

Lab on a Chip

Miniaturisation for chemistry, physics, biology, materials science and bioengineering

www.rsc.org/loc

Volume 12 | Number 15 | 7 August 2012 | Pages 2587–2750



ISSN 1473-0197

RSC Publishing

PAPER

John M. Collins *et al.*
Targeted delivery to single cells in precisely
controlled microenvironments



1473-0197(2012)12:15;1-Y

Lab on a Chip

Miniaturisation for chemistry, physics, biology, materials science and bioengineering

www.rsc.org/loc

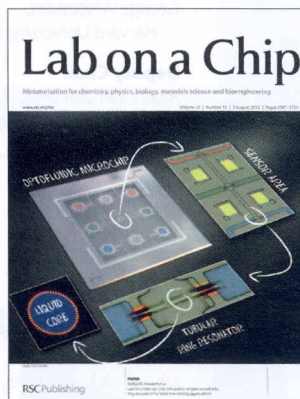
RSC Publishing is a not-for-profit publisher and a division of the Royal Society of Chemistry. Any surplus made is used to support charitable activities aimed at advancing the chemical sciences. Full details are available from www.rsc.org

IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 12(15) 2587–2750 (2012)



Cover
See John M. Collins *et al.*, pp. 2643–2648. Image reproduced by permission of Sarah Kosar from *Lab Chip*, 2012, 12, 2643.



Inside cover
See Stefan M. Harazim *et al.*, pp. 2649–2655. Image reproduced by permission of Stefan M. Harazim from *Lab Chip*, 2012, 12, 2649.

HIGHLIGHT

2597

Research highlights

Šeila Selimović, Gulden Camci-Unal, Mehmet R. Dokmeci and Ali Khademhosseini*

Cellular deformability – An integrated sensor for detection of drug-resistant Tubercle bacilli – High-throughput, high-resolution screening.



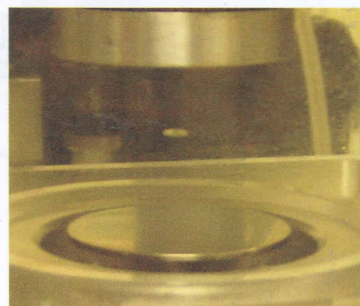
FOCUS

2600

Acoustofluidics 15: streaming with sound waves interacting with solid particles

S. S. Sadhal

A tutorial on the singular perturbation analysis of acoustic streaming around solid particles is presented with examples.

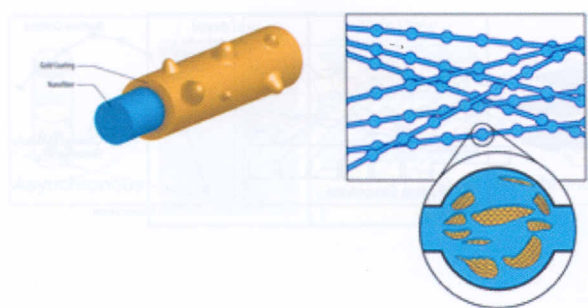


2612

Recent progress in the design of nanofiber-based biosensing devices

Lauren Matlock-Colangelo and Antje J. Baeumner*

This review discusses the nanofiber materials used to increase functional surface area and improve sensitivity of analyte detection within biosensors.



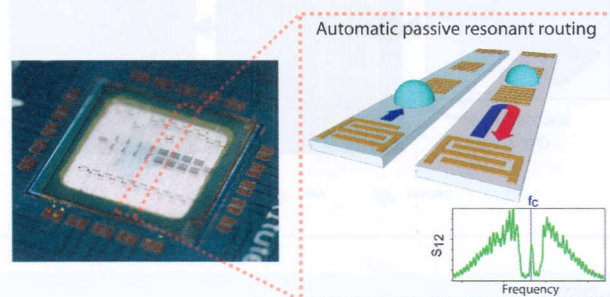
COMMUNICATIONS

2621

Interaction-free, automatic, on-chip fluid routing by surface acoustic waves

Marco Travagliati,* Giorgio De Simoni, Carlo Maria Lazzarini, Vincenzo Piazza, Fabio Beltram and Marco Cecchini

By exploiting the resonant coupling between a travelling wave and the stationary modes of a cavity, we present the first scheme for integrated automatic interaction-free surface acoustic wave routing of fluids.

