

**UNIVERSITY OF RHODE ISLAND**  
**Department of Chemistry**  
**SEMINAR**

**Room 105 Beupre Center**  
**2:00 p.m, Wednesday, November 29, 2017**

***Y.M. Nuwan D.Y. Bandara***

***PhD Seminar***  
***Chemistry Department***  
***URI***

***“Profiling and Modification of Silicon  
Nitride Based Planar Substrates and  
Nanopores”***

***HOST***

***Jason Dwyer***  
***Department of Chemistry***  
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A nanopore—a nanochannel used as the sole fluid path between two electrolyte reservoirs—is a ubiquitous single molecule sensing platform with applications spanning genomic mapping and proteomics most prominently. Solid state nanopores, unlike their naturally occurring protein counterparts, are size tunable and are stable under a broad range of chemical and physical conditions. Silicon nitride, a ubiquitous nanofabrication compatible material, is a prime material of choice for nanopore fabrication with earlier fabrication methods relying on heavy ion bombardment and TEM drilling being expensive, prone to contamination and not readily accessible. More recently, dielectric breakdown of ultra-thin silicon nitride membranes has advanced as a more accessible fabrication method with the added benefit of fabrication taking place in the native sensing environment of the nanopore. Profiling geometric parameters of the nanopore—minimum radius, length and shape—is crucial for sensing experiments. Conductance based models provide insight into these parameters and we propose a framework to extract these parameters based on time-dependent conductance values arising because of nanopore modifications. Silicon nitride nanopores can be modified through electroless plating (extensively studied using planar silicon nitride for ease) and covalent attachment of 1-alkenes (both thermally and photochemically). Electrolessly gold-plated planar silicon nitride supports were also found to be surface enhanced Raman (SER) active. Appropriate combination of the 1-alkene attachment and electroless plating on planar silicon nitride have enabled us to create spatially selective gold patterns—covalently attached alkanes function as molecular barriers for electroless plating. Covalent modifications, especially, modify the surface charge of the nanopore and thus have great implications over translocation of analyte molecules through the nanopore. We have shown, enriching the nanopore surface with amine terminal functional groups helps to slow down  $\lambda$ -DNA by ten-fold compared to bare silicon nitride—providing greater opportunity to profile the molecule as it passes through the nanopore.