## **Contents**

1.	Introduction				
	1.1	What is Biophysics?	1		
	1.2	Cell Components and Their Specific Features	4		
	1.3	The Aim of the Book	7		
2.	The Ordering of Biological Structures				
	2.1	Are They so Ordered in Reality?	8		
	2.2	Entropy and Information	8		
	2.3	What is the Cost of Biological Ordering?	12		
	2.4	The Meaning of Biological Ordering	14		
	2.5	The Necessity of Mechanical Details	18		
	2.6	The Problems	18		
3.	Nonequilibrium Thermodynamics and Biological Physics				
	3.1	Open Systems	19		
	3.2	Phenomenological Relations	20		
	3.3	Stationary States	24		
	3.4	Dissipative Structures	26		
	3.5	Oscillatory Phenomena in Chemistry and Biochemistry	30		
	3.6	The Problems	31		
4.	On the Statistical Physics of Biopolymers				
	4.1	Where does Mechanics Begin?	33		
	4.2	Statistical Physics of a Linear Homopolymer	35		
	4.3	On the Statistical Nonequilibrium of Biopolymer Structures at			
		Different Levels of Organization	44		
	4.4	On Certain Properties of Biopolymer Structures that Can Be			
		Understood in Terms of Their Statistical-Physical Description	46		
5.	Conformational and Configurational Changes of Biopolymers 4				
	5.1	Introductory Remarks	49		
	5.2	Biopolymer Denaturation	50		

		5.2.1 Acid Denaturation of Ferrihemoglobin	51
		5.2.2 Thermal Denaturation of Proteins	57
		5.2.3 On the Kinetics of Denaturation Processes	63
	5.3	On the Difference Between Activation Energy and Activation	
		Enthalpy	65
	5.4	Some Protein Reactions	67
		5.4.1 Hemoglobin Oxygenation	72
		5.4.2 The Oxidation and Reduction of Cytochrome c	76
	5.5	On the Compensation Effect	80
	5.6	On the Validity of the Van't Hoff and Arrhenius Equations and of	
		the Activated State Theory for Biopolymer Reactions	83
	5.7	On Spontaneous Conformational Oscillations of Protein	
		Macromolecules	90
	5.8	Conclusions	91
6.	The	Physics of Enzyme Catalysis	93
•	6.1	Background	93
	6.2	Existing Interpretations of Enzymatic Activity	94
	0.2	6.2.1 Enzyme Increases the Activation Entropy	96
		6.2.2 Enzyme Lowers the Activation Energy	99
		6.2.3 Enzyme Heightens the Probability of Useful Energy	
		Fluctuation	101
		6.2.4 Energy Recuperation	101
	6.3	Conformational Changes as Necessary Steps of Enzymatic Processes	103
	6.4	The Effect of Temperature on Enzymes and on the Activation	100
	0.1	Parameters of Enzyme Reactions	105
	6.5	The Physics of Elementary Steps of Enzyme Catalysis [6.69,72,79,80]	110
	6.6	Dynamic Model for Aspartate-Amino-Transferase	119
	6.7	Conclusions	124
7.	The	Physics of Electron Transfer in Biological Systems	125
	7.1	Overview	125
	7.2	Free Radicals and Radical Ions in Biochemical Reactions	126
	7.3	Electron Transport Chains (ETC) in Mitochondrial and Chloroplast	
		Membranes	137
	7.4	Electron Transfer Reactions and Semiconduction in Biological	
		Systems	151
	7.5	On the Tunnelling Mechanisms of Electron Transfer Between the	
		FTC Components	157

8.	The	Physics of Intracellular Energy Transformation and Accumulation	164
	8.1	Overview	164
	8.2	The ATP Problem	165
	8.3	Substrate Phosphorylation	176
	8.4	Membrane Phosphorylation: Thermodynamic Aspects	180
	8.5	Membrane Phosphorylation: Existing Theories	189
	8.6	Some Physical Aspects of Intracellular Energy Transformation as a	
		Relaxation Process	197
9.	Conc	lusion	207
Ref	erenc	es	209
Sub,	ject .	Index	223