



Diffusion and electrophoretic transport of DNA Polymers in Microfluidic Channels made of PDMS

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Acknowledgements



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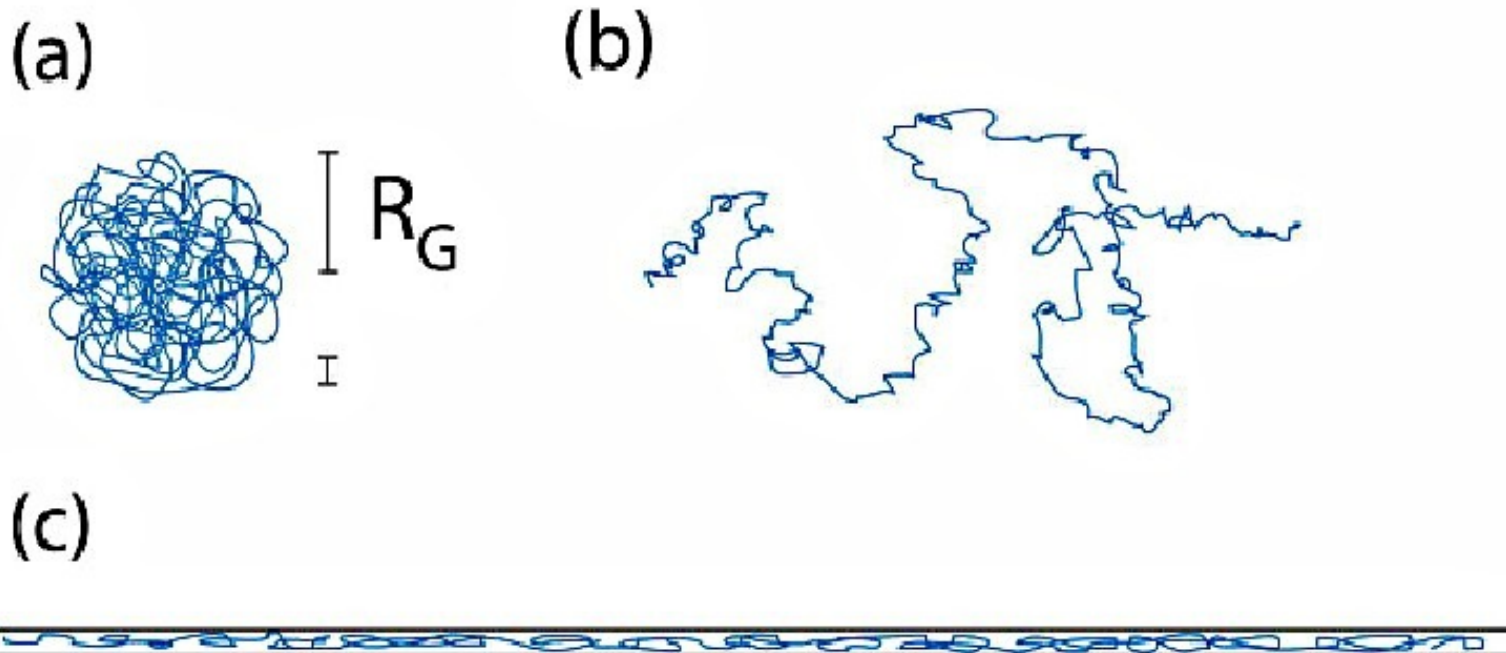


