Materials Science & Engineering Seminar Series

Carnegie Mellon University
Materials Science & Engineering

presents

Molecular Transport in Carbon Nanotube Porins

Dr. Aleksandr Noy
Physics and Life Sciences Directorate, Lawrence Livermore National Laboratory Livermore, CA,
and school of Natural Sciences, University of California Merced, Merced, CA

ABSTRACT:
Living systems control transport of ions or small molecules across biological membranes using ion channels that form highly efficient and selective pores in lipid bilayers. Although bottom-up synthesis and top-down fabrication could produce pores of comparable size, an unresolved challenge remains to build nanopore scaffolds that replicate transport properties of membrane channels. We will show that pores formed by ultra-short carbon nanotubes (CNTs) assembled in the lipid membranes can come close to this goal. These "CNT porins" can transport water, protons, small ions, and DNA and their selectivity can be controlled by the pore size and charge at the pore mouth. Interestingly, these pores also can display the stochastic "gating" behavior common for biological ion channels. We also investigate the role of confinement in these pores and show how it can enhance water and proton transport efficiency. Overall, CNT porins represent a simplified biomimetic system that is ideal for studying fundamentals of transport in biological channels, and for building bioelectronic devices and engineered mesoscale structures.

BIOGRAPHY:

Aleksandr Noy received his BSc from Moscow University (Russia) and PhD in Chemistry from Harvard University in 1998. He received the inaugural E.O. Lawrence Fellowship at the Lawrence Livermore National Laboratory (LLNL) the same year. After completing the Fellowship term he has been promoted to a staff scientist position at LLNL in the Physics and Life Sciences Directorate. He currently has the position of Senior Research Scientist at the Biology and Biotechnology Division at LLNL and also serves as an Adjunct Associate Professor at the School of Natural Sciences at University of California Merced. He has more than 80 publications in different areas of nanoscience. His research interests center on bioelectronics, nanofluidics and molecular transport, and nanopore biophysics.

Doherty Hall 2315, 11:30AM
Friday, March 25, 2016