

Abstract Submitted
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Sequence Heterogeneity Accelerates Protein Search for Targets on DNA¹ ALEXEY SHVETS, ANATOLY KOLOMEISKY, Rice Univ — The process of protein search for specific binding sites on DNA is fundamentally important since it marks the beginning of all major biological processes. We present a theoretical investigation that probes the role of DNA sequence symmetry, heterogeneity and chemical composition in the protein search dynamics. Using a discrete-state stochastic approach with a first-passage events analysis, which takes into account the most relevant physical-chemical processes, a full analytical description of the search dynamics is obtained. It is found that, contrary to existing views, the protein search is generally faster on DNA with more heterogeneous sequences. In addition, the search dynamics might be affected by the chemical composition near the target site. The physical origins of these phenomena are discussed. Our results suggest that biological processes might be effectively regulated by modifying chemical composition, symmetry and heterogeneity of a genome.

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