

Multicolour Illustrative Edition

FUNDAMENTALS OF
BIOCHEMISTRY

For University and College Students in
India and Abroad

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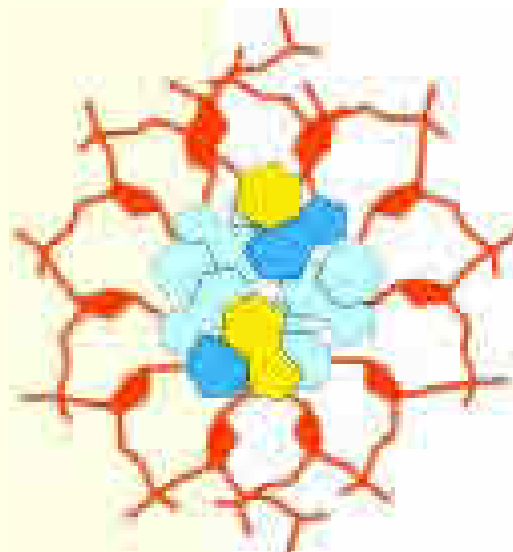
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Sixth Revised
and
Enlarged Edition



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*Dedicated to
my reverend father*
LATE SHRI HAR NARAYAN JAIN
(24-12-1899 — 11-1-1982)

Humanitarian, Philanthropist, Businessman and a True Father

“His life was gentle, and the elements
So mix'd in him that Nature might stand up
And say to all the world, 'This was a man!' ”

—**William Shakespeare**
Julius Caesar, Act V, Scene 5.



“We must trust in nothing but facts
which are presented to us by
nature and cannot deceive.”

—*Antoine Laurent Lavoisier (LT, 1743-1794)*

ABOUT THE AUTHOR

Dr. **J.L. Jain** (born, 20.12.1938) has about 35 years of teaching experience of undergraduate and postgraduate classes. He did M.Sc. (Botany), with specialization in Cytogenetics and Plant Breeding, from Agra University, Agra and was conferred Ph.D. (Virology) from Meerut University, Meerut. He has published about a dozen research papers in various journals of international repute. He has also contributed articles of varied interest in many Magazines and Periodicals.



Dr. J.L. Jain

Dr. Jain has authored many text books pertaining to Botany and Biochemistry, catering to the needs of High School to postgraduate and research students and are being used in India and abroad. He has been an active member of the Leadership Project in Botany, sponsored by the University Grants Commission, New Delhi. He is presently associated with many universities, and prestigious institutions such as Banasthali Vidyapeeth, Jaipur and Madhya Pradesh Bhoj (Open) University, Bhopal, as an expert and counsellor.

Dr. Jain is the recipient of '**Sahitya Bhooshan**' degree from Lucknow, in 1953. He has the rare distinction of being selected fellow of the coveted '**The Linnean Society of London**', the oldest extant society in the world (founded in 1788) devoted to Life Sciences and patronized by Her Most Excellent Majesty Queen Elizabeth II and was awarded **F.L.S.** in 1994.

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PREFACE

TO THE SIXTH EDITION

At the outset, the senior author of the book welcomes his two sons, Dr. Sunjay Jain and Er. Nitin Jain who have joined me as coauthors of this text, a credit which would have been given earlier to them as they were helping in a latent way in the evolution of the book for the past many years.

Thirty two years have elapsed since one of us (JLJ) embarked on the intellectual journey of writing a textbook of Biochemistry. As Biochemistry is growing at a dazzling pace, each edition has been demanding in a different way. In this latest 6th edition, the book has been thoroughly revised, enlarged and updated with not even a single chapter left untouched. Besides, one new chapter **Genetic Code** has been interpolated to enhance the scope and utility of the book. Addition of two new appendices is an added charm of the book : one is ' **The Nobel Prizes** ', the world's most venerated awards and the other is an exhaustive and highly explanatory **Glossary**, containing about 1700 words, along with etymology of many of them. Above and over all, this time the book has been presented in **multicolour edition** with profuse colour illustrations so as to increase its clarity, understandability and legibility, especially of the diagrams.

It is hoped that the present book, in its revised and enlarged multicolour form, would serve in a still better way, the authors are keenly desirous of.

Gratitude is expressed to the students and teachers, both from India and abroad, who have sent in their valuable suggestions which have been given due consideration. We are sincerely thankful to our publishers, specially to Shri Ravindra Kumar Gupta, the Managing Director of the firm, for his wholehearted cooperation and goodwill gesture accorded to. The entire staff of the firm deserves appreciation for their unflinching support during the gestation period of this book. We are also deeply indebted to our own Mrs. Mithlesh K. Jain M.A., for her sustained support of this endeavour from its inception; her wisdom has made all the difference. In fact, we are grateful to our whole family for their patience, buoyancy and encouragement of this venture which was more arduous than anticipated.

Healthy criticism and suggestions for further improvement of the book are solicited.

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J.L. JAIN
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'All the world knows me in my book, and my book in me.'

—*Michael Montaigne*

PREFACE

TO THE FIRST EDITION

Biochemistry is a new branch of science which aims at answering, in chemical language, questions such as 'What is the life made of?' and 'How does it work?' Whereas the eye works at the gross level of visible objects, the microscope reaches down to the cellular level, exposing details of the various cell organelles, including nuclei and other particles. Biochemistry, however, works at a still finer level that cannot be accessed by the ultra-modern optical or phase-contrast microscopes. In other words, it operates at a molecular level and thus brings to light the hidden secrets of life. The rapid development and enormous expansion of every phase of biochemistry has not only markedly enriched our knowledge about the nature of life but has also made biochemistry the very language of life itself.

