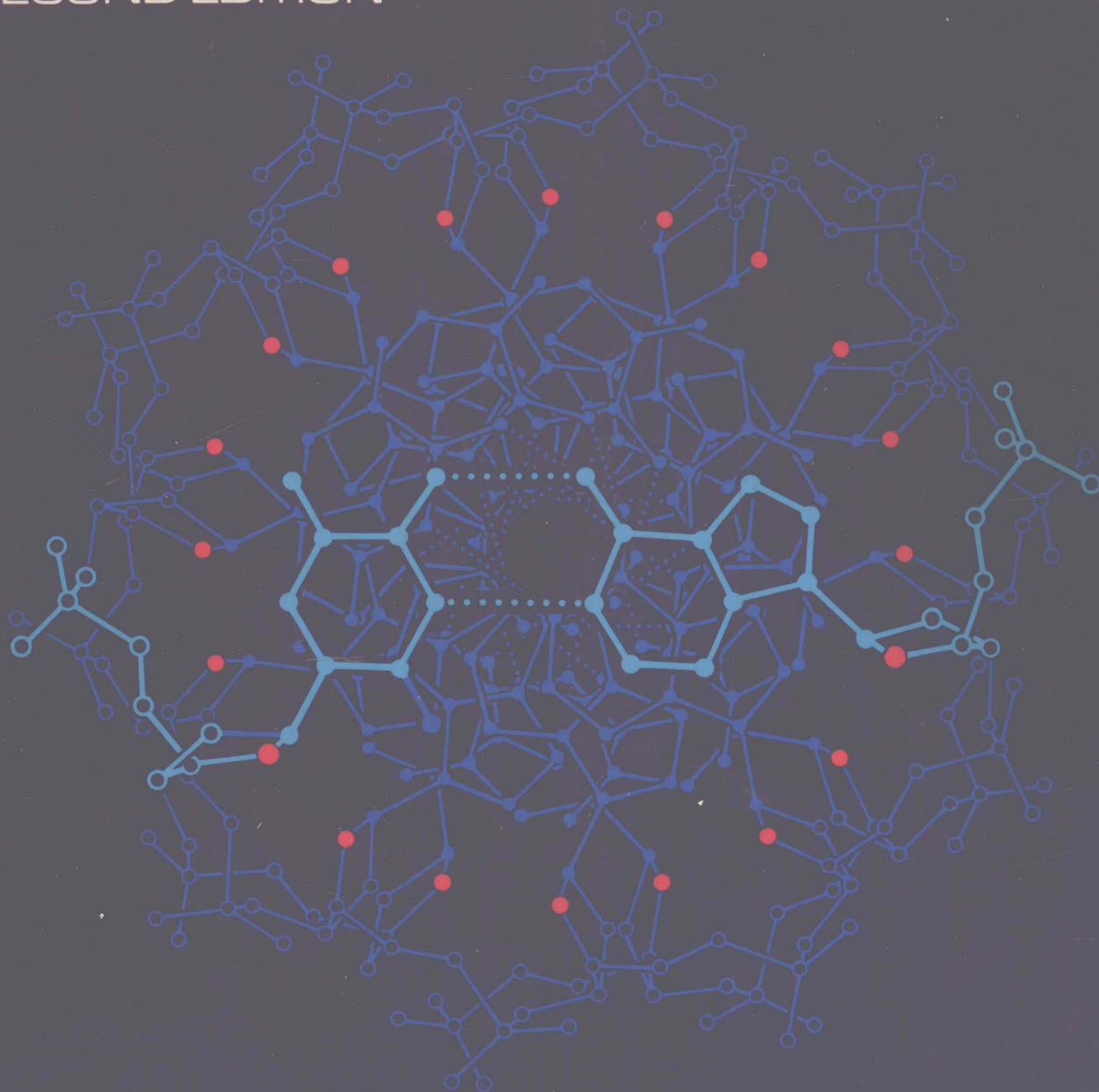


FRANK B. ARMSTRONG

BIOCHEMISTRY

SECOND EDITION



BIOCHEMISTRY

SECOND EDITION

FRANK B. ARMSTRONG

North Carolina State University

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PREFACE

The writing of the second edition of *Biochemistry* was influenced significantly by the constructive critiques and suggestions provided by colleagues, students, reviewers, and users of the first edition. With regard to the changes incorporated into the second edition, two new chapters, Lipid Biosynthesis (Chapter 19) and Recombinant DNA Research (Chapter 26), were added, and presentations in many of the other chapters were revised and/or expanded. Some of these changes include a discussion of glycogen synthesis (Chapter 11), the catalytic mechanism of ribonuclease A (Chapter 13), the glyoxylate cycle (Chapter 16), restriction mapping and the newer systems for DNA sequencing (Chapter 21), the mitochondrial genetic code and attenuation (Chapter 22), intracellular transport of proteins (Chapter 23), recent research findings on prostaglandins (Chapter 24), and the mode of action of vitamins A, D, and K (Chapter 25). Particular attention was also given to an expansion of the presentation on nitrogen metabolism (Chapter 20) by including nitrogen fixation, nitrate reduction, and the synthesis and catabolism of all 11 nonessential amino acids. Also, the discussion on purine metabolism is now complemented by one on pyrimidine metabolism.

The expanded second edition may now contain more material than can be conveniently presented in a one-semester, introductory course in biochemistry. If such is the case, it is hoped that individual instructors will select those topics from the book that best suit their treatment of the discipline in meeting the educational needs of their classes.

In preparing the new edition, I was again fortunate to have the assistance of colleagues who provided critical reviews of individual chapters. For their valuable contributions, my sincere appreciation

is extended to Wendy F. Boss, William E. Donaldson, H. Robert Horton, Daniel W. Israel, William A. Jackson, Bryan H. Johnson, William L. Miller, David W. Niesel, Joanne M. Ravel, and Samuel B. Tove. The useful critiques furnished by the reviewers selected by Oxford University Press are also appreciated. I recognize with gratitude the help provided by Jeanne B. Koger in proofreading the galleys and by Irene Nunes, who carefully and thoroughly copy-edited the manuscript. The impeccable typing of Anne Richardson, who prepared the manuscript, is also gratefully acknowledged. I express a special thanks to my editor, Michael R. Cook, whose dedicated efforts assured a smooth transition from the first to the second edition. Finally, I extend my appreciation and love to my family; their contributions of patience, support, and encouragement made the task of revising the text much easier.

