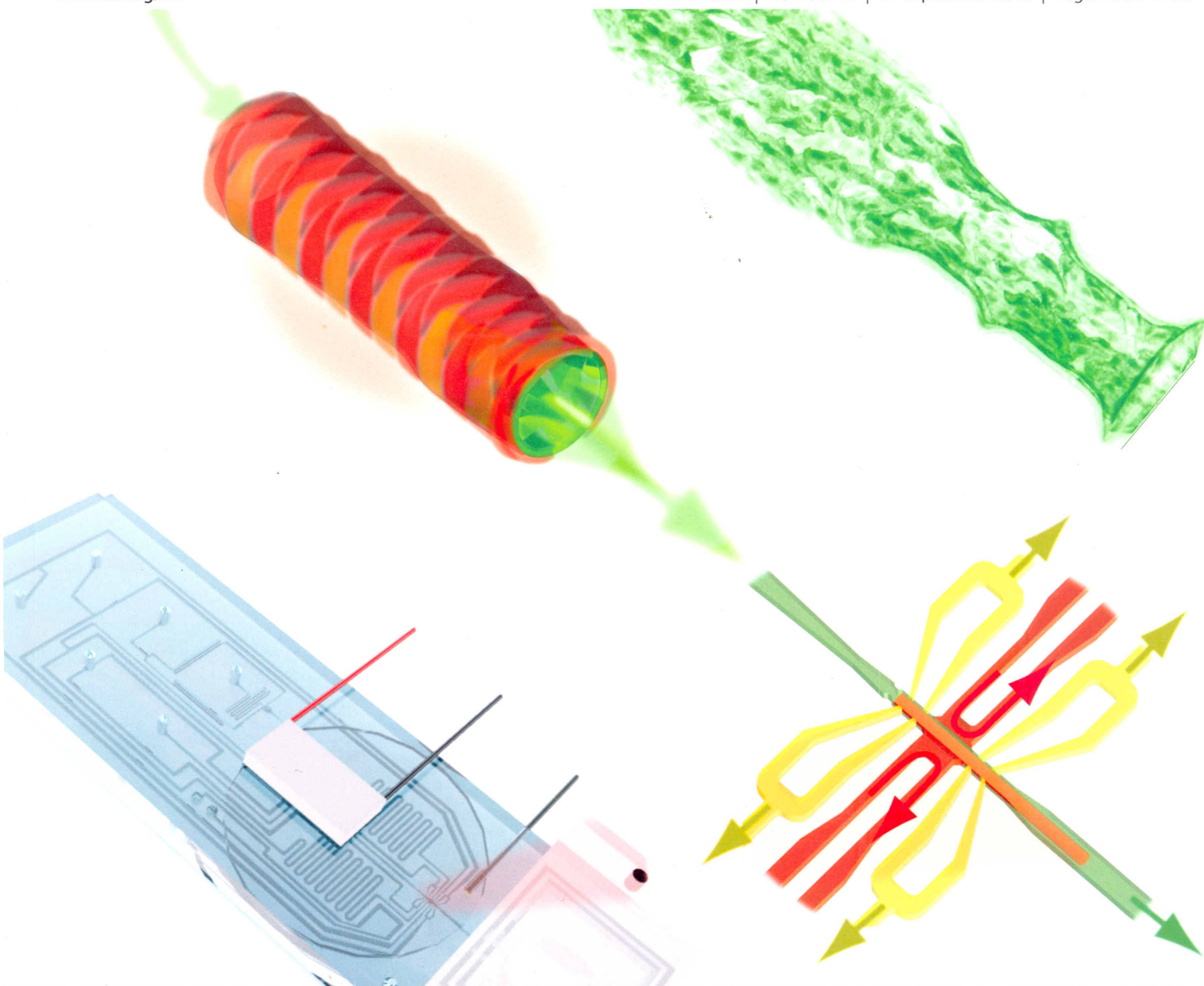


Lab on a Chip

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

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2010 Emerging Investigators Themed Issue

