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Nanochannel Platform for Single-DNA Studies; From DNA-Protein Interaction to Large Scale Genome Sequencing JOHAN VAN DER MAAREL, JEROEN VAN KAN, CE ZHANG, National University of Singapore — The study of nanochannel-confined DNA molecules is of importance from both biotechnological and biophysical points of view. We produce nanochannels in elastomer-based biochips with soft lithography using proton beam writing technology. The cross-sectional diameter of the channels is in the range of 50 to 300 nm. Single DNA molecules confined inside these channels can be visualized with fluorescence microscopy. Two related issues concerning DNA confined in such a nanospace will be discussed. For the first issue, the dynamic effects of nucleoid associated proteins (H-NS and HU) and protamine on the conformation and condensation of DNA will be presented. We use a novel, cross-channel device, which allows the monitoring of the conformational response after a change in environmental solution conditions in situ. The second issue concerns bottlebrush-coated DNA. The bottlebrush has an increased bending rigidity and thickness, which results in an amplified stretch once it is confined inside a nanochannel. It will be demonstrated that large-scale genomic organization can be sequenced using single DNA molecules on an array of elastomeric nanochannels with cross-sectional diameters of 200 nm. Overall, our results show that the effects of proteins on the conformation and folding of DNA are not only related to protein binding, osmolarity, and charge, but that the interplay with confinement in a nanospace is of paramount importance.

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