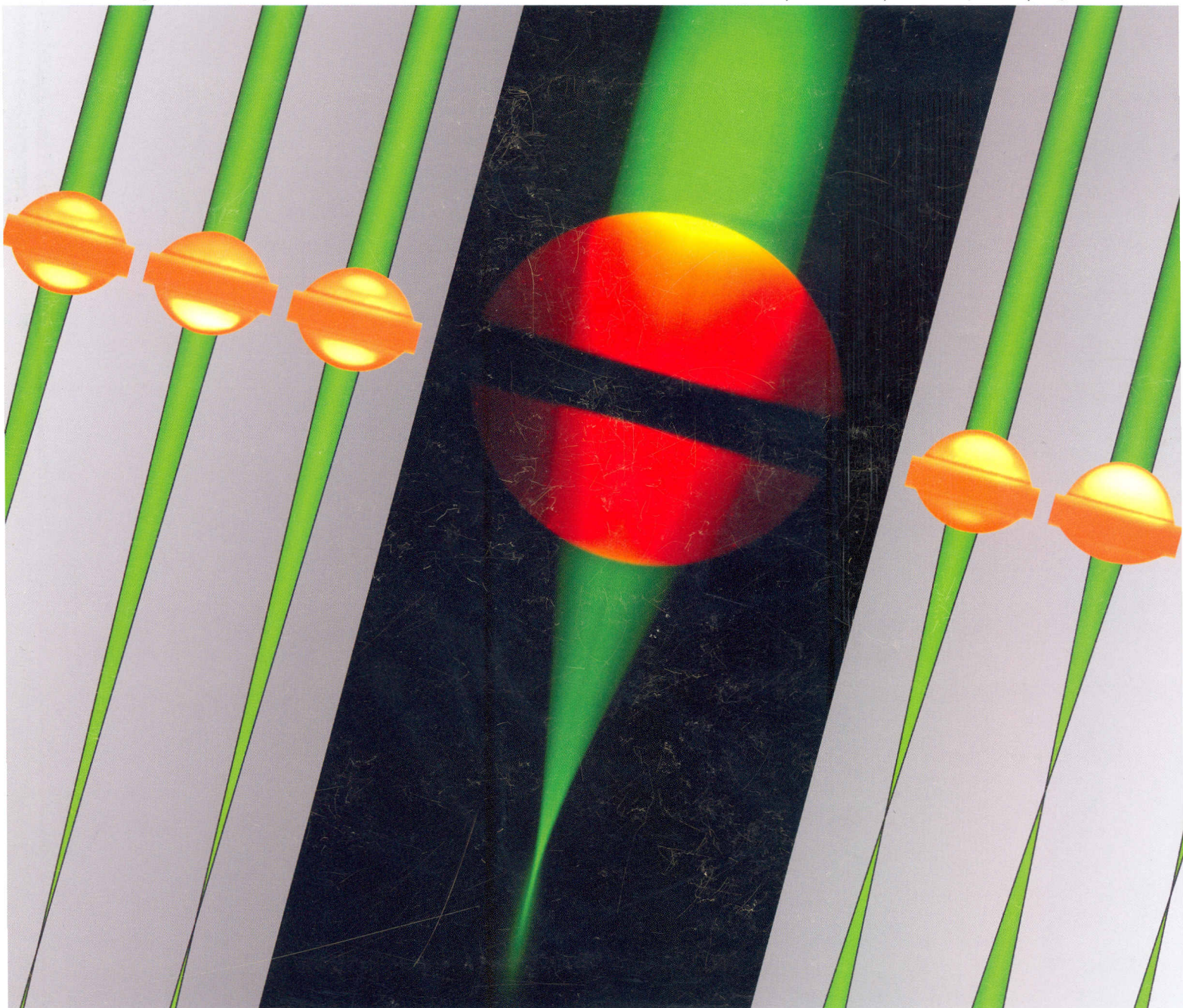


Lab on a Chip

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

www.rsc.org/loc

Volume 11 | Number 3 | 7 February 2011 | Pages 361–556



ISSN 1473-0197

RSC Publishing

PAPER
Hirsa *et al.*
Electromagnetic liquid pistons for capillarity-based pumping