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Günther *et al.*
Probing small arteries

Love *et al.*
Gene expression detection



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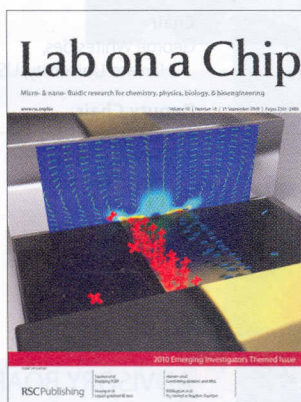
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ISSN 1473-0197 CODEN LCAHAM 10(18) 2301–2480 (2010)



Cover

See Günther *et al.*, pp. 2341–2349. The first scalable platform to probe the function of intact small blood vessels *in vitro* in response to controlled changes in the chemical microenvironment (red and green fluid streams). Image reproduced by permission of Axel Günther from *Lab Chip*, 2010, **10**, 2341.



Inside cover

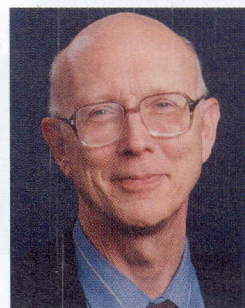
See Squires *et al.*, pp. 2350–2357. A planar metallic strip in a microchannel provides an ideal system to investigate induced-charge electrokinetic flows under various experimental conditions. Image reproduced by permission of Todd M. Squires from *Lab Chip*, 2010, **10**, 2350.

EDITORIAL

2317

Solving problems

George Whitesides considers the lack of commercial development of lab-on-a-chip and microfluidic technologies.



HIGHLIGHT

2319

Research Highlights

Petra S. Dittrich*

Petra Dittrich reviews the current literature in miniaturisation and related technologies.

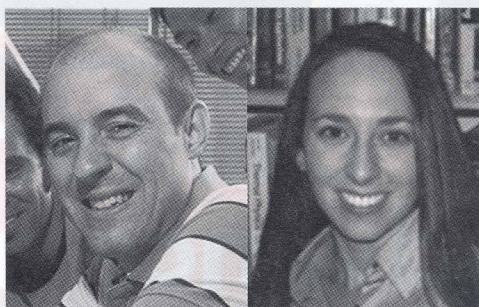


2321

Intimidating yet Inspiring: Emerging Investigators special issue

Aaron Wheeler and Amy Herr

Aaron Wheeler and Amy Herr introduce the 2010 Emerging Investigators issue of *Lab on a Chip*.



PROFILE

2323

Contributors to the Emerging Investigators issue

Lab on a Chip profiles the contributors to the Emerging Investigators issue.



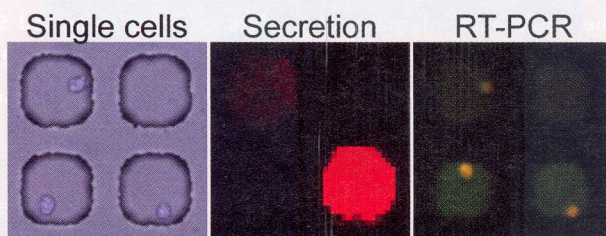
COMMUNICATIONS

2334

Massively parallel detection of gene expression in single cells using subnanolitre wells

Yuan Gong, Adebola O. Ogguniyi and J. Christopher Love*

A microwell-based method allows massively parallel detection of mRNA transcripts directly from individual cells by one-step, single-cell, reverse transcription polymerase chain reaction, and combined with microengraving and image-based cytometry, elucidates the relationship between gene expression and cellular secretion of antibodies in a clonal population.

