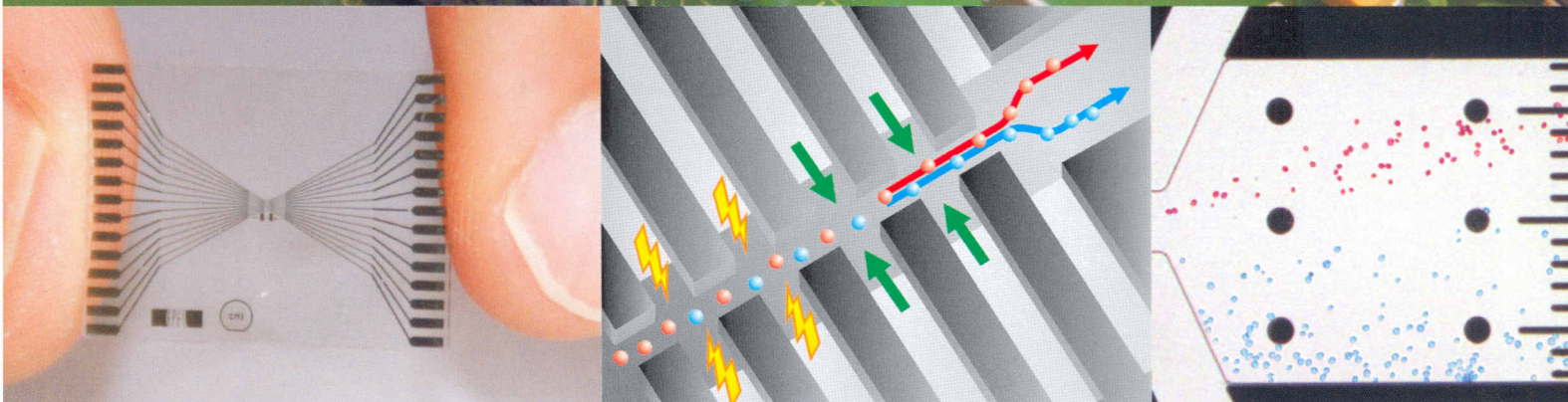
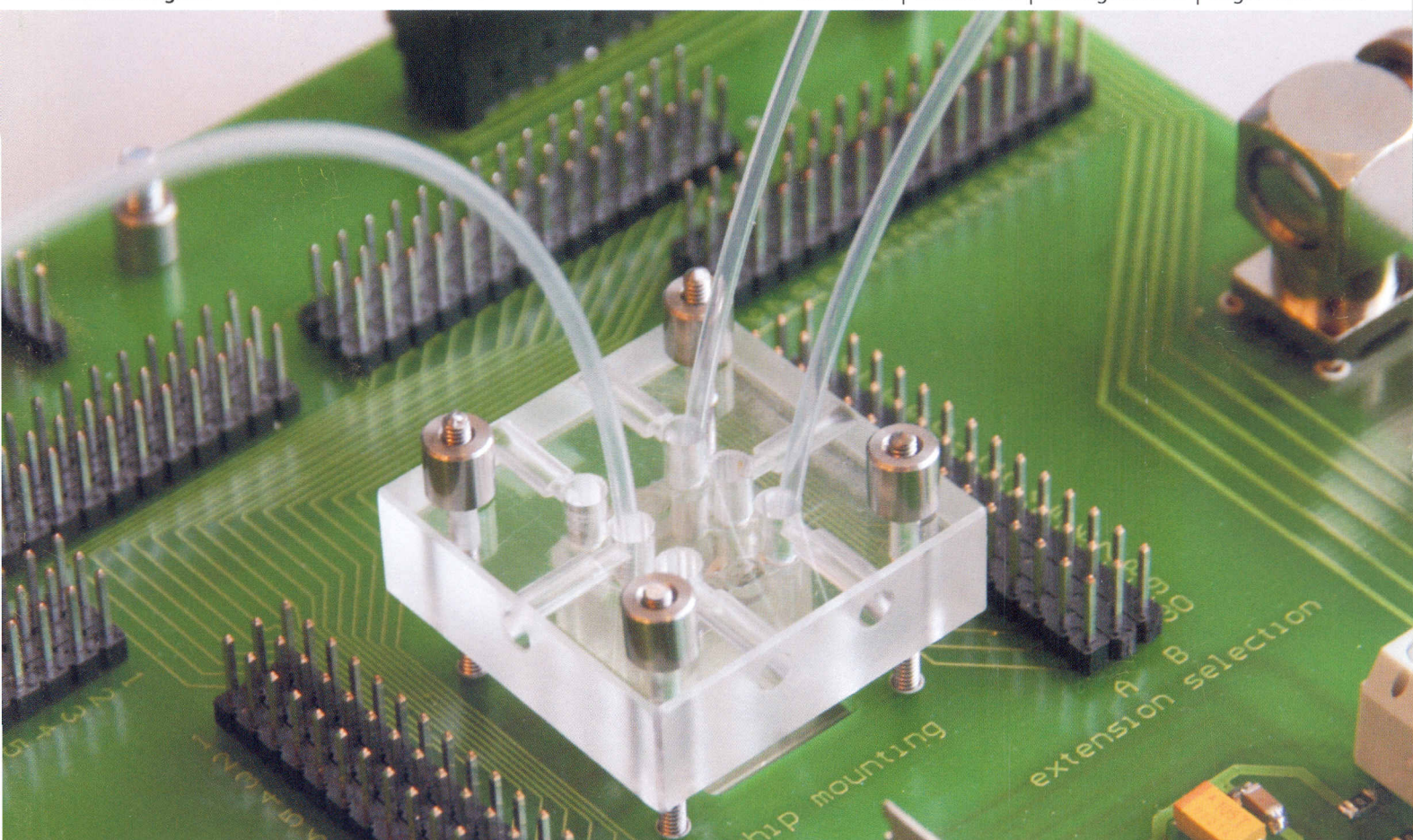


