# ELECTROKINETICALLY-DRIVEN MICROFLUIDICS AND NANOFLUIDICS pdf

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*ELECTROKINETICALLY DRIVEN MICROFLUIDICS AND NANOFLUIDICS Electrokinetics is currently the mechanism of choice for ï¬,uid actuation and bioparticle.*

Droplet-based microfluidics Droplet-based microfluidics is a subcategory of microfluidics in contrast with continuous microfluidics; droplet-based microfluidics manipulates discrete volumes of fluids in immiscible phases with low Reynolds number and laminar flow regimes. Interest in droplet-based microfluidics systems has been growing substantially in past decades. Following the analogy of digital microelectronics, this approach is referred to as digital microfluidics. Le Pesant et al. The technology was subsequently commercialised by Duke University. By using discrete unit-volume droplets, [40] a microfluidic function can be reduced to a set of repeated basic operations, i. This "digitisation" method facilitates the use of a hierarchical and cell-based approach for microfluidic biochip design. Therefore, digital microfluidics offers a flexible and scalable system architecture as well as high fault-tolerance capability. Moreover, because each droplet can be controlled independently, these systems also have dynamic reconfigurability, whereby groups of unit cells in a microfluidic array can be reconfigured to change their functionality during the concurrent execution of a set of bioassays. Although droplets are manipulated in confined microfluidic channels, since the control on droplets is not independent, it should not be confused as "digital microfluidics". One common actuation method for digital microfluidics is electrowetting -on-dielectric EWOD. Many lab-on-a-chip applications have been demonstrated within the digital microfluidics paradigm using electrowetting. However, recently other techniques for droplet manipulation have also been demonstrated using magnetic force [46] , surface acoustic waves , optoelectrowetting , mechanical actuation, [47] etc. Paper-based microfluidics Paper-based microfluidic devices fill a growing niche for portable, cheap, and user-friendly medical diagnostic systems. In order to tune fluid penetration in porous substrates such as paper, in two and three dimensions, the pore structure, wettability and geometry of the microfluidic devices can be controlled while the viscosity and evaporation rate of the liquid play a further significant role. Many such devices feature hydrophobic barriers on hydrophilic paper that passively transport aqueous solutions to outlets where biological reactions take place. A drawback of DNA and protein arrays is that they are neither reconfigurable nor scalable after manufacture. Digital microfluidics has been described as a means for carrying out Digital PCR. Molecular biology[ edit ] In addition to microarrays, biochips have been designed for two-dimensional electrophoresis , [52] transcriptome analysis, [53] and PCR amplification. The resulting landscapes can be used as physical implementations of an adaptive landscape , [55] by generating a spatial mosaic of patches of opportunity distributed in space and time. The patchy nature of these fluidic landscapes allows for the study of adapting bacterial cells in a metapopulation system. The evolutionary ecology of these bacterial systems in these synthetic ecosystems allows for using biophysics to address questions in evolutionary biology. Microfluidics has also greatly aided the study of durotaxis by facilitating the creation of durotactic stiffness gradients. Cellular biophysics[ edit ] By rectifying the motion of individual swimming bacteria, [58] microfluidic structures can be used to extract mechanical motion from a population of motile bacterial cells. Examples of optofluidic devices are tunable microlens arrays [62] [63] and optofluidic microscopes. Microfluidic flow enables fast sample throughput, automated imaging of large sample populations, as well as 3D capabilities. ADE technology is a very gentle process, and it can be used to transfer proteins, high molecular weight DNA and live cells without damage or loss of viability. This feature makes the technology suitable for a wide variety of applications including proteomics and cell-based assays. Electroosmotic pump Microfluidic fuel cells can use laminar flow to separate the fuel and its oxidant to control the interaction of the two fluids without a physical barrier as would be required in conventional fuel cells.

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