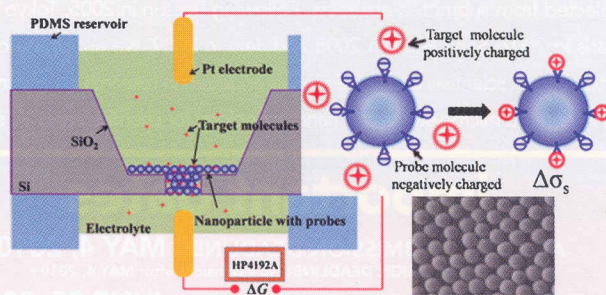


2338

Suspended nanoparticle crystal (S-NPC): A nanofluidics-based, electrical read-out biosensor

Yinhua Lei, Fei Xie, Wei Wang,* Wengang Wu and Zhihong Li

We report a novel approach utilizing a suspended nanoparticle crystal (S-NPC) as an electrical read-out biosensor based on a nanofluidic electrokinetics principle.



2341

A microfluidic platform for probing small artery structure and function

Axel Günther,* Sanjesh Yasotharan, Andrei Vagaon, Conrad Lochovsky, Sascha Pinto, Jingli Yang, Calvin Lau, Julia Voigtlaender-Bolz and Steffen-Sebastian Bolz

We present a microfluidic approach to probe the structure and function of small blood vessels *in vitro*. The platform allows addressing fundamental biological questions and may enable organ-based screens during drug development.

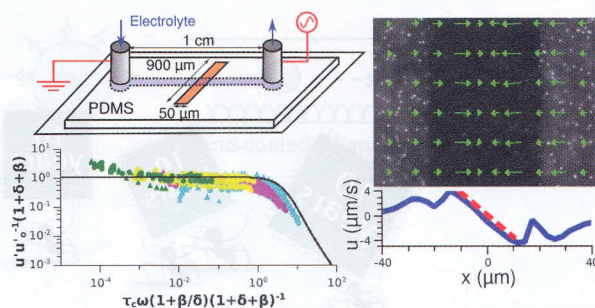


2350

An automated, high-throughput experimental system for induced charge electrokinetics

Andrew J. Pascall and Todd M. Squires*

We present a high-throughput experimental system for induced charge electrokinetics that allows for the direct interrogation of the physico-chemical effects that influence ICEK flows.

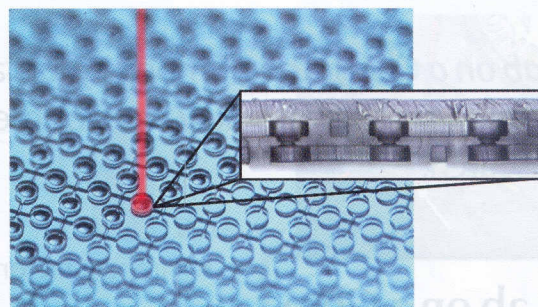


2358

Three-dimensional large-scale microfluidic integration by laser ablation of interlayer connections

Jens Huft, Daniel J. Da Costa, David Walker and Carl L. Hansen*

We present here methods and related instrumentation to combine rapid and precise laser ablation micromachining with PDMS microfluidic device fabrication by Multilayer Soft Lithography (MSL). The marriage of laser micromachining with MSL-based valve integration allows for the high-yield fabrication of topologically complex microfluidic circuits having thousands of layer-layer interconnects and integrated valves.

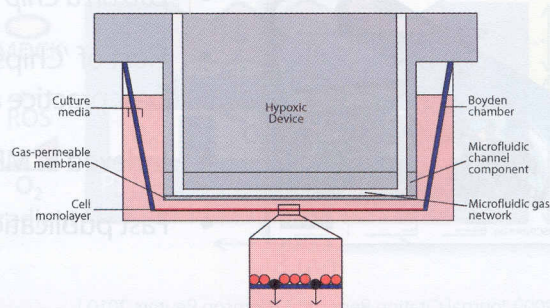


2366

Precise control over the oxygen conditions within the Boyden chamber using a microfabricated insert

Shawn C. Oppegard, Alexander J. Blake, Justin C. Williams and David T. Eddington*

A microfabricated insert has been developed to precisely control the oxygen conditions exposed to cells in a Boyden chamber. The device is easy-to-use and permits novel experiments investigating the effect of hypoxia on cell migration, invasion, and in co-culture studies.

