BIOCHEMISTRY

A CASE-ORIENTED APPROACH

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PREFACE

Over the course of the two previous editions the biochemical information in this book has continued to increase, both in the presentation of basic concepts and in the application of these concepts to analyses of health-related problems. As a result, the biochemical content of the third edition is self-standing and appropriate for a one-semester course in biochemistry. It is, however, organized in a manner less traditional than that found in most textbooks, since significant information on biochemical principles has been incorporated, where it seemed appropriate, into the detailed statements that comprise solutions to the case problems associated with each chapter. The text thus continues to serve a dual function: first, to make students aware of biochemical principles and, second, to provide opportunities to use these principles in analyzing commonly occurring health-related problems. We believe that the second goal is the ultimate objective of biochemical education for the health science student.

At first glance the chapter titles of this book are much like those of other biochemistry texts. Indeed, the first part of each chapter contains material that by itself is of a scope suitable for a one-semester course in general biochemistry. These biochemical principles are needed to understand the chemical and molecular aspects of health science problems. The second part of each chapter amplifies these principles, sometimes adding others as may be particularly relevant to the health-related problem at hand, and applies these facts and concepts to the stated solutions of health-related problems. While the purpose of the case presentations is to illustrate the application of *biochemistry* to health problems, students are often curious to know more about the physiologic or pathologic aspects of the clinical material. This curiosity can be satisfied by reading the references given after each case. Generally, students realize that the purpose of the text is to teach biochemistry, to demonstrate *why* biochemistry is important in the health sciences, and to show *how* biochemical principles are involved in day-to-day professional practice. Experience has shown us that students grasp concepts more clearly when they see a relation between those concepts and their own professional goals. Learning also seems to be more enjoyable when the applications are made evident.

Selected clinical case descriptions and biochemical questions about them are provided with and without written analysis. Those without analysis as well as a series of shorter additional questions at the end of each chapter are meant to be solved by the students. Many of the questions can be answered with a knowledge of the basic biochemistry presented in the first portion of the chapter. Sufficient references are given to answer the questions that are indicated by arrows and not answered in the main body of the text. Similarly, brief unsolved clinical problems are marked by arrows, indicating that outside reading will be required to compose a suitable solution. These questions are included because it is imperative that students become accustomed to the method and value of bibliographic research. The knowledge gained by study of the principles in the first part of the chapter can be extended by independent study of other source materials.

The format of this book allows considerable flexibility. For some students the language statements plus the solved case problems may be sufficient. Others may wish to use the unsolved case problems or the questions for additional study. The last chapter, entitled Comprehensive Case Analysis, represents more of a challenge than the earlier ones and requires that the student have a reasonably good grasp of the preceding material. It also adds considerably to details of some areas of biochemistry not previously treated, such as iron metabolism, defects in collagen synthesis and metabolism, hormone receptors, and receptor binding. This chapter, in particular, requires reference to the original literature to answer certain questions.

As in the past editions we have selected nutrition as the first topic in order to introduce from the very beginning the case-oriented method of study. Many students have been exposed to this subject in their everyday living and in previous schooling. Knowledge of the properties of proteins (Chapter 2) follows, since this material is so essential for later chapters. Chapter 3 deals with enzymes, also essential for understanding of later material. Because errors of fluid and electrolyte regulation are such frequent components of so many diseases, this topic is introduced as Chapter 4. Early introduction to these topics then permits selection of a wide range of case-oriented discussions. The remaining chapters may be covered in virtually any order, but we have found the sequence presented here to be satisfactory. Each chapter has been kept reasonably limited and self-contained, but we have made an effort by cross-references to keep the student's thoughts holistic.

