# PHYSICAL MATHEMATICS SEMINAR

## Translocation of Sugar by Osmosis in Microfluidic Chips and in Trees

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**ABSTRACT:**

Plants are elongate organisms that bridge dynamic and vastly different environments, creating a premium for rapid information distribution. The talk focuses on the translocation of sugar in the so-called phloem network of plants. A model is presented for phloem transport that provides the governing relationship between the radius *r*, and the lengths of the loading ($l_1$) and the translocation ($l_2$) zones in the form of scaling law, $r \sim (l_1)^{1/3} (l_2)^{1/3}$) that maximizes speed. The model is evaluated on "synthetic phloem" fabricated on microfluidic chips [1] and on plants using a novel dye-bleaching method which allows us to measure flow velocities in vivo. Further, the scaling law is tested on plants varying three orders of magnitude in size, finding good agreement between measured and predicted radii, which suggests that phloem is indeed optimized for translocation speed. The talk will also touch upon a recent theoretical work on self-consistent unstirred layers near membranes supporting osmosis [2].

[1] K. H. Jensen, J. Lee, T. Bohr, and H. Bruus. "Osmotically driven flows in microchannels separated by a semipermeable membrane". Lab Chip 9, 2093 (2009).

[2] K. H. Jensen, T. Bohr, and H. Bruus. "Self-consistent unstirred layers in osmotically driven flows". J. Fluid Mech. (in press, 2010).

**TUESDAY, SEPTEMBER 14, 2010**
**2:30 PM**
**Building 2, Room 105**

*Refreshments at 3:30 PM in Building 2, Room 290*

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