

## Preface to Special Topic: Invited Papers from the 2009 Conference on Advances in Microfluidics and Nanofluidics, The Hong Kong University of Science & Technology, Hong Kong, 2009

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The inaugural conference on Advances in Microfluidics and Nanofluidics was aimed at gathering a core group of researchers across a variety of disciplines working in microfluidic and nanofluidic science and engineering with a specific emphasis on activities in the Pacific Rim, particularly given the exponential growth in this research area in Asia in the past decade, driven by significant funding initiatives and the expected growth of a large biotechnology industry within the region. In particular, the objective of the conference was to provide a forum for researchers in this interdisciplinary subject area to disseminate recent theoretical/methodological developments and technological applications, as well as to provide a platform for fostering closer networks and collaborative ties.

The conference, held on 5–7 January 2009 on the picturesque campus of the Hong Kong University of Science and Technology overlooking Causeway Bay, was supported by the various institutes and schools associated with the university, namely, the Institute for Advanced Study, the Institute of Complex Adaptive Matter, the Institute of Integrated Micro Systems, the William Mong Institute of Nano Science and Technology, the Department of Physics, and the School of Science.

The conference consisted of over 130 delegates from across the globe (Fig. 1), including China, Taiwan, Japan, Korea, Singapore, India, the USA, UK, France, The Netherlands, Belgium, Sweden, Australia, and New Zealand, with a third of these made up by postgraduate and a few undergraduate students. The conference was noticeably interdisciplinary in nature, with participants from chemical, mechanical, electrical and biomedical engineering, chemistry, physics, materials science, and applied mathematics.

In total, five sessions comprising 29 invited lectures, 22 contributed talks, and 32 poster presentations were held (Fig. 2). The invited speakers comprised of eminent leaders in the field such as Professor Robert Austin (Princeton University), Professor Paul Bohn (University of Notre Dame), Professor Hsueh-Chia Chang (University of Notre Dame), Professor Chih-Ming Ho (University of California, Los Angeles), Professor Frieder Mugele (University of Twente), Professor Ping Sheng (Hong Kong University of Science and Technology), Professor Patrick Tabeling (Ecole Supérieur de Physique et de Chimie Industrielles, Paris), Professor David Weitz (Harvard University), and Professor Jackie Ying (Institute of Bioengineering and Nanotechnology, Singapore), in addition to prominent younger researchers.

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FIG. 1. Group photograph of the conference delegates.



FIG. 2. Conference delegates during one of the talks.



FIG. 3. Poster session.



FIG. 4. Banquet dinner.

The talks generally fell within three broad themes: Fundamentals of microfluidic science, fundamentals of nanofluidic science, and microfluidic and nanofluidic applications (Figs. 3–5). Lectures devoted to the fundamentals of microfluidics primarily consisted of electrokinetically driven microfluidic transport (actuation and mixing) and manipulation (separation and detection) including electroosmotic flows, electrophoresis, dielectrophoresis, electrowetting, and electrorheo-



FIG. 5. AIP representatives at the conference.

logical fluids, although other novel mechanisms, such as a unique deterministic ratcheting scheme for microfluidic flow fractionation and particle separation, optical manipulation and trapping, and the use of surface acoustic waves to drive ultrafast microfluidic actuation and complex dynamic pattern formation, were also covered. Another recurrent area of research which featured prominently in the talks was the patterning and modification of surfaces and interface, droplet formation and transport, and investigations on wetting and contact line dynamics, given the obvious importance of surfaces and interfaces in microfluidic phenomena.

The large number of talks under the fundamentals of nanofluidics theme reflects the noticeable shift in the attention toward solving important problems at the nanoscale. In particular, electrokinetic transport and gating, enzymatic catalysis, and molecular confinement in nanochannels comprised the overarching topics in this theme. These talks highlight the possibility for a wide range of nanofluidic applications such as molecular sieving, DNA stretching, and biomolecule preconcentration for signal enhancement, amongst others. A side workshop dedicated to exploring fundamental problems in nanofluidics was also held, which covered theoretical analysis and numerical simulations of flow through nanotubes and DNA conformation in confined systems.

The talks on microfluidic and nanofluidic applications largely addressed control, fabrication, and integration issues associated with chip-scale devices for a wide variety of biological applications. There were, in particular, several talks on droplet microfluidics for high throughput genetic screening, flow assisted cell sorting, and polymerosome encapsulation for controlled release drug delivery, as well as integrated microscale devices for immunodiagnosics, guided DNA assembly, gene delivery, and biomaterials synthesis, etc.

Seven perspectives and feature articles by a cross section of the invited speakers covering a wide range of topics including nanoscale electrokinetics, surface acoustic wave microfluidics, nanopore transport, microfluidic analysis of cell mechanics, dielectrophoretic force spectroscopy, and integrated chip-scale device fabrication, appear in the current issue of the journal.<sup>1-7</sup> In addition, a further selection of invited and contributed lectures will be published in a subsequent issue.

The overwhelming success of the conference and the encouraging feedback received from the delegates has motivated the planning of subsequent meetings for the future, which will constitute a series of regular gatherings that we believe will be an effective platform for the dissemination of continued advances and the stimulation of further developments in microfluidic and nanofluidic science and engineering, as well as for the cultivation of close collaboration and cooperative networks.

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