

Lab on a Chip

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

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See Park and Suh, pp. 23–24.
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See Cho *et al.*, pp. 70–78.
Image reproduced by permission of Yoon-Kyoung Cho from *Lab Chip*, 2011, **11**, 70.

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Ten Years Strong

Harp Minhas, Editor, reflects on the past year for *Lab on a Chip* and looks forward to the next.



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LOC Out of the Box: Design, engineering and utility of biotic games

Stephen Quake

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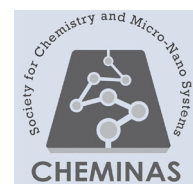
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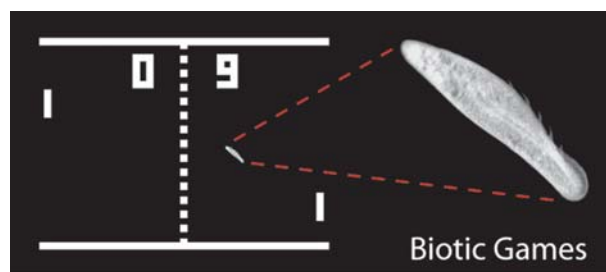
PAPER

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Design, engineering and utility of biotic games

Ingmar H. Riedel-Kruse,* Alice M. Chung, Burak Dura, Andrea L. Hamilton and Byung C. Lee

'Biotic games' operate on biological processes, exhibit unique features such as biological noise and the ability to integrate chemical senses into play, and could help solve educational and scientific challenges.



THEMED ISSUE: 10TH ANNIVERSARY: FOCUS ON KOREA

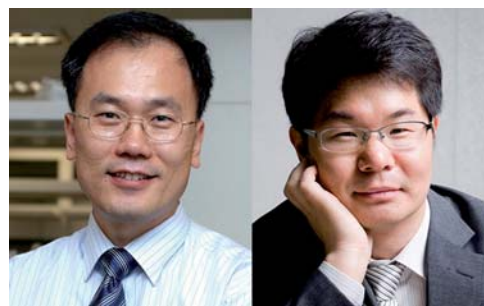
EDITORIAL

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10th Anniversary Issue: Korea

Je-Kyun Park and Kahp-Yang Suh

Shooting for another success like the microelectronics industry—Guest Editors Je-Kyun Park and Kahp-Yang Suh highlight the contribution of Korean research to micro and nanofluidics.



PROFILE

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Contributors to the Korean issue

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



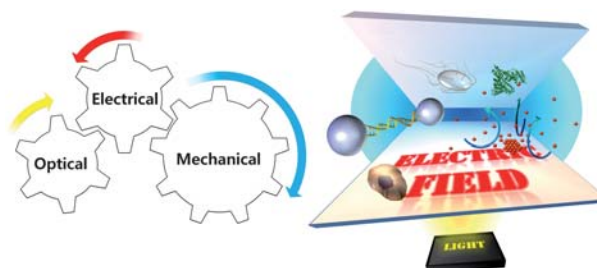
CRITICAL REVIEW

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Optoelectrofluidic platforms for chemistry and biology

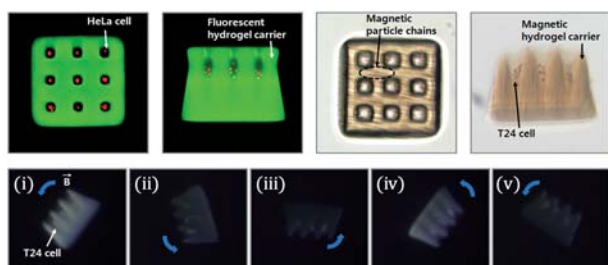
Hyundoo Hwang and Je-Kyun Park*

In this review, we describe recent developments and future perspectives of optoelectrofluidic platforms for chemical and biological applications.



