

Lab on a Chip

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

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10th Anniversary: Focus on the Netherlands

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EDITORIAL
Sabeth Verpoorte
10th Anniversary Issue: The Netherlands



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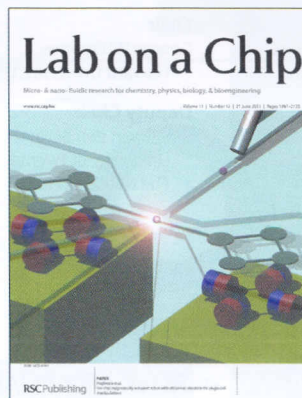
IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 11(12) 1981–2120 (2011)



Cover

See Sabeth Verpoorte, pp. 1991–1992. The cover image contains contributions from the authors who have articles in this issue. The image was realized by Sven de Krou and Gert IJsbrand Salentijn (Department of Pharmacy, University of Groningen), based on a concept by Sabeth Verpoorte. Photograph of windmill taken by Maurits van Dijk, Pharmaceutical Analysis, University of Groningen. Image reproduced by permission of Elisabeth Verpoorte from *Lab Chip*, 2011, **11**, 1991.



Inside cover

See Hagiwara *et al.*, pp. 2049–2054. Image reproduced by permission of Masaya Hagiwara from *Lab Chip*, 2011, **11**, 2049.

THEMED ISSUE: 10TH ANNIVERSARY FOCUS ON THE NETHERLANDS

EDITORIAL

1991

10th Anniversary Issue: The Netherlands

S. Verpoorte

Guest Editor Sabeth Verpoorte highlights the contribution of Dutch research to micro- and nanofluidics.



PROFILE

1993

Contributors to the Netherlands issue

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

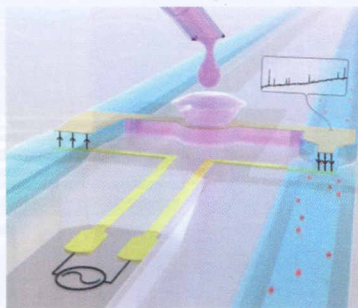


1995

A new floating electrode structure for generating homogeneous electrical fields in microfluidic channels

Loes I. Segerink,* Ad J. Sprenkels, Johan G. Bomer, Istvan Vermes and Albert van den Berg

In this paper we describe a new parallel electrode structure having a floating electrode to generate a homogeneous electrical field.

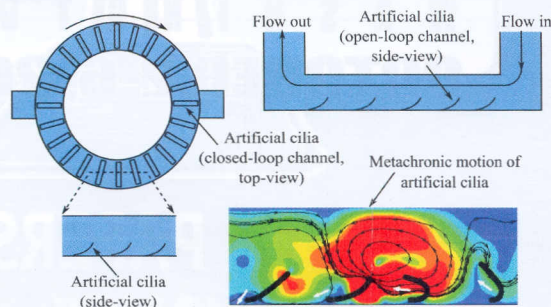


2002

Magnetically-actuated artificial cilia for microfluidic propulsion

S. N. Khaderi, C. B. Craus, J. Hussong, N. Schorr, J. Belardi, J. Westerweel, O. Prucker, J. R uhe, J. M. J. den Toonder and P. R. Onck*

In this paper we quantitatively analyse the performance of magnetically-driven artificial cilia for lab-on-a-chip applications, using a coupled magneto-mechanical solid-fluid interaction model.

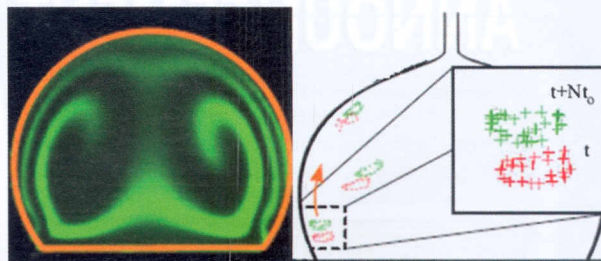


2011

Capillary Stokes drift: a new driving mechanism for mixing in AC-electrowetting

Frieder Mugele,* Adrian Staicu, Rina Bakker and Dirk van den Ende

Electrowetting driven drop oscillations drive chaotic mixing in sessile drops. Left: distribution of dye during drop mixing. Right: colloidal tracer particles report the internal flow field.