Realising the paramount importance of this discipline of science, degree courses in biochemistry are now offered in a good number of colleges and universities. But the students offering this subject at undergraduate level come as raw hand, as biochemistry is not taught to them at the school level. It is, in fact, to meet the requirements of such students that this book has been written. Besides, the book may also serve an useful purpose for higher studies.

The book contains the basic concept of biochemistry written in a manner suited to the broad spectrum of the college students. The matter has been lucidly presented, orderly arranged and profusely illustrated. References have been included at the end of each chapter in order to guide the reader to the classical and current literature. A few appendices are given at the end. These may, however, prove useful to the reader. Some illustrations have been adapted from standard texts, journals and research papers. The sources of all such figures have been duly acknowledged in their legends. The author feels greatly beholden to their authors and publishers.

I am also thankful to my publishers, specially to Sri Shyam Lal Gupta and Sr. T.N. Goel for taking keen interest and in bringing out the book in its present form. Finally, I am grateful to my wife Mrs. Mithlesh K. Jain M.A., for inspiring me in proceeding from thoughts to print.

Helpful suggestions for improvement are welcome.

Saharanpur

J.L. JAIN

LIST OF CHAPTERS

PART I PREFATORY

1. Introduction
2. Water : The Solvent of Life
3. pH and Buffers
4. The Atom and Chemical Bonds

PART II BIOMOLECULES

5. Carbohydrates I – General Structure of Monosaccharides
6. Carbohydrates II – Properties of Monosaccharides
7. Carbohydrates III – Oligosaccharides
8. Carbohydrates IV – Polysaccharides
9. Proteins I – General Structure
10. Proteins II – Classification
11. Proteins III – General Properties
12. Lipids I – General Structure
13. Lipids II – Classification
14. Lipids III – Properties of Fats and Oils
15. Nucleic Acids
16. Enzymes I – Nomenclature and Classification
17. Enzyme II – Characteristics and 3-‘D’ Structure
18. Enzymes III – Mechanism of Enzyme Action

PART III BIOENERGETICS AND METABOLISM

19. Metabolic Concepts
20. Bioenergetics
21. Glycolysis
22. Pyruvate Oxidation and Citric Acid Cycle
23. Electron Transport and Oxidative Phosphorylation
24. Oxidation of Fatty Acids
25. Biosynthesis of Lipids
26. Oxidation of Amino Acids
27. Biosynthesis of Amino Acids
28. Biosynthesis of Proteins
29. Protein Targeting and Degradation
30. Genetic code.

PART IV HORMONE BIOCHEMISTRY

31. Animal Hormones
32. Plant Hormones

PART V NUTRITION BIOCHEMISTRY

33. Fat-soluble Vitamins
34. Water-soluble Vitamins

PART VI ANALYTICAL BIOCHEMISTRY

35. Biochemical Techniques

|

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PART I PREFATORY

1. INTRODUCTION

3-15

- Definition 3
- Historical Resume 4
- Biochemistry as Molecular Logic of Living Organisms 9
- Nature 10
- Axioms of Living Matter 11
- Major Organic Compounds of Animate Objects 12
- The Scientific Method of Approach 13
- Importance 14
- Literature 14



2. WATER : THE SOLVENT OF LIFE

16-35

- General Considerations 16
- Physical Properties of Water 19
- Structure of Water Molecule 21
- Weak Interactions in Aqueous Solutions 24
 - Hydrogen bonding between water molecules 24
 - Hydrogen bonding between water and solute molecules 25
 - Interaction between water and charged solutes 27
 - Interaction between water and nonpolar gases 28
 - Interaction between water and nonpolar compounds 29
 - Van der Waals interactions 30
- Role of Noncovalent Interactions 32
- Role of Water in Life 33



3. pH AND BUFFERS

36-52

- Ionization of Water, Weak Acids and Weak Bases 36
- The pH Scale 37
- Brönsted–Lowry Concept of Acids and Bases 41
 - Strong and weak acids 41
 - Ionization of weak acids 42
 - Titration of a weak acid by a strong base 43
- Buffers 44
 - Henderson–Hasselbalch equation 46



- Biological buffer systems 48
 - The phosphate buffer system 49
 - The bicarbonate buffer system 49
 - The protein buffer systems 50
 - The amino acid buffer systems 50
 - The hemoglobin buffer systems 51

4. THE ATOM AND CHEMICAL BONDS

53-70

- Elementary Composition of Living Matter 53
- Structure of an Atom 55
- Ionization Potential 57
- Nature of Chemical Bonding 58
- Types of Chemical Bonding 58
 - Electrovalent or Polar or Ionic bond 59
 - Covalent or Nonpolar bond 60
 - Electron affinity or Electronegativity 61
 - Polar and nonpolar covalent bonds 62
 - Bond length or Bond distance 63
 - Bond angle 63
 - Bond strength and bond energy 65
 - Coordinate or Semipolar or Dative bond 65
 - Noncovalent bonds or interactions 67
 - Electrostatic or ionic bonds 67
 - Hydrogen bonds 68
 - Hydrophobic or nonpolar interactions 69
 - Van der Waals interactions 70



PART II BIOMOLECULES

5. CARBOHYDRATES-I – GENERAL STRUCTURE OF MONOSACCHARIDES

73-90

- Importance 73
- Nomenclature and Definition 74
- Classification 74, Asymmetry 75
- The 5th Incarnation of Carbon 76, Isomerism 77
- Kiliani Cyanohydrin Synthesis 78
- Optical Isomerism 81, Mutarotation 81
- Formulation of Monosaccharides 82
 - Formula of Glucose—Linear Form 82, Ring Form 82
 - Haworth Perspective Formula 86



