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Stomatal Physics KATHRYN SWEET, Physics Dept, Utah State University, KEITH A. MOTT, Biology Dept, Utah State University, DAVID PEAK, Physics Dept, Utah State University — Stomata, microscopic pores on a leaf's surface, regulate the diffusion of CO2 from, and the diffusion of water vapor to, the air. As a result, stomata are responsible for fixing essentially all carbon in the biosphere and generating almost all water vapor in the atmosphere over landmasses. Despite their profound importance, exactly how stomata respond to temperature, light intensity, and ambient CO2 and humidity, is still a matter of active debate. Most research probing this question focuses on identifying and unraveling complicated biochemistry. Recent investigations in our laboratory, however, indicate that much of stomatal behavior can be understood in terms of a simple vapor phase physical model. Evidence supporting this claim includes: isolated stomata respond to changes in the surrounding humidity identically to how they respond in intact leaves; isolated stomata do not respond to changes in light or CO2, but when brought close to, though not in contact with, mesophyll cells (where photosynthesis occurs), they do respond to both; and isolated stomata open and close when exposed, respectively, to positive and negative vapor phase ions. Ongoing work using state-of-the-art high-resolution thermal imaging and confocal microscopy to further test the hypothesis that stomatal responses to environmental conditions are largely due to just vapor phase physics will be described.

Kathryn Sweet
Utah State University

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