CHAPTER 1 Plant Characteristics!

- Identify common traits of plants.

What are Plants?

Plants are multicellular eukaryotic organisms with cell wallscellulosechloroplasts

How Do Plants Obtain Food?

Almost all plants make food by **photosynthesis**. Only about 1 percent of the estimated 300,000 species of plants have lost the ability to photosynthesize. These other species are consumers, many of them predators. How do plants prey on other organisms? The Venus fly trap in **Figure** 1.1 shows one way this occurs.

FIGURE 1.1

Venus fly trap plants use their flowers to trap insects. The flowers secrete enzymes that digest the insects, and then they absorb the resulting nutrient molecules.

What Do Plants Need?

Plants need temperatures above freezing while they are actively growing and photosynthesizing. They also need sunlight, carbon dioxide, and water for photosynthesis. Like most other organisms, plants need oxygen for cellular respiration and minerals to build proteins and other organic molecules. Most plants support themselves above the ground with stiff stems in order to get light, carbon dioxide, and oxygen. Most plants also grow roots down into the soil to absorb water and minerals. And, of course, we need the energy stored in plants through photosynthesis to survive. Life as we know it would not be possible without plants.

Vocabulary

- **cellulose**: Carbohydrate component of cell walls; characteristic of eukaryotic cell walls.

- **cell wall**: Rigid layer that surrounds the plasma membrane of a plant cell; helps support and protect the cell; also characteristic of many prokaryotes.
- **chloroplast**: Organelle in the cells of plants and algae; site of photosynthesis.
- **photosynthesis**: Process of using the energy in sunlight to make food (glucose).

Summary

- Plants are multicellular eukaryotes. They have organelles called chloroplasts and cell walls made of cellulose.
- Plants also have specialized reproductive organs.
- Almost all plants make food by photosynthesis.
- Life as we know it would not be possible without plants.

CHAPTER 2 Importance of Plants

- Explain the importance of plants.

The Importance of Plants

The importance of plants to humans and just about all other life on Earth is staggering. Life as we know it would not be possible without plants. Why are plants so important?

- Plants supply food to nearly all terrestrial organisms, including humans. We eat either plants or other organisms that eat plants.
- Plants maintain the atmosphere. They produce oxygen and absorb carbon dioxide during **photosynthesis**. Oxygen is essential for cellular respiration for all aerobic organisms. It also maintains the ozone layer that helps protect Earth's life from damaging UV radiation. Removal of carbon dioxide from the atmosphere reduces the greenhouse effect and global warming.
- Plants recycle matter in biogeochemical cycles. For example, through **transpiration**, plants move enormous amounts of water from the soil to the atmosphere. Plants such as peas host bacteria that fix nitrogen. This makes nitrogen available to all plants, which pass it on to consumers.
- Plants provide many products for human use, such as firewood, timber, fibers, medicines, dyes, pesticides, oils, and rubber.
- Plants create habitats for many organisms. A single tree may provide food and shelter to many species of insects, worms, small mammals, birds, and reptiles (see **Figure** 2.1).

FIGURE 2.1

Red-eyed tree frogs like this one live in banana trees.

Vocabulary

- **photosynthesis**: Process of using the energy in sunlight to make food (glucose).
- **pollen**: Tiny grains that bear the male gametes of seed plants and transfer sperm to female reproductive structures.
- **transpiration**: Process in which plants give off water vapor from photosynthesis through tiny pores, called stomata, in their leaves.
- **weed**: Plant that grows in unwanted places.

Summary

- Life as we know it would not be possible without plants.

CHAPTER 3 Plant Adaptations

- Explain how plants have adapted to a diversity of environments.

Look closely at the petals of this flower. Do they look different?

This flower is from an aloe plant. Aloes are succulent plants, which have adaptations that allow them to store water in their enlarged fleshy leaves, stems, or roots. This allows them to survive in arid environments.

Plant Adaptations

Plants live just about everywhere on Earth. To live in so many different habitats, they have evolved adaptations that allow them to survive and reproduce under a diversity of conditions.

All plants are adapted to live on land. Or are they? All living plants today have terrestrial ancestors, but some plants now live in the water. They have had to evolve new adaptations for their watery habitat.

Adaptations to Water

Aquatic plants are plants that live in water. Living in water has certain advantages for plants. One advantage is, well, the wa

Therefore, most aquatic plants do not need adaptations for absorbing, transporting, and conserving water. They can save energy and matter by not growing extensive root systems, vascular tissues, or thick cuticles on leaves. Support is also less of a problem because of the buoyancy of water.

