Preface

This book is an introduction to the new field of proteomics. It is intended to describe how proteins and proteomes can be analyzed and studied. Despite widespread, growing interest in proteomics, an understanding of proteomics tools and technologies is only slowly penetrating the research community at large. This book addresses the need to introduce biologists to new tools and approaches, and is for both students of biology and experienced, practicing biologists. Anyone who has taken a graduate level biochemistry course should be able to take from this book a reasonable understanding of what proteomics is all about and how it is practiced. The experienced biologist should encounter much here that is familiar, but refocused to facilitate studies of the proteome.

The achievement of long-sought milestones in genome sequencing, analytical instrumentation, computing power, and user-friendly software tools has irrevocably changed the practice of biology. After years of studying the individual components of living systems, we can now study the systems themselves in comprehensive scope and in exquisite molecular detail. We therefore face the tasks of effectively employing new technologies, of dealing with mountains of data, and, most important, of adjusting our thinking to understand complex systems as opposed to their individual components.

Introduction to Proteomics: Tools for the New Biology had its origins in a short course on peptide sequencing by mass spectrometry, which was taught by Dr. Donald F. Hunt at the 1998 Association of Biomedical Resource Facilities meeting in Durham, North Carolina. At that time, my colleague Dr. Tom McClure and I were establishing a new proteomics facility in the Center for Toxicology and the Arizona Cancer Center at the University of Arizona. Tom attended the Hunt course and, upon his return, taught the material to a handful of us. We subsequently put together a four-day workshop on mass spectrometry and proteomics, which we taught to 50 participants at the University of Arizona in August, 1999. The participants included graduate students, laboratory staff, and faculty. The enthusiastic response to this workshop reflected the need for some accessible means of introducing scientists to the new

techniques of proteomics and their potential applications in research. That experience provided the impetus for this book.

This is a book for beginners. My goal here is to familiarize the inexperienced reader with the important tools and applications of proteomics. Thus the description of certain instrumentation and applications is not highly rigorous. This book is not intended to be a laboratory manual or a compilation of the latest techniques. There are several excellent volumes available that provide more detailed descriptions of protein analytical techniques, mass spectrometry instrumentation and techniques, and applications of these technologies. The evolution of methods and applications in this area is now so rapid that no book really could be truly up-to-date. What is exciting about my experience in introducing proteomics to colleagues has been the creativity with which they then apply these tools. Ultimately, the exciting potential of proteomics rests with those who can put new technologies to work to address important questions.

I have divided the book into three parts. Part I introduces the subject of proteomics, describes its place in the new biology, and examines the nature of proteomes. Part II introduces the tools of proteomics research and explains how they work. Part III explains how these tools are integrated to solve different types of problems in biology.

I would like to thank Jeanne Burr, Laura Tiscareno, Julie Jones, Dan Mason, Beau Hansen, Hamid Badghisi, Linda Manza, Richard Vaillancourt, Tom McClure, Arpad Somogyi, and George Tsaprailis, who provided valuable suggestions, read and commented on several drafts of book chapters and provided sample data for some of the illustrations. I thank Elizabeth Hedger for excellent secretarial assistance. Finally, I thank my wife Karen and my son Andrew for their patience with me every time I went off with my laptop to write.

Daniel C. Liebler, PhD