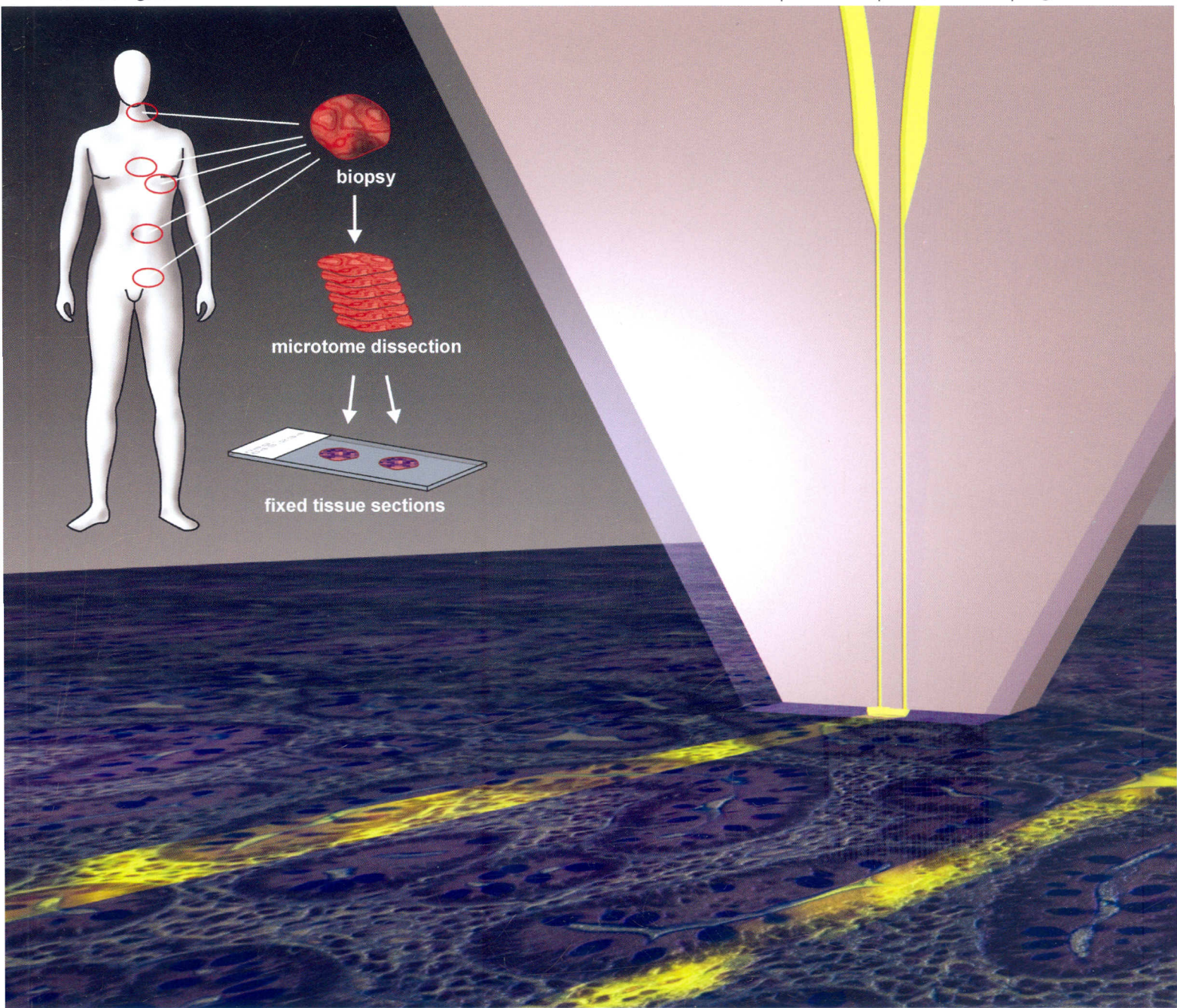
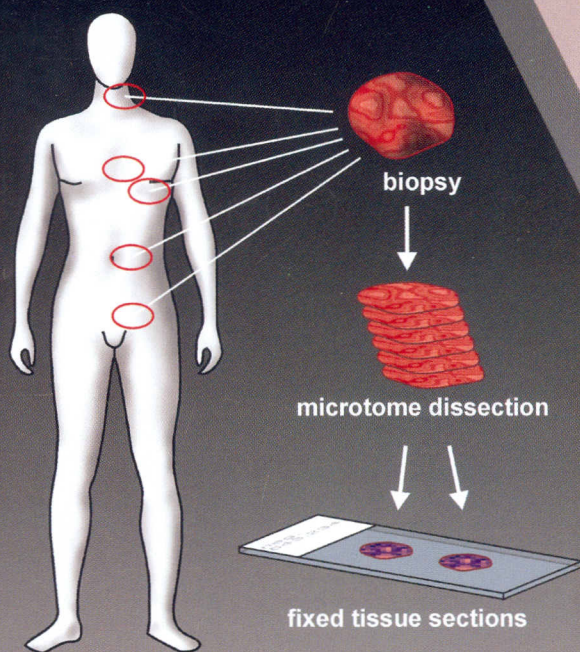