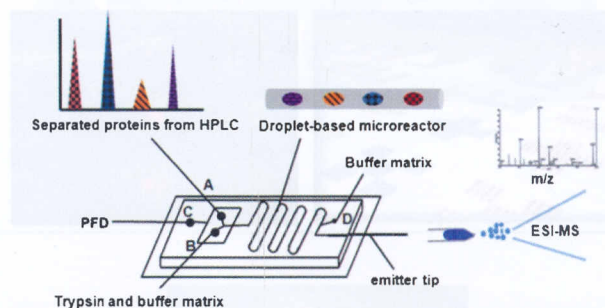


2625

Proteolysis in microfluidic droplets: an approach to interface protein separation and peptide mass spectrometry

Ji Ji, Lei Nie, Liang Qiao, Yixin Li, Liping Guo, Baohong Liu,* Pengyuan Yang* and Hubert H. Girault

A novel means of protein identification was established using droplet-based microreactor as interface between liquid chromatography and mass spectrometry.



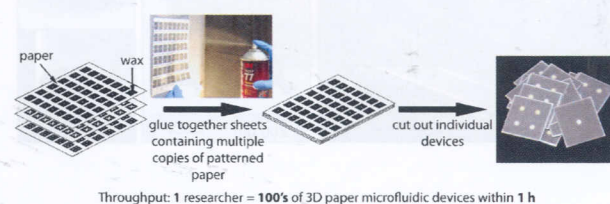
TECHNICAL INNOVATIONS

2630

High throughput method for prototyping three-dimensional, paper-based microfluidic devices

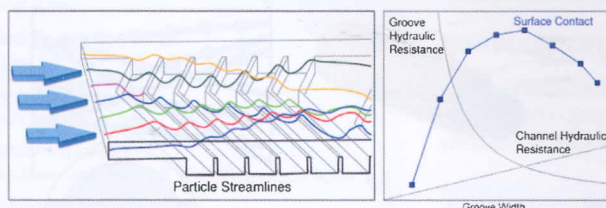
Gregory G. Lewis, Matthew J. DiTucci, Matthew S. Baker and Scott T. Phillips*

A high throughput, operationally straightforward, and inexpensive procedure is now available for prototyping three-dimensional paper-based microfluidic devices with nearly equal ease as the more ubiquitous two-dimensional devices.



Throughput: 1 researcher = 100's of 3D paper microfluidic devices within 1 h

2634

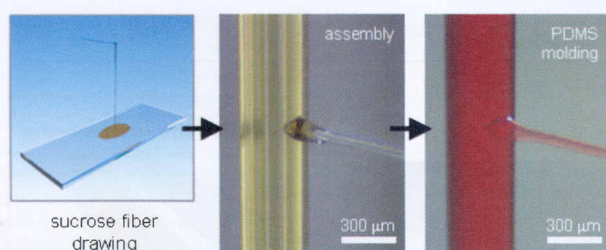


Engineering and analysis of surface interactions in a microfluidic herringbone micromixer

Thomas P. Forbes and Jason G. Kralj*

We present a model and theoretical framework for optimizing the frequency and specific location of surface interactions in a microfluidic herringbone.

2638



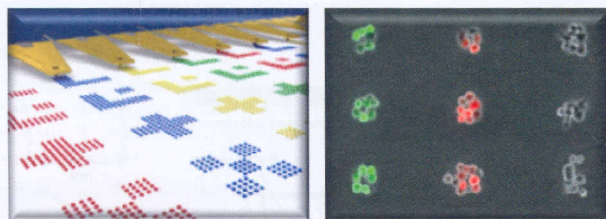
Sucrose-based fabrication of 3D-networked, cylindrical microfluidic channels for rapid prototyping of lab-on-a-chip and vaso-mimetic devices

Jiwon Lee, Jungwook Paek and Jaeyoun Kim*

We present a new fabrication scheme for 3D-networked, cylindrical microfluidic channels, based on shaping, bonding and assembly of water-soluble sucrose fibers.

