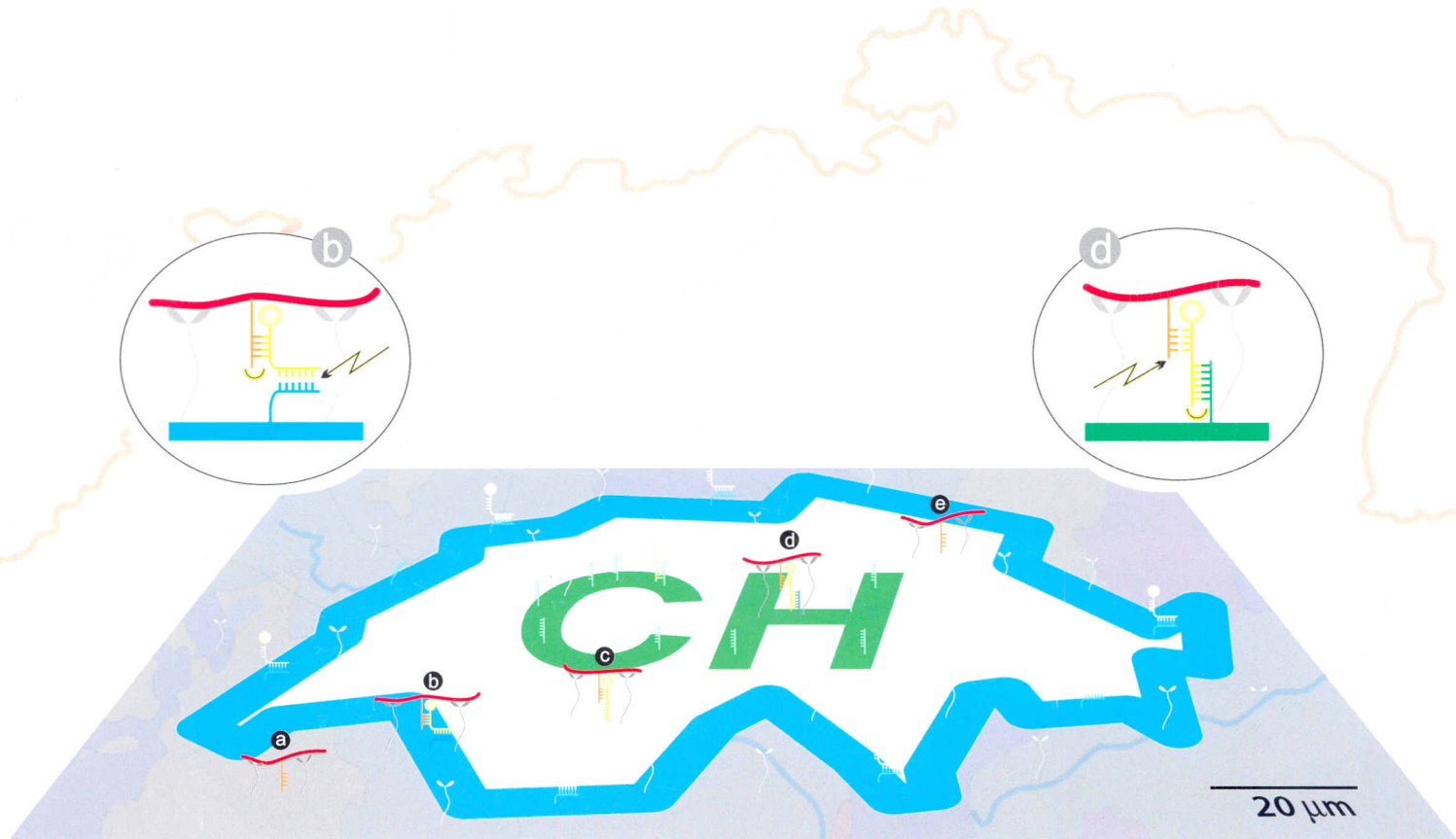


Lab on a Chip

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

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10th Anniversary: Focus on Switzerland

