

Contents

Preface

vii

1. Genome Organization and Evolution

1

• History • DNA Sequencing Technology Developed • Genome Analysis • Research Areas • Study Systems • Genomes and Proteomes • Gene • Proteomes • Eavesdropping on the Transmission of Genetic Information • Mappings between the Maps • The Genome of the Bacterium *Escherichia Coli* • The Genome of One of the Simplest Organisms • Genomes of Eukaryotes • The Genome of *Saccharomyces Cerevisiae* (Baker's Yeast) • The Genome of *Caenorhabditis Elegans*

2. Genetic Code

52

• Discovery • Salient Features • Variations to the Standard Genetic Code • Expanded Genetic Code • Theories on the Origin of the Genetic Code • Control of Gene Expression in Prokaryotes • Gene Regulation in Eukaryotes • Potential Levels of Eukaryotic Gene Control • Regulation of Gene Expression in Eukaryotes • Model Organism Yeast • Genomic Imprinting • Position-effect Variegation in *Drosophila* Reveals Genomic Neighborhoods • Mutations • Cancer

3. Functional Genomics

134

• Goals of Functional Genomics • Techniques and Applications • At the RNA Level: Transcriptome Profiling • At the Protein Level: Protein-protein Interactions • Loss-of-function Techniques • Functional Annotations for Genes • Structural Genomics • Comparative Genomics • Genomics for Health Improvement • The Potential of Genomics • Molecular Diagnostics • The Monoclonal Antibody • Recombinant Vaccines • Types of Recombinant Vaccines • Bioremediation • Sequencing Pathogen Genomes • Female-controlled Protection Against Sexually Transmitted Infections (STIs) • Genomics Capacity Building • What's the Problem?

4. Genes and Adaptation	164
• Typical Behaviour • Behavioural Polytypy • Mendelian Approaches to Behaviour Adaptation • Quantitative Inheritance • Plant Genetic Diversity • Novel Technologies for Biodiversity Assessment and Monitoring • Biotechnological Tools for Conservation • Biotechnology-assisted Crop Improvement • Bioprospecting for Novel Genes • The Exchange of Information and Germplasm • Plant Genetic Variation • Types of Questions, Markers, and Marker Assays • Types of Molecular Markers • Types of Molecular Marker Assays • Nucleic Acid Marker Assays: Total Genomic DNA and Chromosome Markers • Nucleic Acid Marker Assays: Fragment Markers • Nucleic Acid Marker Assays: Nucleotide Sequencing • Guidelines for Selecting Marker Assays • Future Dimensions of Genetic Analysis • Technology Transfer from the Human Genome Project • Present Limitations on Describing Plant Genetic Variation with Molecular Tools	
5. Characteristics of Genetic System	212
• The Genes • Genetic Code • Mendel's First Law: Segregation • Genetic System • Dominance and Recessiveness in Sex-linked Characters • Sex-linked Inheritance in Group II • Role of Development in X-Chromosomes • Night Blindness • The Role of the X-Chromosomes in Development • Autosomes and T-Chromosomes • The Autosomes: Typical Mendelian Inheritance • The Results of Mendelian Inheritance • Inheritance Depending on Two Pairs of Autosomes • The T-Chromosome • The Y-Chromosomes • Three Main Methods of Distribution of Inherited Characteristics • Characteristics Affected both by Genes and by Environment	
6. Genetic Genealogy	263
• History • Interpretation • Uses • History of Molecular Biology • History of DNA Biochemistry • History of RNA Tertiary Structure • History of Protein Biochemistry • RNA • Messenger RNA • Polyadenylation • Nuclear Polyadenylation • Monocistronic Versus Polycistronic mRNA • Small Interfering RNA • MicroRNA	
<i>Bibliography</i>	317
<i>Index</i>	319