# Lab on a Chip

Miniaturisation for chemistry, physics, biology, materials science and bioengineering

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Volume 12 | Number 6 | 21 March 2012 | Pages 997–1192



ISSN 1473-0197

RSC Publishing

COMMUNICATION

Kaigala *et al.*

Micro-immunohistochemistry using a microfluidic probe



1473-0197 (2012) 12:6;1-3

# Lab on a Chip

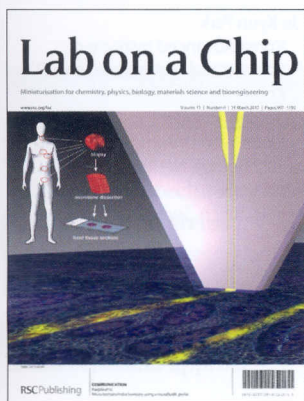
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## IN THIS ISSUE

ISSN 1473-0197 CODEN LCAHAM 12(6) 997–1192 (2012)



### Cover

See Kaigala *et al.*, pp. 1040–1043. Image reproduced by permission of Govind V. Kaigala from *Lab Chip*, 2012, **12**, 1040.



### Inside cover

See Weibel *et al.*, pp. 1052–1059. Image reproduced by permission of Douglas Weibel from *Lab Chip*, 2012, **12**, 1052.

## HIGHLIGHT

1011

### Research highlights

Šeila Selimović, Mehmet R. Dokmeci and Ali Khademhosseini\*

Modeling embryonic development on a microchip - Compound  $\mu$ -lenses - A portable, affordable photolithography system.



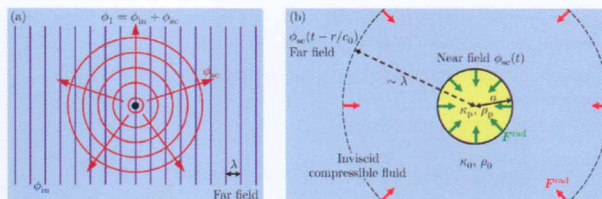
## FOCUS

1014

### Acoustofluidics 7: The acoustic radiation force on small particles

Henrik Bruus

We present the theory of acoustic radiation force; a second-order, time-averaged effect responsible for the acoustophoretic motion of suspended, micrometre-sized particles in an ultrasound field.



1022

**Standards for connecting microfluidic devices?**

Henne van Heeren\*

There is much diversity in microfluidics, but serious work on development of standards is being done by several groups, and the first results become visible. This will undoubtedly have a large impact on all working in this field.



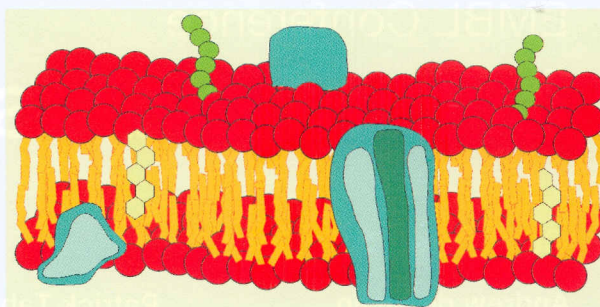
## CRITICAL REVIEW

1026

**Miniaturised technologies for the development of artificial lipid bilayer systems**

Michele Zagnoni

The development of artificial cell membrane microsystems is reviewed, discussing advantages and limitations of classic and unconventional approaches.



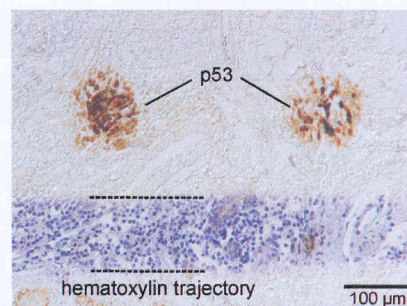
## COMMUNICATIONS

1040

**Micro-immunohistochemistry using a microfluidic probe**

Robert D. Lovchik, Govind V. Kaigala, Marios Georgiadis and Emmanuel Delamarche\*

Micro-immunohistochemistry using a vertical microfluidic probe enables local staining for detecting markers on human tissue sections with thousand-fold area reduction, optimal contrast and in a multiplexed manner.

