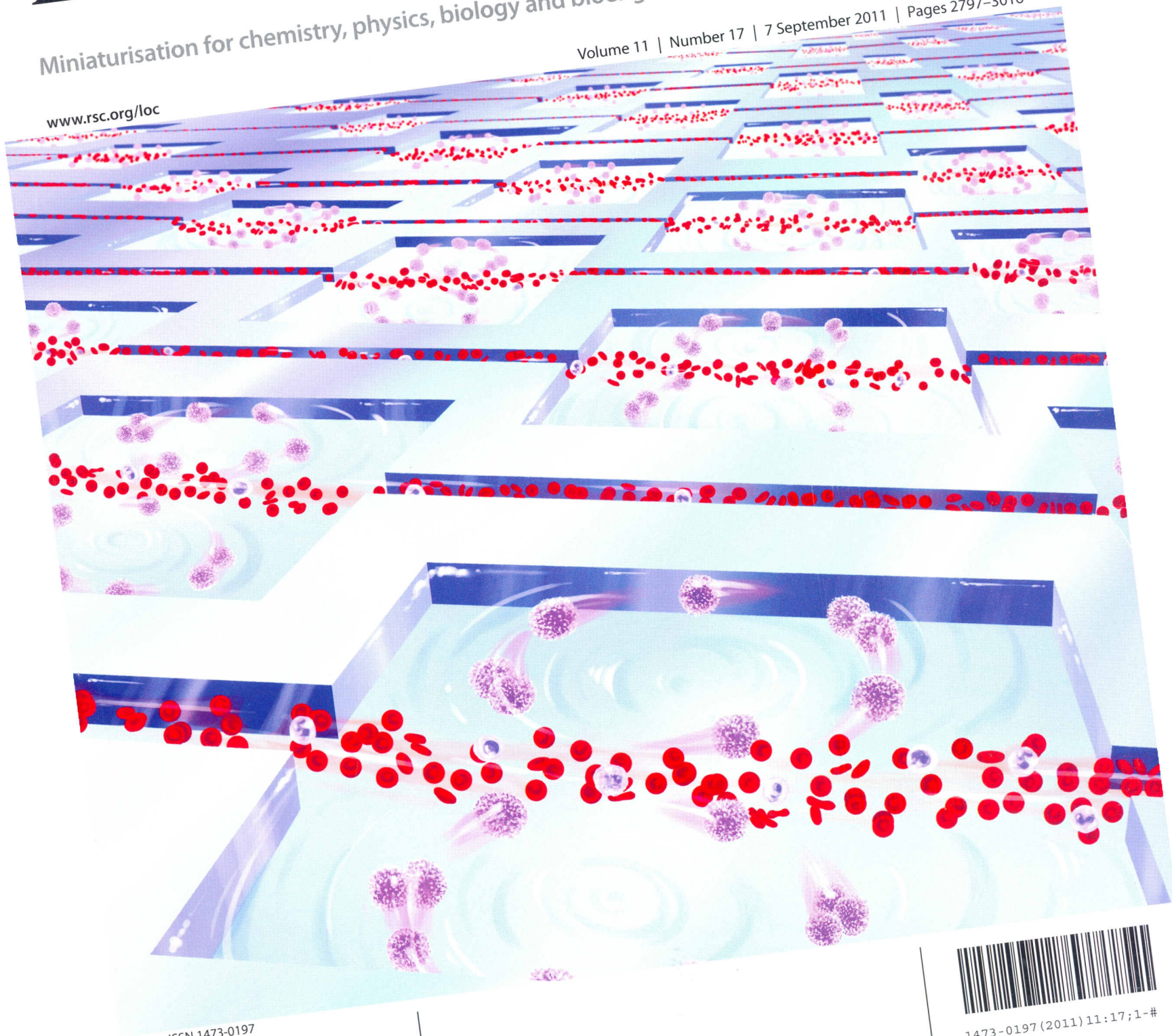


# Lab on a Chip

Miniaturisation for chemistry, physics, biology and bioengineering

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PAPER

Dino Di Carlo *et al.*

Automated cellular sample preparation using a Centrifuge-on-a-Chip



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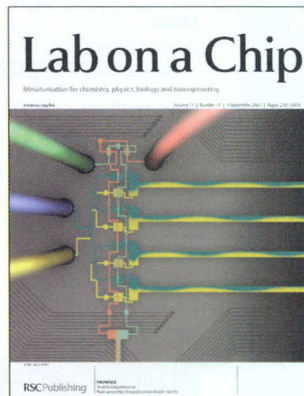
## IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 11(17) 2797-3016 (2011)



### Cover

See Dino Di Carlo *et al.*,  
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### Inside cover

See Shuichi Takayama *et al.*,  
pp. 2813–2818.  
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*Lab Chip*, 2011, **11**, 2813.

