Who Says Plants Don't Move?
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Of course plants move; everyone (except maybe a few wildlife biologists) knows that! Over 120 years ago Charles Darwin and his daughter Francis wrote a book titled *The Power of Movement in Plants*. In fact, the majority of vascular plants are capable of moving some portion of their anatomy in response to external stimuli. Famous examples include Venus fly traps and the folding leaves of the sensitive plant mimosa.

Perhaps the most commonly observed plant movements are floral heliotropisms, where flowers rotate in order to remain oriented toward the sun throughout the day. Sunflowers are a well-known example. Researchers working in arctic and alpine environments have found that heliotropic flowers are warmer inside than those that do not track the sun. Consequently they attract more insects for longer periods of time and have higher rates of pollination and seed set. Warmer flowers also develop fruits faster.

Botanists are just beginning to explore other types of flower movements. Michael Bynum and William Smith at the University of Wyoming studied white gentian (*Gentiana algida*), a species found in many mountain ranges of southwest Montana as well as Wyoming. This low-growing alpine plant has white-and-purple, bottle-shaped flowers nearly two inches long. Bynum and Smith noticed that these gentians often closed their flowers in mid-afternoon. They showed experimentally that corollas close at 60° F, but only if the temperature is falling. These are conditions that generally precede August thunderstorms in the central Rockies. They observed that flowers could close in less than ten minutes and reopen nearly as fast when conditions ameliorated. But why? Bynum and Smith found that flowers artificially forced to stay open during a thunderstorm lost pollen from the anthers and had reduced seed set compared to flowers that were

allowed to close. The corolla not only attracts pollinators, it also acts as an umbrella.

There is a similar story for the Asian wild crocus or pasqueflower (*Pulsatilla cernua* = *Anemone cernua*). These spring wildflowers are erect when they first open, but usually bend over when the anthers ripen, and finally become erect again once the pollen is shed. Researchers found that insects visit nodding and erect flowers with equal frequency and affect pollination equally. However, they discovered that rain causes the pollen grains to burst. So again it appears that the plants are moving their flowers to protect them from the elements. Once the pollen is shed, the flowers become erect, presumably to aid in seed dispersal. Our pasqueflower (*Anemone nuttalliana, A. patens*) often nods during rain or snow events but becomes erect again once good weather returns.

Similar flower movements are practiced by glacier lilies (*Erythronium grandiflorum*). The six tepals are rolled back exposing the anthers on sunny days, but they remain extended over the flower parts at night and on cloudy days. Many evening primroses (*Oenothera* spp.) open their flowers at dusk to attract nigh-flying pollinators and close them again after the sun comes up in the morning. Paying attention to plant behavior adds another dimension to botanizing. They might be a little slow, but plants are very graceful.

Additional reading:

Bynum, M. R. and W. K. Smith. 2001. Floral movements in response to thunderstorms improve reproductive effort in the alpine species *Gentiana algida* (*Gentianaceae*). American Journal of Botany 88: 1088-1095.

Huang, S., Y. Takahashi and A. Dafni. 2002. Why does the flower stalk of *Pulsatilla cernua* (*Ranunculaceae*) bend during anthesis? *American Journal of Botany* 89: 1599-1603.