

Preface

Microfluidics has revolutionized the way we deal with biological samples and biological matrix. It has enabled us to understand how a single cell is completely different from the information we can obtain by current tools and techniques. It is because of the microfluidic technology we are able to study physiology of a single cell and to understand the heterogeneity in the cellular population of the same descent. This is just one example of how microfluidics has changed the way we perceive biological information. This technology has enormous applications in every field of life sciences, from basics to industrial to diagnostics. However, there is a big communication gap between biologists and microtechnologists, which is due to a lack of training in the fields other than theirs.

In the first chapter of this book, we have presented the fundamentals of physics that govern microfluidics. These principles are presented in such a way that biologists can easily understand what controls the fluidics and how to use those for studying biological phenomenon. The second chapter of this book is dedicated to acquaint biologists with an overview of tools, techniques, and applications of microfluidics. The following chapters will cover manufacturing methods for developing custom microfluidic tools including 3D printing. Valving for controlling fluids in fluidic tools is also explained. Surfaces, sensors, and their integration are described such that the layman can understand the concepts. In the following chapters, the application of microfluidics in the field of cell and molecular biology, single cell biology, and disease diagnostics are introduced with simplicity. All these chapters are discussed in relation to commercial technologies so biologists can better correlate functioning of these tools with applications they desire to employ. This book is an attempt to describe the need of novel microtechnologies and their integration strategies for developing a new class of assay systems to retrieve the desired health information of patients in real time. This book also describes the selection and integration of sensor components and of operational parameters for developing point-of-care (POC). System-on-a-Chip (SoC), Diagnostic-on-a-Chip (DoC), and Lab-on-a-Chip (LOC) are the core to the next-generation bioanalytical sciences; therefore, this book can be lab assistance for those who work with

biology-microfluidics interface, thus helping them to understand these systems and allowing them to make educated decisions on selecting the nature and type of microtechnologies that suits best to their methods thereby enhancing the rate of translational research in the field.

Salient Features of This Book

- This book serves as a resource guide for biologists and chemists to understand the complex physics of microfluidics.
- Describes the preparatory methods for developing 3-dimensional microfluidic structure and their use for LOC designing.
- Explains the significance of miniaturization and integration of sensing components to develop wearable sensors for POC.
- Demonstrates the application of microfluidics in life sciences and analytical chemistry including disease diagnostics and separations.
- Motivates new ideas related to novel platforms, valving technology, miniaturized transduction methods, and device integration to develop next-generation sequencing platforms, future diagnostic systems, and platforms for single cell biology applications.
- Discusses the future prospects and challenges of the field of microfluidics in the areas of life.

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