PAPERS

2643

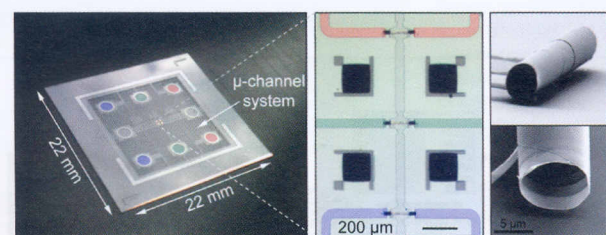


Targeted delivery to single cells in precisely controlled microenvironments

John M. Collins,* Ruby T. S. Lam, Ziping Yang, Bitu Semsarieh, Alexander B. Smetana and Saju Nettikadan*

Tip-based lithography for precision, multiplexed patterning. Fabrication of cellular microenvironment arrays used for targeted delivery to single or few cells.

2649



Lab-in-a-tube: on-chip integration of glass optofluidic ring resonators for label-free sensing applications

Stefan M. Harazim,* Vladimir A. Bolaños Quiñones, Suwit Kiravittaya, Samuel Sanchez* and Oliver G. Schmidt

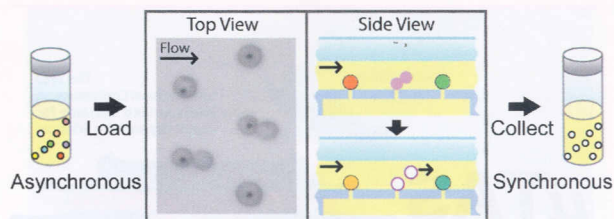
A new assembly methodology combining lab-on-a-chip fabrication techniques and rolled-up nanotech is presented to manufacture fully integrated optofluidic sensors on-chip based on tubular ring resonators made of glass material.

2656

A microfluidic “baby machine” for cell synchronization

Josephine Shaw, Kristofor Payer, Sungmin Son,
William H. Grover and Scott R. Manalis*

The microfluidic “baby machine” holds mammalian cells onto a surface solely by pressure differences, and elutes newborn cells in G1.

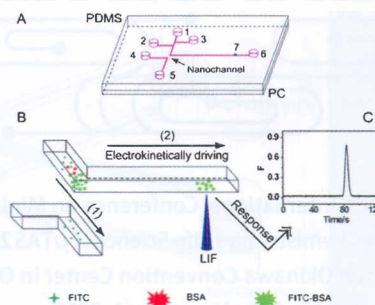


2664

Rapid protein concentration, efficient fluorescence labeling and purification on a micro/nanofluidics chip

Chen Wang, Jun Ouyang, De-Kai Ye, Jing-Juan Xu,
Hong-Yuan Chen and Xing-Hua Xia*

A micro/nanofluidics device has been fabricated to achieve rapid protein concentration, fluorescence labeling and efficient purification of product.

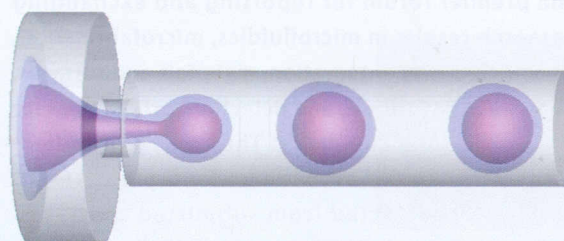


2672

A ternary model for double-emulsion formation in a capillary microfluidic device

Jang Min Park and Patrick D. Anderson*

A ternary diffuse-interface model is presented to predict double-emulsion formation in a capillary microfluidic device.