Juliane Posseckardt



Dr. Ing Steffen Howitz

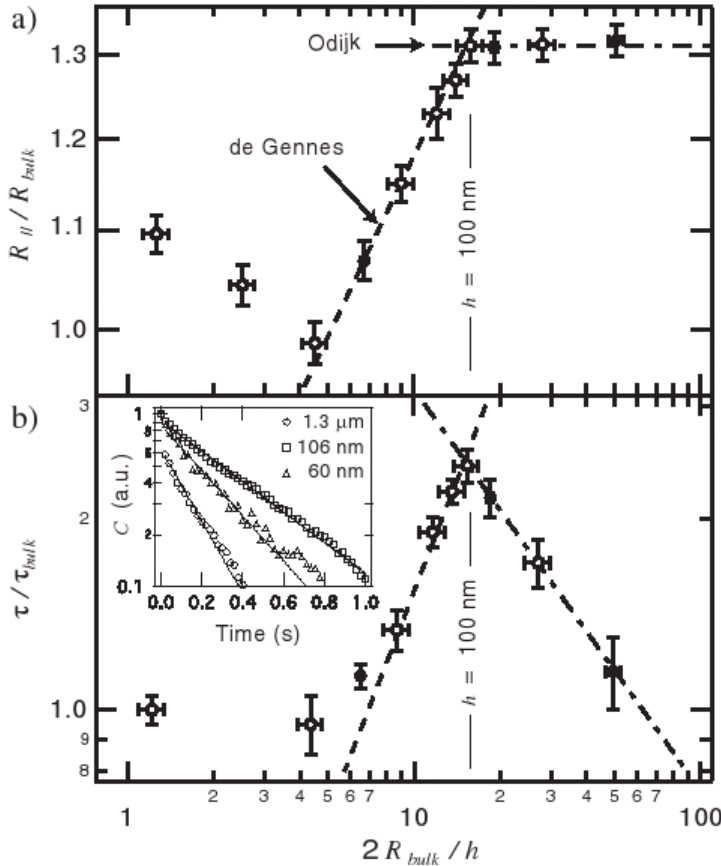
Confinement effects on conformation



Cartoon of a λ -phage DNA molecule (a) unconfined in free solution (R_G : radius of gyration), (b) confined in one dimension as in a nanoslit (depth of slit $< R_G$), (c) confined in a nanochannel (diameter $< R_G$). The three DNA contours have been drawn roughly to scale relative to one another. The small scale bar represents the spatial resolution limit.



Scaling behavior of DNA under confinement



$$R_g = \frac{1}{2N^2} \sum_{i,j=0}^N \langle (\vec{r}_i - \vec{r}_j)^2 \rangle$$

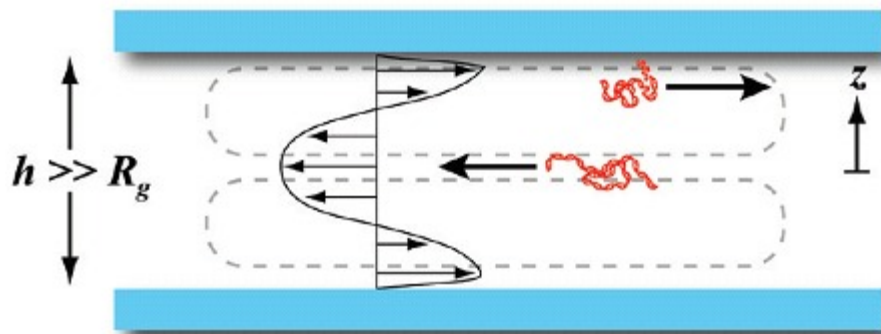
$$R_{||} = \sqrt{(R_M^2 + R_m^2)/2}$$

$$R_{||} \sim aN^{3/5}(R_{\text{bulk}}/h)^{1/4}$$

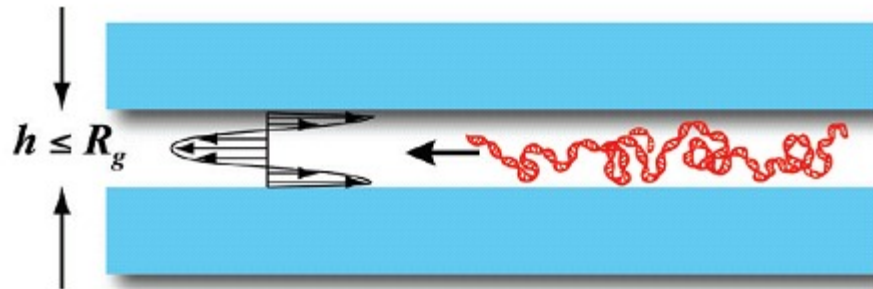
Bonthuis, D. J.; Meyer, C.; Stein, D. & Dekker, C.

Conformation and dynamics of DNA confined in slitlike nanofluidic channels. *Phys Rev Lett*, **2008**, 101

Circulation of DNA in channels



Velocity of a molecule depends on its height, z , in the channel.

