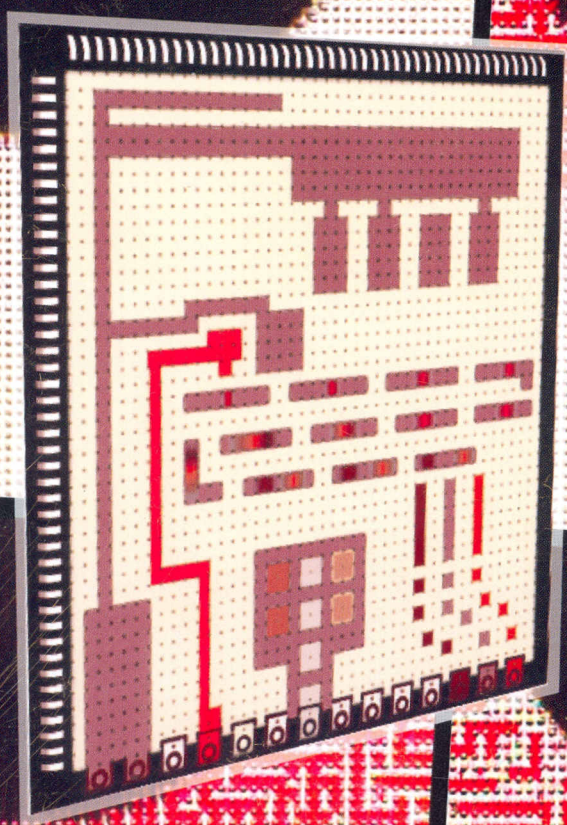


Lab on a Chip

Micro- & nano- fluidic research for chemistry, physics, biology, & bioengineering

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Heikenfeld
Virtual electrowetting channels

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ISSN 1473-0197 CODEN LCAHAM 10(7) 801–924 (2010)



Cover

See Heikenfeld *et al.*, pp. 832–836.
Time lapse experimental photos,
and envisioned programmable
lab-on-a-chip.
Image reproduced by permission
of Jason Heikenfeld from
Lab Chip, 2010, **10**, 832.



Inside cover

See Chiu *et al.*, pp. 837–842.
A filtration app for enriching
circulating tumor cells. A
co-current filtration chip with
improved hydrodynamic design
reduced cellular stress. Image
designed by J. S. Kuo.
Image reproduced by permission
of Daniel Chiu from
Lab Chip, 2010, **10**, 837.

HIGHLIGHT

811

Research Highlights

Petra S. Dittrich*

Petra Dittrich reviews the current literature in miniaturisation
and related technologies.



FOCUS

813

Lost in translation

Holger Becker*

Holger Becker discusses how the academic and industrial
communities can work together on microfluidic projects—part of
a series of Focus articles on the commercialization of
microfluidics.

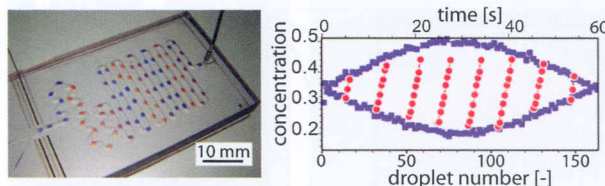


816

High-throughput automated droplet microfluidic system for screening of reaction conditions

Krzysztof Churski, Piotr Korczyk and Piotr Garstecki*

A droplet on demand technique based on external electromagnetic valves allows for high-throughput screening of sequences of droplets of individually addressed chemical compositions.

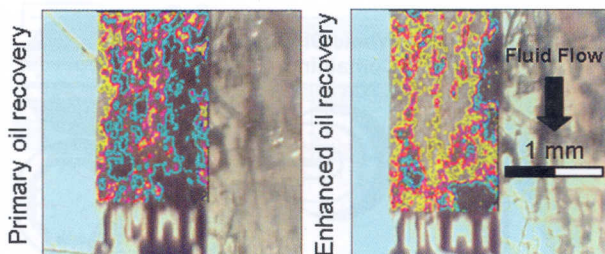


819

Benchmarking methods of enhanced heavy oil recovery using a microscaled bead-pack

Stephen A. Bowden,* Jonathan M. Cooper, Fritz Greub, Dali Tambo and Andrew Hurst

The aim of this paper is to prove that small, microscaled bead-packs can yield geologically useful information, consistent with current models of fractional fluid flow within porous media.