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Vogel
Nanocargo shuttles
Valero
Single cell spectroscopy



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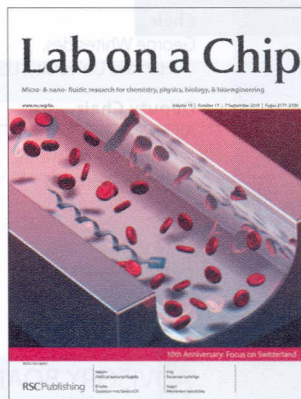
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Cover

See Schmidt and Vogel, pp. 2195–2198.
Loading and unloading of nanocargo by "molecular shuttles" integrated into one device. A kinesin propelled microtubule enters the loading station (map of Switzerland), picks up cargo there, transports it to and delivers it at the unloading station (letters "CH"). Image reproduced by permission of Claudia Schmidt and Viola Vogel from *Lab Chip*, 2010, **10**, 2195.



Inside cover

See Nelson *et al.*, pp. 2203–2215.
Artificial bacterial flagella provide mobile manipulation tools for local fluid flow control and performing batch manipulation of microobjects in liquid. Image reproduced by permission of Li Zhang, Kathrin E. Peyer and Bradley J. Nelson from *Lab Chip*, 2010, **10**, 2203.

HIGHLIGHT

2187

Research Highlights

Petra S. Dittrich*

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



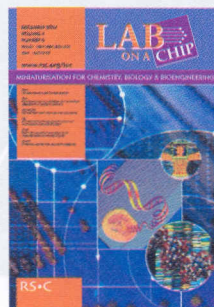
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2190

10th Anniversary Issue: Switzerland

From jewelry to quantum mechanics lab on a chip—Guest Editor Viola Vogel highlights the contribution of Swiss research to micro and nanofluidics.



PROFILE

2192

Main contributors to the 10th Anniversary Swiss issue

Questions and answers, biographical profiles and photographs of the main contributors to the 10th Anniversary Swiss issue.



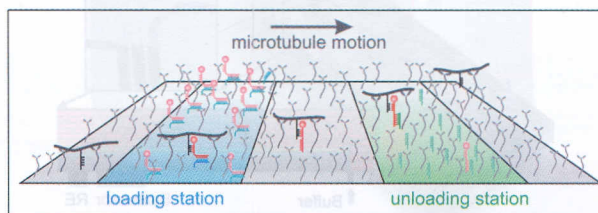
COMMUNICATION

2195

Molecular shuttles powered by motor proteins: loading and unloading stations for nanocargo integrated into one device

Claudia Schmidt and Viola Vogel*

A central challenge on the way to engineer novel materials and nanodevices comprising active transport by nanomotors is the integration of cargo loading and unloading stations on one chip. Exploiting DNA hybridization in zipping and shearing geometry, we demonstrate spatially distinct cargo pick-up and unload by "molecular shuttles" in an integrated device.



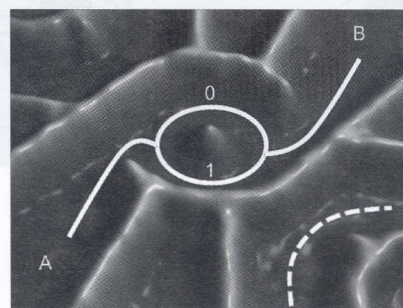
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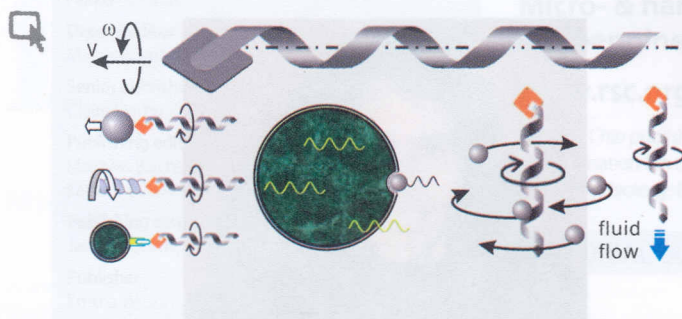
A quantum mechanics lab on a chip

Klaus Ensslin,* Simon Gustavsson, Urszula Gasser, Bruno Küng and Thomas Ihn

By coupling different quantum circuits on a chip charge flow can be monitored in a time-resolved fashion on the level of individual electrons. The perfection of such systems has advanced to a degree where basic quantum mechanical properties can be probed on a semiconductor chip.



