SECTION 1

What Is a Plant?

Key Concept Most plants perform photosynthesis, reproduce, and share some physical characteristics.

What You Will Learn

- All plants share four main characteristics.
- Photosynthesis is a process that occurs in the chloroplasts of plant cells.
- Plant cells have some structures that animal cells do not have.
- Plants reproduce sexually and asexually.

Why It Matters

Plants supply most of the oxygen on Earth and use energy from the sun to make food.

Vocabulary

- nonvascular plant
- vascular plant
- gymnosperm
- angiosperm

READING STRATEGY

Brainstorming The main idea of this section is that all plants share certain characteristics and can be classified in groups. Brainstorm words and phrases related to the characteristics and classification of plants. Record your work in your **Science Journal.**

7.1.b Students know the characteristics that distinguish plant cells from animal cells, including chloroplasts and cell walls.
7.1.d Students know that mitochondria liberate energy for the work that cells do and that chloroplasts capture sunlight energy for photosynthesis.
7.5.a Students know plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism.

Imagine spending a day without plants. It would be impossible to make bread and most other foods. Almost all food is made from plants or from animals that eat plants!

Plant Characteristics

Plants come in many different shapes and sizes. So, what do cactuses, water lilies, ferns, redwoods, and all other plants have in common? Almost all plants share certain characteristics.

Cuticles

Most plants live on 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. Plant cuticles vary in thickness depending on where the plants live. Plants that live in dry climates have thicker cuticles than plants that live in more humid climates do.

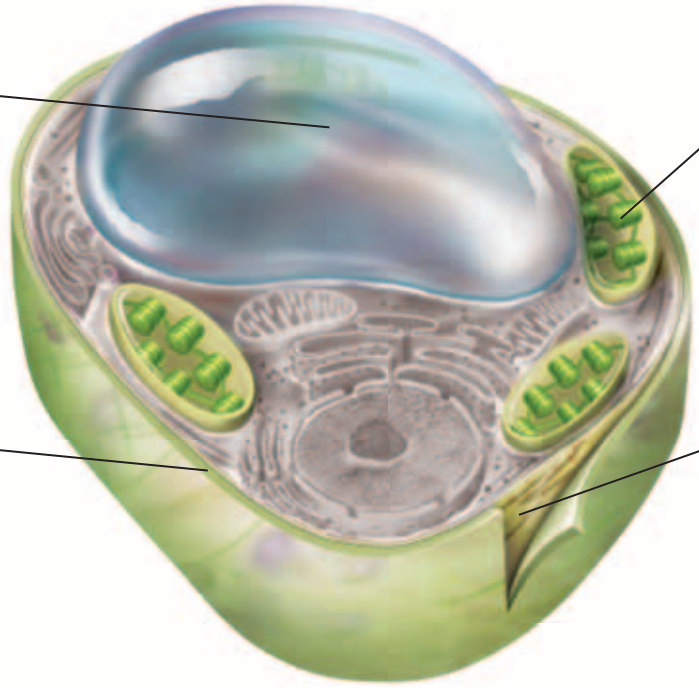
Photosynthesis

Look at **Figure 1.** Do you know why this plant is green? Plant cells contain chlorophyll. *Chlorophyll* is a green pigment that captures energy from sunlight. Chlorophyll is found in chloroplasts. Chloroplasts are organelles that are found only in plant cells and some protist cells. Animal cells do not have chloroplasts. Chloroplasts capture energy from sunlight to make food from carbon dioxide and water. This process is called *photosynthesis*. Because plants make their own food, they are called *producers*.

Standards Check **List an organelle that only plant cells have, and describe its role in a plant cell.** **7.1.b, 7.1.d**

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

Figure 2 Some Structures of a Photosynthetic 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 **Figure 2** shows. Carbohydrates and other materials 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 (SPOH ruh 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, some spores may 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. For a new plant to be produced, a sperm must fertilize an egg. This type of reproduction is called sexual reproduction. The fertilized egg will eventually grow into a sporophyte, and the cycle will begin again. During the sporophyte and gametophyte stages, the plant can be very different sizes.Most plants are also able to reproduce asexually.

Quick Lab

Cell Walls and Wilting

7.1.b

The vacuole and cell wall in plant cells work together to provide a plant with structure. Try this activity to find out how!

1. Take a **small piece of old celery,** and place it in a **beaker** with **colored water.**
2. Record the amount of water in the beaker.
3. Leave the setup overnight.
4. Describe any changes that occurred to the celery and to the volume of the water.
5. Describe how the structure of the plant cell is responsible for the change that you observed.

