UNIVERSITY OF RHODE ISLAND
Department of Chemistry
Ph.D. Seminar

Room 105 Beaupre
2:00 P.M., Friday, March 25, 2022

James Hagan

University of Rhode Island
Department of Chemistry

"Facilitating polysaccharide characterization with native and chemically modified nanopore sensors"

HOST

Dugan Hayes
Department of Chemistry
401-874-5516

Facilitating polysaccharide characterization with native and chemically modified nanopore sensors

James Hagan
Department of Chemistry
University of Rhode Island

Polysaccharides are abundant in nature and prevalent in many physiological systems. This diversity comes from their chemical complexity leading to varied physical properties. However, this complexity also hinders characterization by conventional instrumentation. Our work focuses on proving and chemically improving nanopore sensors for broad applicability to detecting, identifying, and characterizing these ubiquitous biopolymers. Placing a nanopore (e.g. molecular sized fluidic channel) between electrolyte reservoirs can facilitate voltage-driven passage of our analytes of interest, producing current fluctuations directly relating to the single passing molecule's physical properties (e.g. charge, molecular structure, chemical composition). When numerous signals are collected for a given molecule, the resulting data serves as a fingerprint for identification. Compiling libraries of well characterized samples can facilitate nanopore's potential to provide high level characterization on par with current standard methods.

For ease of fabrication and customization, we have focused on silicon nitride (SiN_x) nanopores formed by controlled dielectric breakdown (CBD). This approach allows for on demand and *in situ* fabrication of pores by low-voltage electronics. Chemical tuning of the pore can be applied by two methods: during fabrication with the addition of dilute sodium hypochlorite (e.g. bleach) to the fabrication electrolyte or after fabrication by photohydrosilylation, a wet chemical technique resulting in covalently attached organic monolayers. The customized sensor exhibits optimal current stability and reduced unfavorable analyte interaction or chemically customized surfaces for highly specific sensing applications, respectively. Applying native and chemically tuned nanopores to the analysis of polysaccharide samples offers the possibility to advance both nanopore science and glycomics.