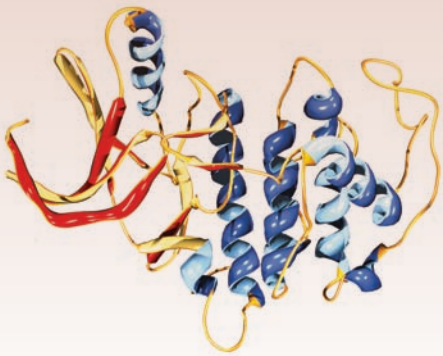

Preface

Considering Metabolism

Metabolic diseases such as diabetes and others associated with the current obesity crisis have thrust metabolism into the forefront of popular thinking. In many ways, metabolism is the central science of biochemistry. This is the view I have adopted as the core concept of this textbook.

Having a research background in metabolism, a long-standing interest in the fundamental topics of biochemistry—including kinetics and thermodynamics—and having taught a one-semester biochemistry course for over 25 years, I have long wanted to write a book that reflects the whole of the subject with the unifying theme of metabolism.

Brevity

A key consideration when writing this text was to keep the book short enough and approachable enough that a student can read it in one semester. The alternative approach—having a book far too long for continuous reading and having the instructor suggest which portions to omit—is already well represented. In my experience, for students who are not biochemistry majors, the fragmentation resulting from parsing longer texts leads to less reading and, therefore, less understanding. The areas of special interest to the instructor can be readily augmented with primary sources, while the textbook provides continuity and context.

I have emphasized recurring ideas such as commonalities in chemical reaction mechanisms and pathway construction as much as possible. The decision of whether the book is for teaching or reference is decidedly in favor of teaching; for example, only a few protein domains are presented. The wealth of information available on the Web (notably ncbi.nlm.nih.gov) can substitute for a more extensive collection. The present text will provide students with an introduction to the foundations of biochemistry.

Organization

The presentation of biochemistry topics is mostly a classical one, with a slight divergence: the introduction to lipids directly follows the chemistry of water. This is in keeping with presenting molecular classes in the order of increasing chemical complexity: water, lipids, carbohydrates, nitrogen compounds. It also has the virtue of contrasting water solubility with water insolubility in the case of lipids.

When using this book for medically oriented courses, the chapter on photosynthesis may be omitted. In that case, however, the photosynthetic "dark reactions" should at least be referenced, as they are similar to those in the pentose cycle; this analogy is made explicit in the chapter on carbohydrate pathways.

Key Features

- **Dual diagrams of enzymatic reactions.** A unique method of presenting electron flow for reaction mechanisms was devised for this book. For each mechanism, the substrate, intermediates, and product are presented on the top line. Below a separator (dotted line), the molecules are redrawn with their electron flows, using the traditional curved arrows. This separation allows the student to visualize the result of the electron flow, which is commonly obscured by the need to show the electron arrows for the next transformation.
- **Word Origins feature box.** Included in most chapters is a box that provides a short history of certain words that are rich in meaning, without which it is often more difficult to understand the underlying concept. Providing an explanation of their origins helps students become familiar with these important terms and achieve a better understanding of what is being described.
- **Thermodynamics treatment.** The development of thermodynamics for metabolic purposes leads to the distinction between two classes of enzymes: near-equilibrium and metabolically irreversible. This allows a simplification, as near-equilibrium reactions are not sites of cellular regulation. The roles of standard, actual, and near-equilibrium states for free energy are distinct and consistently presented to aid student understanding.
- **Chemical mechanisms.** A study of biochemistry should impart a viewpoint enriched by understanding the underlying chemistry of events in living systems. This extended view of biology is best achieved by understanding how enzymatic reactions function. All of the background chemistry needed for this text should be covered by prerequisite courses of chemistry. Some further information is presented in the appendix; a review of organic chemistry reaction mechanisms (most critically, nucleophilic reactions) may be necessary for those who are less comfortable with the material.
- **Enzyme kinetics treatment.** The text emphasizes direct plots of substrate concentration against initial velocity, introducing double-reciprocals only after a complete development of the subject. While in widespread use, the double-reciprocal form is difficult to visualize and leads to the false impression that memorizing patterns of lines for enzyme inhibition provides insight into how inhibitors work. Instead, direct plots, with an emphasis on the behavior of reaction velocity at different substrate concentrations, deliver the message clearly. Coupled with everyday descriptions of the different types of inhibition, these critical ideas are easily grasped. A further distinct notion is the use of the kinetic term V_{max}/K_m rather than K_m in developing kinetics. Too often, "K_m" becomes a focal point and is treated as an equilibrium constant rather than a steady-state constant. This common misuse of K_m versus V_{max}/K_m is part of the reason that many students have difficulty understanding enzyme kinetics, and it is a problem this text carefully avoids.
- **Minimalist molecular biology treatment.** The essence of molecular biology is included in the final two chapters. The emphasis is on providing an overview with a chemical perspective. For example, stacking interactions in DNA, the basis for forming the double helix, are explained in simple, chemical terms.

- **The pathway view.** The distinction between a *reaction* view and a *pathway* view is clearly emphasized to facilitate student comprehension. For example, the distinction between a bound cofactor like $FADH_2$ from a free cofactor like NADH becomes obvious: only NADH can transfer electrons between metabolic reactions.
- **Appendix.** The appendix of this text contains both entries for students needing a little extra help and more advanced material that, while perhaps not appropriate for the level of this particular text, is nonetheless important to the field of biochemistry as a whole. For remediation, basic ideas of mathematics and chemistry with which students traditionally have difficulty can be found in the appendix, as can certain extended pathways like amino acid and cholesterol routes. The advanced material includes the mechanism of aconitase and the role of fluoroacetate, which represent milestone achievements in biochemistry. These may be of interest to the more inquisitive student wishing to go beyond the fundamentals.

Resources

For Instructors

An *Instructor's Media CD*, compatible with Windows® and Macintosh® platforms, provides instructors with the following resources:

- The PowerPoint® ImageBank contains all of the illustrations, photographs, and tables (to which Jones & Bartlett Learning holds the copyright or has permission to reproduce electronically). These images are inserted into PowerPoint slides. Instructors can quickly and easily copy individual images into existing lecture slides.
- The PowerPoint Lecture Outline presentation package provides lecture notes and images for each chapter of *Biochemistry.* Instructors with the Microsoft® PowerPoint software can customize the outlines, art, and order of the presentation.

To receive a copy of the *Instructor's Media CD*, please contact your sales representative.

Also available for qualified instructors to download from the Jones & Bartlett Learning website, www.jblearning.com, are the text files of the *Testbank*.

For Students

To further enhance the learning experience, Jones & Bartlett Learning offers the following ancillary materials:

The *Student Companion Website* (http://science.jbpub.com/biochemistry) provides content exclusively designed to accompany *Biochemistry*. The site hosts an array of study tools including chapter outlines, study quizzes, an interactive glossary, animated flashcards, crossword puzzles, and web links for further exploration of the topics discussed in this book.

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