Encyclopedia of Microfluidics and Nanofluidics

Dongqing Li
Editor-in-Chief

Encyclopedia of Microfluidics and Nanofluidics

Second Edition

With 2200 Figures and 175 Tables

Springer Reference

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Preface to the Second Edition

Microfluidics, nanofluidics, and lab-on-a-chip are among the most rapidly growing fields of scientific research and technology development. In order to meet the needs of research and technology development and to provide a single reference resource with updated reviews and overviews of various directions of microfluidics, nanofluidics, and lab-on-a-chip, the first edition of the *Encyclopedia of Microfluidics and Nanofluidics* was published in 2008. This first edition has been considered as a most valuable reference and highly appreciated by the community over the past several years. In order to keep the information up to date and to add coverage to newly developing areas, we are very pleased to present to you the second edition of the Encyclopedia.

This new edition of the Encyclopedia includes the updated entries of the first edition that cover leading-edge research. Furthermore, this new edition of the Encyclopedia includes over 80 new entries to cover new topics in microfluidics, nanofluidics, and lab-on-chip technology, for example, energy conversion and material synthesis using micro-/nanofluidics, and microfluidic chips made of paper and fabric. The entries are organized around four types – fundamentals, theoretical models and numerical simulations, experimental techniques, and applications and devices. These carefully selected contributions are written by well-known experts in microfluidics and nanofluidics and are reviewed by the editorial board and section editors consisting of internationally leading scientists in these fields.

I would like to thank and congratulate all the contributing authors. Through this Encyclopedia, you have made a great contribution to these fields. I would like to give my sincere thanks to all the section editors for reviewing and editing so many manuscripts to ensure the highest quality. Finally, my great appreciation goes to the colleagues at Springer, Lydia Mueller, Sunali Mull, and Audrey Wong; their persistent efforts and hard work ensured the completion of this Encyclopedia.

Waterloo, Canada
December 2014

Dongqing Li
Editor-in-Chief

Preface to the First Edition

Microfluidics and nanofluidics are among the most rapidly growing fields of scientific research and technology development. Over the past 15 years, research activities in these fields have been increasing exponentially, as evidenced by the number of published papers in the literature. Microfluidics and nanofluidics not only bring exciting opportunities to study the new phenomena unique to these small scales but also enable the development of many new and high-impact technologies from the handheld biomedical laboratory (lab-on-a-chip) to the detection and manipulation of single molecules. While these exciting and interdisciplinary research fields attract more and more researchers, one major challenge is the lack of a single reference resource providing up-to-date reviews and overviews of various directions in the field of microfluidics and nanofluidics. This is the motivation behind the development of the *Encyclopedia of Microfluidics and Nanofluidics*. As a comprehensive resource, no single review paper or several books focused on specific topics can replace the role of an Encyclopedia.

This is the first *Encyclopedia of Microfluidics and Nanofluidics* for the scientific community. It covers the fundamentals, latest developments, and cutting-edge experimental techniques including electrical double layers, optofluidics, DNA lab-on-a-chip, nanosensors, and much more. The high technical quality of the Encyclopedia has been ensured by our International Editorial Board, consisting of leading scientists in these fields and over 250 experts in microfluidics and nanofluidics. The carefully selected entries deliver relevant and comprehensive information and are fully illustrated with thousands of diagrams, photos, and line arts, many in full color.

The Encyclopedia provides basic information on all fundamental and applied aspects of microfluidics and nanofluidics by covering two decades of research. It is the only scientific work of its kind in the field of microfluidics and nanofluidics, bringing together core knowledge and the very latest advances. Written for a wide audience with different levels of experience, it provides valuable information to graduate students and scientists who may be new to these fields of microfluidics and nanofluidics, while providing up-to-date information to active scientists and experts in the field. This outstanding encyclopedia is an indispensable source for research professionals, technology investors, and developers seeking the most up-to-date information on microfluidics and nanofluidics among a wide range of disciplines from science to engineering to medicine.

It took 2 years of hard work of many people for this Encyclopedia to come to light. I would like to give my sincere thanks to the Editorial Board members and many specially invited experts for helping me to review so many manuscripts to ensure the highest quality. I would like to thank and congratulate all the contributing authors. This is your Encyclopedia, and you made the great contribution to these fields. Finally, my heartfelt appreciation goes to the colleagues at Springer, Steven Elliot, Oona Schmid, Sylvia Blago, and Simone Giesler-Güllich; without their persistent efforts and hard work every day, it would not have been possible to complete this Encyclopedia.

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Dr. Dongqing Li was a professor at the University of Alberta, Canada (1993–2000), a professor at the University of Toronto, Canada (2000–2005), the H. Fort Flowers Chair Professor at Vanderbilt University, USA (2005–2008), and the Canada Research Chair in Microfluidics and Nanofluidic (2008–2013). He is currently a professor at the University of Waterloo, Canada. Dr. Li's research is in the areas of electrokinetic microfluidics and lab-on-a-chip technology. Dr. Li has published 260 papers in international journals, over 100 papers in conference proceedings, 31 book chapters, and 3 books. He founded an international journal, *Microfluidics and Nanofluidics*, and served as its editor-in-chief from 2004 to 2012.

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