Lab on a Chip

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

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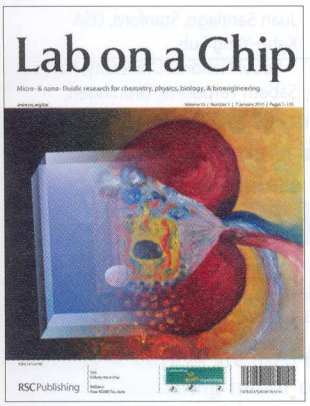
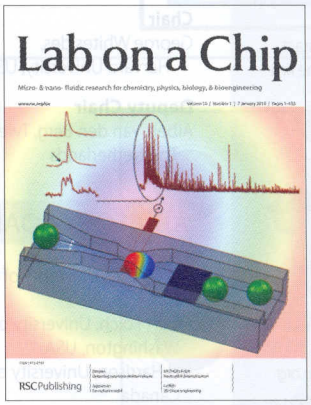


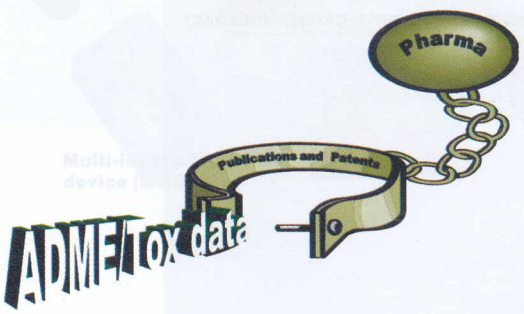
Cover
See Jang and Suh, pp. 36–42.
A simple 'kidney-on-a-chip' in the form of a multi-layer microfluidic device by combining fluidic shear stress and porous membrane support to efficiently culture and analyze renal tubular cells.
Image reproduced by permission of Kahp-Yang Suh from *Lab Chip*, 2010, **10**, 36.



Inside cover
See Dittami and Rabbitt, pp. 30–35.
Electrochemical detection was incorporated in a microchip for recording quantal exocytosis events. Cells automatically depolarized upon entering the electric field gradient in the microchamber enabling flow-through amperometry.
Image reproduced by permission of Gregory Dittami from *Lab Chip*, 2010, **10**, 30.

HIGHLIGHT

PERSPECTIVE



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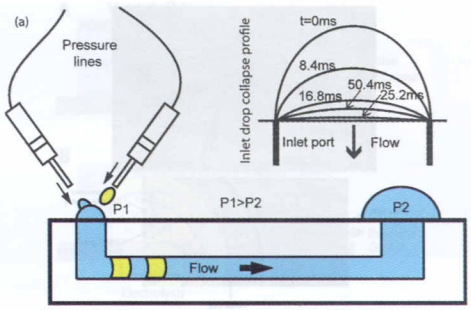
An automated microdroplet passive pumping platform for high-speed and packeted microfluidic flow applications

Pedro J. Resto, Brian J. Mogen, Erwin Berthier and Justin C. Williams*

To enhance the potential of passive pumping, a new 'micro passive pumping' technique has been developed that allows for high throughput fluidic delivery by combining passive pumping with a small droplet-based fluidic ejection system.



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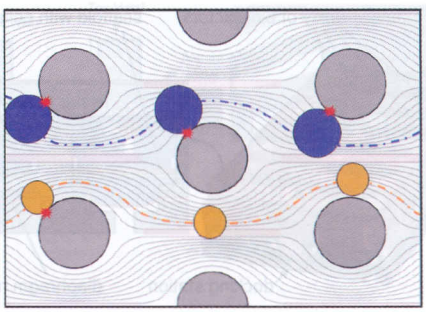
Capture of circulating tumor cells from whole blood of prostate cancer patients using geometrically enhanced differential immunocapture (GEDI) and a prostate-specific antibody

Jason P. Gleghorn, Erica D. Pratt, Denise Denning, He Liu, Neil H. Bander, Scott T. Tagawa, David M. Nanus, Paraskevi A. Giannakakou and Brian J. Kirby*

Microfluidic devices are used for high-efficiency and high-purity capture of circulating tumor cells from peripheral whole blood samples of patients with castrate-resistant prostate cancer.



