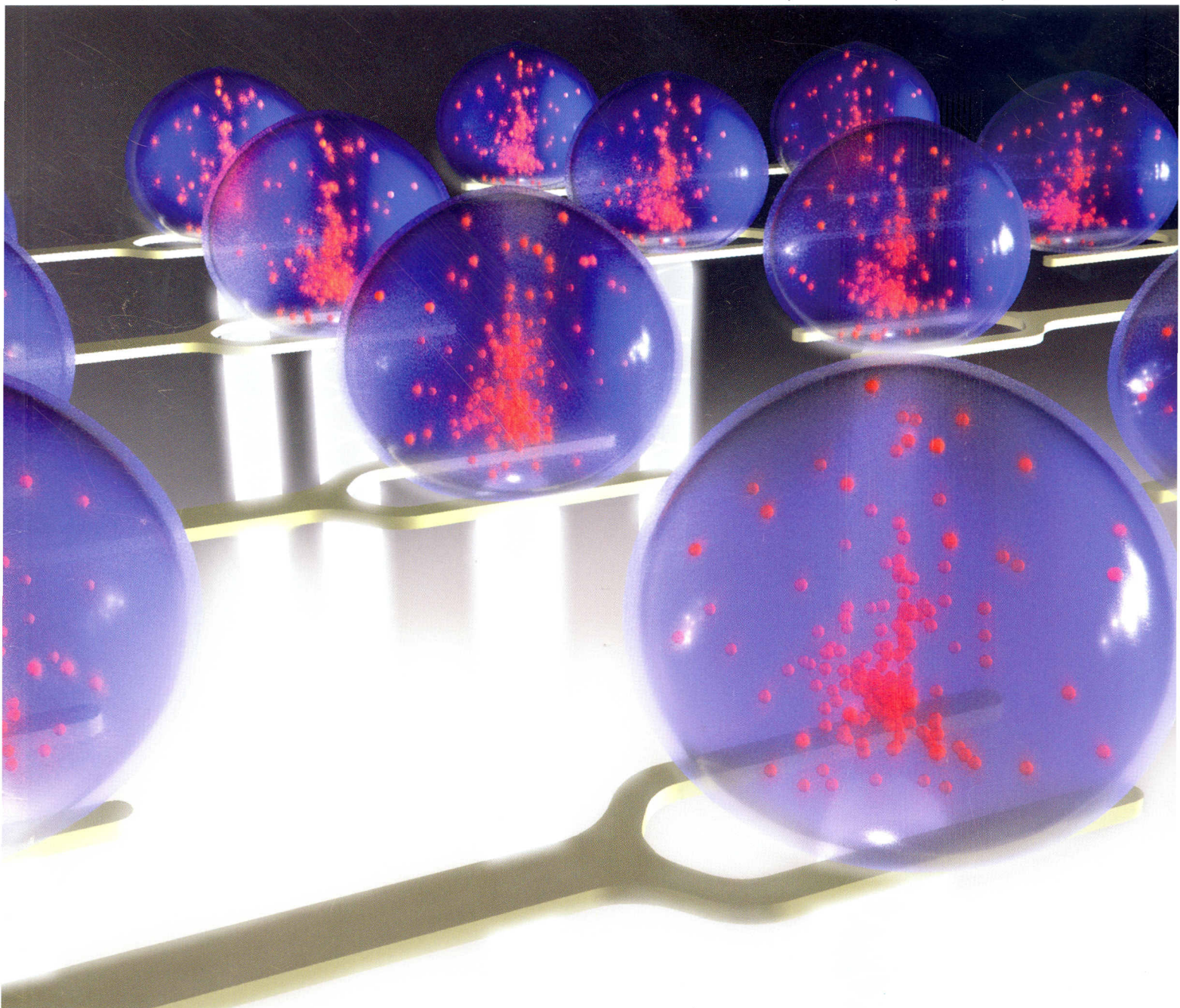


Lab on a Chip

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

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CRITICAL REVIEW

Aloke Kumar *et al.*

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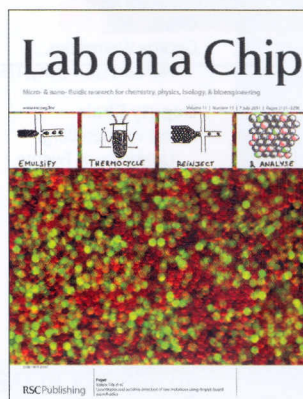
IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 11(13) 2121–2296 (2011)



Cover

See Alok Kumar *et al.*, pp. 2135–2148
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Inside cover

See Valérie Taly *et al.*, pp. 2156–2166.
This article is published alongside Jonathan W. Larson *et al.*, *Lab Chip*, 2011, **11**, 2167.
The members of the group Droplets, Membranes and Interfaces (MPI-ds Goettingen) are acknowledged for their support in preparing the cover page.
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FOCUS

2133

Famous last words...