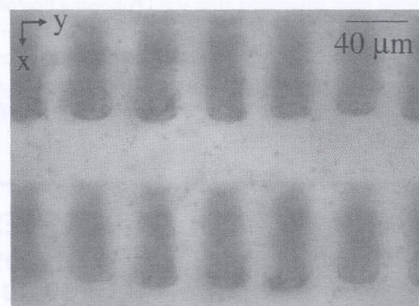


2017

Experimental investigation of the flow induced by artificial cilia

J. Hussong,* N. Schorr,* J. Belardi, O. Prucker, J. R uhe and J. Westerweel

Magnetically actuated artificial cilia of rectangular shape create phase-averaged fluid velocities in the order of $10^2 \mu\text{m s}^{-1}$. Volume flow rates of $14 \pm 4 \mu\text{l min}^{-1}$ can be achieved when no back pressure is built up.

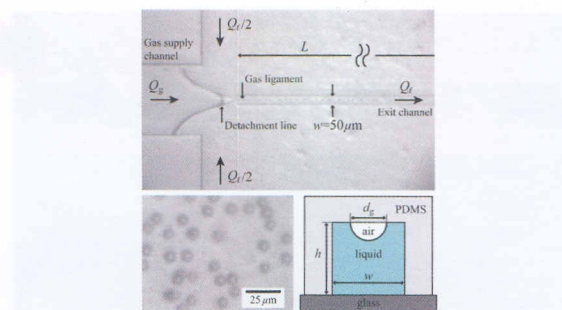


2023

Microbubble generation in a co-flow device operated in a new regime

Elena Castro-Hernández, Wim van Hoeve, Detlef Lohse and José M. Gordillo*

Monodisperse $\sim 5 \mu\text{m}$ bubbles are formed in a long microchannel thanks to a strong pressure gradient and by PDMS hydrophobicity.



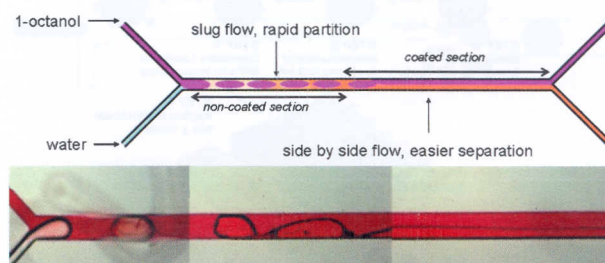
TECHNICAL NOTES

2030

Multiple flow profiles for two-phase flow in single microfluidic channels through site-selective channel coating

Hella Logtenberg, Maria J. Lopez-Martinez, Ben L. Feringa, Wesley R. Browne* and Elisabeth Verpoorte*

An approach to control two-phase flow systems in a PDMS-based microfluidic device using spatially selective surface modification is demonstrated. The system can be used to combine both slug flow and side-by-side flow in one channel, without the need of additional structural elements.

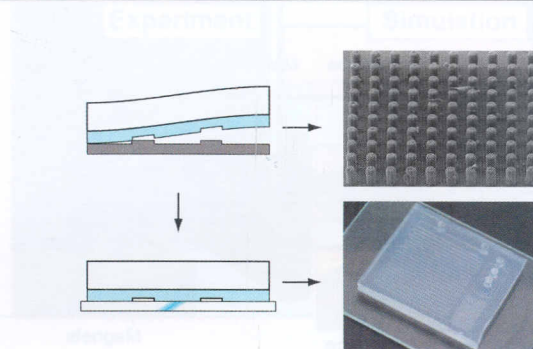


2035

Micromolding of solvent resistant microfluidic devices

Theodorus J. A. Renckens, Dainius Janeliunas, Hilbert van Vliet, Jan H. van Esch, Guido Mul and Michiel T. Kreutzer*

Solvent-resistant PFPE-based microfluidic devices are created using standard micromolding infrastructure and demonstrated for chemistry with organic solvents and acids.



REGULAR RESEARCH ARTICLES

FOCUS

2039

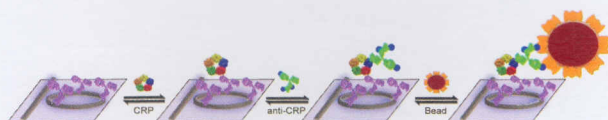
What determines specific cell functions?

Emma Lundberg and Helene Andersson Svahn

Helene Andersson Svahn and Emma Lundberg discuss factors that determine cell specificity, how is it achieved and controlled, and its impact on cell activity and fate – Part of a series of Focus articles elucidating bio-related issues that impact on lab on a chip and microfluidic research.



2042

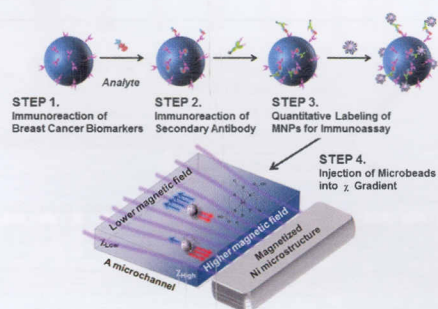


Sensitive on-chip detection of a protein biomarker in human serum and plasma over an extended dynamic range using silicon photonic microring resonators and sub-micron beads

Matthew S. Luchansky, Adam L. Washburn, Melinda S. McClellan and Ryan C. Bailey*

Using arrays of silicon photonic microring resonators, we report a three-step assay for biomarker quantitation in human serum and plasma samples over a dynamic range spanning six orders of magnitude.

