

SECTION

1

What Is a Plant?

Imagine spending a day without plants. What would you eat? It would be impossible to make chocolate chip cookies and many other foods.

Without plants, you couldn't eat much. Almost all food is made from plants or from animals that eat plants. Life would be very different without plants!

Plant Characteristics

Plants come in many different shapes and sizes. So, what do cactuses, water lilies, ferns, and all other plants have in common? One plant may seem very different from another. But most plants share certain characteristics.

Photosynthesis

Take a look at **Figure 1**. Do you know why this plant is green? Plant cells contain chlorophyll (KLAWR uh FIL). *Chlorophyll* is a green pigment that captures energy from sunlight. Chlorophyll is found in chloroplasts (KLAWR uh PLASTS). Chloroplasts are organelles found in many plant cells and some protists. Plants use energy from sunlight to make food from carbon dioxide and water. This process is called *photosynthesis* (FOHT oh SIN thuh sis). Because plants make their own food, they are called *producers*.

What You Will Learn

- Identify four characteristics that all plants share.
- Describe the four main groups of plants.
- Explain the origin of plants.

Vocabulary

nonvascular plant
vascular plant
gymnosperm
angiosperm

READING STRATEGY

Reading Organizer As you read this section, create an outline of the section. Use the headings from the section in your outline.

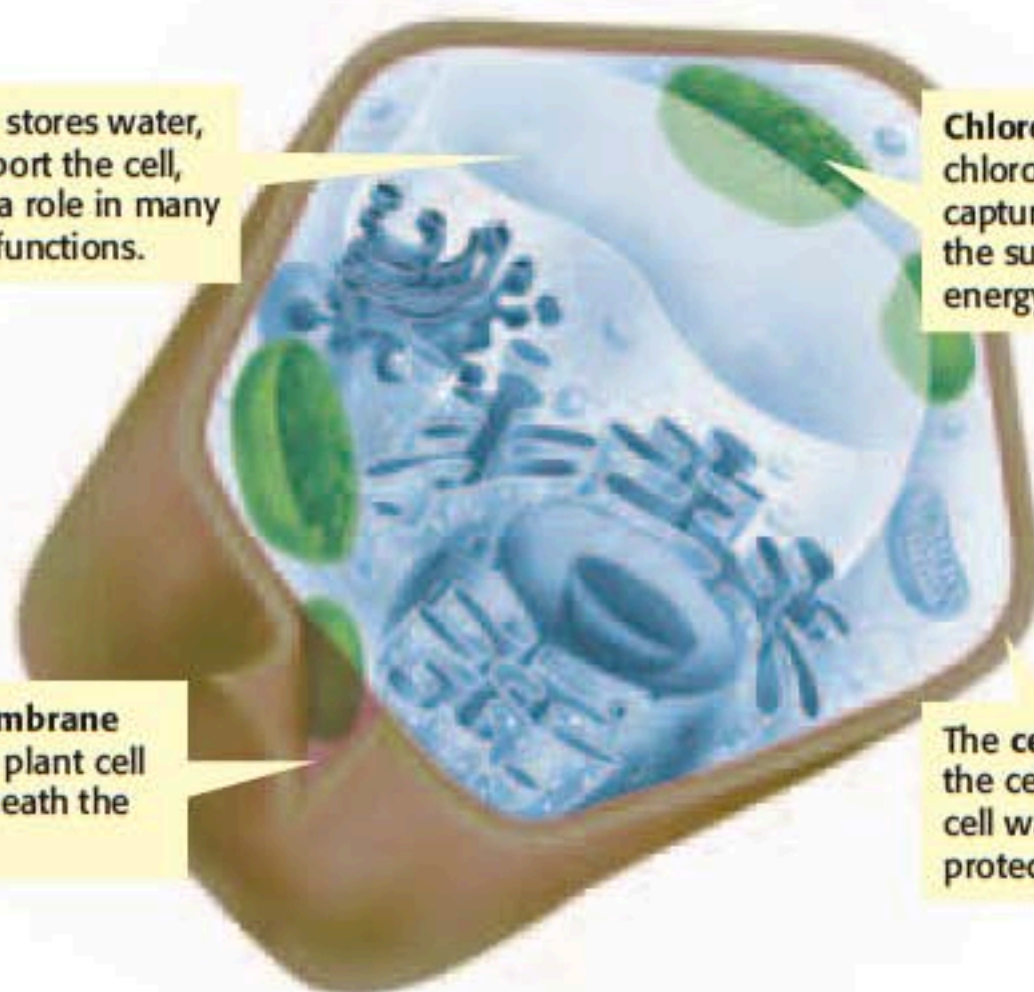


Cuticles

Most plants live on dry land and need sunlight to live. But why don't plants dry out? Plants are protected by a cuticle. A *cuticle* is a waxy layer that coats most of the surfaces of plants that are exposed to air. The cuticle keeps plants from drying out.

Figure 1 *Chlorophyll makes the leaves of this plant green. Chlorophyll helps plants make their own food by capturing energy from sunlight.*

Figure 2 Some Structures of a Photosynthetic Plant Cell



A **vacuole** stores water, helps support the cell, and plays a role in many other cell functions.

Chloroplasts contain chlorophyll. Chlorophyll captures energy from the sun. Plants use this energy to make food.

