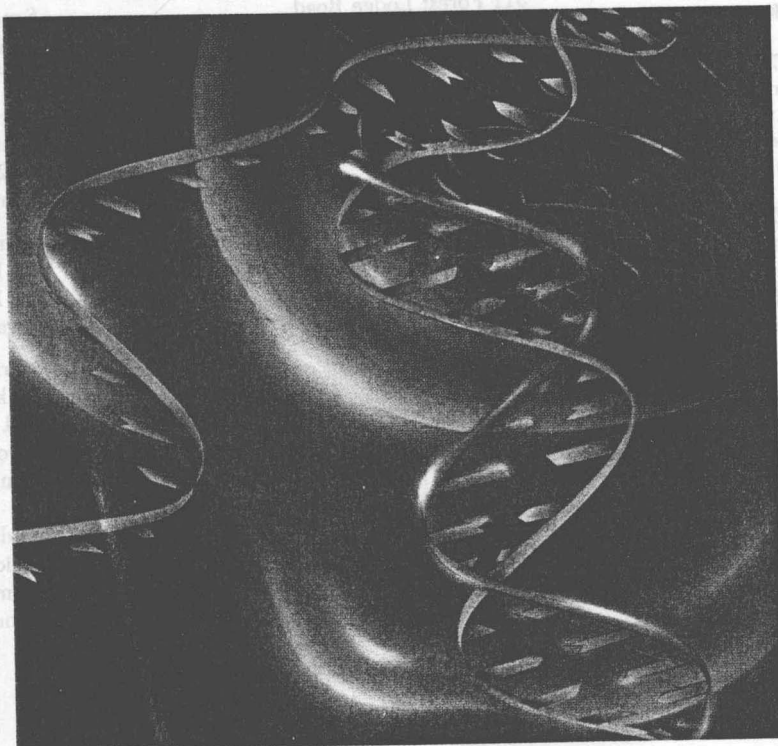


Biochemistry

Concepts and Applications



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Preface

Dedication

To the memory of my parents Sol and Renee Tropp.
To my wife, Roslyn, and to our family, Jonathan,
Lauren, Sarah, Matthew, and Paul.

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Preface

This is an exciting time to be a biochemist. Never has the biochemist's expertise been more in demand for solving the important biological problems and intriguing mysteries that face humankind. Biochemists have made, and continue to make, important contributions to many different fields including medicine, nutrition, genetics, genetic engineering, immunology, evolution, ecology, virology, neurobiology, agriculture, and space exploration. Although the rewards of mastering the field of biochemistry are great, the field is a challenging one to master. Without a solid, carefully constructed foundation, advanced study will be difficult and frustrating.

The purpose of this text is to provide the necessary foundation. Along the way, we as teachers and biochemists also hope to instill an appreciation of the beauty, mystery, and excitement that is an inherent part of biochemistry. This, also, is a goal of the text. I have attempted to meld these two goals in a manner that strengthens the all-important foundation. To this end the text has been carefully organized, and the language crafted to be precise, concise, and simple. Now for an overview.

Organization of the Text

This textbook is divided into four parts. Part I, Biological and Chemical Concepts for Biochemistry, will help ensure that all students have the solid biological and chemical background that is required for the successful and satisfying study of biochemistry. Most students will probably need to review at least some of the concepts in Part 1 before beginning their study of biochemistry. A student with an extensive background in biology, for example, may not have had much exposure to thermodynamics or may have studied the topic so long ago that a review would be helpful. Alternatively, a student with an extensive background in chemistry may need to review important concepts in biology. This text enables the instructor to direct students to specific topics depending on the makeup of a particular class. The remaining parts, Proteins and Membranes, Metabolism and Bioenergetics, and Genetic Information, are the heart of the text and examine important biochemical processes.

Part 2, Proteins and Membranes, explores the chemistry, properties, and functions of proteins, with particular emphasis on the protein catalysts we call enzymes. Since nearly all biochemical reactions are catalyzed by enzymes, Part 2 must be completed before proceeding further. Part 2 also examines biological membranes.

