## Analysis and Applied Mathematics Seminar

# *Osmotic water flow and solute diffusion in moving cells: mathematical model and numerical method*

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**Abstract:** Differences in solute concentration across a semipermeable membrane of cells generates transmembrane osmotic water flow. The interaction of such flows with membrane and flow mechanics is a little explored area despite its potential significance in many biological applications. Particularly, in recent studies, experimental evidence suggests that membrane ion channels and aquaporins (water channels), and thus, solute diffusion and osmosis, play an important role in cell movement. To clarify the role of osmosis in cell movement, one needs to understand the interplay between solute diffusion, osmosis and mechanical forces. In this presentation, we discuss a mathematical model that allows for studying the interplay between diffusive, osmotic and mechanical effects, and the numerical method for solving the model system. An osmotically active solute obeys a advection-diffusion equation in a region demarcated by a deformable membrane. The interfacial membrane allows transmembrane water flow which is determined by osmotic and mechanical pressure differences across the membrane. The numerical method is based on an immersed boundary method for fluid-structure interaction and a Cartesian grid embedded boundary method for the solute. We demonstrate our numerical algorithm with the test case of an osmotic engine, a recently proposed mechanism for cell propulsion.

Monday, November 13 at 4:00 PM in SEO 636

This is joint work with Yoichiro Mori at University of Minnesota.

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