

Abstract Submitted  
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**Electrostatic Effects on the Elasticity of Single ssDNA Molecules**

DUSTIN B. MCINTOSH, OMAR A. SALEH, University of California Santa Barbara — Nucleic acids are highly-charged polyelectrolytes whose structure and function strongly depend on the concentration and type of salt ions in solution. We have created a simple experimental system for studying nucleic acid/ ion interactions, based on magnetic-tweezer measurements of the elasticity of single denatured ssDNA molecules in solutions with a known salt concentration. Using this system, we were able to reconcile single-molecule force-extension data with scaling theories of self-avoiding polymers, and we found that the Kuhn length of ssDNA scales with the Debye length in NaCl solutions. (Saleh et al., PRL 102, 068301 (2009)). Here, we use the system to investigate interactions of ssDNA with multivalent salts. We find that, in divalent salt, ssDNA elasticity is qualitatively similar to that in monovalent salt, but with significant quantitative differences. Notably, at low ionic strength, ssDNA in divalent salt maintains the same low-force scaling behavior (“Pincus blob” regime) as seen in monovalent salts. However, there are differences in the elastic behavior at high forces ( $>$  a few pN). In addition, analysis of the low-force scaling behavior indicates it requires  $\sim 100$  fold smaller concentrations of divalent salt to condense ssDNA. We discuss the data in the context of electrostatic theories, including Debye-Huckel, as well as bulk experiments on similar systems.

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