Part 3, Metabolism and Bioenergetics, examines the synthesis and degradation of biological molecules as well as the mechanisms that regulate these processes. Each of the chapters in Part 3 describes both the biodegradative (catabolic) and biosynthetic (anabolic) pathways for one or more related biomolecules as well as the mechanisms that regulate these pathways. For instance, Chapter 9 examines the biochemical pathways that degrade and synthesize glucose as well as the mechanisms that regulate these pathways. The treatment of the synthesis and degradation of specific biochemical substances in the same chapter allows students ample opportunity not only to compare the two processes, but also to familiarize themselves with substances they will encounter again and again. Furthermore, this approach demonstrates the intricate relationships among biological processes, shows what happens

when the relationships break down, and will hopefully stimulate some critical thinking.

Part 4, Genetic Information, examines the flow of information from the nucleotide language of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) to the amino acid language of proteins. It also examines how basic biochemical knowledge has been exploited to create the field of genetic engineering, suggests how genetic engineering might be used in the future to treat various diseases, and touches on a relatively new issue for biochemists—the ethics of pushing certain frontiers.

Organization within Chapters

Each chapter first introduces the topic at hand, then examines it in a carefully laid out progression, and finally summarizes the major concepts. A list of terms to remember that calls attention to important terms, and suggestions for further reading are also provided. In addition, each chapter has a self-study quiz consisting of modified true/false and multiple choice questions as well as many open-ended questions and problems.

Discovery Approach

One of the distinguishing features of this textbook is the presentation of experimental evidence for the concepts discussed, which allows students to follow the original investigator's logic. Students can be forgiven for not understanding why so many of us derive so much satisfaction from our scientific careers when they rarely, if ever, have the pleasure of solving a scientific mystery or of making a discovery. I hope that by introducing the experimental evidence before presenting the conclusion, the students will see how biochemists examine clues and develop hypotheses. The false leads and misleading data that make the search for truth so challenging must be left out because of space considerations and because they might confuse beginning students. Nevertheless, I hope that students will develop some sense of the way in which biochemists work and biochemical discoveries are made. Although the discovery approach has historical overtones, it is important to remember that a textbook of this type cannot give an accurate historical picture. Significant contributions by many investigators are omitted for reasons of space or clarity. Often, one person is given credit for a discovery when in fact many investigators made major contributions. I apologize to all those investigators who were not given proper credit for their efforts and contributions.

Special Sections within Chapters

Special features, entitled *Clinical Applications*, *Special Topics*, *In the Lab*, and *Looking Deeper*, are provided in each chapter for enrichment and to pique the students' interest. The *Clinical Applications*, which relate biochemical topics to specific health problems, are intended to make biochemistry more meaningful to students who plan to go into a health-related field. The *Special Topics*, which relate a biochemical topic to some nonmedical application, are intended to expand the students' awareness of the impact biochemistry has on all aspects of our lives. *In the Lab* features explain how biochemists gather information and are intended to bridge the gap between lecture and laboratory. The *Looking Deeper* features provide an in-depth look at specific topics such as an enzyme mechanism or a virus life cycle.

Appendices

Four appendices are included at the back of the book. Appendix A describes the RS system of configurational nomenclature, Appendix B examines redox reactions, Appendix C lists the major discoveries in chronological order, and Appendix D provides some useful sites for biochemists on the Internet. An extensive glossary of terms is also provided, as well as answers to the modified true/false and multiple choice questions so students can gauge their level of comprehension.

Answers to Self-Study Problems

Glossary

Index

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Table of Contents

PART I Biological and Chemical Concepts for Biochemistry I

- Chapter 1 Biomolecules 2
- Chapter 2 The Cell 33
- Chapter 3 Energy 63
- Chapter 4 Water 83

PART 2 Proteins and Membranes 100

- Chapter 5 Amino Acids, Peptides, and Polypeptide Chains 102
- Chapter 6 Proteins: Three-Dimensional Structure and Function 143
- Chapter 7 Enzymes, Coenzymes, and Vitamins 176
- Chapter 8 Cellular Membranes: Their Lipids and Proteins 213

PART 3 Metabolism and Bioenergetics 244

- Chapter 9 Glucose Metabolism 246
- Chapter 10 Glycogen Metabolism 289
- Chapter 11 The Citric Acid Cycle 321
- Chapter 12 Electron-Transport System and Oxidative Phosphorylation 343
- Chapter 13 Photosynthesis 371
- Chapter 14 Triacylglycerol Metabolism 412
- Chapter 15 Lipid Metabolism 449
- Chapter 16 Amino Acid Metabolism 498
- Chapter 17 Nucleotide Metabolism 533