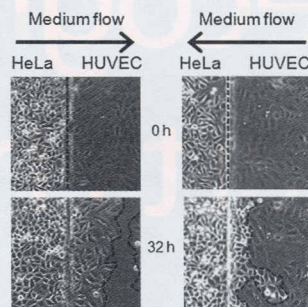


2374

Directing the flow of medium in controlled cocultures of HeLa cells and human umbilical vein endothelial cells with a microfluidic device

Hirokazu Kaji,* Takeshi Yokoi, Takeaki Kawashima and Matsuhiko Nishizawa

A microfluidic device was integrated with a controlled coculture system of HeLa cells and human umbilical vein endothelial cells (HUVECs) to direct signaling factors secreted from the cells to the culture medium.

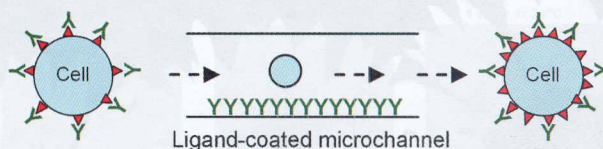


2380

Receptor expression changes as a basis for endothelial cell identification using microfluidic channels

Dwayne A. L. Vickers and Shashi K. Murthy*

Cell receptors are engaged prior to flow through a ligand-coated flow channel and receptor expression profiles are utilized to identify different cell types.

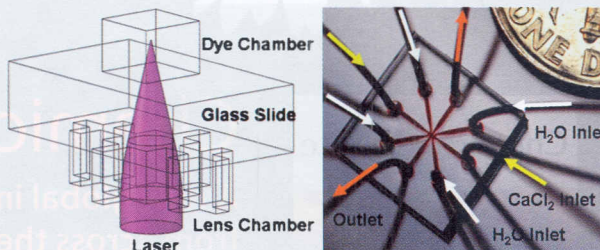


2387

Tunable two-dimensional liquid gradient refractive index (L-GRIN) lens for variable light focusing

Hua Huang, Xiaole Mao, Sz-Chin Steven Lin, Brian Kiraly, Yiping Huang and Tony Jun Huang*

A tunable two-dimensional liquid gradient refractive index (L-GRIN) lens was developed for on-chip variable focusing of light in the out-of-plane direction.

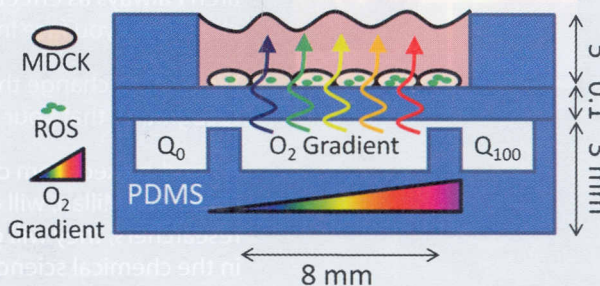


2394

Oxygen gradients for open well cellular cultures via microfluidic substrates

Joe F. Lo, Elly Sinkala and David T. Eddington*

The devices presented here can generate complex oxygen gradients over rapid timescales, permitting investigation of a number of difficult-to-model physiological systems.

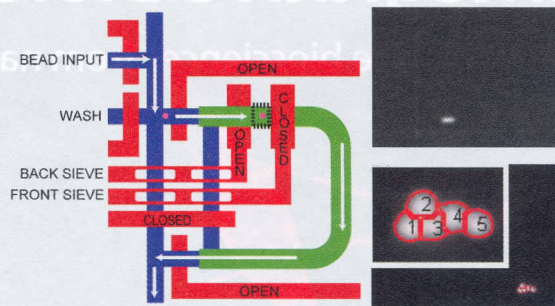


2402

Image-based feedback control for real-time sorting of microspheres in a microfluidic device

Matthew S. Munson, James M. Spotts, Antti Niemistö, Jyrki Selinummi, Jason G. Kralj, Marc L. Salit and Adrian Ozinsky*

We demonstrate an automated particle sorter with single particle precision. It is capable of constructing arrays of diverse particle types in individually addressable microfluidic assay chambers.

