Science at the Edge Seminar Series

Quantitative Biology Graduate Program/ Gene Expression in Development and Disease

Dr. Edward Lyman

Department of Physics and Astronomy
University of Delaware

When anomalous becomes the norm: Lateral (sub)diffusion in cell membranes.

The plasma membrane of our cells is a complex mixture of hundreds of different lipids, proteins, and cholesterol. Lateral heterogeneity in composition is therefore expected, but the observable signatures and functional consequences of such heterogeneity remain controversial. I will present chemically detailed, "all-atom" simulations of lipid mixtures, which suggest a new model for lateral heterogeneity on the nanoscale. Long (10 microsecond) contiguous trajectories provide evidence for subdiffusive transport, recently corroborated by iSCAT single particle tracking data. These observations motivate a stochastic simulation approach which predicts interesting consequences for subdiffusion on the encounter of signaling partners, suggesting a functional role for membrane heterogeneity.

E. Lyman, H. Cui, and G. A. Voth, "Water under the BAR," Biophysical Journal 99, 1783 (2010).

E. Lyman, C. Higgs, B. Kim, D. Lupyan, J. C. Shelley, R. Farid, and G. A. Voth, "A role for a specific cholesterol interaction in stabilizing the Apo configuration of the human A2A adenosine receptor," Structure 17, 1660 (2009).

E. Lyman, J. Pfaendtner, and G. A. Voth, "Systematic multiscale parameterization of heterogeneous elastic network models of proteins," Biophysical Journal 95, 4183 (2008).

E. Lyman and D. M. Zuckerman "On the structural convergence of biomolecular simulations by determination of the effective sample size," J. Phys. Chem. B 111, 12876 (2007).

E. Lyman, F. M. Ytreberg, and D. M. Zuckerman, "Resolution exchange simulation," Phys. Rev. Lett. 96, 028105 (2006).

D. M. Zuckerman and E. Lyman, "A second look at canonical sampling of biomolecules using replica exchange simulation," J. Chem. Theory Comput. 2, 1200 (2006).

Friday, October 9, 2015 at 11:30a.m.
Room 1400 BPS

Refreshments at 11:15