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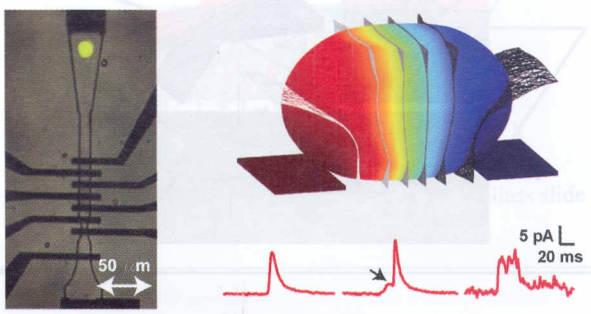
Electrically evoking and electrochemically resolving quantal release on a microchip

Gregory M. Dittami* and Richard D. Rabbitt

We present a microchip-based approach for studying cellular exocytosis. The technique combines electrochemical detection, microfluidics, and electrically-induced cell depolarization to achieve quantal resolution and flow-through (cytometric) exocytosis detection.



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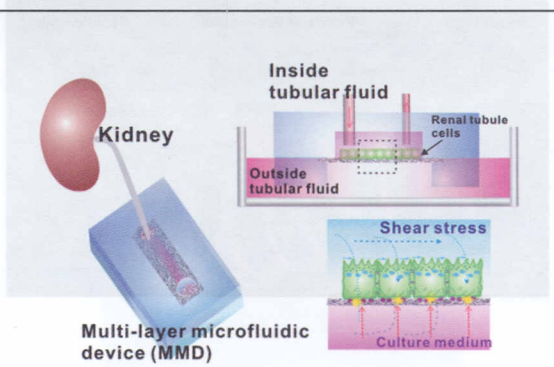
A multi-layer microfluidic device for efficient culture and analysis of renal tubular cells

Kyung-Jin Jang and Kahp-Yang Suh*

A simple "kidney-on-a-chip" in the form of a multi-layer microfluidic device (MMD) is presented by combining fluidic shear stress and porous membrane support to efficiently culture and analyze renal tubular cells.



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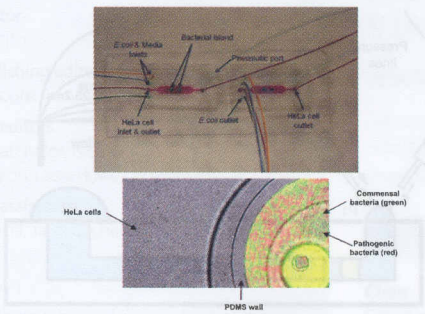

Co-culture of epithelial cells and bacteria for investigating host–pathogen interactions

Jeongyun Kim, Manjunath Hegde and Arul Jayaraman*

We describe a microfluidic co-culture model for simultaneous and localized culture of epithelial cells and bacteria. This model can be used for screening GI tract signals and putative probiotic bacterial strains.

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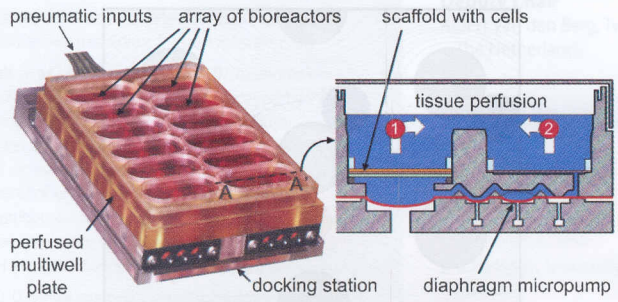

Perfused multiwell plate for 3D liver tissue engineering

Karel Domansky, Walker Inman, James Serdy, Ajit Dash, Matthew H. M. Lim and Linda G. Griffith*

The perfused multiwell plate for 3D tissue culture has built-in micropumps, is easy-to-use, and employs a docking design that facilitates handling and integration into conventional incubation and assay tools.

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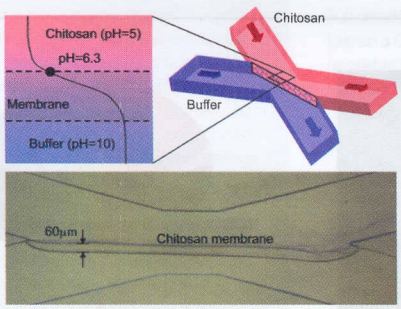

In situ generation of pH gradients in microfluidic devices for biofabrication of freestanding, semi-permeable chitosan membranes

Xiaolong Luo, Dean Larios Berlin, Jordan Betz, Gregory F. Payne, William E. Bentley* and Gary W. Rubloff*

Biofabrication exploits biologically derived materials and biocatalysts for fabrication. This paper reports the *in situ* biofabrication of a freestanding biopolymer membrane structure using a pH gradient generated at a flow interface in microfluidics.