6. CARBOHYDRATES-II – PROPERTIES OF MONOSACCHARIDES

91-99

- Reaction of glycosidic OH group 91
- Reaction involving both glycosidic and alcoholic OH groups 92
- Reaction of alcoholic group 92
- Reaction involving both alcoholic OH and CHO/CO groups 93
- Reactions of CHO/CO group 93

7. CARBOHYDRATES-III – OLIGOSACCHARIDES

100-113

- Conformation of Pyranose and Furanose Rings 100
- Sucrose or Saccharose 101
- The Artificial or Synthetic Sweeteners 104, Lactose 106
- Maltose 108, Cellobiose 110, Isomaltose 111, Trehalose 111

(xii)



Comparative Chart of Important Disaccharides 112

8. CARBOHYDRATES IV – POLYSACCHARIDES

114-131

Homopolysaccharides 115

Starch 115, Glycogen 118, Inulin 118
Cellulose 119, Pectin 122, Chitin 122
Hemicelluloses 123, Xylan 123
Heteropolysaccharides 123, Mucopolysaccharide 124
Hyaluronic Acid 124, Chondroitin 125
Chondroitin Sulfates 126, Dermatan Sulfate 126
Keratosulfate 126, Heparin 126

Analysis of Carbohydrates 127

Comparative Chart of Important Homopolysaccharides 129



9. PROTEINS I – GENERAL STRUCTURE

132-203

Importance 132

Amino Acids 133

Structure 133, Specific rotation 134

Distribution in proteins 135

Location in proteins 135, Physical properties 135

Electrochemical properties 136, Classification 139

Based on the composition of the side chain or R group 139

Based on the number of amino and carboxylic groups 139

Based on the polarity of the side chain or R group 141

Nonstandard Protein Amino Acids 144

Nonprotein Amino Acids 145

Peptides 146

Peptide bond 146, N- and C-terminals 147

Representation of peptide chain 148,

Naming of peptide chain 148

Determination of amino acid sequence of a polypeptide 148

Stereochemistry of peptide chains 149, Biological roles 150

Chemical Bonds Involved in Protein Structure 150

Primary bond – Peptide bond 151

Secondary bonds– Disulfide, Hydrogen, Nonpolar or hydrophobic and
Ionic or electrostatic bonds 151

Characteristics of Chemical Bonds 155

Protein Configuration 155

Primary structure : Amino acid sequence 156

Rigid and planar peptide bond 156, Ramachandran Plot 158

Secondary structure : Helix formation 160

α -helix 160, β -pleated sheet 164, Random coil 165

Other secondary structures– β turn, Collagen triple helix, Elastin 165

Hydrogen bonding potentialities of proteins 170

Tertiary structure : Folding of the chain 171

Myoglobin 171, Ribonuclease 176

Carboxypeptidases 177

Quaternary structure : Protein-protein interactions 179

Tobacco mosaic virus 179, Hemoglobin 180

Similarity in 30-‘D’structure of hemoglobin and myoglobin 181

Hemoglobin as an allosteric protein 183

Cooperativity in oxygen-binding of hemoglobin 183

The Bohr effect 184

BPG as a hemoglobin regulator 185

Oxygen affinity of fetal hemoglobin 185



- Oxygenation of hemoglobin 186
- Mechanism of allosteric interactions of hemoglobin 188
 - Sequential model 188, Concerted model 189
 - Dynamics of Globular Protein Structure 190
 - Prediction of Secondary and Tertiary Protein Structure 195
 - Cleavage of a Protein 197

Biological Roles of Proteins 198

10. PROTEINS II – CLASSIFICATION

204–213

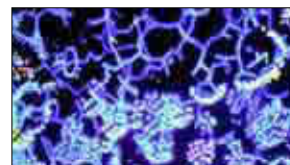
- Classification Based on the Source of Protein Molecule 204
- Classification Based on the Shape of Protein Molecule 205
 - Globular proteins 205
 - Fibrous proteins 205
- Classification Based on Composition and Solubility 206
 - Simple proteins– Protamines and Histones. Albumins. Globulins. Glutelins. Prolamines. Scleroproteins or Albuminoids 206
 - Conjugated proteins–Metalloproteins, Chromoproteins. Glycoproteins and Mucoproteins. Phosphoproteins. Lipoproteins. Nucleoproteins 208
 - Derived proteins – Primary derived proteins– Proteins. Metaproteins. Coagulated proteins. 209
 - Secondary derived proteins– Proteoses. Peptones. Polypeptides. 209
- Two (2nd and 3rd) Systems of Classification Merged and Outlined. 210*
- Classification Based on Biological Function 210
 - Egg Proteins 212, Milk Proteins 213



11. PROTEINS III–GENERAL PROPERTIES

214–229

- Physical Properties– Colour and taste. Shape and size. Molecular weight. Colloidal nature. Denaturation. Amphoteric nature. Ion binding capacity. Solubility. Optical activity 214
- Chemical Properties 219
 - Hydrolysis 219, Reactions involving COOH group 220
 - Reactions involving NH₂ group 221
 - Reactions involving both COOH and NH₂ groups 222
 - Reactions involving R group or side chain 225
 - Reactions involving SH group 226
- Colour Reactions for Amino Acids in a Tabulated Form 226*