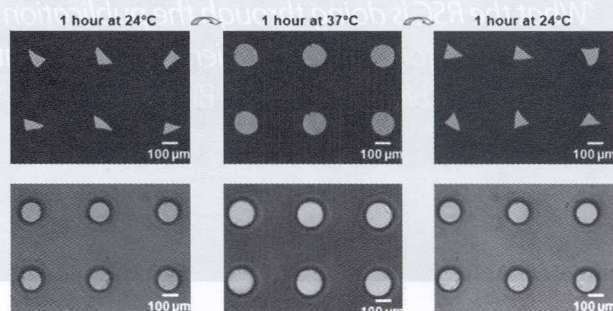


2411

Stimuli-responsive microwells for formation and retrieval of cell aggregates

Halil Tekin, Michael Anaya, Mark D. Brigham, Claire Nauman, Robert Langer* and Ali Khademhosseini*

We demonstrate that shape changing microwells can be made from temperature responsive polymers. The temperature induced changes in microwell diameters applied mechanical forces to cell aggregates that resulted in their retrieval from the microwell arrays with high efficiency.



2419

Detection of waterborne parasites using field-portable and cost-effective lensfree microscopy

Onur Mudanyali, Cetin Oztoprak, Derek Tseng, Anthony Erlinger and Aydogan Ozcan*

We investigate the use of a field-portable and cost-effective lensfree holographic microscope to image and detect pathogenic protozoan parasites such as *Giardia Lamblia* and *Cryptosporidium Parvum* at low concentration levels.

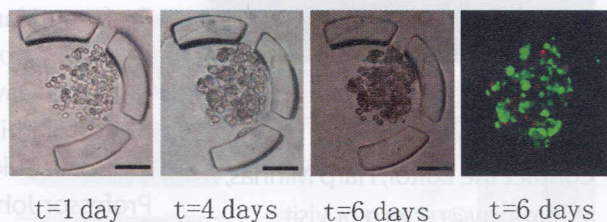


2424

Droplet-based microfluidic system for multicellular tumor spheroid formation and anticancer drug testing

Linfen Yu, Michael C. W. Chen and Karen C. Cheung*

We demonstrate a droplet-based microfluidic platform for three-dimensional cell culture and drug toxicity testing. Tumor cells encapsulated in alginate droplets form multicellular tumor spheroids, and the dose-dependent response of spheroids to doxorubicin can be imaged and quantified.

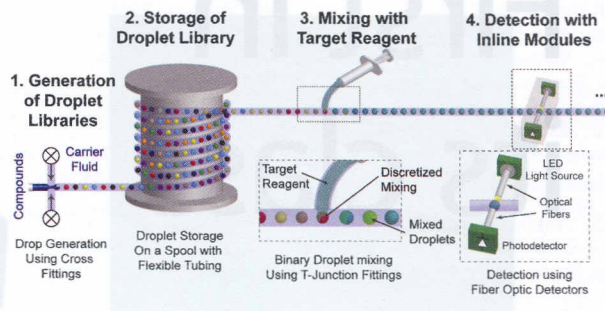


2433

A modular approach for the generation, storage, mixing, and detection of droplet libraries for high throughput screening

Varun Trivedi, Ankur Doshi, G. K. Kurup, E. Ereifej, P. J. Vandevord and Amar S. Basu*

We apply a modular approach to droplet-based fluidics, utilizing commercially available components for unit operations. Three protocols are demonstrated: the mix and read assay, microfractionation in droplets, and *in situ* cell encapsulation and culture.