2045



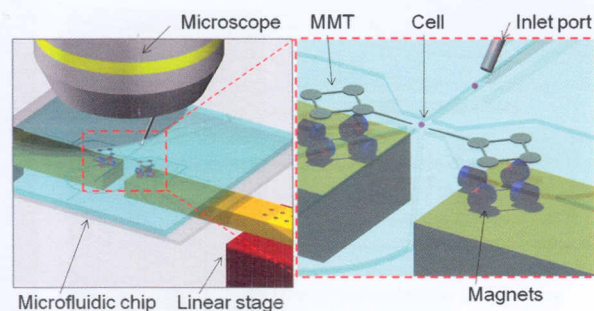
Versatile immunoassays based on isomagnetophoresis

Young Ki Hahn and Je-Kyun Park*

We report an isomagnetophoretic immunoassay capable of detecting an attomolar level of proteins and adjusting the dynamic range of target analytes.

PAPERS

2049

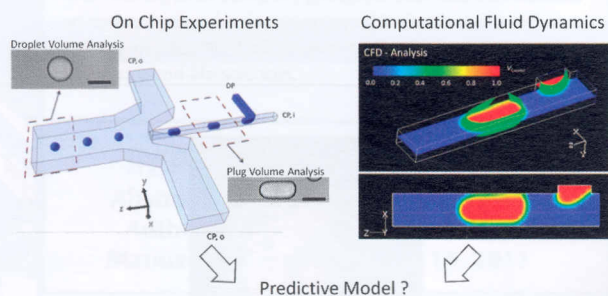


On-chip magnetically actuated robot with ultrasonic vibration for single cell manipulations

Masaya Hagiwara,* Tomohiro Kawahara, Yoko Yamanishi, Taisuke Masuda, Lin Feng and Fumihito Arai

We present the innovative driving method for an on-chip robot actuated by permanent magnets in a microfluidic chip. A piezoelectric ceramic is applied to microfluidic chip to reduce the friction on the microrobot significantly. Then the microrobot achieved high accuracy, high speed and high power on-hip actuation for cell manipulations.

2055



Systematic investigation of droplet generation at T-junctions

Thomas Schneider, Daniel R. Burnham, Jaylen VanOrden and Daniel T. Chiu*

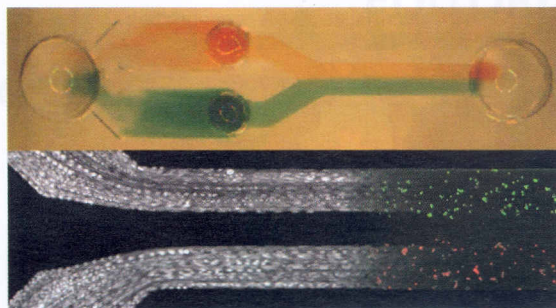
Experimental and computational validation of an elegant predictive model for plug volume estimation at microfluidic T-junctions.

2060

Pipette-friendly laminar flow patterning for cell-based assays

Erwin Berthier, Jay Warrick, Ben Casavant and David J. Beebe*

We present a passive microfluidic method that enables short-term laminar flow patterning of multiple fluids using a single pipette and allows each sample to be loaded in any sequence, at any point in time relative to one another.

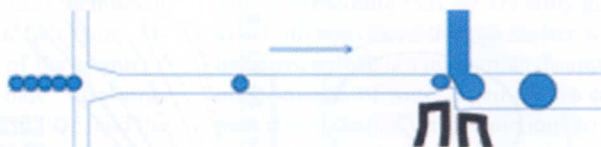


2066

On-chip background noise reduction for cell-based assays in droplets

Pascaline Mary, Angela Chen, Irwin Chen, Adam R. Abate and David A. Weitz*

This article reports a method to reduce the background noise in solution when performing heterogeneous assays in droplets.

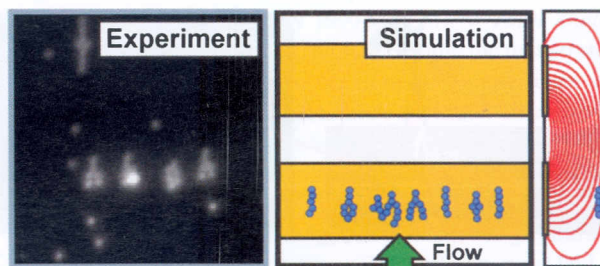


2071

Emergent behavior in particle-laden microfluidic systems informs strategies for improving cell and particle separations

Michael D. Vahey and Joel Voldman*

Using a combined experimental and theoretical approach, we present an investigation of particle interactions and their implications for the performance of microfluidic devices for concentrating and sorting particles.