As a result, adaptations such as strong woody stems and deep anchoring roots are not necessary for most aquatic plants.

Living in water does present challenges to plants, however. For one thing, pollination by wind or animals isn't feasible under water, so aquatic plants may have adaptations that help them keep their flowers above water . For instance, water lilies have bowl-shaped flowers and broad, flat leaves that float. This allows the lilies to collect the maximum amount of sunlight, which does not penetrate very deeply below the water's surface. Plants that live in moving water, such as streams and rivers, may have different adaptations. For example, cattails have narrow, strap-like leaves that reduce their resistance to the moving water (see **Figure** 3.1).

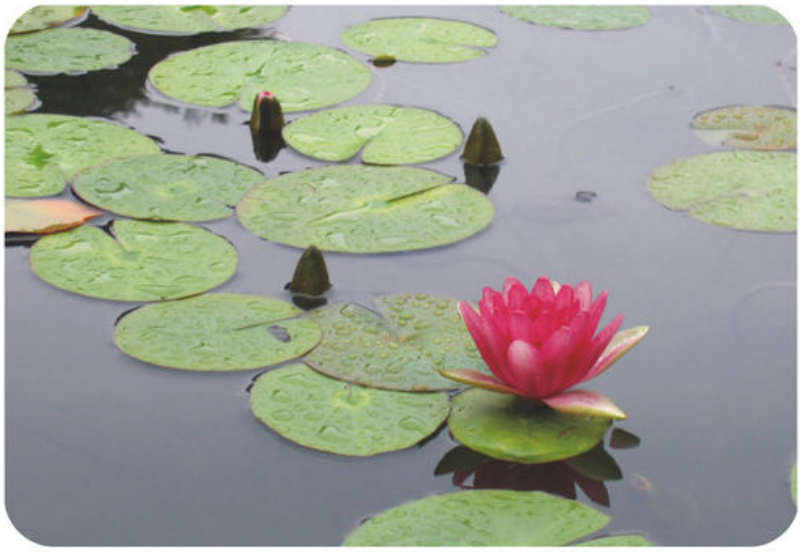
Adaptations to Extreme Dryness

Plants that live in extremely dry environments have the opposite problem: how to get and keep water. Plants that are adapted to very dry environments are called **xerophytes**. Their adaptations may help them increase water intake, decrease

The saguaro cactus pictured in **Figure** below has adapted in all three ways. When it was still a very small plant, just a few inches high, its shallow roots already reached out as much as 2 meters (7 feet) from the base of the stem. By now, its root system is much more widespread . It allows the cactus to gather as much moisture as possible from rare rainfalls. The saguaro doesn't have any leaves to lose water by transpiration. It also has a large, barrel-shaped stem that might try to get at the water inside.

Vocabulary

- **epiphyte**: Plant that is adapted to grow on other plants and obtain moisture from the air.
- **xerophyte**: Plant that is adapted to a very dry environment.



Water Lilies

Cattails

FIGURE 3.1

Water lilies and cattails have different adaptations for life in the water. Compare the leaves of the two kinds of plants. How do the leaves help the plants adapt to their watery habitats?

Summary

- Plants live just about everywhere on Earth, so they have evolved adaptations that allow them to survive and reproduce under a diversity of conditions.
- Various plants have evolved adaptations to live in the water, in very dry environments, or in the air as epiphytes.

