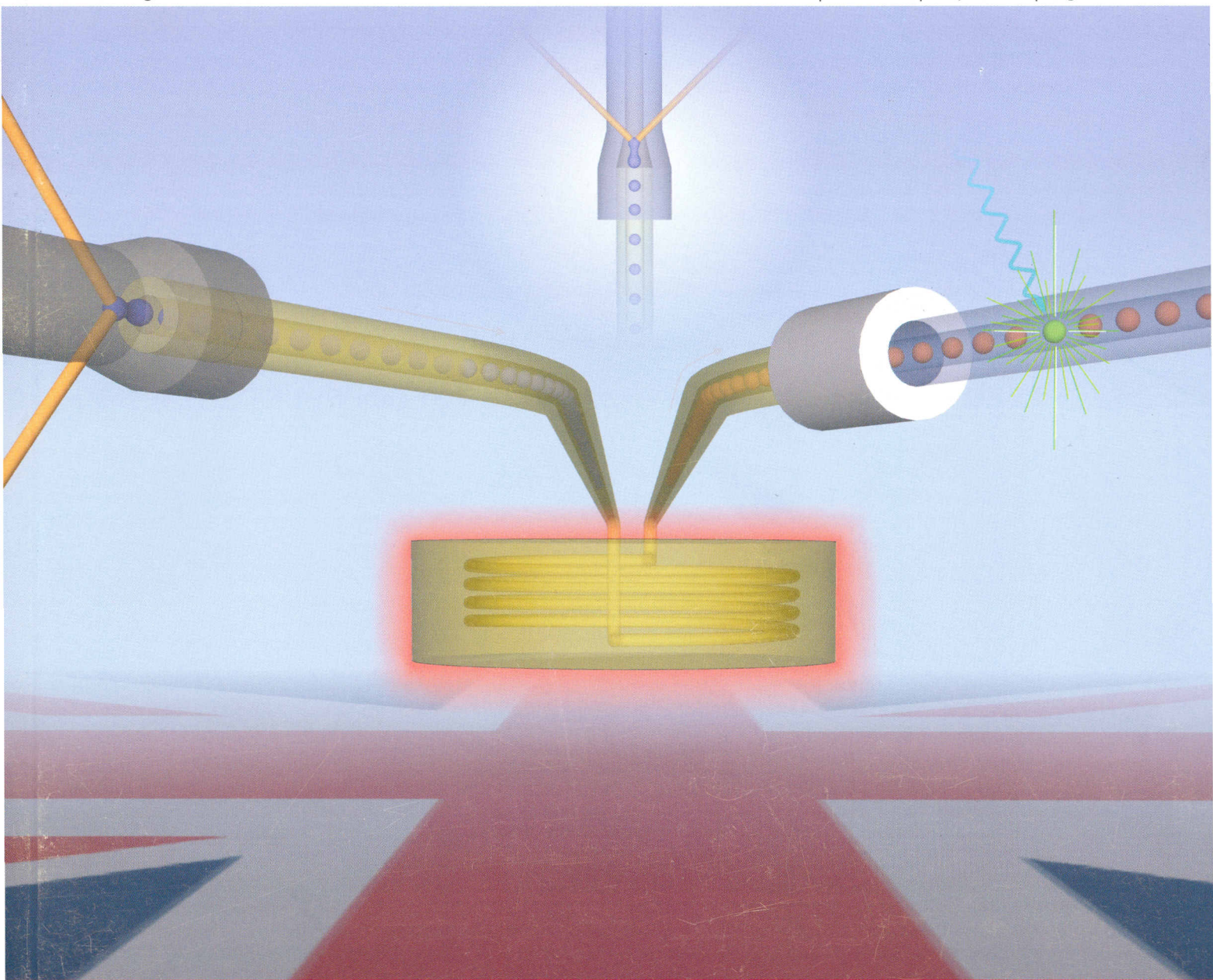


Lab on a Chip

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

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10th Anniversary: Focus on United Kingdom

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PAPER
deMello *et al.*
A stable droplet reactor for high
temperature nanocrystal synthesis



