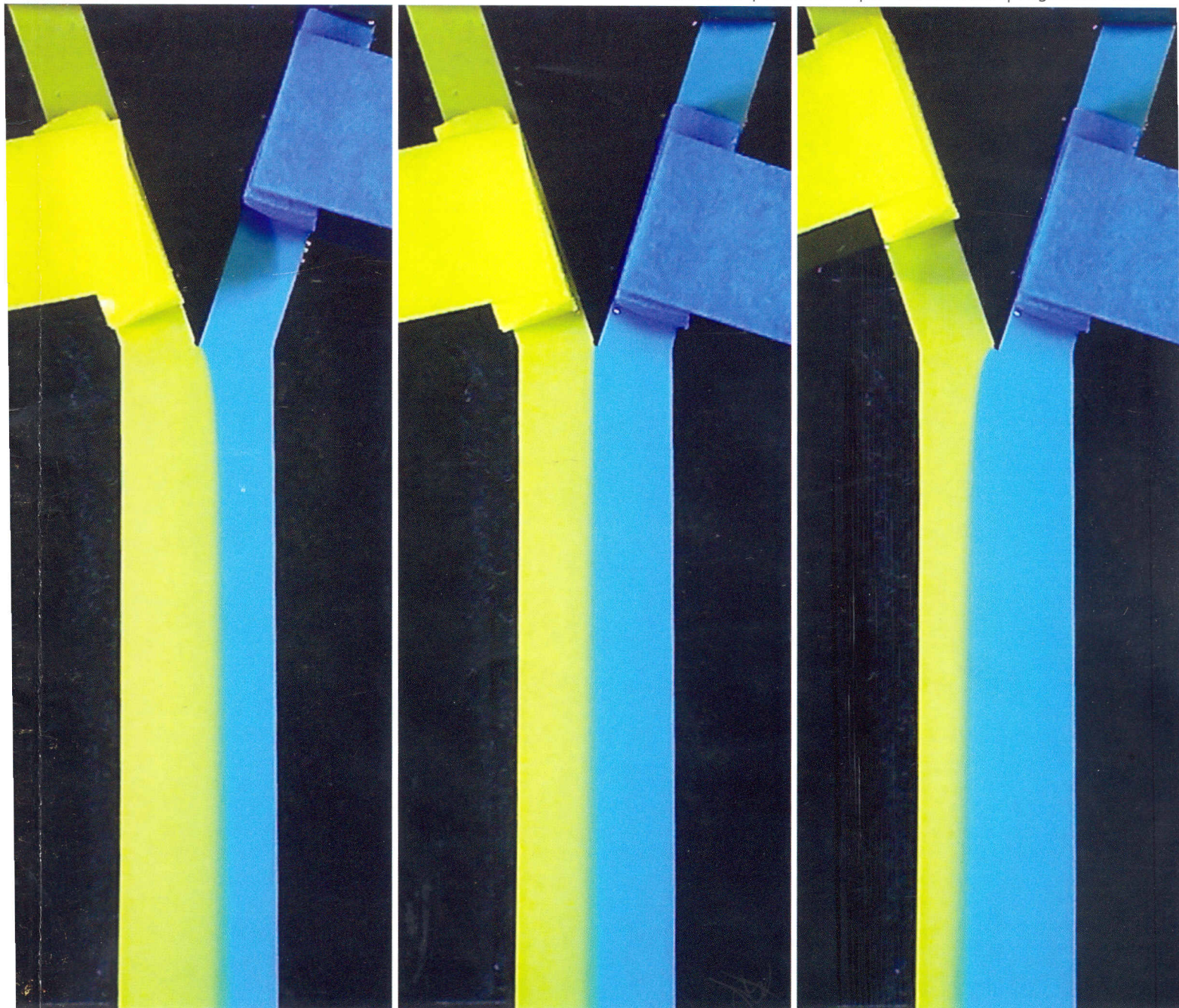


Lab on a Chip

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

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Volume 10 | Number 20 | 21 October 2010 | Pages 2637–2824