## HIGHLIGHT

2811

### Research highlights

Šeila Selimović and Ali Khademhosseini\*

Šeila Selimović and Ali Khademhosseini review the current literature in miniaturisation and related technologies.



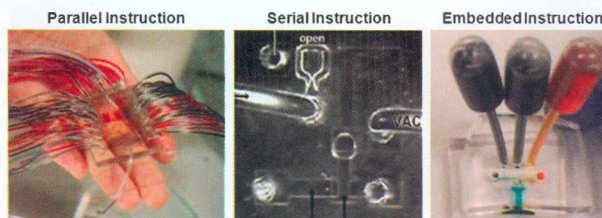
## FRONTIER

2813

### Next-generation integrated microfluidic circuits

Bobak Mosadegh, Tommaso Bersano-Begley,  
Joong Yull Park, Mark A. Burns and Shuichi Takayama\*

This mini-review provides an overview of the various approaches of using networks of elastomeric valves for controlling fluid flow in microfluidic devices.

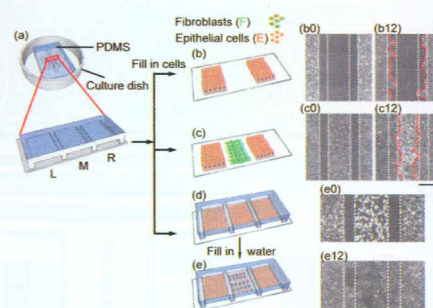


2819

**A microchip-based model wound with multiple types of cells**

Yunyan Xie, Wei Zhang,\* Liming Wang, Kang Sun, Yi Sun and Xingyu Jiang\*

Here we report a microchip that achieves co-culture of different types of cells and a “wound” without mechanical tension on adjacent normal cells, and explore the dynamics of epithelial collective migration triggered by a real cell group.

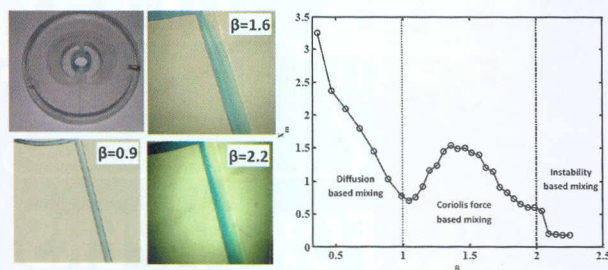


2823

**Anomalous mixing behaviour in rotationally actuated microfluidic devices**

Debapriya Chakraborty, Marc Madou and Suman Chakraborty\*

We analyse mixing in rotating platforms (Lab-on-a-CD) to identify three different regimes—diffusion based mixing, Coriolis force based mixing and instability based mixing.



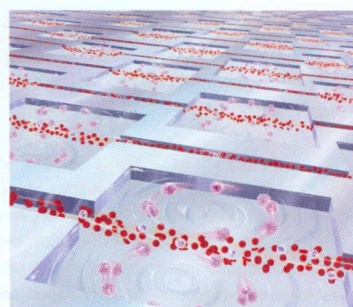
## PAPERS

2827

**Automated cellular sample preparation using a Centrifuge-on-a-Chip**

Albert J. Mach, Jae Hyun Kim, Armin Arshi, Soojung Claire Hur and Dino Di Carlo\*

We developed a microfluidic chip that can perform all of the operations attributed to a benchtop centrifuge, including high-throughput cell concentration, size-based cell sorting and solution exchange.

