Section 1

The Characteristics of Seed Plants

Reading Preview

Key Concepts

- What three characteristics do seed plants share?
- How do seeds become new plants?
- What are the main functions of roots, stems, and leaves?

Key Terms

- phloem • xylem • pollen
- seed • embryo • cotyledon
- germination • root cap
- cambium • stomata
- transpiration

Target Reading Skill

Outlining As you read, make an outline about seed plants that you can use for review. Use the red headings for the main ideas and the blue headings for the supporting ideas.

The Characteristics of Seed Plants
I. What is a seed plant?
A. Vascular tissue
B.
II. How seeds become new plants
A.
B.

Lab zone **Discover Activity**

Which Plant Part Is It?

1. With a partner, carefully observe the items of food your teacher gives you.
2. Make a list of the food items.
3. For each food item, write the name of the plant part—root, stem, or leaf—from which you think it is obtained.

Think It Over

Classifying Classify the items into groups depending on the plant part from which the food is obtained. Compare your groupings with those of your classmates.

Have you ever planted seeds in a garden? If so, then you may remember how it seemed to take forever before those first green shoots emerged. Shortly afterwards, you saw one set of leaves, and then others. Then a flower may have appeared. Did you wonder where all those plant parts came from? How did they develop from one small seed? Read on to find out.

What Is a Seed Plant?

The plant growing in your garden was a seed plant. So are most of the other plants around you. In fact, seed plants outnumber seedless plants by more than ten to one. You eat many seed plants—rice, peas, and squash, for example. You wear clothes made from seed plants, such as cotton and flax. You may live in a home built from seed plants—oak, pine, or maple trees. In addition, seed plants produce much of the oxygen you breathe.

Seed plants share two important characteristics. They have vascular tissue, and they use pollen and seeds to reproduce. In addition, all seed plants have body plans that include roots, stems, and leaves. Like seedless plants, seed plants have complex life cycles that include the sporophyte and the gametophyte stages. In seed plants, the plants that you see are the sporophytes. The gametophytes are microscopic.

FIGURE 1
Harvesting Wild Rice
Like all seed plants, wild rice plants have vascular tissue and use seeds to reproduce. The seeds develop in shallow bodies of water, and the plants grow up above the water's surface. These men are harvesting the mature rice grains.

Vascular Tissue Most seed plants live on land. Recall from Chapter 4 that land plants face many challenges, including standing upright and supplying all their cells with food and water. Like ferns, seed plants meet these two challenges with vascular tissue. The thick walls of the cells in the vascular tissue help support the plants. In addition, food, water, and nutrients are transported throughout the plants in vascular tissue.

There are two types of vascular tissue. **Phloem** (FLOH um) is the vascular tissue through which food moves. When food is made in the leaves, it enters the phloem and travels to other parts of the plant. Water and minerals, on the other hand, travel in the vascular tissue called **xylem** (ZY lum). The roots absorb water and minerals from the soil. These materials enter the root's xylem and move upward into the stems and leaves.

Pollen and Seeds Unlike seedless plants, seed plants can live in a wide variety of environments. Recall that seedless plants need water in their surroundings for fertilization to occur. Seed plants do not need water for sperm to swim to the eggs. Instead, seed plants produce **pollen,** tiny structures that contain the cells that will later become sperm cells. Pollen delivers sperm cells directly near the eggs. After sperm cells fertilize the eggs, seeds develop. A **seed** is a structure that contains a young plant inside a protective covering. Seeds protect the young plant from drying out.

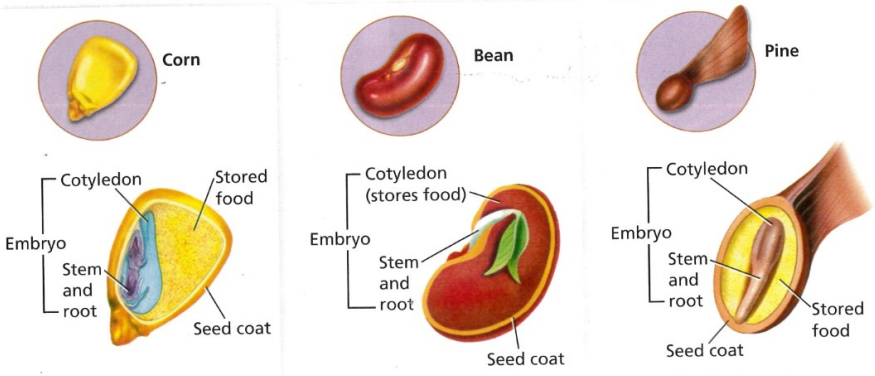
Reading Checkpoint **What material travels in phloem? What materials travel in xylem?**

FIGURE 2

Seed Structure

The structures of three different seeds are shown here.

