

VOLUME 1

I Basic Principles in the Diagnosis and Management of Infectious Diseases

A MICROBIAL PATHOGENESIS

1 A Molecular Perspective of Microbial Pathogenicity 1

David A. Relman, Stanley Falkow, and Lalita Ramakrishnan

2 The Human Microbiome of Local Body Sites and Their Unique Biology 12

Kjersti Aagaard, Ruth Ann Luna, and James Versalovic

3 Prebiotics, Probiotics, and Synbiotics 22

Lea Ann Chen and Cynthia L. Sears

B HOST DEFENSE MECHANISMS

4 Innate (General or Nonspecific) Host Defense Mechanisms 28

Alan C. Embry, Edmund C. Tramont, and Carl W. Dieffenbach

5 Adaptive Immunity: Antibodies and Immunodeficiencies 35

Holly H. Birdsall and Arturo Casadevall

6 Cell-Mediated Defense Against Infection 51

Michail S. Lionakis and Tobias M. Hohl

7 Mucosal Immunity 73

Peter B. Ernst and Hiroshi Kiyono

8 Granulocytic Phagocytes 83

Frank R. DeLeo and William M. Nauseef

9 Complement and Deficiencies 99

Sanjay Ram

10 Human Genetics and Infection 123

Tom Parks, Adrian V.S. Hill, and Stephen J. Chapman

11 Nutrition, Immunity, and Infection 132

Henry Redel and Bruce Polksky

12 Evaluation of the Patient With Suspected Immunodeficiency 142

Steven M. Holland and John I. Gallin

C EPIDEMIOLOGY OF INFECTIOUS DISEASE

13 Applied Epidemiology for the Infectious Diseases Physician 154

Sarah-Blythe Ballard and David L. Blazes

14 Emerging and Reemerging Infectious Disease Threats 164

Alexandra Levitt, Nancy Messonnier, Daniel Jernigan, Timothy M. Uyeki, Christopher R. Braden, Ronald Rosenberg, and Rima F. Khabbaz

15 Bioterrorism: An Overview 181

Noreen A. Hynes and Luciana L. Borio

D CLINICAL MICROBIOLOGY

16 The Clinician and the Microbiology Laboratory: Test Ordering, Specimen Collection, and Result Interpretation 194

Robin Patel

E ANTIINFECTIVE THERAPY

17 Principles of Antiinfective Therapy 211

Brad Spellberg

18 Molecular Mechanisms of Antibiotic Resistance in Bacteria 222

Steven M. Opal and Aurora Pop-Vicas

19 Pharmacokinetics and Pharmacodynamics of Antiinfective Agents 240

Manjunath P. Pai, Mackenzie L. Cottrell, and Joseph S. Bertino, Jr.

