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MATHAMATICS COLLOQUIUM
JOINT WITH BIOPHYSICS &
SYSTEMS BIOLOGY SEMINAR

"Stochastic and Continuum Dynamics in Cellular Transport"

Abstract: The cellular cytoskeleton ensures the dynamic transport, localization, and anchoring of various proteins and vesicles. In the development of egg cells into embryos, messenger RNA (mRNA) molecules bind and unbind to and from cellular roads called microtubules, switching between bidirectional transport, diffusion, and stationary states. Since models of intracellular transport can be analytically intractable, asymptotic methods are useful in understanding effective cargo transport properties as well as their dependence on model parameters.

We consider these models in the framework of partial differential equations as well as stochastic processes and derive the effective velocity and diffusivity of cargo at large time for a general class of problems. Including the geometry of the microtubule filaments allows for better prediction of particle localization and for investigation of potential anchoring mechanisms. Our numerical studies incorporating model microtubule structures suggest that anchoring of mRNA-molecular motor complexes may be necessary in localization, to promote healthy development of oocytes into embryos. I will also briefly go over other ongoing projects and applications related to cellular transport.

January 24, 2019
10:00am - 11:00am
Donald Bren Hall 4011