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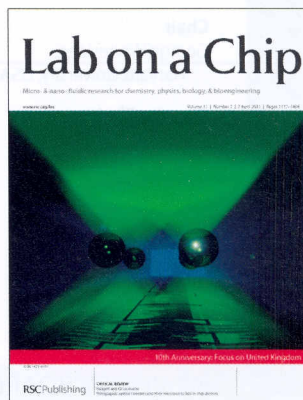
IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 11(7) 1177-1404 (2011)



Cover

See deMello *et al.*, pp. 1221–1227. Image reproduced by permission of John deMello from *Lab Chip*, 2011, **11**, 1221.



Inside cover

See Padgett and Di Leonardo, pp. 1196–1205. Image reproduced by permission of Miles Padgett from *Lab Chip*, 2011, **11**, 1196.

THEMED ISSUE: 10TH ANNIVERSARY FOCUS ON UNITED KINGDOM

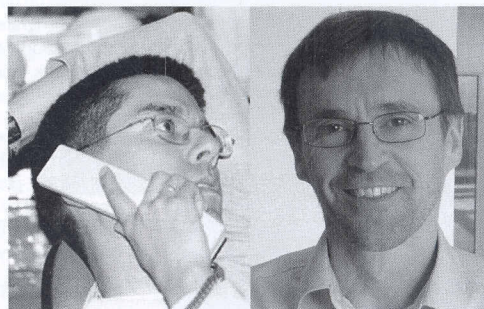
EDITORIAL

1191

10th Anniversary Issue: UK

Andrew deMello and Hywel Morgan

Guest Editors Andrew deMello and Hywel Morgan highlight the contribution of UK research to micro and nanofluidics.



PROFILE

1193

Contributors to the 10th Anniversary UK issue

Lab on a Chip profiles the contributors to the 10th Anniversary UK issue.

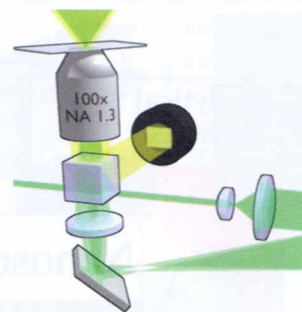


1196

Holographic optical tweezers and their relevance to lab on chip devices

Miles Padgett* and Roberto Di Leonardo*

Holographic optical tweezers can trap and move many objects simultaneously and their compatibility with other optical techniques, particularly microscopy, means that they are highly appropriate to lab-on-chip systems.

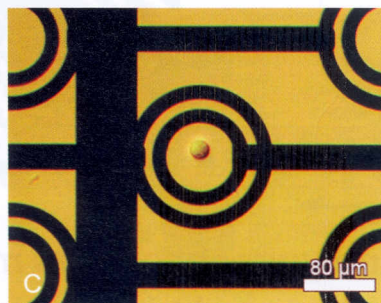


1206

In search of the skeletal stem cell: isolation and separation strategies at the macro/micro scale for skeletal regeneration

David Gothard,* Rahul S. Tare, Peter D. Mitchell, Jonathan I. Dawson and Richard O. C. Oreffo*

Current *in vitro* skeletal stem cell populations express heterogeneity, demonstrating a need for innovative separation methodology with high purity isolation.



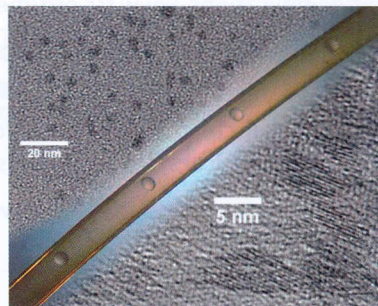
PAPERS

1221

A stable droplet reactor for high temperature nanocrystal synthesis

A. M. Nightingale, S. H. Krishnadasan, D. Berhanu, X. Niu, C. Drury, R. McIntyre, E. Valsami-Jones and J. C. deMello*

We report a stable capillary-based droplet reactor for the controlled synthesis of metal, metal-oxide and compound semiconductor nanoparticles. The reactor operates over a wide range of flow conditions and at temperatures of up to 250 °C.