12. LIPIDS I – GENERAL STRUCTURE

230–243

- Importance 230, Definition 231
- Two Components– Alcohol and Fatty acids
 - Alcohols– Saturated and Unsaturated 232
 - Fatty acids–Nomenclature (Genevan system) 232
 - Saturated fatty acids 233
 - Unsaturated fatty acids–Geometric isomerism and Nonconjugated double-bond system 235
 - Hydroxy fatty acids. 238
 - Cyclic fatty acids. 239
- Biological Roles of Lipids 240



13. LIPIDS II – CLASSIFICATION

244–268

- Simple Lipids– Fats and oils. Waxes 245
- Compound Lipids 248
 - Phospholipids 248, Phosphoglycerides. 249
 - Phosphoinositides. 251, Phosphosphingosides 251
 - Glycolipids 252 also Gangliosides. 253
 - Sulfolipids. 254 Sulfatids. 254

(xiv)

Derived Lipids 255

Steroids 255, C₂₉, C₂₈ and C₂₇ steroids 257

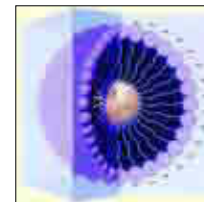
C₂₄ steroids. 261, C₂₁, C₁₉ and C₁₈ steroids. 262

Terpenes 263, Monoterpenes and sesquiterpenes. 264

Diterpenes. 264, Triterpenes 265, Polyterpene. 265

Carotenoids– Lycopene 266, Carotenes. 266

Xanthophylls 268



14. LIPIDS III – PROPERTIES OF FATS AND OILS

269–279

Physical properties 269

State 269, Colour, odour and taste 269

Solubility 269, Melting point. Specific gravity 270

Geometric isomerism 270, Insulation 271

Emulsification 271

Surface tension 271

Chemical Properties 271

Reactions involving COOH group 271

Hydrolysis 271, Saponification 272

Hydrolytic rancidity 273

Reactions involving double bond 273

Hydrogenation 273, Halogenation. 273, Oxidation 273

Oxidative rancidity 274, Reactions involving OH groups 275

Dehydration (=Acrolein test) 275

Quantitative Tests 275

Analytical Values for Some Liquids in Tabulated Form 276

Fats– Facts and Fantasies 276

15. NUCLEIC ACIDS

280–332

Introduction 280, Historical Resume 280, Definition 281

Types 282

Three Components–Phosphoric acid 282, Pentose sugar 283

Nitrogenous bases. (Also Modified bases) 284

Nucleosides 287, Nucleotides 290, Deoxyribonucleic Acid 292

Internucleotide linkages 293

Base composition 294, Evolution of Waston-Crick model 298

Double helical structure 299

Denaturation and renaturation 304

Molecular weight 306, Length 306

Shape and size 306, Variants of double helical DNA 307

DNAs with unusual structures 312

Single-stranded DNA 314, Ribonucleic acid 314

Differences with DNA 315

Ribosomal RNA 318, Transfer RNA 320

Messenger RNA 325, Heterogeneous nuclear RNA 328

Informosome 329

16. ENZYMES I – NOMENCLATURE AND CLASSIFICATION

333–348

Importance 333, Historical Resume 337

Nomenclature and Classification 338

Substrate acted upon by the enzyme 338

Type of reaction catalyzed 338

Substrate acted upon and type of reaction catalyzed 338

Substance that is synthesized 338

Chemical composition of the enzyme 339

Substance hydrolyzed and the group involved 339

Over-all chemical reaction taken into consideration



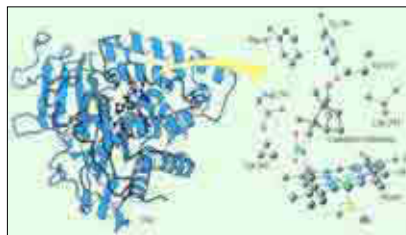
(= I.U.B. system of classification) 339
Isoenzymes or Isozymes 343, Multienzyme Systems 344
Biological Roles of Enzymes 344

17. ENZYME II – CHARACTERISTICS AND THREE-DIMENSIONAL STRUCTURE **349–371**

Chemical Nature of Enzymes 349
Characteristics of Enzymes 350
Colloidal nature. 350, Catalytic nature 350
 Specificity of enzyme action. 352
 Thermolability 355, Reversibility of a reaction 357
 pH sensitivity 358
Three-dimensional Structure of the Enzymes 359
 Ribonuclease 359, Lysozyme 360, Chymotrypsin 363

18. ENZYMES III – MECHANISM OF ENZYME ACTION **372–404**

Energy Mechanics of Enzymatic Reactions 372
Michaelis Menten Hypothesis 375
Michaelis-Menten equation 375
Lineweaver-Burk equation. 376
Significance of K_m and V_m values 378
Active Site 379



 Fischer's lock and key model 380
 Koshland's induced fit model 381
Enzyme Reaction Rates 382
Modifiers of Enzyme Activity 384
 Inorganic modifiers or Enzyme activators 385
 [also Regulation of enzyme activity]
 Organic modifiers or Enzyme inhibitors 387
 Reversible enzyme inhibition 388
 Competitive inhibition. 389, Noncompetitive inhibition 392
 Uncompetitive inhibition 392
 Irreversible enzyme inhibition 392
 Bisubstrate reactions 393
Allosteric Enzymes 397
 Simple sequential model 399
 Concerted or symmetry model 400

