Chemical & Physical Sciences
UNIVERSITY OF TORONTO
MISSISSAUGA

COLLOQUIUM

TUESDAY OCTOBER 4TH, 2011
12:00 P.M. (SHARP) – 1:00 P.M.
INSTRUCTIONAL BUILDING 240

Anton Zilman

Department of Physics, University of Toronto

"Selective transport through nano-channels: biology, physics and nanotechnology."

Functioning of living cells requires selective transport of proteins and other molecular signals into and out of the cell, as well between various cell compartments. Much of such transport is conducted by nano-scale channels and gates, which function without direct input of metabolic energy and without channel transitions from an 'open' to a 'closed' state during transport. Mechanisms of selectivity of such channels provide inspiration for bio-engineering applications, in particular for design of selective nano-molecular sensors and sieves.

Precise mechanisms of selective transport through such 'always open' biological and artificial nano-channels are still unknown. I will review the biophysics of such channels, with the emphasis on the functioning of the Nuclear Pore Complex – a biological nano-gate that carries the transport between the cell nucleus and the cytoplasm. I will present a theoretical model to explain the mechanisms of selectivity of transport through such nano-channels. The theory provides a simple physical mechanism for selectivity based on the differences in the kinetics of transport through the channel between different molecular species. In particular, the theory explains how the channels can remain selective in the presence of vast amounts of non-specific noise. The theoretical predictions explain previous experimental results and have lead to the creation of bio-mimetic molecular nano-filters.