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Dynamics of a DNA sequence in interphase cells revealed by fast-tracking in a two-photon microscope

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Abstract

The structure and dynamics of DNA is thought to be essential for several aspects of the nuclear function. Previous studies show that the motion of chromatin is mainly random and constrained. However, other studies report a longer scale motion, probably related to transcription. In this work, we studied in-vivo the dynamics of a DNA sequence labeled with enhanced-green fluorescent protein by using a new fast-tracking technique in a two-photon microscope. This method presents less overall photobleaching and higher spatial and temporal resolutions than previous methods used for studying DNA dynamics. We verified that the fluorescent-tagged sequence undergoes random motion confined to a given space until it jumps to another region of constrained motion. By analyzing the velocity distribution in the trajectories, we could determine that the velocity during the jumps is higher than the average velocity. This behavior could be explained by a model which considers two states for the local DNA sequence: a free state in which the motion of the sequence is only restricted by its neighbors and a bound state in which the sequence is attached to an unknown nuclear component and moves faster and in a more directional motion. Supported by the NIH, PHS 5 P41-RRO3155, NIH R01 GM42516 and UIUC.