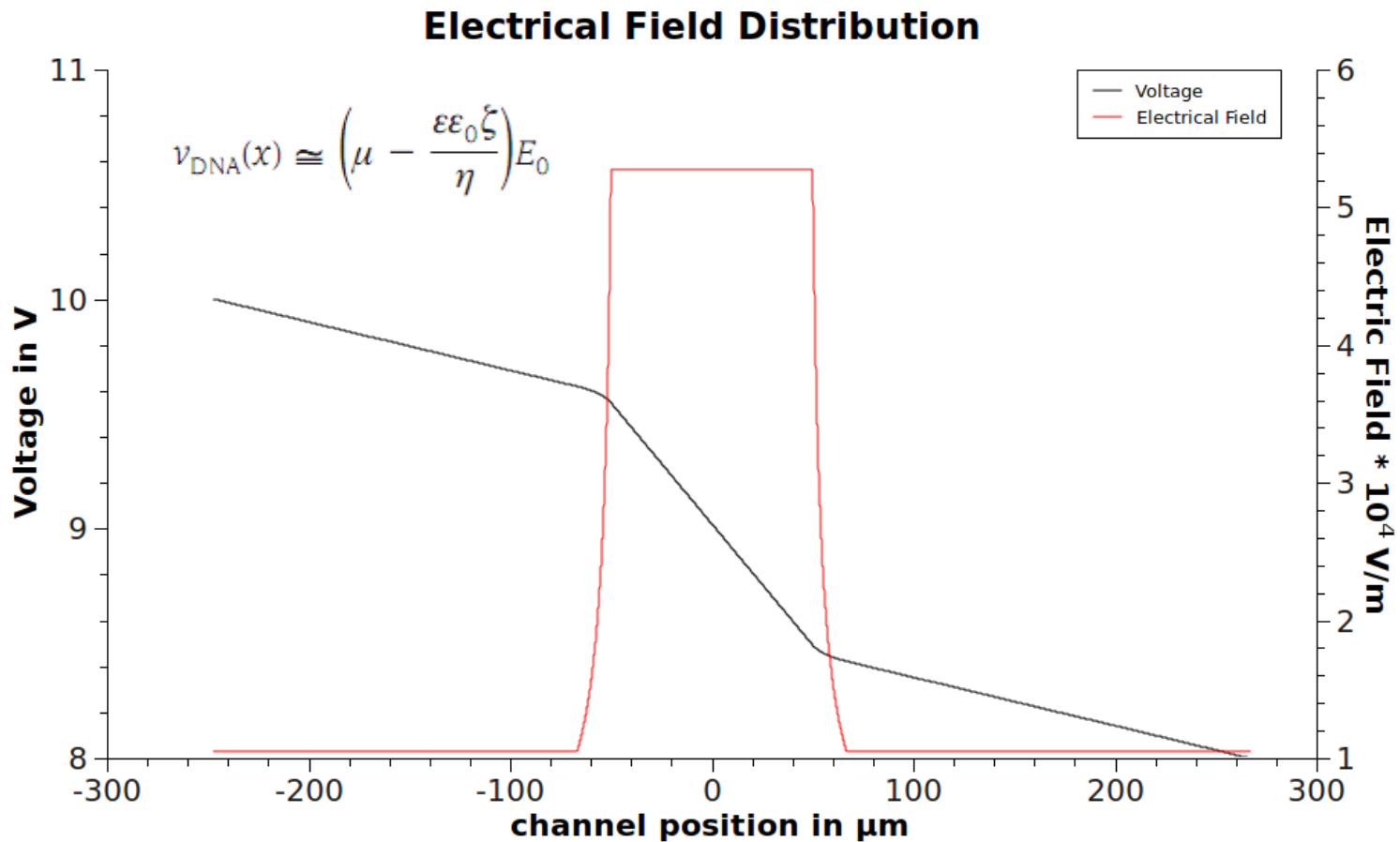


The transport of a polymer is predicted to become z -independent in the nano-confined regime