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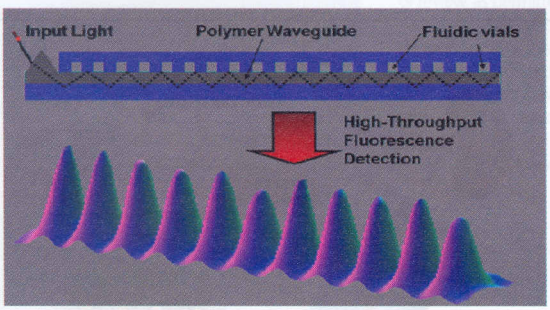

Fabrication of a cyclic olefin copolymer planar waveguide embedded in a multi-channel poly(methyl methacrylate) fluidic chip for evanescence excitation

Paul I. Okagbare, Jason M. Emory, Proyag Datta, Jost Goettert and Steven A. Soper*

A polymer chip with integrated optics for high-throughput fluorescence detection consisting of a monolithic prism steering excitation light into an embedded waveguide situated orthogonal to a series of fluidic channels.

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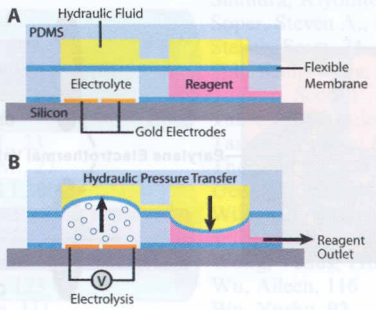
Low-power microfluidic electro-hydraulic pump (EHP)

Clarissa Lui,* Scott Stelick, Nathaniel Cady and Carl Batt

Low-power microfluidic electro-hydraulic pumps utilize the principle of hydraulics to deliver fluids at precise flow rates while the novel design successfully separates the reagent fluid from the electrolytic fluid.



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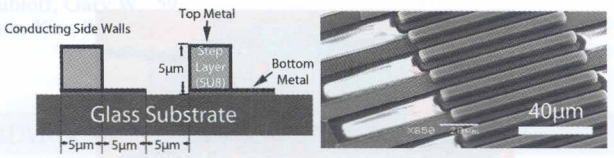
Ultrafast high-pressure AC electro-osmotic pumps for portable biomedical microfluidics

Chien-Chih Huang, Martin Z. Bazant and Todd Thorsen*

In this paper, the development of a novel low power (mW), low current (mA) AC microfluidic pump is described that is capable of generating kPa head pressures.



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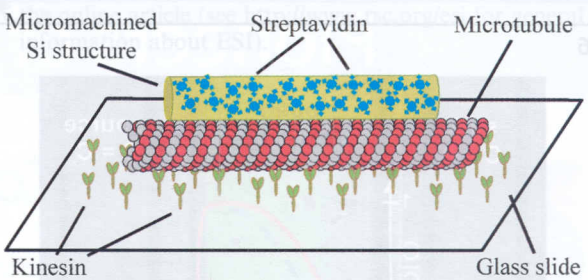
A nano-needle/microtubule composite gliding on a kinesin-coated surface for target molecule transport

Mehmet C. Tarhan,* Ryuji Yokokawa, Céline Bottier, Dominique Collard and Hiroyuki Fujita

We have separated the cargo attachment from the transport mechanism by using micromachined nano-needles as carriers in a gliding assay-based system. Microtubule-independent functionalization diversifies the possibility for target molecule attachment without sacrificing the transport characteristics.



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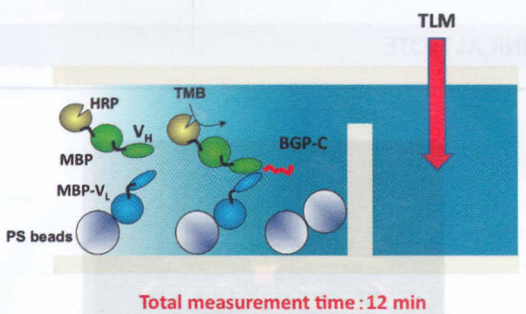
Micro OS-ELISA: Rapid noncompetitive detection of a small biomarker peptide by open-sandwich enzyme-linked immunosorbent assay (OS-ELISA) integrated into microfluidic device

Masaki Ihara, Amane Yoshikawa, Yushu Wu, Hiroko Takahashi, Kazuma Mawatari, Kiyohito Shimura, Kae Sato, Takehiko Kitamori and Hiroshi Ueda*

The combination of open-sandwich ELISA and microfluidics allowed rapid and sensitive diagnosis of osteocalcin C-terminal peptide in serum.



