

[Talk 24] Anomalous diffusion during polymer translocation: We can even have a negative "diffusion coefficient"!

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DNA translocations through nanopores typically occur over timescales much shorter than the DNA relaxation time. Therefore, the process is highly out of equilibrium. Coarse-grained Langevin Dynamics simulations demonstrate that the translocation times are significantly dependent upon the initial polymer conformations - a phenomenon called molecular individualism. In addition to thermal noise, the range of the initial polymer conformations contribute to the width of the translocation time distribution. By deforming the polymer prior to-and during-the translocation process, we study ways in which the range of initial conformations can be reduced as a means to produce more deterministic translocation events. To achieve this, we focus on using geometrical confinement as well as via the use of additional external forces applied on the polymer ends. We show how the translocation time distribution is affected by both the amplitude of the thermal noise and the degree of polymer deformation when we apply external constraints. Different confining geometries can be chosen to achieve i) translocation events which take a longer time period; ii) translocation time distributions with a smaller variance; and/or iii) mean translocation rates that are much more constant throughout the process. Interestingly, we find that there are cases where the effective diffusivity is negative during the process.