Holger Becker reflects on the last two years of writing for *Lab on a Chip*—part of a series of Focus articles on the commercialization of microfluidics.



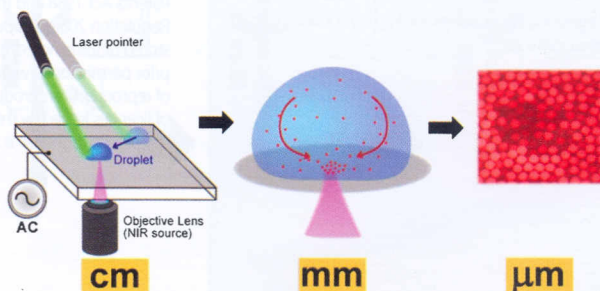
CRITICAL REVIEW

2135

Hybrid opto-electric manipulation in microfluidics—opportunities and challenges

Alok Kumar,* Stuart J. Williams, Han-Sheng Chuang, Nicolas G. Green and Steven T. Wereley

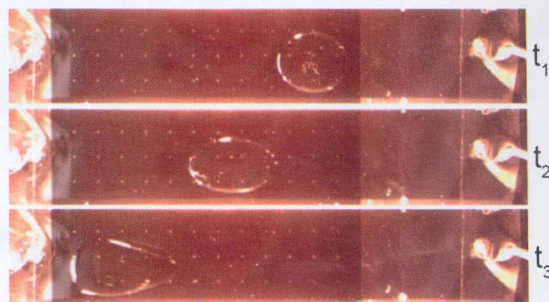
This critical review discusses the fundamentals and applications of various hybrid opto-electric manipulation techniques for microfluidics.



2149

Continuous electrowetting *via* electrochemical diodesChristopher W. Nelson, Corey M. Lynch
and Nathan B. Crane*

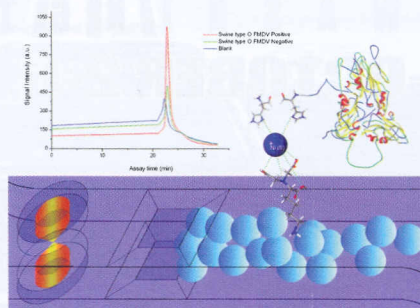
We present a novel droplet transport method combining diode-like conduction and electrowetting on dielectric to achieve unique droplet actuation performance.



2153

Rapid screening swine foot-and-mouth disease virus using micro-ELISA systemYiyang Dong,* Yan Xu, Zaixin Liu, Yuanfang Fu,
Toshinori Ohashi, Yo Tanaka, Kazuma Mawatari
and Takehiko Kitamori*

Microfluidic thermal lens microscopy was first utilized to screen swine foot-and-mouth disease virus (FMDV) with recombinant protein pre-coated polystyrene micro-beads.

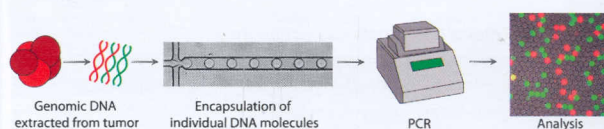


PAPERS

2156

Quantitative and sensitive detection of rare mutations using droplet-based microfluidicsDeniz Pekin, Yousr Skhiri, Jean-Christophe Baret,
Delphine Le Corre, Linas Mazutis, Chaouki Ben Salem,
Florian Millot, Abdeslam El Harrak, J. Brian Hutchison,
Jonathan W. Larson, Darren R. Link, Pierre Laurent-Puig,
Andrew D. Griffiths* and Valérie Taly*

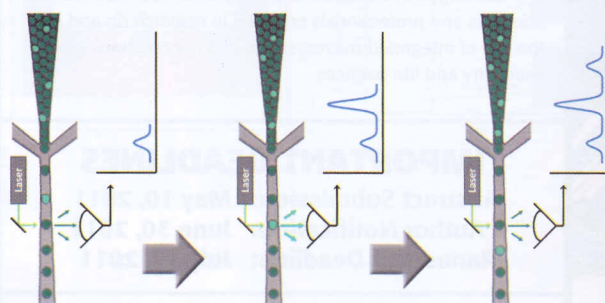
A droplet-based microfluidic method to perform digital PCR in millions of picolitre droplets allowing the highly sensitive detection of mutated DNA in a quantitative manner.