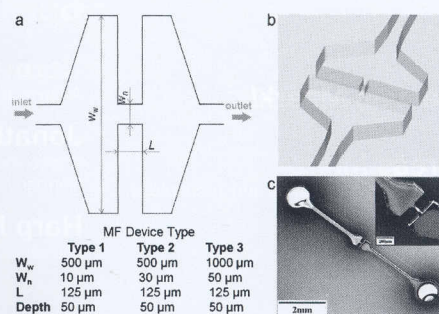


1044

**Hydrodynamic shearing of DNA in a polymeric microfluidic device**

Irina V. Nesterova, Mateusz L. Hupert, Malgorzata A. Witek and Steven A. Soper\*

We report a polymer-based microfluidic device that establishes an efficient and inexpensive platform with performance comparable to a commercially available bench-top system.

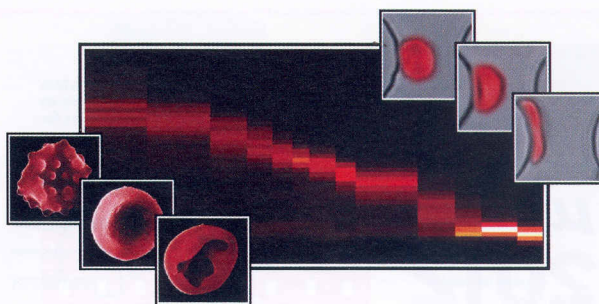


1048

**Sorting cells by size, shape and deformability**

Jason P. Beech,\* Stefan H. Holm, Karl Adolffson and Jonas O. Tegenfeldt

While size has been widely used as a parameter in cellular separations, in this communication we show how shape and deformability, a mainly untapped source of specificity in preparative and analytical microfluidic devices can be measured and used to separate cells.



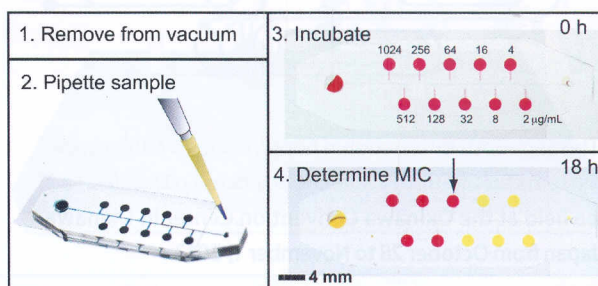
## PAPERS

1052

**A self-loading microfluidic device for determining the minimum inhibitory concentration of antibiotics**

Nate J. Cira, Jack Y. Ho, Megan E. Dueck and Douglas B. Weibel\*

We present a degas driven flow microfluidic device that partitions and isolates a sample into dead end chambers and use this device to determine the minimum inhibitory concentration (MIC) of antibiotics against bacteria.

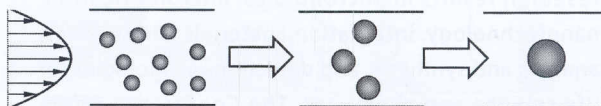


1060

**A microfluidic method to study demulsification kinetics**

Thomas Krebs,\* Karin Schroen and Remko Boom

A microfluidic method to assess the kinetics of droplet coalescence in dense flowing emulsions is presented.

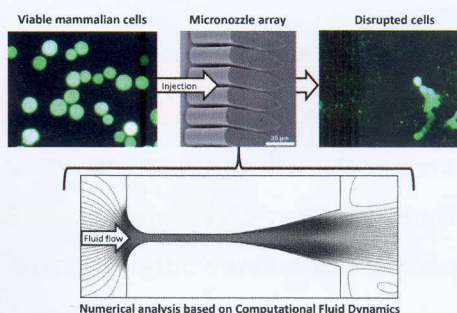


1071

**Mechanical disruption of mammalian cells in a microfluidic system and its numerical analysis based on computational fluid dynamics**

Matthias Wurm and An-Ping Zeng\*

We devised a mechanical approach to obtain a quick and reagentless disruption of mammalian cells and developed a mathematical model to predict cell disruption in microfluidic systems based on CFD-analysis.

