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Multiple Pathways of Single-Stranded DNA Stretching Observed Using Single-Molecule Manipulation[1]

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DNA has a double helix structure and contains the genetic code of life. When the information needed to be read, the DNA double helix has to be opened up to allow access to the bases that make up the DNA. During the reading process the DNA adopt a different conformation, and the energetics and mechanics of the dynamic process is important in gene regulation. We used an atomic force microscope to pull single DNA molecules and measured the force associated with the conformational changes of poly(dA), a single-stranded DNA composed of uniform A bases. We found that the DNA can be stretched in two different ways, and the DNA can hop between these two conformations. These results suggest that poly(dA) has a novel conformation when highly stretched, and the unique conformation makes poly(dA) more stable at large extensions. The unique property of poly(dA) may play a role in biological processes such as gene expression. Moreover, single molecule force measurement allows us to quantify the elastic and thermodynamic properties of single biological molecules, and may ultimately be developed into a tool for drug screening.

[1] W.-S. Chen, W.-H. Chen, Z. Chen, A. A. Gooding, K.-J. Lin, and C.-H. Kiang, "Direct Observation of Multiple Pathways of Single-Stranded DNA Stretching," *Phys. Rev. Lett.* **105** (2010) 218104.

[2] C. P. Calderon, W.-H. Chen, K.-J. Lin, N. C. Harris, and C.-H. Kiang, "Quantifying DNA Melting Transitions using Single-Molecule Force Spectroscopy," invited paper in special issue on DNA Melting, *J. Phys.: Condens. Matter* **21** (2009) 034114.

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