Preface

Biotechnology has become the catchword in the life sciences over the past several years. Universities and state governments are setting up biotechnology centers; there are biotechnology companies, as well as biotechnology divisions of major pharmaceutical companies. The most tangible products of biotechnology are proteins. Several proteins produced by recombinant DNA technology, such as interferon, growth hormone, and tissue plasminogen activator (TPA), are already being marketed for human therapeutic applications. It is expected that proteins will eventually constitute a major class of pharmaceutical products.

The purpose of this volume is to fill an educational gap concerning a fundamental understanding of proteins and their place in the current era of biotechnology. Although there are a number of books on the subject of proteins, they tend to be highly technical and geared toward the practicing protein chemist. Biochemistry textbooks are too focused on basic principles. Each chapter in this volume was written by a scientist whose work is directly relevant to that topic. Their mission was to (1) present the fundamental principles, (2) provide an overview, and (3) explain the practical implications in the context of biotechnology.

Chapter 1 is written by Sidney Udenfriend, an eminent scientist who, over four decades, has made important contributions to analytical biochemistry. His historical perspective illustrates the remarkable progress made in protein research.

Russ Lehrman, in Chapter 2, presents the fundamentals of protein structure. He covers the properties of the amino acid subunits and how they are arranged in proteins, from primary to quaternary level structure. Various methods of depicting three-dimensional protein structures are provided, as representative of illustrations found in the scientific literature.

The fundamental principles of protein biosynthesis are presented in Chapter 3. The individual steps of this process are detailed, from the organization of the genetic information to posttranslational modifications of the assembled protein. A discussion of considerations relevant to the production of recombinant proteins is included.

Considering the importance of separation techniques to virtually all aspects of protein purification and analysis, Chapter 4 describes principles and practices of liquid chromatography and electrophoresis. This prepares readers for the subject matter in some of the later chapters. Jodi Fausnaugh incorporates illustrations typical of those found in protein research.

In Chapter 5, Milton Hearn describes proteins from a functional viewpoint. Besides their role as structural components of cells and tissues, proteins as effectors of biological activity can be divided into six major groups. Details are given on the molecular events that lead to the observed physiological phenomena.

Chapter 6 presents the challenge of isolating new active proteins from biological sources. This process is documented using two examples from the author's personal experience. The complexities and surprises of natural systems are exemplified with the interferon and enkephalin families of proteins.

Chapter 7 elaborates on the interferon story depicted in the preceding chapters. Fazal Khan describes the isolation process for a recombinant human interferon. Production of clinical supplies of this rare natural protein represents a hallmark achievement in biotechnology.

Another example of recombinant DNA methodology is given in Chapter 8 by Barry Jones, who presents a mixture of genetic engineering, enzymology and synthetic chemistry to overcome technological barriers to the production of the peptide hormone, calcitonin.

Chapter 9 is a presentation of the approaches and techniques used for determination of primary structure. These principles are applicable to both natural proteins isolated in trace amounts, as well as to recombinant proteins produced in copious amounts. The analysis of a protein produced by recombinant DNA technology illustrates some concerns of the biotechnology industry.

As opposed to protein biosynthesis, chemical synthesis is often the method of choice for peptides smaller than 50 residues. Chet Meyers reviews the history and methodology of solid phase peptide synthesis in Chapter 10. Also discussed is the use of small peptides for clinical as well as research purposes, especially with regard to analogs having unusual modifications.

In Chapter 11, Sidney Pestka provides an overview of the application of recombinant DNA technology. The essential techniques used in cloning genes for specific proteins are explained. The author uses his own research experience on interferon to illustrate this technology.

In the final chapter, Jim Bausch is concerned with monoclonal antibodies. This type of protein deserves special attention, considering its unique characteristics and wide range of medical and research applications.

The content, style, and technical level of this volume are aimed at a more general audience. It is not intended to be a cookbook of procedures or an in-depth study on any particular subject, but is designed to provide a solid foundation for understanding proteins in their various aspects. Individuals in the pharmaceutical industry are considered to constitute a major segment of the readership. This volume may also be a useful textbook for an advanced biochemistry course. The editor and authors hope that they have fulfilled their objectives in an informative and enjoyable format.

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