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**The Dynamics of Semi-flexible Polymers:  
double stranded DNA and DNA-RecA complex**

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**Abstract**

The position dependent internal dynamics of semi-flexible polymers is discussed. We present measurements of monomers' kinetics in double-stranded DNA (dsDNA) and single-stranded DNA-RecA complex (ssDNA-RecA). The main parameter of interest by which these polymers differ is their rigidity, which is defined by their persistence length. Although both polymers can be classified as semi-flexible, their rigidities are very different: for dsDNA the persistence length is about 50nm, while the persistence length of ssDNA-RecA complex is about  $1\mu\text{m}$ . Measurements of monomers dynamics at three and two different positions along the polymer chain for dsDNA and ssDNA-RecA complex, respectively, are presented. The polymers were specifically labeled at a single position with a fluorescent molecule. Using Fluorescence Correlation Spectroscopy technique we measured the fluctuations in the fluorescence, which revealed the time dependence of the labeled monomers' mean square displacement (MSD),  $\langle r^2(t) \rangle$ . The MSD is measured over a wide range of time scales, from  $\sim 4\mu\text{s}$  to  $\sim 0.2\text{s}$ . Two regimes become apparent from the temporal MSD measurements: at long time scales, the diffusion of the polymer as a whole, and at short times, the internal dynamics of the polymer. The latter exhibit behavior of  $\langle r^2 \rangle = Kt^{1/2}$  for dsDNA and  $\langle r^2 \rangle = Kt^{3/4}$  for ssDNA-RecA complex, which is in agreement with the Rouse model and the theory of stiff polymers, respectively. We show that consistently, the dynamics of an end positioned monomer is faster than a central positioned monomer.