

BASIC MOLECULAR BIOLOGY

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Preface

This is an introductory textbook in molecular biology. It is based on the one-semester course that I teach at the State University College at Buffalo, New York, where it is offered as an elective subject for undergraduate students majoring in biology. This does not mean that the book is directed toward any particular college or university level; it is suitable for freshmen with a good background in general biology and chemistry. In compiling the text, I have assumed that anyone wishing to acquire a knowledge of molecular biology will have already studied general chemistry and biology. I have not, therefore, included the customary chapters on the elementary facts of atomic and molecular structure, but have included chapters on cell division and Mendelian genetics for the sake of completeness in developing the themes of biological replication and information transfer.

There are several good books on molecular biology currently available, but many of these seem to be either too advanced or too elementary as beginning textbooks. Others, although of the right level of difficulty, are too detailed. This textbook will satisfy a need felt by other teachers in the field for a textbook of a specific level.

My approach is structural. The introductory chapter on selected relevant physicochemical principles is followed by four main sections. First, protein molecules and assemblies of protein molecules are discussed under the broad theme of the relation of structure to function. Here, the structural and mechanical roles of fibrous proteins are described and the influence of amino acid composition in determining their distinctive properties is discussed. The role of the globular proteins as the carriers and catalysts of cells and organisms is presented next. Distinction is made between *enzymes*, which are globular proteins with specific combining capacity and catalytic activity, and *emphores*, such as antibodies and the oxygen-binding proteins, which have specific binding capacity but no catalytic function. The importance of quaternary structure in physiological regulation is discussed.

Biomembranes as protein-lipid assemblies are considered under the general area of bioenergetics and energy transduction. In this section, the complex structure of biological energy transducers is described with emphasis on the common features—the intricate structure of stacked parallel phospholipid membranes, compartmentalization, and spatial organization.

Biological replication and the storage and transmission of genetic information is the subject of the third section, which deals with protein-nucleic acid assemblies. Recent ideas on the ultrastructural organization of the interphase cell nucleus and of metaphase chromosomes are introduced, and ribosomes and their role in the structural basis of protein synthesis are discussed.

The preceding sections may be described as analytic, because the cell is systematically dissected into its macromolecular components. The fourth section can be thought of as synthetic; it demonstrates how these macromolecular components are put together to form a living cell. The underlying theme is that despite the seeming diversity of cell types and structures, cells really are composed of only a relatively few "standard parts." These are found in fairly simple form in procaryotic cells, but they are elaborated into more complex structures in eucaryotic cells.

The temptation to delve deeply into certain exciting aspects of molecular biology has been resisted. In an introductory text, the clear exposition of fundamentals with a minimum of detailed information is of greater importance. There are ample suggestions for further reading if the student wishes to pursue a given topic in greater depth.

The description of the genetic control of protein synthesis and the treatment of molecular genetics are not as detailed or as thorough as they are in many other molecular biology textbooks. This is intentional. The modern science of molecular biology was ushered in with the elucidation of the role of nucleic acids in determining the structure of cellular proteins. Exciting and fundamental as this topic is, I have tried to show that molecular biology is something more than this, and that equally exciting fields in areas other than molecular genetics are opening up and expanding all the time. In other words, my aim is a balanced approach, which some of the otherwise good textbooks in this field do not provide.

Fred W. Price

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F.W.P.

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PART ONE

INTRODUCTORY