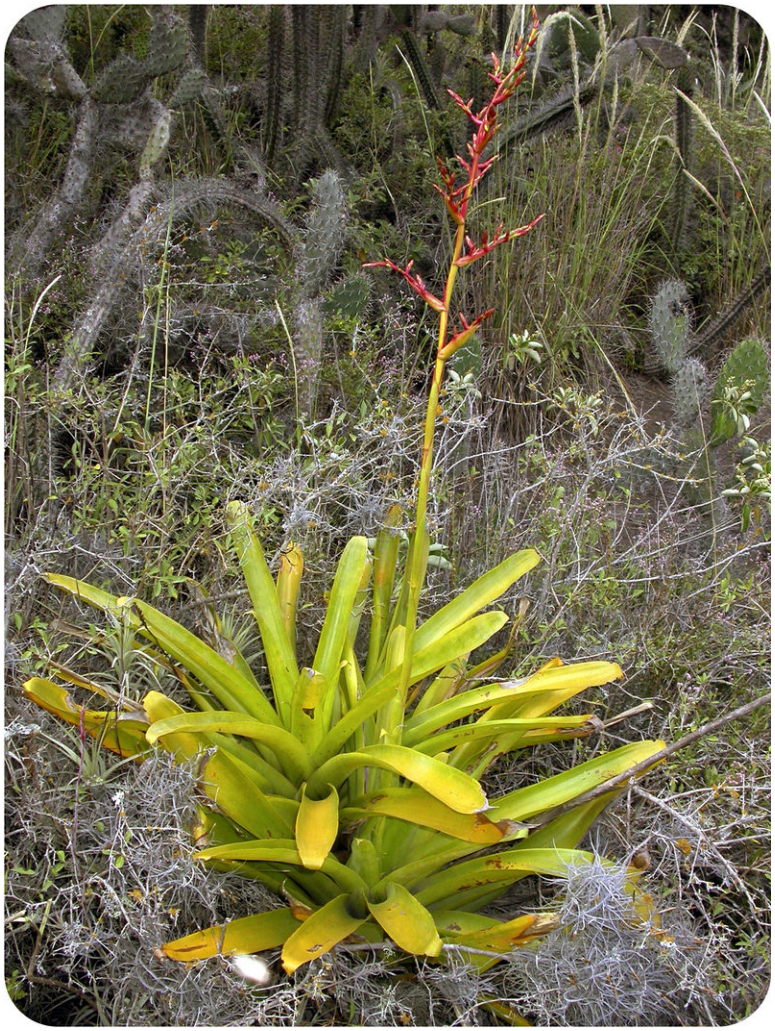


FIGURE 3.2

The leaves of this bromeliad are specialized to collect, store, and absorb rainwater.

CHAPTER 4 Plant Tissues

- Compare and contrast different types of plant tissues.

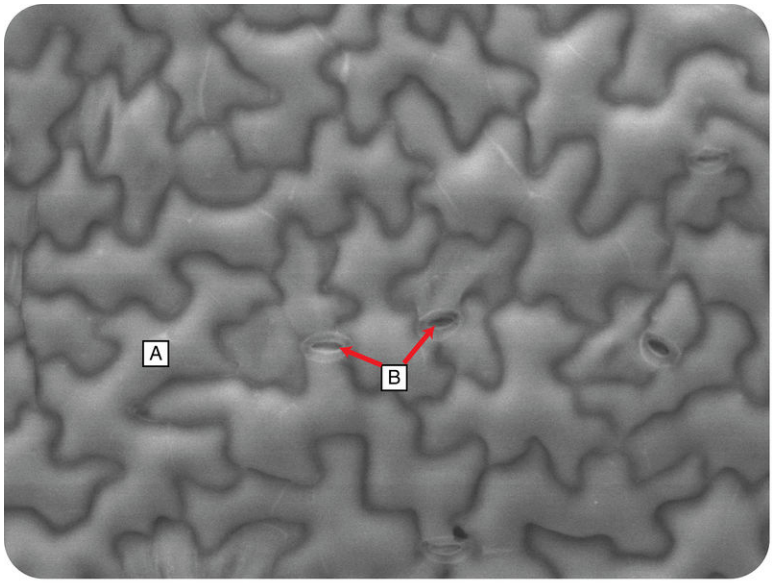
Plant Tissues

As for all animals, your body is made of four types of tissue: epidermal, muscle, nerve, and connective tissues. Plants, too, are built of tissues, but not surprisingly, their very different lifestyles derive from different kinds of tissues. All three types of plant cells are found in most plant tissues. Three major types of plant tissues are dermal, ground, and vascular tissues.

Dermal Tissue

Dermal tissue covers the outside of a plant in a single layer of cells called the **epidermis**. You can think of the epidermis as the plant's skin. It mediates most of the interactions between a plant and its environment. Epidermal cells secrete a waxy substance called **cuticle**, which coats, waterproofs, and protects the above-ground parts of plants. Cuticle helps prevent water loss, abrasions, infections, and damage from toxins.

This tissue includes several types of specialized cells. Pavement cells, large, irregularly shaped parenchymal cells which lack chloroplasts, make up the majority of the epidermis. Within the epidermis, thousands of pairs of bean-shaped schlerenchymal **guard cells** swell and shrink by osmosis to open and close **stomata**, tiny pores which control the exchange of oxygen and carbon dioxide gases and the release of water vapor. The lower surfaces of some leaves contain as many as 100,000 stomata per square centimeter.



