MAR05-2004-001054

Abstract for an Invited Paper
for the MAR05 Meeting of
the American Physical Society

**DNA Flexibility**

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Classic experimental and theoretical analyses led to a unified view of DNA as a semiflexible polymer, characterized by a bending persistence length, P, ~50 nm (~150 bp). In this view, DNA lengths that are greater than P are, on average, spontaneously gently bent, and require relatively little force to bend significantly, while DNA lengths that are shorter than P are nearly straight, and require great force to bend significantly. Nevertheless, sharply bent DNA plays important roles in biology. We used the method of ligase catalyzed DNA cyclization to investigate the spontaneous looping of short DNAs. Remarkably, DNAs as short as 84 bp spontaneously bend into circles, and 94 bp DNA sequences cyclize up to $10^5$ times more easily than predicted from classic theories of DNA bending. In subsequent studies we find that the twistability of sharply looped DNAs exceeds the prediction of classic theories by up to 400-fold. These results can only be understood by greatly enhanced DNA flexibility, not by permanent bends. Our results provide striking support for two new theories of DNA mechanics based on local melted or kinked regions, and they establish DNA as an active participant in the formation and function of looped regulatory complexes *in vivo*.