Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Direct imaging of LacI repressor protein sliding along DNA YAN-MEI WANG, XIAO-JUAN GUAN, LING GUO, EDWARD COX, ROBERT AUSTIN, Princeton University — LacI repressor protein was observed in 1970 to bind to its operator site 100 times faster than allowed by diffusion [1]. A facilitated diffusion model incorporating1-D sliding and 3-D diffusion of the nonspecifically bound protein has been suggested to explain this phenomenon [2]. We have imaged the nonspecific binding of GFP-LacI monomers to elongated DNA molecules using single molecule imaging techniques. Upon binding to DNA, LacI proteins were observed to either be stationary, or slide along DNA. The characteristics of the sliding motion fit that of 1-D Brownian motion (with and without drift). The 1-D diffusion constant of the sliding proteins is 104 nm2/s, and it is 104 times lower than a typical protein's 3- D diffusion constant, 108 nm2/s. The characteristic dissociation time for both the stationary and the sliding proteins is 6s, and it is 100 times longer than the known dissociation time of 0.08s. The sliding length (DNA length scanned by the protein, not counting repeatedly scanned bases) ranges from 300 bp to 3000 bp, and it is significantly higher than the calculated optimal sliding length of 100 bp. We will discuss how these abnormal parameters alter the LacI specific binding speed. [1] A. D Riggs, S. Bougeois and M Cohn, J. Mol. Biol. 53, 401- 417 (1970). [2] O. G. Berg and C. Blomberg, Biophys. Chem., 4, 367-381 (1976).

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Date submitted: 01 Dec 2004 Electronic form version 1.4