15 min plus follow-up

Plant Classification

Plants 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

nonvascular plant (nahn VAHS kyuh luhr PLANT) a plant that lacks specialized conducting tissues and true roots, stems, and leaves

Mosses, liverworts, and hornworts are nonvascular plants. A **nonvascular plant** is a plant that does not 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

vascular plant (VAHS kyuh luhr PLANT) a plant that has specialized tissues that conduct materials from one part of the plant to another

gymnosperm (JIM noh SPUHRM) a woody, vascular seed plant whose seeds are not enclosed by an ovary or fruit

Wordwise The root *gymn-* means "naked." The root *-sperm* means "seed."

angiosperm (AN jee oh SPUHRM) a flowering plant that produces seeds within a fruit

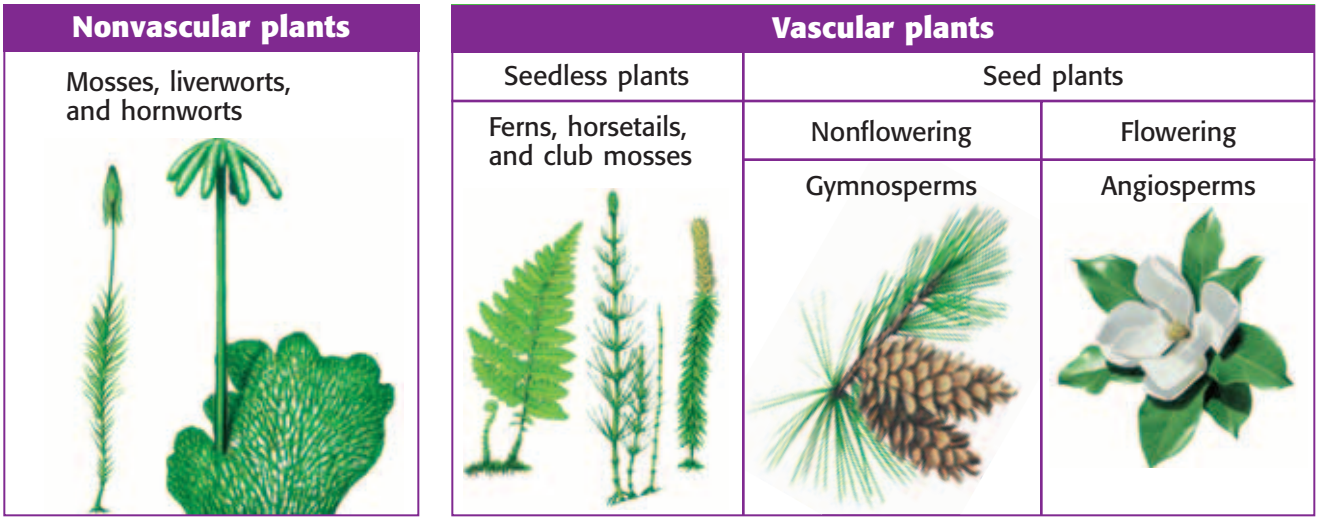
Wordwise The root *angi-* means "vessel."

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 and nutrients 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.** Flowering seed plants are called **angiosperms.** The four main groups of plants are shown in **Figure 3.**

Standards Check **What is vascular tissue?** 7.5.a

Figure 3 The Main Groups of Plants



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?

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 the green alga is not a plant.

Green algae lack structures that are present in some plants, such as specialized tissues. But 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. Also, green algae have a two-stage life cycle. Because of these similarities, most scientists think that green algae and plants share a common ancestor.

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**

7.1.b, 7.1.d, 7.5.a

Summary

- All plants make their own food and have cuticles, cells 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 that they have a common ancestor.

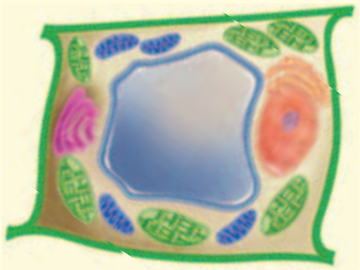
Understanding Concepts

1. **Listing** What are four characteristics that all plants share?
2. **Comparing** What is the relationship between chlorophyll and chloroplasts?
3. **Analyzing** Describe the plant life cycle.

Critical Thinking

4. **Making Inferences** One difference between plant cells and animal cells is that animal cells lack cell walls. What is the function of the cell wall?
5. **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.

INTERPRETING GRAPHICS Use the diagram below to answer the next question.



6. **Identifying Relationships** Which structures in the cell above are found only in plant cells? What do each of these structures do in the cell?

Internet Resources

For a variety of links related to this chapter, go to www.scilinks.org

Topic: Plant Characteristics; How Are Plants Classified?

SciLinks code: HY71158; HY70763