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HOW PROTEINS FIND THEIR TARGETS ON DNA

Protein searching and recognizing the targets on DNA one of the most fundamental processes in biology, and it was the subject of many experimental and theoretical studies. It is often argued that some proteins are capable of finding their targets 10-100 times faster than predicted by the three-dimensional diffusion rate. Current views of this facilitated diffusion phenomena suggest that a combination of three-dimensional and one-dimensional searches could explain such behavior. However, recent single-molecule experiments showed that the diffusion constants of the protein motion along DNA are usually very small. We present a theoretical approach that describes some physical-chemical aspects of the target search on DNA. It is argued that correlations and non-specific interactions are critically important. Our analysis shows that the acceleration in the search time could be achieved at some intermediate strength of the protein-DNA binding energy and for intermediate concentrations of free protein molecules.