PART III BIOENERGETICS AND METABOLISM

19. METABOLIC CONCEPTS **407–433**

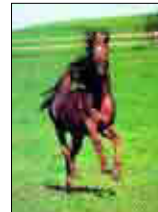
Definition of Metabolism 407
Terminology of Metabolism 408
Metabolic Pathways 414
 Catabolic pathways 415,
 Anabolic pathways 416
Central Pathways 416
Catabolism versus Anabolism 417
Anaplerotic Pathways 422,
Secondary Pathways 422
Unifying Themes of Metabolic Pathways 422
Regulation of Metabolic Pathways 430
Evolution of Metabolic Pathways 431



20. BIOENERGETICS

434–457

- Coupling 434, Concept of Energy 435
- Thermodynamic Principles 435
 - The first law 435, The second law 436, Combining the two laws 437
- Relationship Between Standard Free Energy Change and Equilibrium Constant 439
- Standard Free Energy Changes at pH 7.0 or $\Delta G^{0'}$. 441
- Differences Between ΔG and $\Delta G^{0'}$. 442
- Standard Free Energy Values of Chemical Reactions are additive. 443
- ATP as Universal Currency of Free Energy in Biological Systems 444
- Free Energy of Hydrolysis of ATP and Other Organophosphates 446
- Structural Basis of the High Group Transfer Potential of ATP 448
- ATP Hydrolysis and Equilibria of Coupled Reactions 450
- Role of High Energy Phosphates as the 'Energy Currency' of the Cell 451
 - Processes which generate ~ P 451
 - Processes which utilize ~ P 452
- Interconversion of Adenine Nucleotides 453



21. GLYCOLYSIS

458–480

- General Considerations of Glycolysis 459
- Two Phases of Glycolysis 460
 - Preparatory phase 460, Payoff phase 461
- Enzymes Involved in Glycolysis 462
- Kinds of Reactions in Glycolysis 462
- Reaction Steps of Glycolysis (10 steps) 464
- Stoichiometry of Glycolysis 475
 - Overall balance sheet 475, Energy yield 475
- Muscle (or anaerobic) Glycolysis and Homolactic Fermentation 475
- Alcoholic Fermentation 477



22. PYRUVATE OXIDATION AND CITRIC ACID CYCLE

481–521

- Three Stages of Cell Respiration 481
- Oxidative Decarboxylation of Pyruvate to Acetyl-CoA 483
- Regulation of Oxidative Decarboxylation of Pyruvate 486
- Citric Acid Cycle or Krebs's Cycle or Acetyl-CoA Catabolism 488
- Enzymes Involved in the Citric Acid Cycle 488
- Overview of the Citric Acid Cycle 490
- Reaction Steps of the Citric Acid Cycle (8 steps) 491
- Stoichiometry of the Citric Acid Cycle 500
 - Overall balance sheet 500, Energy yield 502
- Role of Water in the Citric Acid Cycle 503
- Stereospecificity of the Citric Acid Cycle 503
 - Biological asymmetry of citrate 503
 - Geometrical specificity of succinate dehydrogenase 505
 - Geometrical specificity of fumarate hydratase 505
- Regulation of the Citric Acid Cycle 505
- Amphibolic Roles of the Citric Acid Cycle 510
 - Biosynthetic roles 511, Anaplerotic roles 512
- Carbon Dioxide-fixation Reactions (=Wood-Werkmann's Reactions) 512
- Modification of the Citric Acid Cycle : Glyoxylate Cycle 514

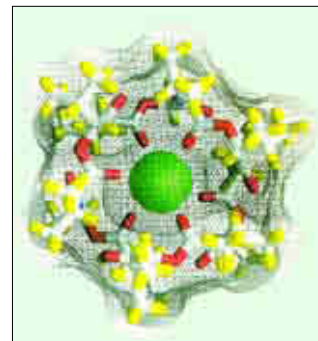


23. ELECTRON TRANSPORT AND OXIDATIVE PHOSPHORYLATION

522–563

- Electron Flow as Source of ATP Energy 522
- Site of Oxidative Phosphorylation. 524
- ATP synthetase (=F₀F₁AT Pase). 525
- Electron-transferring Reactions 528

| | |
|---|-------------------------------------|
| Standard Oxidation–reduction Potential | 528 |
| Electron Carriers | 531 |
| Pyridine nucleotides | 531 |
| NADH dehydrogenase (=NADH-Q reductase) | 533 |
| Ubiquinone (=Coenzyme Q) | 534 |
| Cytochromes | 535 |
| Electron-transport Complexes | 538 |
| Incomplete Reduction of Oxygen | 541 |
| Mechanisms of Oxidative Phosphorylation | 542 |
| Chemical coupling hypothesis | 542 |
| Conformational coupling hypothesis | 543 |
| Chemiosmotic coupling hypothesis | 544 |
| Salient features | 544, Evidences in favour 545 |
| Oxidation reduction loop | 546, Proton transport mechanism 547 |
| Inner membrane transport systems | 547 |
| Oxidation of Extramitochondrial NADH | 549 |
| (=NADH Shuttle Systems) | |
| Malate-oxaloacetate-aspartate shuttle | 549 |
| Glycerophosphate-dihydroxyacetone phosphate shuttle | 550 |
| ATP Yield and P : O Ratio | 550 |
| Roles of Electron Transport Energy | 552 |
| Respiratory Inhibitors | 553 |
| Inhibitors of electron transport | 553 |
| Inhibitors of oxidative phosphorylation | 555 |
| Uncouplers of oxidative phosphorylation | 555 |
| Ionophores of oxidative phosphorylation | 556 |
| Regulatory Controls among Glycolysis, the Citric Acid Cycle and Oxidative Phosphorylation | 558 |



