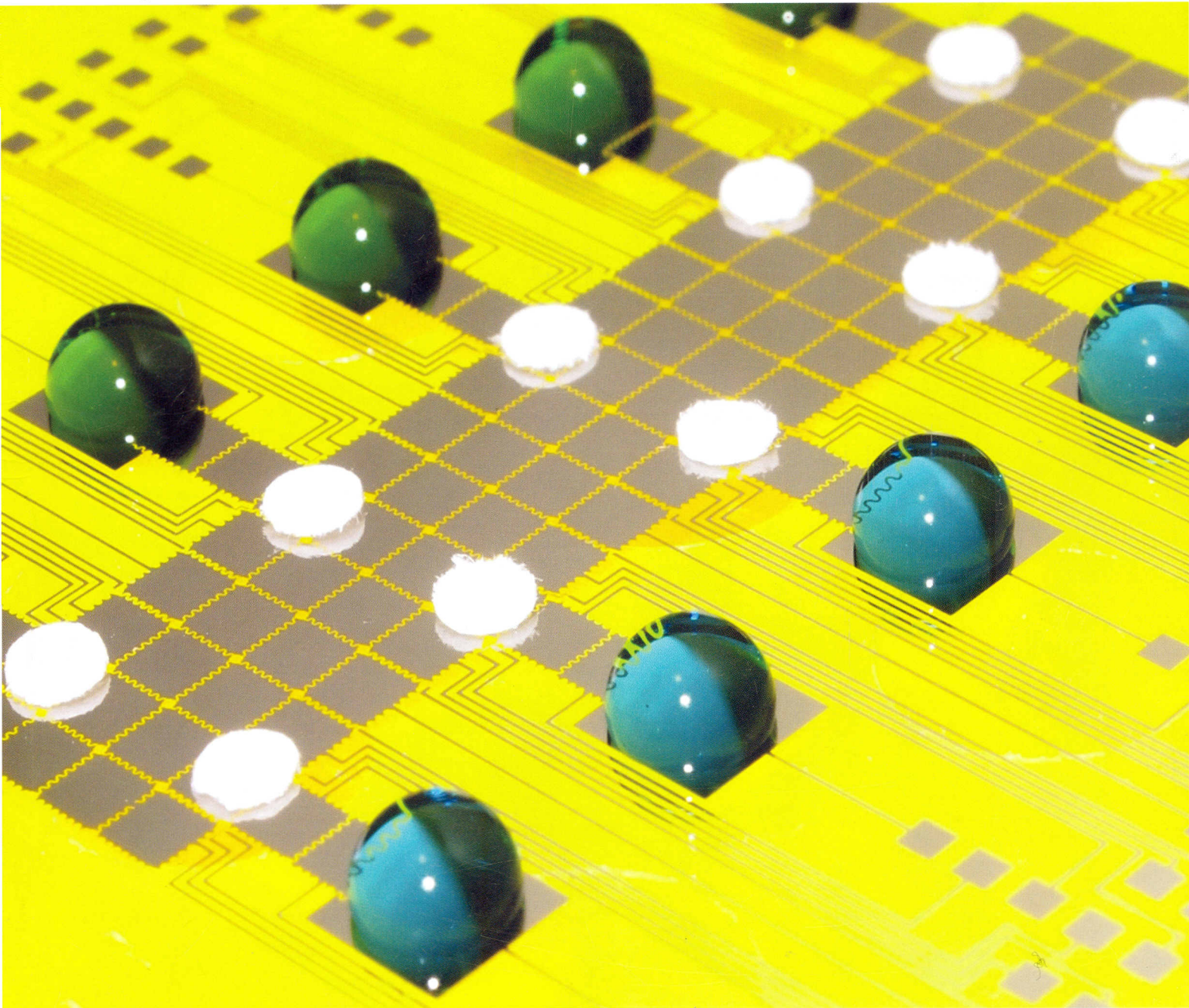


# Lab on a Chip

Miniaturisation for chemistry, physics, biology and bioengineering

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**PAPER**

Aaron R. Wheeler *et al.*

A digital microfluidic method for dried blood spot analysis



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# Lab on a Chip

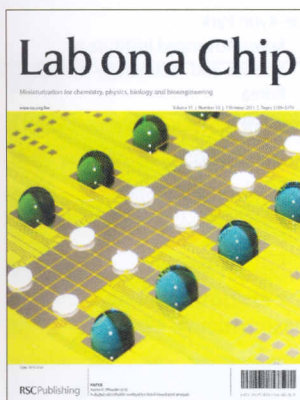
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## IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 11(19) 3199–3370 (2011)



### Cover

See Aaron R. Wheeler *et al.*, pp. 3218–3224.

