

Seed Plants

Think about the seed plants that you use during the day. You likely use dozens of seed plants, from the food you eat to the paper you write on.


The two groups of vascular plants that produce seeds are gymnosperms and angiosperms. Gymnosperms are trees and shrubs that do not have flowers or fruit. Angiosperms have flowers and seeds that are protected by fruit.

Characteristics of Seed Plants

As with seedless plants, the life cycle of seed plants alternates between two stages. But seed plants, such as the plant in **Figure 1**, differ from seedless plants in the following ways:

- Seed plants produce seeds. Seeds nourish and protect young sporophytes.
- Unlike the gametophytes of seedless plants, the gametophytes of seed plants do not live independently of the sporophyte. The gametophytes of seed plants are tiny. The gametophytes form within the reproductive structures of the sporophyte.
- The sperm of seedless plants need water to swim to the eggs of female gametophytes. The sperm of seed plants do not need water to reach an egg. Sperm form inside tiny structures called **pollen**. Pollen can be transported by wind or by animals.

These three characteristics of seed plants allow them to live just about anywhere. For this reason, seed plants are the most common plants on Earth today.

 **Reading Check** List three characteristics of seed plants. (See the Appendix for answers to Reading Checks.)



What You Will Learn

- Describe three ways that seed plants differ from seedless plants.
- Describe the structure of seeds.
- Compare angiosperms and gymnosperms.
- Explain the economic and environmental importance of gymnosperms and angiosperms.

Vocabulary

pollen
pollination

READING STRATEGY

Reading Organizer As you read this section, make a table comparing angiosperms and gymnosperms.

pollen the tiny granules that contain the male gametophyte of seed plants

Figure 1 Dandelion fruits, which each contain a seed, are spread by wind.

The Importance of Angiosperms

Flowering plants provide many land animals with the food they need to survive. A field mouse that eats seeds and berries is using flowering plants directly as food. An owl that eats a field mouse is using flowering plants indirectly as food.

People use flowering plants in many ways. Major food crops, such as corn, wheat, and rice, are flowering plants. Some flowering plants, such as oak trees, are used for building materials. Flowering plants, such as cotton and flax, are used to make clothing and rope. Flowering plants are also used to make medicines, rubber, and perfume oils.

 **Reading Check** How are flowering plants important to humans?

Internet Activity

For another activity related to this chapter, go to go.hrw.com and type in the keyword **HL5PL1W**.

SECTION Review

Summary

- Seeds nourish the young sporophyte of seed plants. Seed plant gametophytes rely on the sporophyte. Also, they do not need water for fertilization.
- Seeds nourish a young plant until it can make food by photosynthesis.
- Gymnosperms do not have flowers or fruits. Gymnosperm seeds are usually protected by cones. Gymnosperms are used for building materials, paper, resin, and medicines.
- Angiosperms have flowers and fruits. Angiosperms are used for food, medicines, fibers for clothing, rubber, and building materials.

Using Key Terms

1. In your own words, write a definition for each of the following terms: *pollen* and *pollination*.

Understanding Key Ideas

2. One advantage of seed plants is that
 - a. seed plants grow in few places.
 - b. they can begin photosynthesis as soon as they begin to grow.
 - c. they need water for fertilization.
 - d. young plants are nourished by food stored in the seed.
3. The gametophytes of seed plants
 - a. live independently of the sporophytes.
 - b. are very large.
 - c. are protected in the reproductive structures of the sporophyte.
 - d. None of the above
4. Describe the structure of seeds.
5. Briefly describe the four groups of gymnosperms. Which group is the largest and most economically important?
6. Compare angiosperms and gymnosperms.

Math Skills

7. More than 265,000 species of plants have been discovered. Approximately 235,000 of those species are angiosperms. What percentage of plants are NOT angiosperms?