PART 4 Genetic Information 560

- Chapter 18 Deoxyribonucleic Acid Structure and Function 562
- Chapter 19 DNA Replication and Repair 603
- Chapter 20 Ribonucleic Acid Structure and Metabolism 642
- Chapter 21 Protein Synthesis 692
- Chapter 22 Recombinant DNA Technology 733

Appendices 772

- Appendix A The *RS* System of Configurational Nomenclature 772
- Appendix B Redox Reactions 775
- Appendix C Important Milestones in Biochemistry 782
- Appendix D Some Important Internet Sites for Biochemistry 790

Answers to Self-Study Problems 794

Glossary 801

Index 825

Detailed Table of Contents

PART I Biological and Chemical Concepts for Biochemistry I

CHAPTER 1 Biomolecules 2

1.1 Introduction 2

1.2 Stereoisomerism 4

IN THE LAB
Optical Rotation 6

1.3 Water-soluble Biomolecules 9

1.4 Lipid Molecules 24

1.5 Biochemical Transformations 27

CHAPTER 2 The Cell 33

2.1 Introduction 33

2.2 The Prokaryotic Cell 34

LOOKING DEEPER
Viruses 35

CLINICAL APPLICATION
The Bacterial Cell Wall and the Antibiotic Penicillin 40

2.3 The Eukaryotic Cell 45

LOOKING DEEPER
Cellulose 47

LOOKING DEEPER
Origin of Mitochondria 49

CLINICAL APPLICATION
I Cell Disease 52

CLINICAL APPLICATION
Cancer Cells and Chemical Signals 54

2.4 Tissues and Organs 57

CHAPTER 3 Energy 63

3.1 Introduction 63

3.2 The First Law of Thermodynamics 64

SPECIAL TOPIC
Units of Energy 65

- 3.3 The Second Law of Thermodynamics 67**
- 3.4 Chemical Reactions and Free Energy 69**
- 3.5 Living Organisms as Steady-State Systems 71**
- 3.6 ATP, the Universal Energy-Transfer Molecule 73**

CHAPTER 4 Water 83

- 4.1 Introduction 83**
- 4.2 Water's Remarkable Physical Properties 84**
- 4.3 Water's Extraordinary Solvent Properties 87**
- 4.4 Water's Acid-Base Properties 90**

PART 2 Proteins and Membranes 100

CHAPTER 5 Amino Acids, Peptides, and Polypeptide Chains 102

- 5.1 Introduction 102**
- 5.2 The Acid-Base Properties of Amino Acids 103**
- 5.3 Amino Acid Side Chains 105**
- 5.4 The Peptide Bond 108**
 - IN THE LAB**
Chromatographic Separation of Amino Acids 109
 - SPECIAL TOPIC**
Aspartame 115
- 5.5 Protein Classification 115**
- 5.6 Protein Purification 118**
 - IN THE LAB**
Spectrophotometric Techniques 119
- 5.7 Amino Acid Sequences of Polypeptides 125**
 - CLINICAL APPLICATION**
Sickle-Cell Anemia 126
- 5.8 Glycoproteins 136**