Lab on a Chip

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

www.rsc.org/loc

Volume 10 | Number 16 | 21 August 2010 | Pages 2005–2176



ISSN 1473-0197

RSC Publishing

Mernier
Electrical lysis device with
dielectrophoretic cell sorting

Baroud
Dynamics of microfluidic droplets



1473-0197(2010)10:16;1-4

Lab on a Chip

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

www.rsc.org/loc

RSC Publishing is a not-for-profit publisher and a division of the Royal Society of Chemistry. Any surplus made is used to support charitable activities aimed at advancing the chemical sciences. Full details are available from www.rsc.org

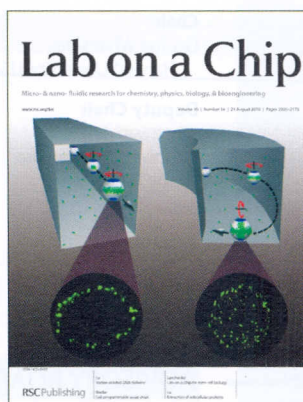
IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 10(16) 2005–2176 (2010)



Cover

See Mernier *et al.*, pp. 2077–2082. Efficiency of yeast cell lysis assessed in continuous flow using dielectrophoretic sorting with so-called “liquid electrodes”. Image reproduced by permission of Guillaume Mernier, Niccolò Piacentini, Thomas Braschler, Nicolas Demierre and Philippe Renaud from *Lab Chip*, 2010, **10**, 2077.



Inside cover

See Lu *et al.*, pp. 2057–2061. DNA delivery into cells by electroporation is greatly enhanced by curvature-induced flow effects. Image reproduced by permission of Jun Wang, Yihong Zhan, Victor M. Ugaz and Chang Lu from *Lab Chip*, 2010, **10**, 2057.

HIGHLIGHT

2017

Research Highlights

Petra S. Dittrich*

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



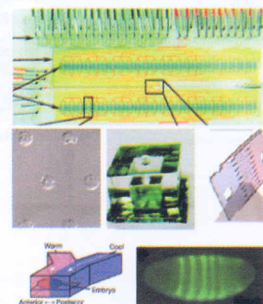
TUTORIAL REVIEW

2019

Lab-on-a-chip devices as an emerging platform for stem cell biology

Kshitiz Gupta, Deok-Ho Kim, David Ellison, Christopher Smith, Arnab Kundu, Jessica Tuan, Kaho-Yang Suh and Andre Levchenko*

This extensive review details the progress in lab-on-a-chip experiments with stem cells. Studies and unique challenges involving biochemical, cell-cell, and biomechanical interactions of stem cells with their microenvironment are discussed.