Inferring *How is the stored food used?*



Lab zone Try This Activity

The In-Seed Story

1. Your teacher will give you a hand lens and two different seeds that have been soaked in water.
2. Carefully observe the outside of each seed. Draw what you see.
3. Gently remove the coverings of the seeds. Then carefully separate the parts of each seed. Use a hand lens to examine the inside of each seed. Draw what you see.

Observing Based on your observations, label the parts of each seed. Then describe the function of each part next to its label.

How Seeds Become New Plants

All seeds share important similarities. **Inside a seed is a partially developed plant. If a seed lands in an area where conditions are favorable, the plant sprouts out of the seed and begins to grow.**

Seed Structure A seed has three main parts—an embryo, stored food, and a seed coat. The young plant that develops from the zygote, or fertilized egg, is called the **embryo.** The embryo already has the beginnings of roots, stems, and leaves. In the seeds of most plants, the embryo stops growing when it is quite small. When the embryo begins to grow again, it uses the food stored in the seed until it can make its own food by photosynthesis. In all seeds, the embryo has one or more seed leaves, or **cotyledons** (kaht uh LEED unz). In some seeds, food is stored in the cotyledons. In others, food is stored outside the embryo. Figure 2 compares the structure of corn, bean, and pine seeds.

The outer covering of a seed is called the seed coat. Some familiar seed coats are the "skins" on lima beans and peanuts. The seed coat acts like plastic wrap, protecting the embryo and its food from drying out. This allows a seed to remain inactive for a long time. In many plants, the seeds are surrounded by a structure called a fruit, which you will learn more about in Section 3.

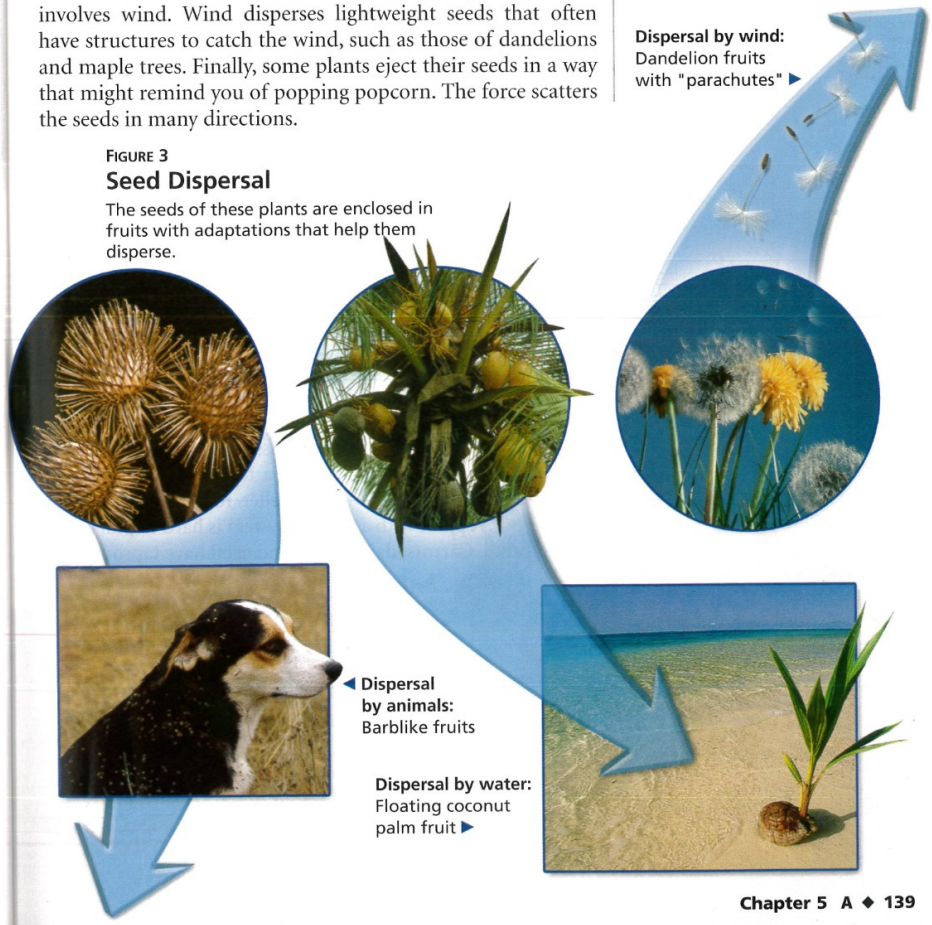
Seed Dispersal After seeds have formed, they are usually scattered, sometimes far from where they were produced. The scattering of seeds is called seed dispersal. Seeds are dispersed in many ways. One method involves other organisms. For example, some animals eat fruits, such as cherries or grapes. The seeds inside the fruits pass through the animal's digestive system and are deposited in new areas. Other seeds are enclosed in barblike structures that hook onto an animal's fur or a person's clothes. The structures then fall off the fur or clothes in a new area.

