Physics > Biological Physics

Footprint traversal by ATP-dependent chromatin remodeler motor

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ATP-dependent chromatin remodeling enzymes (CRE) are bio-molecular motors in eukaryotic cells. These are driven by a chemical fuel, namely, adenosine triphosphate (ATP). CREs actively participate in many cellular processes that require accessibility of specific segments of DNA which are packaged as chromatin. The basic unit of chromatin is a nucleosome where 146 bp $\sim$ 50 nm of a double stranded DNA (dsDNA) is wrapped around a spool formed by histone proteins. The helical path of histone-DNA contact on a nucleosome is also called "footprint". We investigate the mechanism of footprint traversal by a CRE that translocates along the dsDNA. Our two-state model of a CRE captures effectively two distinct chemical (or conformational) states in the mechano-chemical cycle of each ATP-dependent CRE. We calculate the mean time of traversal. Our predictions on the ATP-dependence of the mean traversal time can be tested by carrying out {\it in-vitro} experiments on mono-nucleosomes.

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