20 Penicillins and β -Lactamase Inhibitors 251

Yohei Doi

21 Cephalosporins 268

Alexander J. Lepak and David R. Andes

22 Ertapenem, Imipenem, Meropenem, Doripenem, and Aztreonam 285

Yohei Doi

23 Antibiotic Allergy 291

Merin Elizabeth Kuruvilla and David A. Khan

24 Fusidic Acid 298

Jason Trubiano and M. Lindsay Grayson

25 Aminoglycosides 305

James E. Leggett

26 Tetracyclines, Glycylcyclines, and Chloramphenicol 318

Matthew Moffa and Itzhak Brook

27 Rifamycins 337

Melanie Jane Maslow and Cynthia Portal-Celhay

28 Metronidazole 350

Jerod L. Nagel and David M. Aronoff

29 Macrolides and Clindamycin 359

Whitney J. Nesbitt and David M. Aronoff

- 30 Glycopeptides (Vancomycin and Teicoplanin) and Lipoglycopeptides (Telavancin, Oritavancin, and Dalbavancin) 375**
Barbara E. Murray, Cesar A. Arias, and Esteban C. Nannini
- 31 Daptomycin and Quinupristin-Dalfopristin 396**
Jose M. Munita, Barbara E. Murray, and Cesar A. Arias
- 32 Polymyxins (Polymyxin B and Colistin) 405**
Keith S. Kaye, Jason M. Pogue, and Donald Kaye
- 33 Linezolid, Tedizolid, and Other Oxazolidinones 410**
Heather L. Cox and Gerald R. Donowitz
- 34 Sulfonamides and Trimethoprim; Trimethoprim-Sulfamethoxazole 416**
Stephen H. Zinner and Kenneth H. Mayer
- 35 Quinolones 426**
David C. Hooper and Jacob Strahilevitz
- 36 Unique Antibacterial Agents 449**
Gerard R. Barber
- 37 Urinary Tract Agents: Nitrofurantoin, Fosfomycin, and Methenamine 461**
James M. Horton
- 38 Topical Antibacterials 466**
Judith A. O'Donnell, Steven P. Gelone, and Naasha J. Talati
- 39 Antimycobacterial Agents 477**
David E. Griffith, Julie V. Philley, and Richard J. Wallace, Jr.
- 40A Antifungal Agents: Amphotericin B 497**
David A. Stevens
- 40B Antifungal Drugs: Azoles 501**
George R. Thompson III
- 40C Antifungal Drugs: Echinocandins 509**
Cornelius J. Clancy and M. Hong Nguyen
- 40D Antifungal Drugs: Flucytosine 515**
Benjamin Colton
- 41 Antimalarial Drugs 519**
James S. McCarthy and Richard N. Price
- 42 Drugs for Protozoal Infections Other Than Malaria 535**
James S. McCarthy, Glenn W. Wortmann, and Louis V. Kirchhoff
- 43 Drugs for Helminths 544**
James S. McCarthy and Thomas A. Moore
- 44 Antiviral Agents: General Principles 556**
Raphael Dolin and Janet Morgan
- 45 Antiviral Drugs for Influenza and Other Respiratory Virus Infections 560**
Fred Y. Aoki
- 46 Antivirals Against Herpesviruses 577**
Fred Y. Aoki
- 47 Antiviral Drugs Against Hepatitis Viruses 596**
Jules L. Dienstag
- 48 Miscellaneous Antiviral Agents (Interferons, Tecovirimat, Imiquimod, Pocapavir, Pleconaril) 620**
Raphael Dolin and Stephen R. Walsh
- 49 Immunomodulators 627**
Andrea V. Page and W. Conrad Liles
- 50 Hyperbaric Oxygen 655**
Juan Carlos Sarria and Norbert J. Roberts, Jr.
- 51 Antimicrobial Stewardship 661**
Conan MacDougall and Sara E. Cosgrove
- 52 Designing and Interpreting Clinical Studies in Infectious Diseases 668**
John H. Powers III
- 53 Outpatient Parenteral Antimicrobial Therapy 685**
Howard S. Gold and Mary T. LaSalvia
- 54 Tables of Antiinfective Agent Pharmacology 693**
Ryan L. Crass, Joseph S. Bertino, Jr., and Manjunath P. Pai

II Major Clinical Syndromes

A FEVER

- 55 Temperature Regulation and the Pathogenesis of Fever 777**
Mohammad M. Sajadi and Andrej A. Romanovsky
- 56 Fever of Unknown Origin 790**
William F. Wright
- 57 The Acutely Ill Patient With Fever and Rash 801**
Jonathan J. Juliano, Myron S. Cohen, and David J. Weber

B UPPER RESPIRATORY TRACT INFECTIONS

- 58 The Common Cold 819**
Yehuda Z. Cohen
- 59 Pharyngitis 824**
Anthony R. Flores and Mary T. Caserta
- 60 Acute Laryngitis 832**
Brenda L. Tesini and Mary T. Caserta
- 61 Otitis Externa, Otitis Media, and Mastoiditis 835**
Stephen I. Pelton
- 62 Sinusitis 844**
Gregory P. DeMuri and Ellen R. Wald
- 63 Epiglottitis 855**
Jennifer L. Nayak and Geoffrey A. Weinberg
- 64 Infections of the Oral Cavity, Neck, and Head 859**
Anthony W. Chow

