Contents

Preface ix
Acknowledgements x
Contributors x

A contemporary approach to microbiology
Microbes and parasites 1

SECTION 1 THE ADVERSARIES: MICROBES

1. Microbes as parasites
   The varieties of microbes 7
   Living inside or outside cells 8
   Systems of classification 9

2. The bacteria
   Structure 11
   Nutrition 13
   Growth and division 13
   Gene expression 14
   Extrachromosomal elements 17
   Mutation and gene transfer 19
   Survival under adverse conditions 24
   The genomics of medically important bacteria 24

3. The viruses
   Infection of host cells 29
   Replication 31
   Outcome of viral infection 33
   Major groups of viruses 35

4. The fungi
   Major groups of disease-causing fungi 39

5. The protozoa 43

6. The helminths and arthropods
   The helminths 47
   The arthropods 49

7. Prions
   ‘Rogue protein’ pathogenesis 53
   Development and transmission of prion diseases 54
   Medical problems posed by prion disease 54

8. The host–parasite relationship
   The normal flora 57
   Symbiotic associations 60
   The characteristics of parasitism 62
   The evolution of parasitism 63

SECTION 2 THE ADVERSARIES: HOST DEFENSES

9. The innate defenses of the body
   Defense against entry into the body 72
   Defenses once the microorganism penetrates the body 72

10. Adaptive responses provide a ‘quantum leap’ in effective defense
    The role of antibodies 87
    The role of T lymphocytes 89
    Extracellular attack on large infectious agents 93
    Local defenses at mucosal surfaces 94

11. The cellular basis of adaptive immune responses
    B and T cell receptors 100
    Clonal expansion of lymphocytes 102
    The role of memory cells 103
    Stimulation of lymphocytes 104
    Cytokines 104
    Regulatory mechanisms 106
    Tolerance mechanisms 106
12. Background to the infectious diseases
Host–parasite relationships 117
Causes of infectious diseases 118
The biologic response gradient 120

13. Entry, exit and transmission
Sites of entry 123
Exit and transmission 130
Types of transmission between humans 132
Transmission from animals 137

14. Immune defenses in action
Complement 143
Acute phase proteins and pattern recognition receptors 144
Fever 144
Natural killer cells 144
Phagocytosis 145
Cytokines 147
Antibody-mediated immunity 148
Cell-mediated immunity 151
Recovery from infection 154

15. Spread and replication
Features of surface and systemic infections 157
Mechanisms of spread through the body 159
Genetic determinants of spread and replication 162
Other factors affecting spread and replication 163

16. Parasite survival strategies and persistent infections
Parasite survival strategies 167
Concealment of antigens 169
Antigenic variation 172
Immunosuppression 173
Persistent infections 176

17. Pathologic consequences of infection
Pathology caused directly by the microorganism 184
Pathologic activation of natural immune mechanisms 187
Pathologic consequences of the immune response 189
Skin rashes 193
Viruses and cancer 194

18. Upper respiratory tract infections
The common cold 201
Pharyngitis and tonsillitis 202
Parotitis 210
Otitis and sinusitis 211
Acute epiglottitis 213
Oral cavity infections 213
Laryngitis and tracheitis 214
Diphtheria 214

19. Lower respiratory tract infections
Acute infections 217
Chronic infections 232
Parasitic infections 237

20. Urinary tract infections
Acquisition and etiology 241
Pathogenesis 242
Clinical features and complications 244
Laboratory diagnosis 245

21. Sexually transmitted diseases
STDs and sexual behavior 251
Syphilis 251
Gonorrhea 256
Chlamydial infection 258
Other causes of inguinal lymphadenopathy 261
Mycoplasmas and non-gonococcal urethritis 262
Other causes of vaginitis and urethritis 262
Genital herpes 263
Human papillomavirus infection 264
Human immunodeficiency virus 264
Opportunistic STDs 273
Arthropod infestations 275

22. Gastrointestinal tract infections
Diarrheal diseases caused by bacterial or viral infection 277
Food poisoning 292
Helicobacter pylori and gastric ulcer disease 293
Parasites and the gastrointestinal tract  293
Systemic infection initiated in the gastrointestinal tract  300

23. Obstetric and perinatal infections
Infections occurring in pregnancy  313
Congenital infections  313
Infections occurring around the time of birth  318

