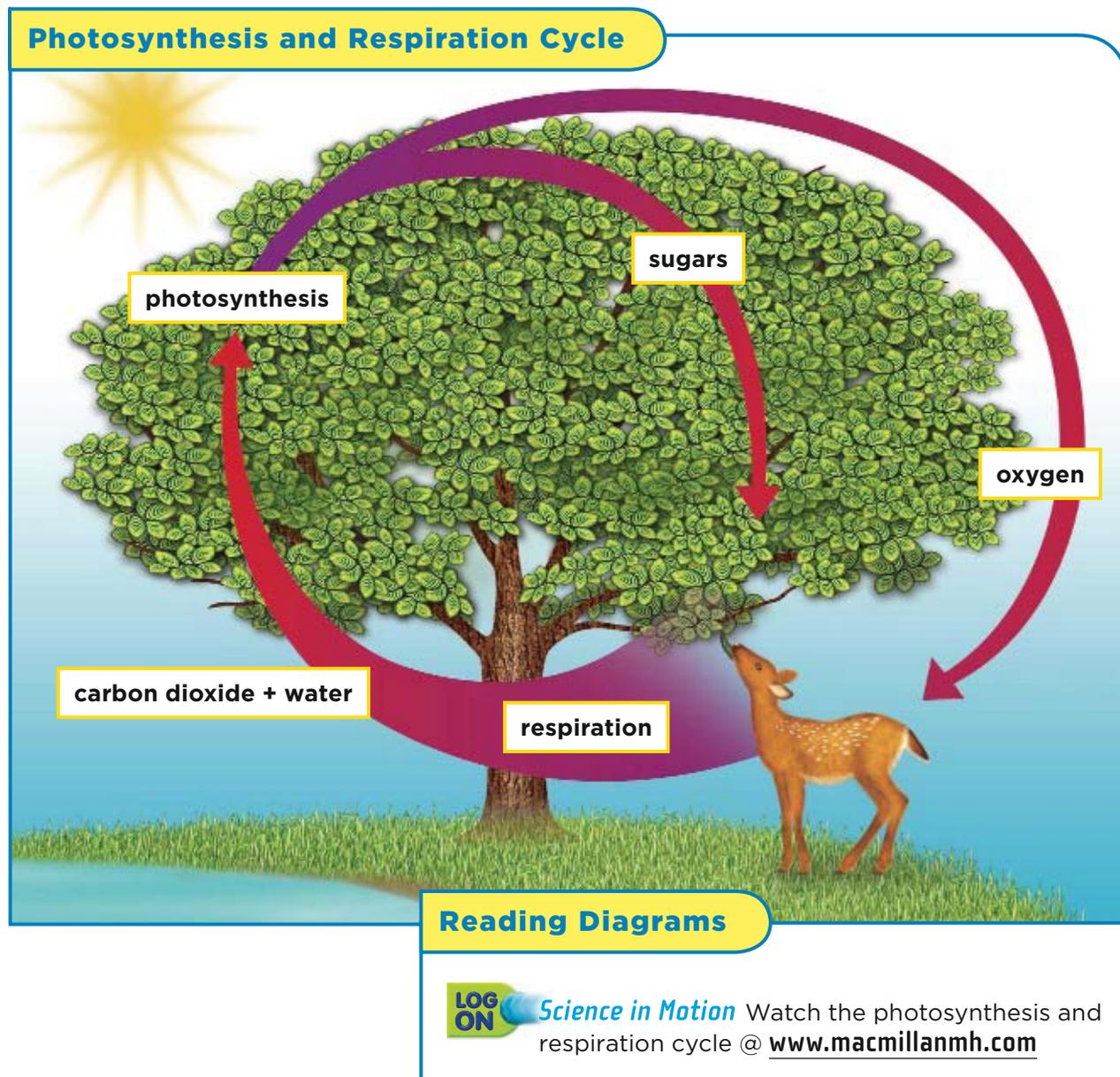
Respiration takes place in the parts of a cell called mitochondria. Oxygen and sugar go into the mitochondria. The oxygen breaks down the sugar and energy is given off. Two waste products are made in the process: carbon dioxide and water.



Respiration in a Cell



Animals and plants give off the two waste products, carbon dioxide and water. Plants then take in carbon dioxide and water and use them to make food. The two processes, photosynthesis and respiration, happen over and over again.



✓ Quick Check

18. What is produced by photosynthesis? _____
19. What is produced by respiration? _____

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