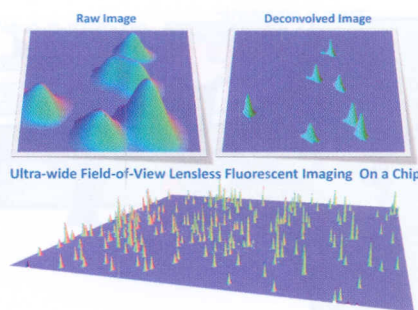


824

Wide field-of-view lens-free fluorescent imaging on a chip

Ahmet F. Coskun, Ting-Wei Su and Aydogan Ozcan*

We demonstrate an on-chip fluorescent detection platform that can simultaneously image fluorescent micro-objects or labeled cells over an ultra-large field-of-view of 2.5 cm × 3.5 cm without the use of any lenses, thin-film filters and mechanical scanners.

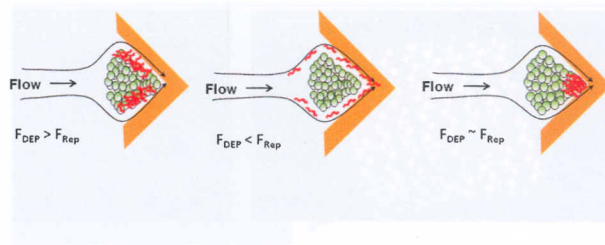


828

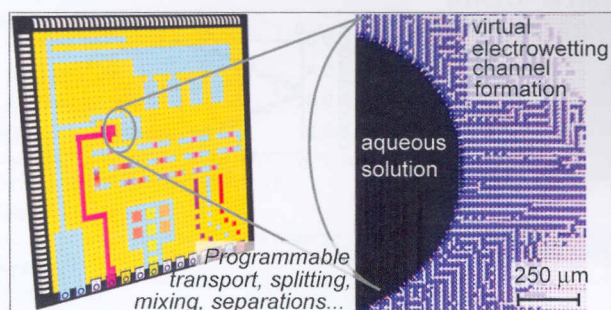
A rapid field-use assay for mismatch number and location of hybridized DNAs

I-Fang Cheng, Satyajyoti Senapati, Xinguang Cheng, Sagnik Basuray, Hsien-Chang Chang and Hsueh-Chia Chang*

Development of rapid and highly sensitive hand-held DNA hybridization assay platform would transform field-use diagnostics. Here, we demonstrate how AC and flow fields near a nanostructure assembly can be designed to concentrate DNA molecules at a localized position in a microfluidic channel for rapid and sensitive DNA hybridization assay.



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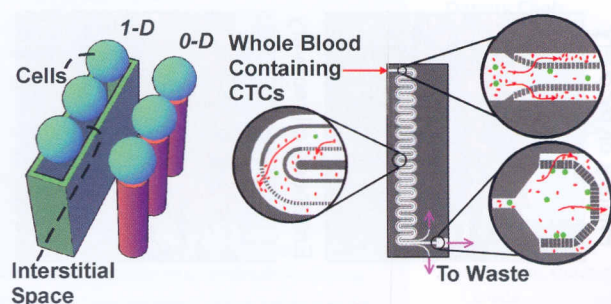


Virtual electrowetting channels: electronic liquid transport with continuous channel functionality

Manjeet Dhindsa, Jason Heikenfeld,* Seyeoul Kwon, Jungwon Park, Philip D. Rack and Ian Papautsky

Reported is a new mechanism for transport of liquid in virtual electrowetting channels. These channels form as voltage is applied to an array of polymer posts. This work has the potential to combine the advantages of programmable electrowetting and continuous channel functionality.

837

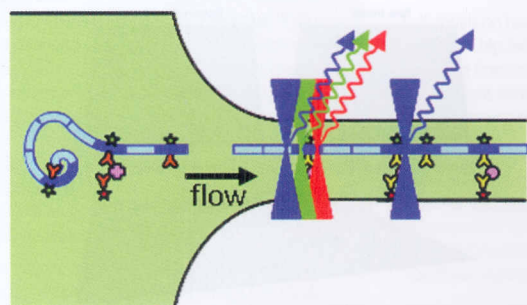


Deformability considerations in filtration of biological cells

Jason S. Kuo, Yongxi Zhao, Perry G. Schiro, Laiying Ng, David S. W. Lim, J. Patrick Shelby and Daniel T. Chiu*

Microfabrication offers new possibilities to design fluidic environments for reducing cellular stress during the filtration of circulating tumor cells.

