Abstract Submitted
for the 4CF11 Meeting of
The American Physical Society

Biomembrane Structure and Dynamics Controlled by Dehydration and Osmotic Stress JACOB KINNUN, Department of Physics, University of Arizona, Tucson, AZ 85721, K.J. MALLIKARJUNAIAH, AVIGDOR LEFTIN, Department of Chemistry and Biochemistry, University of Arizona, Tucson, Arizona 85721, HORIA PETRACHE, Department of Physics, Indiana University-Purdue University, Indianapolis, IN 46202, MICHAEL BROWN, Department of Chemistry and Biochemistry, University of Arizona, Tucson, Arizona 85721 — Membrane deformation and dynamics and their effects on membrane protein function remain mysterious. With osmolytes and dehydration we observe deformation of DMPC-d_{54} lipid membranes via solid-state ^{2}H NMR spectroscopy. A unified theoretical framework predicts that membrane osmotic pressure depends inversely on the number waters per lipid. Through temperature variation we find osmotic pressure is generated by membrane undulations and lipid protrusions. We extend this thermodynamic framework via a mean-torque model to analyze the compressibility of the lipids. Under pressure, the area per lipid decreases and hydrocarbon thickness increases as described by a compressibility modulus. Changes in membrane thickness result in hydrophobic mismatch which affect protein-lipid interactions. Our findings show how altering membrane structure and dynamics affect membrane protein function.

Jacob Kinnun
Department of Physics, University of Arizona, Tucson, AZ 85721

Date submitted: 16 Sep 2011 Electronic form version 1.4