2203

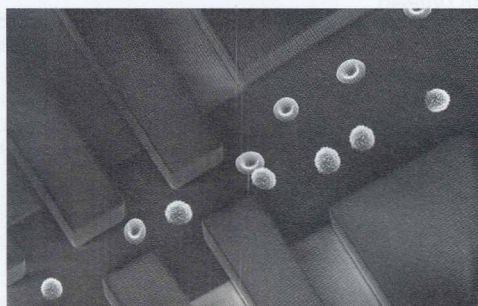


Artificial bacterial flagella for micromanipulation

Li Zhang, Kathrin E. Peyer and Bradley J. Nelson*

This article reviews recent developments in artificial bacterial flagella (ABFs) and discusses challenges and opportunities in pursuing applications. Micromanipulation and localized fluid flow control using ABFs are also presented.

2216



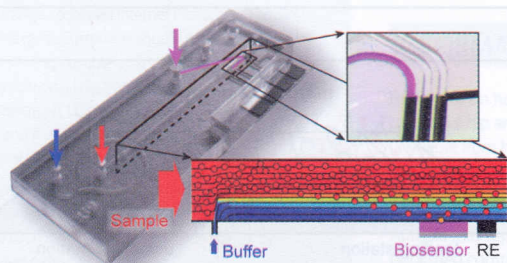
A unified approach to dielectric single cell analysis: Impedance and dielectrophoretic force spectroscopy

Ana Valero,* Thomas Braschler and Philippe Renaud

Flow-cytometer and cell-sorting microdevice capable of measuring the spectral impedance of individual cells as well as discriminating between cell types according to their dielectric properties, aimed at diagnostic applications for cell counting and separation in hematology, oncology or toxicology.

PAPERS

2226

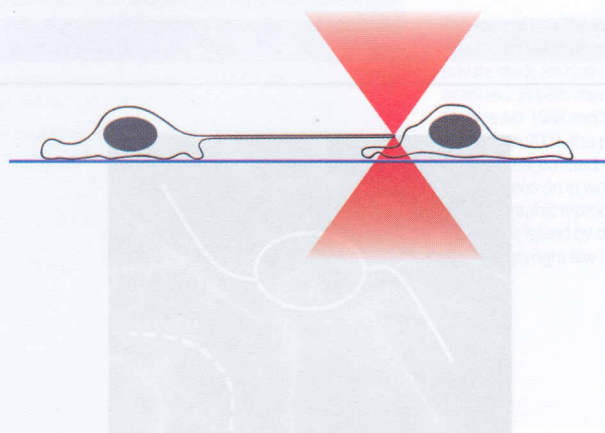


Continuous-flow multi-analyte biosensor cartridge with controllable linear response range

Olivier Frey,* Sara Talaei, Peter D. van der Wal, Milena Koudelka-Hep and Nico F. de Rooij

Simplest microfluidic multi-analyte biosensor cartridge allowing post-fabrication functionalization by capillary-driven, on-chip focussed dispensing and on-line linear range adjustment using horizontal sheath-flow.

2235



Membrane nanotubes drawn by optical tweezers transmit electrical signals between mammalian cells over long distances

Pedro Pascoal, Davor Kosanic, Marinela Gjoni and Horst Vogel*

Membrane nanotubes drawn from a live cell by a laser trap (red) offer novel possibilities for downscaling single-cell bioanalytics, forming 3D intercellular electrical connections, probing noninvasively local mechanical properties of cell membranes, and tearing micrometre-sized autonomous signaling containers.