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## HIGHLIGHT

3211

### Research highlights

Šeila Selimović and Ali Khademhosseini\*

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



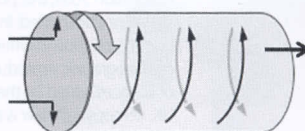
## COMMUNICATION

3214

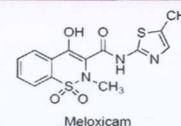
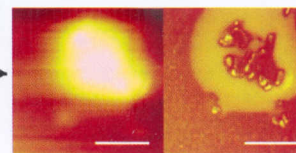
### Nanosized drug formulations under microfluidic continuous flow

Selvi Dev, K. Swaminathan Iyer\* and Colin L. Raston\*

We present a simple method involving a rotating tube processor to fabricate ultrafine crystalline drug nanoparticles under microfluidic continuous flow.



Rotating tube microfluidic continuous flow fabrication of ultrafine encapsulated drug nanoparticles

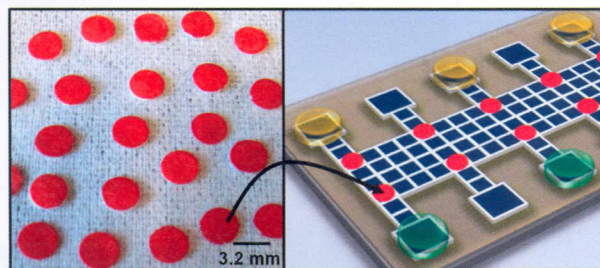


3218

**A digital microfluidic method for dried blood spot analysis**

Mais J. Jebrail, Hao Yang, Jared M. Mudrik,  
Nelson M. Lafrenière, Christine McRoberts,  
Osama Y. Al-Dirbashi, Lawrence Fisher,  
Pranesh Chakraborty and Aaron R. Wheeler\*

A method for the quantitative analysis of dried blood spots powered by digital microfluidics.

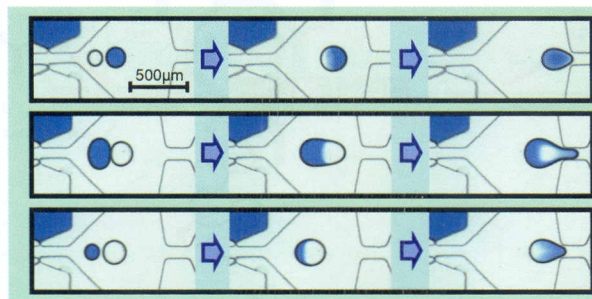


3225

**Coalescence-assisted generation of single nanoliter droplets with predefined composition**

Jonathan Shemesh, Avital Nir, Avishay Bransky  
and Shulamit Levenberg\*

We demonstrate the reproducible generation of nanoliter-volume droplets with precise chemical composition, by merging two synchronized, actively generated droplets.

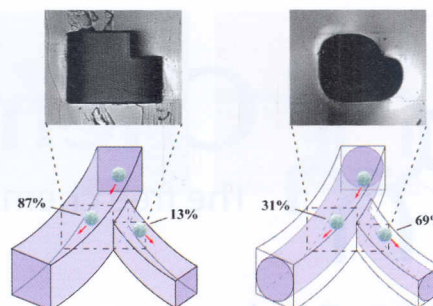


3231

**Traffic of leukocytes in microfluidic channels with rectangular and rounded cross-sections**

Xiaoxi Yang, Omid Forouzan, Jennie M. Burns  
and Sergey S. Shevkoplyas\*

This paper describes the effect of cross-sectional geometry on traffic of leukocytes through a non-symmetrical bifurcation comprising rectangular and rounded microchannels.

