

SECTION 3 **Plant Development and Responses**



California Science Standards

7.1.f, 7.5.a

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- What happens as plants develop?
- How do hormones affect plants?
- How do plants respond to the environment?

STUDY TIP

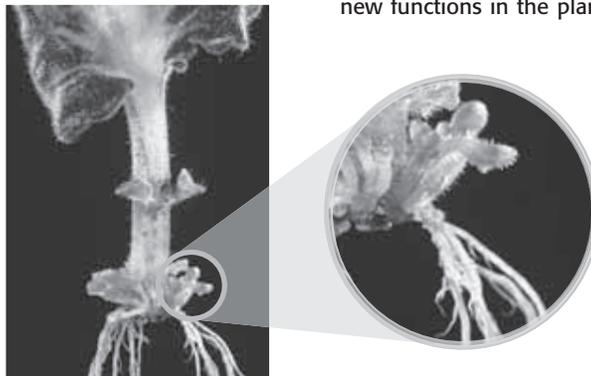
List As you read, list the different stimuli a plant responds to and describe the plant's response.

What Happens As Plants Grow and Develop?

Plants and animals both grow and develop. However, plants develop differently than animals do. For example, as a baby bird develops, its cells *differentiate*, or become specialized to do a job. The bird's cells will differentiate only once. The cells of some plants, however, differentiate many times as the plant develops.

Imagine if you could grow another person from one organ, such as a heart. Humans cannot do this, of course, but some plants can grow a new plant this way. Some leaf cells can differentiate into cells that become roots and stems. This is a form of asexual reproduction.

The cells in this African violet leaf are differentiating. The differentiating cells will have new functions in the plant.



TAKE A LOOK

1. Identify What organs will be formed from these differentiated cells?

READING CHECK

2. Define What is a stimulus?

WHEN PLANT CELLS DIFFERENTIATE

Plants grow and develop in response to stimuli. A **stimulus** (plural, *stimuli*) is anything that causes a reaction or change in an organism. Hot weather, for example, is a stimulus that your body may respond to by sweating. Many of a plant's responses to stimuli are caused by hormones. ✓

SECTION 3 Plant Development and Responses *continued*

What Is a Hormone?

What would happen if a plant could not respond to changes in its environment? The plant would probably die. A plant must respond to change so that it can still get the resources it needs to survive and reproduce.

A *hormone* is a chemical in a plant that causes cells to react in certain ways. Plants make hormones in response to the environment. For example, a change in the amount of available light causes a plant to make hormones called *auxins*. These hormones cause the plant's cells to grow differently so that they can get as much light as possible.

HORMONE EFFECTS ON PLANT LIFE CYCLES

Hormones play important roles in each stage of a plant's life cycle. Hormones allow the plant to develop when conditions are favorable, such as in rainy, warm weather. For example, some hormones keep seeds dormant, or inactive. Other hormones end dormancy and cause the seed to grow. Another hormone causes roots and stems to grow.

HORMONE USES IN AGRICULTURE

Plants make their own hormones. For example, *ethylene* is a hormone that causes fruits to ripen. However, humans often add hormones to plants to make fruits grow larger or to make fruits ripen sooner. Some fruits, such as bananas, are picked before they are ripe so that they can be shipped. Ethylene can be used to ripen these plants later.



Critical Thinking

3. Apply Concepts It is important for a plant to make a hormone that keeps its seeds dormant. What do you think is the reason?

TAKE A LOOK

4. Explain Which of these bunches of grapes do you think was treated with a hormone? Explain.

SECTION 3 Plant Development and Responses *continued*

How Do Plants Respond to the Environment?

What happens when you get cold? Do you shiver? Do your teeth chatter? These are your responses to an environmental stimulus such as cold air. Plants also respond to environmental stimuli, but not to the same ones we do and not in the same way. Plants respond to stimuli such as light and the pull of gravity.

Some plants respond to a stimulus, such as light, by growing in a particular direction. Growth in response to a stimulus is called a **tropism**. A tropism is either positive or negative. Plant growth toward a stimulus is a positive tropism. Plant growth away from a stimulus is a negative tropism. ✓

READING CHECK

5. Define What is a tropism?

PLANT GROWTH IN RESPONSE TO LIGHT

Recall that plants need sunlight in order to make food. What would happen to a plant that could get light from only one direction, such as through a window? To get as much light as possible, it would need to grow toward the light.

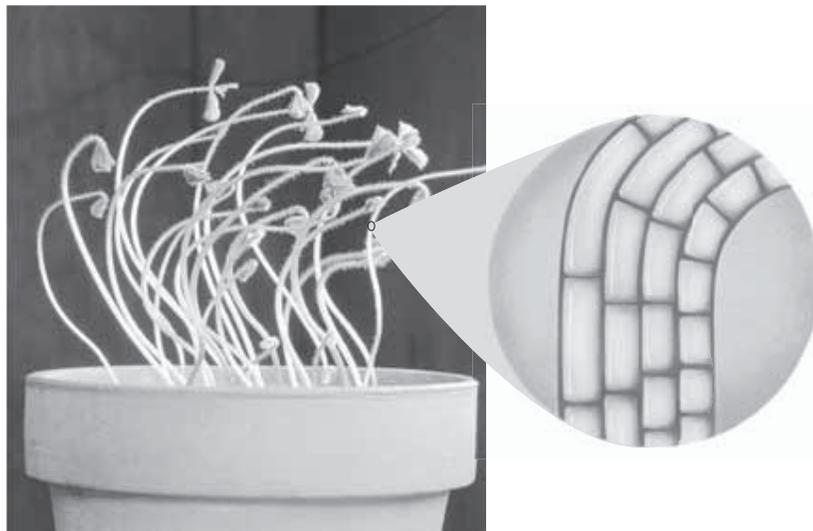
A plant will respond to low light levels by making auxins. These hormones build up on the shaded side of the shoot. They cause cells in the shade to grow longer than the cells facing the light. The plant stem bends because its cells are different sizes. This growth in response to light is called *phototropism*. Auxins also cause plants to grow in response to gravity.

