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Dynamics of Carbon Nanotube Porins in Supported Lipid Bilayers[1] MARY LOWE, KYLEE SULLIVAN, JOSEPH LOPEZ, Loyola University Maryland, YULIANG ZHANG, ALEKSANDR NOY, Lawrence Livermore National Laboratory — Cell membranes in bacteria and eukaryotes possess transmembrane proteins called "porins," which provide channels for ions and small molecules to enter or exit the cell. The cell membrane is composed of a phospholipid bilayer that behaves like a two-dimensional fluid in which lipids and membrane proteins laterally diffuse within the plane. Recently techniques have been developed to insert carbon nanotubes with a 1.5 nm diameter into a lipid bilayer to form "carbon nanotube porins" (CNTPs). Using high-speed atomic force microscopy, we recorded the movement of CNTPs in real time in a lipid bilayer supported on a mica surface. The diffusion coefficient was measured for varying concentrations of phospholipids DOPC and DMPC. The data reveal that the CNTP diffuses more quickly at lower concentrations of DMPC, exhibits fluctuations in tilt with respect to the membrane normal, and changes its azimuthal orientation within the membrane over time. Molecular dynamics simulations of a CNTP in DOPC:DMPC bilayers support our experimental findings and reveal additional information on molecular structures and movements of the CNTP and lipids. CNTPs can be a biomimetic platform for studying biological channels, or a means of developing stochastic sensors for measuring ionic transport through pores.

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