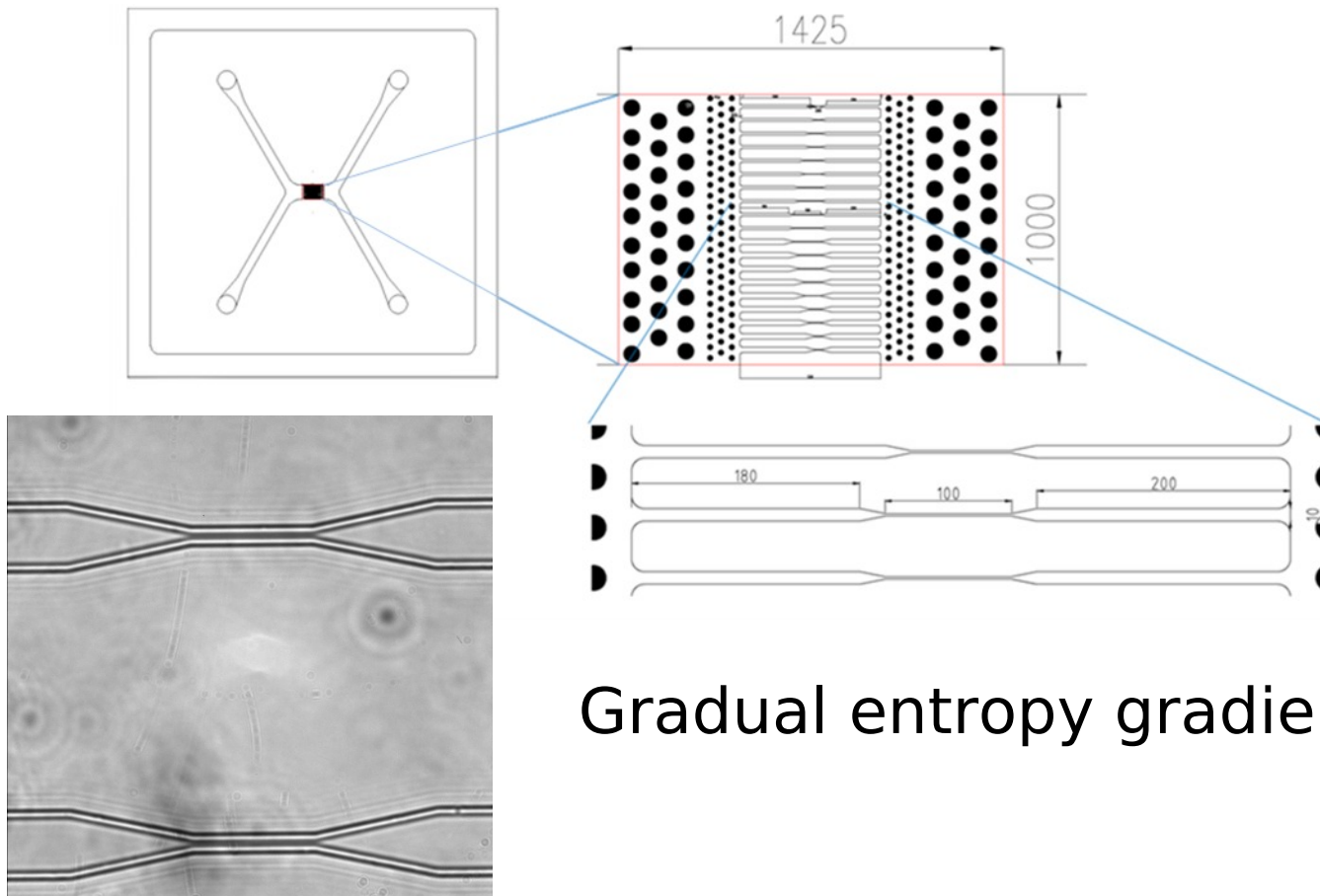
Stein, D.; Deurvorst, Z.; van der Heyden, F. H. J.; Koopmans, W. J. A.; Gabel, A. & Dekker, C. Electrokinetic Concentration of DNA Polymers in Nanofluidic Channels, *Nano Letters*, **2010**, *10*, 765-772