843

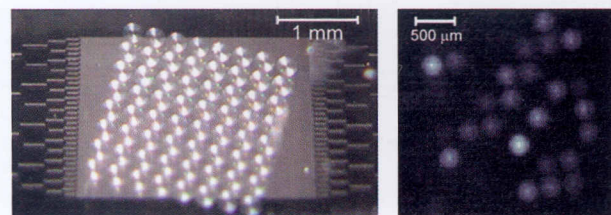


A microfluidic chip-compatible bioassay based on single-molecule detection with high sensitivity and multiplexing

Randall E. Burton,* Eric J. White, Ted R. Foss, Kevin M. Phillips, Robert H. Meltzer, Nanor Kojanian, Lisa W. Kwok, Alex Lim, Nancy L. Pellerin, Natalia V. Mamaeva and Rudolf Gilmanshin

We present a novel DNA-based reagent uniquely suited for microfluidics-based bioassays. Examples are shown indicating the enormous potential of this technology for rapid, sensitive detection of many analytes simultaneously.

852



High-throughput fluorescence detection using an integrated zone-plate array

Ethan Schonbrun,* Adam R. Abate, Paul E. Steinvurzel, David. A. Weitz and Kenneth B. Crozier

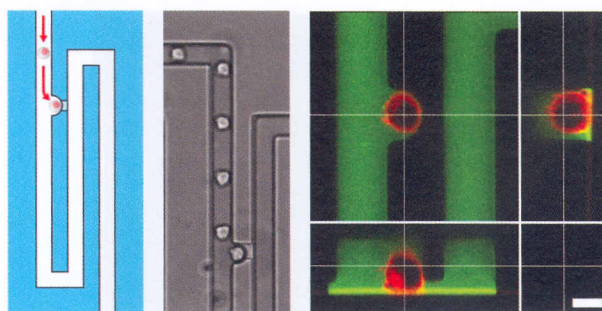
We present a fluorescence measurement platform based on a microfabricated zone-plate array integrated into a parallelized microfluidic device. The parallelization of microfluidics and optics produces an integrated system capable of analysis of nearly 200 000 drops per second.

857

Optimization of microfluidic single cell trapping for long-term on-chip culture

Stefan Kobel, Ana Valero, Jonas Latt, Philippe Renaud and Matthias Lutolf*

We present a novel high-throughput single cell trap with trapping yields of nearly 100% that enables the stable long-term culture of non-adherent single cells with a viability of more than 90%.

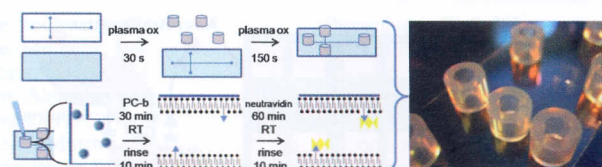


864

Air-stable supported membranes for single-cell cytometry on PDMS microchips

K. Scott Phillips, Kyung Mo Kang, Louise Licata and Nancy L. Allbritton*

Protein-reinforced supported membranes were used to coat PDMS/glass microchips used for single-cell cytometry. The rSBM coatings yielded excellent separations, were air-stable, and could be stored dehydrated for 1–2 months.

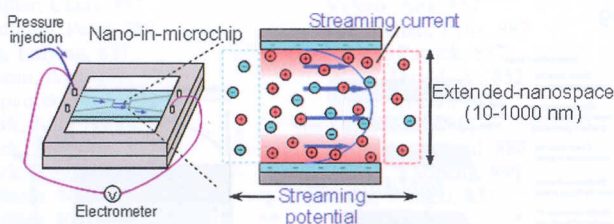


871

Streaming potential/current measurement system for investigation of liquids confined in extended-nanospace

Kyojiro Morikawa, Kazuma Mawatari, Masaru Kato, Takehiko Tsukahara and Takehiko Kitamori*

We report a new method for measuring the streaming potential/current in size-controlled 2D extended-nanospace on glass substrate to investigate chemistry and fluidics in extended-nanospace.

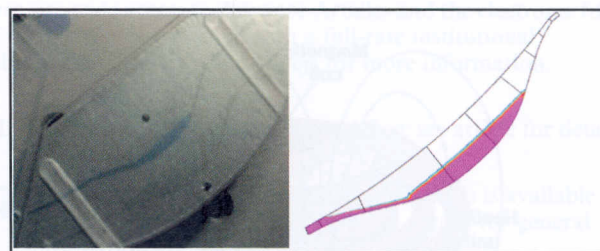


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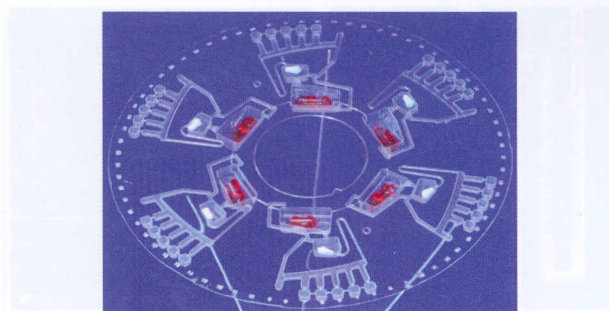
Numerical modeling and experimental validation of uniform microchamber filling in centrifugal microfluidics

Jonathan Siegrist,* Mary Amasia, Navdeep Singh, Debjyoti Banerjee and Marc Madou

An advanced numerical model is developed to simulate the uniform filling of long, wide channels on centrifugal platforms with complex surface interactions. Correlation between the model and the experimental observations are shown to be excellent.