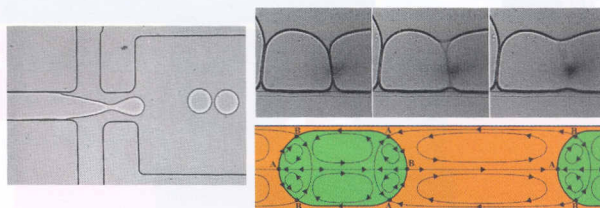


2032

Dynamics of microfluidic droplets

Charles N. Baroud,* Francois Gallaire and Rémi Danga

We describe the physics underlying three key processes in droplet microfluidics: Drop formation, transport, and merging. The recent observations are treated in light of classical fluid dynamics results.



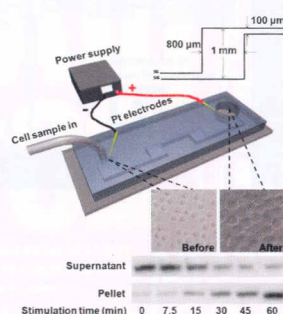
COMMUNICATIONS

2046

One-step extraction of subcellular proteins from eukaryotic cells

Yihong Zhan, Victoria A. Martin, Robert L. Geahlen and Chang Lu*

Microfluidic flow-through electroporation is applied to breach cell membranes and extract cytosolic proteins selectively in a single step.

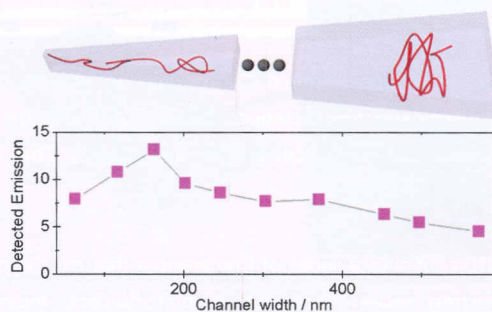


2049

Fluorescence enhancement of single DNA molecules confined in Si/SiO₂ nanochannels

Fredrik Westerlund, Fredrik Persson, Anders Kristensen and Jonas O. Tegenfeldt*

We demonstrate an enhancement of the detected emission intensity from single YOYO-labeled DNA molecules that varies significantly with the width of 180 nm deep silicon nanofunnels. Our findings are important both for increasing the photon budget as well as for avoiding systematic biases in quantitative fluorescence microscopy.

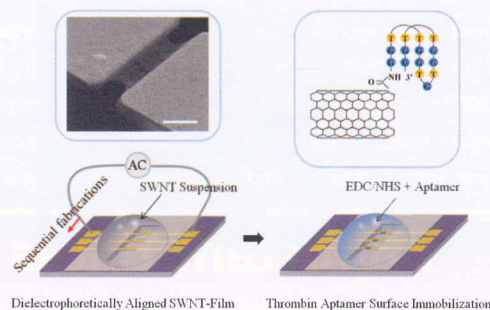


2052

Real-time, step-wise, electrical detection of protein molecules using dielectrophoretically aligned SWNT-film FET aptasensors

Taechang An, Ki Su Kim, Sei Kwang Hahn* and Geunbae Lim*

We describe a one-step method for the fabrication of dielectrophoretically aligned SWNT-films and a demonstration of a real-time, label-free, target-specific, rapid, step-wise, and electrical detection of thrombin molecules using the thrombin aptamer-functionalized addressable suspended SWNT-film FET biosensors.

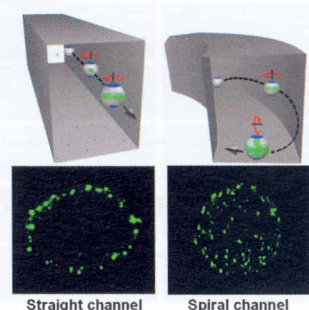


2057

Vortex-assisted DNA delivery

Jun Wang, Yihong Zhan, Victor M. Ugaz and Chang Lu*

We introduce a new way to achieve greatly enhanced delivery of exogenous DNA payloads into cells, taking advantage of fundamental physics of curvature-induced flow effects in particle laden suspensions.