Raleigh, North Carolina

F.B.A.

PREFACE TO FIRST EDITION

Biochemistry is for an introductory course designed to accommodate undergraduates from widely varying curricula. For an instructor, the current broad interest in such offerings in biochemistry poses the challenge of teaching a course that meets the educational needs of majors from preprofessional programs, biological sciences, agricultural sciences, chemistry, engineering, and science education curricula. Such a generalized course has been taught by Frank B. Armstrong at North Carolina State University since 1968 and by Thomas Peter Bennett at the Rockefeller University. It was this mutual interest in teaching introductory biochemistry that prompted us to engage in the collaborative effort that made *Biochemistry* a reality.

The topics covered in the text were selected after seeking the advice of a number of instructors from various campuses who teach courses in biochemistry. A majority of the material, therefore, represents a basic core of instruction that all those consulted considered necessary for an introductory course and that we have found desirable in our own teaching. In the interest of brevity, the text is written in a simple, direct style. Where appropriate, the text is accented with historical notes, definitions, or information pertaining to the relevant aspects of the material being presented; medical anomalies, for example, are tied to inborn errors of metabolism.

Chapters 1 through 5 are introductory in nature and recognize the various backgrounds of students taking their first course in biochemistry. This section includes a brief history of biochemistry, emphasizing the development of molecular biology; a review of the elements needed for life and of biogeochemical cycles; a discussion of water and buffers; chemical topics that are important to the subsequent text; and an overview of cell biology.

Amino acids and proteins are two of the classes of biomolecules discussed in the book's second section, Chapters 6–13. A presentation of the molecular aspects of the structure and biological function of proteins, with emphasis on myoglobin, hemoglobin, and enzymes, precedes a description of other principal types of biomolecules, i.e., carbohydrates, lipids, nucleic acids, and B-vitamins.

