Special issue on Cell and Tissue Engineering in Microsystems

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Eight years ago, we co-authored a review entitled 'Tissue Engineering at the Microscale.' At the time, we were fresh assistant professors, unburdened by the experience and wisdom that had been developed in the field. For better or for worse, what we outlined at the time was a synergy between the length scales accessible to microtechnology and the fundamental length scales in tissue biology: the cellular microenvironment of 1–10 microns that dictates cell function, the 10–100 micron scale needed to control multicellular interactions, and the 100–1000 micron scale required to construct the essential functional units of tissue. This range of features can now be accessed both with traditional silicon photolithography as well as emerging non-traditional materials and tools such as plastics, milling, and the like. Even the 'interconnect' problem inherent in spanning multiple length scales has seen technological progress, providing new approaches to the challenges of building hierarchical biological systems.

As we have watched the community evolve over the last few years, the landscape has been highly dynamic—the tissue engineering 'bubble' with several high-profile failed ventures, the international debate on stem cells and the realization that tissue engineering would be a necessary part of any clinical implementation that might come to pass, and—in parallel—challenges in the MEMS landscape with the downsizing of optical telecommunications and repositioning of prominent microfluidics ventures. In our view the parallel and simultaneous difficulties in commercialization of BioMEMS and Tissue Engineering has led to a 'sweet spot' in time. In the last 5 years, both communities have had to grapple with products that were technology-driven rather than market-driven. And both communities have had to reconsider which applications are the low-hanging fruit and which represent the truly disruptive opportunities. This special issue of *Lab on a Chip* reflects what we see as a growing trend that has come out of this 'regrouping': to capture the capabilities that have been well-developed in microtechnology by integration with critical problems in tissue engineering, and more broadly the use of mammalian cells in human health.

For example, in this issue we find several themes emerging: fabrication of templates to control cell adhesion and ultimately their fate (Piel *et al.*, Desai *et al.*,), the use of microfluidics to manipulate cells, perfuse the tissue, and observe cellular responses (Shuler *et al.*, Bashir *et al.*, Voldmann, Yu *et al.*, Cooper *et al.*, Thorsen *et al.*, Beebe *et al.*), tools for the fabrication of three-dimensional multicellular tissues (Bhatia *et al.*, Golden and Tien, Gottwald *et al.*, Khademhosseini *et al.*), and techniques to improve the potential to generate differentiated progeny from stem cells (Vunjak-Novakovic and Langer *et al.*, Khademhosseini and Langer *et al.*, Takayama *et al.*)

Looking back, we now see that several areas have matured as we had hoped while others have not yet come to fruition. Some areas that were unanticipated hold enormous potential such as chip technologies for the developing world. We invite you to share the work of our colleagues in this special issue and hope that you recognize it as just a glimpse of exciting things to come.

Sangeeta N. Bhatia
Massachusetts Institute of Technology, USA
Christopher Chen
University of Pennsylvania, USA

