Expert Opinion

Lab-on-a-Chip European Congress 2010

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On 25 and 26 May 2010, the fourth Lab-on-a-Chip European Congress took place in Dublin, Ireland. This article reviews some key presentations as well as the overall trends observed in the field of microfluidics as presented in this conference. While, as in most microfluidic conferences, no spectacular innovations have been presented indicating a certain maturing of the technology, the widening impact of microfluidics technology in a large variety of application fields can be observed. This was reflected in the multitude of applications presented covering fields as diverse as sport science, protein crystallisation, biosensors in a large variety, cell-based assays and point-of-care diagnostics.

Keywords: analytical chemistry, chip, Lab-on-a-Chip, microfluidics

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1. Introduction

The fourth Lab-on-a-Chip European Congress, after Edinburgh 2007, Barcelona 2008 and Stockholm 2009, took place on 25 and 26 May 2010 in Dublin, Ireland, co-located with the conferences 'Advances in Microarray Technology', 'Single Cell Analysis' and 'Advances in BioDetection Technologies'. As all these fields use overlapping technologies and address to a certain extent overlapping subjects, the conference could almost be looked at as a single conference on miniaturisation technologies for the life sciences with four parallel tracks. With a total of 72 oral presentations and 59 posters, embedded in a substantial industrial exhibition with 25 booths, complemented by two pre-conference short-courses on applications and fabrication technologies of microfluidics as well as lunch-time seminars from industrial participants, this event enabled the ~ 300 participants to gain a comprehensive overview on the current state of the field. This article highlights several talks from the Lab-on-a-Chip European Congress in addition to select examples relevant for the lab-on-a-chip community from other conferences.

2. Highlights

Fernando Benito-Lopez from the CLARITY Centre in Dublin, Ireland, presented a foil-based microfluidics-based patch for real-time monitoring of physiological parameters based on the analysis of sweat. The detection mechanism is based on pH-sensitive dyes which are incorporated in an ionogel matrix. The ionogel is a hybrid material fabricated from a hydrogel polymer and an ionic liquid. This allows for a high binding capacity of molecules (dyes or molecular capture probes) while allowing for a comparative ease in deposition. This class of material could, therefore, find potential use in a wide range of microfluidic-based applications.

Evangelos Gogolides and co-workers from the NCSR Institute of Microelectronics in Athens, Greece, reported on the microfabrication of TiO_2-ZrO_2 based microcolumns for affinity chromatography on a chip. They have demonstrated the manufacturing of microchannels in polymeric substrates using plasma etching [1]

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which generates a polymer surface with tunable surface roughness and a very high surface area. This polymer surface can then simply be dip-coated with a solution containing TiO_2-ZrO_2 which after a low temperature annealing process forms an affinity column. A successful separation of a complex casein tryptic digest mixture was demonstrated.

Nicole Pamme from the University of Hull, the UK, presented work on continuous flow processing in microfluidic devices using magnetic forces, opposed to the conventional batch processing frequently used in synthetic or analytical task on- or off-chip. The advantages are the feasibility of separating large sample volumes and a fast optimisation of separation conditions as well as the possible combination with downstream applications. Examples demonstrated are the sorting of magnetically labelled HeLa cells and macrophages, the size sorting and focusing of PS beads; the performance of sandwich assays is < 1 min [2].

Jon Cooper from Glasgow University, the UK, reported on the manipulation of liquids using surface acoustic waves (SAW). In contrast to the previously used methods, Cooper and co-workers used a microstructured superstrate on a piezoelectric substrate to control, mix and manipulate liquids with SAWs. Due to the high energy densities achievable with SAWs in liquid, the nebulisation of samples could be observed which allows the realisation of a very elegant sample interface into a mass spectrometer [3].

Dolores Martinez from the National Research Council of Canada, Ottawa, showed examples of planar patch-clamping chips and strategies for the micropatterning of cellular networks on chips [4]. The chemical patterning was achieved by chemical modification of SiN surfaces with poly-d-lysine transferred from PDMS stamps in order to promote adhesion and guidance of cryo-preserved primary rat cortical neurons. Neurons could thus be positioned and grown over microhole features which serve as patch-clamp interfaces with gigaseal performance on the chip. High quality electrophysiological data with low noise background could be recorded with the device.

Aran Mitchell from the Royal Melbourne Institute of Technology, Melbourne, Australia, presented work on a microfluidic platform which enables researchers to study the aggregation of platelets in blood vessels and their subsequent formation into a thrombus [5]. The microfluidic device mimics a microvessel with a constriction which induces dynamic mechanical stress in the platelets. Theoretical modelling of the hydrodynamic properties of the devices as well as experiments showed an accurate *in vivo* like behaviour of the platelets, making the device a useful tool to study platelet functionality for cardiovascular diseases as well as drug-related platelet responses.

3. Expert opinion

Microfluidics as a scientific discipline is now ~ 20 years old and still shows an exponential growth in the number of publications [6]. In addition, the commercialisation of analytical or diagnostic systems incorporating microfluidic functionality is now massively gaining speed [7,8]. This development of the field is also reflected in the evolution of the relevant scientific meetings. It can be observed that genuine innovations in the scientific work are becoming very rare compared to earlier years, indicating a certain maturing of the field. Instead, a broadening of methodologies, beginning with a sample preparation to detection methods and materials can be observed. Microfluidics as a science has reached a stage where the understanding of the physical phenomena has reached a very high level, as indicated in the reliability of the theoretical modelling and the evolution of microfluidic device design, as well as the widespread and increasingly commercial availability of the manufacturing technologies necessary for producing microfluidic devices. For this reason, spectacular breakthroughs and generic innovation are becoming scarce, a fact which once in a while is mourned by some academics but is in my opinion an universal indicator of the level of maturity of any given discipline. On the other hand, however, the number of applications of microfluidics in a very diverse range of disciplines is increasing and a growing number of groups are working on problems in their respective fields which would open pathways to the commercialisation of novel instruments or methods. It is the strong point of the Lab-on-a-Chip European Congress (and its global counterpart, the Lab-on-a-Chip World Congress, to be hosted next in San Diego on 28 and 29 September 2010) that this conference represents a good mixture of academic and commercially oriented work, having several speakers from industry as well as an excellent industrial exhibition which hosted most of the relevant players in the microfluidics business community. By co-hosting this conference with the conferences 'Advances in Microarray Technology', 'Single Cell Analysis' and 'Advances in BioDetection Technologies', it allowed the participants to widen their focus to neighbouring application fields with relevance to the microfluidic community, through talks such as 'Two Novel Platforms For Single Cell Proteomics: Label-Free Optical Analogues of 2DNMR and Microfluidic Chips Incorporating Single Molecule Readout' by David Klug, Imperial College or 'Approaches to Life Detection, Quantification and Characterisation in Remote and Extreme Environments' by David Cullen, Cranfield University. The fact that the number of participants has been steady compared to the last 2 years, despite the current budget situation, indicates that the conference fills a relevant niche in the event landscape, largely by its unique integrative approach bringing participants from academia and industry together to help bridge the gap between these communities. It can only be hoped that this successful concept will be continued in the years to come and acts as a model for other microfluidics-centred events.

Declaration of interest

The author is an employee of microfluidic ChipShop GmbH.

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