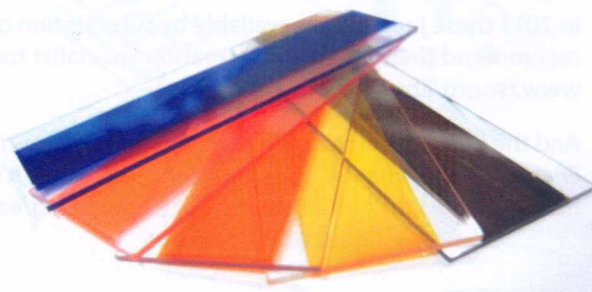


1228

Non-emissive colour filters for fluorescence detection

Mikihide Yamazaki, Oliver Hofmann, Gihan Ryu, Li Xiaoe, Tai Kyu Lee, Andrew J. deMello and John C. deMello*

We report non-fluorescent colour filters based on dye-sensitised titania that provide a low-cost alternative to interference filters for applications requiring non-emissive filtering.

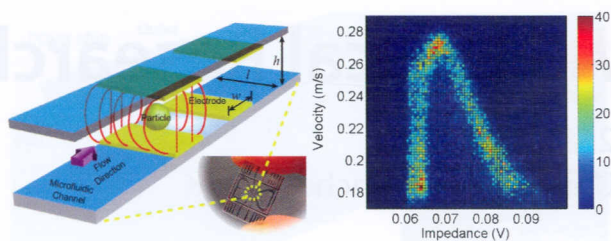


1234

Positional dependence of particles in microfluidic impedance cytometry

Daniel Spencer and Hywel Morgan*

Numerical modelling and experimental data are used to evaluate the impedance signal for particles flowing through a microfluidic impedance cytometer at different positions in the channel.

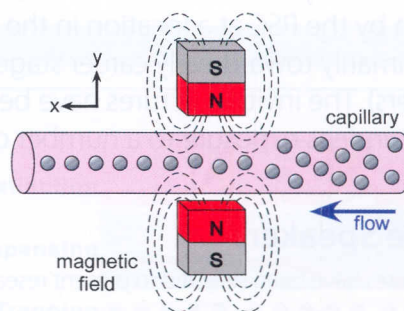


1240

Flow focussing of particles and cells based on their intrinsic properties using a simple diamagnetic repulsion setup

Angeles Ivón Rodríguez-Villarreal, Mark D. Tarn, Leigh A. Madden, Julia B. Lutz, John Greenman, Josep Samitier and Nicole Pamme*

We present diamagnetic repulsion as a novel method for performing label-free particle and cell focussing.

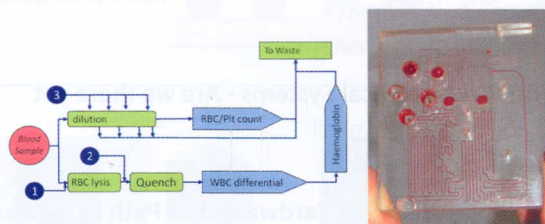


1249

Integrated systems for rapid point of care (PoC) blood cell analysis

Cees van Berkel, James D. Gwyer, Steve Deane, Nicolas Green, Judith Holloway, Veronica Hollis and Hywel Morgan*

Microfluidic sample processing is combined with an impedance based cell identification and enumeration technique in the development of a point of care (PoC) full blood count (FBC) system.