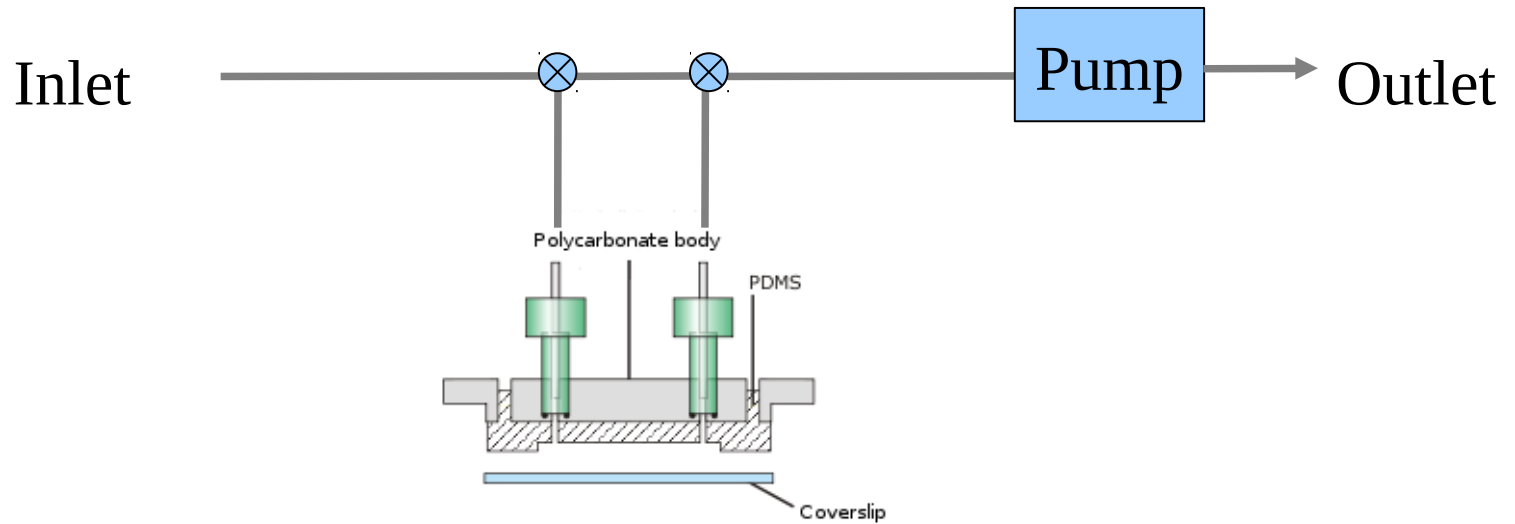
Simulated voltage profile



PDMS stamp

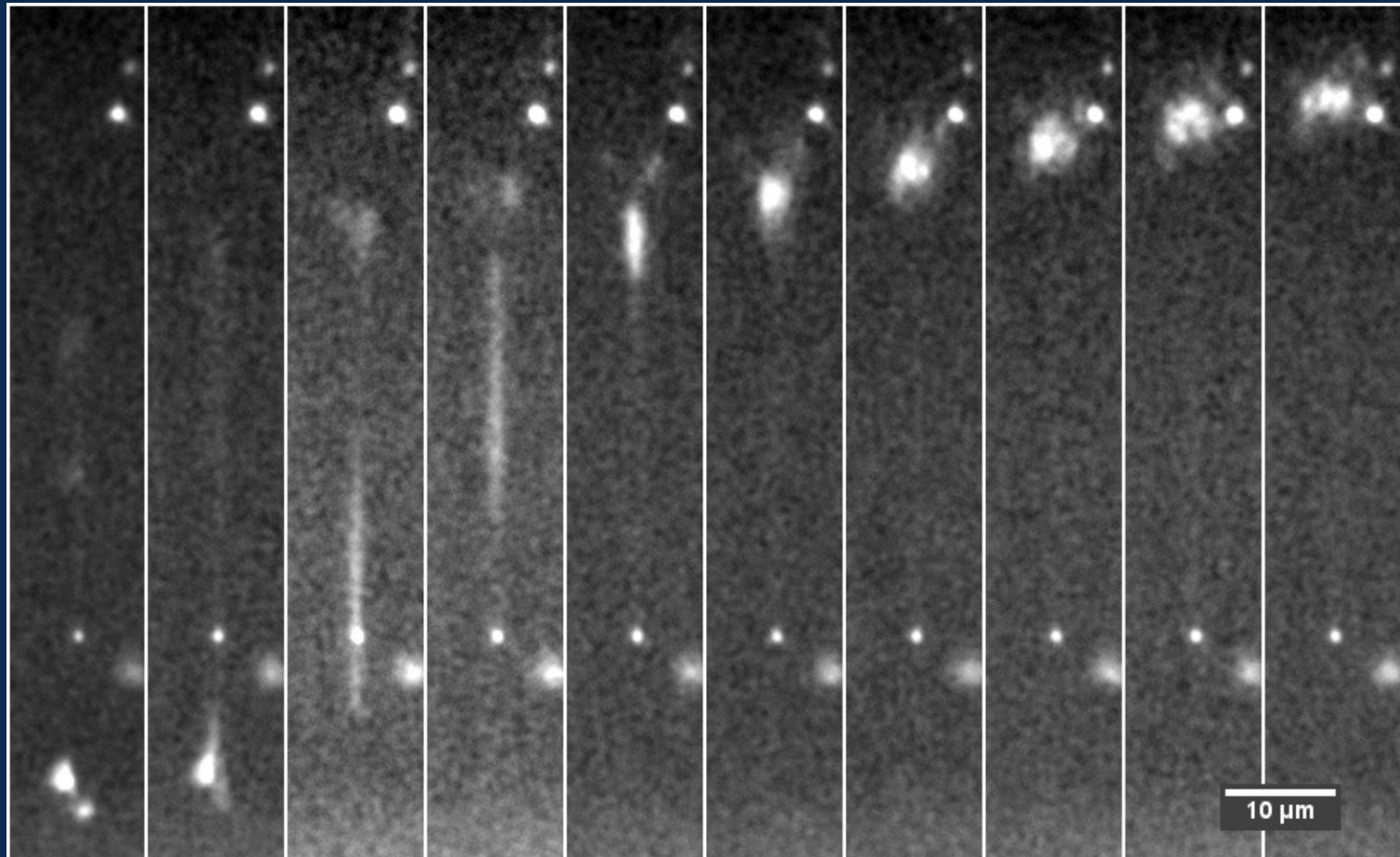


Filling procedure