PAPERS

2242

Miniaturized system for isotachopheresis assays

G. V. Kaigala, M. Bercovici, M. Behnam, D. Elliott, J. G. Santiago and C. J. Backhouse*

We present a self-contained hand-held device for isotachopheresis with fluorescence-based detection. Our device is suitable for both direct and indirect analysis of analytes, and we demonstrate its application for label-free detection of explosives and herbicides in river water.



2251

Non-contact acoustic cell trapping in disposable glass capillaries

Björn Hammarström, Mikael Evander, Herve Barbeau, Mattias Bruzelius, Jörgen Larsson, Thomas Laurell* and Johan Nilsson

Reproducible non-contact cell trapping in a disposable device using off-the-shelf components with accurate frequency prediction and high trapping forces.



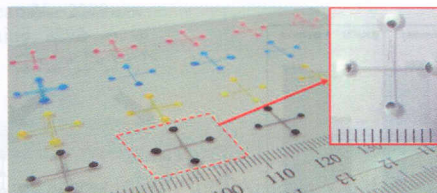
Disposable Acoustic Trapping Capillary

2258

Capillary driven low-cost V-groove microfluidic device with high sample transport efficiency

Junfei Tian, Dushmantha Kannangara, Xu Li and Wei Shen*

Low-cost sensors incorporating non-porous surface liquid transport channels and printable porous detection zones enable biochemical analysis to be performed with less than 1000 nL of fluids.

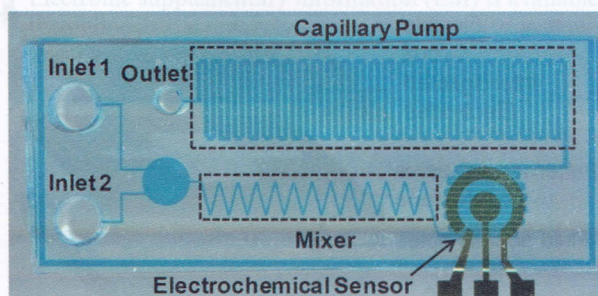


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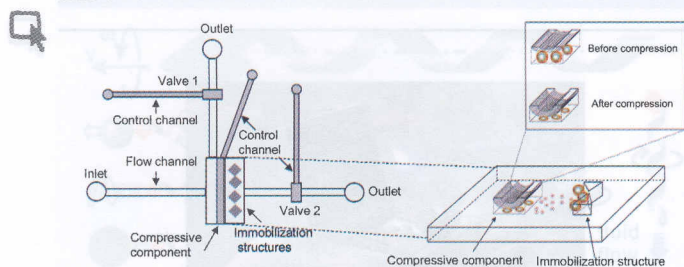
A self-pumping lab-on-a-chip for rapid detection of botulinum toxin

Peter B. Lillehoj, Fang Wei and Chih-Ming Ho*

A robust poly(dimethylsiloxane) (PDMS) surface treatment was utilized for the development of a self-pumping lab-on-a-chip (LOC) to rapidly detect minute quantities of toxic substances.



2271



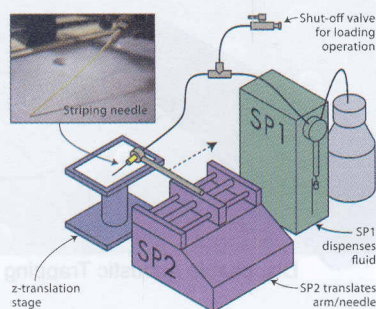
Real-time monitoring of suspension cell-cell communication using an integrated microfluidics

Tao Xu, Wanqing Yue, Cheuk-Wing Li, Xinsheng Yao,*
Guoping Cai and Mengsu Yang*

Real-time monitoring of suspension cell-cell communication is achieved by a microfluidics device with integrated functions of cell entrapment and immobilization, selective exertion of mechanical stimulation, and fluid control.

