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DNA in nanofluidic devices

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Nanochannels with a channel cross-section of around 100 nm x 100 nm or less are emerging as a powerful new technique for single-molecule DNA analysis. In these nanochannels, DNA is linearized to a constant fraction of its contour length, and thus spatial locations measured by fluorescence microscopy can be directly related to genomic locations. Because the stretching in nanochannels is caused by lateral confinement, molecules are free to undergo longitudinal fluctuations. Hence, time-averaging over a single molecule is meaningful, and a high resolution can be achieved even using few molecules. We will present how DNA imaging in nanochannels can be applied to common tasks in molecular biology that go beyond simple sizing. In particular, we will discuss the genomic identification of human DNA fragments using fluorescent markers, and how to perform enzymatic reactions, such as restriction mapping using endonucleases, in nanochannels. We will also present our recent progress in the development of "nanoplumbing", that is devices that contain junctions of nanochannels. We will show how device dimensions influence the transport of DNA at those nanochannel junctions, and how those properties can be utilized in the design of devices and exotic materials.