ISSN 1473-0197

RSC Publishing

Osborn
Microfluidics without pumps

Ricco
Single-use optofluidic valves



1473-0197(2010)10:20;1-7

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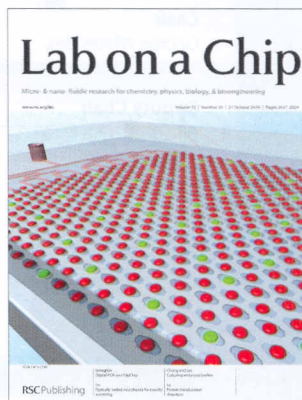
IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 10(20) 2637–2824 (2010)



Cover

See Osborn *et al.*, pp. 2659–2665. Simply moving sample pads relative to the intersection between two nitrocellulose inlets alters the relative flow rates in the common channel; there is no need for expensive pumps in 2-dimensional paper devices. Image reproduced by permission of Jennifer L. Osborn from *Lab Chip*, 2010, **10**, 2659.



Inside cover

See Ismagilov *et al.*, pp. 2666–2672. SlipChip microfluidic platform provides a simple format to compartmentalize and amplify single copies of nucleic acid for digital PCR. Image reproduced by permission of Rustem F. Ismagilov from *Lab Chip*, 2010, **10**, 2666.

HIGHLIGHT

2649

Research Highlights

Petra S. Dittrich*

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



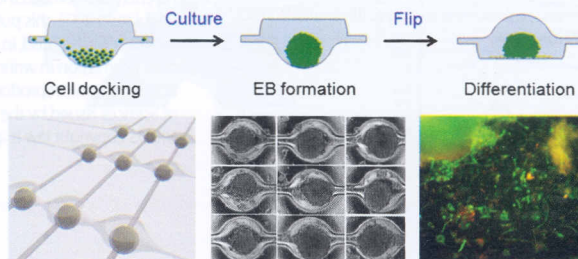
COMMUNICATIONS

2651

Development of a multi-layer microfluidic array chip to culture and replat uniform-sized embryoid bodies without manual cell retrieval

Edward Kang, Yoon Young Choi, Yesl Jun, Bong Geun Chung* and Sang-Hoon Lee*

A multilayer microfluidic array chip to culture and replat embryoid bodies.

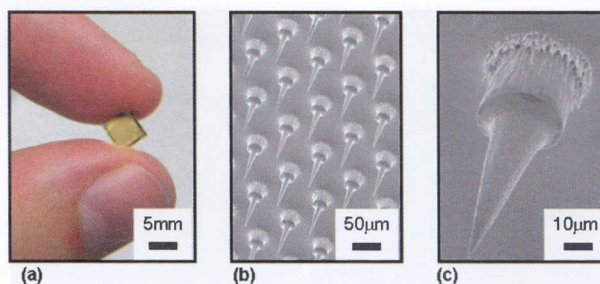


2655

Surface-modified microprojection arrays for intradermal biomarker capture, with low non-specific protein binding

Simon R. Corrie,* Germain J. P. Fernando, Michael L. Crichton, Marion E. G. Brunck, Chris D. Anderson and Mark A. F. Kendall*

Herein we describe a novel microprojection array which samples specific circulating biomarkers in the skin epithelia in a minimally invasive manner.



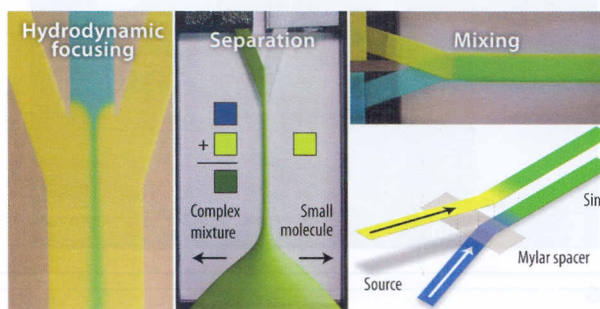
PAPERS

2659

Microfluidics without pumps: reinventing the T-sensor and H-filter in paper networks

Jennifer L. Osborn,* Barry Lutz, Elain Fu, Peter Kauffman, Dean Y. Stevens and Paul Yager

We demonstrate translation of well-known microfluidic devices for hydrodynamic focusing, sized-based extraction of molecules from complex mixtures, micromixing, and dilution onto low-cost paper-based devices.

