EPIC Members Event Report
MicroTAS 2013

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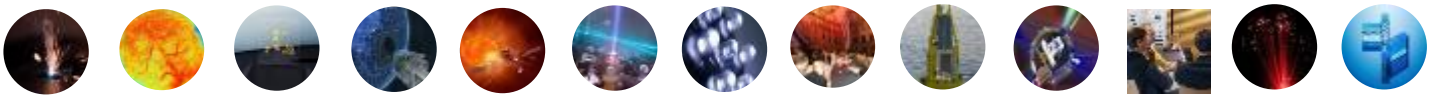
Prepared by :
Dr. Andreu Llobera
ERC Starting Grant Researcher
Centre Nacional de Microelectronica
Campus UAB
08193 Bellaterra, Barcelona, Spain
Tel: +34 93 5947700
andreu.llobera@imb-cnm.csic.es
www.cnm.es

About the EPIC Members Event Reports

Initiated by the founder of EPIC Dr. Thomas Pearsall in 2003, these reports are prepared by members of EPIC to the benefit of the wider community. If you did not have a chance to attend the event but would like to know some key highlight, this report is for you. Emphasis is placed on exploring technical and business opportunities for the members of EPIC.



MicroTAS 2013

The event was chaired by Prof. Roland Zengerle from the University of Freiburg, being the co-chairs Prof. A. Manz (KIST-Europe), Prof. P. Schwille (MPI Biochemistry) and Dr. H. Becker (Microfluidic ChipShop). In its **17th edition**, more than **1200 attendees** were registered. **587 poster presentations** and **102 oral presentations** were selected among the 1178 submitted abstracts, as well as 8 plenary presentations. This year, special emphasis was placed on assuring industrial partners the required impact of their products. This was done by providing them with the appropriate dissemination environment. This was achieved not only by having an excellent **exhibition hall where 43 exhibitors** could be allocated, but also with seven "industrial stages" where the companies could make presentations focusing on their own products and/or interests, as well as five "live labs" where on-site demonstrations of equipment and hands-on experiments could be performed. These two latter proposals, firstly introduced in MictoTAS conference, had a huge success, being the maximum people allowed in most of the times overpassed. As a result of that, the impact that the companies had, in terms of attendees visiting the booths and interest on the products shown at both industrial stages and live labs, was dramatically increased as compared to previous years. Because of this large success, in the following years a similar, yet improved platform, from which the companies may have a direct access to a broad audience, will also be considered.

In previous MicroTAS conferences, there was a specific session regarding optical readout. This year it did not occur, but rather systems with optical/photonic readout could be found in most of the sessions. This is related to the fact that optics and photonic readout in micro total analysis systems (μTAS) is progressively been accepted by the scientific community, and therefore it is not considered a potentially interesting detection approach, but rather a reliable, highly sensitive measurement method that tackles several drawbacks of their electrical/mechanical/magnetic counterparts.

Exhibition industrial stage at MicroTAS 2013

One of the most attended talks during the conference was the one given by Prof. A. Ozcan, from UCLA (USA) entitled "*Computational Imaging, Sensing and Diagnostics*", where he described the developments done at his lab regarding **computational biophotonics techniques for microscopy, tomography, sensing and diagnostics applications**. Prof. A. Ozcan demonstrated that the global connectivity can be used in advantage for developing portable micro-analysis devices integrated on cell phones with outstanding performance. Examples of such vision were presented, as could be A lens free holographic microscope that weights ~45 grams designed to image various body fluids and it is suitable for diagnosis of infectious diseases as well as screening of pathogens in water sources, a wide-field fluorescent microscope installed on a cell phone through a custom made portable interface, or a flow-cytometer on a cell phone. In this latter case, a microfluidic system was used to bring the analyte

volume to the region of the cell phone camera, where fluorescent images can be taken and further analysis can be pursued regarding relative concentration of a given analyte in the sample.