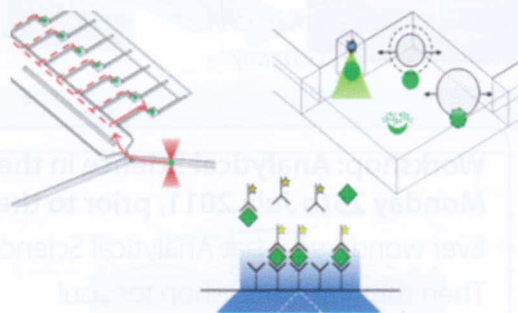


1256

A first step towards practical single cell proteomics: a microfluidic antibody capture chip with TIRF detection

Ali Salehi-Reyhani,* Joseph Kaplinsky, Edward Burgin, Miroslava Novakova, Andrew J. deMello, Richard H. Templer, Peter Parker, Mark A. A. Neil, Oscar Ces, Paul French, Keith R. Willison and David Klug*

A technology platform to undertake the analysis of protein copy number from single cells has been developed. We demonstrate the ability to count protein copy number from single cells in a manner which could be applied in principle to any set of proteins and for any cell type without the need for genetic engineering.

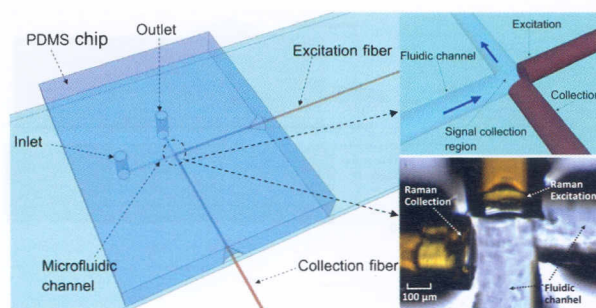


1262

Waveguide confined Raman spectroscopy for microfluidic interrogation

Praveen C. Ashok,* Gajendra P. Singh, Helen A. Rendall, Thomas F. Krauss and Kishan Dholakia

A fiber based microfluidic Raman spectroscopic detection scheme that is alignment-free and scalable to be combined with other microfluidic functional devices.



REGULAR RESEARCH ARTICLES

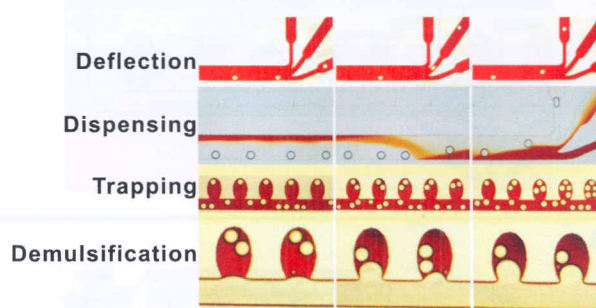
COMMUNICATIONS

1271

On-demand microfluidic droplet manipulation using hydrophobic ferrofluid as a continuous-phase

Kai Zhang, Qionglin Liang,* Xiaoni Ai, Ping Hu, Yiming Wang and Guoan Luo*

We present a method that can implement multiple essential microdroplet operation units, including splitting, dispensing, oil-phase exchange, trapping, release and demulsification, by combining hydrophobic ferrofluid with microfluidic chips.

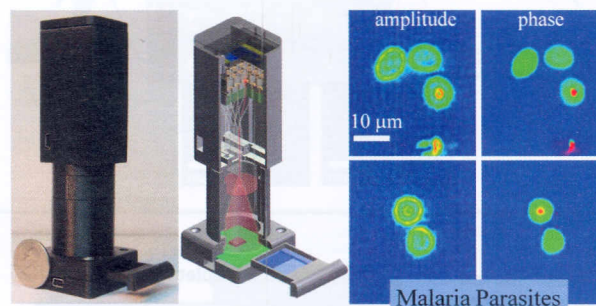


1276

Holographic pixel super-resolution in portable lensless on-chip microscopy using a fiber-optic array

Waheb Bishara,* Uzair Sikora, Onur Mudanyali, Ting-Wei Su, Oguzhan Yaglidere, Shirley Luckhart and Aydogan Ozcan*

We report imaging of malaria parasites using a portable lensless on-chip microscope that can achieve $<1 \mu\text{m}$ resolution over a wide field-of-view of $\sim 24 \text{ mm}^2$.



