

Glycolysis Illustrates How Enzymes Couple Oxidation to Energy Storage	76	The Regulation of the Src Protein Kinase Reveals How a Protein Can Function as a Microprocessor	155
Organisms Store Food Molecules in Special Reservoirs	78	Proteins That Bind and Hydrolyze GTP Are Ubiquitous Cell Regulators	156
Most Animal Cells Derive Their Energy from Fatty Acids Between Meals	81	Regulatory Proteins GAP and GEF Control the Activity of GTP-Binding Proteins by Determining Whether GTP or GDP Is Bound	157
Sugars and Fats Are Both Degraded to Acetyl CoA in Mitochondria	81	Proteins Can Be Regulated by the Covalent Addition of Other Proteins	157
The Citric Acid Cycle Generates NADH by Oxidizing Acetyl Groups to CO <sub>2</sub>	82	An Elaborate Ubiquitin-Conjugating System Is Used to Mark Proteins	158
Electron Transport Drives the Synthesis of the Majority of the ATP in Most Cells	84	Protein Complexes with Interchangeable Parts Make Efficient Use of Genetic Information	159
Amino Acids and Nucleotides Are Part of the Nitrogen Cycle	85	A GTP-Binding Protein Shows How Large Protein Movements Can Be Generated	160
Metabolism Is Highly Organized and Regulated	87	Motor Proteins Produce Large Movements in Cells	161
Summary	88	Membrane-Bound Transporters Harness Energy to Pump Molecules Through Membranes	163
Problems	88	Proteins Often Form Large Complexes That Function as Protein Machines	164
References	108	Scaffolds Concentrate Sets of Interacting Proteins	164
<b>Chapter 3 Proteins</b>	<b>109</b>	Many Proteins Are Controlled by Covalent Modifications That Direct Them to Specific Sites Inside the Cell	165
→ THE SHAPE AND STRUCTURE OF PROTEINS	109	A Complex Network of Protein Interactions Underlies Cell Function	166
→ The Shape of a Protein Is Specified by Its Amino Acid Sequence	109	Summary	169
Proteins Fold into a Conformation of Lowest Energy	114	Problems	170
The $\alpha$ Helix and the $\beta$ Sheet Are Common Folding Patterns	115	References	172
Protein Domains Are Modular Units from Which Larger Proteins Are Built	117	<b>Chapter 4 DNA, Chromosomes, and Genomes</b>	<b>173</b>
→ Few of the Many Possible Polypeptide Chains Will Be Useful to Cells	118	<b>THE STRUCTURE AND FUNCTION OF DNA</b>	<b>173</b>
Proteins Can Be Classified into Many Families	119	A DNA Molecule Consists of Two Complementary Chains of Nucleotides	175
→ Some Protein Domains Are Found in Many Different Proteins	121	The Structure of DNA Provides a Mechanism for Heredity	177
Certain Pairs of Domains Are Found Together in Many Proteins	122	In Eukaryotes, DNA Is Enclosed in a Cell Nucleus	178
→ The Human Genome Encodes a Complex Set of Proteins, Revealing That Much Remains Unknown	122	Summary	179
Larger Protein Molecules Often Contain More Than One Polypeptide Chain	123	<b>CHROMOSOMAL DNA AND ITS PACKAGING IN THE CHROMATIN FIBER</b>	<b>179</b>
Some Globular Proteins Form Long Helical Filaments	123	Eukaryotic DNA Is Packaged into a Set of Chromosomes	180
Many Protein Molecules Have Elongated, Fibrous Shapes	124	Chromosomes Contain Long Strings of Genes	182
Proteins Contain a Surprisingly Large Amount of Intrinsically Disordered Polypeptide Chain	125	The Nucleotide Sequence of the Human Genome Shows How Our Genes Are Arranged	183
Covalent Cross-Linkages Stabilize Extracellular Proteins	127	Each DNA Molecule That Forms a Linear Chromosome Must Contain a Centromere, Two Telomeres, and Replication Origins	185
Protein Molecules Often Serve as Subunits for the Assembly of Large Structures	127	DNA Molecules Are Highly Condensed in Chromosomes	187
Many Structures in Cells Are Capable of Self-Assembly	128	Nucleosomes Are a Basic Unit of Eukaryotic Chromosome Structure	187
Assembly Factors Often Aid the Formation of Complex Biological Structures	130	The Structure of the Nucleosome Core Particle Reveals How DNA Is Packaged	188
Amyloid Fibrils Can Form from Many Proteins	130	Nucleosomes Have a Dynamic Structure, and Are Frequently Subjected to Changes Catalyzed by ATP-Dependent Chromatin Remodeling Complexes	190
Amyloid Structures Can Perform Useful Functions in Cells	132	Nucleosomes Are Usually Packed Together into a Compact Chromatin Fiber	191
Many Proteins Contain Low-complexity Domains that Can Form "Reversible Amyloids"	132	Summary	193
Summary	134	<b>CHROMATIN STRUCTURE AND FUNCTION</b>	<b>194</b>
<b>PROTEIN FUNCTION</b>	<b>134</b>	Heterochromatin Is Highly Organized and Restricts Gene Expression	194
All Proteins Bind to Other Molecules	134	The Heterochromatic State Is Self-Propagating	194
The Surface Conformation of a Protein Determines Its Chemistry	135	The Core Histones Are Covalently Modified at Many Different Sites	196
Sequence Comparisons Between Protein Family Members Highlight Crucial Ligand-Binding Sites	136	Chromatin Acquires Additional Variety Through the Site-Specific Insertion of a Small Set of Histone Variants	198
Proteins Bind to Other Proteins Through Several Types of Interfaces	137	Covalent Modifications and Histone Variants Act in Concert to Control Chromosome Functions	198
Antibody Binding Sites Are Especially Versatile	138	A Complex of Reader and Writer Proteins Can Spread Specific Chromatin Modifications Along a Chromosome	199
The Equilibrium Constant Measures Binding Strength	138	Barrier DNA Sequences Block the Spread of Reader-Writer Complexes and thereby Separate Neighboring Chromatin Domains	202
Enzymes Are Powerful and Highly Specific Catalysts	140	The Chromatin in Centromeres Reveals How Histone Variants Can Create Special Structures	203
Substrate Binding Is the First Step in Enzyme Catalysis	141	Some Chromatin Structures Can Be Directly Inherited	204
Enzymes Speed Reactions by Selectively Stabilizing Transition States	141		
Enzymes Can Use Simultaneous Acid and Base Catalysis	144		
Lysozyme Illustrates How an Enzyme Works	144		
Tightly Bound Small Molecules Add Extra Functions to Proteins	146		
Multienzyme Complexes Help to Increase the Rate of Cell Metabolism	148		
→ The Cell Regulates the Catalytic Activities of Its Enzymes	149		
Allosteric Enzymes Have Two or More Binding Sites That Interact	151		
Two Ligands Whose Binding Sites Are Coupled Must Reciprocally Affect Each Other's Binding	151		
Symmetric Protein Assemblies Produce Cooperative Allosteric Transitions	152		
→ Many Changes in Proteins Are Driven by Protein Phosphorylation	153		
→ A Eukaryotic Cell Contains a Large Collection of Protein Kinases and Protein Phosphatases	154		