



Chemical & Physical Sciences
UNIVERSITY OF TORONTO
MISSISSAUGA

COLLOQUIUM

TUESDAY NOVEMBER 22ND, 2011
12:00 P.M. (**SHARP**) – 1:00 P.M.
INSTRUCTIONAL BUILDING 240

Michael T. Woodside

University of Alberta, Physics

“OBSERVING THE FOLDING AND MISFOLDING OF SINGLE PROTEIN MOLECULES WITH FORCE SPECTROSCOPY”

Proteins self-assemble ("fold") reliably into many different structures capable of an astounding range of functions, but our inability to predict folding from sequence remains a major challenge of modern science. I will discuss experiments on single prion protein molecules that allow us to follow the change in structure of the protein as it folds in real time, by applying tension across the protein with optical tweezers. The prion protein is responsible for "mad cow" disease, through the action of an incorrectly folded structure that is infectious. By pulling apart the protein structure and letting it refold, we are able to observe both the native folding pathway and several non-native pathways leading from the unfolded state. Interestingly, the incorrect structures form more frequently than the correct structure, but they are much less stable. I will also discuss how time correlations in the length of the molecule can be used to derive the microscopic transition rates, and how the free-energy landscape through which the protein moves can be reconstructed from fluctuation theorems.