PAPERS

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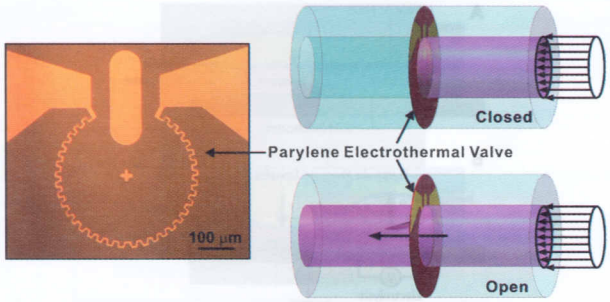

A low power, on demand electrothermal valve for wireless drug delivery applications

Po-Ying Li, Tina K. Givrad, Roya Sheybani, Daniel P. Holschneider, Jean-Michel I. Maarek and Ellis Meng*

A simple, single-use Parylene-based electrothermal valve enables low power operation (~mW) for wireless drug delivery applications. This valve features a novel Ω-shaped resistive metallic element that is rapidly activated (~ms) to allow on demand delivery.

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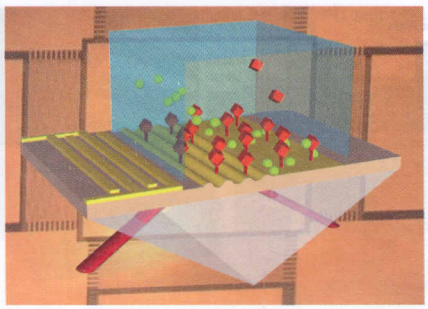

Integrated active mixing and biosensing using surface acoustic waves (SAW) and surface plasmon resonance (SPR) on a common substrate

Alan Renaudin, Vincent Chabot, Etienne Grondin, Vincent Aimez and Paul G. Charette*

We demonstrate a method for improved surface plasmon resonance (SPR) biosensing by integrating active microfluidic mixing directly onto an SPR substrate. On-chip mixing *via* surface acoustic waves (SAW) results in accelerated binding kinetics and reduced non-specific binding.

METHOD

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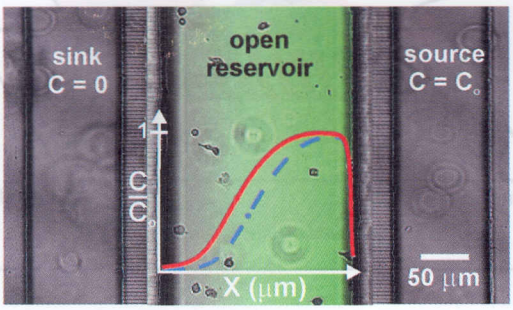

A new method for studying gradient-induced neutrophil desensitization based on an open microfluidic chamber

Thomas M. Keenan,* Charles W. Frevert, Aileen Wu, Venus Wong and Albert Folch

During inflammation neutrophils modulate their sensitivity to various chemotactic factor gradients to find the most direct path to the damaged or infected site. Keenan *et al.* describe a new method for examining gradient-induced homologous and heterologous neutrophil desensitization using a previously-developed open-chamber microfluidic gradient generator.

TECHNICAL NOTE

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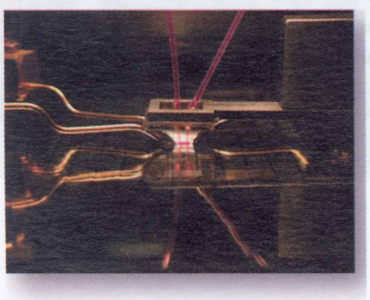

Microfluidic probe: a new tool for integrating microfluidic environments and electronic wafer-probing

David A. Routenberg and Mark A. Reed*

A "microfluidic probe" is presented, which allows rapid and repeatable, simultaneous on-wafer fluidic and electronic probing. The probes are easily fabricated using standard soft-lithography.