C PLEUROPULMONARY AND BRONCHIAL INFECTIONS

- 65 Acute Bronchitis** 875
Edward E. Walsh
- 66 Acute Exacerbations of Chronic Obstructive Pulmonary Disease** 879
Michael D. Weiden, Leopoldo N. Segal, and Harold W. Horowitz
- 67 Acute Pneumonia** 889
Jennifer S. Daly and Richard T. Ellison III
- 68 Pleural Effusion and Empyema** 914
Mark Parta
- 69 Bacterial Lung Abscess** 926
Joanna K. Nelson and Julie Parsonnet
- 70 Chronic Pneumonia** 932
Peter G. Pappas
- 71 Cystic Fibrosis** 947
Ryan Perkins, Francisco M. Marty, and Ahmet Z. Uluer

D URINARY TRACT INFECTIONS

- 72 Urinary Tract Infections** 962
Jack D. Sobel and Patricia Brown

E SEPSIS

- 73 Sepsis and Septic Shock** 990
Tom van der Poll and Willem Joost Wiersinga

F INTRAABDOMINAL INFECTIONS

- 74 Peritonitis and Intraperitoneal Abscesses** 1009
Larry M. Bush and Matthew E. Levison
- 75 Infections of the Liver and Biliary System (Liver Abscess, Cholangitis, Cholecystitis)** 1037
Costi D. Sifri and Lawrence C. Madoff
- 76 Pancreatic Infection** 1046
Miriam Baron Barshak
- 77 Splenic Abscess** 1056
Lawrence C. Madoff
- 78 Appendicitis** 1059
Costi D. Sifri and Lawrence C. Madoff
- 79 Diverticulitis and Neutropenic Enterocolitis** 1064
Costi D. Sifri and Lawrence C. Madoff

G CARDIOVASCULAR INFECTIONS

- 80 Endocarditis and Intravascular Infections** 1068
Thomas L. Holland, Arnold S. Bayer, and Vance G. Fowler, Jr.
- 81 Prosthetic Valve Endocarditis** 1109
Raj Palraj, Bettina M. Knoll, Larry M. Baddour, and Walter R. Wilson

- 82 Infections of Nonvalvular Cardiovascular Devices** 1124
M. Rizwan Sohail, Walter R. Wilson, and Larry M. Baddour

- 83 Prevention of Infective Endocarditis** 1141
Bruno Hoen, Xavier Duval, and David T. Durack

- 84 Myocarditis and Pericarditis** 1151
Kirk U. Knowlton, Jeffrey L. Anderson, Maria C. Savoia, and Michael N. Oxman
- 85 Mediastinitis** 1165
Trevor C. Van Schooneveld and Mark E. Rupp

H CENTRAL NERVOUS SYSTEM INFECTIONS

- 86 Approach to the Patient With Central Nervous System Infection** 1176
Rodrigo Hasbun and Allan R. Tunkel
- 87 Acute Meningitis** 1183
Rodrigo Hasbun, Diederik van de Beek, Matthijs C. Brouwer, and Allan R. Tunkel
- 88 Chronic Meningitis** 1220
John E. Bennett and Susan E. Hoover
- 89 Encephalitis** 1226
J. David Beckham and Kenneth L. Tyler
- 90 Brain Abscess** 1248
Juan C. Gea-Banacloche and Allan R. Tunkel

- 91 Subdural Empyema, Epidural Abscess, and Suppurative Intracranial Thrombophlebitis** 1262
Allan R. Tunkel

- 92 Cerebrospinal Fluid Shunt and Drain Infections** 1272
Adarsh Bhimraj and Allan R. Tunkel

I SKIN AND SOFT TISSUE INFECTIONS

- 93 Cellulitis, Necrotizing Fasciitis, and Subcutaneous Tissue Infections** 1282
Mark S. Pasternack and Morton N. Swartz
- 94 Myositis and Myonecrosis** 1307
Mark S. Pasternack
- 95 Lymphadenitis and Lymphangitis** 1317
Mark S. Pasternack