Critical Thinking

8. **Making Inferences** In what ways are flowers and fruits adaptations that help angiosperms reproduce?
9. **Applying Concepts** An angiosperm lives in a dense rainforest, close to the ground. It receives little wind. Several herbivores live in this area of the rainforest. What are some ways the plant can ensure its seeds are carried throughout the forest?

SCILINKS.

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

Topic **Plants with Seeds**

SciLinks code: **HSM1168**

Angiosperms

Vascular plants that produce flowers and fruits are called *angiosperms*. Angiosperms are the most abundant plants today. There are at least 235,000 species of angiosperms. Angiosperms can be found in almost every land ecosystem.

Angiosperm Reproduction

Flowers help angiosperms reproduce. Some angiosperms depend on the wind for pollination. But others have flowers that attract animals. As shown in **Figure 5**, when animals visit different flowers, the animals may carry pollen from flower to flower.

Fruits surround and protect seeds. Some fruits and seeds have structures that help the wind carry them short or long distances. Other fruits attract animals that eat the fruits. The animals discard the seeds away from the plant. Some fruits, such as burrs, are carried from place to place by sticking to the fur of animals.

 **Reading Check** Why do angiosperms have flowers and fruits?

Two Kinds of Angiosperms

Angiosperms are divided into two classes—monocots and dicots. The two classes differ in the number of cotyledons, or seed leaves, their seeds have. Monocot seeds have one cotyledon. Grasses, orchids, onions, lilies, and palms are monocots. Dicot seeds have two cotyledons. Dicots include roses, cactuses, sunflowers, peanuts, and peas. Other differences between monocots and dicots are shown in **Figure 6**.



Figure 5 This bee is on its way to another squash flower, where it will leave some of the pollen it is carrying.