Math Focus

6. Calculate Suppose a plant bends toward light at a rate of 0.3° per minute. In how many hours will the plant bend 90° ?

TAKE A LOOK

7. Explain Place an **X** on the picture to show where the light must be coming from. Explain your answer.



SECTION 3 Plant Development and Responses *continued*

PLANT GROWTH IN RESPONSE TO GRAVITY

Gravity can change the direction in which a plant’s roots and shoots grow. Most shoot tips grow upward, away from the center of Earth. Most root tips grow downward, toward the center of Earth. If a plant is placed on its side or turned upside down, the roots and shoots will change direction. Shoots will turn to grow away from the Earth. Roots will turn to grow toward the Earth. This response is called *gravitropism*.

Gravitropism

To grow away from the pull of gravity, this plant has grown upward.



TAKE A LOOK

8. Apply Concepts Look at the plant on the left. Draw an arrow on the flower pot to show the direction the roots are probably growing.

9. Explain Look at the plant on the right. What do you think made its stem bend?

What Happens to Plants When Seasons Change?

Have you ever noticed that some plants will drop their leaves in the fall even before the weather turns cool? How do the plants know that fall is coming? We often notice the changing seasons because the temperature changes. Plants, however, respond to change in the length of the day.

SHORT DAY AND LONG DAY PLANTS

Days are longer in summer and shorter in winter. The change in amount of daylight is a stimulus for many plants. Some plants that bloom in winter, such as poinsettias, need shorter periods of daylight to reproduce. They are called *short-day plants*. Others, such as clover, reproduce in spring or summer. They are called *long-day plants*.

Math Focus

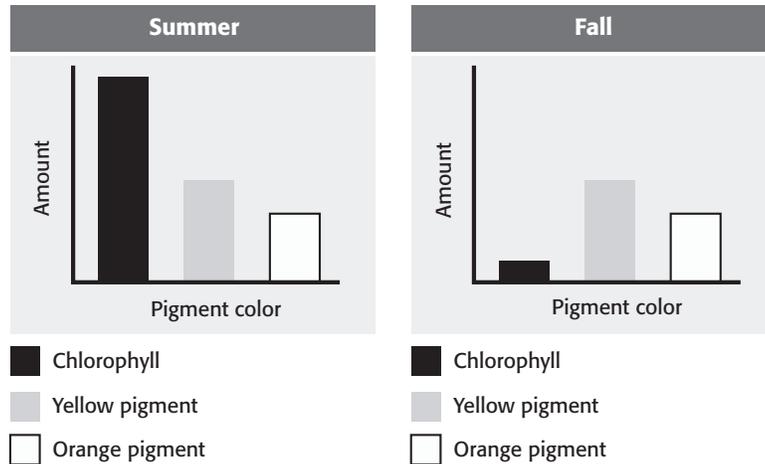
10. Calculate It must be dark for 70% of a 24-hour period before a certain plant will bloom. How many hours of daylight does this plant need to bloom?

SECTION 3 Plant Development and Responses *continued*

EFFECT OF SEASONS ON LEAF COLOR

The leaves of some trees may change color as seasons change. As the days shorten in fall, the chlorophyll in leaves breaks down. This makes the orange and yellow pigments in the leaves easier to see. During the summer, chlorophyll hides other pigments.

Amount of Leaf Pigment Based on Season



TAKE A LOOK

11. Identify Which pigment's level decreases between summer and fall?

12. Identify Which pigments' levels stay the same between summer and fall?

LOSS OF LEAVES

Every tree loses leaves throughout its life. Leaves are shed when they become old. For example, pine trees lose some of their leaves year-round. Because leaves are lost and replaced throughout the year, the tree always has some leaves. These trees are called *evergreen*. A leaf of an evergreen tree is covered with a thick cuticle. The cuticle protects the leaf from cold and dry weather.

Deciduous trees lose all of their leaves at about the same time each year. This generally happens as days shorten. The loss of leaves helps these plants survive cold or dry weather. In colder areas, deciduous trees usually lose their leaves before winter begins. In areas that have wet and dry seasons, deciduous trees lose their leaves before the dry season.

 **Say It**

Describe What is your favorite kind of tree? Use the Internet or reference books to find out if that tree is evergreen or deciduous. Describe to the class what the tree looks like and where it lives.

Section 3 Review

SECTION VOCABULARY

stimulus anything that causes a reaction or change in an organism or any part of an organism

tropism growth of all or part of an organism in response to an external stimulus, such as light

Wordwise The root *trop* means "to turn."

1. Compare How is cell differentiation different in plants and animals?

2. Compare What is the difference between a negative tropism and a positive tropism?

3. Explain What happens when a plant gets light from only one direction?

4. Explain Why do leaves look green during the summer even though they have orange and yellow pigments?

5. Explain Many evergreen trees live in areas with long, cold winters. How can they keep their leaves all year?
