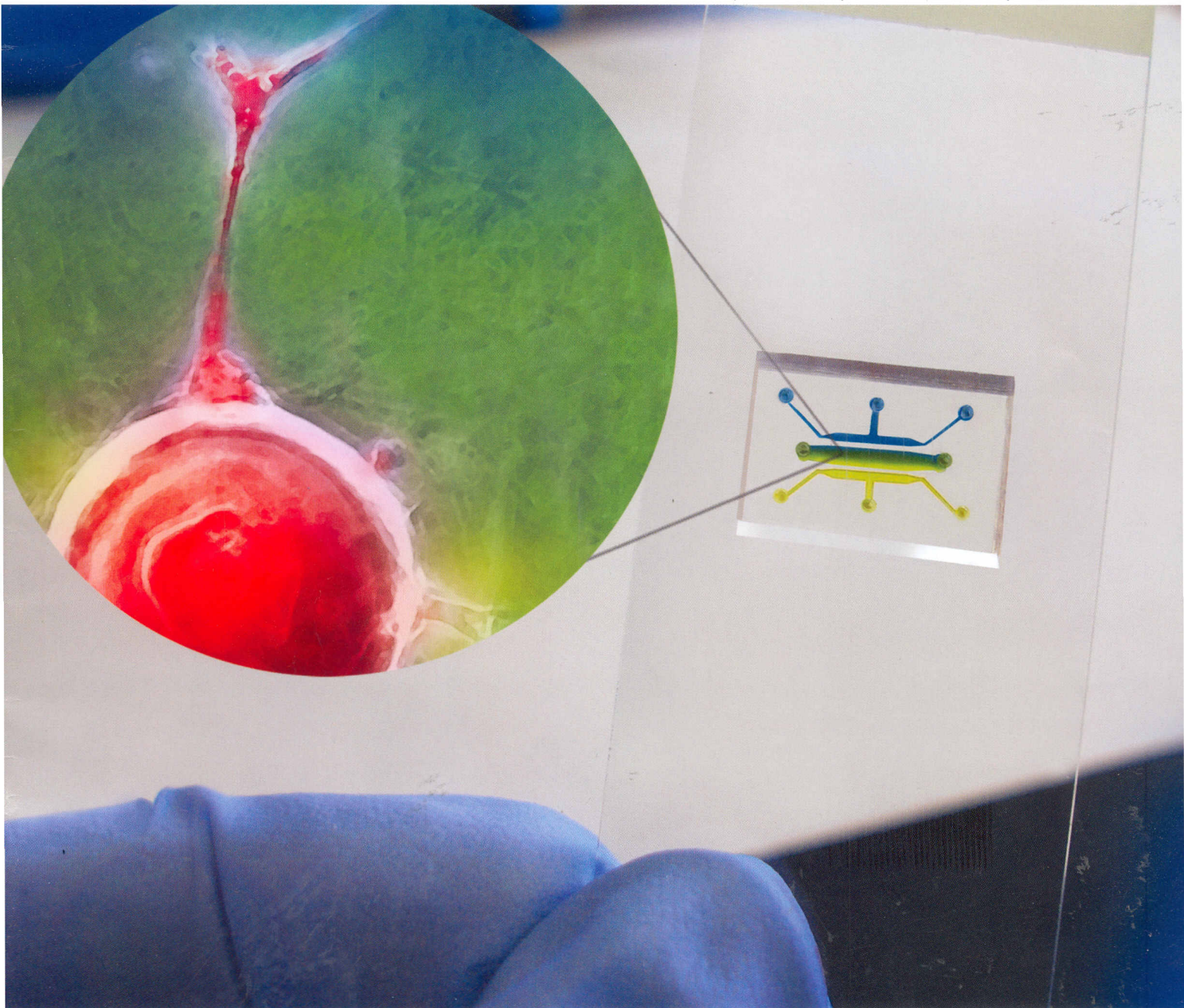


Lab on a Chip

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

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ISSN 1473-0197

RSC Publishing

PAPER

Shamloo and Heilshorn
Matrix density mediates polarization
and lumen formation of endothelial
sprouts in VEGF gradients