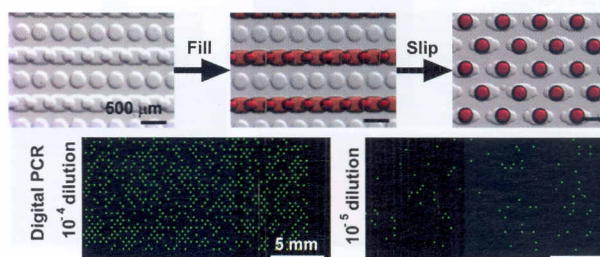


2666

Digital PCR on a SlipChip

Feng Shen, Wenbin Du, Jason E. Kreutz, Alice Fok and Rustem F. Ismagilov*

SlipChip microfluidic technology to count nucleic acids by using digital PCR.

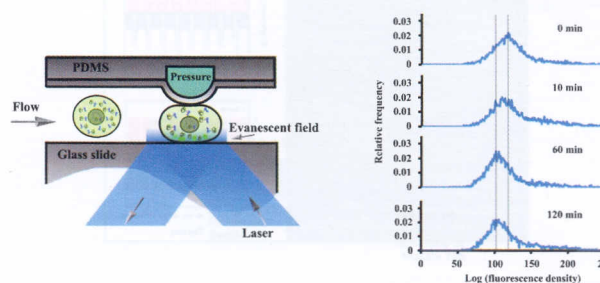


2673

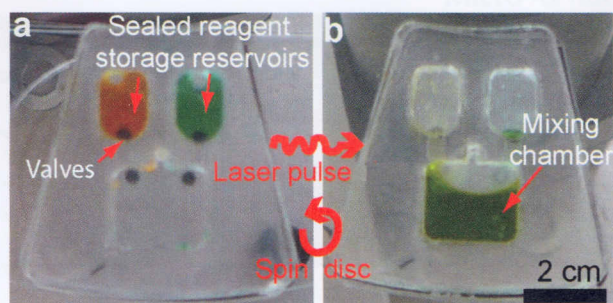
Quantitative analysis of protein translocations by microfluidic total internal reflection fluorescence flow cytometry

Jun Wang, Bei Fei, Robert L. Geahlen and Chang Lu*

Total internal reflection fluorescence flow cytometry was used to study both cytosol to plasma membrane and cytosol to nucleus translocations.



2680

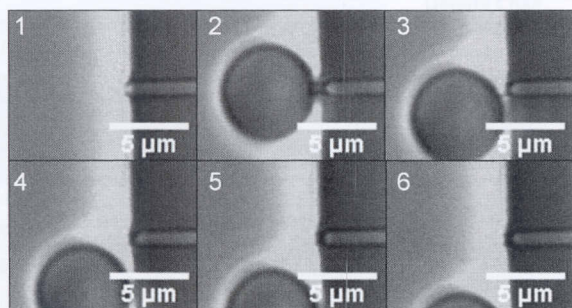


Optically addressable single-use microfluidic valves by laser printer lithography

Jose L. Garcia-Cordero, Dirk Kurzbuch, Fernando Benito-Lopez, Dermot Diamond, Luke P. Lee and Antonio J. Ricco*

Novel optofluidic valves are fabricated by laser printing toner spots onto a plastic foil that isolates fluidic components. The valves open using a light pulse from a CD/DVD-type laser.

2688

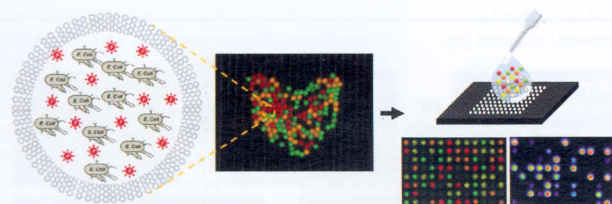


On-demand generation of monodisperse femtolitre droplets by shape-induced shear

Seung-Yong Jung, Scott T. Retterer and C. Patrick Collier*

A new method is described for creating individual femtolitre-scale aqueous droplets on demand at a microfabricated junction, based solely on a local increase in channel height at the junction.