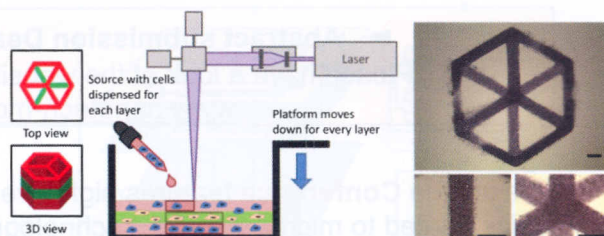


2062

Three-dimensional photopatterning of hydrogels using stereolithography for long-term cell encapsulation

Vincent Chan, Pinar Zorlutuna, Jae Hyun Jeong, Hyunjoon Kong and Rashid Bashir*

Using an adapted stereolithography apparatus, complex three-dimensional structures with multi-cell type layering were fabricated from photopolymerizable hydrogels for long-term cell encapsulation.

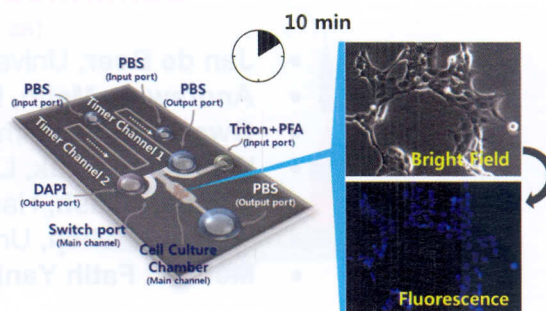


2071

A Cell Programmable Assay (CPA) chip

Jongil Ju, Jay Warrick and David J. Beebe*

We present “Cell Programmable Assay” (CPA) chips that utilize passive pumping for the culture and autonomous staining of cells to simply common protocols.

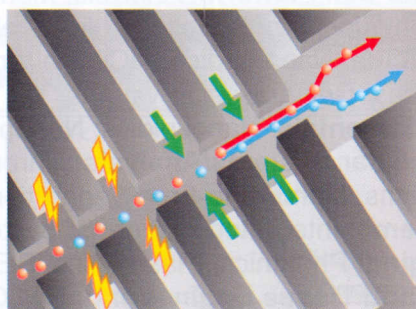


2077

Continuous-flow electrical lysis device with integrated control by dielectrophoretic cell sorting

Guillaume Mernier,* Niccolò Piacentini, Thomas Braschler, Nicolas Demierre and Philippe Renaud

We present a novel microfluidic device, featuring the combination of electrical lysis and control of lysis efficiency by dielectrophoretic cell sorting in continuous flow, both using an innovative electrode design called “liquid electrodes”.

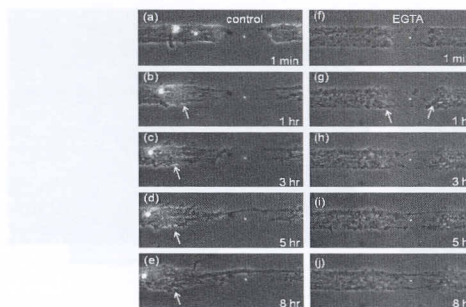


2083

Examination of axonal injury and regeneration in micropatterned neuronal culture using pulsed laser microbeam dissection

Amy N. Hellman, Behrad Vahidi, Hyung Joon Kim, Wael Mismar, Oswald Steward, Noo Li Jeon and Vasan Venugopalan*

We describe the integrated use of pulsed laser microbeam irradiation and microfluidic cell culture to examine the dynamics of axonal injury and regeneration *in vitro*.

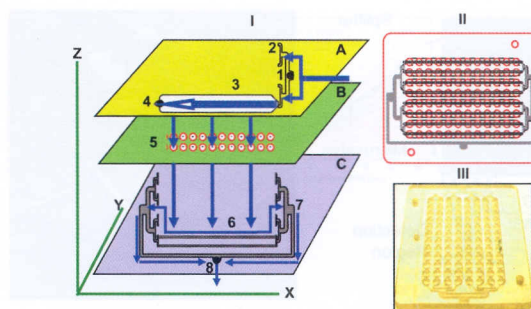


2093

ELISA-LOC: lab-on-a-chip for enzyme-linked immunodetection

Steven Sun, Minghui Yang, Yordan Kostov and Avraham Rasooly*

Functional elements of ELISA-LOC: an expanded 3D design of a single node, 96 well LOC, the complete design overlay of the assembled 96 well device and the actual ELISA-LOC device.