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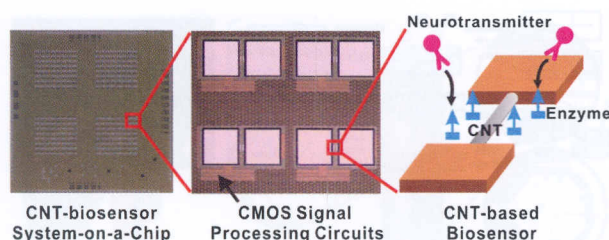


Microfluidic lab-on-a-foil for nucleic acid analysis based on isothermal recombinase polymerase amplification (RPA)

Sascha Lutz,* Patrick Weber, Max Focke, Bernd Faltin, Jochen Hoffmann, Claas Müller, Daniel Mark, Günter Roth, Peter Munday, Niall Armes, Olaf Piepenburg, Roland Zengerle and Felix von Stetten

A lab-on-a-foil for isothermal recombinase polymerase amplification (RPA) of dsDNA is presented. All liquid and dry reagents are prestored. The chip is processed and read out in a standard laboratory device.

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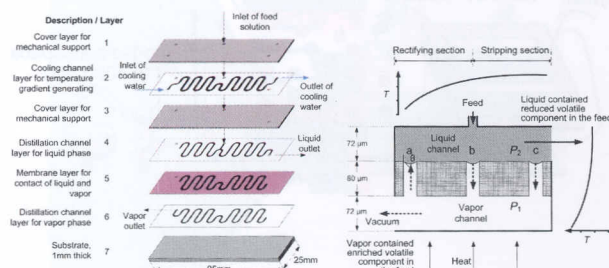


Biosensor system-on-a-chip including CMOS-based signal processing circuits and 64 carbon nanotube-based sensors for the detection of a neurotransmitter

Byung Yang Lee, Sung Min Seo, Dong Joon Lee, Minbaek Lee, Joohyung Lee, Jun-Ho Cheon, Eunju Cho, Hyunjoong Lee, In-Young Chung, Young June Park,* Suhwan Kim* and Seunghun Hong*

Uniform arrays of carbon nanotube (CNT)-based biosensors were integrated with CMOS signal-processing circuits into a CNT-biosensor system-on-a-chip (SoC) for the detection of glutamate, a neurotransmitter.

899

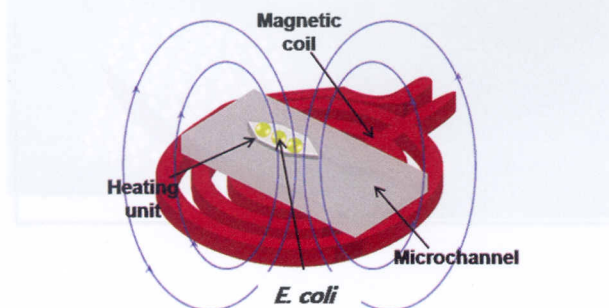


Vacuum membrane distillation by microchip with temperature gradient

Yaopeng Zhang, Shinji Kato* and Takanori Anazawa

A microfluidic setup for water-methanol distillation is proposed by generating a temperature gradient on a miniaturized system of vacuum membrane distillation.

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Wireless induction heating in a microfluidic device for cell lysis

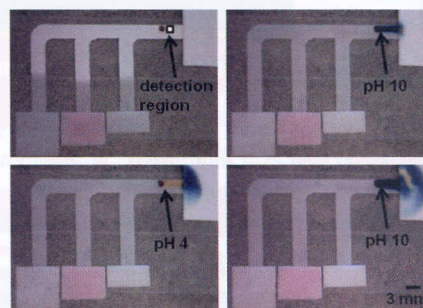
Seung-ki Baek, Junghong Min and Jung-Hwan Park*

A wireless induction heating system in a microfluidic device was devised for cell lysis to achieve convenience, portability and economic efficiency by wireless operation, easy fabrication and disposability.

Controlled reagent transport in disposable 2D paper networks

Elain Fu,* Barry Lutz, Peter Kauffman and Paul Yager

Demonstration of programmed fluid delivery using a simple 2D paper network. The geometry of the network results in the sequential arrival of fluid from each of the three inlets, buffers of pH 10, 4 and 10 that produce a change in the color of the pH indicator in the “detection zone” from blue to yellow to blue.



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