2167

Multiplex digital PCR: breaking the one target per color barrier of quantitative PCRQun Zhong, Smiti Bhattacharya, Steven Kotsopoulos,
Jeff Olson, Valérie Taly, Andrew D. Griffiths,
Darren R. Link and Jonathan W. Larson*

A general purpose and easy-to-use method for multiplexing quantitative digital PCR beyond the conventional limitations of color-encoded probes was demonstrated by simultaneously genotyping several common markers for spinal muscular atrophy.

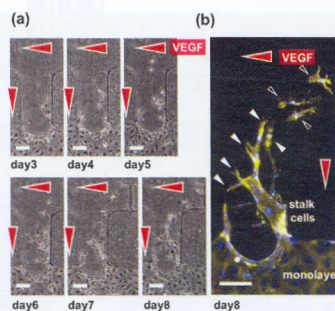


2175

In vitro 3D collective sprouting angiogenesis under orchestrated ANG-1 and VEGF gradients

Yoojin Shin, Jessie S. Jeon, Sewoon Han, Gi-Seok Jung, Sehyun Shin, Sang-Hoon Lee, Ryo Sudo, Roger D. Kamm and Seok Chung*

Here, we have developed a unique hydrogel incorporating microfluidic platform which mimics the physiological microenvironment in 3D under a precisely orchestrated gradient of soluble angiogenic factors, VEGF and ANG-1.



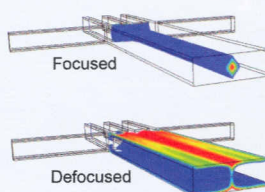
2182

Dynamic control of 3D chemical profiles with a single 2D microfluidic platform

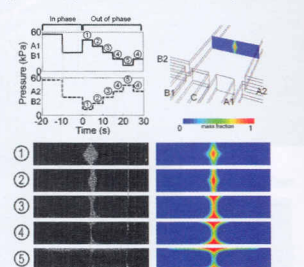
YongTae Kim, Sagar D. Joshi, Lance A. Davidson, Philip R. LeDuc* and William C. Messner*

We describe the ability to create rapidly and precisely tunable 3D profiles with a 2D single layer microfluidic platform.

Microvortex-induced 3D patterns in a single-layer microfluidics



Dynamic, precise control of 3D patterns

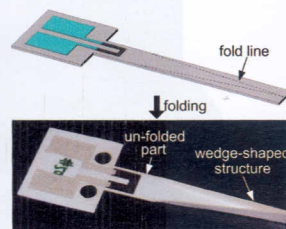
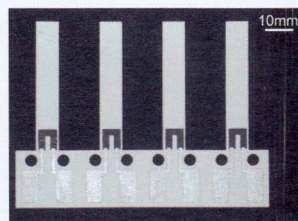


2189

Paper-based piezoresistive MEMS sensors

Xinyu Liu, Martin Mwangi, XiuJun Li, Michael O'Brien and George M. Whitesides*

This paper describes the development of piezoresistive MEMS sensors made from paper, with moderate sensing performance and very low cost.

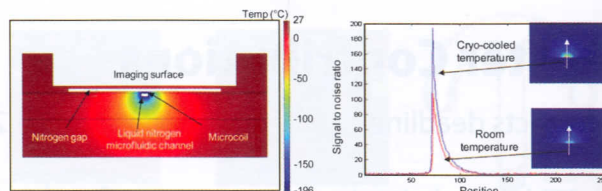


2197

A magnetic resonance (MR) microscopy system using a microfluidically cry-cooled planar coil

Chiwan Koo, Richard F. Godley, Jaewon Park, Mary P. McDougall, Steven M. Wright and Arum Han*

A microfluidically cry-cooled magnetic resonance (MR) planar coil to achieve high signal to noise ratio (SNR) for MR microscopy application is presented.

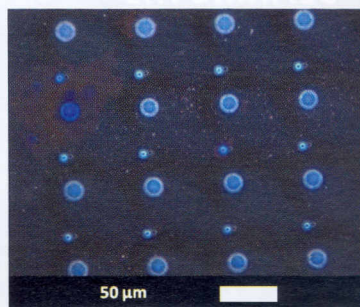


2204

Chip-based size-selective sorting of biological cells using high frequency acoustic excitation

Gunjan Agarwal* and Carol Livermore*

This study demonstrates high throughput cell sorting and the precise, selective placements of cells in trapping sites by means of high-frequency acoustic excitations.