24. OXIDATION OF FATTY ACIDS

564–593

| | |
|---|----------------------|
| Introduction | 564 |
| Oxidation of Fatty Acids | 567 |
| General considerations | 567 |
| Activation of a fatty acid | 569 |
| Reactions of fatty acid oxidation | 570 |
| Oxidation of Even-chain Saturated Fatty Acids (=Knoop's β Oxidation Pathway) | 570 |
| Four steps of β oxidation | 572 |
| Stoichiometry of β oxidation | 574 |
| Oxidation of Unsaturated Fatty Acids | 576 |
| Oxidation of monounsaturated fatty acids | 576 |
| Oxidation of polyunsaturated fatty acids | 576 |
| Oxidation of Odd-chain Fatty Acids | 578 |
| Methylmalonate pathway | 579 |
| β - hydroxypropionate pathway | 581 |
| α Oxidation of Fatty Acids | 581 |
| ω Oxidation of Fatty Acids | 582, Ketogenesis 584 |
| General considerations | 584 |
| Biosynthesis and utilization of ketone bodies | 585 |
| Ketogenic and antiketogenic substances | 586 |
| Regulation of ketogenesis | 587 |
| Fatty Acid Oxidation in Peroxisomes | 588 |
| Metabolic Water | 589 |



25. BIOSYNTHESIS OF LIPIDS

594–640

| | |
|---------------------------------------|-----|
| Nature and Distribution of Fat Stores | 594 |
|---------------------------------------|-----|

- Biosynthesis of Fatty Acids 595
 - Acetyl-CoA transport into the cytosol 596
 - Production of malonyl-CoA 596
 - Intermediates in fatty acid synthesis and the ACP 599
 - The fatty acid synthase complex 600
 - The fatty acid synthase from some organisms 601
 - Priming of the fatty acid synthesis by acetyl-CoA 601
 - Growth of the fatty acyl chain by two carbons 601
 - Stoichiometry of fatty acid synthesis 605
 - Comparison of fatty acid synthesis and degradation 605
- Biosynthesis of Long-chain Fatty Acids 607
- Biosynthesis of Unsaturated Fatty Acids 608
- Biosynthesis of Eicosanoids 610
- Biosynthesis of Triacylglycerols 612
- Biosynthesis of Membrane Phospholipids 615
 - Phospholipid synthesis in *Escherichia coli* 616
 - Phospholipid synthesis in eukaryotes 618
 - Interrelationship among the eukaryotic pathways 619
 - Biosynthesis of sphingolipids 620
- Biosynthesis of Cholesterol 621
 - Plasma lipoproteins 624
 - Chylomicrons 630
 - Regulation of cholesterol biosynthesis 632
- Biosynthesis of Steroid Hormones 634



26. OXIDATION OF AMINO ACIDS

641–674

- Introduction 641
- Amino Group Metabolism 642
 - Transfer of amino groups to glutamate 643
 - Removal of amino groups from glutamate 647
 - Transport of ammonia through glutamine to liver 647
 - Glucose–Alanine cycle 648
- Nitrogen Excretion 649
 - The urea cycle 650
 - The “Krebs bicycle” 652
 - Energetics of the urea cycle 653
 - Genetic defects in the urea cycle 653
- Pathways of Amino Acid Catabolism 654
 - Ten amino acids are degraded to acetyl-CoA. 656
 - Five amino acids are converted into α -ketoglutarate 660
 - Four amino acids are converted into succinyl-CoA 662
 - Three branched-chain amino acids are degraded in extrahepatic tissues. 662
 - Two amino acids are degraded to oxaloacetate. 664
- Inborn Errors of Amino Acid Catabolism 665
 - Alkaptonuria 668, Albinism 668, Phenylketonuria 668
 - Maple syrup urine disease 670



27. BIOSYNTHESIS OF AMINO ACIDS

675–717

- An Overview of Amino Acid Biosynthesis 675
 - General considerations 675
 - Essential and nonessential amino acids 676
 - Metabolic precursors of amino acids 678
- An overview of Nitrogen Metabolism 680
 - Nitrogen cycle 680
 - Nitrogenase complex 682
 - Reduction of nitrate and nitrite 684

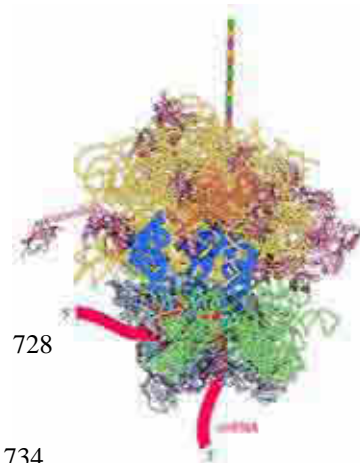


- Fixation of Ammonia into Amino Acids 685
- Biosynthesis of Amino Acids 687
 - Syntheses of amino acids of α -ketoglutarate precursor family 687
 - Syntheses of amino acids of 3-phosphoglycerate precursor family 692
 - Syntheses of amino acids of oxaloacetate and pyruvate precursor family 698
 - Syntheses of amino acids of PEP-erythrose- 4-phosphate precursor family 698
 - Synthesis of amino acid of ribose-5-phosphate precursor family 702
- Regulation of Amino Acid Biosynthesis 702
 - Sequential feedback control 705
 - Differential multiple enzyme control 706
 - Concerted feedback control 706
 - Cumulative feedback control 706
- Molecules Derived from Amino Acids 707
 - Biosynthesis of porphyrins 707
 - Biosynthesis of bile pigments 709
 - Biosynthesis of creatine and glutathione 709
 - Biosynthesis of neurotransmitters 711
 - Formation of nitric oxide from arginine 713
 - Biosynthesis of lignin, tannin and auxin 714
 - Biosynthesis of papaverine from tyrosine 714