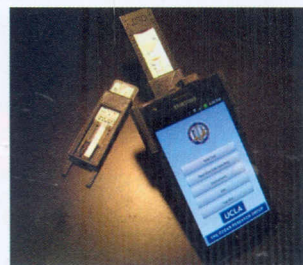


2678

Integrated rapid-diagnostic-test reader platform on a cellphone

Onur Mudanyali, Stoyan Dimitrov, Uzair Sikora,
Swati Padmanabhan, Isa Navruz and Aydogan Ozcan*

We demonstrate a cellphone-based rapid-diagnostic-test reader platform that can work with various types of lateral flow immuno-chromatographic assay to sense the presence of a target analyte in a sample.

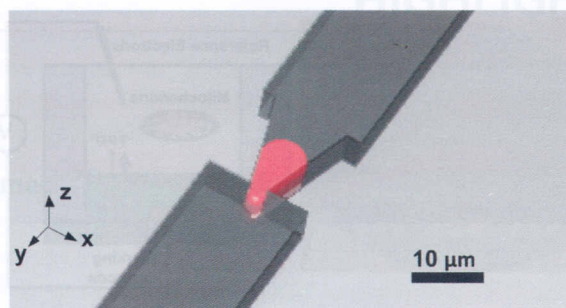


2687

Microfluidic micropipette aspiration for measuring the deformability of single cells

Quan Guo, Sunyoung Park and Hongshen Ma*

Microfluidic device for measuring the deformability of single cells using threshold deformation pressure through micro-scale constrictions similar to micropipette aspiration.

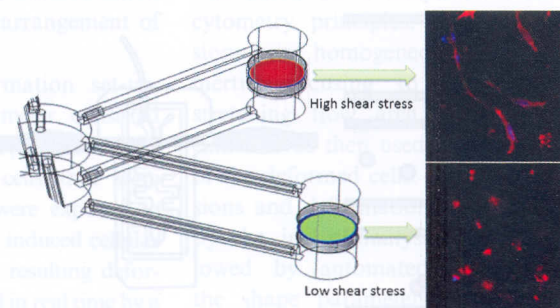


2696

A multi-shear perfusion bioreactor for investigating shear stress effects in endothelial cell constructs

Menahem Y. Rotenberg, Emil Ruvinov, Anna Armoza and Smadar Cohen*

Micro-fabricated multi-shear perfusion bioreactor able to deliver six different levels of shear stresses ($1\text{--}13\text{ dyne cm}^{-2}$) to six constructs simultaneously, during a single run, induces different lengths of HUVEC cell sprouts.

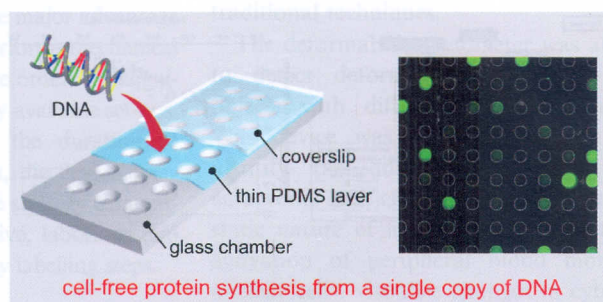


2704

Cell-free protein synthesis from a single copy of DNA in a glass microchamber

Taiji Okano, Tomoaki Matsuura, Yasuaki Kazuta, Hiroaki Suzuki and Tetsuya Yomo*

Glass and PDMS hybrid microchambers were fabricated to conduct protein synthesis from a single copy of DNA using the *in vitro* transcription and translation system.