COMMUNICATION

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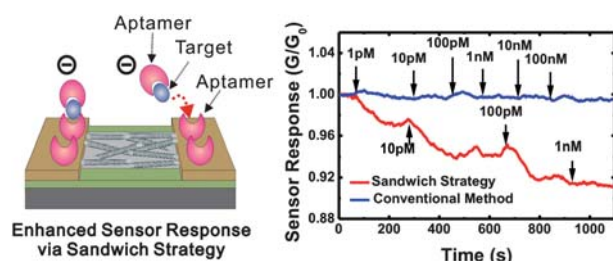
Single exposure fabrication and manipulation of 3D hydrogel cell microcarriers

Lily Nari Kim, Sung-Eun Choi, Junhoi Kim, Hyoki Kim and Sunghoon Kwon*

We present a simple and high-throughput method for fabricating free-floating hydrogel cell microcarriers using single exposure UV patterning. We also demonstrate magnetic manipulation of the cell microcarriers using a magnetic nanoparticle-embedded structure for an active agitation and a solution exchange.

PAPERS

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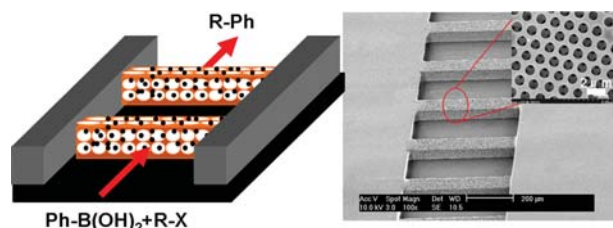


Aptamer sandwich-based carbon nanotube sensors for single-carbon-atomic-resolution detection of *non-polar* small molecular species

Joohyung Lee, Minjoung Jo, Tae Hyun Kim, Ji-Young Ahn, Dong-ki Lee, Soyoun Kim* and Seunghun Hong*

Herein, we describe the *aptamer sandwich-based* carbon nanotube sensors for the highly selective and sensitive detection of small pollutant molecules including *non-polar* species.

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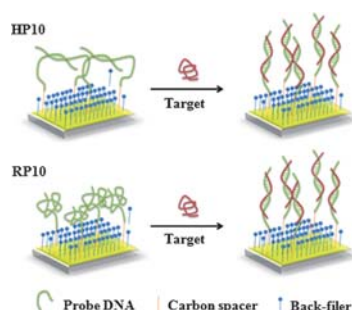


Practical approach for macroporous structure embedded microfluidic system and the catalytic microchemical application

ZuoYi Xiao, Yun Zhao, Anjie Wang, Jayakumar Perumal and Dong-Pyo Kim*

A 3D ordered macroporous pattern embedded microchannel, fabricated by conventional microtransfer molding and photolithography techniques, was used as a catalytic microreactor.

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Analysis of DNA hybridization regarding the conformation of molecular layer with piezoelectric microcantilevers

Shun Zheng, Jun Hwan Choi, Sang Myung Lee, Kyo Seon Hwang, Sang Kyung Kim* and Tae Song Kim*

We report how secondary structures in oligonucleotide monolayer change the surface property of a dynamic mode microcantilever and subsequently affect its oscillating behavior. Using fabricated microcantilevers, real time changes in resonant frequency upon hybridization were measured by utilizing different probe and target sets.

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Fully integrated lab-on-a-disc for simultaneous analysis of biochemistry and immunoassay from whole blood

Beom Seok Lee, Yang Ui Lee, Han-Sang Kim, Tae-Hyeong Kim, Jiwoon Park, Jeong-Gun Lee, Jintae Kim, Hanshin Kim, Wee Gyo Lee and Yoon-Kyoung Cho*

We report a fully integrated lab-on-a-disc system for simultaneous analysis of clinical chemistry and enzyme-linked immuno-sorbent assay (ELISA) from whole blood.

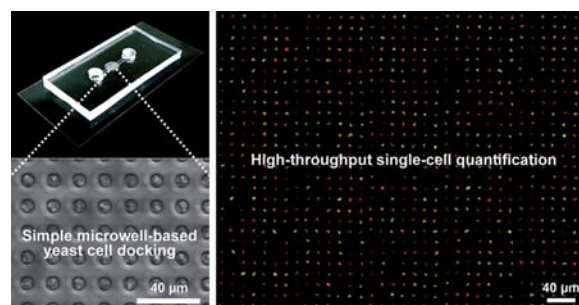


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High-throughput single-cell quantification using simple microwell-based cell docking and programmable time-course live-cell imaging

Min Cheol Park, Jae Young Hur, Hye Sung Cho, Sang-Hyun Park* and Kahp Y. Suh*

We present a simple yet robust microwell-based fluidic platform for capturing individual yeast cells at a density of ~ 3900 cells per mm^2 and measuring time-course single-cell response on a large scale.

