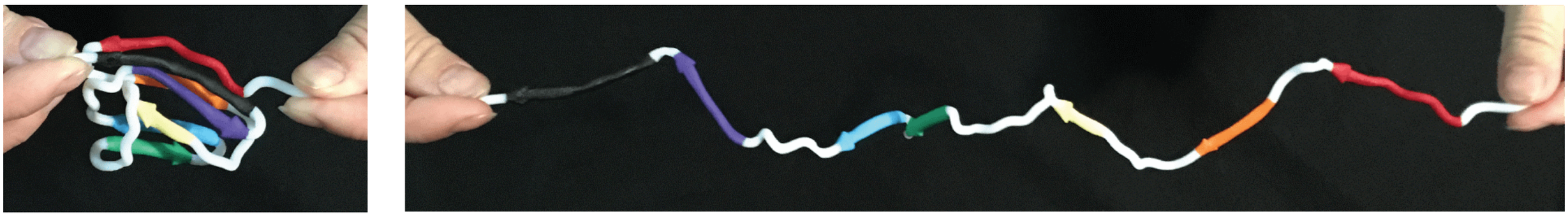

Department of Chemical and Physical Sciences Colloquium Seminar Series
Wednesday, November 6, 2019 3:00pm in CC2150

Dr. Ionel Popa

Department of Physics
University of Wisconsin-Milwaukee

Protein unfolding:
From single molecules to soft robotics

At the nanoscopic level, many proteins have evolved to respond to various stimuli by unfolding, but how this process results in gain-of-function is currently poorly understood. In my lab, we use a single molecule approach based on magnetic tweezers and covalent attachment to characterize the unfolding response under force of single proteins. Using this approach, we have determined the mechanical stability and energy landscape of multidomain proteins and have described how proteins use the unfolding response in a unique quantized way. The folding states of these domains constitute the zeros and ones of a basic computation unit which proteins use to transduce a mechanical signal into a length change. Based on the specific unfolding response of proteins, we then back engineered biomaterials that show similar responses to muscle tissue. These protein-based hydrogels can harvest the unfolding response of proteins to reversibly morph in various shapes, of critical importance for soft robotics. Our results help place protein unfolding as an important mechanism that some tissues use to adjust their elasticity and efficiently store and release energy, and represent a novel bottom-up approach to produce new biomaterials that can actively respond to their environment.