The **cell membrane** surrounds a plant cell and lies beneath the cell wall.

The **cell wall** surrounds the cell membrane. The cell wall supports and protects the plant cell.


Cell Walls

How do plants stay upright? They do not have skeletons like many animals do. Instead, plant cells are surrounded by a rigid cell wall. The cell wall lies outside the cell membrane, as shown in **Figure 2**. Carbohydrates and proteins in the cell wall form a hard material. Cell walls support and protect the plant cell. Some plant cells also have a secondary cell wall that forms after the cell is mature. When this wall has formed, a plant cell cannot grow larger.

Reproduction

Plants have two stages in their life cycle—the sporophyte (SPAWR uh FIET) stage and the gametophyte (guh MEET uh FIET) stage. In the sporophyte stage, plants make spores. In a suitable environment, such as damp soil, the spores of some plants grow. These new plants are called *gametophytes*.

During the gametophyte stage, female gametophytes produce eggs. Male gametophytes produce sperm. Eggs and sperm are sex cells. Sex cells cannot grow directly into new plants. Instead, a sperm must fertilize an egg. The fertilized egg grows into a sporophyte. The sporophyte makes more spores. So, the cycle starts again.

 **Reading Check** How do plants reproduce? (See the Appendix for answers to Reading Checks.)

CONNECTION TO Social Studies

Countries and Crops Without plants, most life on land couldn't survive. But plants are important for more than the survival of living things. Many countries rely on plants for income. Identify five major food crops. Then, find out which countries are the main producers of these crops and how much the countries produce each year. Make a table to show your findings.

Plant Classification

Although all plants share basic characteristics, they can be classified into four groups. First, they are classified as nonvascular plants and vascular plants. Vascular plants are further divided into three groups—seedless plants, nonflowering seed plants, and flowering seed plants.

Nonvascular Plants

Mosses, liverworts, and hornworts are nonvascular plants. A **nonvascular plant** is a plant that doesn't have specialized tissues to move water and nutrients through the plant. Nonvascular plants depend on diffusion to move materials from one part of the plant to another. Diffusion is possible because nonvascular plants are small. If nonvascular plants were large, the cells of the plants would not get enough water and nutrients.

Vascular Plants

In the same way that the human body has special tissues to move materials through the body, so do many plants. A plant that has tissues to deliver water and nutrients from one part of the plant to another is called a **vascular plant**. These tissues are called *vascular tissues*. Vascular tissues can move water to any part of a plant. So, vascular plants can be almost any size.

Vascular plants are divided into three groups—seedless plants and two types of seed plants. Seedless vascular plants include ferns, horsetails, and club mosses. Nonflowering seed plants are called **gymnosperms** (JIM noh SPUHRMZ). Flowering seed plants are called **angiosperms** (AN jee oh SPUHRMZ). The four main groups of plants are shown in **Figure 3**.


 **Reading Check** What are the four main groups of plants?

Figure 3 The Main Groups of Plants

Nonvascular plants

Mosses, liverworts, and hornworts



Vascular plants

Seedless plants

Ferns, horsetails, and club mosses



Seed plants

Nonflowering

Gymnosperms



Flowering

Angiosperms



The Origin of Plants

Imagine that you traveled back in time about 440 million years. The Earth seems like a strange, bare, and unfriendly place. For one thing, no plants live on land. So, where did plants come from?

Take a look at **Figure 4**. The photo on the left shows a green alga. The photo on the right shows a fern. The green alga may look like a plant, such as a fern, but it isn't a plant. However, green algae and plants have many similarities. Green algae cells and plant cells have the same kind of chlorophyll. They have similar cell walls. Green algae and plants make their own food through photosynthesis. Both store energy in the form of starch. Like plants, green algae have a two-stage life cycle. Because of these similarities, some scientists think that green algae and plants share a common ancestor.

✓ Reading Check What are some characteristics that green algae and plants have in common?



Figure 4 The similarities between a modern green alga (left) and plants, such as ferns (right), suggest that both may have originated from an ancient species of green algae.

SECTION Review

Summary

- All plants make their own food and have cuticles, cell walls, and a two-stage life cycle.
- Plants are first classified into two groups: nonvascular plants and vascular plants. Vascular plants are further divided into seedless plants, gymnosperms, and angiosperms.
- Similarities between green algae and plants suggest they may have a common ancestor.

Using Key Terms

For each pair of terms, explain how the meanings of the terms differ.

1. *nonvascular plants* and *vascular plants*
2. *gymnosperms* and *angiosperms*

Understanding Key Ideas

3. Which of the following plants is nonvascular?
a. ferns c. gymnosperms
b. mosses d. club mosses
4. What are four characteristics that all plants share?
5. What do green algae and plants have in common?
6. Describe the plant life cycle.

Math Skills

7. A plant produced 200,000 spores and one-third as many eggs. How many eggs did the plant produce?

Critical Thinking

8. **Making Inferences** One difference between green algae and plants is that green algae do not have a cuticle. Why don't green algae have a cuticle?
9. **Applying Concepts** Imagine an environment that is very dry and receives a lot of sunlight. Water is found deep below the soil. Which of the four groups of plants could survive in this environment? Explain your answer.

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Topic: Plant Characteristics;
How Are Plants Classified?

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