

Physics Colloquium

Monday October 4th, 2004 4:15 PM,
428 Pupin Hall

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"Force-clamp AFM techniques monitor the folding/unfolding reactions of a single protein"

Abstract:

Due to the force of gravity and the need for living organisms to do mechanical work, mechanical stretching is most likely to have played a central role in the evolution of proteins. Mechanically stretching proteins creates a novel and well-defined starting point for observing folding/unfolding reactions. We have developed single molecule AFM techniques that can apply a mechanical force in the 10-500 pN range to an engineered polyprotein. For example, we follow the end-to-end length of the small protein ubiquitin during its folding/unfolding reaction at the single molecule level. Ubiquitin was first unfolded and extended at a high force of ~ 110 pN, then the stretching force was quenched to 10-40 pN and protein folding was observed. In contrast to expectations, the observed folding trajectories were continuous and marked by several distinct stages. The time taken to fold was dependent on the contour length of the unfolded protein and on the stretching force applied during folding. The folding collapse was marked by large fluctuations in the end-to-end length of the protein, which vanished upon the final folding contraction. These direct observations of the complete unfolding and then folding trajectory of a protein provide a benchmark to determine the mechanisms of protein folding.



Host: Aron Pinczuk