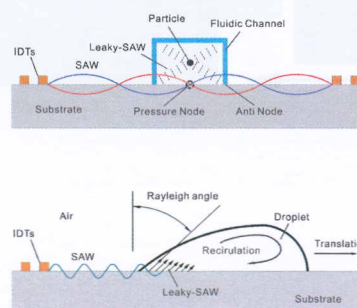
FRONTIER

1280

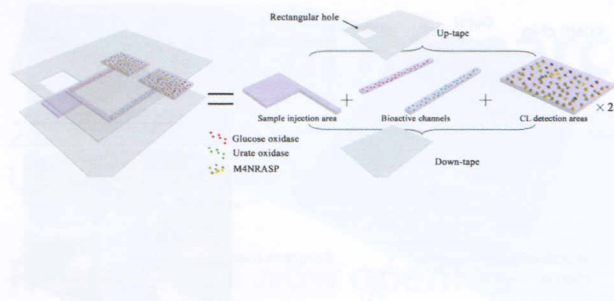
Recent advances in particle and droplet manipulation for lab-on-a-chip devices based on surface acoustic waves

Zhuochen Wang and Jiang Zhe*

We review the most recent advances of the past two years in SAW based particle and liquid droplet manipulation for lab-on-a-chip devices including particle focusing and separation, particle alignment and patterning, particle directing, and liquid droplet delivery.



1286

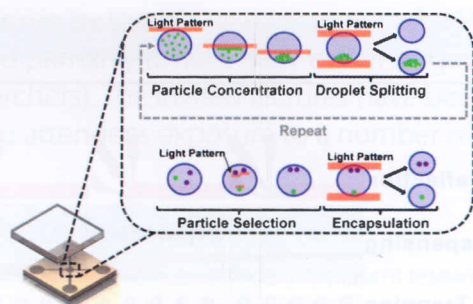


Microfluidic paper-based chemiluminescence biosensor for simultaneous determination of glucose and uric acid

Jinghua Yu,* Lei Ge, Jiadong Huang, Shoumei Wang and Shenguang Ge

In this study, a novel microfluidic paper-based chemiluminescence analytical device (μ PCAD) with a simultaneous, rapid, sensitive and quantitative response for glucose and uric acid was designed.

1292

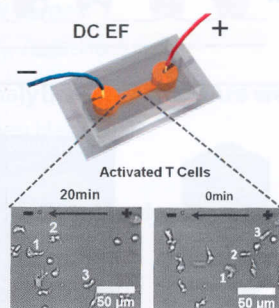


A unified platform for optoelectrowetting and optoelectronic tweezers

Justin K. Valley,* Shao NingPei, Arash Jamshidi, Hsan-Yin Hsu and Ming C. Wu

A platform unifying both optoelectrowetting and optoelectronic tweezers is presented allowing both particle and droplet manipulation over a continuous substrate.

1298

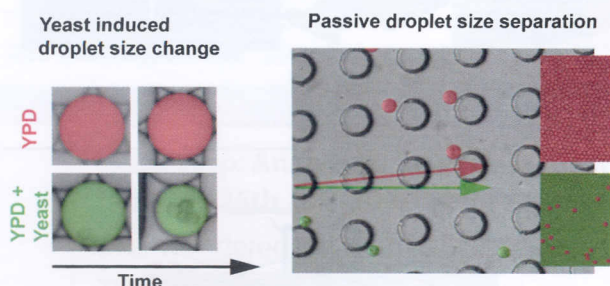


Activated T lymphocytes migrate toward the cathode of DC electric fields in microfluidic devices

Jing Li, Saravanan Nandagopal, Dan Wu, Sean F. Romanuk, Kausik Paul, Douglas J. Thomson and Francis Lin*

We employed microfluidic devices to successfully identify electro taxis of human activated T lymphocytes and compare it to chemotaxis.

1305



Droplet size based separation by deterministic lateral displacement—separating droplets by cell-induced shrinking

Haakan N. Joensson,* Mathias Uhlén and Helene Andersson Svahn

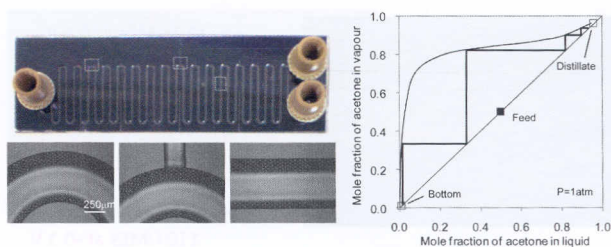
Passive droplet size separation by deterministic lateral displacement (DLD). Utilizing yeast cell induced droplet shrinking, linking biological content with physical droplet size, to separate cell-containing droplets.