Prof. A. Ozcan (UCLA) during his plenary presentation

In addition, among the top quality contributions (8.7% acceptance ratio), there were several of them in which the detection method was optical. For example, J.P. Beech, from Lund University (Sweden) showed that DNA experiences shortening due to photo damage during fluorescence imaging. This damage is proportional to the DNA concentration, which therefore becomes critical in microfluidic conditions. To tackle this issue, he proposed using oxygen free gas to propel the buffer solution inside the device.

Also related to DNA imaging, H. Yasaki (Nagoya University, Japan) showed that single DNA molecules could be arrayed on grooves located on a microfluidic channel and afterwards being imaged by super resolution imaging such as stimulated emission depletion (STED).

Clearly, with the progressive the implementation of µTAS in market products, the lowering of the fabrication costs is a key factor. An alternative to the standard moulding techniques was proposed by K. Xu (University of Virginia, USA). He demonstrated that a CO_2 laser ablation can be used to obtain high quality Glass-PDMS-glass µTAS with high throughput, such as a finger-driven micro devices that can meter and deliver (MAD) multiple solutions.

There were also a significant contributions regarding detection methods. T.H.H. Le (University of Tokyo, Japan) showed that the excitation of Optical Near-Field (ONF) generated on nanostructures has apparent higher energy, therefore being possible to excite a molecule with incident photon energy lower than that of its absorption. His work introduced the differential interference contrast Thermal Lens Microscopy (DIC-TLM) based on the photothermal interferometry principle.

Clear applications of photonic systems were also presented at the conference, as for instance for the detection of abuse drugs. R. Walczak (Wrocław University of Technology, Poland) introduced the "Skinpatch", a non-invasive system for monitoring, via human sweat, the presence of cocaine over long period. Fluorescence was measured by hand held reader.

Interestingly, all the contributions in the Immunoassays topic had, as a common subject, the use of light as interrogation mechanism. Firstly, H. Yang (École Polytechnique Fédérale de Lausanne, Switzerland) showed that the fluorescent signal from a surface-based immunoassay can be focused self-assembled dielectric microlenses. Mouse IgG diluted in phosphate buffered saline (PBS) was used as target antigen, being possible to detect concentrations down to 2 ng/mL. Then, Surface Plasmon Resonance (SPR) was implemented in a sequence-selective immunoassay chip for DNA methylation analysis. Using the method proposed by R. Kurita (National Institute of Advanced Industrial Science and Technology, Japan), it was possible to obtain the methylation status in 45 min without employing the

conventional bisulfite reaction, PCR amplification or sequencing. Finally, D. Han (Department of Bio and Brain Engineering, KAIST, South Korea) presented an integrated immunoassay platform which makes use of optically-induced electrokinetics from dynamic light patterns. In this context, it allows re-programmable binding on specific spot areas, resulting in an overall reduction of the reaction time, as well as signal enhancement due to local concentration of molecules.

Photodegradation is generally associated with unwanted side-effects either light power or wavelength. Nevertheless, M. Tamura (University of Tsukuba, Japan) encapsulated cells in photodegradable hydrogels. By using computer-controlled light irradiation, specific areas can be selectively separated and retrieved without any damage in terms of cell growth. This methodology and the photodegradable hydrogel opens the possibility to perform cell separation based on the cellular morphology in 3D environment with a minimum resolution of 20 µm.