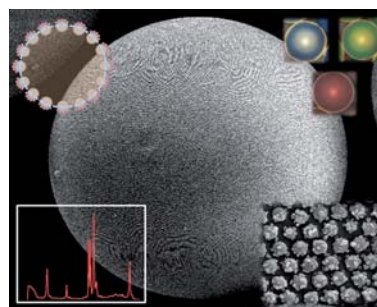


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Microfluidic fabrication of SERS-active microspheres for molecular detection

Hyerim Hwang, Shin-Hyun Kim and Seung-Man Yang*

SERS-active microspheres showing high sensitivity and fast binding kinetics have been prepared by combination of colloidal self-assembly and selective metal deposition.

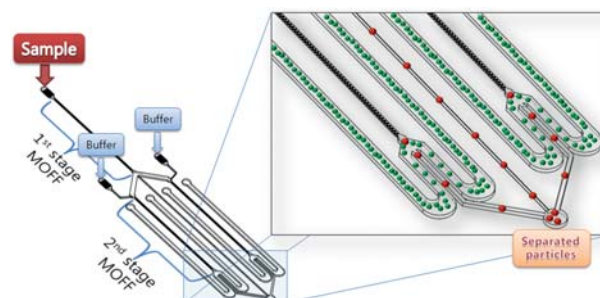


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Multistage-multiorifice flow fractionation (MS-MOFF): continuous size-based separation of microspheres using multiple series of contraction/expansion microchannels

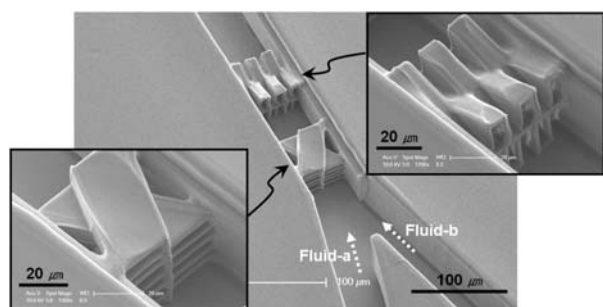
Tae Seok Sim, Kiho Kwon, Jae Chan Park, Jeong-Gun Lee* and Hyo-Il Jung*

We introduce a novel hydrodynamic particle separation method using a Multistage-Multiorifice Flow Fractionation to overcome the technical limit derived from the reciprocal relationship between recovery and purity of a single MOFF.



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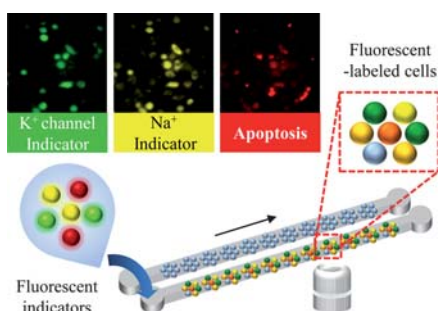


Three-dimensionally crossing manifold micro-mixer for fast mixing in a short channel length

Tae Woo Lim, Yong Son, Yu Jin Jeong, Dong-Yol Yang,*
Hong-Jin Kong, Kwang-Sup Lee and Dong-Pyo Kim

We report a neo-conceptive three-dimensionally (3D) crossing manifold micromixer (CMM) embedded in a microchannel fabricated by sequential processes of photolithography and two photon absorption stereolithography; this leads to a microfluidic system with a built-in micromixer in a site controlled manner.

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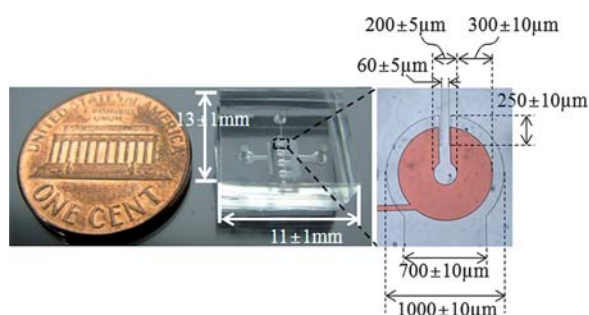
High-content screening of drug-induced cardiotoxicity using quantitative single cell imaging cytometry on microfluidic device

Min Jung Kim, Su Chul Lee, Sukdeb Pal, Eunyoung Han
and Joon Myong Song*

New paradigm of high content screening for drug-induced cardiotoxicity was demonstrated using multicolor single cell imaging cytometry.

