

Preface

Chemical cytometry has grown into a mature field after decades of development. Although the exact definition of chemical cytometry varies among different researchers, most chemical cytometry studies involve breaching the cell membrane for probing intracellular molecules. As one will find from this book, chemical cytometry and related methods have provided a powerful set of tools that can be used to tackle diverse problems over a wide range of topics. Chemical analysis of cells at the single-cell level provides several distinct advantages: first, it allows probing the heterogeneity of a cell population; second, it is possible to look into the functions/behaviors of a cell or a subcellular component as a biological unit; third, the sensitivity permits investigation of scarce biological samples such as those derived from primary materials. The state-of-the-art sensors provide the capability for examining single cells by optical, electronic, and other spectroscopic means. However, when a single-cell study is conceived, both the feasibility and the necessity need to be intensively debated: Is the molecule of interest abundant enough for the detection method of choice? Will the single-cell data yield unique information that is not available from bulk studies? Is heterogeneity in the cell population expected? How many cells need to be examined in order to generate conclusions with statistical significance for the population?

The goal of this book is to provide a survey of the field of chemical cytometry and single-cell analysis. It covers important topics such as analysis of proteins and nucleic acids from single cells, common approaches such as capillary electrophoresis and microfluidics, and widely-used detection methods such as optical, electrochemical, and mass spectrometric tools. The collection does not mean to be exhaustive. The hope is that, by knowing the works by some of the best researchers in the field and understanding the rationale behind them, scientists can assess the potential utility of chemical cytometry approach in their own work.

I would like to express my gratitude to all the authors who contributed to the book, and to Frank Weinreich and Heike Noethe at Wiley-VCH for their assistance.

West Lafayette, Indiana, November 2009

Chang Lu