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Electrophoresis of a polyelectrolyte through a nanopore SANDIP GHOSAL, Northwestern University (Mech. Eng.) — Translocation of polyelectrolytes (such as DNA) through natural and artificial nanopores can be detected with single molecule resolution by monitoring the resistivity of the pore (*Nature Biotechnology* (2001) **19**, pp. 248). The technique could evolve into a technology for sequencing DNA at speeds that are orders of magnitude faster than what is currently possible. Here a hydrodynamic model to determine the electrophoretic speed of a polyelectrolyte through a nanopore is presented. It is assumed that the speed is determined by a balance of electrical and viscous forces arising from within the pore and that classical continuum electrostatics and hydrodynamics may be considered applicable. An explicit formula for the translocation speed as a function of the pore geometry and other physical parameters is obtained and is shown to be consistent with experimental measurements on DNA translocation through nanopores in silicon membranes. Secondary effects such as the hydrodynamic friction on the part of the polymer outside the nanopore must also be considered to explain the weak dependence of the translocation speed on the polymer length.

Sandip Ghosal
Northwestern University (Mech. Eng.)

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