# Preface

Microchip capillary electrophoresis emerged as an important new analytical technique in the early 1990s out of the pioneering work of a group of dedicated scientists at Ciba Geigy. This new technique was a result of the marriage of the ability of conventional capillary electrophoresis to analyze ultrasmall volumes (nL) and microfabrication techniques perfected in the semiconductor industry to produce very small structures in silicon. The resulting technology holds significant promise to improve our ability for analysis of biological systems because it can handle objects as small or smaller than a single cell, integrate such sample processing steps as filtration and the polymerase chain reaction, and generate answers in seconds or minutes compared with the hours used for many traditional techniques. The goal of this volume of Humana's series *Methods in Molecular Biology*™ is to provide the reader an overview of the methods currently in place for microchip capillary electrophoresis, as well as to provide useful practical information on how to get started in the field.

The text of *Microchip Capillary Electrophoresis* is divided into four sections. Part I deals with fabrication methods for the production of microchips because this is fundamental to the ability to use the technology. The chapters are divided based on the substrate material and include glass (Chapter 2), poly-(dimethylsiloxane) (Chapter 3), and other polymers including poly-methylmethacrylate (Chapter 4). The information provided in these chapters should be suitable for even the novice to produce simple microchips for standard separations. Part II discusses methods to control the surface chemistry and measure the resulting alterations in microfluidic devices. Surface chemistry plays an important role in systems at this scale and must be carefully considered for optimal operation. Chapter 5 provides a general overview of several methods of both adsorbed and covalent surface modification. Chapter 6 provides more detail on a simple, yet effective, adsorbed coating system. Part III describes different detection modes for microchip capillary electrophoresis with detail provided for mass spectrometry (Chapter 7), electrochemistry (Chapter 8), and finally conductivity (Chapter 9). The last section of this book outlines applications of microchip capillary electrophoresis for biological analysis. Chapters 10–12 deal with the analysis of DNA, proteins, and peptides, respectively. Chapter 13 discusses techniques for measuring the impact of surface modification on flow in microfluidic channels. Chapter 14 discusses single cell analysis. The last chapter (Chapter 15) is a forward-looking review of the integration of the polymerase chain reaction into a capillary electrophoresis microchip, part of the next generation of a technology that is focused on the eventual integration of all laboratory functions in a single device.

*Microchip Capillary Electrophoresis* is intended to be both a practical guide for those interested in using this exciting new technology in their own research, as well as an important source of fundamental information detailing how the technique works at the molecular scale. As such, our book is not meant to be an all inclusive, exhaustive text on every aspect of microchip capillary electrophoresis. Readers are encouraged to use the book as the reference guide it was intended to be, and then move on to seek current literature in this rapidly evolving field for applications more specific to their work.

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***Charles S. Henry***