Figure 6 Two Classes of Angiosperms

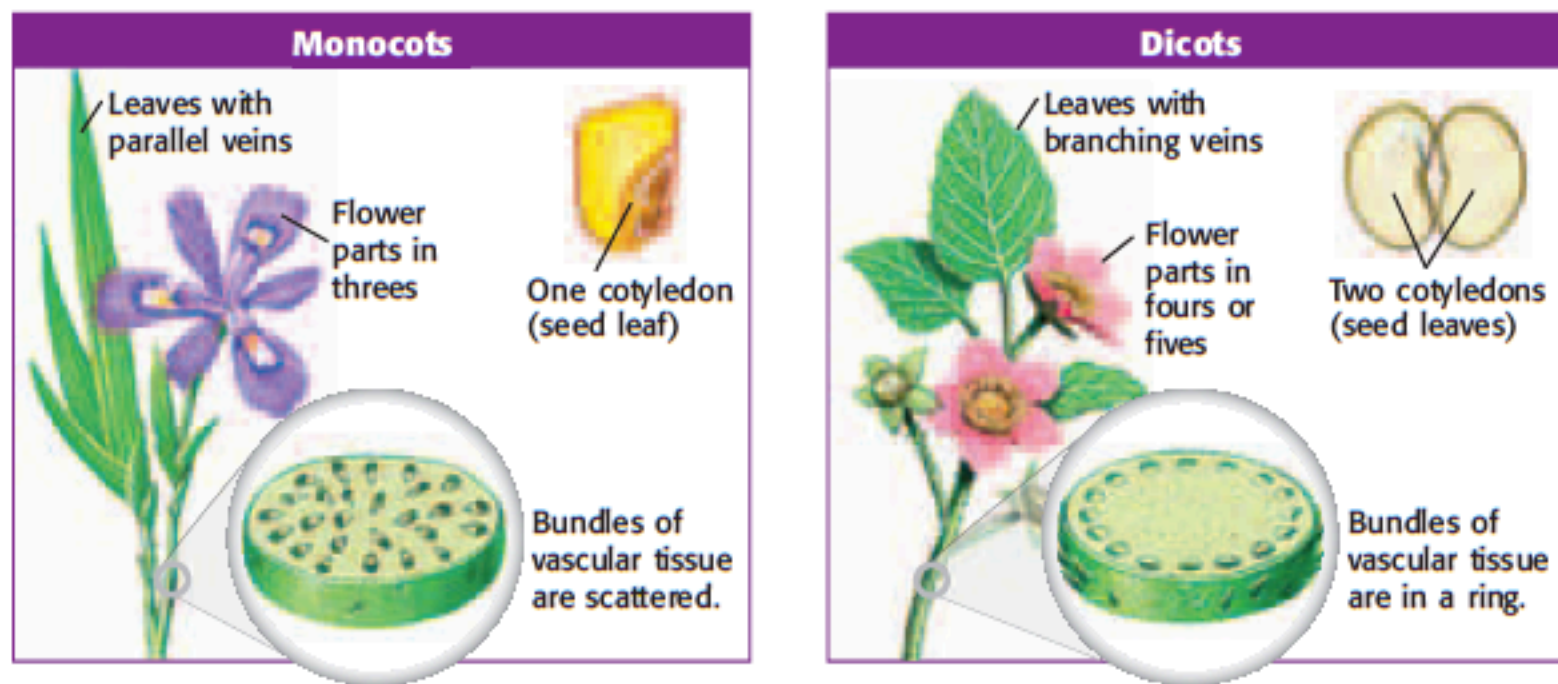
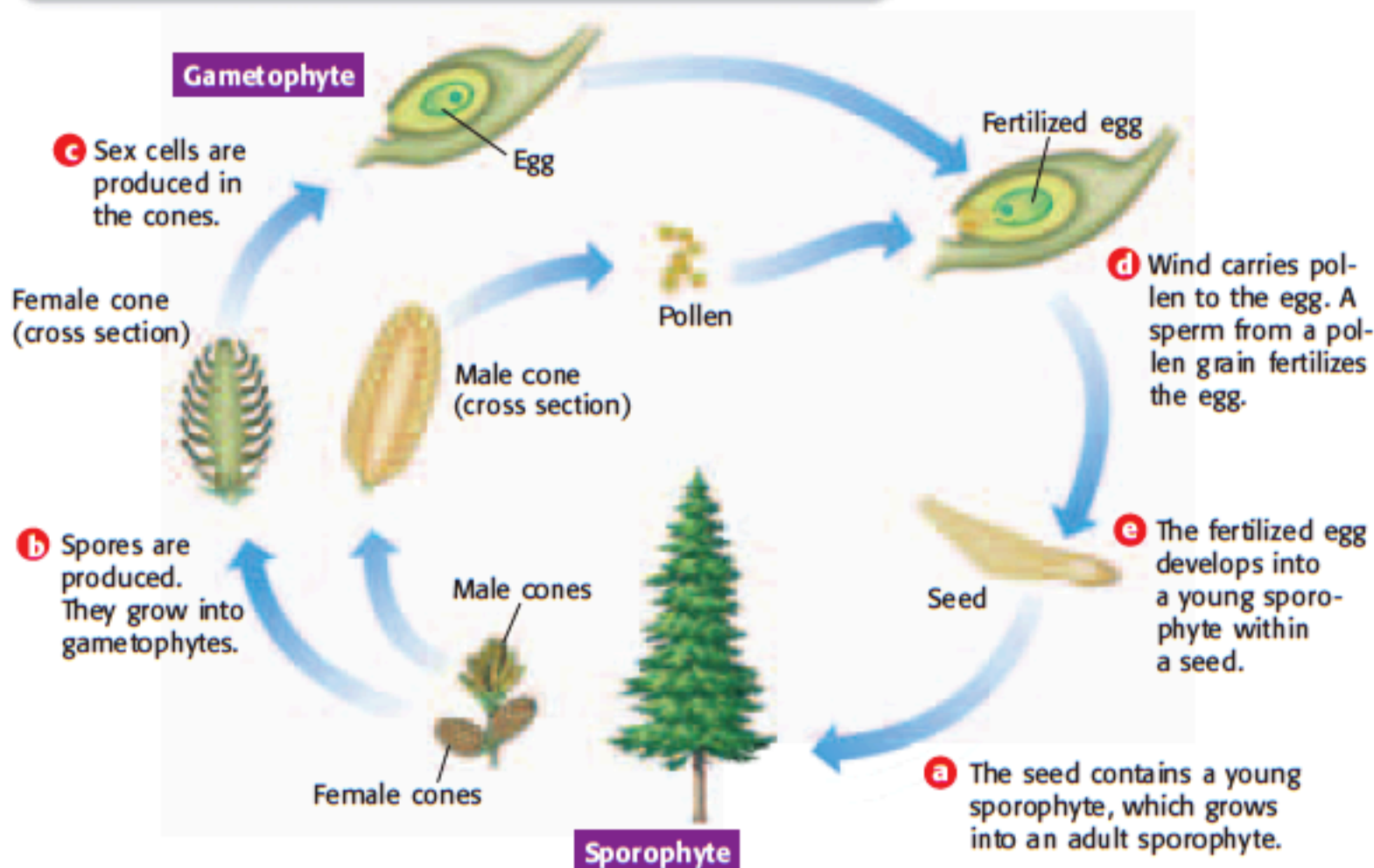


