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Nano-scale pores for sensing and single-molecule characterization

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Biological protein pores and pore-forming peptides can generate a pathway for the flux of ions and other charged and polar species across otherwise impermeable cellular membranes. In nature, these nanopores have diverse and essential functions that range from maintaining cell homeostasis and participating in cell signaling to activating or killing cells. The combination of nano-scale dimensions and inherent sophisticated functionality of these biological pores have made them particularly attractive for the growing field of bionanotechnology where their applications range from single-molecule sensing to drug delivery and targeted killing of malignant cells. Recently, nano-scale pores fabricated in synthetic materials have also emerged as powerful platforms for single-molecule sensing and characterization. In this talk, I present two examples of application of biological and synthetic nanopores for detection and characterization of molecular processes on lipid membranes. In the first example, we applied an ion channel-forming peptide, gramicidin A, for sensing and detection of membrane-associated enzymatic activities and binding interactions. In the second example, we modified a synthetic nanopore by coating its walls with non-fouling lipid bilayers to enable sensing and characterization of single protein molecules as well as molecular processes on lipid bilayers.

Biography

Majd received her Ph.D. in Biomedical Engineering at the University of Michigan, Ann Arbor, in 2009. After a short postdoctoral training at the University of Michigan, Dr. Majd joined the Department of Bioengineering at the Pennsylvania State University as an Assistant Professor in January of 2011. She currently has a courtesy appointment in Department of Engineering Science and Mechanics. Research efforts and interests in Dr. Majd's group lie at the interface of membrane biophysics, electrophysiology, biomateri¬als, micro/nano fabrication, and biosensing for diagnostic and therapeutic applications.

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