1473-0197(2011)11:3;1-A

Lab on a Chip

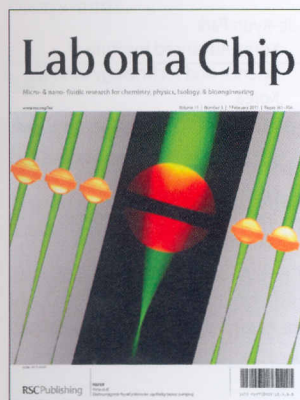
Micro- & nano- fluidic research for chemistry, physics, biology, & bioengineering

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 11(3) 361–556 (2011)



Cover

See Hirsra *et al.*, pp. 393–397.
Image reproduced by permission of Amir H. Hirsra from *Lab Chip*, 2011, **11**, 393.



Inside cover

See Park and Kim *et al.*, pp. 378–380.
Image reproduced by permission of Chan Beum Park and Dong-Pyo Kim from *Lab Chip*, 2011, **11**, 378.

EDITORIAL

375

Circulating tumor cells: the Grand Challenge

Jaap den Toonder

Jaap den Toonder, *Lab on a Chip* Editorial Board Member, discusses how the field of circulating tumour cells defines one of the Grand Challenges for the microfluidics community.



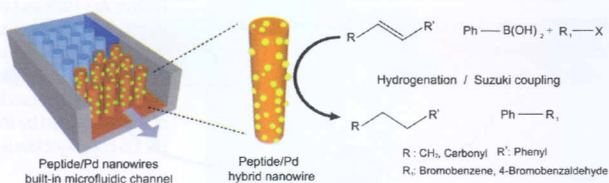
COMMUNICATIONS

378

A microfluidic system incorporated with peptide/Pd nanowires for heterogeneous catalytic reactions

Hyang-Im Ryoo, Joon Seok Lee, Chan Beum Park* and Dong-Pyo Kim*

Highly stable peptide/Pd nanowires built-in microfluidic system for heterogeneous catalytic hydrogenation and Suzuki coupling reactions.

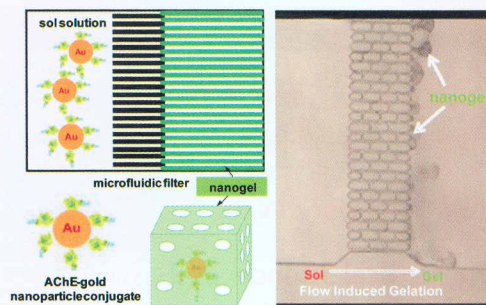


381

Enzyme entrapped nanoporous scaffolds formed through flow-induced gelation in a microfluidic filter device for sensitive biosensing of organophosphorus compounds

Donglai Lu, Guocheng Shao, Dan Du, Jun Wang, Limin Wang, Wanjun Wang and Yuehe Lin*

A novel and versatile processing method was developed for the formation of gel scaffolds with *in situ* AChE–AuNPs immobilization for biosensing of organophosphorus compounds.

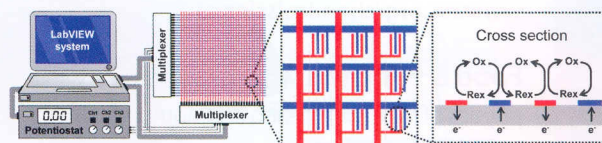


385

Addressable electrode array device with IDA electrodes for high-throughput detection

Kosuke Ino,* Wataru Saito, Masahiro Koide, Taizo Umemura, Hitoshi Shiku and Tomokazu Matsue*

An electrochemical device is proposed for high-throughput electrochemical detection that consists of 32 row and 32 column electrodes on a single glass substrate.