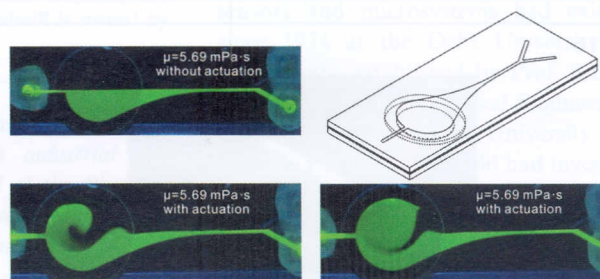


2081

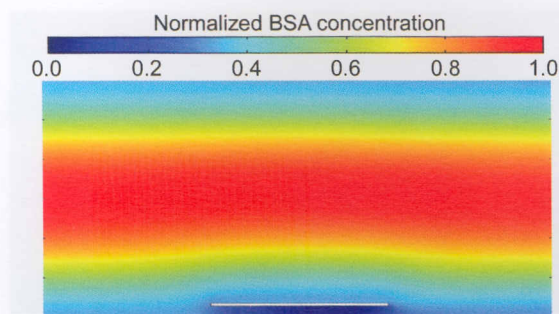
Mixing enhancement for high viscous fluids in a microfluidic chamber

Shasha Wang, Xiaoyang Huang* and Chun Yang

Enhancement of micromixing in high viscous fluids with bubbles generated by a piezoelectric actuator.



2088

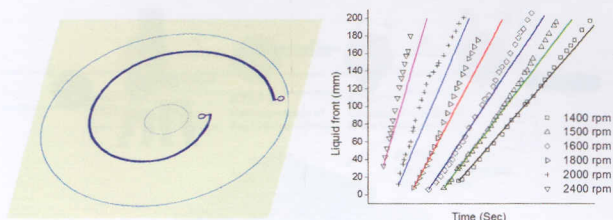


Transient deflection response in microcantilever array integrated with polydimethylsiloxane (PDMS) microfluidics

R. R. Anderson, W. Hu, J. W. Noh, W. C. Dahlquist, S. J. Ness, T. M. Gustafson, D. C. Richards, S. Kim, B. A. Mazzeo, A. T. Woolley and G. P. Nordin*

We report the integration of a nanomechanical sensor consisting of 16 silicon microcantilevers with polydimethylsiloxane (PDMS) microfluidics.

2097

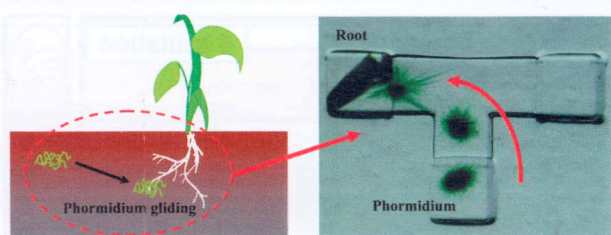


Analysis and modeling of flow in rotating spiral microchannels: towards math-aided design of microfluidic systems using centrifugal pumping

Lin Wang, Mary-Catherine Kropinski and Paul C. H. Li*

Liquid flow in the spiral microchannel generated by centrifugal force is modeled. The predicted flow velocities from the mathematical model and the CFD program show reasonable agreement with the experimental data.

2109



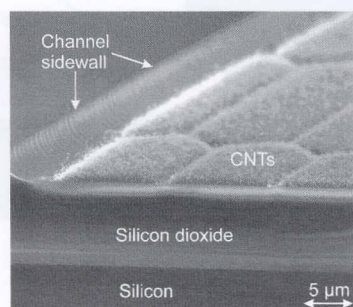
3D microfluidic chips with integrated functional microelements fabricated by a femtosecond laser for studying the gliding mechanism of cyanobacteria

Yasutaka Hanada,* Koji Sugioka, Ikuko Shihira-Ishikawa, Hiroyuki Kawano, Atsushi Miyawaki and Katsumi Midorikawa

We present fabrication of microfluidic chips integrated with optical waveguides and filters for studying the gliding mechanism of *Phormidium*.

TECHNICAL NOTE

2116



Carbon nanotube based separation columns for high electrical field strengths in microchip electrochromatography

Klaus B. Mogensen,* Miaoxiang Chen, Kristian Molhave, Peter Boggild and Jörg P. Kutter

Patterning carbon nanotubes into an array of pillars makes it possible to increase the electrical field strength applied across a separation column by more than one order of magnitude.