

Electrochemistry in Synthetic and Biological Nanopores

Anna E.P. Schibel, Thomas Edwards, Ryuji Kawano,
Wenjie Lan, Deric Holden, and Henry S. White
Department of Chemistry
University of Utah
315 S 1400 E, Rm 2020
SLC, UT 84112

This presentation will describe recent investigations of molecular and particle transport in synthetic nanopores and protein ion channels. Our research has focused on the use of nanopores for single-molecule detection, particle analysis, and sequencing of biopolymers (e.g., DNA) using glass and quartz nanopore membranes.

A method is described for fabricating 25 to 75 μm -thick fused quartz membranes containing a single conical shaped nanopore (orifice radius ranging from 10 to 1000 nm). The quartz nanopore membrane (QNM) provides an excellent solid support structure for lipid bilayers in ion channel recordings due to the large electrical resistivity of fused quartz. Electrical measurements demonstrate that the leakage current through 1,2-diphytanoyl-*sn*-glycero-3-phosphocholine (DPhPC) bilayers suspended across the orifice of ~ 900 nm-radius QNMs is immeasurably small, corresponding to bilayer resistances greater than 10^{12} ohms. The QNMs were used to observe the translocation of single-stranded DNA oligomers (poly-dA 50-mer and poly-dA 20-mer) through the ion channel α -hemolysin reconstituted in a DPhPC bilayer suspended across the QNM orifice. Detection and counting of 28-nm-radius polystyrene nanoparticles using a 50-nm radius orifice QNM are also demonstrated. Nanoparticle detection events through the QNM were simulated using finite element software.