28. BIOSYNTHESIS OF PROTEINS

718-772

- General Considerations 718
- Major Breakthroughs in Protein Synthesis 720
 - Ribosomes as the site of Protein Synthesis 720
 - RNA as a receptor molecule 720
 - Adaptor hypothesis 721
- Central Dogma of Molecular Genetics 721
- Phases of Protein Synthesis 722
- The Two Components in Protein Synthesis 724
 - Ribosome 724
 - Transfer RNA 728
- Activation of Amino Acids 728
 - Two classes of aminoacyl-tRNA synthetases 728
 - Proofreading by some aminoacyl-tRNA synthetases 728
 - The "second genetic code" 733
 - Direction of the growth of polypeptide chain 733
- Initiation of Protein Synthesis 734
 - Translation of messenger RNA in 5' @ 3' direction 734
 - Coupling between transcription and translation in bacteria 734
 - Polyribosomes 735
 - N-formylmethionine as initiator of protein synthesis in bacteria 735
 - The three steps of initiation process 737
 - Shine-Dalgarno sequence 739
- Elongation of the Polypeptide Chain 740
 - Codon recognition 741
 - Peptide bond formation 741
 - GTPase rate of EF-Tu as the pace setter of protein synthesis 746
- Termination of Polypeptide Synthesis and Release of Polypeptide Chain 747
- Folding and Processing of Polypeptide chain 749
- Energy Requirements for Peptide Bond Formation 752
- Inhibitors of Protein Synthesis 752
- Eukaryotic Protein Synthesis 757
- Protein Synthesis in Mitochondria and Chloroplasts 759
- Salient Features of Ribosomal Protein Synthesis 762
- Biosynthesis of Short Peptides 762

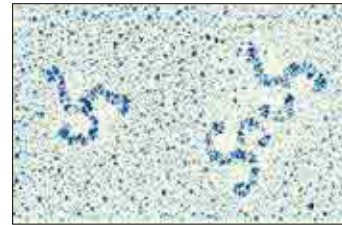


Synthesis of gramicidin 762
Synthesis of glutathione 762
Evolution of Protein Synthesis 765

29. PROTEIN TARGETING AND DEGRADATION

773–808

General Considerations 773
Free and Membrane-bound Ribosomes 774
Signal Hypothesis 776
Glycosylation of Proteins at the Level of ER 779
 Core glycosylation 779, Terminal glycosylation 781
 GTP-GDP cycle and the signal sequence 785
 Chaperones and the nascent protein folding 786
Envelope Carrier Hypothesis 787
Proteins with a Carboxyl-terminal KDEL Sequence 788
(=Recycling of Resident Proteins of the ER)
 Protein transport to lysosomes 789
 Protein transport to mitochondria 791
 Protein transport to chloroplasts 791
 Protein transport to peroxisomes 792
 Protein transport to nucleus 793
Bacterial Signal Sequences and Protein Targeting 794
Eukaryotic Protein Transport Across Membranes 796
Protein Import by Receptor-mediated Endocytosis 797
 Cell-surface receptors and clathrin 798
 Receptor-mediated Endocytosis 799
Protein Degradation 800
 Protein degradation in prokaryotes 802
 Protein degradation in eukaryotes 802
 Ubiquitin proteolytic system 802, Polyubiquitin system 803



30. GENETIC CODE

809–829

General Considerations 809, Nature of the Genetic Code 810
The Genetic Code 812, Characteristics of the Genetic Code 814
Deciphering the Genetic Code or Codon Assignment 818
Multiple Recognition of Codons and Wobble Hypothesis 823
Preferential Codon Usage 825
Mutations and the Genetic Code 825
New Genetic Codes 827, Overlapping Genes 828
Evolution of The Genetic Code 829



PART IV HORMONE BIOCHEMISTRY

31. ANIMAL HORMONES

835–915

Definition 835, General Functions 836
Invertebrate Hormones 838
Hormones from Coelenterata, 838
Annelida, Arthropoda, Mollusca and Echinodermata 838
Vertebrate Hormones – Classification outlined 842
Steroidal Hormones 844
 Ovarian hormones– Structure. Biosynthesis. Metabolism. Functions. Castration 844

Testicular hormones–Structure. Biosynthesis. Metabolism. Functions. Castration 848
 Adrenal cortical hormones – Secretory gland. Structure. Functions 850
 Hypoadrenocorticism 853
 Hyperadrenocorticism. Adrenal decortication 853
 Corpusluteal hormones– Structure. Biosynthesis. Metabolism. Functions. [also Relaxin] 854
 Prohormones or Hormogens 857
 Peptide Hormones 857
 Hormones of the pancreas– Secretory gland. Structure. Biosynthesis. Functions. Hypoglycemic agents 857
 Hyperglycemic agents 864
 Hormones of the hypothesis– Secretory gland. Structure. Functions.
 Hypopituitarism. 866
 Hyperpituitarism. 875, Hypophysectomy 876
 Hormones of the parathyroid – Secretory gland. Structure. Functions. Hypoparathyroidism. 877
 Hyperparathyroidism. 878
 Hormones of the gastrointestinal tract 879
 Amino Acid Derivatives 880
 Thyroidal hormones – Secretory gland. Structure. Functions. Goitrogens. Hypothyroidism. 880
 Hyperthyroidism. [also Thyrocalcitonin]. 882
 Adrenal medullary hormones – Structure. Functions. Adrenal demedullation. 885
 Parahormones or Tissue Hormones 887
 Pineal hormone – Melatonin 887
 Renal hormones – Erythropoietin and Renin 888
 Eicosanoid hormones 889
 Prostaglandins 889
 Thromboxanes and Prostacyclins 892
 Leucotrienes 893
 Opiate peptides 897
 Vasoactive Peptides 897
 Neurohypophyseal hormones 897
 Angiotensins 897, Kinins 897
 Hormone from Thymus 899
 Pheromones or ‘Social’ Hormones 899
 Mechanisms of Hormone Action 903
Characteristics of Animal Hormones in Tabulated Form 908