Celebrating
10
Years of publishing



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Lab on a Chip

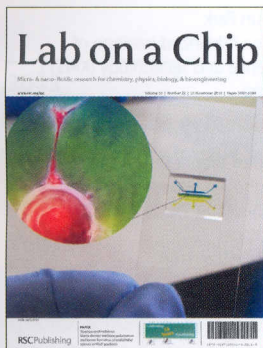
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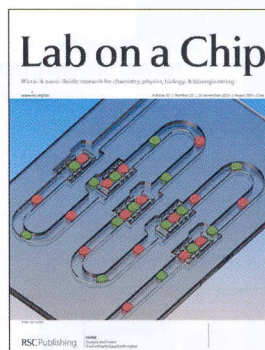
IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 10(22) 2997–3184 (2010)



Cover

See Shamloo and Heilshorn, pp. 3061–3068. Endothelial cells coordinate their 3D migration to form capillary-like sprouts inside microfluidic devices with stable growth factor gradients. Images acquired by Amir Shamloo and Hui Xu and digital artwork by Chelsea Castillo, reproduced by permission of Sarah C. Heilshorn from *Lab Chip*, 2010, **10**, 3061.



Inside cover

See Zagnoni and Cooper, pp. 3069–3073. A microfluidic droplet-based shift register enables the controllable formation, storage and retrieval of serially arrayed water-in-oil droplet networks to be automated in a high throughput manner. Image reproduced by permission of Michele Zagnoni and Jonathan M. Cooper from *Lab Chip*, 2010, **10**, 3069.

HIGHLIGHT

3011

Research Highlights

Petra S. Dittrich*

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



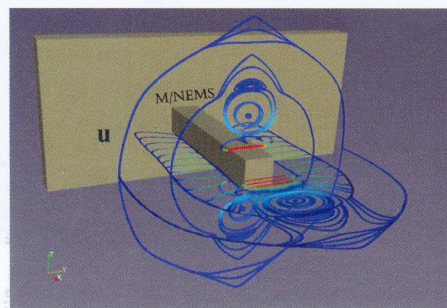
CRITICAL REVIEWS

3013

High-frequency nanofluidics: a universal formulation of the fluid dynamics of MEMS and NEMS

K. L. Ekinci,* V. Yakhot, S. Rajauria, C. Colosqui and D. M. Karabacak

In this review, we provide an introduction to high-frequency nanofluidics, with emphasis on both theory and experiments.

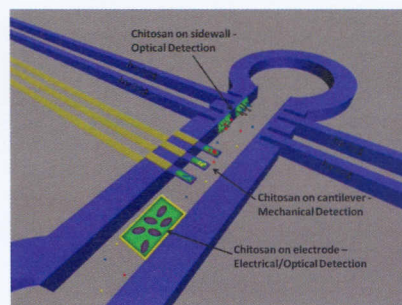


3026

Chitosan: an integrative biomaterial for lab-on-a-chip devices

S. T. Koev, P. H. Dykstra, X. Luo, G. W. Rubloff, W. E. Bentley, G. F. Payne and R. Ghodssi*

This review covers the various ways that the polysaccharide chitosan can add biological functionality to a host of micro-scale devices.

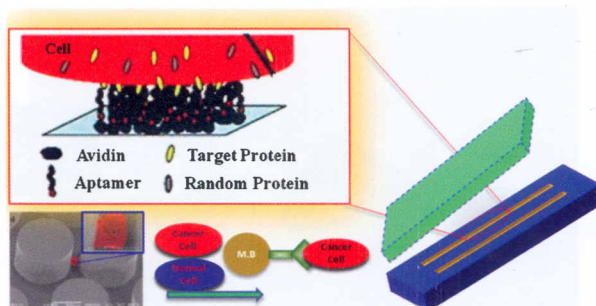


3043

Adhesion based detection, sorting and enrichment of cells in microfluidic Lab-on-Chip devices

Tohid Fatanat Didar and Maryam Tabrizian*

This critical review paper presents the state of the art in adhesion-based microfluidic devices used for sorting, detecting and the enrichment of different cell lines, with a particular focus on specific adhesion of desired cells on surfaces modified with ligands.



