

Lab on a Chip

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

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Vunjak-Novakovic *et al.*
Surface-patterned electrode bioreactor

van Thriel, West *et al.*
The network formation assay

Celebrating
10
Years of publishing



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Lab on a Chip

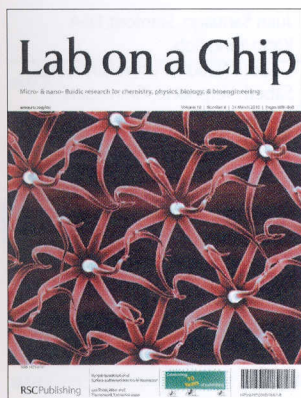
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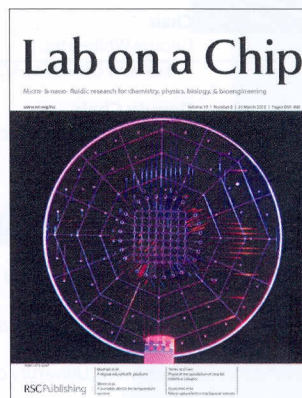
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Cover

See Minhas pp. 681–682.
The fabricated 3-D microstructure is an output of dynamic mode multidirectional UV lithography. The unit structure shows the flower-like (lotus) shape and the tip of each leaf is connected with each other forming a hand-in-hand coalition. Image reproduced by permission of Jungkwun 'JK' Kim and Yong-Kyu 'YK' Yoon from *Lab Chip*, 2010, **10**, 681.



Inside cover

See Mathies *et al.*, pp. 685–691.
A digital microfluidic Automaton, based on 2-dimensional microvalve array technology, enables the execution of diverse microfluidic programs for the rapid automation of bioassays. Image reproduced by permission of Erik C. Jensen, Bharath P. Bhat and Richard A. Mathies from *Lab Chip*, 2010, **10**, 685.

EDITORIAL

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Lab on a Chip!Art in Science and MicroTAS 2009

November 1–5, 2009, Jeju, Korea

Once again the μ TAS conference was a huge success. *Lab on a Chip* played a significant role at the meeting in supporting the community through a series of prizes and awards.



HIGHLIGHT

683

Research Highlights

Petra S. Dittrich*

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

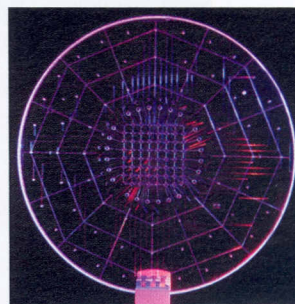


685

A digital microfluidic platform for the automation of quantitative biomolecular assays

Erik C. Jensen, Bharath P. Bhat and Richard A. Mathies*

A digital microfluidic Automaton, based on a 2-dimensional microvalve array technology, is developed and optimized for sample processing and analysis. The programmable performance of diverse microfluidic manipulations on a common chip format enables the rapid automation of bioassays.

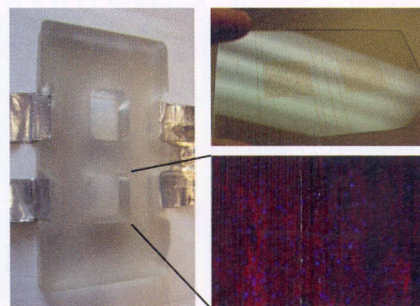


692

Surface-patterned electrode bioreactor for electrical stimulation

Nina Tandon, Anna Marsano, Robert Maidhof, Keiji Numata, Chrystina Montouri-Sorrentino, Christopher Cannizzaro, Joel Voldman and Gordana Vunjak-Novakovic*

Laser ablation of indium-tin-oxide coated glass slides has enabled scientists to miniaturize electrodes for bioreactor applications involving pulsatile electrical stimulation.

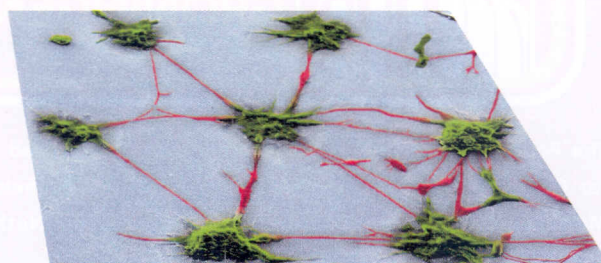


701

The network formation assay: a spatially standardized neurite outgrowth analytical display for neurotoxicity screening

Jean-Philippe Frimat, Julia Sisnaiske, Subanatarajan Subbiah, Heike Menne, Patricio Godoy, Peter Lampen, Marcel Leist, Joachim Franzke, Jan G. Hengstler, Christoph van Thriel* and Jonathan West*

A neurite outgrowth analytical display based on micropatterning neuronal cells has been developed and applied to acrylamide neurotoxicity testing.