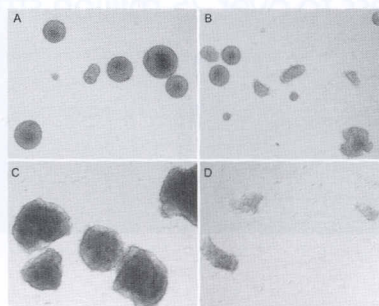


3241

**Biogrid—a microfluidic device for large-scale enzyme-free dissociation of stem cell aggregates**

Lars Wallman, Elisabet Åkesson, Dario Ceric,  
Per Henrik Andersson, Kelly Day, Outi Hovatta, Scott Faldi,  
Thomas Laurell and Erik Sundström\*

As proof-of-concept, we demonstrate that the Biogrid device can be successfully used for repeated passage of human neural stem/progenitor cells cultured as so-called neurospheres, as well as for passage of suspension cultures of human embryonic stem cells.



3249

### Flexible microfluidic devices with three-dimensional interconnected microporous walls for gas and liquid applications

Po Ki Yuen\* and Michael E. DeRosa

We present a method of fabrication and the application of flexible microfluidic devices with three-dimensional (3D) interconnected microporous walls based on treatment using a solvent/non-solvent mixture at room temperature.

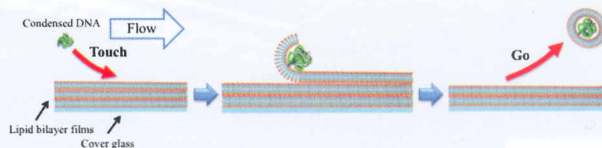


3256

### A touch-and-go lipid wrapping technique in microfluidic channels for rapid fabrication of multifunctional envelope-type gene delivery nanodevices

Katsuma Kitazoe, Jun Wang, Noritada Kaji,\*  
Yukihiro Okamoto, Manabu Tokeshi, Kentaro Kogure,  
Hideyoshi Harashima and Yoshinobu Baba

A novel touch-and-go lipid wrapping technique was demonstrated for production of lipid bilayer-encapsulated DNA complexes with a narrow size distribution.

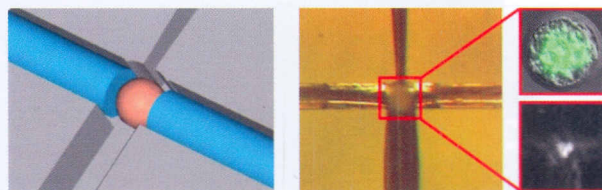


3263

### Supravital fluorometric apoptosis detection in a single mouse embryo using lab-on-a-chip

Rafał Walczak,\* Patrycja Śniadek, Jan A. Dziuban,  
Joanna Kluger and Anna Chelmońska Soyta

A lab-on-a-chip, co-working with miniaturized optical instrumentation, allowing supravital examination of single embryos for the presence of apoptotic blastomers with full after lab-on-a-chip "recovery" and maintenance of their further developmental capacity is presented.

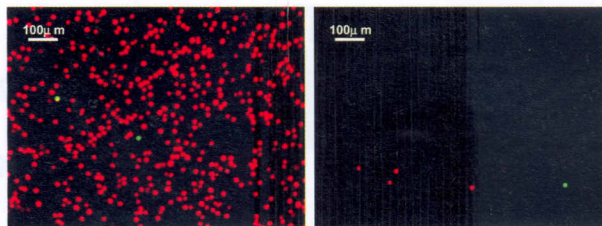


3269

### A high-performance microsystem for isolating circulating tumor cells

Xiangjun Zheng, Luthur Siu-Lun Cheung,  
Joyce A. Schroeder, Linan Jiang and Yitshak Zohar\*

Utilizing two-step attachment/detachment flow rates, target cells are isolated from binary mixtures with high sensitivity and specificity in antibody-functionalized microchannels.