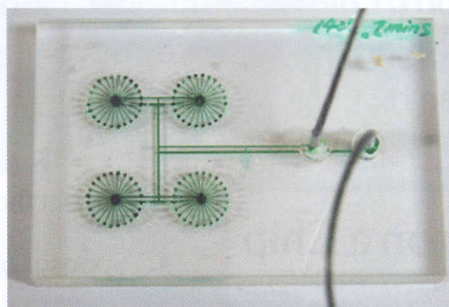
COMMUNICATIONS

3054

Design of a compact microfluidic device for controllable cell distribution

Jing-Liang Li,* Daniel Day and Min Gu*

A microfluidic device with circularly arranged microchambers for radial and controllable cell distribution.

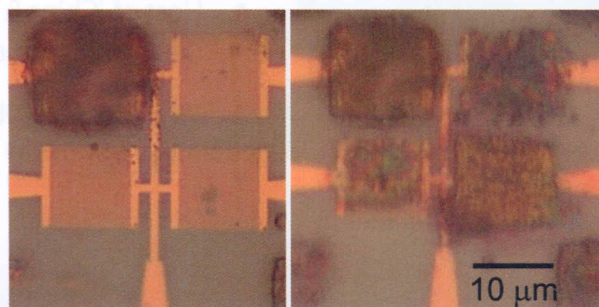


3058

Densely integrated array of chemiresistor vapor sensors with electron-beam patterned monolayer-protected gold nanoparticle interface films

E. Covington, F. I. Bohrer, C. Xu, E. T. Zellers* and Ç. Kurdak*

Electron-beam induced crosslinking is used to successively pattern films of four different monolayer-protected gold nanoparticles (MPN) on an array of four 100-μm² chemiresistors (CR) separated by 4 μm. Differential vapor sensitivities are comparable to those of larger CRs with unpatterned MPN films and permit vapor discrimination. This is the smallest MPN-coated CR array yet reported.

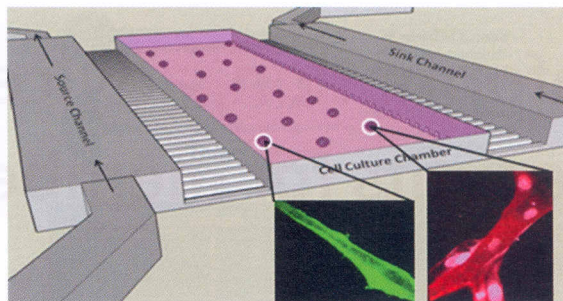


3061

Matrix density mediates polarization and lumen formation of endothelial sprouts in VEGF gradients

Amir Shamloo and Sarah C. Heilshorn*

A microfluidic platform was developed that independently controls soluble growth factor gradients and 3D matrix density in order to study the coordinated development of multi-cellular structures such as nascent blood vessels.

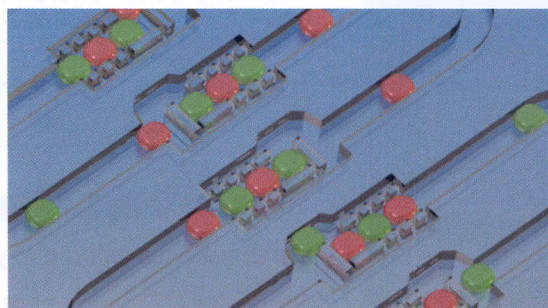


3069

A microdroplet-based shift register

Michele Zagnoni and Jonathan M. Cooper

Microfluidic droplet-based shift registers enable the controllable serial formation, storage and retrieval of arrayed droplet networks to be achieved in an automatable and high throughput manner.