Accumulation of molecules due to the electric field



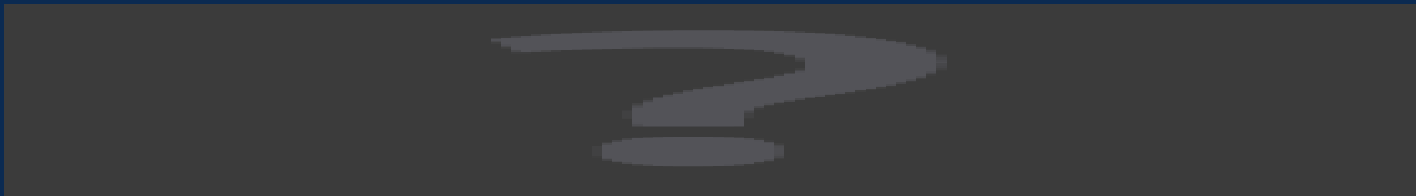
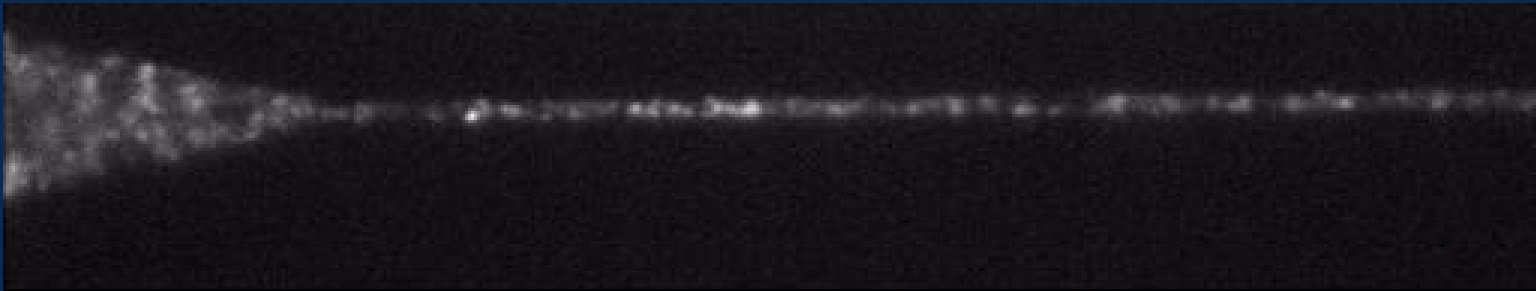