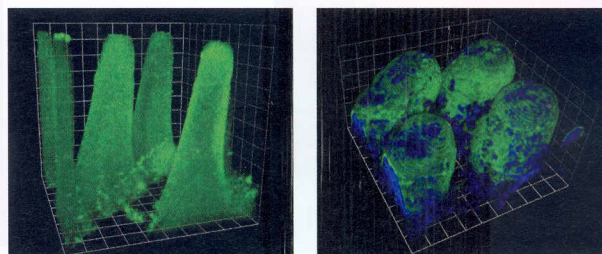


389

Microscale 3-D hydrogel scaffold for biomimetic gastrointestinal (GI) tract model

Jong Hwan Sung, Jiajie Yu, Dan Luo, Michael L. Shuler and John C. March*

Sacrificial molding of alginate from a polydimethylsiloxane (PDMS) template results in fabrication of a high-resolution, microscale 3-D hydrogel structure for biomimetic tissue.

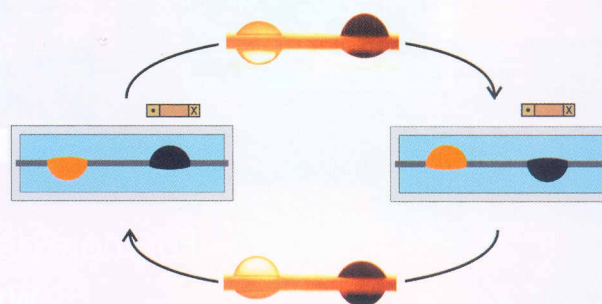


393

Electromagnetic liquid pistons for capillarity-based pumping

Bernard A. Malouin Jr, Michael J. Vogel, Joseph D. Olles, Lili Cheng and Amir H. Hirsra*

Electronically-controlled liquid pistons featuring finely tunable displacements are demonstrated as either resonators or discrete pumps of an optical fluid, enabling fast adaptive liquid lenses.

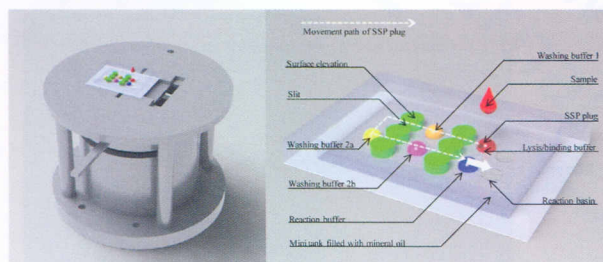


398

A surface topography assisted droplet manipulation platform for biomarker detection and pathogen identification

Yi Zhang, Seungkyung Park, Kelvin Liu, Jennifer Tsuan, Samuel Yang and Tza-Huei Wang*

A fully functional, miniaturized droplet system for disease biomarker detection from crude biosamples with real-time results readout and melting curve analysis.

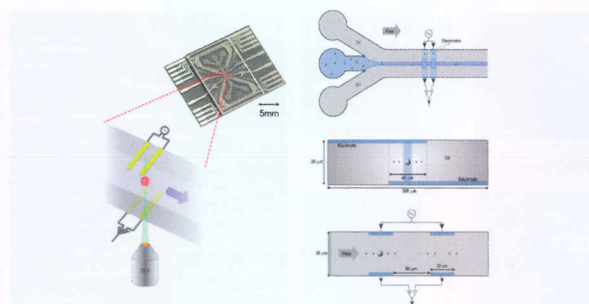


407

Micro-impedance cytometry for detection and analysis of micron-sized particles and bacteria

Catia Bernabini, David Holmes and Hywel Morgan

We describe a microfluidic impedance cytometer that uses an insulating sheath flow in a wide channel to detect and discriminate micron sized particles such as beads and bacteria.