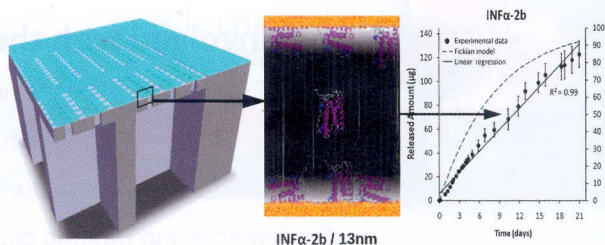


3074

A robust nanofluidic membrane with tunable zero-order release for implantable dose specific drug delivery

Daniel Fine, Alessandro Grattoni, Sharath Hosali, Arturas Ziemys, Enrica De Rosa, Jaskaran Gill, Ryan Medema, Lee Hudson, Milos Kojic, Miljan Milosevic, Louis Brousseau III, Randy Goodall, Mauro Ferrari* and Xuewu Liu*

A mechanically robust implantable nanofluidic membrane, with 5 to 22 nm nanochannels, for long-term zero-order drug release.

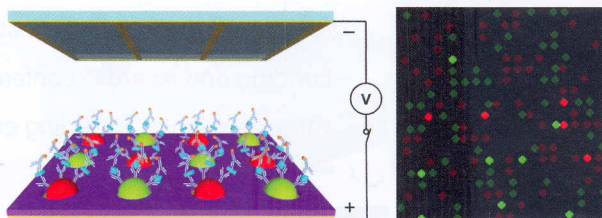


3084

Multiplexed protein detection using antibody-conjugated microbead arrays in a microfabricated electrophoretic device

Kristopher D. Barbee, Alexander P. Hsiao, Eric E. Roller and Xiaohua Huang*

We describe a microfluidic device for assembling high-density arrays of antibody-conjugated microbeads for multiplexed protein detection. Using both spatial and fluorescence encoding strategies, we have demonstrated that the antibody-conjugated microbeads can be encoded and used to perform sensitive on-chip immunoassays.

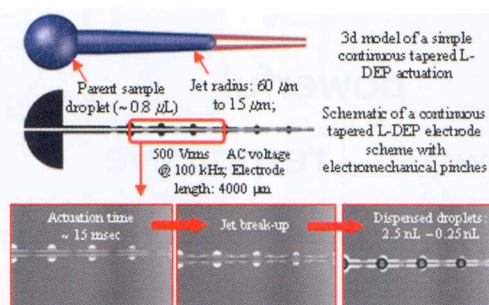


3094

Liquid DEP actuation and precision dispensing of variable volume droplets

Ravi Prakash, Reginald Paul and Karan V. I. S. Kaler*

This article demonstrates the rapid, reliable and automated microactuation of aqueous samples by leveraging the phenomena of liquid dielectrophoresis (L-DEP) and utilizing a pair of tailored coplanar electrodes to realize a precision and variable volume (sub-nanolitre) droplet dispensing surface microfluidic (SMF) device.

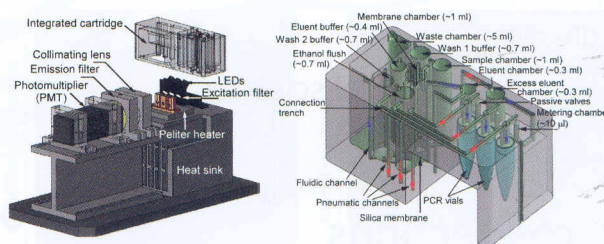


3103

A self-contained all-in-one cartridge for sample preparation and real-time PCR in rapid influenza diagnosis

Guolin Xu, Tseng-Ming Hsieh, Daniel Y. S. Lee, Emril Mohamed Ali, Hong Xie, Xing Lun Looi, Evelyn S.-C. Koay, Mo-Huang Li* and Jackie Y. Ying*

This work demonstrates a fully automated system with multiplexing capability for the rapid diagnosis of infectious diseases. The system automatically performs DNA/RNA sample preparation, reagent metering, aliquot dispensing, and real-time RT-PCR with self-contained reagents in a disposable polymer cartridge.