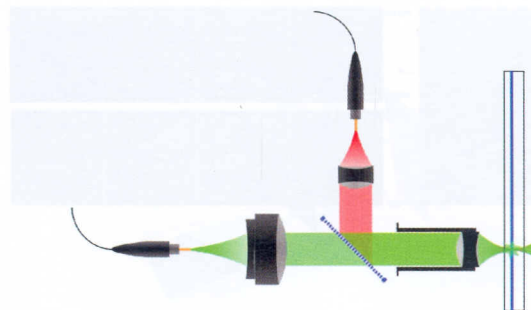


2101

Non-invasive analysis in micro-reactors using Raman spectrometry with a specially designed probe

Sergey Mozharov, Alison Nordon, John M. Girkin* and David Littlejohn*

Factors affecting the efficiency of collecting Raman spectra from narrow micro-channels have been investigated, and as a result, an efficient low-cost, non-contact Raman probe has been devised for real-time analysis of liquids in micro-reactor channels.

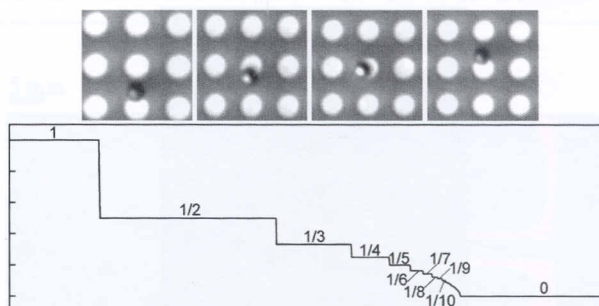


2108

The synchronization of superparamagnetic beads driven by a micro-magnetic ratchet

Lu Gao,* Norman J. Gottron III, Lawrence N. Virgin and Benjamin B. Yellen*

A superparamagnetic bead is depicted moving in a traveling magnetic field wave. The velocity follows a devil's staircase hierarchy going from 1 to 0 as the driving frequency surpasses a critical threshold.



2115

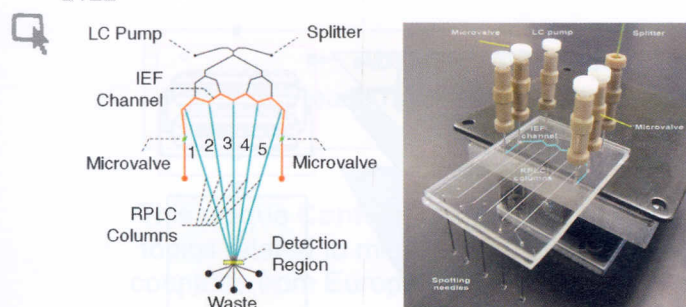


Low-temperature, simple and fast integration technique of microfluidic chips by using a UV-curable adhesive

Rerngchai Arayanarakool, Séverine Le Gac and Albert van den Berg*

A low-temperature, easy and fast bonding technique is described for assembly of micro-structured substrates. This bonding approach uses an intermediate layer of a UV-curable adhesive and is applicable for various materials.

2122

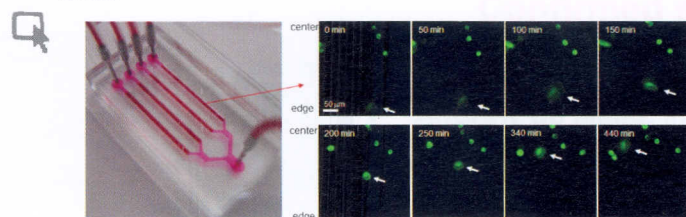


Mixed-mode electrokinetic and chromatographic peptide separations in a microvalve-integrated polymer chip

Jikun Liu, Chien-Fu Chen, Shuang Yang, Chien-Cheng Chang and Don L. DeVoe*

Thermoplastic chips integrating PDMS microvalves have been fabricated for on-line IEF-RPLC. Two-dimensional peptide separations and off-line hyphenation with MALDI-MS are demonstrated towards bottom-up global proteomic studies.