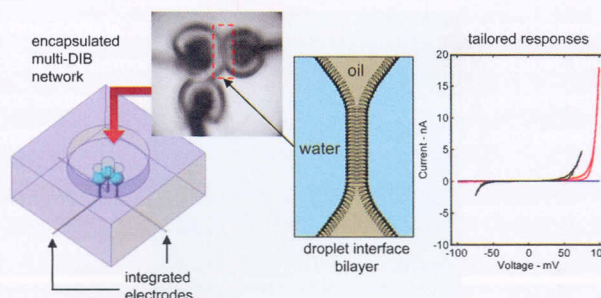


710

Physical encapsulation of droplet interface bilayers for durable, portable biomolecular networks

Stephen A. Sarles and Donald J. Leo*

We demonstrate the physical encapsulation of droplet interface bilayers within solid substrates for constructing self-contained, portable biomolecular networks for new types of lab-on-chip devices.

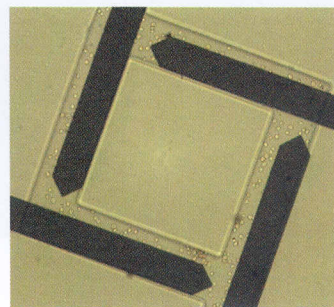


718

Integrated AC electrokinetic cell separation in a closed-loop device

Zachary Gagnon, Jill Mazur and Hsueh-Chia Chang*

We integrate electrothermally induced micro-pumps and dielectrophoretic (DEP) traps into micro-circulating fluidic channel loops for effective and rapid yeast cell concentration and separation.

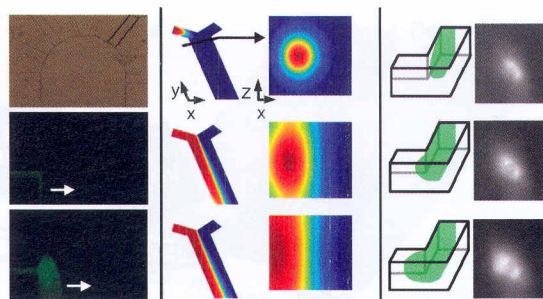


727

Pressure-driven laminar flow switching for rapid exchange of solution environment around surface adhered biological particles

Peter B. Allen, Graham Milne, Byron R. Doecker and Daniel T. Chiu*

This paper describes a technique for rapidly exchanging the solution environment near a surface by displacing laminar flow fluid streams using sudden changes in applied pressure.

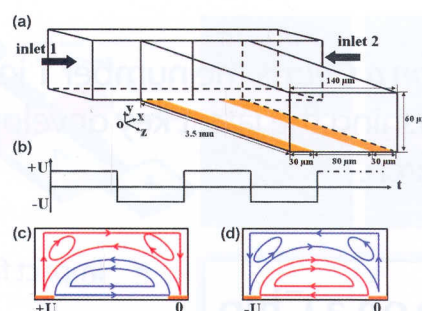


734

Chaotic mixing in microchannels *via* low frequency switching transverse electroosmotic flow generated on integrated microelectrodes

Hongjun Song, Ziliang Cai, Hongseok (Moses) Noh and Dawn J. Bennett*

We demonstrated a chaotic micromixer to enhance the mixing effect *via* periodical switching transverse EOF, which is generated by applying a low frequency electric field on a pair of electrodes placed at the bottom of the channel.

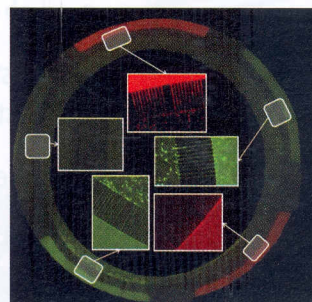


741

Circular compartmentalized microfluidic platform: Study of axon–glia interactions

Suneil Hosmane, In Hong Yang, April Ruffin, Nitish Thakor* and Arun Venkatesan*

We describe the development of a customizable circular microfluidic platform to investigate axon–glia co-culture interactions. Using this microfluidic platform, we demonstrate a preferential accumulation of microglia near injured CNS axons, an important event implicated in several neuroinflammatory diseases.

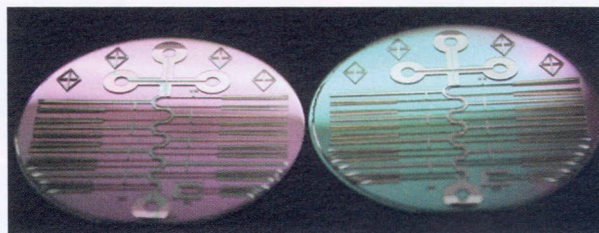


748

Microfabricated polymer chip with integrated U-bend waveguides for evanescent field absorption based detection

Amit Prabhakar and Soumyo Mukherji*

Microfluidic channels interfaced with microfabricated polymer waveguides. U-Bend polymer waveguides form part of the microfluidic channel wall, thereby creating an evanescent wave absorption based sensor.

