BME Seminar Series

Thursday, April 18th, 2019
10:10 am, Room 012, Brauer Hall

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"Driving Forces of Greasy Protein Association in Greasy Membranes"

Abstract:
Membrane proteins are the molecular gatekeepers of biology. They govern the passage of charged and polar species in and out of cells, thus enabling the storage of potential energy that fuels life. Despite their overwhelming importance, we still do not understand the basic physical reasons why membrane proteins associate and assemble to form stable structures in the lipid bilayer. For soluble proteins, the burial of hydrophobic groups away from aqueous interfaces is a major driving force, but membrane-embedded proteins cannot experience hydrophobic forces, as the lipid bilayer lacks water. A fundamental conundrum thus arises: how does a greasy protein surface find its greasy protein partner in the greasy lipid bilayer to fold faithfully into its native structure? In our lab, we measure the thermodynamics of membrane protein assembly, directly in lipid bilayers, using model systems of membrane protein dimerization. We approach these three curious questions with a variety of experimental techniques including membrane protein purification and functional reconstitution, electrophysiology, x-ray crystallography, single-molecule TIRF microscopy and computational modeling. With this, we are able to fully interrogate the physical driving forces that determine how and why greasy membrane proteins form stable structures inside the greasy lipid membrane.

Biography:
Janice L. Robertson obtained her Honours Bachelor of Science degree from the University of Toronto in Theoretical Physiology and Mathematics in 2002. She was first introduced to membrane proteins while studying in the laboratory of Dr. Peter Backx, where she carried out mathematical modeling of the cardiac action potential and conducted electrophysiological studies of voltage-gated sodium channels. She continued to study membrane permeation during her PhD, where she worked with Dr. Benoît Roux and Dr. Larry Palmer at the Weill Cornell Graduate School of Medical Sciences, carrying out computational studies aimed at investigating how changes in inward rectifier potassium channel sequence leads to changes in function. For her postdoctoral training, she switched disciplines and studied with Dr. Chris Miller at HHMI/Brandeis University, focusing on experimental membrane protein biochemistry while investigating the structure and function of anion transporters and channels. In 2011, she received a K99/R00 award from NIH/NIGMS, which enabled her to develop novel single-molecule fluorescence microscopy methods to study membrane protein assembly in membranes. In 2013, she started her independent research laboratory in the Department of Molecular Physiology and Biophysics at the University of Iowa, and in 2018 moved her laboratory to the Department of Biochemistry and Molecular Biophysics at Washington University in St. Louis. Her laboratory studies the fold, form and function of membrane proteins in membranes by integrating membrane protein biochemistry, single-molecule microscopy and computational modeling.

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