A second means of dispersal is water. Water can disperse seeds that fall into oceans and rivers. A third dispersal method involves wind. Wind disperses lightweight seeds that often have structures to catch the wind, such as those of dandelions and maple trees. Finally, some plants eject their seeds in a way that might remind you of popping popcorn. The force scatters the seeds in many directions.

FIGURE 3

Seed Dispersal

The seeds of these plants are enclosed in fruits with adaptations that help them disperse.



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Germination After a seed is dispersed, it may remain inactive for a while before it germinates. **Germination** (jur muh NAY shun) occurs when the embryo begins to grow again and pushes out of the seed. Germination begins when the seed absorbs water from the environment. Then the embryo uses its stored food to begin to grow. As shown in Figure 4, the embryo's roots first grow downward; then its stem and leaves grow upward. Once you can see a plant's leaves, the plant is called a seedling.

A seed that is dispersed far from its parent plant has a better chance of survival. When a seed does not have to compete with its parent for light, water, and nutrients, it has a better chance of becoming a seedling.

Reading Checkpoint **What must happen in order for germination to begin?**

Roots

Have you ever tried to pull a dandelion out of the soil? It's not easy, is it? That is because most roots are good anchors. Roots have three main functions. **Roots anchor a plant in the ground, absorb water and minerals from the soil, and sometimes store food.** The more root area a plant has, the more water and minerals it can absorb.

Types of Roots The two main types of root systems are shown in Figure 5. A fibrous root system consists of many similarly sized roots that form a dense, tangled mass. Plants with fibrous roots take much soil with them when you pull them out of the ground. Lawn grass, corn, and onions have fibrous root systems. In contrast, a taproot system has one long, thick main root. Many smaller roots branch off the main root. A plant with a taproot system is hard to pull out of the ground. Carrots, dandelions, and cacti have taproots.

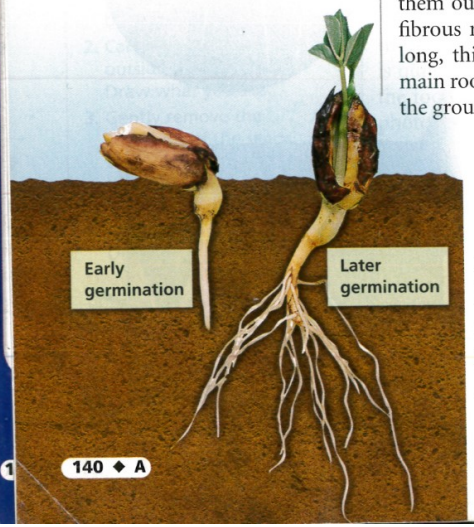

FIGURE 4
Germination
The embryo in this peanut seed uses its stored food to germinate. First, the embryo's roots grow downward. Then, its stem and leaves begin to grow upward.

The Structure of a Root In Figure 5, you can see the structure of a typical root. Notice that the tip of the root is rounded and is covered by a structure called the root cap. The **root cap** protects the root from injury from rocks as the root grows through the soil. Behind the root cap are the cells that divide to form new root cells.

Root hairs grow out of the root's surface. These tiny hairs can enter the spaces between soil particles, where they absorb water and minerals. By increasing the surface area of the root that touches the soil, root hairs help the plant absorb large amounts of substances. The root hairs also help to anchor the plant in the soil.

Locate the vascular tissue in the center of the root. The water and nutrients that are absorbed from the soil quickly move into the xylem. From there, these substances are transported upward to the plant's stems and leaves.

Phloem transports food manufactured in the leaves to the root. The root tissues may then use the food for growth or store it for future use by the plant.

Reading Checkpoint **What is a root cap?**

FIGURE 5
Root Structure
Some plants have fibrous roots while others have taproots. A root's structure is adapted for absorbing water and minerals from the soil.
Relating Cause and Effect *How do root hairs help absorb water and minerals?*