Advances in Microfluidics and Nanofluidics

5–7 January 2009
Hong Kong

The first conference on Advances in Microfluidics and Nanofluidics, held at the Hong Kong University of Science & Technology, was aimed at gathering a core group of researchers across a variety of disciplines working in micro/nanofluidic science and engineering. Specifically, the objective of the conference was to provide a forum for researchers in this interdisciplinary subject area to disseminate recent theoretical developments and technological applications as well as a platform for fostering closer networks and collaborative ties.

Despite the particular emphasis on activities in the Pacific Rim, given the exponential growth in this research area in Asia in the past decade, which has largely been driven by significant funding initiatives and the expectation that a large biotechnology industry will be spawned in the region, the conference retained an international flavour. There were over 130 participants from around the world (China, Taiwan, Japan, Korea, Singapore, India, USA, UK, France, the Netherlands, Belgium, Sweden, Australia, and New Zealand, amongst others). A third of this number comprised postgraduate and undergraduate students. Of note was the interdisciplinary nature of the meeting, with delegates from physics, chemistry, applied mathematics, materials science and all main branches of engineering. There were in total five sessions, made up of 29 invited lectures, 22 contributed talks and 32 poster presentations. A workshop on fundamental problems in nanofluidics was also held, chaired by Professor Robert Austin (Princeton University). The talks were centered around three main topics, namely, fundamentals in microfluidics, fundamentals in nanofluidics, and their applications particularly in biological engineering.

Many of the lectures on the fundamentals of microfluidics focused on electrokinetically-driven microfluidic transport and manipulation (electroosmotic flow, electrophoresis, dielectrophoresis, electrowetting, and electrorheological 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 discussed. Another area of research which featured prominently in the fundamental microfluidics theme was surface patterning and modification, droplet formation and transport, and investigations on wetting and contact line dynamics, given their importance in microfluidic phenomena.

The talks on fundamentals of nanofluidics were centered around recurrent themes of electrokinetic transport and molecular confinement in nanochannels reflecting the importance of these problems in nanoscale fluid transport. These talks also highlighted the possibility for a wide range of nanofluidic applications such as molecular siev-

Figure 1:
Delegates at the Advances in Microfluidics and Nanofluidics Conference in Hong Kong.

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ing, DNA stretching, biomolecule preconcentration for signal enhancement, and enzymatic catalysis, amongst others. The side workshop on fundamental problems in nanofluidics, on the other hand, covered theoretical analysis and numerical simulations of flow through nanotubes and DNA conformation in confined systems. The talks on microfluidic and nanofluidic applications largely dealt with fabrication, control and integration issues associated with lab-on-a-chip devices for a variety of 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 miniaturized devices for immunodiagnostics, guided DNA assembly, gene delivery, and biomaterials synthesis, etc. Perspectives and feature articles by several invited speakers covering nanoscale electrokinetics, surface acoustic wave microfluidics, nanopore transport, microfluidic analysis of cell mechanics, dielectrophoretic force spectroscopy and intregrated chip-scale device fabrication have already appeared in a special issue of Biomicrofluidics (American Institute of Physics) [1–7], which is the official journal of the conference. A further selection of invited and contributed lectures will be published in a second special issue.

Sponsorship of the meeting was kindly provided by 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, which are associated institutes and schools of the Hong Kong University of Science & Technology. Given the encouraging feedback from the participants, the overwhelming success of the conference and the encouraging feedback received from the delegates, we plan to organize subsequent meetings in the future, which is to constitute a series of regular gatherings that we believe will be effective for the dissemination of continued advances and the stimulation of further developments in microfluidic and nanofluidic science and engineering, in addition to fostering closer collaboration.

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