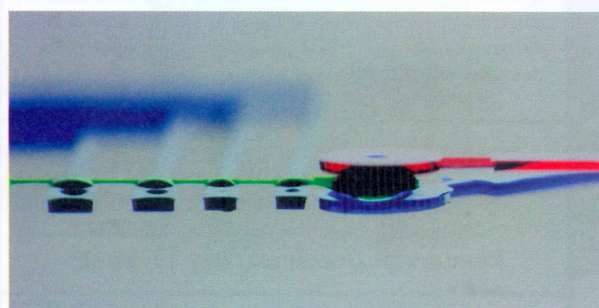


2835

**Discretely tunable optofluidic compound microlenses**

Peng Fei, Zi He, Chunhong Zheng, Tao Chen, Yongfan Men and Yanyi Huang\*

A PDMS-based compound microlens using discretely actuation of integrated valves to accurately tune focal length and zooming power.

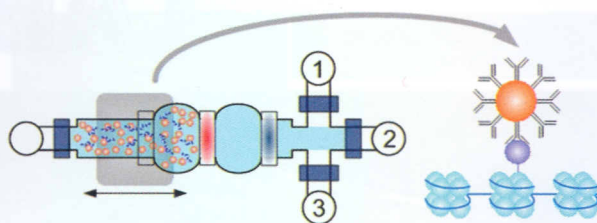


2842

### Histone modification analysis by chromatin immunoprecipitation from a low number of cells on a microfluidic platform

Tao Geng, Ning Bao, Michael D. Litt, Trevor G. Glaros, Liwu Li and Chang Lu\*

We present a microfluidic device for chromatin immunoprecipitation (ChIP) assays based on 50 cells. Such a device may find applications in the epigenetic analysis of cells.

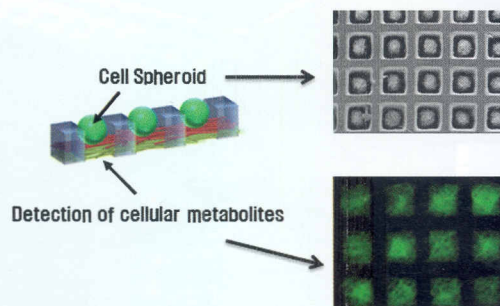


2849

### Micropatterns of double-layered nanofiber scaffolds with dual functions of cell patterning and metabolite detection

Hyun Jong Lee, Han-Soo Kim, Hyun Ok Kim and Won-Gun Koh\*

Double-layered nanofiber scaffolds micropatterned with hydrogel that are able to create microarray of cell spheroids and detect cellular metabolite simultaneously.

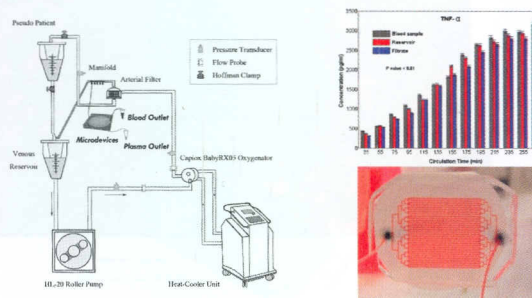


2858

### Microfiltration platform for continuous blood plasma protein extraction from whole blood during cardiac surgery

Kiana Aran,\* Alex Fok, Lawrence A. Sasso, Neal Kamdar, Yulong Guan, Qi Sun, Akif Ündar and Jeffrey D. Zahn\*

A membrane-based microfiltration device to assist in continuous monitoring of a patient's inflammatory response during cardiac surgeries involving cardiopulmonary bypass (CPB) procedures.

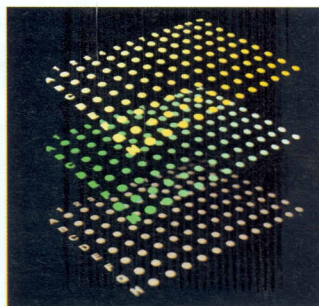


2869

### Printed two-dimensional micro-zone plates for chemical analysis and ELISA

Junfei Tian, Xu Li and Wei Shen\*

A novel printing method can create 2D micro-zones with different functionalities on a same substrate for low-cost diagnostics.

