Nanomechanics with Optical Tweezers: How Cellular Machines Recombine DNA and Work Against Protein Friction

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Abstract:

Molecular machines are fascinating devices that drive self-organization in cells. While the protein components of many biological machines have been identified, the mechanical principles that govern the operation of biological machines are poorly understood. For example, how much force can they generate; and what limits their speed and efficiency?
We use a high-resolution optical tweezers apparatus to measure intermolecular forces that are central to biological questions such as how proteins move and diffuse along microtubules or how double-stranded DNA breaks are repaired. I will introduce our optical tweezers, recent improvements of the latter, and their use in measuring the nanomechanics of individual kinesins and a DNA repair protein involved in homologous recombination.

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