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Translocation and unzipping kinetics of DNA molecules using a nanopore

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We have developed a method to dynamically set the voltage applied across a phospholipid bilayer that contain a single α -Hemolysin pore[1]. With this method the entry rate of single-stranded DNA or RNA molecules into the nanometer scale pore, and the voltage wave used to induce their unzipping rate, are independently controlled. Thus, hundreds of polynucleotides can be individually analyzed in a short period of time (a few minutes). We have used this method to characterized the unzipping kinetics of DNA hairpin molecules under fixed voltage amplitudes (V), or steady voltage ramps (\dot{V}). We found that at high voltages ($V > 30$ mV) or at high voltage ramps ($\dot{V} > 5$ V/s) the unzipping process can be described by a single step kinetics model with negligible re-zipping probability. But at the low voltage (or voltage ramp) regime re-zipping probability must be included to account for our data[2]. A model that includes re-zipping is introduced and is used to fit our data at low and high voltages. From the fits we estimate the effective DNA charge inside the nanopore and the unzipping rate of the hairpins at the limit of zero force. 1. M. Bates, M. Burns, and A. Meller, *Biophys. J.* **84** (4), 2366 (2003). 2. J. Mathé, H. Visram, V. Viasnoff, Y. Rabin and A. Meller, *Biophys. J.* **87** (5), 3205 (2004).