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Title:

Droplet based microfluidics for high-throughput bioassays

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A recent trend in biosensor technology is the integration of biosensing assays in microfluidic devices. These devices allow automated, high throughput analyses, in combination with significantly reduced amounts of sample and reagents. An upcoming category of microfluidics is the droplet based microfluidics, involving the transport of individual droplets by a carrier flow. In this two- or multiphase systems, thousands of nanoliter droplets (from 3000 per second to 1 per minute) can be formed, merged, mixed and split. Hence, this platform serves as a powerful tool to create high-throughput nanoreactors.

This work presents the production and use of a droplet based lab-on-a-chip in poly(dimethyl)siloxane (PDMS). The nanodrops are generated by mixing two immiscible fluids: perfluorocarbon oil (as carrier phase) and water (as nanoreactor). In the PDMS channels, at the T-junction, the water phase is injected in the perfluoroil, forming drops of water in a continuous oil phase.

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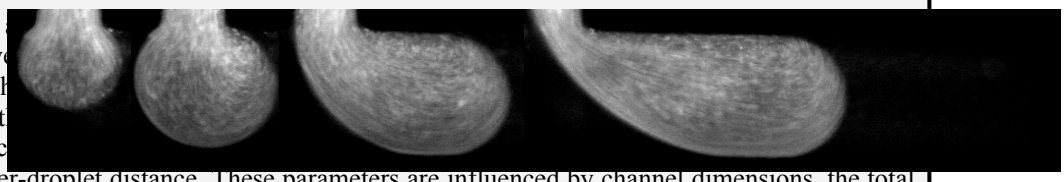

inter-droplet distance. These parameters are influenced by channel dimensions, the total flow speed, the flow ratio (of water and oil) and the concentration of surfactants.

The chip will be used for the execution of an IgE-bioassay, utilising magnetic nanoparticles. Antibodies are immobilised on the surface of these particles and capture the IgE-molecules in the sample. Separating the beads from most of the sample volume (using external magnets), results in an increased concentration of IgE, thereby improving detection limits. A second fluorescent labelled antibody is used to qualify the amount of captured IgE.

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