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Polymer Translocation: What Can We Learn From An Exactly Solvable One-Dimensional Model?[1]

GARY W. SLATER, University of Ottawa

The translocation of a polymer through a narrow hole or channel is generally not a quasi-static process (as we have shown using a detailed Molecular Dynamics simulation with explicit solvent). Nevertheless, numerous analytical models have relied on this approximation/assumption in order to make progress. A simple approach is then to describe the problem in terms of the translocation coordinate (e.g., the number of monomer on the *trans* side of the wall), which effectively makes it a one-dimensional problem with an external driving field and a entropy-related potential landscape. Our group has exploited this simple idea to its fullest using a lattice Monte-Carlo-like model that provides exact numerical results, even for extremely rare events. In this presentation, I will explain how this simplified model is built and how it can be modified to include a variety of additional effects such as polymer stiffness or the differences between the various monomer types in a biopolymer like DNA. I will review the main results obtained to date, focusing on the transitions between the low- and high- field regimes, and between the short- and long- polymer chain limits. Finally, I will examine the role of attractive interactions between the polymer and specific sites inside the channel.

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