Introduction to the Mechanisms of Directed Cell Migration themed issue

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We are pleased to present a themed issue of Integrative Biology on “Mechanisms of Directed Cell Migration”. The original idea for this special issue arose at the Gordon conference on “Gradient sensing and directed cell migration” in Galveston, TX in 2009. We were struck by the significant penetration technology has made in the “chemotaxis” field or more broadly into inquiries aimed at understanding the mechanisms of directed cell migration. The integration of technology and biology has matured further here than in many other areas of biological study—thus, Integrative Biology seemed the perfect home for a special issue on this topic. We are pleased to present thirteen papers that represent a broad spectrum of technology and biology from some of the top labs in the field. The contributions include five reviews, two technical innovations and six articles. The issue covers more traditional topics and examples including studies involving neutrophil (Berthier et al. DOI: 10.1039/c0ib00030b, Ambravaneswaran et al. DOI: 10.1039/c0ib00011f) and Dictyostelium (Janetopoulos et al. DOI: 10.1039/c0ib00033g) chemotaxis. These papers are complemented by two modeling papers including a review of tools for analyzing cell shape (Xiong et al. DOI: 10.1039/c0ib00036a) and a model for the evolving cell membrane (Neilson et al. DOI: 10.1039/c0ib00047g). Other papers explore more emerging topics related to non-leukocyte and amoeboid migration. There are two critical reviews focused on mechano-biology and amoeboid migration research was facilitated by an 5 year NIH “retraining” award in cancer biology.

David J. Beebe is a Professor and Associate Chair for Research and Faculty Development in the Department of Biomedical Engineering at the University of Wisconsin-Madison. He is also a member of the UW Comprehensive Cancer Center and the Wisconsin Institutes for Medical Research. He is the recipient of the IEEE EMBS Early Career Achievement Award, the Lab on a Chip, Royal Society of Chemistry/Corning, Pioneers of Miniaturization Prize, the Romnes Award at UW-Madison and is a Fellow of the American Institute for Medical and Biological Engineering. He has also served as an Associate Editor for Journal of MicroElectroMechanical Systems, the Journal of Biomechanical Engineering, Lab on a Chip, and was a founding Scientific Editor of Integrative Biology. Prof. Beebe is also the co-founder of three biotechnology companies and an inventor on 20 issued patents. Past research topics have included development of non-traditional autonomous microfluidic devices and systems, and the study of cell and embryo development in microenvironments. David’s current interests center around the creation and use of microfluidic tools to understand cancer biology and improve cancer diagnosis and monitoring. His migration to more biological focused research was facilitated by an 5 year NIH “retraining” award in cancer biology.

Anna Huttenlocher is a Professor in the Departments of Medical Microbiology and Immunology and Pediatrics at the University of Wisconsin-Madison. She is a physician scientist who sees patients with autoimmune disease and primary immunodeficiency disorders. She is Director of Pediatric Rheumatology and Associate Director of the Medical scientist Physician training program (MSTP) at the University of Wisconsin-Madison. She is also a member of the UW Comprehensive Cancer Center, Biotechnology Training Program, Cell and Molecular Biology program, Molecular and Cellular Pharmacology and Cancer Biology programs. She is the recent recipient of the APS Norman J. Siegel Outstanding Science Award, the Romnes Award at UW-Madison, has membership in the American Society of Clinical Investigation, membership on the Journal of Cell Biology Editorial Board and Chair of the 2009 Gordon conference focused on gradient sensing and directed cell migration. Dr. Huttenlocher’s research focuses on understanding the basic molecular mechanisms that regulate directed migration of cancer cells and the chemotaxis of leukocytes using both in vitro and in vivo model systems with zebrafish.
(Guck et al. DOI: 10.1039/c0ib00050g) and collective cell migration (Khalil et al. DOI: 10.1039/c0ib00052c). Two additional critical reviews survey the application of microfluidics to the study of directed cell migration (Kim et al. DOI: 10.1039/c0ib00055h, Ahmed et al. DOI: 10.1039/c0ib00049c). These are complemented with two technical innovations pointing towards technology for in vivo studies (Raja et al. DOI: 10.1039/c0ib00044b) and improved methods for studying axon guidance (Folch et al. DOI: 10.1039/c0ib00038h). Finally, the role of chemotaxis in cancer is examined (Torisawa et al. DOI: 10.1039/c0ib00041h). The papers in this issue highlight advances in technology that allow investigators to address fundamental questions about directed migration that provide insight into basic mechanisms and provide tools for drug discovery and clinical intervention.

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