TECHNICAL NOTES

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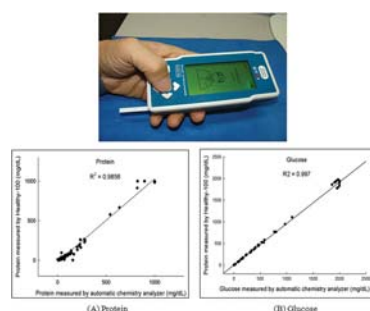


A multicellular spheroid formation and extraction chip using removable cell trapping barriers

Hye-Jin Jin, Young-Ho Cho,* Jin-Mo Gu, Jhngook Kim
and Yong-Soo Oh

The present spheroid chip offers a simple and effective method to obtain uniform and small-sized 3D spheroids for cell-based biomedical research.

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A simple and smart telemedicine device for developing regions: a pocket-sized colorimetric reader

Dae-Sik Lee,* Byoung Goo Jeon, Chunhwa Ihm,
Je-Kyun Park and Mun Yeon Jung

Here, we describe a pocket-sized colorimetric urinalysis reader with clinical assessments as a simple and smart telemedicine device for developing regions.

REGULAR RESEARCH ARTICLES

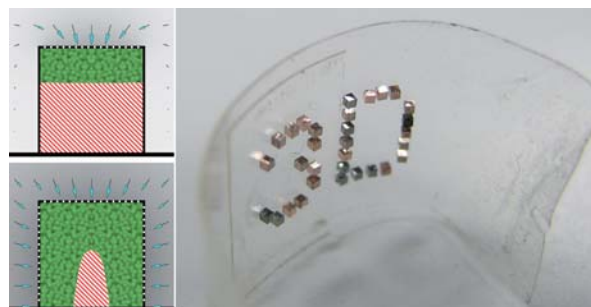
COMMUNICATION

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Three-dimensional microwell arrays for cell culture

Christina L. Randall, Yevgeniy V. Kalinin, Mustapha Jamal, Tanmay Manohar and David H. Gracias*

We propose the concept of 3D microwell arrays and describe their utility for cell culture applications.



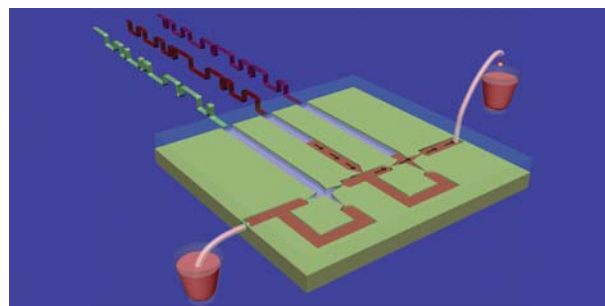
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A micro surface tension pump (MISPU) in a glass microchip

Xing Yue (Larry) Peng*

A non-membrane micro surface tension pump was fabricated on a glass microchip (without any additional materials) by one-step glass etching. The digital gas pressure controls the input valve, the output valve and a piston for pumping. Without any moving parts, this durable one-layer reversible micro pump maintained its efficiency (10 nl s^{-1} and 1 kPa) of pumping water over a 20 day test.

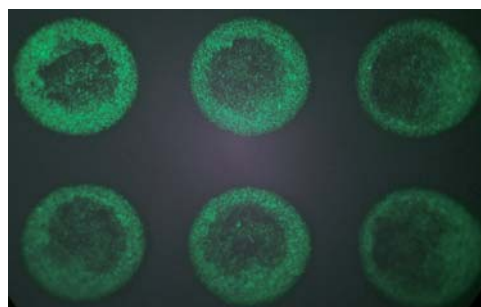


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A printed nanolitre-scale bacterial sensor array

Sahar Melamed, Laura Ceriotti, Wilfried Weigel, François Rossi, Pascal Colpo and Shimshon Belkin*

A nanolitre scale array of genetically engineered sensor bacteria, “tailored” to emit a dose dependent optical signal in the presence of target compounds, has been deposited on a modified glass surface, retaining their biosensing capabilities over prolonged periods.