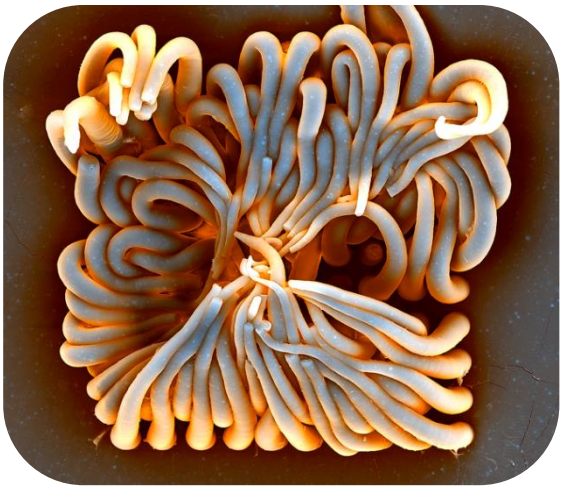
Agilent Germany (K. Kraiczek) presented the first multi-wavelength DUV-LED-based HPLC absorption, with two operation modes. In single wavelength mode and with optical referencing, the limit of detection (LOD) was shown to be comparable to conventional state-of-the-art HPLC detectors. Conversely, using 8 wavelengths and without optical referencing - the LOD is about 10x higher.
Finally H. Deschout (Laboratory of General Biochemistry and Physical Pharmacy, Ghent University, Belgium) was putting emphasis of early cancer detection by presenting a method for measuring Cell-derived membrane vesicles that are released in body fluids. The size and concentration of such membrane vesicles directly in body fluids are emerging as potential non-invasive biomarkers for diseases like cancer. In his work, he integrated light sheet illumination in a microfluidic chip. In this approach, it was possible to perform single particle tracking measurements of the size and concentration of membrane vesicles in cell culture medium, as well as in interstitial fluid collected from primary human breast tumours.

Harp Minas, from RsC, presenting the Pioneers of Miniaturisation prize 2013

Several awards were given to outstanding works and careers within this community. Concretely, the "*Pioneers of Miniaturisation*" prize 2013 (supported by Corning Inc. and Lab on a Chip) recognises outstanding achievements and significant contributions to the understanding and advancement of micro- and nano-scale science. This year, the award was given to Professor Shuichi Takayama, from the University of Michigan, USA for his outstanding contributions to a better understanding of healthy and diseased states by applying stimuli of different origin to cell cultures to create in vivo environments of physiological relevance. The Analytical Chemistry Young Innovator Award was given to Professor Hang Lu, from Georgia Institute of Technology, USA. The best oral (the Widmer Award) was given to Lian Leng, from the University of Toronto, Canada for her work entitled "*Skin Printer: Microfluidic Approach for*

Skin Regeneration and Wound Dressings". To promote research among your researchers, three CHEMINAS posters were awarded, being this year Yuya Morimoto (University of Tokyo, Japan), James Che (University of California, Los Angeles, USA) and Pilgyu Kang (Cornell University, USA).

Finally, the Art in Science Award for the MictoTAS conference 2013, whose aim is "to draw attention to the aesthetic value in scientific illustrations while still conveying scientific merit" was given to Ye Wang, from the Eindhoven University, The Netherlands for the work entitled "Artificial Life". A SEM image of artificial cilia (microhairs) made with Polydimethylsiloxane (PDMS) and magnetic nanoparticles using a glass mold made of femtosecond laser modification and hydrofluoric acid (HF) etching.



Art in Science Award 'Artificial Life'

For additional information, please contact the author of this event report:
Dr.Andreu Llobera, ERC Starting Grant Researcher
Centre Nacional de Microelectronica, Campus UAB
08193 Bellaterra, Barcelona, Spain
andreu.llobera@imb-cnm.csic.es
www.cnm.es

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IMB-CNM is the largest public microelectronics R&D centre in Spain. The National Microelectronics Center belongs to the Spanish National Research Council and its main activity is R&D in silicon-based micro- and nano-electronics. Founded in 1985, it is staffed by 220 people, about 65 of whom are researchers and about 60 Ph.D. students. The annual ordinary budget for 2010 was around 12 million € with income from external funding (contracted research and industrial projects) of around 42%. CNM is constituted by three Institutes: Instituto de Microelectrónica de Barcelona, IMB-CNM, Instituto de Microelectrónica de Madrid, IMM-CNM, and Instituto de Microelectrónica de Sevilla, IMSE-CNM.

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