

Microdroplets in Microfluidics: towards a new tool for single cell experiments

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In recent years there has been an enormous interest in exploiting droplet-based microfluidic devices for performing on-chip biochemical reactions including enzyme kinetics, protein crystallization, PCR and *in vitro* translation and transcription. Nanoliter droplets of water in oil emulsions can be created inside microfluidic devices and can be merged, split and sorted using electric fields, while the contents can be analyzed with sensitive optical techniques. The very high throughput of these devices, up to 10,000 per second, drives research in this area to include directed evolution on-chip and single cell gene expression experiments.

In my talk, I will present some of our recent results on *in vitro* translation and transcription inside droplets, parallel enzymatic reactions, emulsion separation on chip, coupling of fluorescence detection with sorting and mass spectrometric analysis of droplets contents, and progress in developing tools for single cell ‘cellulomics’.

Recent publications

Simultaneous Determination of Gene Expression and Enzymatic Activity in Individual Bacterial Cells in Microdroplet Compartments

J. U. Shim, L. F. Olguin, G. Whyte, D. Scott, A. Babbie, C. Abell, W. T. S. Huck, F. Hollfelder

J. Am. Chem. Soc. **2009**, *131*, 15251-15256.

Coupling Microdroplet Microreactors with Mass Spectrometry: Reading the Contents of Single Droplets Online

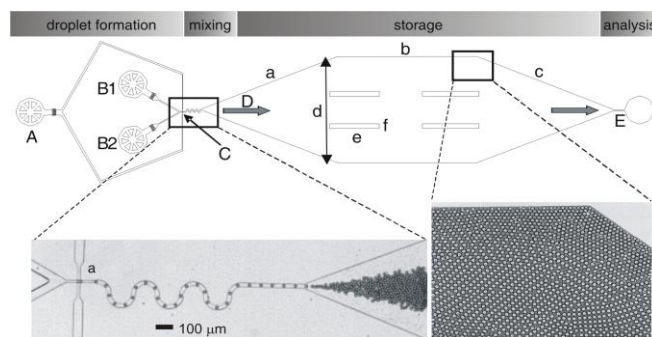
L. M. Fidalgo, G. Whyte, B.T. Ruotolo J. L. P. Benesch, F. Stengel, C. Abell, C. V. Robinson, W. T. S. Huck

Angew. Chem. Int. **2009**, *48*, 3665-3668

From Microdroplets to Microfluidics: Selective Emulsion Separation in Microfluidic Devices

L. M. Fidalgo, G. Whyte, D. Bratton, C. F. Kaminski, C. Abell, W. T. S. Huck

Angew. Chem. Int. **2008**, *47*, 2042-2045



*An integrated device for monitoring time-dependent *in vitro* expression from single DNA molecules in picolitre droplets*