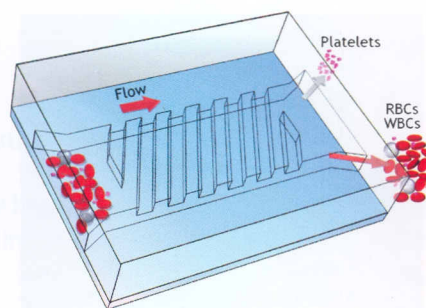


413

Hydrophoretic high-throughput selection of platelets in physiological shear-stress range

Sungyoung Choi, Taeyun Ku, Seungjeong Song, Chulhee Choi and Je-Kyun Park*

This paper demonstrates the use of hydrophoretic size separation in a wide channel for platelet purification and its parallelization to augment its throughput capability, while maintaining physiological shear-stress range.

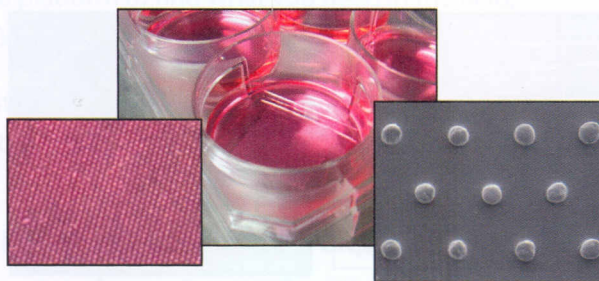


419

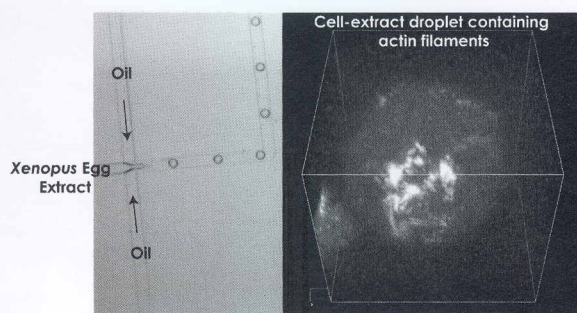
Microarrays for the scalable production of metabolically relevant tumour spheroids: a tool for modulating chemosensitivity traits

Heike Hardelauf, Jean-Philippe Frimat, Joanna D. Stewart, Wiebke Schormann, Ya-Yu Chiang, Peter Lampen, Joachim Franzke, Jan G. Hengstler, Cristina Cadenas, Leoni A. Kunz-Schughart and Jonathan West*

Microarray pitch can be used to precisely modulate the proliferation rate, scale and metabolic state of tumour spheroids.



429

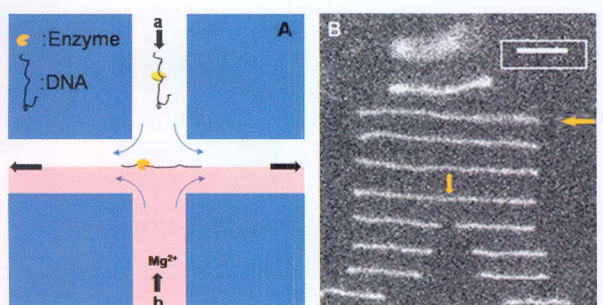


Towards high throughput production of artificial egg oocytes using microfluidics

A. M. Jimenez, M. Roché, M. Pinot, P. Panizza, L. Courtois and Z. Gueroui*

We use microfluidic strategies to encapsulate biologically functional eukaryotic cytoplasm (*Xenopus* egg extracts) in micron-sized droplets. Our approach provides an alternative solution for drug screening using a phenotype-based assay.

435

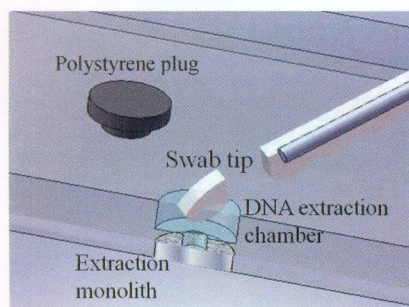


Exploring both sequence detection and restriction endonuclease cleavage kinetics by recognition site via single-molecule microfluidic trapping

Weilin Xu and Susan J. Muller*

In this paper we demonstrate the feasibility of a single-molecule microfluidic approach to both sequence detection and obtaining kinetic information for restriction endonucleases, by recognition site, on dsDNA.