2695

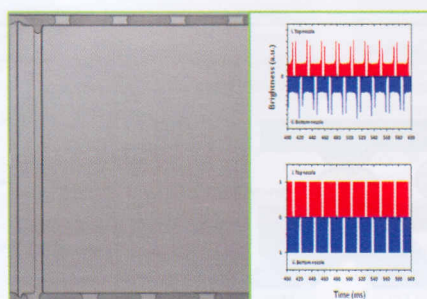


Randomly distributed arrays of optically coded functional microbeads for toxicity screening and monitoring

Joo-Myung Ahn, Joong Hyun Kim, Ji Hoon Kim and Man Bock Gu*

A simple, fast, and non-tedious fabrication of cell array chips using functional microbeads containing both bioluminescent bacteria for specific toxicity sensing and fluorescent microspheres as self-identification code.

2702



Passive self-synchronized two-droplet generation

Jongin Hong, Minsuk Choi, Joshua B. Edel* and Andrew J. deMello*

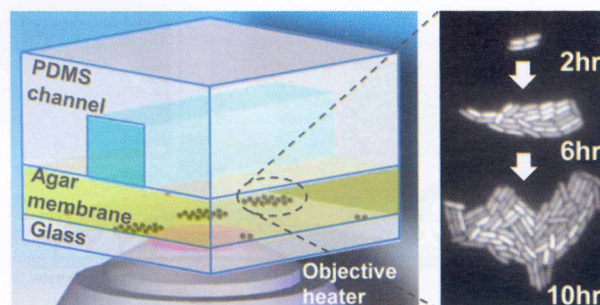
We describe the use of two passive components to achieve controllable and alternating droplet generation in a microfluidic device. The approach overcomes the problems associated with irregularities in channel dimensions and fluid flow rates, and allows precise pairing of alternating droplets in a high-throughput manner. We study droplet generation and self-synchronization in a quantitative fashion by using high-speed image analysis.

2710

An agar gel membrane-PDMS hybrid microfluidic device for long term single cell dynamic study

Jeong Wong, Shota Atsumi, Wei-Chih Huang, Tung-Yun Wu, Taizo Hanai, Miu-Ling Lam, Ping Tang, Jian Yang, James C. Liao and Chih-Ming Ho*

A microfluidic platform for long term single-cell tracking and cultivation with dynamic chemical perturbation capability, highlighting a simple device assembly between PDMS microchannel and agar membrane through conformal sealing.

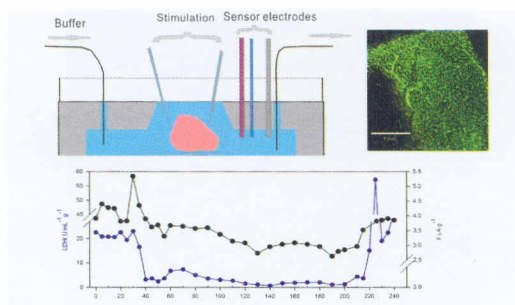


2720

Microfluidic perfusion system for maintaining viable heart tissue with real-time electrochemical monitoring of reactive oxygen species

Lih-Tyng Cheah, Yue-Hua Dou, Anne-Marie L. Seymour, Charlotte E. Dyer, Stephen J. Haswell, Jay D. Wadhawan and John Greenman*

A microfluidic device has been developed to maintain viable heart tissue samples in a biomimetic microenvironment. Real-time electrochemical assessment of total reactive oxygen species gave complementary results to conventional, off-chip, assay.