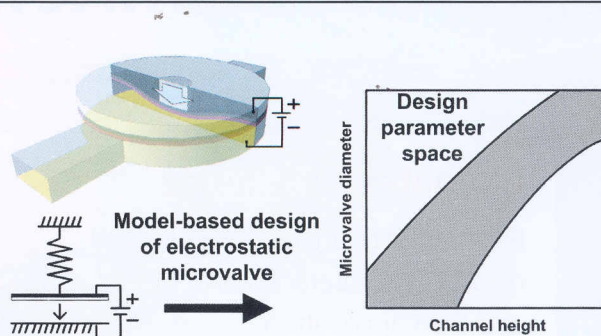


1078

### Design considerations for electrostatic microvalves with applications in poly(dimethylsiloxane)-based microfluidics

Amit V. Desai, Joshua D. Tice, Christopher A. Apblett and Paul J. A. Kenis\*

We present an analytical model to guide the design of electrostatic microvalves that can be integrated into microfluidic chips using standard fabrication processes and can reliably operate at low actuation potentials (<250 V).

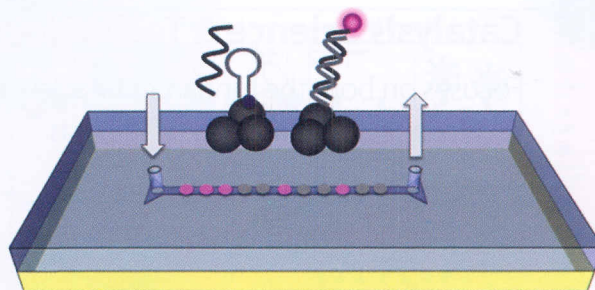


1089

### Microfluidic nanoplasmonic-enabled device for multiplex DNA detection

Hsin-I Peng, Christopher M. Strohsahl and Benjamin L. Miller\*

Uniform coating of Ag nanoparticles leads to a rapid, arrayable and self-labelled microfluidic device able to detect DNA in real time.

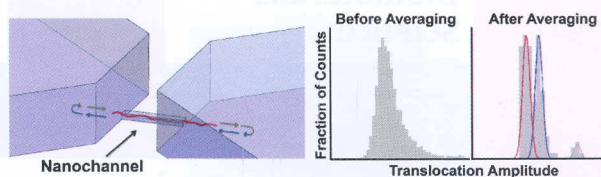


1094

### Enhanced discrimination of DNA molecules in nanofluidic channels through multiple measurements

Yi-Heng Sen, Tarun Jain, Carlos A. Aguilar and Rohit Karnik\*

Multiple measurements on the same DNA molecule translocating through a nanochannel enable enhanced discrimination between molecules of different lengths.

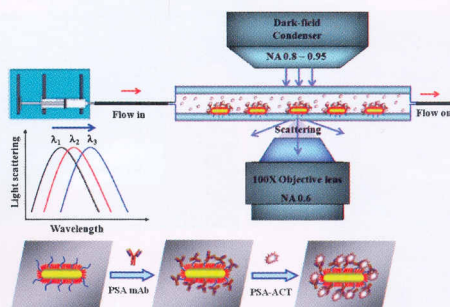


1102

### Rational aspect ratio and suitable antibody coverage of gold nanorod for ultra-sensitive detection of a cancer biomarker

Phuoc Long Truong, Byung Woo Kim and Sang Jun Sim\*

By experimentally determining the optimal sensitivity of Au nanorods for an individual optical nanosensor and optimizing the accessibility between the carboxyl groups of the self-assembled monolayer on the gold nanorod surface and the PSA mAb, the individual Au nanorod sensor was effectively exploited for the detection of a PSA biomarker with 1 aM sensitivity ( $\sim 6 \times 10^5$  molecules).

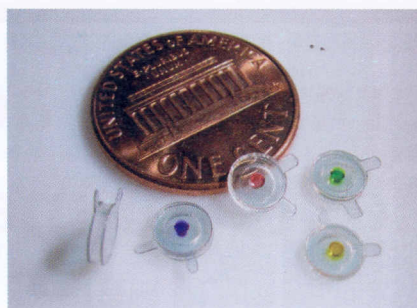


1110

**Droplet-based interfacial capacitive sensing**

Baoqing Nie, Siyuan Xing, James D. Brandt and Tingrui Pan\*

We presented a novel droplet-based pressure sensing device, utilizing an elastic electrolyte–electrode contact with large interfacial capacitance, to achieve ultrahigh sensitivity ( $1.58 \mu\text{F kPa}^{-1}$ ) and resolution (1.8 Pa) with flexible and transparent constructs.