32. PLANT HORMONES

916–956

Definition 916, Auxins 917, Definition. 917
 Oat Coleoptile and the Auxins 917, Extraction. 919
 Bioassay. 919, Biochemistry 919
 Biogenesis. 924, Distribution. 925, Concentration. 926
 Translocation. 926, Mechanism of Action. 927
 Gibberellins 934, Discovery. 934, Definition. 934
 Isolation, Distribution and Biosynthesis. Chemistry 935
 Physiological roles. Relationship between auxins and gibberellins. 938
 Cytokinins 941 Discovery and nomenclature. 941, Definition. 941
 Isolation, Distribution and Biosynthesis 942
 Chemistry. Physiological Roles. 943

- Other Natural growth Hormones in Plants 946, Ethylene. 946
- Discovery, Distribution and biosynthesis. 946
- Physiological Roles. 946
- Ethylene versus Auxin. 949, Growth Inhibitors 950
- Introduction. 950, Characteristics. 950
- Abscisic acid or abscisin II or dormin. 951
 - Distribution and biosynthesis. Chemistry. 952
 - Physiological Roles. 952
- Morphactins. 953
- Oligosaccharins and other plant hormones 953
- Hormonal interactions. 954
 - Plant Hormones versus Animal Hormones 954

PART V NUTRITION BIOCHEMISTRY

33. FAT-SOLUBLE VITAMINS

959-987

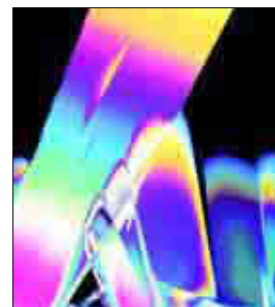
- Historical Resume. 959, Definition. 961
- General Characteristics. 962
- Classification. Storage. 962
- Daily Requirements of Vitaminoses 963
- History. Occurrence. Structure. Properties, Metabolism. Deficiency and Human Requirements of – 964
 - Vitamin A. 966, Vitamin D. 972, Vitamin E. 977
 - Vitamin K. 979, Coenzyme Q. 982, and Stigmasterol. 983
- Characteristics of Fat-soluble Vitamins in Tabulated Form* 984



34. WATER-SOLUBLE VITAMINS

988-1024

- History 989, Occurrence. 989, Structure. 989
- Properties. 990, Metabolism. 990
- Deficiency and Human Requirements of – 991
 - Vitamin B₁ 992, Vitamin B₂, 992, Vitamin B₃, 994
 - Vitamin B₅, 995, Vitamin B₆, 997, Vitamin B₇, 999
 - Vitamin B₉, 1002, Vitamin B₁₂ 1004, Vitamin C. 1009
 - Choline, 1015, Inositol, 1016
 - Para-aminobenzoic acid, 1017
 - Alpha-lipoic acid, 1017, Carnitine 1018
 - and Bioflavonoids. 1019, Vitamers (= isotels) 1020



PART VI ANALYTICAL BIOCHEMISTRY

35. BIOCHEMICAL TECHNIQUES

1027-1048

- Observations on Tissues 1027
 - Perfusion. 1027, Tissue slices. 1028
- Homogenization. 1028,
- Differential centrifugation. 1029
- Chromatography 1030
 - Paper chromatography 1031
 - Ascending and descending. One-dimensional and two-dimensional.
 - Thin layer chromatography 1035
 - Ion exchange chromatography 1035

Isotopic Tracer Technique 1036
 Stable isotopes – Mass spectrometer. 1037
 Radioactive isotopes – Geiger-Muller counter. Scintillation counting. Applications. 1037
 Neutron activation. 1039
 Spectrophotometry– Principle. Spectrophotometer. Applications. 1039
 Electrophoresis– Principle. Electrophoresis apparatus. Modification. 1040
 Ultracentrifugation– Principle. Ultracentrifuge. 1043



APPENDICES

1049–1090

Appendix I : Selected Bibliography 1051
 Appendix II : Greek Alphabet 1054
 Appendix III : Exponential Notation 1055
 Appendix IV : The International System of Units 1056
 Appendix V : Comparison of Metric and Other Units 1061
 Appendix VI : Mathematical Signs and Symbols 1063
 Appendix VII : Relative Sizes of Structures, from Atoms to Eggs 1064
 Appendix VIII : List of Abbreviations and Symbols 1065
 Appendix IX : The Nobel Prizes 1079
 Appendix X : Chronological Table of Important Biochemical Events 1082

GLOSSARY

1093-1162

ANSWERS TO PROBLEMS

1163-1198

INDICES

Index I : Author Index
 Index II : Subject Index

1201-1212
1213-1230