Curriculum Connections

Investigating Plant Tropisms

The garden structures described in this issue provide a multitude of opportunities for discovering how plants grow and respond to stimuli in the environment. A response to stimuli by plants is called a tropism, which comes from the Greek word meaning “turn.” Plant tropisms that are easy to observe in the garden include heliotropism (response to the sun), geo- or gravitropism (response to gravity) and thigmatropism (response to touch.)

Before introducing these terms to your students, take them exploring in the garden to observe the ways plants grow. Ask them, *Which plants in the garden climb? Do they wind clockwise or counterclockwise? Which ones creep across the ground? Which grow upright?* Dig some weeds to observe what the roots look like. *Do they grow straight or crooked? What directions do they go in?* Observe flowers at different times of the day and note how they respond to sunlight. *Are some open in the morning but not in the evening? Do some plants lift off of the soil as it warms up during the day?* Have students note their ideas and questions in their garden journals for further investigation. They will likely have many good questions about what makes plants grow the way they do. You can help them answer some of their questions by conducting the following experiments with your garden structures.

Thigmatropism

Different parts of plants can respond to touch. Some leaves, like those of the sensitive plant (*Mimosa pudica*) will close when you touch them. Roots use touch sensitivity to find their way downward through the soil, moving away from objects like stones in their path. This is called negative thigmatropism, since they move away from the object that touches them. Climbing vines with tendrils actually reach out and grow toward the touch of a pole or string, their tendrils eventually coiling around the object and using it as a support to grow on. This is called positive thigmatropism. The coiling is caused by the sides of the tendril growing at different rates.

After observing the climbing plants on your garden structures, try this experiment with your students. Divide a garden plot in half and plant two rows of beans or peas. As the seedlings emerge, give the plants on one side thin stakes to climb on. Compare the two sides regularly over several weeks. What happens to the plants that don’t have support? (Pea vines will lean on one another or anything else they can grasp with their tendrils for support, and form a matted "wall" that leans toward the ground as it gets larger and heavier.)

Heliotropism

Did you know that in Spanish, the word for sunflower is *girasol*, and in French it is *tournesol?* Both mean “turn-sun.” Sunflowers and some other species of plants turn to stay exposed to the sun throughout the day. That makes a sunflower house an ideal laboratory for studying heliotropism. Researchers have found that flowers that do this stay warmer inside than those that remain stationary. As a result, they attract more insects over a longer period and have higher rates of pollination.

When the sunflowers begin to bloom, have your students observe the sunflower house at various times throughout the day. Ask them to note the sun direction and the direction the sunflowers are facing and record this information in their journals (This would be a good opportunity to teach them how to read a compass!) Have them research other flowers that are heliotropic. What other experiments does this inspire them to try?

Many plants' leaves also show heliotropic movement. Leaves orient themselves to expose as much surface area as possible to the sun during the day. All legume plants do this, so be sure to watch your peas and beans for signs of heliotropism.

Geotropism
Use your root view box to see what happens below the soil surface after you plant a seed. Plant a variety of seeds and watch as the roots go down, with the force of gravity (positive geotropism), and the shoots go up against the force of gravity (negative geotropism.) Your students can test if this is always true by planting an equal number of radish seeds on wet paper towels in two similar jars, labeled “A” and “B.” Sprout the seeds in the dark until the stems are about one inch long. Keep both jars in the dark. Turn one jar on its side and keep the other upright for 24 hours. Have students observe how the stems and roots of each plant are growing, and draw the growth pattern in their journals. Have them rotate jar A every 24 hours but keep B upright. Can they fool the plant into not knowing which way is up or down?

Which will win: geotropism or thigmatropism?
Another engaging experiment to try is to divide the root view box in half by placing a thin board across the narrow part of the box. Fill one side of the box with a good potting soil mix. On the other side of the box use potting soil that has been mixed with gravel, rocks, sticks and other “obstacles.” Plant carrot seeds on each side. Watch what happens as the carrot roots try to grow down, with gravity (geotropism), but also try to grow away from the rocks in their path (thigmatropism). You may end up with some pretty crazy “dancing” carrots!

You’ll find more experiments to try at the Web sites on our Resource Page.

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