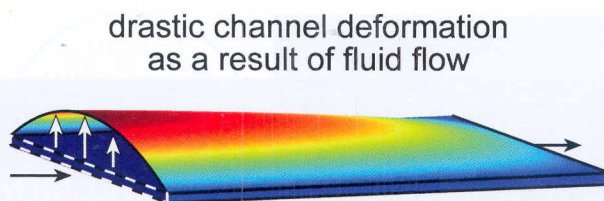


3112

Design rules for pumping and metering of highly viscous fluids in microfluidics

Sarah L. Perry, Jonathan J. L. Higdon and Paul J. A. Kenis*

Design rules to facilitate flow of highly viscous fluids in microfluidic channels while accounting for the dynamics of channel deformation.

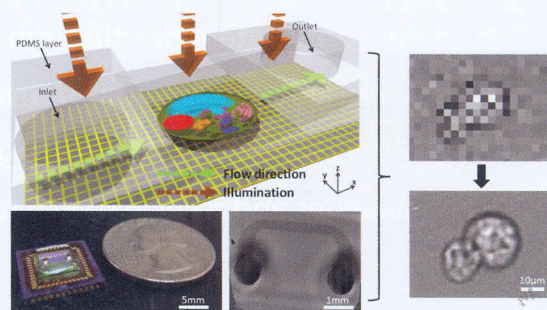


3125

Sub-pixel resolving optofluidic microscope for on-chip cell imaging

Guoan Zheng,* Seung Ah Lee, Samuel Yang and Changhui Yang

We report a sub-pixel resolving optofluidic microscope (SROFM) based on the pixel super-resolution algorithm, for low-cost and simple on-chip imaging solution for biomedical needs.

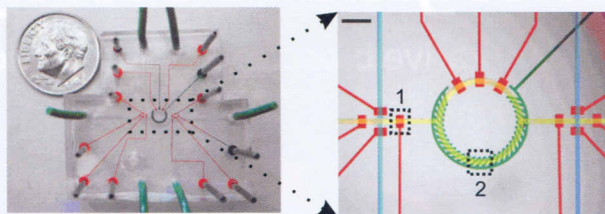


3130

A helical flow, circular microreactor for separating and enriching “smart” polymer–antibody capture reagents

John M. Hoffman, Mitsuhiro Ebara, James J. Lai, Allan S. Hoffman, Albert Folch and Patrick S. Stayton*

Capture of stimuli-responsive polymer–streptavidin nanoparticles on “smart” channel surfaces in a helical flow, recirculating microreactor. Raising the temperature of the channel with an integrated heater results in the formation of poly(*N*-isopropylacrylamide)–streptavidin particles that can be efficiently moved to the channel capture surface for purification and enrichment.

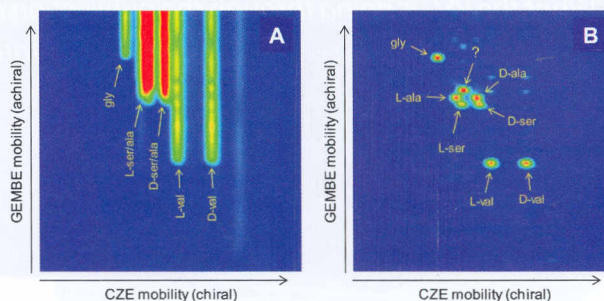


3139

2D separations on a 1D chip: gradient elution moving boundary electrophoresis—chiral capillary zone electrophoresis

David Ross,* Jonathan G. Shackman, Jason G. Kralj and Javier Atencia

A method is described for two-dimensional separations using a microfluidic chip normally employed for single dimension electrophoresis. The method combines gradient elution moving boundary electrophoresis and chiral capillary zone electrophoresis.