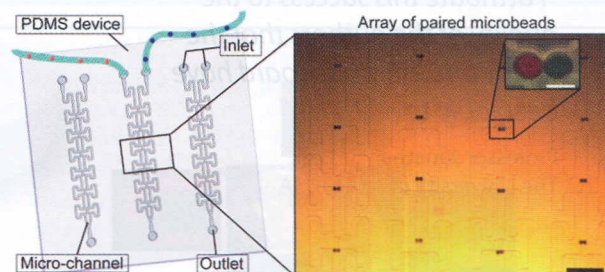


2443

A dynamic microarray device for paired bead-based analysis

Tetsuhiko Teshima, Hirotaka Ishihara, Kosuke Iwai, Aki Adachi and Shoji Takeuchi*

A meander-shaped dynamic microarray device allows us to pair two different types of microbeads and is useful for the analysis of the interaction between the microbeads in a trapping site.

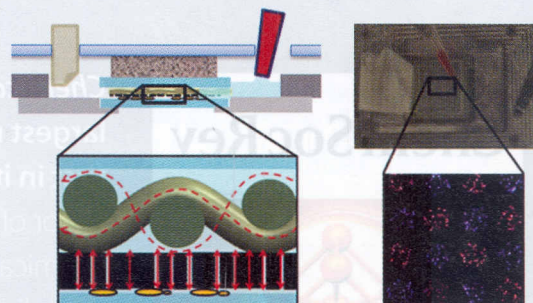


2449

Microfluidic perfusion system for culturing and imaging yeast cell microarrays and rapidly exchanging media

Maryam Mirzaei, Mateu Pla-Roca, Roozbeh Safavieh, Elena Nazarova, Mohammadali Safavieh, Huiyan Li, Jackie Vogel and David Juncker*

We present a microfluidic perfusion system that is compatible with high resolution, real time observation of arrays of cells and can be operated using a conventional micropipette and a paper wick, without need for complex peripherals.

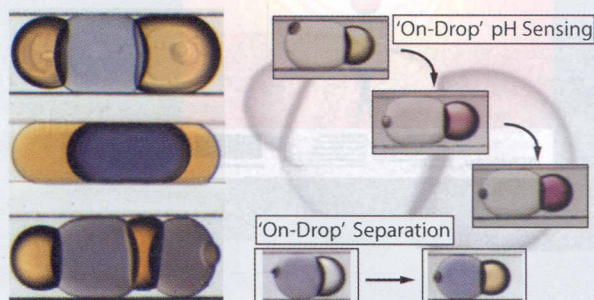


2458

Ionic liquid-based compound droplet microfluidics for 'on-drop' separations and sensing

Zahra Barikbin, Md. Taifur Rahman, Pravien Parthiban, Anandkumar S. Rane, Vaibhav Jain, Suhanya Duraiswamy, S. H. Sophia Lee and Saif A. Khan*

A new and general scheme for analytical applications of droplet microfluidics, in which ionic liquid-based compound droplets function not only as isolated reaction flasks, but are also capable of 'on-drop' separation and sensing.



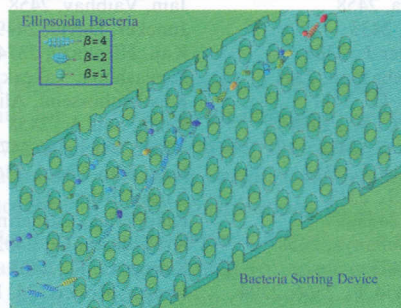
METHOD

2464

A new method for simulating the motion of individual ellipsoidal bacteria in microfluidic devices

Min-Cheol Kim and Catherine Klapperich*

In this report, we show how a novel simulation method may be applied to design efficient microfluidic hydrodynamic bacterial cell traps and for cell separations.



TECHNICAL NOTE

2472

Shrink film patterning by craft cutter: complete plastic chips with high resolution/high-aspect ratio channel

Douglas Taylor, David Dyer, Valerie Lew and Michelle Khine*

Using a film that shrinks by 95% and a low-cost craft cutter, we can make custom and complete 3D plastic microfluidic chips within minutes for immunoassays. Notably, we can achieve high aspect ratio channels as well.

