

Genome mapping in nanochannel arrays

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Silicon nano channel arrays with channel cross section on the order of 50-100nm are now routinely fabricated and have recently been commercialized. These nanostructures allow stretching individual DNA molecules inside the channels by applying an electric field. By attaching fluorescent molecules to genetic and epigenetic marks on the DNA molecule, the stretched DNA is visualized as a pattern of fluorescent spots along the DNA molecules. We show how physical extension of long DNA molecules on surfaces and in nanofluidic channels reveals this information in the form of a linear, optical “barcode”, like beads threaded on a string, where each bead represents a distinct type of observable. Recent results from our lab demonstrate our ability to detect genetic structural variations (SVs), DNA repeats, DNA epigenetic modifications and various forms of DNA damage on individual genomic DNA molecules.