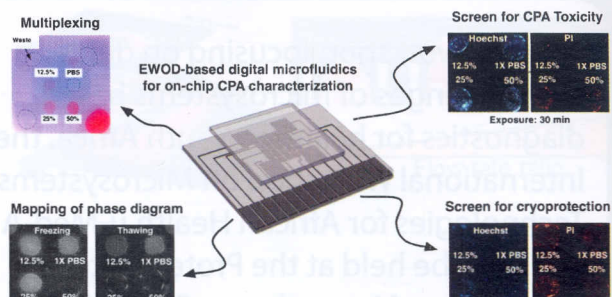


2212

On-chip characterization of cryoprotective agent mixtures using an EWOD-based digital microfluidic device

Sinwook Park, Pavithra A. L. Wijethunga, Hyejin Moon and Bumsoo Han*

We present an electro-wetting-on-dielectric microfluidic platform capable of on-chip screening and characterization of cryoprotective agent mixtures cell-type specifically.

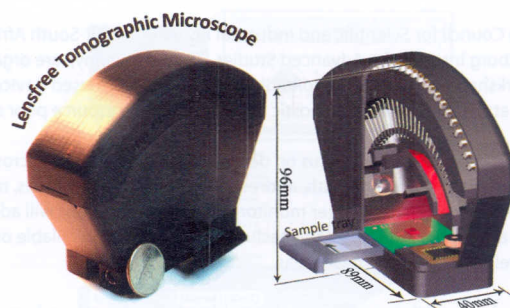


2222

Field-portable lensfree tomographic microscope

Serhan O. Isikman, Waheb Bishara, Uzair Sikora, Oguzhan Yaglidere, John Yeah and Aydogan Ozcan*

We present a field-portable and cost-effective lensfree tomographic microscope that weighs ~110 grams, and offers 3D imaging of a large volume (~20 mm³) on a chip with <7 μm axial resolution.

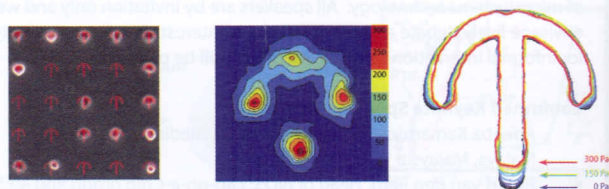


2231

A new micropatterning method of soft substrates reveals that different tumorigenic signals can promote or reduce cell contraction levels

Qingzong Tseng, Irene Wang, Eve Duchemin-Pelletier, Ammar Azioune, Nicolas Carpi, Jie Gao, Odile Filhol, Matthieu Piel, Manuel Théry* and Martial Balland*

We developed a new method to micropattern extracellular matrix proteins on poly-acrylamide gels in order to control simultaneously cell geometry and mechanics.

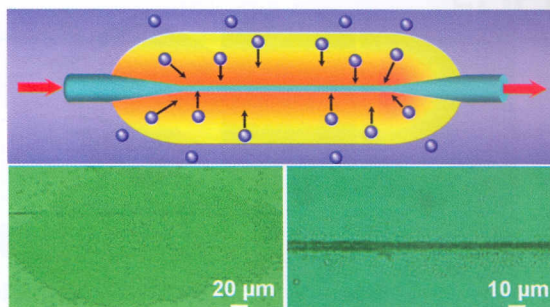


2241

Photophoretic assembly and migration of dielectric particles and *Escherichia coli* in liquids using a subwavelength diameter optical fiber

Hongxiang Lei, Yao Zhang, Xingmin Li and Baojun Li*

We demonstrate a photophoretic assembly and migration of dielectric (SiO_2 and TiO_2) particles and *Escherichia coli* in liquids by using a subwavelength diameter fiber.



2247

Development and characterization of a microfluidic chamber incorporating fluid ports with active suction for localized chemical stimulation of brain slices

Yujie Tanye Tang, Jichul Kim, Héctor E. López-Valdés, K. C. Brennan and Y. Sungtaek Ju*

We report a microfluidic chamber incorporating integrated fluid injection and suction ports to achieve localized chemical stimulation of brain slices.

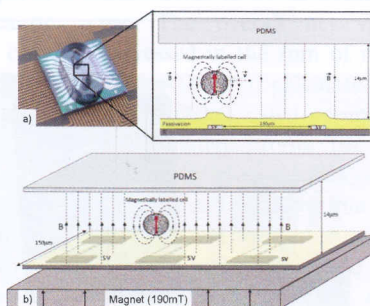


2255

Magnetoresistive chip cytometer

J. Loureiro,* P. Z. Andrade, S. Cardoso, C. L. da Silva, J. M. Cabral and P. P. Freitas

Although conventional state-of-the-art flow cytometry systems provide rapid and reliable analytical capacities, they are bulky, expensive and complex. To overcome these drawbacks, this work describes an integrated device comprising microfluidic channels and incorporated spin-valve sensors.