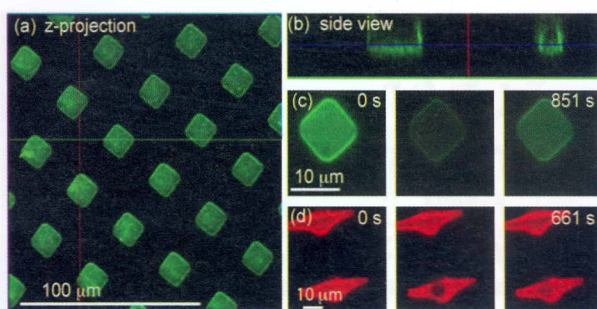


2876

### Single cell 3-D platform to study ligand mobility in cell–cell contact

Mirjam Andreasson-Ochsner, Gregory Romano, Maria Håkanson, Michael L. Smith, Deborah E. Leckband, Marcus Textor and Erik Reimhult\*

To study the effect of the lateral mobility of cell adhesive ligands in three dimensions we present and characterize a platform, which enables patterning of single cells into microwells presenting a cell membrane mimetic interface pre-patterned to its walls.

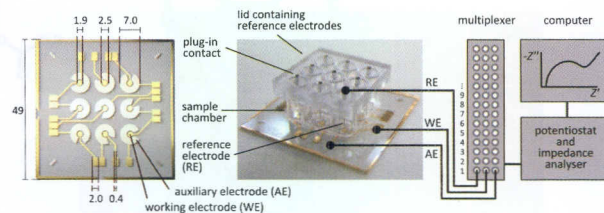


2884

### An electrode array for electrochemical immuno-sensing using the example of impedimetric tenascin C detection

Anja Steude, Sabine Schmidt, Andrea A. Robitzki and Oliver Pänke\*

The capabilities of a novel electrode array are exemplified by the impedimetric detection of tumour marker tenascin C.

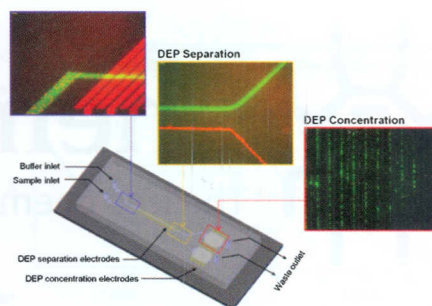


2893

### Continuous dielectrophoretic bacterial separation and concentration from physiological media of high conductivity

Seungkyung Park, Yi Zhang, Tza-Huei Wang\* and Samuel Yang\*

We present a microfluidic device for continuous bacterial separation and concentration from physiological sample matrices.

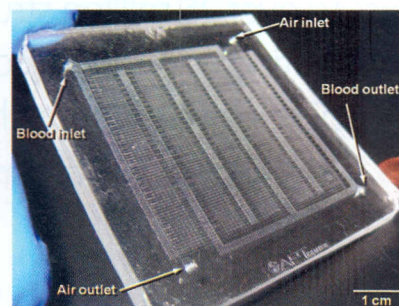


2901

### Bio-inspired, efficient, artificial lung employing air as the ventilating gas

Joseph A. Potkay,\* Michael Magnetta, Abigail Vinson and Brian Cmolik

We report a small-scale, microfabricated artificial lung that uses new mathematical modeling and a bio-inspired design to achieve oxygen exchange efficiencies much larger than current devices, thereby enabling air to be utilized as the ventilating gas.

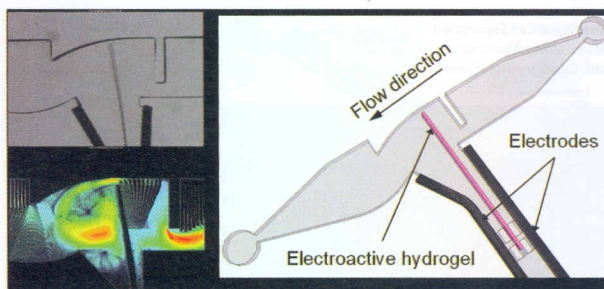


2910

### A low-energy-consumption electroactive valveless hydrogel micropump for long-term biomedical applications

Gu Han Kwon, Gi Seok Jeong, Joong Yull Park, Jin Hee Moon and Sang-Hoon Lee\*

Here, an electroactive hydrogel micropump that shows extremely low energy consumption and high durability after 6 months operation was developed.

