

Macromolecular Translocation through Nanopores

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The translocation of a single macromolecule through a protein pore or a solid-state nanopore involves three major stages (1): (a) approach of the macromolecule towards the pore, (b) capture/recognition of the macromolecule at the pore entrance, and (c) threading through the pore. All of these stages are controlled by conformational entropy of the macromolecule, charge decoration and the geometry of the pore, hydrodynamics, and electrostatic interactions. Chief among the contributing factors are the entropic barrier presented by the pore to the penetration of the macromolecule, pore-polymer interactions, electroosmotic flow, and the drift-diffusion of the macromolecule in electrolyte solutions. A unifying theory of these contributing factors will be described in the context of a few illustrative experimental data on DNA-translocation through protein pores, solid-state nanopores, and solid-state nanofluidic channels. Future challenges to specific biological systems will be briefly discussed.

References

- [1] M. Muthukumar, "Polymer Translocation", CRC Press, Boca Raton, 2011.