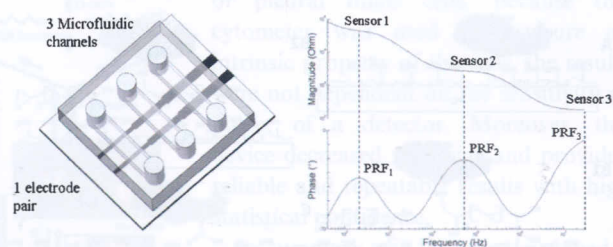


2712

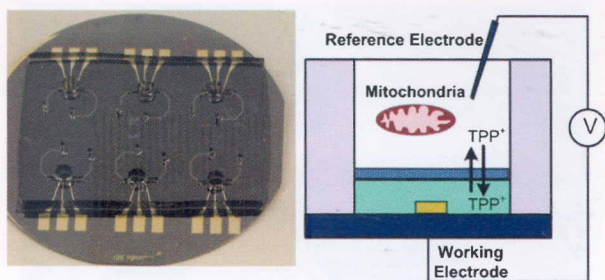
A microfluidic-based frequency-multiplexing impedance sensor (FMIS)

Robert Meissner,* Pierre Joris, Bilge Eker, Arnaud Bertsch and Philippe Renaud

We present a novel technology for the simultaneous and simple impedimetric screening of multiple microfluidic channels with only one electrode pair.



2719

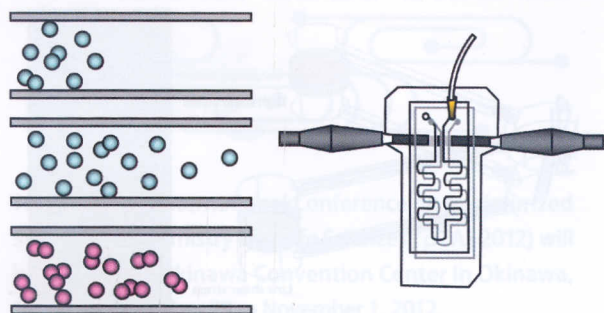


Wafer-scale mitochondrial membrane potential assays

Tae-Sun Lim, Antonio Davila Jr, Katayoun Zand, Douglas C. Wallace and Peter J. Burke

We present a novel technique for wafer-scale fabrication of devices to measure mitochondrial membrane potential in a microfluidic environment.

2726

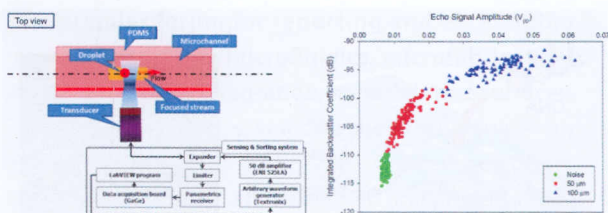


A novel microfluidics-based method for probing weak protein–protein interactions

Darren Cherng-wen Tan, I Putu Mahendra Wijaya, Mirjam Andreasson-Ochsner, Elena Nikolaevna Vasina, Madhavan Nallani, Walter Hunziker* and Eva-Kathrin Sinner*

We present an easily operated and customisable microfluidic platform for the study of weak protein–protein interactions, particularly between membrane proteins.

2736

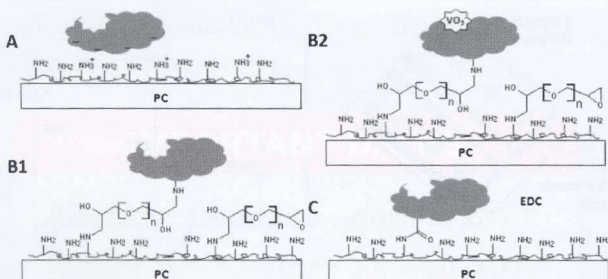


Microfluidic droplet sorting with a high frequency ultrasound beam

Changyang Lee, Jungwoo Lee,* Hyung Ham Kim, Shia-Yen Teh, Abraham Lee, In-Young Chung, Jae Yeong Park and K. Kirk Shung

An acoustic single-droplet based sorting technique has been developed, employing high frequency focused ultrasonic transducers and microfluidic channels.

2743



Functionalization of polycarbonate with proteins; open-tubular enzymatic microreactors

D. Ogończyk,* P. Jankowski and P. Garstecki

This paper examines a set of techniques for the immobilization of enzymes on the surface of microchannels fabricated in polycarbonate (PC).