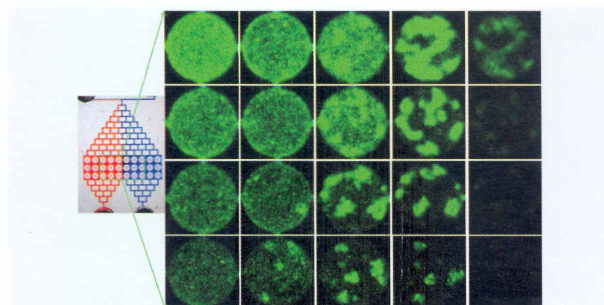


2916

### A microfluidic concentrator array for quantitative predation assays of predatory microbes

Seongyong Park, Dasol Kim, Robert J. Mitchell and Taesung Kim\*

A microfabricated concentrator array device makes it possible to quantify the predation rate of *Bdellovibrio bacteriovorus*, a predatory microbe, toward its prey, *Escherichia coli* str. MG1655.

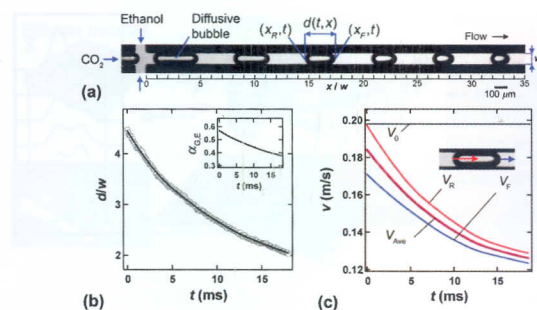


2924

### Dissolution of carbon dioxide bubbles and microfluidic multiphase flows

Ruopeng Sun and Thomas Cubaud\*

We examine the impregnation of liquids (water, ethanol, and methanol) with  $\text{CO}_2$  using microfluidic technology.

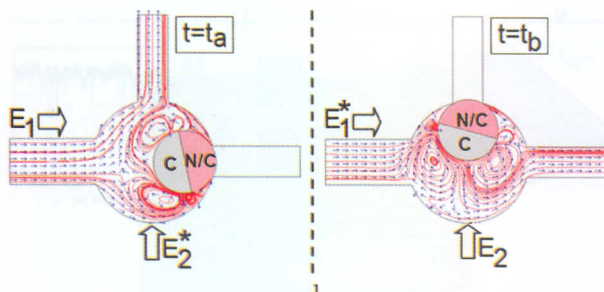


2929

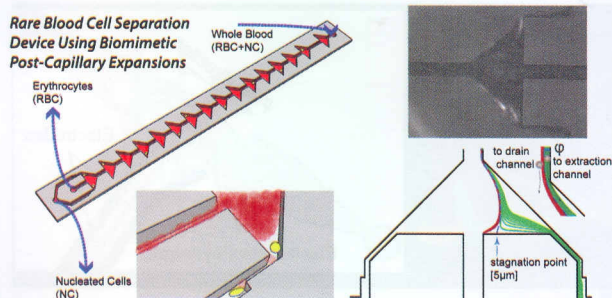
### Micro-valve using induced-charge electrokinetic motion of Janus particle

Yasaman Daghighi and Dongqing Li\*

A new micro-valve using the electrokinetic motion of a Janus particle is introduced.



2941

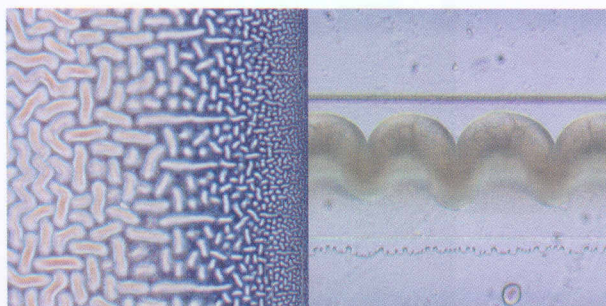


### Biomimetic postcapillary expansions for enhancing rare blood cell separation on a microfluidic chip

Abhishek Jain and Lance L. Munn\*

We have developed and optimized a biomimetic microfluidic device to enrich the nucleated cell population starting from a sample of whole, unprocessed blood using only appropriately-designed microchannels.

