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Ratcheting polymerase through DNA with small translocation energy bias

In gene transcription, RNA polymerase move processively along DNA to synthesize a complementary RNA strand from the template DNA. It has been suggested that the polymerase proceeds in a Brownian ratchet fashion, with its forward directionality supported not mechanically, but chemically, by nucleotide incorporation during RNA synthesis. Combining recent experimental data from single molecule force measurements with information from high-resolution molecular structures, we present a computational model dissecting details of the polymerization mechanism. From current model we notice that a small free energy bias exists in the polymerase translocation, either to serve for nucleotide selection in maintaining transcription fidelity, or to coordinate with some protein factor for certain functional control.