CENTER *for* APPLIED MOLECULAR MEDICINE

University of Southern California Physical Sciences in Oncology Center

Monthly Seminar Series

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"Stretching of Lipid Membranes Using Optical Forces"

FRIDAY, JANUARY 25, 2012

NOON - 1:00 P.M.

Q & A to follow

(Pizza and beverages will be served for attendees at 11:45 a.m.)

HARKNESS AUDITORIUM

HSC - Clinical Sciences Building, **2nd Floor**
2250 Alcazar Street, Los Angeles, CA

ABSTRACT:

Membrane bending and stretching control key aspects of cellular function, and changes in chemical composition alter membrane mechanical properties. GUVs are model lipid bilayer systems that have become popular for investigating membrane mechanical properties. The ability of membranes to bend under low stress is characterized by the bending modulus (κ_B). We show that the optical stretcher, or dual-beam optical trap (DBOT), provides a method for non-invasive application of time-dependent forces on a GUV, allowing rapid measurement of the bending modulus. The applied stress in a DBOT elongates the GUV, increasing its eccentricity. We increase the optical power in the DBOT as a function of time and extract the resulting surface area strain (percent change in surface area) from analysis of microscope video images. The lateral tension on the membrane at each power level is calculated from the surface stress. The bending modulus can be extracted from the slope of the area strain vs. surface stress plot. We compare the bending modulus values obtained from a lipid bilayer in liquid phase, 1-palmitoyl-2-oleoyl-*sn*-glycero-3-phosphocholine (POPC), and bilayer in gel phase, 1,2-dipalmitoyl-sn-glycero-3-phosphocholine (DPPC). We observe that the bending modulus of gel phase bilayer is larger than the lipid phase bilayer. We then show that we can use our high-throughput setup to measure the bending modulus of populations of GUVs and obtain ensemble statistics. We compare the bending modulus of POPC lipid bilayer with and without cholesterol and show that the addition of cholesterol does not significantly affect the bending modulus.

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