2948

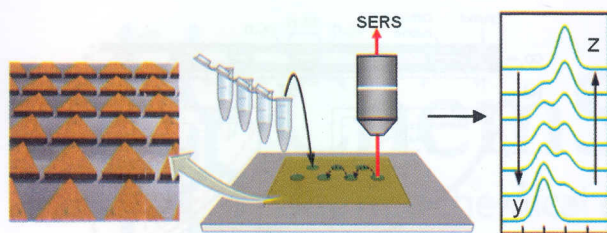


### Reaction-diffusion phenomena in a PDMS matrix can modify its topography

Christophe Provin\* and Teruo Fujii

Using dilute acid and base, we prove that a reaction-diffusion process may occur inside a PDMS matrix, which generates localized stress that creates wrinkles and pores.

2955

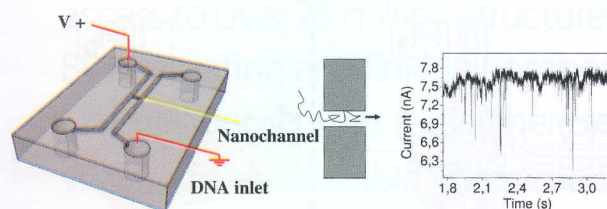


### On-chip approach for traceable quantification of biomarkers based on isotope-dilution surface-enhanced Raman scattering (IDSERS)

Fatemeh Yaghoobian, Thomas Weimann, Bernd Güttler and Rainer Stosch\*

We present a complete on-chip procedure for the quantification of biomarkers in human serum based on isotope-dilution surface-enhanced Raman scattering (IDSERS).

2961



### DNA detection with a polymeric nanochannel device

Paola Fanzio,\* Valentina Mussi, Chiara Manneschi, Elena Angeli, Giuseppe Firpo, Luca Repetto and Ugo Valbusa

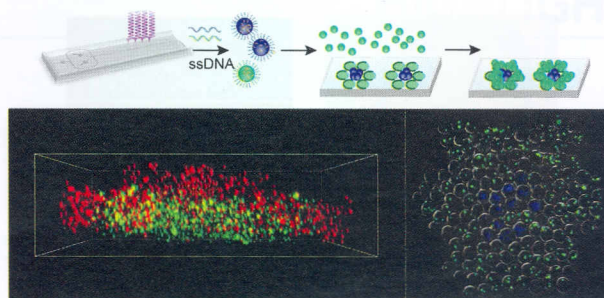
We present the fabrication procedure and the characterization of a polymeric nanochannel device able to electrically detect single DNA molecules.

2967

### DNA-templated assembly of droplet-derived PEG microtissues

Cheri Y. Li, David K. Wood, Caroline M. Hsu and Sangeeta N. Bhatia\*

Multicellular tissue constructs are patterned by DNA-templated assembly of 100  $\mu\text{m}$  cell-laden microtissues, fabricated using a microdroplet-generated emulsion of photopolymerizable hydrogel.

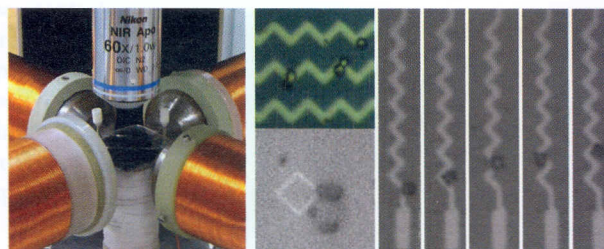


2976

### Magnetic domain wall conduits for single cell applications

M. Donolato,\* A. Torti, N. Kostashe, M. Deryabina, E. Sogne, P. Vavassori, M. F. Hansen and R. Bertacco

The controlled trapping and manipulation of individual yeast cells have been achieved *via* displacement and annihilation of domain walls in micro- and nano-sized magnetic structures.

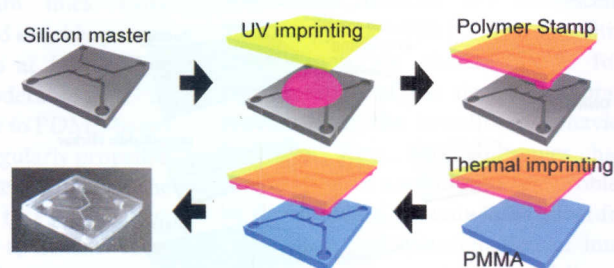


2984

### Complete plastic nanofluidic devices for DNA analysis *via* direct imprinting with polymer stamps

Jiahao Wu, Rattikan Chantiwas, Alborz Amirsadeghi, Steven A. Soper and Sungook Park\*

A simple, rapid and cost effective method for fabrication of polymer-based nanofluidic devices with sub-100 nm nanochannels using direct imprinting with a polymer stamp.



