

Contents

List of Figures	ix
List of Tables	xv
Preface	xvii
About the Author	xix

1. Membranes

1.1 Membrane Lipids	1
1.2 Cholesterol	5
1.3 Membrane Proteins	6
Questions	7

2. Proteins

2.1 Amino Acids	9
2.2 Protein Structure	15
2.3 The Hydrophobic Effect	21
2.4 A Return to Membranes	23
Questions	32
Related Reading	33

3. Cellular Transport

3.1 Membrane Transporters	35
3.2 Vesicular Transporters: Endocytosis	47
3.3 Receptor Fates	54
3.4 Lysosomes Are for Degradation, But Are They Safe?	62
Questions	63
Related Reading	64

4. Genes: The Blueprints for Proteins

4.1 Nucleotides and Nucleic Acids	65
4.2 From Genes to Proteins	77
Questions	104
Related Reading	105

5. Cell Growth	
5.1 The Eukaryotic Cell Cycle	107
5.2 Growth Curves and Their Phases	114
5.3 Mathematics of the Growth Curve	121
5.4 Counting Cell Numbers	126
5.5 Counting Cell Mass	130
5.6 Scale-Up	132
Questions	137
Related Reading	142
6. Microbial Killing	
6.1 The Gram Stain	143
6.2 Microbial Resistance to Killing	146
6.3 Sterilization, Disinfection, and Sanitization	148
6.4 Microbial Cell Death	152
Questions	162
Related Reading	163
7. Cell Culture and the Eukaryotic Cells Used in Biotechnology	
7.1 Adherent Cells Versus Nonadherent Cells	165
7.2 Primary Cells, Cancer Cells, and Cell Lines	165
Questions	172
Related Reading	172
8. Fluorescence	
8.1 Stokes' Experiments	173
8.2 Fluorophore Properties	177
8.3 Fluorescence Detection	181
8.4 FRET	183
Questions	185
Related Reading	186
9. Locating Transcriptional Control Regions: Deletion Analysis	
9.1 An Example of Deletion Analysis	188
Questions	190
10. Agarose Gels	
10.1 Application of Agarose Gels: Gel Shift	197
10.2 Application of Agarose Gels: DNA Footprinting	197
10.3 Application of Agarose Gels: Restriction Analysis	202

Questions	203
Related Reading	206
11. The Polymerase Chain Reaction	
11.1 Melt	207
11.2 Anneal	208
11.3 Extend	212
11.4 PCR Loops	213
11.5 An Application of Traditional PCR	215
11.6 Traditional Versus Real-Time PCR	219
11.7 Real-Time PCR	222
Questions	233
Related Reading	236
12. Genetic Engineering	
12.1 Plasmid Architecture	237
12.2 Molecular Cloning	239
12.3 A Single Plasmid Is Not Enough	250
12.4 Spectrophotometry	265
12.5 What We Have Learned so Far	269
Questions	270
Related Reading	274
13. Gene Delivery	
13.1 Gene Delivery Vehicles: An Overview	276
13.2 Gene Methods in Greater Detail	277
13.3 Preparation of Nonyviral Gene Delivery Complexes	304
Questions	308
Related Reading	309
14. RNAi	
14.1 Cosuppression	313
14.2 RNA Interference	316
14.3 miRNA	319
Questions	321
Related Reading	321
15. DNA Fingerprinting	
15.1 Older DNA Fingerprinting Uses RFLPs	323
15.2 Newer DNA Fingerprinting Uses STRs	325
Questions	329
Related Reading	329

16. Fermentation, Beer, and Biofuels	
16.1 Glycolysis	331
16.2 Fermentation	335
16.3 The Production of Beer	339
16.4 Fermentation to Produce Biofuels	345
Questions	350
Related Reading	351
17. Stem Cells and Tissue Engineering	
17.1 Potential	355
17.2 An Alternate View of Stem Cells	356
17.3 Using Stem Cells	357
17.4 Tissue Engineering and Regenerative Medicine	358
17.5 Bioreactors	361
17.6 Polymeric Scaffolds	365
17.7 Bringing it all Together: A Tissue Engineering Application	370
Questions	371
Related Reading	372
18. Transgenics	
18.1 Ice-Minus Bacteria	375
18.2 Bt Plants	375
18.3 Herbicide Resistance	377
18.4 Tomatoes	379
18.5 Rice	383
18.6 Terminators and Traitors	389
Questions	391
Related Reading	392
19. Patents and Licenses	
19.1 Types of Patents	393
19.2 Licenses	396
19.3 After a License Is Granted	399
Questions	401
Index	403