443

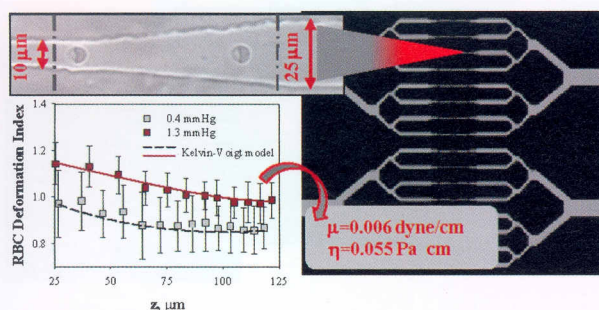


Development of a real-world direct interface for integrated DNA extraction and amplification in a microfluidic device

Kirsty J. Shaw, Domino A. Joyce, Peter T. Docker, Charlotte E. Dyer, Gillian M. Greenway, John Greenman and Stephen J. Haswell*

Development of a real-world to chip interface for the integrated release, extraction and PCR amplification of DNA from buccal swab samples.

449

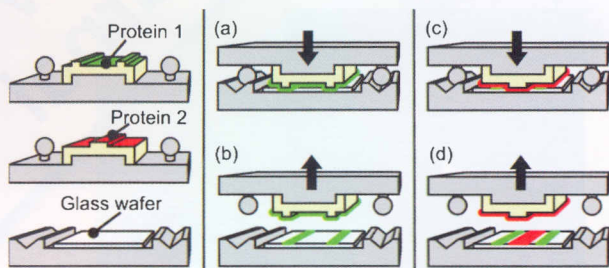


Microfluidics analysis of red blood cell membrane viscoelasticity

Giovanna Tomaiuolo, Mario Barra, Valentina Preziosi, Antonio Cassinese, Bruno Rotoli and Stefano Guido*

A novel methodology to measure red blood cell surface viscosity η and membrane shear elasticity μ in converging/diverging microfluidic channel is developed.

455

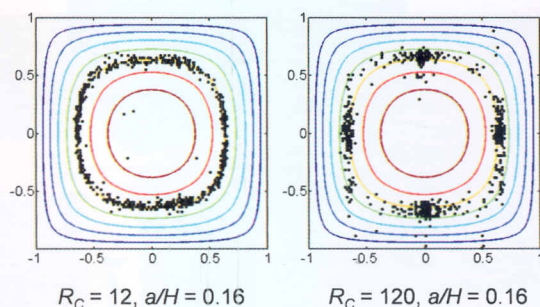


High-precision microcontact printing of interchangeable stamps using an integrated kinematic coupling

Christine A. Trinkle* and Luke P. Lee

We demonstrate a novel microcontact printing method that uses an integrated kinematic coupling device to provide rapid, highly repeatable placement of surface patterns; individual stamps can be removed, replaced, or exchanged with submicron repeatability.

460

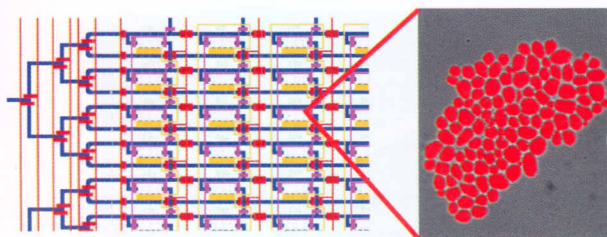


Lateral and cross-lateral focusing of spherical particles in a square microchannel

Yong-Seok Choi, Kyung-Won Seo and Sang-Joon Lee*

A transition in the inertial migration mode from the lateral to the cross-lateral is reported in a square microchannel by using a simple digital holographic microscopy technique.