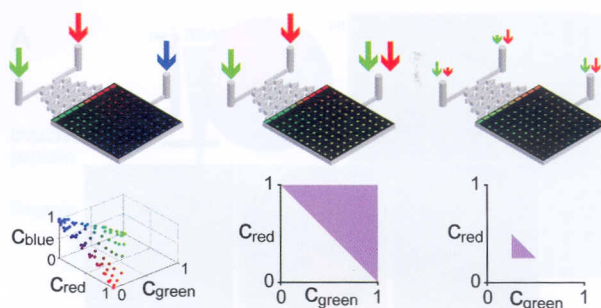


3277

### An integrated microfluidic device for two-dimensional combinatorial dilution

Yun-Ho Jang, Matthew J. Hancock, Sang Bok Kim, Šeila Selimović, Woo Young Sim, Hojae Bae and Ali Khademhosseini\*

A microfluidic system forms combinations of input solutions in a well array to produce well concentrations spanning an arbitrary triangle in 2D concentration space.

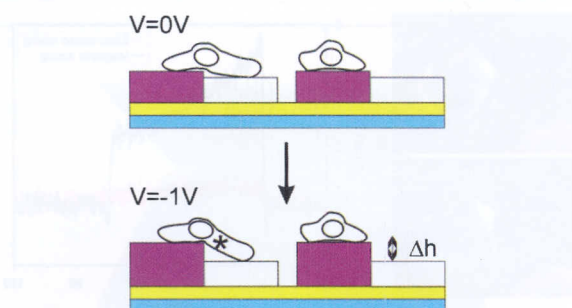


3287

### Mechanical stimulation of epithelial cells using polypyrrole microactuators

Karl Svennersten, Magnus Berggren, Agneta Richter-Dahlfors and Edwin W. H. Jager\*

A microfabricated chip comprising polypyrrole microactuators provides basal mechanical stimulation to individual renal epithelial cells, which response is monitored as an increase in intracellular  $\text{Ca}^{2+}$ .

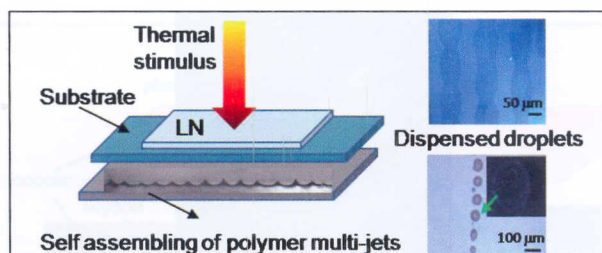


3294

### Self-assembling of multi-jets by pyro-electrohydrodynamic effect for high throughput liquid nanodrops transfer

Sara Coppola, Veronica Vespini, Simonetta Grilli and Pietro Ferraro\*

A nozzle-less multichannels inkjet system for high-throughput nanodroplets transfer has been developed through the electrohydrodynamics (EHD) excitation of surface capillary waves in liquid viscous films. Printing of polymer with dispersed carbon nanotubes (CNTs) is demonstrated.

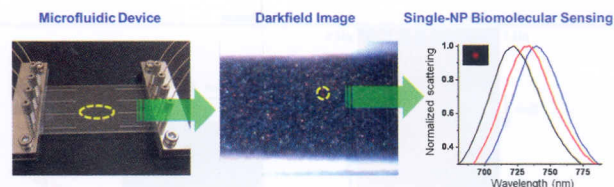


3299

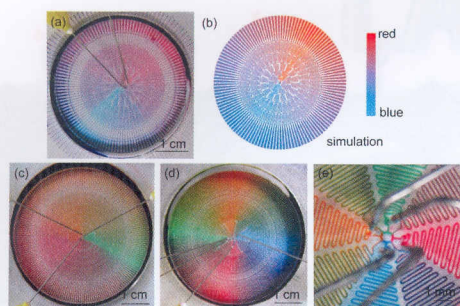
### In situ assembly, regeneration and plasmonic immunosensing of a Au nanorod monolayer in a closed-surface flow channel

Longhua Guo, Youju Huang, Yoshikuni Kikutani, Yo Tanaka, Takehiko Kitamori and Dong-Hwan Kim\*

This work demonstrates a simple and efficient approach for the *in situ* assembly, regeneration and label-free biomolecular sensing of a AuNR monolayer on the inner-wall of a glass/silica-based, closed-surface flow channel.