Figure 4 Pine Life Cycle



Gymnosperm Life Cycle

The gymnosperms that are most familiar to you are probably the conifers. The word *conifer* comes from two words that mean “cone-bearing.” Conifers have two kinds of cones—male cones and female cones. The spores of each kind of cone become tiny gametophytes.

The male gametophytes of gymnosperms are found in pollen. Pollen contain sperm. The female gametophytes produce eggs. Wind carries pollen from the male cones to the female cones. This transfer of pollen from the male cones to the female cones is called **pollination**. The female cones can be on the same plant. Or, they can be on a different plant of the same species.

Sperm from pollen fertilize the eggs of the female cone. A fertilized egg develops into a young sporophyte within the female cone. The sporophyte is surrounded by a seed. Eventually, the seed is released. Some cones release seeds right away. Other cones release seeds under special circumstances, such as after forest fires. If conditions are right, the seed will grow. The life cycle of a pine tree is shown in **Figure 4**.

pollination the transfer of pollen from the male reproductive structures to the female structures of seed plants

Reading Check Describe the gymnosperm life cycle.

Gymnosperms

Seed plants that do not have flowers or fruit are called *gymnosperms*. Gymnosperm seeds are usually protected by a cone. The four groups of gymnosperms are conifers, ginkgoes, cycads, and gnetophytes (NEE toh FIETS). You can see some gymnosperms in **Figure 3**.

The Importance of Gymnosperms

Conifers are the most economically important gymnosperms. People use conifer wood for building materials and paper products. Pine trees produce a sticky fluid called *resin*. Resin is used to make soap, turpentine, paint, and ink. Some conifers produce an important anticancer drug. Some gnetophytes produce anti-allergy drugs. Conifers, cycads, and ginkgoes are popular in gardens and parks.

Figure 3 Examples of Gymnosperms



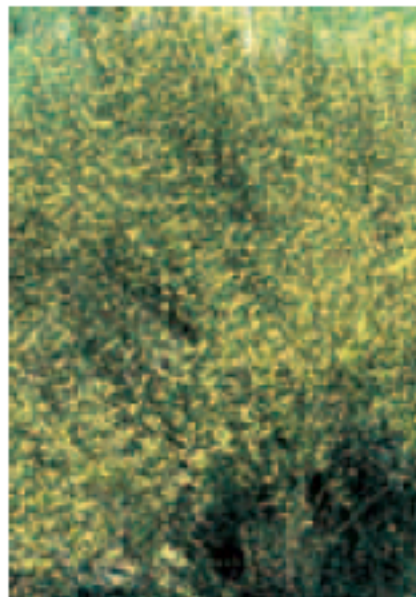
◀ **Conifers** The conifers, such as this ponderosa pine, are the largest group of gymnosperms. There are about 550 species of conifers. Most conifers are evergreens that keep their needle-shaped leaves all year. Conifer seeds develop in cones.



