DNA and RNA unzipping using nanopore force spectroscopy
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RNA molecules can be electrophoretically threaded through nanoscale pores, such as
the ~1.5 nm alpha-Hemolysin. Information about their translocation dynamics is
obtained by probing the ionic current flowing through the pore during their passage.
We experimentally study the translocation process of unstructured and structured
DNA molecules through a single nanopore. We find that the translocation process
depends on DNA properties, such as its sequence and its direction of entry. With
intense electrical field structured DNA and RNA can be unzipped in a controlled
way, and the unzipping kinetics can be directly quantified. We study the unzipping
kinetics of DNA and RNA molecules under a wide range of voltage gradients. We
find that the unzipping kinetics is characterized by two limiting regimes: the strong
field limit in which the system is unzipped in an irreversible process, and the weak
field regime, in which it is in quasi equilibrium. Interestingly the unzipping kinetics
of RNA molecules is very different from their DNA analogues. A theoretical model
that accounts for our experimental results will be discussed.