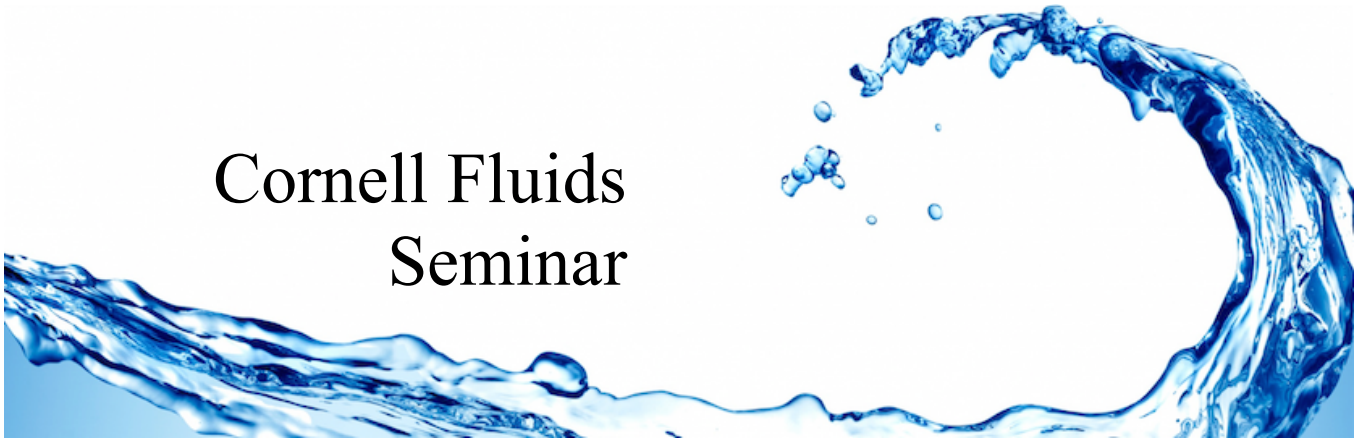


Tuesday, September 19, 2017, 12 pm
116 Upson Hall

# Measurement and Modeling of Woody Plant Water Transport Dynamics

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Climate change has caused extreme weather conditions, resulted in substantial variations in precipitation frequency, and presented particular challenges to plant life in both natural and agricultural contexts. It is important to study how the plants adapt to the water stress, not only to improve the water use efficiency in agriculture, but also to understand how the crops and forests respond to climate change, and how, inversely, their responses could potentially impact climate change. In an era of high-technology, we are still lacking an accurate and robust tool to monitor the water stress of plants in an automated, cost-effective manner.

I would like to introduce a newly designed water stress sensor, a micro-tensiometer (μTM). This microelectromechanical system translates the chemical potential of water into mechanical stress – tension -- within an internal liquid volume that, in turn, is measured with a strain gauge. The μTM sensor is as small as a pen, and can be easily installed into any water containing material of interest -- soil, plants, food, cosmetics, medicines, and cements – to provide continuous measurements of the chemical potential.

In this talk, I will: 1) introduce the thermodynamics and transport phenomena of water motion in plants; 2) explain the plant-mimetic design principles of our μTM and its applications in measuring water stress in plants; 3) describe our continuous measurements of water stress in apple trees to provide unprecedented insights into the transient response of plants to varying environmental parameters; and 4) introduce a mathematical framework that accounts for both physical (e.g., poroelastic diffusion) and biological (e.g., active regulation of boundary layer resistance) to model the observed dynamics. I will conclude with perspectives on using the μTMs: 1) to study the adaptation of crops and forests to soil water deficit; 2) as part of the agricultural precise irrigation system and provide a feedback loop for controlled water-delivery.