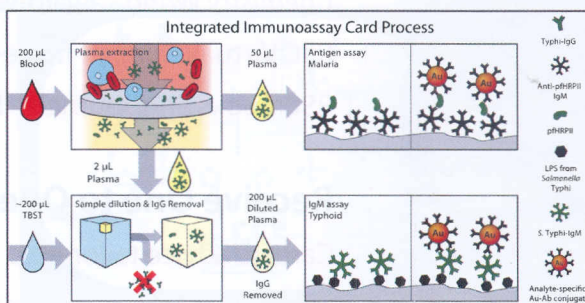


1119

**Progress toward multiplexed sample-to-result detection in low resource settings using microfluidic immunoassay cards**

Lisa Lafleur,\* Dean Stevens, Katherine McKenzie, Sujatha Ramachandran, Paolo Spicar-Mihalic, Mitra Singhal, Amit Arjyal, Jennifer Osborn, Peter Kauffman, Paul Yager and Barry Lutz

We describe a platform that detects disease-specific antigens and IgM antibodies. The disposable microfluidic cards are based on a flow-through membrane immunoassay carried out on porous nitrocellulose.

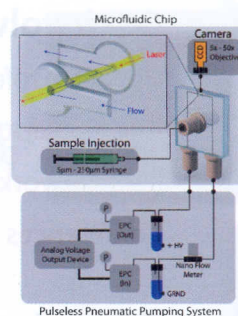


1128

**Single particle analysis using fluidic, optical and electrophoretic force balance in a microfluidic system**

Qin Lu, Alex Terray, Greg E. Collins and Sean J. Hart\*

A unique microfluidic system is developed which enables the interrogation of a single particle by using multiple force balances from a combination of optical force, hydrodynamic drag force, and electrophoretic force.

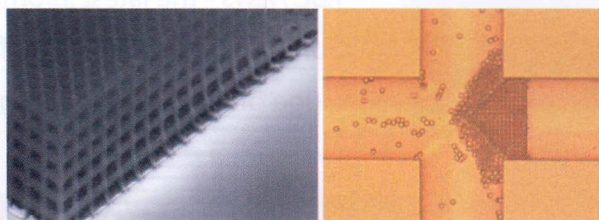


1135

**Integrated three-dimensional filter separates nanoscale from microscale elements in a microfluidic chip**

Lorenzo Amato, Yu Gu, Nicola Bellini, Shane M. Eaton, Giulio Cerullo and Roberto Osellame\*

Integration of a size-based three-dimensional filter, with micrometre-sized pores, in an already sealed commercial microfluidic chip by two-photon polymerization.

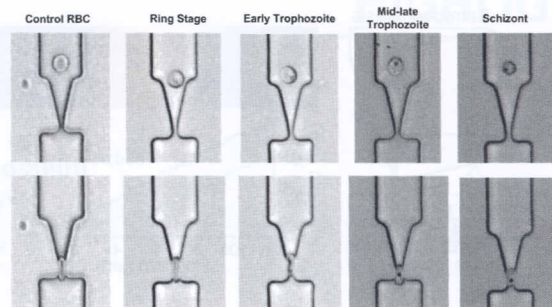


1143

### Microfluidic biomechanical assay for red blood cells parasitized by *Plasmodium falciparum*

Quan Guo, Sarah J. Reiling, Petra Rohrbach and Hongshen Ma\*

We present a microfluidic device for measuring the deformability of red blood cells parasitized by *Plasmodium falciparum*, the most prevalent species of parasites that cause malaria. Parasitized cells from ring to schizont stages were shown to be 1.5 to 200 times stiffer than uninfected cells, with clearly distinguishable deformability distributions over their respective populations.

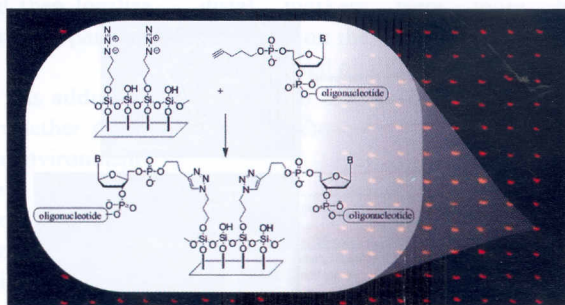


1151

### Application of click chemistry to the production of DNA microarrays

Barbara Uszczyńska, Tomasz Ratajczak, Emilia Frydrych, Hieronim Maciejewski, Marek Figlerowicz, Wojciech T. Markiewicz and Marcin K. Chmielewski\*

The CuAAC reaction was applied as the novel method of DNA immobilization on a modified solid support. The click reaction enables the covalent binding of DNA modified with pentynyl groups at its 5'-end to azide-loaded slides.