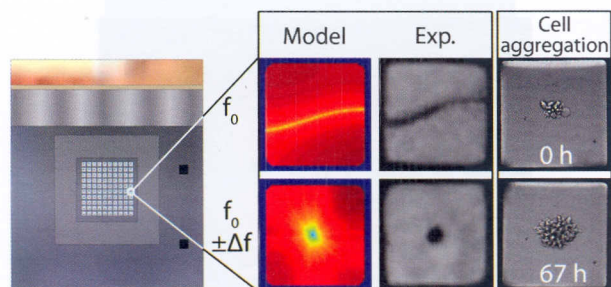


2727

Ultrasound-controlled cell aggregation in a multi-well chip

Bruno Vanherberghen, Otto Manneberg, Athanasia Christakou, Thomas Frisk, Mathias Ohlin, Hans M. Hertz, Björn Önfelt* and Martin Wiklund*

We demonstrate a microplate platform for parallelized aggregation and positioning of cells, based on frequency-modulated ultrasonic actuation. The method is biocompatible over more than 12 hours and will enable dynamic studies of cell-cell interactions by high-resolution optical microscopy.

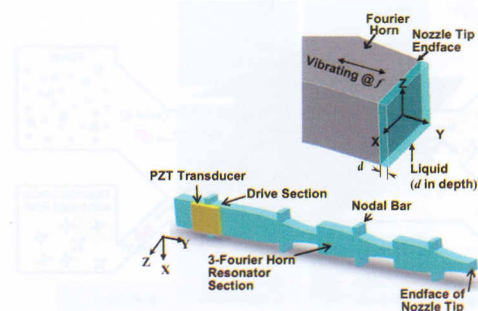


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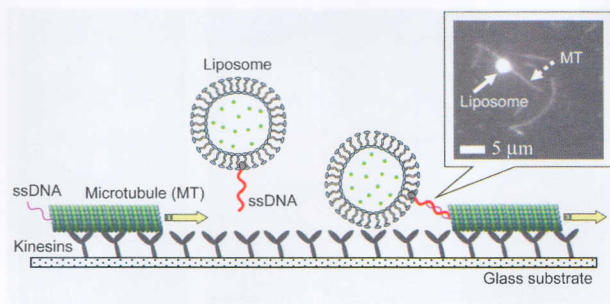
Miniaturized multiple Fourier-horn ultrasonic droplet generators for biomedical applications

Chen S. Tsai,* Rong W. Mao, Shih K. Lin, Ning Wang and Shirley C. Tsai

MEMS-based miniaturized silicon ultrasonic nozzles of a simple architecture with multiple Fourier horns excite MHz Faraday waves and produce monodisperse droplets of diameter 2.2–4.6 μm at high throughput and very low electrical drive power.



2741

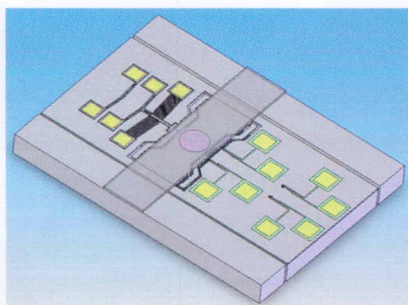


Biomolecular-motor-based autonomous delivery of lipid vesicles as nano- or microscale reactors on a chip

Satoshi Hiyama,* Yuki Moritani, Riho Gojo, Shoji Takeuchi and Kazuo Sutoh*

This article presents the first demonstration of selective, autonomous, and parallel loading, transport, and unloading of lipid vesicles (liposomes) as nano- or microscale reactors using biomolecular-motor-based motility and DNA hybridization.

2749

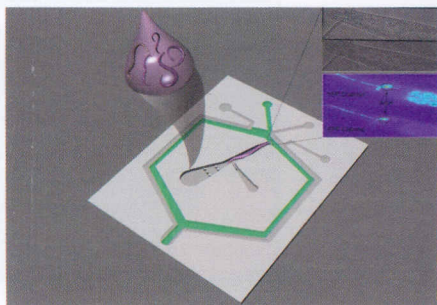


Development of a MEMS based dynamic rheometer

Gordon F. Christopher,* Jae Myung Yoo, Nicholas Dagalakis, Steven D. Hudson* and Kalman B. Migler*

We describe a Micro-Electro-Mechanical System (MEMS) approach to measure the dynamic rheology of soft matter, which is capable of measuring moduli from 50 Pa to 10 kPa over a range of 3 to 3000 rad s^{-1} using less than 5 nL of sample. This device provides a new way to characterize dynamic microrheology of novel materials that will prove useful in many areas including biorheology, microfluidics and polymer thin films.