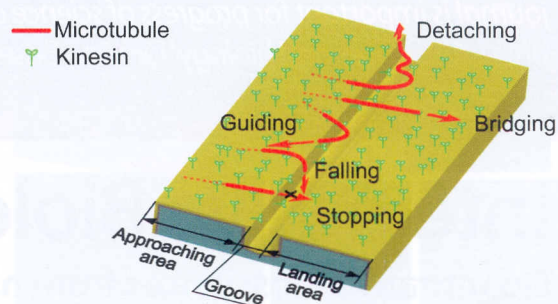


755

Size sorting of kinesin-driven microtubules with topographical grooves on a chip

Shukei Sugita,* Tatsuya Murase, Naoya Sakamoto, Toshiro Ohashi and Masaaki Sato

Microtubules (MTs) approaching micro-scale grooves showed five unique events whose occurrence probabilities depended on length of MTs and width of grooves. This study suggests feasibility for the development of a device sorting MTs.

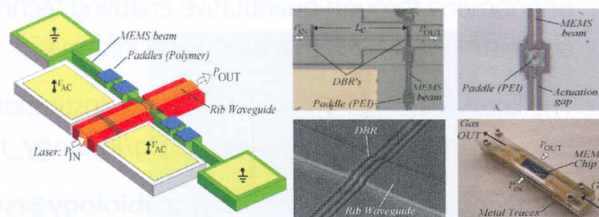


762

Waveguide micro-opto-electro-mechanical resonant chemical sensors

Marcel W. Pruessner,* Todd H. Stievater, Mike S. Ferraro, William S. Rabinovich, Jennifer L. Stepnowski and R. Andrew McGill

We demonstrate a MEMS chemical sensor with high sensitivity on-chip in-plane optical waveguide interferometric readout. Relative humidity sensing is performed and the device's vapour sensing and mass-loading resolution is measured and analyzed.

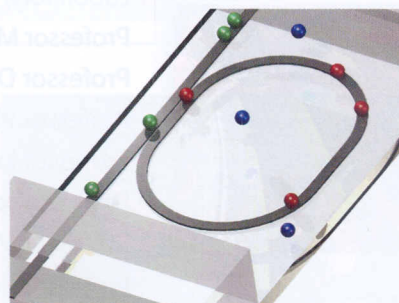


769

Optofluidic ring resonator switch for optical particle transport

Allen H. J. Yang and David Erickson*

In this work, we demonstrate an optofluidic switch using a microring resonator architecture to sort particles trapped in the evanescent field of solid-core SU-8 polymer waveguides.



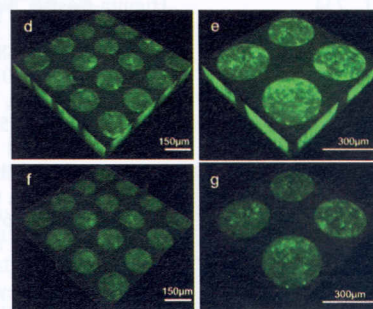
PAPERS

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High throughput assembly of spatially controlled 3D cell clusters on a micro/nanoplatfom

Daniel Gallego-Perez, Natalia Higuera-Castro, Sadhana Sharma, Rashmeet K. Reen, Andre F. Palmer, Keith J. Gooch, L. James Lee, John J. Lannutti and Derek J. Hansford*

A platform is presented for the guided assembly of microtissue, based on microwells that govern cluster size and shape, and nanofibers that support cluster formation and other functions. This platform has applications in cell therapy, cell and developmental biology, and drug discovery.

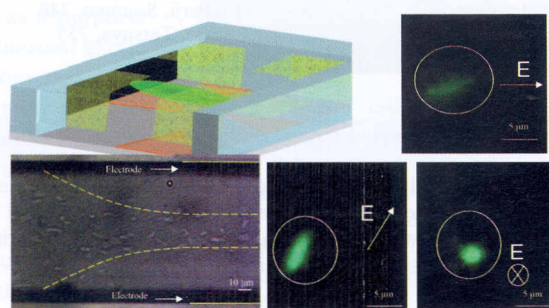


783

3-dimensional electrode patterning within a microfluidic channel using metal ion implantation

Jae-Woo Choi,* Samuel Rosset, Muhamed Niklaus, James R. Adleman, Herbert Shea and Demetri Psaltis

We utilize a metal ion-implantation process at a 40° angle to pattern 3D electrodes within a fluidic channel made of polydimethylsiloxane (PDMS). The chip is used to demonstrate electro-orientation and dielectrophoretic focusing of *E. coli*.

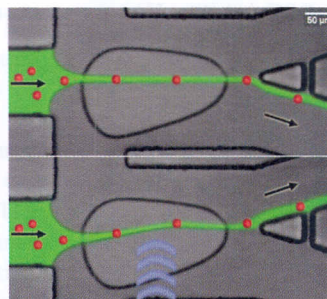


789

Surface acoustic wave actuated cell sorting (SAWACS)

T. Franke,* S. Braunnüller, L. Schmid, A. Wixforth and D. A. Weitz

We describe a novel microfluidic cell sorter based on an acoustic streaming effect induced by surface acoustic waves (SAW). We have successfully sorted cells at rates as high as 2 kHz in a PDMS device.



TECHNICAL NOTE

795

A portable device for temperature control along microchannels

Daniele Vigolo, Roberto Rusconi, Roberto Piazza and Howard A. Stone*

A silver-filled epoxy can be used to fill microchannels. After curing, when a current passes, it serves as a heater. The microdevice can be operated with a battery, is portable, and inexpensive.

