Plant Responses to External Stimuli

Most plants are rooted in place. However, they can still respond to external stimuli in a variety of ways that promote survival. One type of behavioral response in plants is **tropism**, a directed growth or movement in response to a stimulus. Tropism can be **positive tropism** towards the stimulus. Tropism can also be **negative tropism**, a directed growth or movement away from the stimulus.

Plants may respond to the following external stimuli:

- **Light**: Plants rely on **photosynthesis** to convert light energy into chemical energy. Plants often grow towards a light source. This behavioral response is called **positive phototropism**. Some plants actually move to follow the Sun as it travels through the sky each day. The turning response to follow the sun is called **heliotropism**. This allows the plant to maximize its exposure to light energy.

- **Gravity**: Geotropism (**Gravitropism**) is the growth of a plant in a particular direction in response to gravity. Roots grow downward (positive) in response to gravity. This is an important behavior that helps plants grow roots into the soil where they can soak up water and nutrients needed for the plant to survive.

Look at the images below. Which type of behavioral response is **best** illustrated in each image?

![Image 1](image1.png)

![Image 2](image2.png)

**look out!**

Plants respond to touch by changing their growth patterns. However, plants do not have a nervous system like animals. Instead, they coordinate their behavioral responses using plant hormones that travel inside the plant.
PLANT EXTERNAL AND INTERNAL

Plant Responses to Internal Stimuli

All organisms have internal communication pathways to help them maintain homeostasis. Plants need water and nutrients to grow. If water is lacking, the plant may wilt in response. If nutrients are missing from the plant’s environment, its growth might be stunted. These are examples of biological responses.

As with responses to external stimuli, plants rely on hormones to send signals within the plant in order to respond to internal stimuli. For example, some hormones signal a plant to expand its root system in response to lack of water or nutrients.

Up Goes the Water

Water is very important to plants. Plants need water to produce food and grow. Plants make their own food through a complex, sunlight-powered process called photosynthesis. Simply put, in photosynthesis, water absorbed by a plant’s roots and carbon dioxide taken from the air by a plant’s leaves combine to make the plant’s food.

Water helps transport nutrients throughout all parts of the plant. Water also helps support the plant by filling up the cells that make up the plant so it can stand up straight.

Water is absorbed from the soil into the roots of a plant. However, to reach the leaves where photosynthesis takes place, water must move upward to the top of the plant. Water travels through long, thin tubes running up from the roots through the stems and leaves called xylem.

Water moves up the xylem through a process called capillary action. Capillary action allows water to be pulled through the thin tubes because the molecules of the water are attracted to the molecules that make up the tube. The water molecules at the top are pulled up the tube and the water molecules below them are pulled along because of their attraction to the water molecules above them. A sponge also absorbs water through capillary action. The sponge is filled with thin spaces that act like thin tubes.

When plants have more water in their leaves than they need, they get rid of this extra water through a process called transpiration. During transpiration, water evaporates from holes in the surfaces of leaves into the air. As water molecules evaporate from plant leaves, they attract the water molecules still in the plant, helping to pull water up through the stems from the roots. The combination of transpiration and capillary action delivers the water from the bottom to the top of a plant.
Stomata and The Guard Cells

The underside of plant leaves has pore-like openings called stomata. Stomata allow gases to enter and exit a plant leaf. Two cells surround each stomata. These cells are called guard cells. Guard cells open and close a stoma.

Guard cells keep stoma open to allow carbon dioxide and oxygen to enter and exit a leaf. Guard cells keep stoma open just enough to allow photosynthesis to take place. Guard cells close stoma to prevent water loss. Water loss from leaves is called transpiration. Guard cell close stoma when it is hot and dry. They also close stoma at night when photosynthesis cannot take place.

The opening and closing of stomata is an example of a negative feedback mechanism. Guard cells respond to water pressure in the leaf. High water pressure causes the guard cells to keep the stomata open. When water pressure is low, the leaf is losing water. The guard cells close stomata in response to low water pressure.