2758

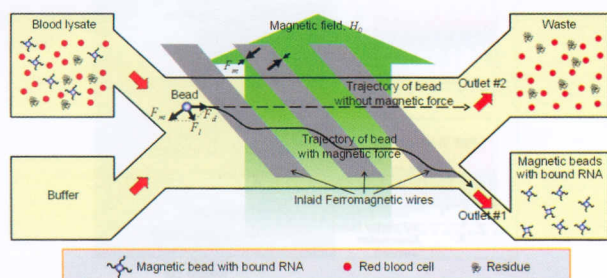


An automated microfluidic platform for calcium imaging of chemosensory neurons in *Caenorhabditis elegans*

Trushal Vijaykumar Chokshi, Daphne Bazopoulou and Nikos Chronis*

Here, we describe the development of an automated microfluidic-based platform for performing automated neuronal functional (calcium) imaging in the roundworm *Caenorhabditis elegans*. We believe that such a technology will be an essential tool for obtaining repeatable and accurate functional imaging data from a large population of worms, in order to minimize stochastic biological noise and identify statistically significant trends.

2764



High-speed RNA microextraction technology using magnetic oligo-dT beads and lateral magnetophoresis

Hwanyong Lee, Jinhee Jung, Song-I Han and Ki-Ho Han*

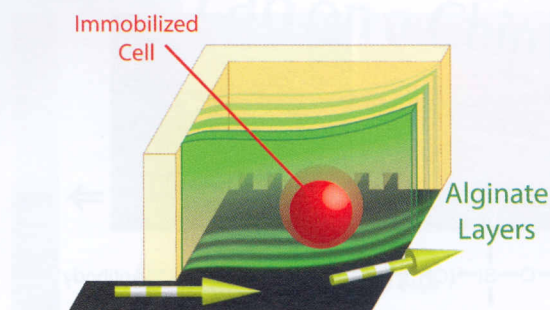
Magnetic beads with bound RNA are laterally migrated and separated from a blood lysate, passing over an inlaid ferromagnetic wire array, by a high-speed RNA microseparator.

2771

Fluidic microstructuring of alginate hydrogels for the single cell niche

Thomas Braschler,* Ana Valero, Ludovica Colella, Kristopher Pataky, Juergen Brugger and Philippe Renaud

Engineering the single cell niche with sub-micrometre resolution by microfluidic layer-by-layer deposition of chemically distinct alginates.

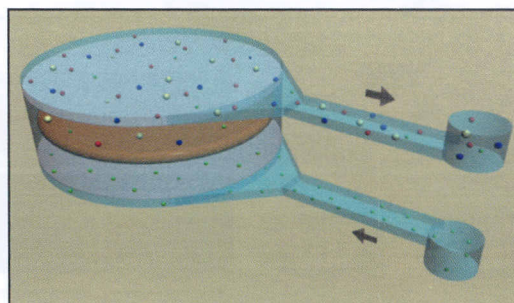


2778

A microfluidic approach for *in vitro* assessment of interorgan interactions in drug metabolism using intestinal and liver slices

Paul M. van Midwoud, Marjolijn T. Merema, Elisabeth Verpoorte and Geny M. M. Groothuis*

This paper describes the single and co-incubation of precision-cut liver and intestinal slices. This new system mimics the first-pass metabolism in the body, and it will increase our insight into interorgan interactions.