466

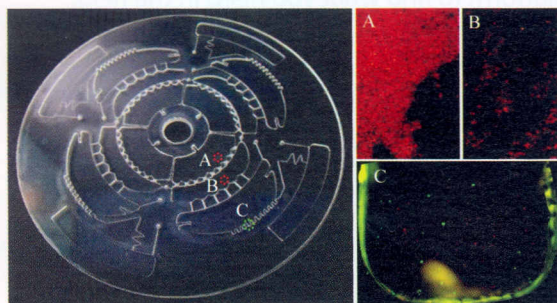


High-throughput tracking of single yeast cells in a microfluidic imaging matrix

D. Falconnet, A. Niemistö, R. J. Taylor, M. Ricicova, T. Galitski, I. Shmulevich and C. L. Hansen*

We describe a high-throughput microfluidic imaging system capable of performing 128 time-lapse live-cell imaging experiments over 24 hours. A combination of patterned gel polymerization and programmable diffusive mixing allows for the long-term tracking of single cells through precisely defined medium conditions.

474



Separation and detection of rare cells in a microfluidic disk via negative selection

Chen-Lin Chen, Ken-Chao Chen, Yu-Cheng Pan, Tai-Ping Lee, Lo-Chang Hsiung, Cheng-Ming Lin, Chang-Yu Chen, Ching-Hung Lin, Bor-Luen Chiang and Andrew M. Wo*

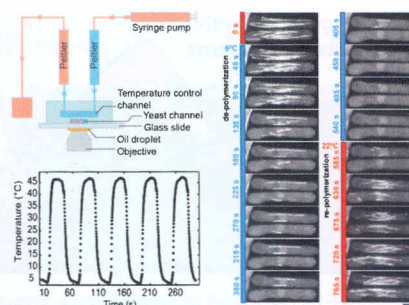
This paper presents a microfluidic disk to enumerate rare cells via immunomagnetic negative selection. Results show 60% recovered cells over sample concentrations from 10^{-3} to 10^{-6} , superior to that of autoMACS (37.3%) and BD IMagnet (48.3%).

484

Fast microfluidic temperature control for high resolution live cell imaging

Guilhem Velve Casquillas, Chuanhai Fu, Mael Le Berre, Jeremy Cramer, Sebastien Meance, Adrien Plecis, Damien Baigl, Jean-Jacques Greffet, Yong Chen, Matthieu Piel and Phong T. Tran*

A new microfluidic device capable of fast temperature switching is described. This device is anticipated to help biologists study temperature-sensitive mutations at high spatiotemporal resolution.

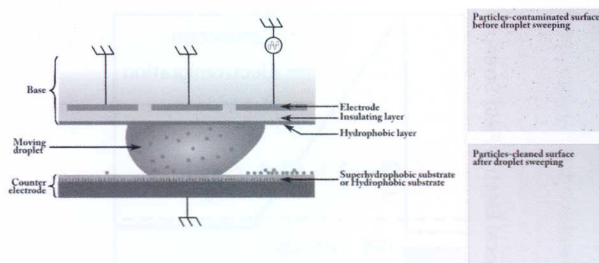


490

EWOD driven cleaning of bioparticles on hydrophobic and superhydrophobic surfaces

M. Jönsson-Niedziółka, * F. Lapierre, Y. Coffinier, S. J. Parry, F. Zoueshtiagh, T. Foat, V. Thomy and R. Boukherroub

An original study using electrowetting droplet displacement on the cleaning efficiency of electrostatically deposited bioparticles (proteins, bacterial spores and bacteriophages). Particle type and surface hydrophobicity strongly influence the cleaning efficiencies.