The molecular basis of bioenergetics serves as a prelude to the third section (Chapters 14–20), which includes the production of chemical energy by living systems and interrelated topics on intermediary metabolism. The synthesis of ATP is the underlying theme of the chapters on glycolysis, tricarboxylic acid cycle, electron transport, oxidative phosphorylation, and photosynthesis. Carbon metabolism, emphasized in the presentation of the recovery of energy from sugars, is complemented by a discussion of the metabolism of nitrogen-containing biomolecules. This section concludes with a presentation of the molecular aspects of human nutrition.

The last section, Chapters 21–24, returns to some of the key accomplishments attained by molecular studies of biological phenomena. Chapter 21 on hormones includes the impressive strides that have been made toward understanding the molecular basis of hormone action. Chapters 22–24 are devoted to the classes of macromolecules of the Central Dogma, stressing molecular studies on DNA, RNA, and protein synthesis, respectively. A discussion of the coding capacity of the bacteriophage ϕ X174 was selected for the book's closing, since the results of these studies succinctly exemplify the revolutionary impact that molecular biology continues to have on the study of biology.

The authors gratefully acknowledge those who aided in the preparation of *Biochemistry*. The following provided constructive critiques of many of the chapters and contributions of information and materials: Drs. Mary Bonneville, Janice Glenn, Thomas Conway, H. Robert Horton, Evan E. Jones, Joseph S. Kahn, Ian S. Longmuir, A. Russell Main, John F. Roberts, and Harold F. Swaisgood. The reviews and information provided by Mr. Hugh Craft are also acknowledged, and a special acknowledgment goes to Mr. Richard R. Randall, who served as an in-house editor for the manuscript. Thanks are given to the graduate students of the Department of Biochemistry at North Carolina State University for their careful help in proofreading the galleys. Appreciation is also expressed for the critical persistence and guidance of Mr. Robert

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FRANK BRADLEY ARMSTRONG

Raleigh, North Carolina

THOMAS PETER BENNETT

Philadelphia, Pennsylvania

December, 1978

But the task of the biochemist is, after all, the study of the physicochemical processes associated with the manifestations of what we call life—not the life of some particular animal or group of animals, but life in its most general sense.

ERNEST BALDWIN, 1937
Preface to *An Introduction
to Comparative Biochemistry*

LIST OF CHAPTERS

1	An Historical Review	3
2	Chemical Elements and Biogeochemical Cycles	15
3	Water as the Solvent of Life	25
4	Some Basic Aspects of the Chemistry of Life	41
5	Cells: Biological Units of Molecular Organization	51
6	Proteins I: Amino Acid Components and Structural Features	67
7	Proteins II: Determination of Amino Acid Sequences	87
8	Proteins III: Structure and Function	105
9	Proteins IV: Enzymes	129
10	B-Vitamins as Coenzymes	163
11	Carbohydrates	183

12	Lipids and Membranes	205
13	Nucleic Acids	225
14	Energy and Life	251
15	Anaerobic Synthesis of ATP (Glycolysis) and Pentose Phosphate Pathway	267
16	Aerobic Synthesis of ATP I: Tricarboxylic Acid Cycle	297
17	Aerobic Synthesis of ATP II: Electron Transport and Oxidative Phosphorylation	315
18	Photosynthesis: Sine Qua Non of Life	341
19	Lipid Biosynthesis	367
20	Nitrogen Metabolism	395
21	Molecular Insights into DNA	437
22	Genetic Information: Transcription and Its Control	473
23	Translation of Genetic Information	503
24	Hormones: Intercellular Chemical Messengers	537
25	Basic Aspects of Human Nutrition	567
26	Recombinant DNA Research	597
	Answers	625
	Index	635

CONTENTS

1 An Historical Review 3

Introduction	3
Nineteenth Century	3
First Fifty Years of This Century	7
Emergence of Molecular Biology	9

2 Chemical Elements and Biogeochemical Cycles 15

Introduction	15
The Carbon Cycle	16
The Nitrogen Cycle	18
The Phosphorus Cycle	19
The Oxygen Cycle	19
The Water Cycle	20
Modification of Biogeochemical Cycles	21