3305

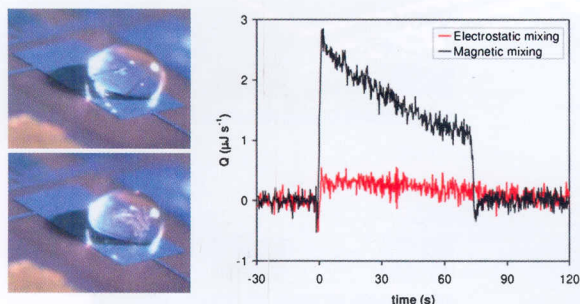


### A radial microfluidic concentration gradient generator with high-density channels for cell apoptosis assay

Chun-Guang Yang, Ying-Fan Wu, Zhang-Run Xu\* and Jian-Hua Wang\*

An integrated concentration gradient generator with stepwise linear concentrations in high-density channels is developed and applied for high-throughput apoptosis analysis.

3313

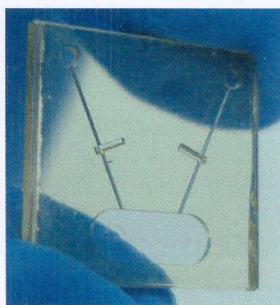


### Rapid mixing of sub-microlitre drops by magnetic micro-stirring

Dirk De Bruyker,\* Michael I. Recht, Ali Asgar S. Bhagat, Francisco E. Torres, Alan G. Bell and Richard H. Bruce

We demonstrate rapid mixing of sub-microlitre droplets (250 nl) using miniaturized magnetic stir bars. Drop mixing times are measured by FRET.

3320

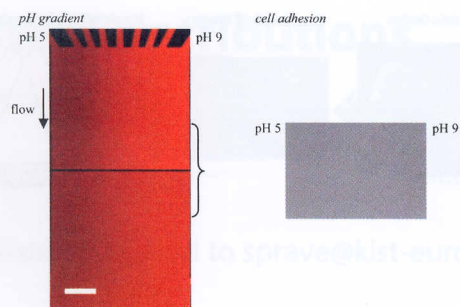


### SU8 diaphragm micropump with monolithically integrated cantilever check valves

Aitor Ezkerra,\* Luis José Fernández, Kepa Mayora and Jesús Miguel Ruano-López

Novel SU8 micropump with out-of-plane cantilever check-valves and wafer-level bonded PDMS membrane, readily integratable inside a microfluidic network.

3326



### Polyelectrolyte multilayers generated in a microfluidic device with pH gradients direct adhesion and movement of cells

K. Kirchhof, A. Andar, H. B. Yin, N. Gadegaard, M. O. Riehle and T. Groth\*

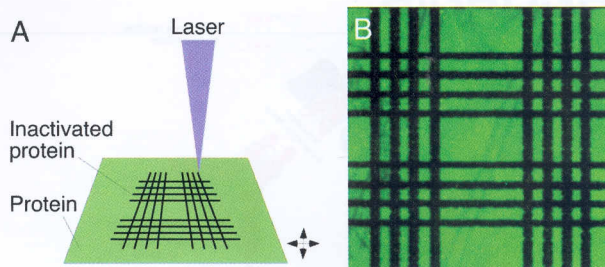
A microfluidic device is used to establish pH gradients during polyelectrolyte multilayer formation across the microfluidic channel, which is visualized by confocal laser scanning microscopy in the left image. Resulting multilayers lead to increasing adhesion and active movement of MG-63 osteoblasts from pH 5 to pH 9 regions (right image).

3336

### Laser inactivation protein patterning of cell culture microenvironments

William F. Heinz, Maria Hoh and Jan H. Hoh\*

We present a new approach for protein micropatterning in which a focused laser is used to locally inactivate proteins on a protein coated substrate.



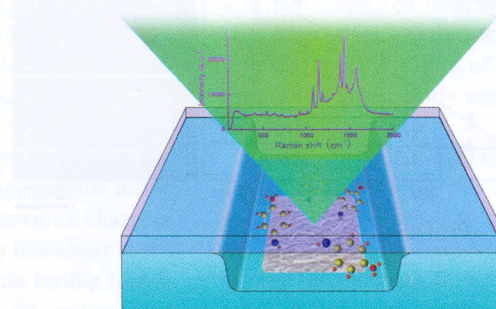
### TECHNICAL NOTES

3347

### Localized flexible integration of high-efficiency surface enhanced Raman scattering (SERS) monitors into microfluidic channels

Bin-Bin Xu, Zhuo-Chen Ma, Lei Wang, Ran Zhang, Li-Gang Niu, Zhe Yang, Yong-Lai Zhang, Wan-Hua Zheng, Bing Zhao, Ying Xu, Qi-Dai Chen, Hong Xia\* and Hong-Bo Sun\*

A facile approach for flexible integration of high efficiency surface enhanced Raman scattering (SERS) monitors in a continuous microfluidic channel.