◀ **Ginkgoes** Today, there is only one living species of ginkgo, the ginkgo tree. Ginkgo seeds are not produced in cones. The seeds have fleshy seed coats and are attached directly to the branches of the tree.



◀ **Cycads** The cycads were more common millions of years ago. Today, there are only about 140 species of cycads. These plants grow in the Tropics. Like conifer seeds, cycad seeds develop in cones.



◀ **Gnetophytes** About 70 species of gnetophytes, such as this joint fir, exist today. Many gnetophytes are shrubs that grow in dry areas. The seeds of most gnetophytes develop in cones.

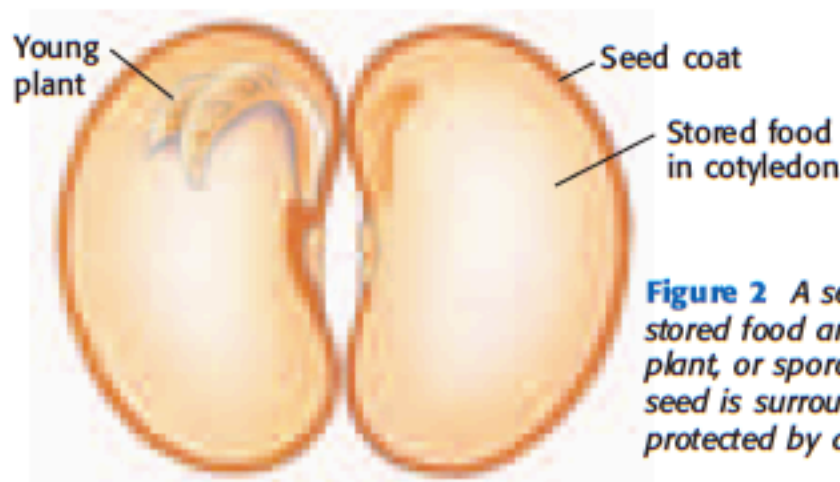


Figure 2 A seed contains stored food and a young plant, or sporophyte. A seed is surrounded and protected by a seed coat.

The Structure of Seeds

A seed forms after fertilization, when sperm and eggs are joined. A seed is made up of three parts, as shown in **Figure 2**. The first part is a young plant, or the sporophyte. The second part is stored food. It is often found in the cotyledons (KAHT uh LEED uhnz), or the seed leaves of the young plant. Finally, a seed coat surrounds and protects the young plant.

Seed plants have some advantages over seedless plants. For example, when a seed begins to grow, the young plant uses the food stored in the seed. The spores of seedless plants don't have stored food to help a new plant grow. Another advantage of seed plants is that seeds can be spread by animals. The spores of seedless plants are usually spread by wind. Animals spread seeds more efficiently than the wind spreads spores.

✓ Reading Check Describe two advantages that seed plants have over seedless plants.

CONNECTION TO Environmental Science

WRITING SKILL

Animals That Help Plants

Animals need plants to live, but some plants benefit from animals, too. These plants produce seeds with tough seed coats. An animal's digestive system can wear down these seed coats and speed the growth of a seed. Identify a plant that animals help in this way. Then, find out how being eaten by animals makes it possible for seeds to grow. Write about your findings in your science journal.

Quick Lab

Dissecting Seeds

1. Soak a lima bean seed in water overnight. Draw the seed before placing it in the water.
2. Remove the seed from the water. Draw what you see.
3. The seed will likely look wrinkly. This is the seed coat. Use a toothpick to gently remove the seed coat from the lima bean seed.
4. Gently separate the halves of the lima bean seed. Draw what you see.
5. What did you see after you split the lima bean seed in half?
6. What part of the seed do you think provides the lima bean plant with the energy to grow?