Accumulation of DNA molecules due to electric field

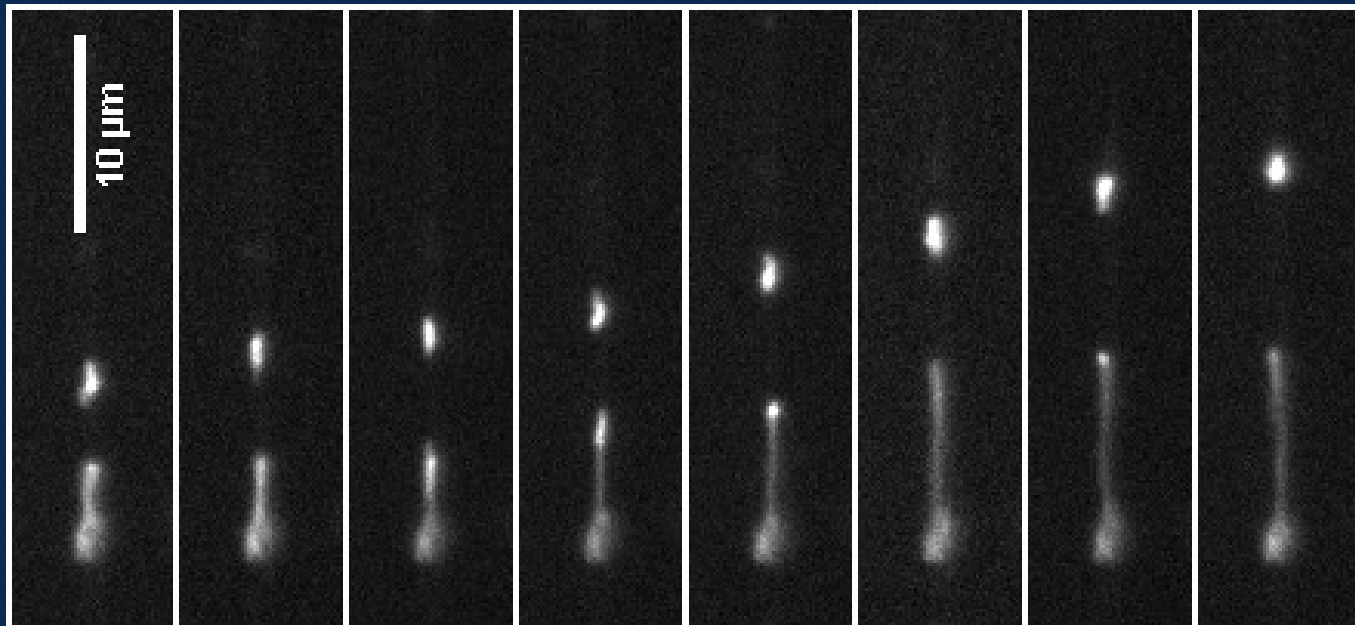




Diffusion of DNA molecules in equilibrium

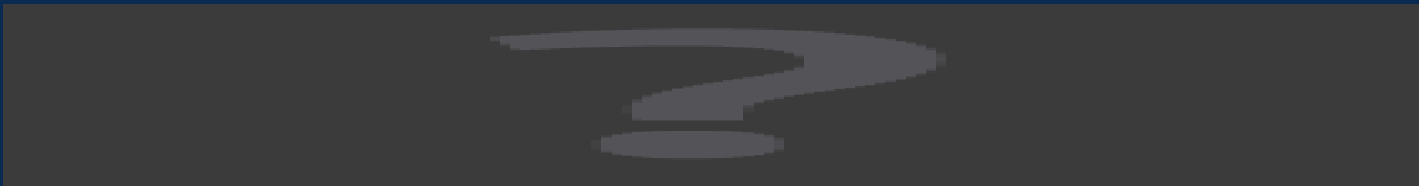
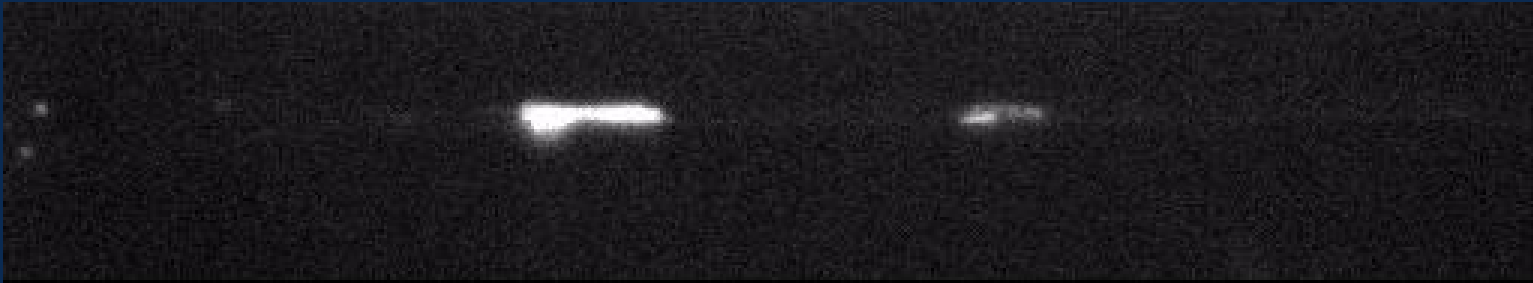


Stretching of DNA in flow



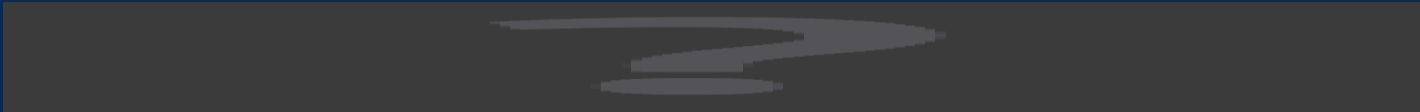
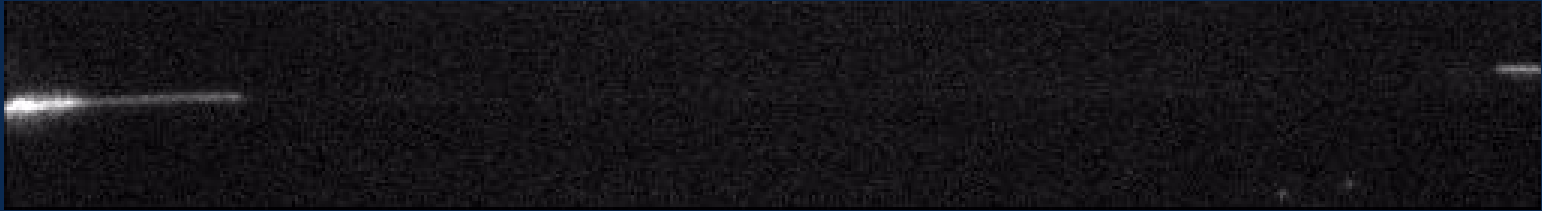