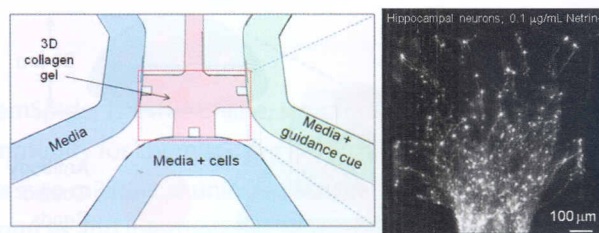


497

A high-throughput microfluidic assay to study neurite response to growth factor gradients

Chandrasekhar R. Kothapalli, Ed van Veen, Sarra de Valence, Seok Chung, Ioannis K. Zervantonakis, Frank B. Gertler and Roger D. Kamm*

We describe a three-channel microfluidic device to study the role of chemogradients on neurite outgrowth and guidance in 3D scaffolds, using experimental and computational studies. The stable chemogradients in these devices could also be used to screen potential drugs for neuron pathway regeneration under disease/injury conditions, cell migration and cell-cell interactions.

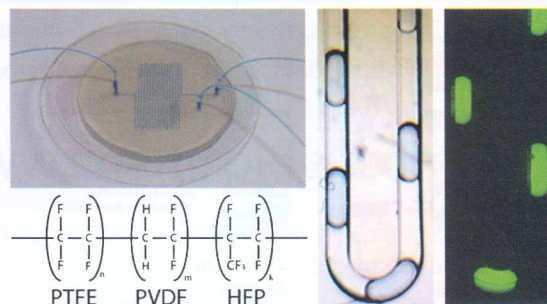


508

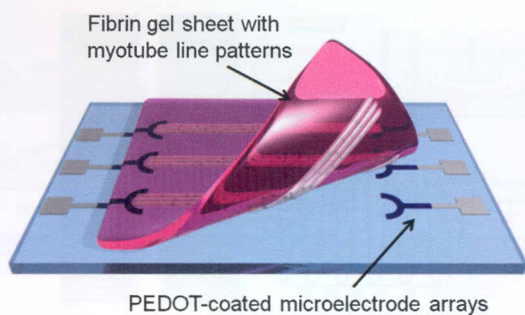
New family of fluorinated polymer chips for droplet and organic solvent microfluidics

Stefano Begolo, Guillaume Colas, Jean-Louis Viovy* and Laurent Malaquin*

We present a new family of microfluidic fluorinated chips that are suitable for the manipulation of microdroplets and organic solvents.



513

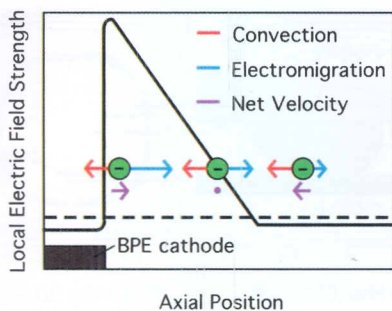


Spatiotemporally controlled contraction of micropatterned skeletal muscle cells on a hydrogel sheet

Kuniaki Nagamine, Takeaki Kawashima, Soichiro Sekine, Yuichiro Ido, Makoto Kanzaki and Matsuhiko Nishizawa*

We have developed gel sheet-supported C_2C_{12} myotube micropatterns and combined them with a microelectrode array chip to afford a skeletal muscle cell-based bioassay system.

518

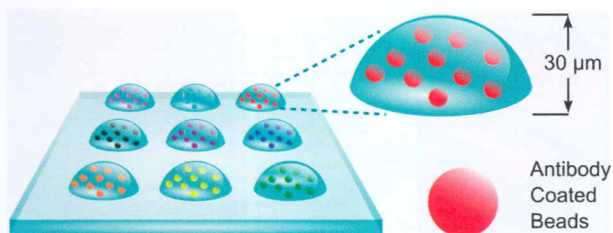


Bipolar electrode focusing: tuning the electric field gradient

Robbyn K. Anand, Eoin Sheridan, Dzmitry Hlushkou, Ulrich Tallarek* and Richard M. Crooks*

Bipolar electrode focusing locally enriches analytes along an extended electric field gradient. The response of the electric field gradient to the manipulation of several experimental parameters is discussed.