3 Water as the Solvent of Life 25

Introduction	25
Physical Properties of Water	26
Some Biological Importances of Water	28
Water as a Solvent	28
Hydrogen Ion Concentration of Biological Systems	29
Dissociation of Water	29
pH Scale	30
Brönsted–Lowry Acids and Bases	31

	Strong and Weak Acids	31
	Ionization of Weak Acids	32
	Henderson–Hasselbalch Equation	33
	Titration of a Weak Acid by a Strong Base	33
	Dissociable Biological Compounds	35
	Physiological Buffer Systems	36
4	Some Basic Aspects of the Chemistry of Life	41
	Introduction	41
	Bonding Properties of Carbon	41
	Asymmetry of Carbon Compounds	42
	<i>cis-trans</i> Isomerism	44
	Noncovalent Interactions	45
	Van der Waals Forces	45
	Hydrogen Bonds	46
	Ionic Bonds	47
	Hydrophobic Interactions	47
5	Cells: Biological Units of Molecular Organization	51
	Introduction	51
	Two Basic Types of Cells	52
	Diversity Among Cells	53
	Procaryotic Cell	53
	Animal Cell	55
	Cell membrane 55, Nucleus 56, Mitochondria 56, Rough and smooth endoplasmic reticula 57, Golgi apparatus 59, Lysosomes 59, Microbodies or peroxisomes 60	
	Plant Cell	60
	Cell wall 61, Vacuoles 62, Glyoxysomes 62, Chloroplasts 62	
6	Proteins I: Amino Acid Components and Structural Features	67
	Introduction	67
	Two General Properties of Amino Acids	68
	General Bonding Features of Polypeptides	71

Amino Acid Residues of Polypeptides	71
Nonpolar R groups 72, Uncharged polar R groups 73, Negatively charged (acidic) polar R groups 74, Positively charged (basic) polar R groups 74, <i>Allo</i> forms of amino acids 74	
Some Other Naturally Occurring Amino Acids	75
Structural Levels of Proteins	76
Primary structure 77, Secondary structure 77, Tertiary structure 79, Quaternary structure 80	
Specification of Conformation by Primary Structure	81
Two Major Types of Protein Conformation	82

7 Proteins II: Determination of Amino Acid Sequences 87

Introduction	87
Determination of Amino Acid Composition	88
Determination of Amino-Terminal Amino Acid	91
Determination of Carboxyl-Terminal Amino Acid	93
Selective Fragmentation of a Polypeptide	95
Edman Degradation	98
Required Second Fragmentation	100
The Complete Sequence	100

8 Proteins III: Structure and Function 105

Introduction	105
Myoglobin	107
General molecular features 107, Tertiary structure 107	
Hemoglobins	109
Tertiary and quaternary structure 110, Biological significance of quaternary structure 111, Oxygen dissociation curves 112, Molecular aspects of hemoglobin oxygenation 113, Bisphosphoglycerate as a hemoglobin regulator 115, Physiological importance of hemoglobin regulation 116, Hemoglobin as a H^+ and CO_2 transport protein 117, Binding of H^+ and CO_2 to deoxyhemoglobin 118, N- and C-terminal residues of hemoglobin 119	
Medical Aspects of Hemoglobin Abnormalities	119
Sickle-cell anemia 119, History of sickle-cell research 120, Molecular basis of sickle-cell anemia 121, Individual	

genetics of sickle-cell anemia 123, Population genetics of sickle-cell anemia 123, An anemia related to sickle-cell anemia 124, Hemoglobin and molecular biology 124