24. Central nervous system infections
Invasion of the central nervous system  323
The body's response to invasion  324
Meningitis  325
Encephalitis  331
Neurologic diseases of possible viral etiology  337
Spongiform encephalopathy caused by scrapie-type agents  337
CNS disease caused by parasites  338
Brain abscesses  339
Tetanus and botulism  339

25. Infections of the eye
Conjunctivitis  343
Infection of the deeper layers of the eye  345

26. Infections of the skin, soft tissue, muscle and associated systems
Bacterial infections of skin, soft tissue and muscle  350
Mycobacterial diseases of the skin  357
Fungal infections of the skin  359
Parasitic infections of the skin  264
Mucocutaneous lesions caused by viruses  366
Smallpox  373
Measles  374
Rubella  375
Other infections producing skin lesions  376
Kawasaki syndrome  377
Viral infections of muscle  377
Parasitic infections of muscle  377
Joint and bone infections  378
Infections of the hemopoietic system  380

27. Vector-borne infections
Arboviruses infections  383
Infections caused by Rickettsiae  386
Borrelia infections  389
Protozoal infections  391
Helminth infections  397

28. Multisystem zoonoses
Arenavirus infections  401
Korean hemorrhagic fever  402
Marburg and Ebola hemorrhagic fevers  402
Q fever  403
Anthrax  404
Plague  405
Yersinia enterocolitica infection  407
Tularemia  407
Pasteurella multocida infection  407
Leptospirosis  407
Rat bite fever  408
Brucellosis  409
Helminth infections  410

29. Fever of unknown origin
Definitions of fever of unknown origin  413
Causes of FUO  413
Investigation of classical FUO  414
Treatment of FUO  415
FUO in specific patient groups  415
Infective endocarditis  416

30. Infections in the compromised host
The compromised host  423
Infections of the host with deficient innate immunity due to physical factors  426
Infections associated with secondary adaptive immunodeficiency  429
Other important opportunistic pathogens  431

DIAGNOSIS AND CONTROL

31. Strategies for control: an introduction
Epidemiologic considerations  441
Detection and diagnosis  447
Chemotherapy versus vaccination  447
Control versus eradication  450

32. Diagnosis of infection and assessment of host defense mechanisms
Aims of the clinical microbiology laboratory  453
Specimen processing  453
Non-cultural techniques for the laboratory diagnosis of infection  455
Cultivation (culture) of microorganisms  462
Identification of microorganisms grown in culture 464
Antibody detection methods for the diagnosis of infection 466
Assessment of host defense systems 468
Protocols for specimen processing 471

33. Attacking the enemy: antimicrobial agents and chemotherapy
Selective toxicity 473
Discovery and design of antibacterial agents 473
Classification of antibacterial agents 474
Resistance to antibacterial agents 475
Classes of antibacterial agents 477
Inhibitors of cell wall synthesis 478
Inhibitors of protein synthesis 485
Inhibitors of nucleic acid synthesis 492
Antimetabolites affecting nucleic acid synthesis 494
Other agents that affect DNA 496
Inhibitors of cytoplasmic membrane function 496
Urinary tract antiseptics 496
Antituberculous agents 496
Antibacterial agents in practice 497
Antibiotic assays 499
Antiviral therapy 499
Antifungal agents 504
Antiparasitic agents 505
Use and misuse of antimicrobial agents 507

34. Vaccination
The aims of vaccination 513
Requirements of a good vaccine 514
Types of vaccine 516
Special considerations 520
Community-based control by vaccination 524
Factors influencing the success of vaccination 527
Current vaccine practice 528

35. Passive and non-specific immunotherapy
Passive immunization with antibody 539
Non-specific cellular immunostimulation 542
Correction of host immunodeficiency 543

36. Hospital infection, sterilization and disinfection
Common hospital-acquired infections 546
Important causes of hospital infection 546
Sources and routes of spread of hospital infection 548
Host factors and hospital infection 549
Consequences of hospital infection 551
Protection of hospital infection 551
Investigating hospital infection 555
Sterilization and disinfection 556

Appendix – Pathogen parade 567
Answers 631
Index 640
Medical microbiology, the large subset of microbiology that is applied to medicine, is a branch of medical science concerned with the prevention, diagnosis and treatment of infectious diseases. In addition, this field of science studies various clinical applications of microbes for the improvement of health. There are four kinds of microorganisms that cause infectious disease: bacteria, fungi, parasites and viruses, and one type of infectious protein called prion.