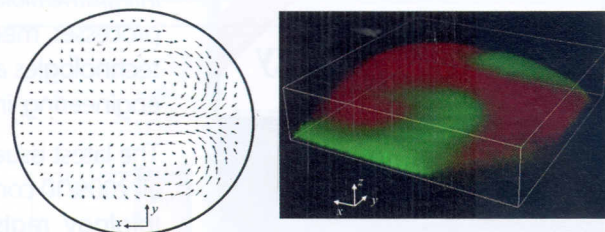


3149

Enhanced mixing of droplets during coalescence on a surface with a wettability gradient

Yu-Hsuan Lai, Miao-Hsing Hsu and Jing-Tang Yang*

The mixing of biochemical droplets on a wettability-gradient surface is improved when coalescence occurs so near the gradient that internal recirculation flow is created because of release of surface energy.

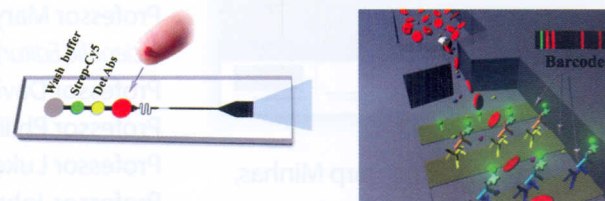


3157

A self-powered, one-step chip for rapid, quantitative and multiplexed detection of proteins from pinpricks of whole blood

Jun Wang, Habib Ahmad, Chao Ma, Qihui Shi, Ophir Vermesh, Udi Vermesh and James Heath*

A filter paper powered chip, designed for point-of-care diagnostics, is demonstrated for sequentially and automatically executing all steps required for a quantitative, multiplex protein assay from a pin prick of whole blood.

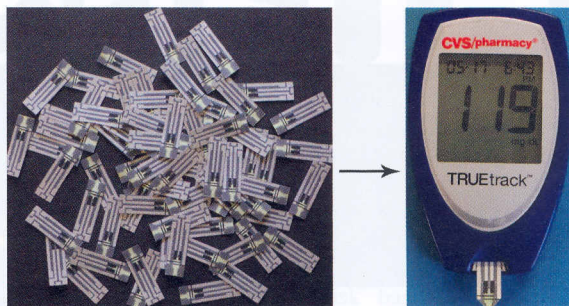


3163

Integration of paper-based microfluidic devices with commercial electrochemical readers

Zhihong Nie, Frédérique Deiss, Xinyu Liu, Ozge Akbulut and George M. Whitesides*

This paper describes the integration of simple paper-based analytical devices with commercial electrochemical readers (glucometers) for rapid, quantitative electrochemical detection of a range of analytes.

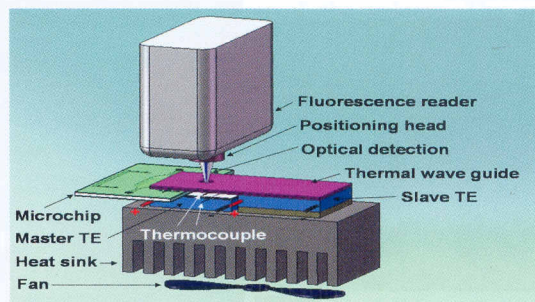


3170

A large volume, portable, real-time PCR reactor

Xianbo Qiu, Michael G. Mauk, Dafeng Chen, Changchun Liu and Haim H. Bau*

A portable PCR system with a relatively large reaction volume and double-sided heating for point of care applications.



TECHNICAL NOTE

3178

Size-selective immunofluorescence of *Mycobacterium tuberculosis* cells by capillary- and viscous forces

Woon-Hong Yeo, Fong-Li Chou, Gareth Fotouhi, Kieseok Oh, Blake T. Stevens, Hsiu-Yang Tseng, Dayong Gao, Amy Q. Shen, Jae-Hyun Chung* and Kyong-Hoon Lee*

The size-selective capturing mechanism using a microtip is demonstrated for rapid screening of *Mycobacterium tuberculosis*.