9 Proteins IV: Enzymes 129

Introduction	129
General Catalytic Properties of Enzymes	130
Classification of Enzymes by Catalytic Function	132
Enzyme Assays	134
Enzyme Reaction Rates	135
Michaelis–Menten Equation	136
Lineweaver–Burk Plot	138
Enzyme Inhibition	139
Competitive Inhibition	139, Noncompetitive Inhibition
140, Irreversible Inhibition	140
Lineweaver–Burk Plots of Inhibition	141
Active Site and Substrate Binding	142
Quaternary Structure and Isozymes	143
Allosteric Enzymes	145
Catalytic Effectiveness of Enzymes	145
Acid–Base Catalysis	146
Chymotrypsin	147
Activation of chymotrypsinogen	147, Three-dimensional
structure of chymotrypsin	147, Substrate specificity of
chymotrypsin	148
Proposed Catalytic Mechanism of Chymotrypsin	150
“Charge relay system”	150, Double-displacement
mechanism for the hydrolysis of peptide bonds	151
Biochemical Evolution	153
Enzymology and Industry	156

10 B-Vitamins as Coenzymes 163

Introduction	163
The B-Vitamins	164
Thiamin	164, Nicotinamide 165, Riboflavin 168, Vitamin
B ₆	169, Biotin 171, Pantothenic acid 172, Folic acid
173, Vitamin B ₁₂	174, Lipoic acid 177
B-Vitamin Supplementation of Foods	178

11 Carbohydrates 183

Introduction 183

Monosaccharides 184

Nomenclature and Fischer projections 184, Closed-ring structures 185, Haworth projections 186, Other monosaccharides of importance 187

Oligosaccharides 189

Sugars as reducing agents 191, Sugars and other molecules as sweeteners 192

Polysaccharides 192

Starches and glycogen 192, Glycogen synthesis 194, Cellulose 196, Conformations of cellulose and starch 197, Heteroglycans 197, Chemical and functional versatility 199

The Many Uses of Polysaccharides 200

Dextrins 200, Dextrans 200, Additional comments 201

12 Lipids and Membranes 205

Introduction 205

Triacylglycerols 206

Structural components 206, Saponification 207

Lipids of Membranes 208

Phosphoglycerides 208, Sphingolipids 210, Glycolipids 210

Abnormal Lipid Metabolism 211

Tay-Sachs disease 212, Fabry disease 213, Gaucher disease 213, Niemann-Pick disease 213, Impaired biosynthesis of lipids 214

Membranes 215

Bilayer lipid membranes 215, Proteins of membranes 218, Fluid mosaic model of membranes 219

13 Nucleic Acids 225

Introduction 225

Levels of Nucleic Acid Structure 226

Nitrogenous bases 226, Nucleosides 228, Nucleotides 229, Polynucleotide structure 231

Structure of DNA 232

	Molecular Species of RNA	234
	Sequencing of tRNAs	236
	RNA Hydrolysis	237
	Alkaline Hydrolysis	237
	Proposed Catalytic Mechanism of Ribonuclease A	239
	Structure of tRNAs	242
	Nucleic Acids as Hereditary Material	243
14	Energy and Life	251
	Introduction	251
	Free Energy Change of a Chemical Reaction	252
	Standard Free Energy Changes	253
	ATP as an Energy Carrier	254
	Hydrolysis of AMP	257
	Other Phosphorylated Biomolecules	258
	Hydrolytic Reactions Yielding a Large Negative ΔG°	259
	Synthesis of Nucleoside Triphosphates	262
	Synthesis of ATP from AMP and ADP	263
15	Anaerobic Synthesis of ATP (Glycolysis) and Pentose Phosphate Pathway	267
	Introduction	267
	Reactions of the Glycolytic Pathway	269
	Phosphorylation of glucose 269, Derivation of glucose 6-phosphate from glycogen 269, Production of D-fructose 1,6-bisphosphate 272, 6-Phosphofructokinase as a regulatory enzyme 273, Metabolic production of D-glyceraldehyde 3-phosphate 274, <i>sn</i> -Glycerol 3-phosphate dehydrogenase 274, Thermodynamics of the aldolase and triosephosphate isomerase reactions 275, Oxidation of D-glyceraldehyde 3-phosphate 276, First synthesis of ATP 277, Second synthesis of ATP 278, Production of lactate 279	
	Efficiency of Energy Conservation	279
	Alcoholic Fermentation	280
	2,3-Bisphosphoglycerate Synthesis and Degradation	281
	Gluconeogenesis from Lactate	282
	Physiologically irreversible reactions of glycolysis	282,