528



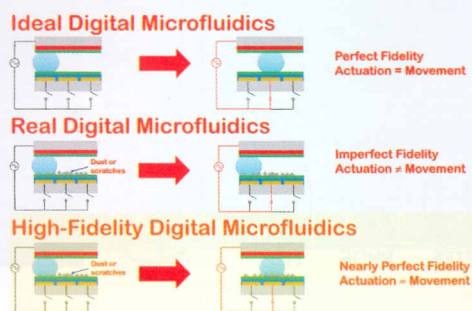
Hydrogel droplet microarrays with trapped antibody-functionalized beads for multiplexed protein analysis

Huiyan Li, Rym Ferial Leulmi and David Juncker*

We present a novel 3D antibody microarray format based on the entrapment of antibody-coated microbeads within porous alginate droplets that are spotted with an inkjet printer. The beads-in-gel droplet microarray helped enhance mass transport and was used for multiplexed, highly sensitive immunoassays of cancer-related proteins in diluted serum.

TECHNICAL NOTES

535

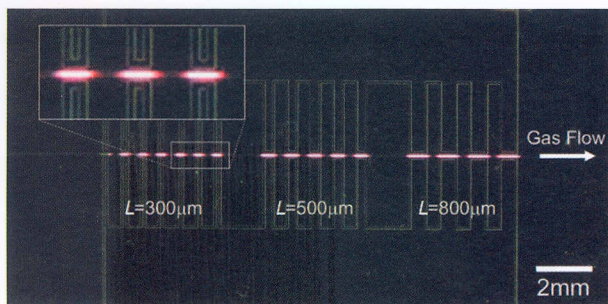


A feedback control system for high-fidelity digital microfluidics

Steve C. C. Shih, Ryan Fobel, Paresh Kumar and Aaron R. Wheeler*

A new digital microfluidic feedback and control system requiring only a few resistors and capacitors for high-fidelity digital microfluidics.

541

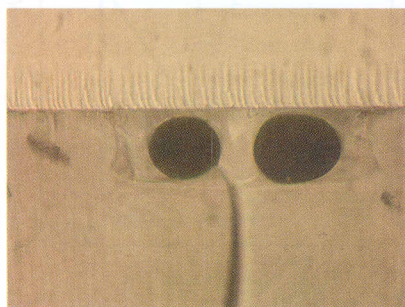


Microplasma patterning of bonded microchannels using high-precision "injected" electrodes

Craig Priest,* Philipp J. Gruner, Endre J. Szili, Sameer A. Al-Bataineh, James W. Bradley, John Ralston, David A. Steele and Robert D. Short

A rapid, high-precision method for *localised* plasma-treatment of *bonded* PDMS microchannels is demonstrated. Aligned electrodes were prepared by injection of molten gallium into microchannel guides. Microplasmas were then generated at these electrodes and used for surface patterning of regions (as small as 100 μm) along the length of the microchannel.

545



A fast and simple method to fabricate circular microchannels in polydimethylsiloxane (PDMS)

Mohamed Abdelgawad, Chun Wu, Wei-Yin Chien, William R. Geddie, Michael A. S. Jewett and Yu Sun*

A coating of liquid PDMS is applied on the walls of rectangular microchannels to give them a circular cross-section.

Looking for free content?

Then register for an RSC Publishing personal account. Giving you access to all free content on the RSC Publishing platform, it includes:

- All content of our newest journals for the first 2 volumes
- Any articles that are part of a special free access promotion
- A sample chapter from each book in the RSC eBook Collection

and much more.

With your username and password you can access the free content any time, any place – all you need is internet access.

So don't delay – register today.

RSC Publishing

www.rsc.org/personalregistration

Registered Charity Number 207890