MAR13-2012-020109

Abstract for an Invited Paper
for the MAR13 Meeting of
the American Physical Society

Polymer Translocation in a Crowded Environment: Effects due to Obstacle Density and Arrangement

HENDRICK W. DE HAAN, Department of Physics, University of Ottawa

The translocation of a polymer across a membrane through a nanopore has received much attention, primarily due to emerging nanotechnology applications such as DNA sequencing. However, translocation is also a process that is ubiquitous in the natural world with examples including the transport of DNA and proteins across cell walls. Considering this latter motivation, the environment in which translocation occurs is relatively complicated with many intracellular and extracellular inclusions such as the cell organelles, soluble proteins, and components of the cytoskeleton and extracellular matrix. In this talk, we examine translocation in such a crowded environment via computer simulations in which we place immobile, spherical "obstacles" on both sides of the membrane. We show that an effective driving force arises i) when the concentration of obstacles across the pore differs and ii) when the arrangement of obstacles across the pore differs. A simple force model is used to estimate the magnitude of these entropic driving forces. Good agreement is found between the results and the simple models. Simulations are also performed with both effects present such that a bias resulting from a lower concentration of obstacles on the *cis* side of the membrane is opposed by a bias arising from an increased amount of disorder on *trans*. Results from this setup indicate that in a real system where both effects are likely to play a role, it could be difficult to guess even the direction of the intrinsic resulting driving force, let alone the magnitude. We also present results from simulations in which the obstacles are mobile but restricted to different degrees.