J GASTROINTESTINAL INFECTIONS AND FOOD POISONING

- 96 Syndromes of Enteric Infection** 1330
Regina C. LaRocque and Jason B. Harris
- 97 Esophagitis** 1340
Paul S. Graman
- 98 Diarrhea With Little or No Fever** 1346
Luther A. Bartelt and Richard L. Guerrant
- 99 Acute Dysentery Syndromes (Diarrhea With Fever)** 1357
Aldo A.M. Lima, Cirle A. Warren, and Richard L. Guerrant
- 100 Typhoid Fever, Paratyphoid Fever, and Typhoidal Fevers** 1365
Jason R. Andrews, Jason B. Harris, and Edward T. Ryan

101 Foodborne Disease 1380 <i>Karen K. Wong and Patricia M. Griffin</i>	O ACQUIRED IMMUNODEFICIENCY SYNDROME
102 Tropical Sprue and Environmental Enteric Dysfunction 1395 <i>Honorine D. Ward and Christine A. Wanke</i>	118 Global Perspectives on Human Immunodeficiency Virus Infection and Acquired Immunodeficiency Syndrome 1583 <i>Peter Piot</i>
K BONE AND JOINT INFECTIONS	
103 Infectious Arthritis of Native Joints 1400 <i>Christopher A. Ohl</i>	119 Epidemiology and Prevention of AIDS and HIV Infection, Including Preexposure Prophylaxis and HIV Vaccine Development 1599 <i>Carlos del Rio, James W. Curran, Lindsey R. Baden, and Dan H. Barouch</i>
104 Osteomyelitis 1418 <i>Aaron J. Tande, James M. Steckelberg, Douglas R. Osmon, and Elie F. Berbari</i>	120 Diagnosis of Human Immunodeficiency Virus Infection 1619 <i>Francesco Simonetti, Robin Dewar, and Frank Maldarelli</i>
105 Orthopedic Implant–Associated Infections 1430 <i>Werner Zimmerli and Parham Sendi</i>	121 The Immunology of Human Immunodeficiency Virus Infection 1642 <i>Susan Moir, Mark Connors, and Anthony S. Fauci</i>
L DISEASES OF THE REPRODUCTIVE ORGANS AND SEXUALLY TRANSMITTED DISEASES	
106 Genital Skin and Mucous Membrane Lesions 1443 <i>Michael H. Augenbraun</i>	122 General Clinical Manifestations of Human Immunodeficiency Virus Infection (Including Acute Retroviral Syndrome and Oral, Cutaneous, Renal, Ocular, Metabolic, and Cardiac Diseases) 1658 <i>Timothy R. Sterling and Richard E. Chaisson</i>
107 Urethritis 1452 <i>Tara M. Babu, Marguerite A. Urban, and Michael H. Augenbraun</i>	123 Pulmonary Manifestations of Human Immunodeficiency Virus Infection 1675 <i>Paul E. Sax and Kevin L. Ard</i>
108 Vulvovaginitis and Cervicitis 1462 <i>Marie Abdallah, Michael H. Augenbraun, and William McCormack</i>	124 Gastrointestinal, Hepatobiliary, and Pancreatic Manifestations of Human Immunodeficiency Virus Infection 1684 <i>Saleh A. Alqahtani and Mark S. Sulkowski</i>
109 Infections of the Female Pelvis 1477 <i>Richard H. Beigi</i>	125 Neurologic Diseases Caused by Human Immunodeficiency Virus Type 1 and Opportunistic Infections 1690 <i>Omar K. Siddiqi, Shruti Agnihotri, and Igor J. Koralnik</i>
110 Prostatitis, Epididymitis, and Orchitis 1486 <i>Catherine C. McGowan</i>	126 Human Immunodeficiency Virus Infection in Women 1707 <i>Susan E. Cohn, Catherine A. Chappell, and Monica Gandhi</i>
M EYE INFECTIONS	
111 Introduction to Eye Infections 1493 <i>Marlene L. Durand</i>	127 Pediatric Human Immunodeficiency Virus Infection 1732 <i>Geoffrey A. Weinberg and George K. Siberry</i>
112 Microbial Conjunctivitis 1497 <i>Nalin M. Kumar, Scott D. Barnes, Deborah Pavan-Langston, and Dimitri T. Azar</i>	128 Antiretroviral Therapy for Human Immunodeficiency Virus Infection 1739 <i>Athe M.N. Tsibris and Martin S. Hirsch</i>
113 Microbial Keratitis 1508 <i>Dimitri T. Azar, Joelle Hallak, Scott D. Barnes, Pushpanjali Giri, and Deborah Pavan-Langston</i>	129 Management of Opportunistic Infections Associated With Human Immunodeficiency Virus Infection 1761 <i>Henry Masur</i>
114 Endophthalmitis 1523 <i>Marlene L. Durand</i>	
115 Infectious Causes of Uveitis 1531 <i>Marlene L. Durand</i>	
116 Periocular Infections 1541 <i>Marlene L. Durand</i>	
N HEPATITIS	
117 Viral Hepatitis 1548 <i>Jules L. Dienstag</i>	P MISCELLANEOUS SYNDROMES
	130 Chronic Fatigue Syndrome (Systemic Exertion Intolerance Disease) 1787 <i>N. Cary Engleberg</i>