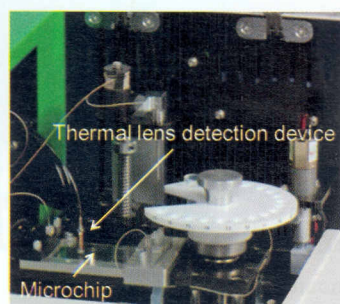
## TECHNICAL NOTES

2990

### Thermal lens detection device

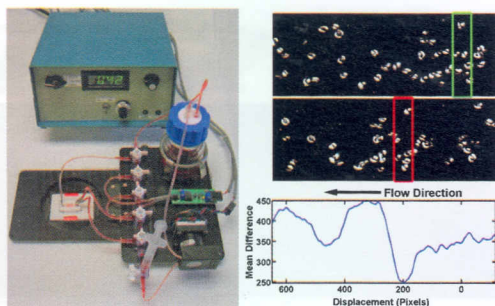
Kazuma Mawatari, Toshinori Ohashi, Tomohiko Ebata, Manabu Tokeshi and Takehiko Kitamori\*

A thermal lens detection device was developed to realize an easy-to-use, portable and sensitive detector for nonfluorescent molecules.





2994



### A microfluidic system to study cytoadhesion of *Plasmodium falciparum* infected erythrocytes to primary brain microvascularendothelial cells

Thurston Herricks,\* Karl B. Seydel, George Turner, Malcolm Molyneux, Robert Heyderman, Terrie Taylor and Pradipsinh K. Rathod.

We present a microfluidic culture system for studying *Plasmodium falciparum* interactions with primary brain microvascularendothelial cells.

3001

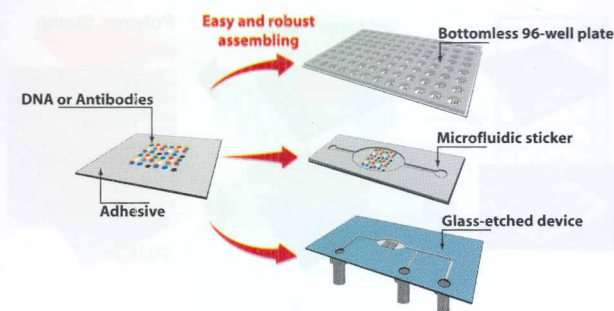


### Integration of a macro/micro architected compartmentalised neuronal culture device using a rapid prototyping moulding process

Martin Arundell,\* V. Hugh Perry and Tracey. A. Newman

A one step rapid prototyping technique for the fabrication of a compartmentalised neuronal culture device.

3006

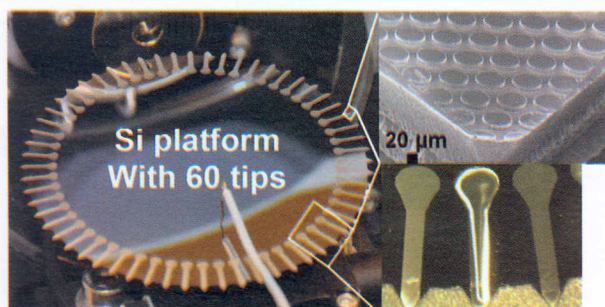


### Adhesive microarrays for multipurpose diagnostic tools

Benjamin P. Corgier, Céline A. Mandon, Gaelle C. Le Goff, Loïc J. Blum and Christophe A. Marquette\*

Adhesive surfaces were used for the immobilization of biomolecule microarrays and for the assembly of these microarrays with 3D structures.

3011



### A microfabricated silicon platform with 60 microfluidic chips for rapid mass spectrometric analysis

Lauri Sainiemi,\* Teemu Nissilä, Risto Kostianen, Raimo A. Ketola and Sami Franssila

An integrated rotating silicon platform with 60 miniaturized ESI chips for rapid mass spectrometric analyses.