Preface

Microfluidics is the fine art of creation and manipulation of small portions of fluids, often realized by flow within small, sub-millimeter-scale channels. These small dimensions allow the fluid flow to be controlled with exquisite precision, thereby paving a path for use of microfluidics as a fundament for a multitude of applications in the analytical and preparative sciences, covering a whole alphabet of fields: analytics, biophysics, chemical engineering, diagnostics, and so on. Further use of this method in the realm beyond academic research, such as that of commercial fine-chemical production, sensor development, or encapsulation of active substances, is presently being explored. Microfluidics, though, is a demanding field and working area that requires both profound theoretical understanding and experimental skills. As there is no standard in education and training on this method in many fields of study that actually can benefit most from this technique, we reasoned that an introductory textbook might be helpful. This is what the present book is about. It addresses late-stage students or early-stage researchers, typically at the transition from university studies to PhD research, in fields such as biotechnology, cell biology, chemistry, or chemical engineering. Its prime target is to serve beginners, people who may have read papers or listened to talks highlighting the benefits of microfluidics and now desire (or have been told by their advisors) to apply this method to their own research. The present textbook is targeted at helping these people by introducing the basic physics and working principles of the method, along with introducing its practical implementation. We, the authors, both trained as chemists and specialized in the discipline of polymer science, have gained most of the knowledge laid down in this book by self-experience and by training from colleagues during the times of our PhD and postdoctoral research at Harvard University in the group of David A. Weitz (further refined by additional research with Wilhelm T. S. Huck at Radboud University Nijmegen for J. Thiele). We would like to express our gratitude to our main teachers on microfluidics during these times, who were Adam R. Abate, Mark B. Romanowsky, and Thomas Pfohl (formerly at MPI for Dynamics and Self Organization).

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