2130

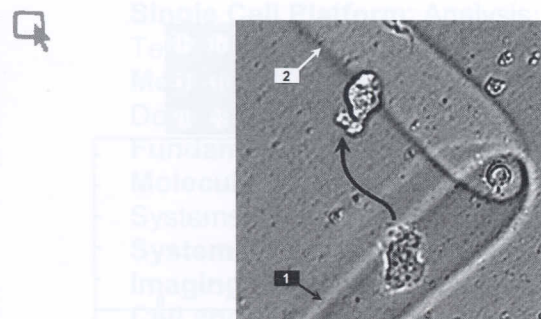


Simple haptotactic gradient generation within a triangular microfluidic channel

Jungyul Park,* Deok-Ho Kim, Gabriel Kim, Younghoon Kim, Eunpyo Choi and Andre Levchenko*

In this study we describe a simple alternative method to create highly defined and predictable gradients of surface bound molecules.

2139



Dynamic remodeling of subcellular chemical gradients using a multi-directional flow device

Samira Moorjani, Rex Nielson, Xinming A. Chang and Jason B. Shear*

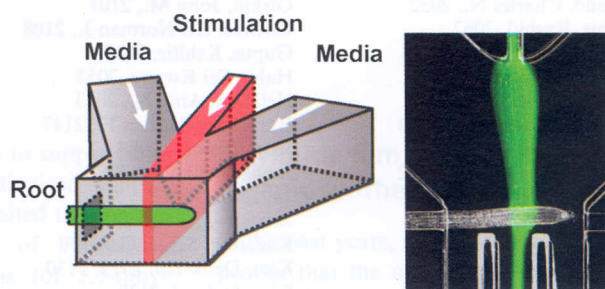
Steering chemotactic laminar streams in a microfluidic chamber directs chemotaxis of motile cells.

2147

Chemical stimulation of the *Arabidopsis thaliana* root using multi-laminar flow on a microfluidic chip

Matthias Meier,* Elena M. Lucchetta
and Rustem F. Ismagilov*

In this article, we develop and characterize a microfluidic platform based on laminar flow to create environments of different local chemical concentrations around a live *Arabidopsis thaliana* root.

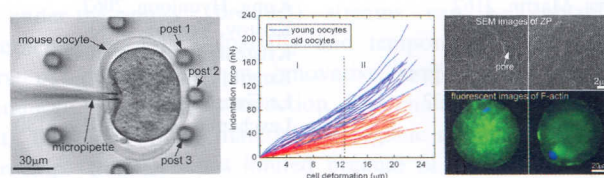


2154

In situ mechanical characterization of mouse oocytes using a cell holding device

Xinyu Liu, Roxanne Fernandes, Andrea Jurisicova,
Robert F. Casper and Yu Sun*

We demonstrate a cellular force measurement technique for mechanical characterization of mouse oocytes during microinjection, which is capable of distinguishing healthy mouse oocytes from those with aging-induced cellular defects.

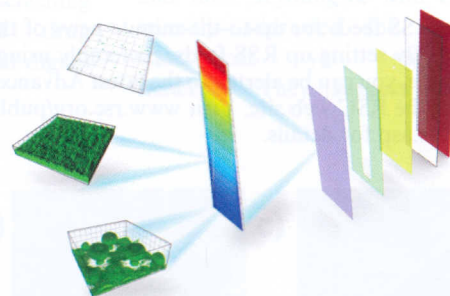


2162

Microfluidic dissolved oxygen gradient generator biochip as a useful tool in bacterial biofilm studies

Maciej Skolimowski,* Martin Weiss Nielsen, Jenny Emnéus,
Søren Molin, Rafael Taboryski, Claus Sternberg,
Martin Dufva and Oliver Geschke

We demonstrate a microfluidic chip for microbial culturing under different oxygen environments. The novel method for generating an oxygen gradient within culture chamber is demonstrated and applied for *P. aeruginosa* biofilm development.



TECHNICAL NOTE

2170

Rapid prototyping of microfluidic devices for integrating with FT-IR spectroscopic imaging

K. L. Andrew Chan, Xize Niu, Andrew J. de Mello
and Sergei G. Kazarian*

Photograph of the microfluidic device prepared by direct wax printing (left) and the label-free FTIR image of the laminar flows selectively highlighting the fluid entering from the top.