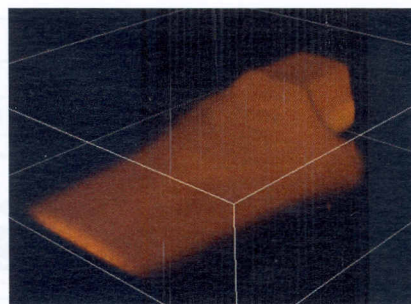


2787

Effect of diffusion on impedance measurements in a hydrodynamic flow focusing sensor

Mansoor Nasir, Dorielle T. Price, Lisa C. Shriver-Lake and Frances Ligler*

Hydrodynamic focusing in 2D confined a conducting stream within a nonconducting sheath. Confining the stream to maximize sensitivity for detection of captured bacteria required interactive optimization of both Re and flow-rate ratio.

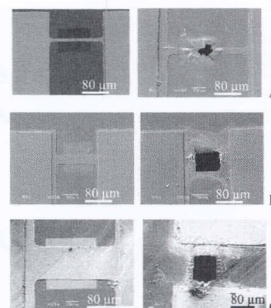


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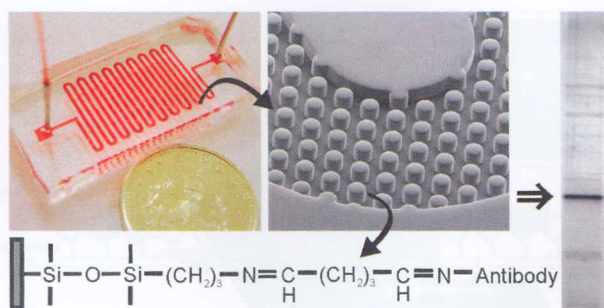
Electro-thermally induced structural failure actuator (ETISFA) for implantable controlled drug delivery devices based on Micro-Electro-Mechanical-Systems

N. M. Elman,* B. C. Masi, M. J. Cima and R. Langer

Thermally induced structural failure was demonstrated as a feasible activation mechanism that holds great promise for controlled release in biomedical microdevices.



2805



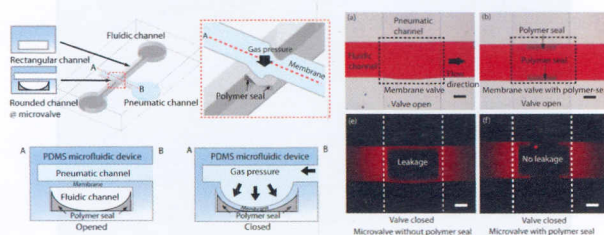
On-chip immunoprecipitation for protein purification

Mairi E. Sandison,* Sarah A. Cumming, Walter Kolch and Andrew R. Pitt

We describe an antibody functionalised microcolumn and an optimised method for performing on-chip immunoprecipitation on microlitre sample volumes, applying it to the enrichment of proteins from cellular lysates.

TECHNICAL NOTES

2814

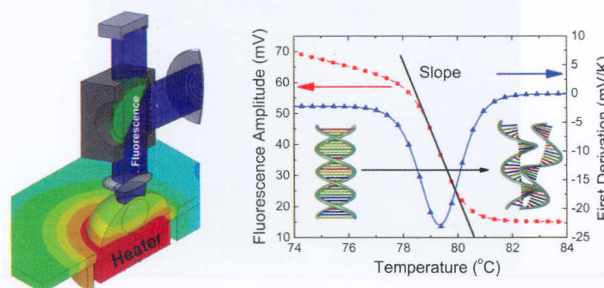


Fabrication of membrane-type microvalves in rectangular microfluidic channels via seal photopolymerization

Wook Park, Sangkwon Han and Sunghoon Kwon*

We present a polymer sealing method to fabricate PDMS membrane-type microvalves for rectangular microchannels.

2818



Non-contact fluorescent bleaching-independent method for temperature measurement in microfluidic systems based on DNA melting curves

Pavel Neuzil,* Fang Cheng, Jeffrey Bo Woon Soon, Lan Liu Qian and Julien Reboud

We present a non-contact bleaching independent method to measure temperature in microfluidic systems, based on the analysis of the fluorescence from an intercalator during DNA melting. This technique also determines the heat transfer rates, and spatial temperature non-uniformities in the sample.