In our one-semester courses, Chapters 1 through 13 are covered in a 14-week period—for the most part, one chapter per week. The chapters that sometimes require a slightly longer time for completion are Acid-Base, Fluid, and Electrolyte Control (Chapter 4), Carbohydrate Metabolism (Chapter 7), and Hormonal Regulation of Metabolism (Chapter 13). Weekly contact involves 5 lecture hours for the class as a whole and 2 hours of discussion and review in small groups. All 5 lecture hours are usually devoted to coverage of the basic biochemistry section of the particular chapter. In some instances, however, one of these lectures is employed to present greater amplification of some important biochemical feature taken from the clinical examples section of the text. For example, phenylketonuria in Chapter 6, diabetes mellitus in Chapter 7, and hyperlipidemia in Chapter 10 have been highlighted by special lecture time devoted to recent developments. About 1½ hours of the small-group discussions are devoted to the clinical examples section of each chapter. This section begins with a general discussion of the clinical cases that have been worked out in the text, in an attempt to strengthen correlation of that information with the basic principles enunciated in the earlier part of the given chapter. Following this, students are asked to present one or more of the cases and additional problems not worked out in the text, either in oral or written presentations. Chapter 14 may be covered during the final week of independent study, with daily 2-hour tutorial sessions scheduled on a voluntary attendance basis.

It is recommended that examinations be based entirely on the analysis of cases. We have employed questions requiring short answers, multiple choices, and brief calculations. Our examinations are largely designed to be machine graded. In all instances the questions should be based on clinical situations, real or not, designed to gauge the student's capacity to deal with applications of basic biochemistry.

The third edition benefits from continued refinement of this teaching program for students of medicine, which is now in its ninth year at the University of Iowa. The program based on this approach has been extended to physicians' assistant students, and it has been used for students of dentistry. Elsewhere this book has been used in colleges of allied health sciences, medicine, nursing, osteopathic medicine, pharmacy, and veterinary medicine. In some instances it is used, as at Iowa, as the sole instructional source. In others it is used, in association with a more classic text, as a source of enrichment in learning.

This edition has been extensively revised and enlarged. Perhaps the most notable change is the use of SI units. In May, 1977, the Thirtieth World Health Assembly endorsed the use of the Système Internationale d'Unites (SI) in medicine. These units have

since been adopted in most countries, and the process of change is underway in some publications and in some health care institutions in the United States. The advantages for the scientific community of a uniform system for expressing molar concentrations, pressures, temperatures, and other physical properties is clear, but the implementation in the health sciences may be delayed by the need to maintain communication with those now in clinical practice. This places a burden on the basic sciences, where new health sciences students first must be prepared for the eventual change to SI units. For this reason the present edition of this text frequently presents both units, the SI units and, in parentheses, the presently used units, with the hope that students can learn in either system but be prepared to communicate in the SI system. A more complete description of the SI system is found in Appendix E with a table of the more common measures given inside the back cover of the book. We look on this editorial change as an experiment and will appreciate some expression of reader reaction.

Certain other changes are worth noting. From experience we have found that particular problems have had a higher teaching value than others. The good ones have been retained and updated, whereas those of lesser value have been replaced. A larger number of case problems have been worked out. More pertinent references to both solved and unsolved case problems have been included for the benefit of student and teacher alike. In the basic biochemistry sections of the text, more extensive discussion of such important topics as cell membranes, the theory of oxidative phosphorylation, biosynthesis of glycoproteins, lipoproteins, prostaglandins, DNA sequencing, and RNA splicing can be found. Complex figures have been broken down into more numerous, simpler ones for easier study and comprehension. A list of biochemical topics contained in the case problems has been added to the table of contents.

Past editions of this book benefited from advice and criticism of numerous friends and colleagues. Their efforts are reflected in this edition. We here expess our deep appreciation to new friends, including A. Arnone, J. E. Donelson, H. E. Hamilton, P. Hinkle, C. A. Hogben, T. C. Kisker, W. J. Lennarz, B. J. McCabe, M. Osborne, E. Racker, P. M. Seebohm, D. E. Shaw, and D. C. Zavala.

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