Movement in Plants

Hypothesizing that plant movements should also be subject to natural selection, inasmuch as they allow individuals, to greater or lesser degrees, to bend, twist, and adjust to their respective environments, in 1880 Darwin compiled many years of study into a book entitled *The Power of Movement in Plants* (see *The Portable Darwin*). In my class, we explore plant movement by adapting several of his studies.

Darwin noticed that plants move in several ways. One important kind of movement is known as *tropism*, defined as a growth movement related to the location of a particular stimulus, examples of which include *phototropism* (reaction to light), *thigmotropism* (reaction to touch), and *geotropism* (reaction to gravity). Darwin observed plant movements under many different conditions, such as admitting light to potted plants from only one direction or by restricting plant growth with panes of glass.

Students may investigate tropisms in a variety of ways:

1) *Phototropism*. Look for phototropism in growing plants (any easy and relatively fast growing species will do (such as bean, tomato, or potato) by placing a potted specimen in a box with one or two large holes cut out of the side(s). First, predict what might happen, and then observe the specimen for a few days, recording changes in terms of measured growth, narratives, and/or labeled drawings. How do students explain the positive phototropism (movement toward light) that they are likely to observe? (Students may realize at this point that phototropism allows plants to find more light and therefore to photosynthesize more efficiently.) Consider what might happen to a plant that *didn't* move phototropically. Students should understand that without phototropism, plants are not as likely to survive, since they would encounter less light with which to photosynthesize food.)

2) *Thigmotropism*. Predict, observe, and describe, via journal entries, the tendency of a climbing specimen's (e.g., morning glory) tendrils to wind around solid support objects such as appropriately placed sticks. This is an example of positive thigmotropism (movement toward the object). How far can the tendrils "reach"? How might it be advantageous for a plant to "climb" like this? Consider growth, access to sunlight, and reproductive strategies. (Students are often surprised to find that a plant can "feel" its environment.)

3) *Geotropism*. Observe geotropism in bean seedlings by placing dry beans on wet paper towels within resealable plastic bags until the beans germinate and begin to grow shoots and roots, and then hanging the bags upside down for a few days. Record predictions and findings in journals, using descriptions and drawings. Students may predict that shoots will continue to grow down while roots continue to grow up. They will find, however, that stems and leaves exhibit negative geotropism (away from gravity's pull), while roots demonstrate positive geotropism (toward gravity's pull). What might be the result if a plant did not demonstrate those movements? (Students should realize that shoots and roots must grow in the proper direction for plants to thrive.)

Students can be further challenged by noticing plant movements in the "big picture." Do your observational results agree with Darwin's thought that plant movements are subject to natural selection? That is, do plants' adaptive movements confer a survival advantage? For instance, how might a plant benefit from moving toward the Sun or away from gravity? What is the benefit to its seedlings? Which plant is more likely to reproduce seedlings that germinate, a plant that adapts to its environment by specific movements or a plant that does not? Students will begin to understand, in the manner of Darwin, that adaptive movement provides very real benefits for plants in terms of feeding themselves and reproducing.

Porter, D.M., and P.W. Graham. 1993. *The portable Darwin*. New York: Penguin Books.