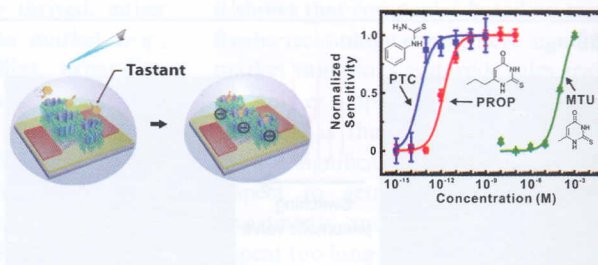


2262

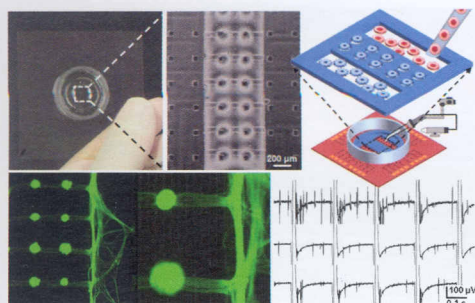
“Bioelectronic super-taster” device based on taste receptor-carbon nanotube hybrid structures

Tae Hyun Kim, Hyun Seok Song, Hye Jun Jin, Sang Hun Lee, Seon Namgung, Un-kyung Kim, Tai Hyun Park* and Seunghun Hong*

We developed a human taste receptor-based “bioelectronic super-taster” that shows high sensitivity and human-like selectivity.



2268

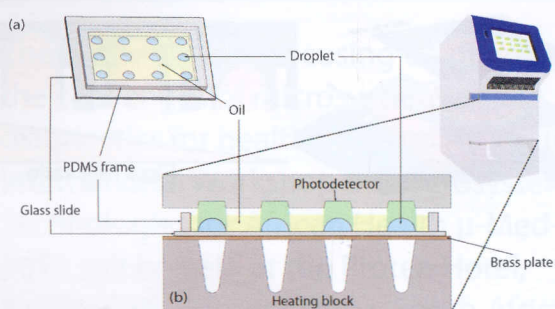


Device for co-culture of sympathetic neurons and cardiomyocytes using microfabrication

Akimasa Takeuchi,* Shingo Nakafutami, Hiromasa Tani, Masahide Mori, Yuzo Takayama, Hiroyuki Moriguchi, Kiyoshi Kotani, Keiko Miwa, Jong-kook Lee, Makoto Noshiro and Yasuhiko Jimbo

Multi-compartment cell-culture dish with an embedded microelectrode-array was developed. We demonstrate modification of beating rate of cultured cardiomyocytes induced by electrical stimulation to co-cultured sympathetic neurons.

2276



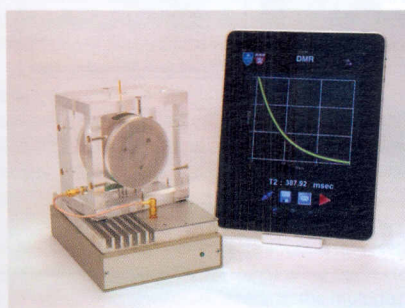
Real-time PCR of single bacterial cells on an array of adhering droplets

Xu Shi, Liang-I Lin, Szu-yu Chen, Shih-hui Chao,* Weiwen Zhang and Deirdre R. Meldrum

We developed an inexpensive chip-level device that is compatible with a commercial real-time PCR thermal cycler to perform quantitative PCR for single bacterial cells.

TECHNICAL NOTES

2282

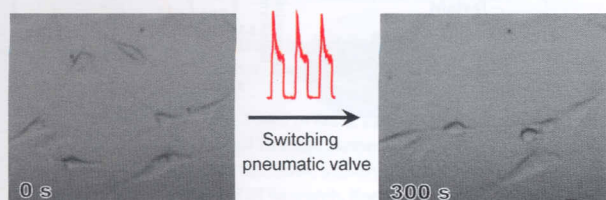


Miniature magnetic resonance system for point-of-care diagnostics

David Issadore, Changwook Min, Monty Liang, Jaehoon Chung, Ralph Weissleder and Hakho Lee*

A next generation diagnostic magnetic resonance (DMR) system is presented. The system automatically tunes its measurement parameters, enabling robust diagnostics at point-of-care settings

2288



Pumping-induced perturbation of flow in microfluidic channels and its implications for on-chip cell culture

Jianhua Zhou, Kangning Ren, Wen Dai, Yihua Zhao, Declan Ryan and Hongkai Wu*

We investigate perturbations of flows in PDMS microchannels under different pumping conditions and their possible implications for on-chip cell culture.