TECHNICAL NOTES

2279

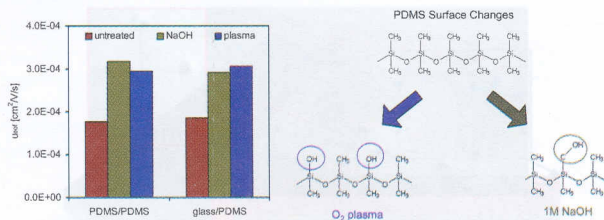


Laboratory-scale protein stripping system for patterning biomolecules onto paper-based immunochromatographic test strips

Michael A. Nash,* John M. Hoffman, Dean Y. Stevens,
Allan S. Hoffman, Patrick S. Stayton and Paul Yager

A simple yet effective system utilizing laboratory syringe pumps to pattern narrow lines of biomolecules onto porous membranes is described. This method proved useful for the laboratory-scale fabrication of lateral flow biosensors.

2283

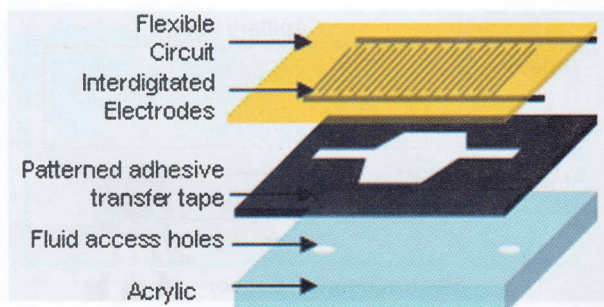


Sodium hydroxide treatment of PDMS based microfluidic devices

Ingrid Hoek,* Febyl Tho and W. Mike Arnold

Treatment of PDMS/PDMS and glass/PDMS microchannels with aqueous NaOH leads to a doubling of the electroosmotic flow. This high flow rate is comparable to the flow rates achieved by treating PDMS microchannels with O₂ plasma. Contact angle measurements and ATR-FTIR analysis show that the surface chemistry of the NaOH treated PDMS differs from O₂ plasma treated PDMS.

2286



Rapid prototyping of robust and versatile microfluidic components using adhesive transfer tapes

Pulak Nath,* Derek Fung, Yuliya A. Kunde, Ahmet Zeytun,
Brittany Branch and Greg Goddard

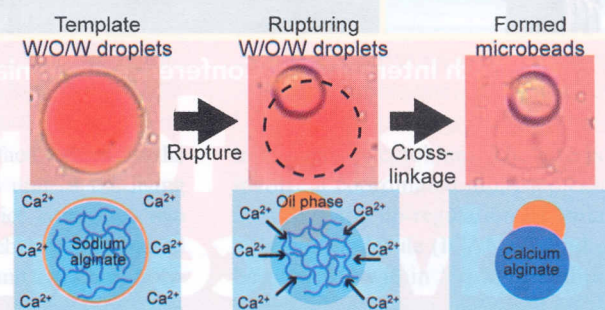
A rapid microfluidic prototyping technique is reported using adhesive transfer tapes to fabricate wide variety of functional microfluidic devices (e.g. an acoustic mixer, a DEP particle trap, a complex microchannel network, a high temperature bioreactor and a novel world-to-chip interface), which demonstrate the robustness and versatility of fabricating integrated lab on a chip systems.

2292

Formation of monodisperse calcium alginate microbeads by rupture of water-in-oil-in-water droplets with an ultra-thin oil phase layer

Daisuke Saeki, Shinji Sugiura, Toshiyuki Kanamori, Seigo Sato and Sosaku Ichikawa*

We report a novel formation method of calcium alginate microbeads by rupture of water-in-oil-in-water droplets. Immediately after the rupture induced by an osmotic pressure difference, alginate in the internal aqueous phase was cross-linked with calcium ion diffused from the external aqueous phase, and calcium alginate microbeads were formed.



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