CHAPTER 6 Proteins: Three-Dimensional Structure and Function 143

6.1 Introduction 143

6.2 Secondary Structure 144

CLINICAL APPLICATIONS
Collagen Defects 152

6.3 Tertiary and Quaternary Structures 152

6.4 Polypeptide Chain Folding 165

IN THE LAB

SDS-Polyacrylamide Gel Electrophoresis 166

CLINICAL APPLICATION

Immunosuppressors 169

CHAPTER 7 Enzymes, Coenzymes, and Vitamins 176

7.1 Introduction 176

7.2 Basic Concepts 177

CLINICAL APPLICATION

Enzymes and Medical Diagnosis 178

7.3 Vitamins and Coenzymes 180

7.4 Enzyme Nomenclature 182

7.5 Enzyme Kinetics 184

SPECIAL TOPIC

Abzymes 189

7.6 Michaelis–Menten Kinetics 189

LOOKING DEEPER

Derivation of the Michaelis–Menten Equation 192

CLINICAL APPLICATION

Wernicke–Korsakoff Syndrome 195

7.7 Enzyme Inhibition 198

7.8 Allosteric Effects 201

LOOKING DEEPER

Models for Allosteric Effects 204

CHAPTER 8 Cellular Membranes: Their Lipids and Proteins 213

8.1 Introduction 213

8.2 Lipid Chemistry 214

CLINICAL APPLICATION
Platelet-Activating Factor 216

CLINICAL APPLICATIONS
Sphingolipid Storage Diseases 223

8.3 Lipid Bilayers 226

8.4 Protein Organization in Cellular Membranes 230

IN THE LAB
Freeze Fracture Electron Microscopy 232

SPECIAL TOPIC
Lipid Group Anchors 234

8.5 The Cytoskeleton 239

CLINICAL APPLICATION
Antimitotic Agents and Cancer 240

PART 3 Metabolism and Bioenergetics 244

CHAPTER 9 Glucose Metabolism 246

9.1 Introduction 246

9.2 Sources of Glucose 247

CLINICAL APPLICATION
Lactosemia 250

9.3 The Glycolytic Pathway 254

IN THE LAB
Radioactive Tracers 260

LOOKING DEEPER
Hexokinase Isozymes 261

LOOKING DEEPER
Phosphoglucose Isomerase, a General Acid-Base Catalyst 262

LOOKING DEEPER
Fructose-1,6-bisphosphate Aldolase and Covalent Catalysis 264

LOOKING DEEPER
Mechanism of Action of Glyceraldehyde-3-Phosphate
Dehydrogenase 267

LOOKING DEEPER
Mechanism of Action of Phosphoglyceromutase 270

LOOKING DEEPER
Pyruvate Kinase Isozymes 271

LOOKING DEEPER
Thiamine Pyrophosphate and Pyruvate Decarboxylase 273

9.4 The Gluconeogenic Pathway 274

9.5 The Pentose Phosphate Pathway 280

CHAPTER 10 Glycogen Metabolism 289

10.1 Introduction 289

10.2 The Glycogen Breakdown Pathway 290

10.3 The Glycogen Synthetic Pathway 295

CLINICAL APPLICATION

UDP-Glucose and Galactosemia 296

10.4 Hormonal Regulation of Glycogeneolysis 299

SPECIAL TOPIC

Calcium Regulation 301

CLINICAL APPLICATION

Cholera Toxin 307

CHAPTER 11 The Citric Acid Cycle 321

11.1 Introduction 321

11.2 Pyruvate Dehydrogenase 322

LOOKING DEEPER

Pyruvate Dehydrogenase 324

11.3 The Citric Acid Cycle 325

LOOKING DEEPER

Citrate Synthase 329

SPECIAL TOPIC

Fluorocitrate 330

CHAPTER 12 Electron-Transport System and Oxidative Phosphorylation 343

12.1 Introduction 343

12.2 The Electron-Transport Chain 344

CLINICAL APPLICATION

Amyotrophic Lateral Sclerosis 352

12.3 Oxidative Phosphorylation 353

12.4 ATP Synthetic Machinery 356

12.5 The Chemiosmotic Hypothesis 358

12.6 Total ATP Production from Glucose Catabolism 366

CHAPTER 13 Photosynthesis 371

13.1 Introduction 371

13.2 The Photosynthetic Reaction 372

13.3 Chloroplasts 374

13.4 Light-dependent Reactions 376

13.5 Chloroplast Pigments and Photosystems 377

LOOKING DEEPER

Properties of Light 379

LOOKING DEEPER

The Discovery of Photosynthetic Units 382

13.6 The Bacterial Photosystem 392

IN THE LAB

Spectroscopic Studies of the Reaction Center 394

13.7 Light-independent Reactions 396

CHAPTER 14 Triacylglycerol Metabolism 412

14.1 Introduction 412

14.2 Triacylglycerol Degradation 414

14.3 Fatty Acid Degradation 416

CLINICAL APPLICATION

Carnitine Deficiency Syndrome 420

LOOKING DEEPER

Polyunsaturated Fatty Acid Oxidation 423

SPECIAL TOPIC

The Glyoxylate Pathway 428

14.4 Ketone Body Formation 429

CLINICAL APPLICATION

Diabetes 432

14.5 Fatty Acid Synthesis 429

14.6 Triacylglycerol Synthesis 442

CLINICAL APPLICATION

Fat-Signaling Hormone 444

CHAPTER 15 Lipid Metabolism 449

15.1 Introduction 449