1311

Development of multistage distillation in a microfluidic chip

K. F. Lam, E. Cao, E. Sorensen and A. Gavriilidis*

Multistage microscale distillation chips were designed, fabricated and evaluated for the separation of acetone–water and methanol–toluene mixtures.

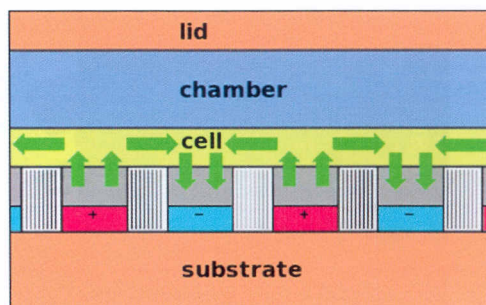


1318

3D numerical simulation of a lab-on-a-chip—increasing measurement sensitivity of interdigitated capacitors by passivation optimization

Christian Jungreuthmayer,* Gerald M. Birnbaumer, Juergen Zanghellini and Peter Ertl

A novel design of dielectric sensors is presented in this work, which offers a significant increase of the measurement sensitivity of LOCs.

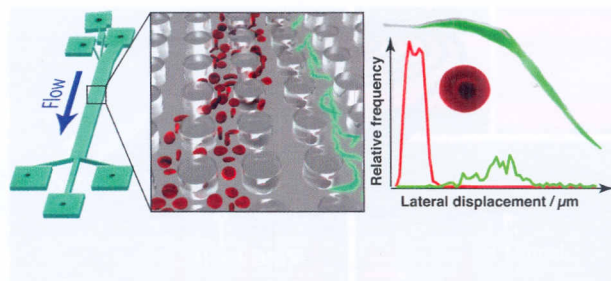


1326

Separation of parasites from human blood using deterministic lateral displacement

Stefan H. Holm, Jason P. Beech, Michael P. Barrett and Jonas O. Tegenfeldt*

We present the use of a modified deterministic lateral displacement device to separate living parasites from human blood. Trypanosomes cause human African trypanosomiasis (sleeping sickness) and finding parasites in a patient's blood is the only way at present to safely diagnose the disease.

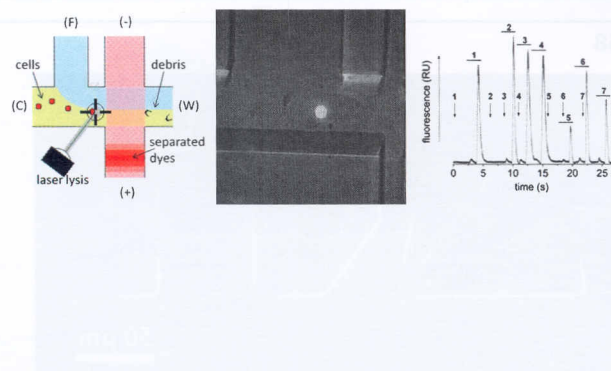


1333

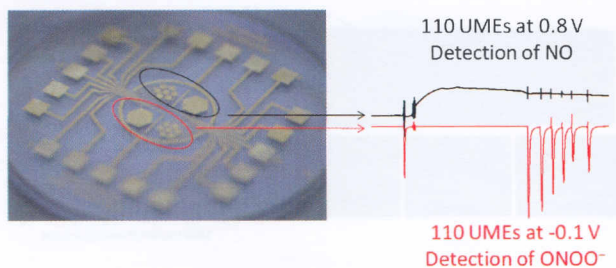
Continuous analysis of dye-loaded, single cells on a microfluidic chip

K. Scott Phillips, Hsuan Hong Lai, Emily Johnson, Christopher E. Sims and Nancy L. Allbritton*

Continuous analysis of fluorescent dyes in single cells is achieved in a supported-membrane-coated, hybrid glass/PDMS microchip.