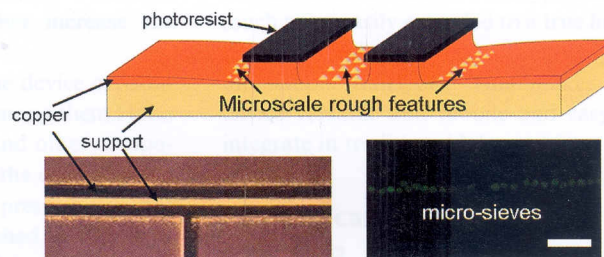


3352

### Integrated sieving microstructures on microchannels for biological cell trapping and droplet formation

Wanqing Yue, Cheuk-Wing Li, Tao Xu and Mengsu Yang\*

A single step photolithographic process was developed to generate sieving microstructures for size-dependent trapping of cells and droplets formation.

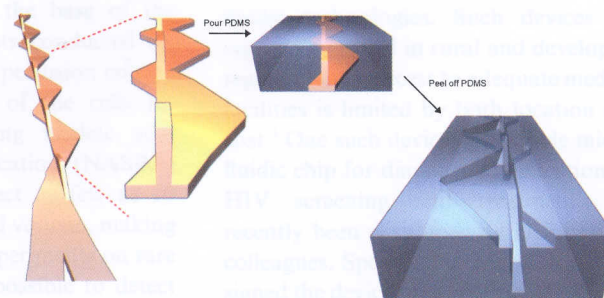


3356

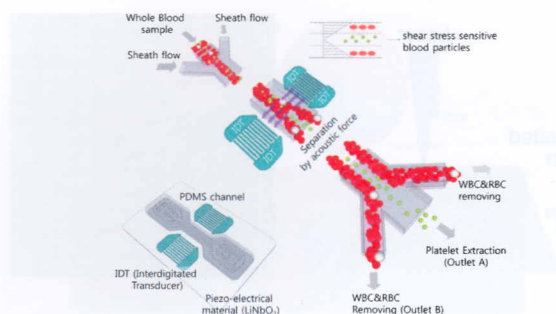
### Microfluidic baker's transformation device for three-dimensional rapid mixing

Takao Yasui,\* Yusuke Omoto, Keiko Osato, Noritada Kaji, Norikazu Suzuki, Toyohiro Naito, Masaki Watanabe, Yukihiro Okamoto, Manabu Tokeshi, Eiji Shamoto and Yoshinobu Baba

A new passive-type micromixer, termed a microfluidic baker's transformation device, was developed by using precision diamond cutting and PDMS replication.



3361

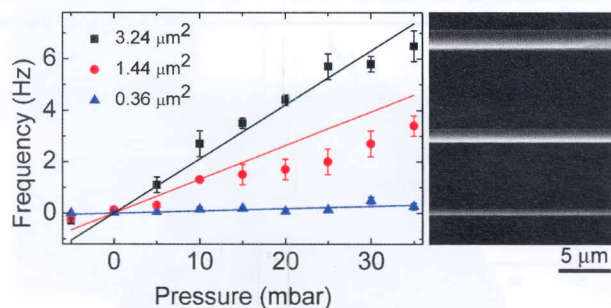


### Separation of platelets from whole blood using standing surface acoustic waves in a microchannel

Jeonghun Nam, Hyunjung Lim, Dookon Kim and Sehyun Shin\*

We propose a method to separate platelets from undiluted whole blood using standing surface acoustic waves (SSAWs) in a microfluidic device.

3365



### Parallel sub-micrometre channels with different dimensions for laser scattering detection

Stefano Pagliara, Catalin Chimerele, Richard Langford, Dirk G. A. L. Aarts and Ulrich F. Keyser\*

Parallel sub-micrometre channels with variable height obtained by replicating Pt wires are exploited for the laser detection of pressure-driven translocating colloids.