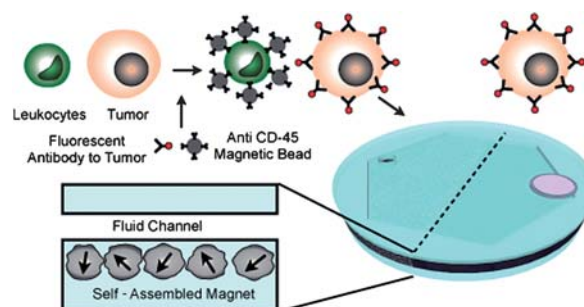


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Self-assembled magnetic filter for highly efficient immunomagnetic separation

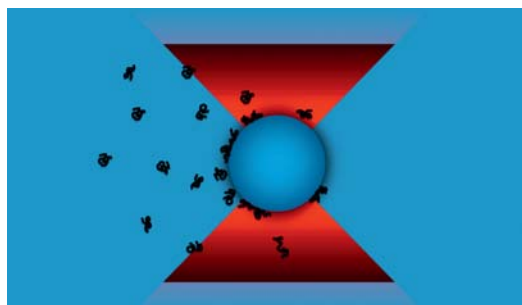
David Issadore, Huilin Shao, Jaehoon Chung, Andita Newton, Mikael Pittet, Ralph Weissleder and Hakho Lee*

We present a self-assembled magnetic filter: an inexpensive, compact microfluidic chip to efficiently remove magnetically tagged cells from suspension.



PAPERS

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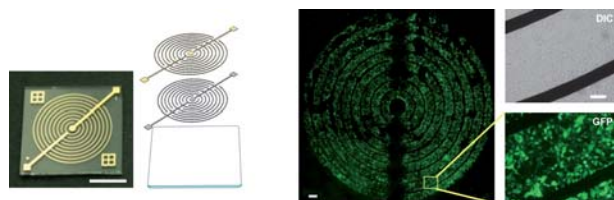


Polymer adsorption onto a micro-sphere from optical tweezers electrophoresis

Jan A. van Heiningen and Reghan J. Hill*

Optical tweezers electrophoresis, which is extraordinarily sensitive to polymer layer thickness in a micro-fluidic flow environment, demonstrates that polymer adsorption dynamics, and the 'equilibrium' layer, depend on polymer concentration, flow rate, and flow configuration; a symmetric flow configuration can significantly reduce deleterious electro-osmotic flow influences.

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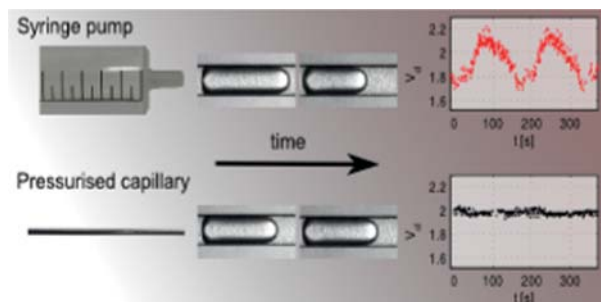
An efficient and high-throughput electroporation microchip applicable for siRNA delivery

Huang Huang, Zewen Wei, Yuanyu Huang, Deyao Zhao, Lianghong Zheng, Tianjing Cai, Mengxi Wu, Wei Wang, Xianfeng Ding, Zhuan Zhou, Quan Du,* Zhihong Li* and Zicai Liang*

Efficient *in situ* cell transfection using electroporation microchip fabricated by standard MEMS technology.

TECHNICAL NOTE

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Effects of unsteadiness of the rates of flow on the dynamics of formation of droplets in microfluidic systems

Piotr M. Korczyk, Olgierd Cybulski, Sylwia Makulska and Piotr Garstecki*

Oscillations of the input rates of flow have a significant impact on the dynamics of formation of droplets in microfluidic systems and on the quality of generated emulsions.