1342

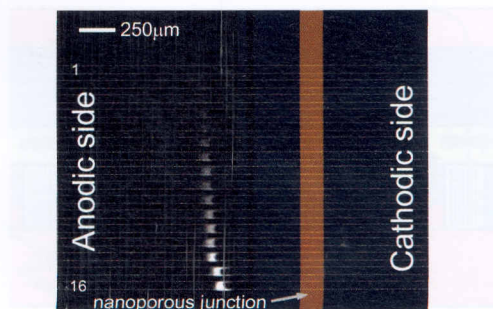


On-chip multi-electrochemical sensor array platform for simultaneous screening of nitric oxide and peroxynitrite

Damien Quinton, Aurélie Girard, Loan To Thi Kim, Vincent Raimbault, Laurent Griscom, Florence Raza, Sophie Griveau and Fethi Bedioui*

Elaboration, characterization and application of an on-chip multi-electrochemical sensor (UME) array platform for simultaneous screening of nitric oxide and peroxynitrite.

1351

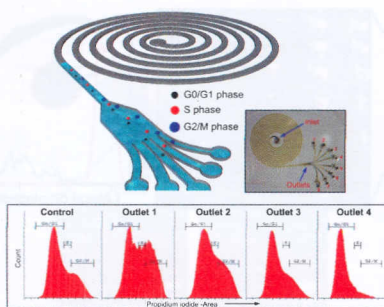


Massively parallel concentration device for multiplexed immunoassays

Sung Hee Ko, Sung Jae Kim, Lih Feng Cheow, Leon I Kwan Hyung Kang* and Jongyoon Han*

Nanofluidic concentrators were massively parallelized with increasing the number of inlets/outlets, while one can control accumulation speeds at each channel.

1359



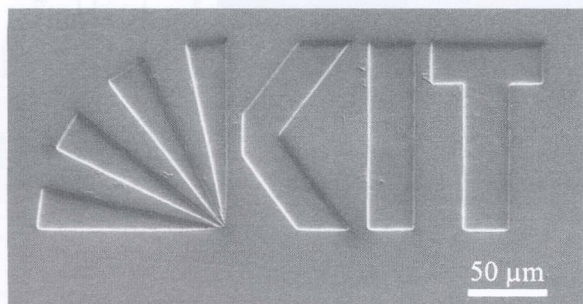
High-throughput cell cycle synchronization using inert forces in spiral microchannels

Wong Cheng Lee, Ali Asgar S. Bhagat, Sha Huang, Krystyn J. Van Vliet, Jongyoon Han* and Chwee Teck

In this paper, we introduce a spiral microfluidic device to successfully fractionate several asynchronous mammalian lines, as well as primary cells comprising bone marrow-derived human mesenchymal stem cells (hMSCs) into enriched subpopulations of G0/G1 (>85%), S, and G2/M phases by exploiting the relationship between cell diameter and cell

TECHNICAL NOTES

1368



Rapid prototyping of microstructures in polydimethylsiloxane (PDMS) by direct UV-lithography

Tim Scharnweber,* Roman Truckenmüller, Andrea M. Schneider, Alexander Welle, Martina Reinl and Stefan Giselbrecht*

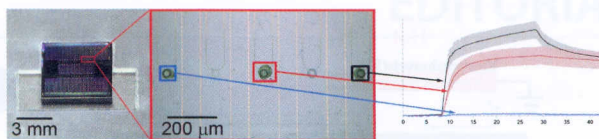
We report on a straightforward and convenient way to produce microstructures in PDMS by direct UV-lithography following development of the latent image. The advantages of this structuring technique are the low requirements regarding equipment and chemicals, the ease of handling and the high flexibility in pattern generation.