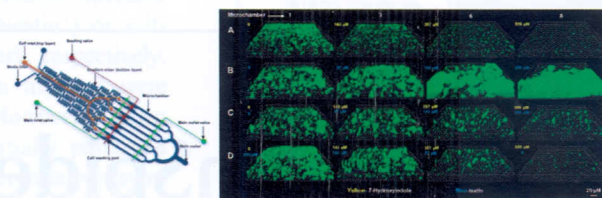


1157

### A microfluidic device for high throughput bacterial biofilm studies

Jeongyun Kim, Manjunath Hegde, Sun Ho Kim, Thomas K. Wood and Arul Jayaraman\*

We describe the development of a microfluidic flow cell ( $\mu$ FC) device for investigating bacterial biofilm formation in response to different concentrations of soluble signals, either individually or in combination.

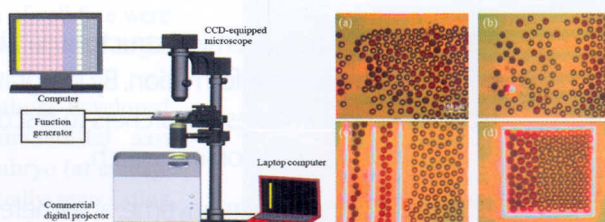


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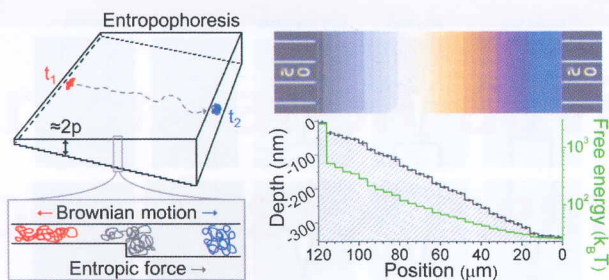
### The application of an optically switched dielectrophoretic (ODEP) force for the manipulation and assembly of cell-encapsulating alginate microbeads in a microfluidic perfusion cell culture system for bottom-up tissue engineering

Yen-Heng Lin, Ya-Wen Yang, Yi-Dao Chen, Shih-Siou Wang, Yu-Han Chang\* and Min-Hsien Wu\*

The application of an optically switched dielectrophoretic (ODEP) force in a microfluidic perfusion cell culture system for bottom-up tissue engineering.



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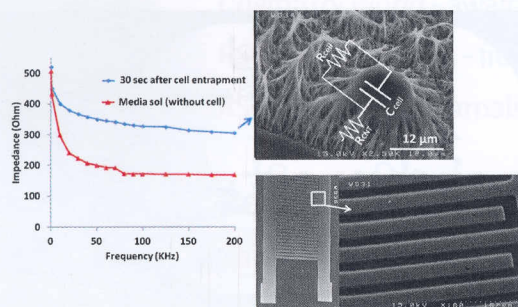


### DNA molecules descending a nanofluidic staircase by entropophoresis

Samuel M. Stavis,\* Jon Geist, Michael Gaitan, Laurie E. Locascio and Elizabeth A. Strychalski

Complex nanofluidic confinement established a free energy landscape that enabled passive control over the transport and concentration of DNA molecules.

1183



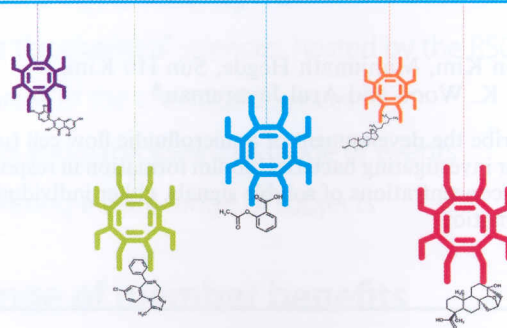
### A vertically aligned carbon nanotube-based impedance sensing biosensor for rapid and high sensitive detection of cancer cells

Mohammad Abdolahad, Mohammad Taghinejad, Hossein Taghinejad, Mohsen Janmaleki and Shams Mohajerzadeh\*

Great mechanical and electrical interactions between cancer cells and carbon nanotubes were applied for a new cancer cell impedance biosensor.



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