

Contents

Preface	v
Section A – The microbial world	1
A1 The microbial world	1
Section B – Systematics	5
B1 Prokaryotic systematics	5
B2 Identification of Bacteria	8
B3 Inference of phylogeny from rRNA gene sequence	11
Section C – Microbiology	15
C1 Discovery and history	15
C2 Prokaryotic diversity	17
C3 Culture of bacteria in the laboratory	20
C4 Enumeration of microorganisms	24
C5 Looking at microbes	28
C6 The major prokaryotic groups	35
C7 Composition of a typical prokaryotic cell	45
C8 The bacterial cell wall	51
C9 Cell division	57
C10 Bacterial flagella and movement	61
C11 Prokaryotes and their environment	64
Section D – Microbial growth	69
D1 Measurement of microbial growth	69
D2 Batch culture in the laboratory	76
D3 Large-scale and continuous culture	80
Section E – Microbial metabolism	85
E1 Heterotrophic pathways	85
E2 Electron transport, oxidative phosphorylation, and β -oxidation of fatty acids	90
E3 Autotrophic reactions	94
E4 Other unique microbial biochemical pathways	102
Section F – Prokaryotic DNA and RNA metabolism	107
F1 DNA – the primary informational macromolecule	107
F2 Genomes	111
F3 DNA replication	116
F4 Transcription	124
F5 Messenger RNA and translation	134
F6 Signal transduction and environmental sensing	137
F7 DNA repair	142

F8	Transfer of DNA between cells	146
F9	Recombination	151
F10	Bacteriophages	156
F11	Plasmids	161
Section G	– Industrial microbiology	165
G1	Biotechnology	165
G2	Food microbiology	167
G3	Recombinant microorganisms in biotechnology	172
G4	Microbial bioproducts	176
Section H	– Eukaryotic microbes: an overview	179
H1	Taxonomy	179
H2	Eukaryotic cell structure	183
H3	Cell division and ploidy	190
Section I	– The fungi and related phyla	196
I1	Fungal structure and growth	196
I2	Fungal nutrition	201
I3	Reproduction in fungi	204
I4	Beneficial effects	211
I5	Detrimental effects	215
Section J	– Archaeplastida, Excavata, Chromalveolata, and Amoebozoa	217
J1	Taxonomy and structure	217
J2	Nutrition and metabolism	228
J3	Life cycles	234
J4	Beneficial effects	243
J5	Detrimental effects	246
Section K	– The viruses	248
K1	Virus structure	248
K2	Virus taxonomy	253
K3	Virus genomes	258
K4	Virus proteins	267
K5	Cell culture and virus propagation	273
K6	Virus assay	279
K7	Virus replication	285
K8	Virus infections	296
K9	Viruses and the immune system	303
K10	Virus vaccines	308
K11	Antiviral chemotherapy	313
K12	Plant viruses	319
K13	Prions and transmissible spongiform encephalopathies	324
Further reading		330
Abbreviations		332
Index		334