1372

Multiplexed inkjet functionalization of silicon photonic biosensors

James T. Kirk, Gina E. Fridley, Jeffrey W. Chamberlain, Elijah D. Christensen, Michael Hochberg and Daniel M. Ratner*

This work describes a rapid piezoelectric non-contact printing technique for the multiplexed functionalization of dense arrays of silicon photonic biosensors.



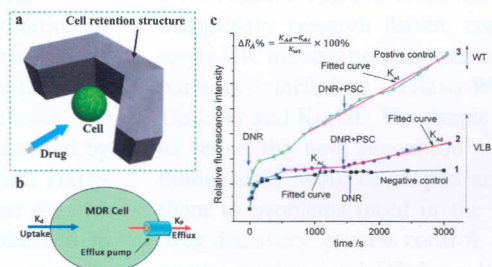
1378

A simple and fast microfluidic approach of same-single-cell analysis (SASCA) for the study of multidrug resistance modulation in cancer cells

XiuJun Li, Yuchun Chen and Paul C. H. Li*

To study multidrug resistance, a new microfluidic approach combined with the concept of 'same-single-cell analysis' (SASCA) has been developed by investigating drug accumulation in MDR cancer cells, with the advantages of simpler protocols, faster assay, and more 'identical' and reliable controls compared to previous methods.

XiuJun Li, Yuchun Chen, Paul C.H. Li*

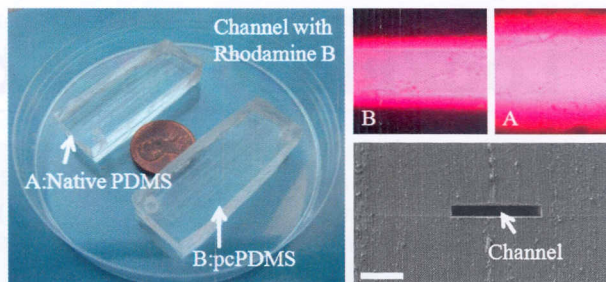


1385

Studies on Parylene C-caulked PDMS (pcPDMS) for low permeability required microfluidics applications

Yinhua Lei, Yaoping Liu, Wei Wang,* Wengang Wu and Zhihong Li

This note introduced a complete fabrication strategy of Parylene C-caulked PDMS (pcPDMS) for low permeability required microfluidics applications.

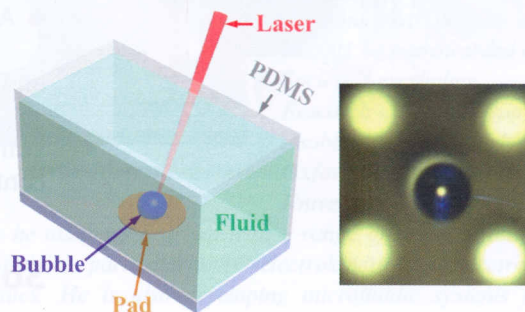


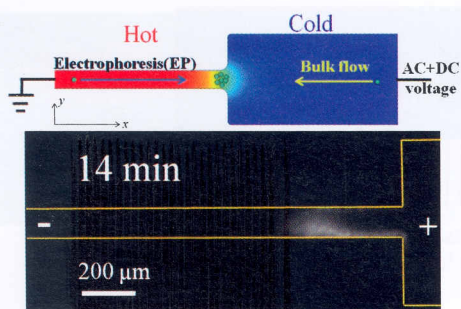
1389

Laser-induced thermal bubbles for microfluidic applications

Kai Zhang, Aoqun Jian, Xuming Zhang,* Yu Wang,* Zhaohui Li and Hwa-yaw Tam

We present a unique bubble generating technique in microfluidic chips using continuous-wave laser-induced heat, which allows the generation of bubbles at almost any location in the microchannel and thus enables microfluidic control at any point of interest.





Towards high concentration enhancement of microfluidic temperature gradient focusing of sample solutes using combined AC and DC field induced Joule heating

Zhengwei Ge, Wei Wang and Chun Yang*

An improved electrokinetic technique for enhancing microfluidic temperature gradient focusing of sample solutes using combined AC and DC field induced Joule heating effects in PDMS microchannels.

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