The epidermis of Arabidopsis shows both pavement cells (A) and stomata made of sclerenchymal guard cells (B), which control water loss and gas exchange.

FIGURE 4.1

The epidermis of Arabidopsis**guard cells** (B), which control water loss and gas exchange.

Ground Tissue

Ground tissue makes up much of the interior of a plant and carries out basic metabolic functions. Ground tissue in stems provides support and may store food or water. Ground tissues in roots may also store food.

Vascular Tissue

Vascular tissue runs through the ground tissue inside a plant. Your body was able to grow from a single cell to perhaps 100 trillion cells because, 21 days after fertilization, a tiny heart began to pump blood throughout your tiny self – and it hasn't stopped since. The blood it pumps carries water, oxygen and nutrients to each one of your trillions of cells, and removes CO_2 and other wastes. Of course plants don't have hearts, but they do have vessels that transport water, minerals, and nutrients through the plant. These vessels are the vascular tissue, and consist of **xylem** and **phloem**. in bundles, as shown in **Figure** 4.2.

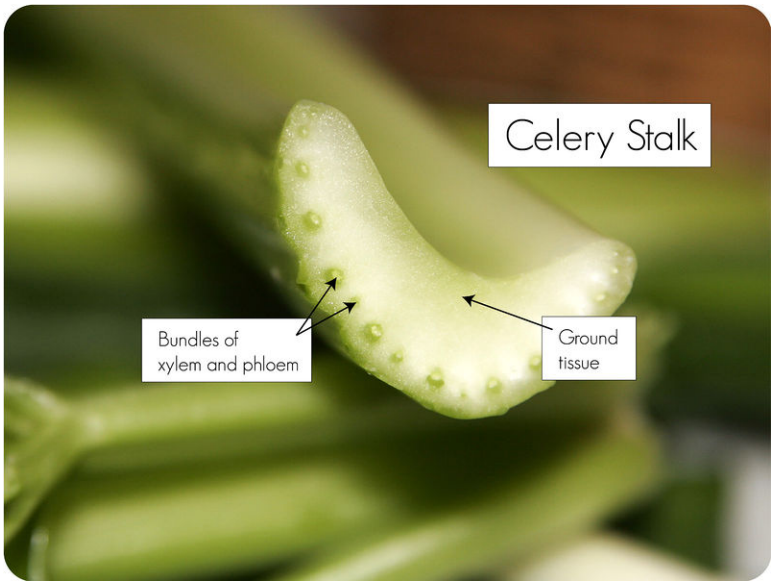


FIGURE 4.2

Bundles of xylem and phloem run through the ground tissue inside this stalk of celery. What function do these tissues serve?

Vocabulary

- **cuticle**: Waxy, waterproof substance produced by epidermal cells of leaves, shoots, and other above-ground parts of plants; prevents damage and loss of water by evaporation.
- **dermal tissue**: Type of plant tissue that covers the outside of a plant in a single layer of cells called the epidermis.
- **epidermis**: In animals, outer layer of skin that consists mainly of epithelial cells and lacks nerve endings and blood vessels; in plants, outer layer of dermal tissue.
- **ground tissue**: Type of plant tissue making up most of the interior of the roots and stems of plants; carries out basic metabolic functions and provides support and storage.
- **guard cells**: Bean-shaped schlerenchymal cells in the epidermis; swell and shrink by osmosis to open and close stomata.
- **phloem**: Type of plant vascular tissue; transports food from photosynthetic cells to other parts of the plant.
- **stomata** (singular, **stoma**): Tiny pore in the epidermis of a plant leaf that controls transpiration and gas exchange with the air.

- **vascular tissue**: Type of tissue in plants that transports fluids through the plant; includes xylem and phloem.
- **xylem**: Type of plant vascular tissue; transports water and dissolved nutrients from roots to stems and leaves.

Summary

- The three types of plant cells are found in each of the major types of plant tissues: dermal, ground, and vascular tissues.
- Dermal tissue covers the outside of a plant in a single layer of cells called the epidermis. It mediates most of the interactions between a plant and its environment.
- Ground tissue makes up most of the interior of a plant. It carries out basic metabolic functions and stores food and water.
- Vascular tissue runs through the ground tissue inside a plant. It consists of bundles of xylem and phloem, which transport fluids throughout the plant.