Abstract Submitted
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Force-induced DNA interactions: From polymer elasticity to protein dynamics MARK WILLIAMS, Northeastern University — As DNA is stretched with optical tweezers, the force-extension curve is strongly altered in the presence of ligands that bind to double- and single-stranded forms of DNA. These ligands can alter the length of the molecule, its elasticity, and the relative stability of the two forms of DNA. Small molecules that intercalate between the DNA base pairs increase the length of DNA, and this length increase can be used to precisely quantify the ligand-DNA binding energy. For complex small molecules such as Actinomycin D, slow binding kinetics can be directly measured, allowing complete characterization of the energy landscape for DNA-ligand binding. DNA bending proteins such as eukaryotic HMGB proteins alter the flexibility of the molecule, and the change in DNA persistence length can also be used to quantify DNA-protein binding affinity. In addition, these measurements allow protein-DNA interaction kinetics to be measured. In the case of HMGB proteins, I will show how we can independently measure microscopic and macroscopic dissociation events. We find that these proteins dissociate rapidly from local DNA binding sites, while remaining associated overall to the DNA molecule for a longer time. This result has important implications for protein-DNA interactions in the cell.

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