Stretching of DNA in Flow (switch off)





Stretching of DNA in Flow (switch on)

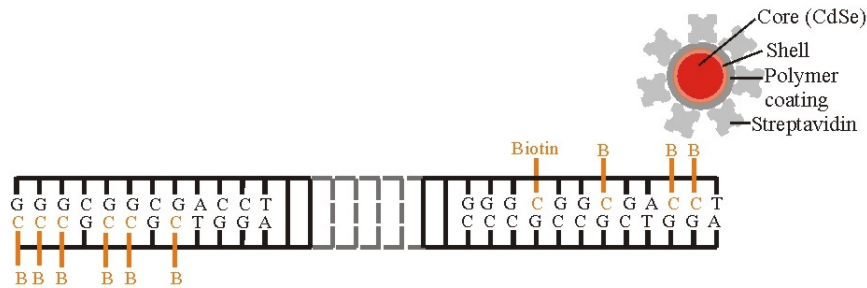




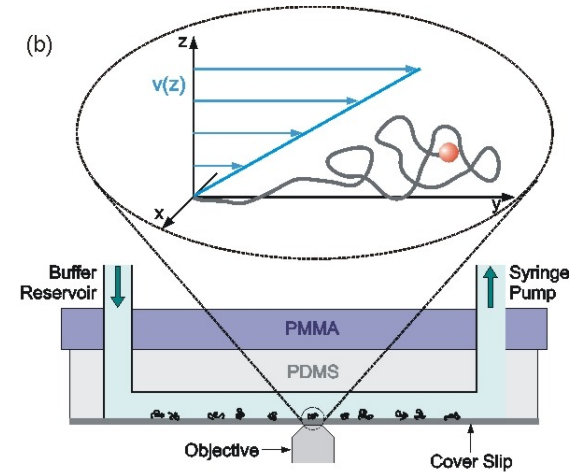
Thank you for your kind attention.

DNA conjugated with quantum dots

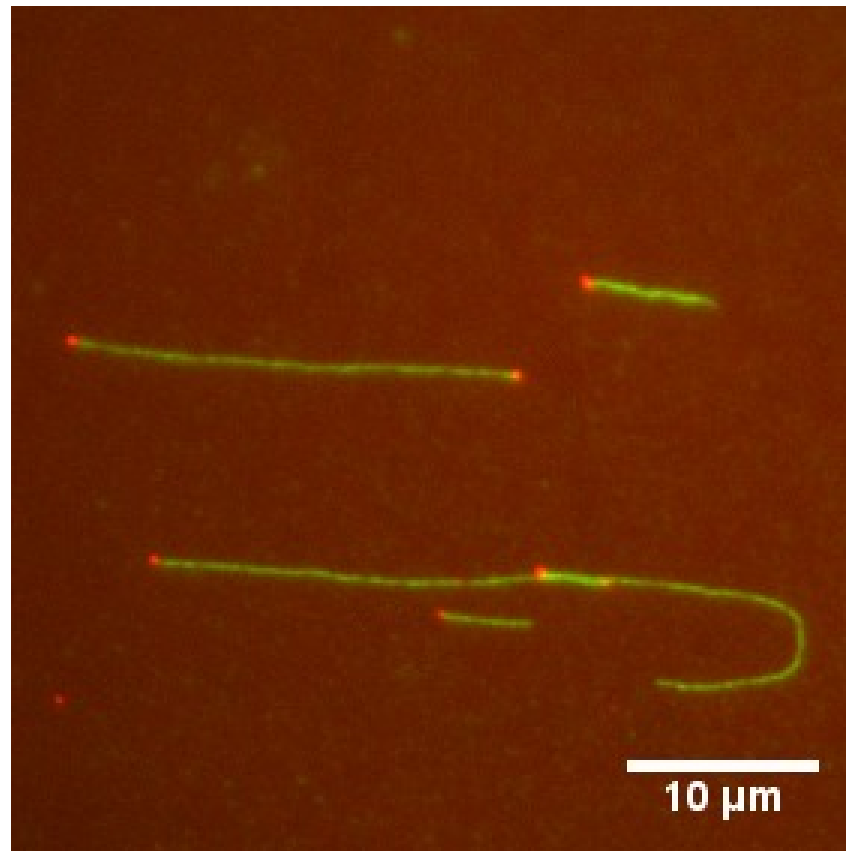
(a)



(b)



DNA conjugated with quantum dots





Fluctuation of DNA conjugated quantum dots