VOLUME 2

III Infectious Diseases and Their Etiologic Agents

A VIRAL DISEASES

- 131 Biology of Viruses and Viral Diseases** 1795
James D. Chappell and Terence S. Dermody

i. DNA Viruses • a. Poxviridae

- 132 Orthopoxviruses** *Vaccinia (Smallpox Vaccine), Variola (Smallpox), Monkeypox, and Cowpox* 1809
Brett W. Petersen and Inger K. Damon

- 133 Other Poxviruses That Infect Humans: Parapoxviruses (Including Orf Virus), Molluscum Contagiosum, and Yatapoxviruses** 1818
Brett W. Petersen and Inger K. Damon

b. Herpesviridae

- 134 Introduction to Herpesviridae** 1822
Jeffrey I. Cohen

- 135 Herpes Simplex Virus** 1828
Joshua T. Schiffer and Lawrence Corey

- 136 Chickenpox and Herpes Zoster (Varicella-Zoster Virus)** 1849
Richard J. Whitley

- 137 Cytomegalovirus** 1857
William J. Britt

- 138 Epstein-Barr Virus (Infectious Mononucleosis, Epstein-Barr Virus–Associated Malignant Diseases, and Other Diseases)** 1872
Eric C. Johannsen and Kenneth M. Kaye

- 139 Human Herpesvirus Types 6 and 7 (Exanthem Subitum)** 1891
Jeffrey I. Cohen

- 140 Kaposi Sarcoma–Associated Herpesvirus (Human Herpesvirus 8)** 1897
Kenneth M. Kaye

- 141 Herpes B Virus** 1904
Jeffrey I. Cohen

c. Adenoviridae

- 142 Adenoviruses** 1908
Kathryn E. Stephenson, Elizabeth G. Rhee, and Dan H. Barouch

d. Papillomaviridae

- 143 Papillomaviruses** 1916
William Bonnez

- 144 JC, BK, and Other Polyomaviruses: Progressive Multifocal Leukoencephalopathy (PML)** 1931
C. Sabrina Tan and Igor J. Koralnik

e. Hepadnaviridae

- 145 Hepatitis B Virus** 1940
Chloe Lynne Thio and Claudia Hawkins

- 146 Hepatitis Delta Virus** 1964
Chloe Lynne Thio and Claudia Hawkins

f. Parvoviridae

- 147 Human Parvoviruses, Including Parvovirus B19V and Human Bocaparvoviruses** 1968
Kevin E. Brown

ii. RNA Viruses • a. Reoviridae

- 148 Orthoreoviruses and Orbiviruses** 1976
Kenneth L. Tyler

- 149 Coltiviruses (Colorado Tick Fever Virus) and Seadornaviruses** 1980
Daniel M. Pastula and Kenneth L. Tyler

- 150 Rotaviruses** 1983
Philip R. Dormitzer

b. Togaviridae

- 151 Alphaviruses (Chikungunya, Eastern Equine Encephalitis)** 1997
Lewis Markoff

- 152 Rubella Virus (German Measles)** 2007
Anne A. Gershon

c. Flaviviridae

- 153 Flaviviruses (Dengue, Yellow Fever, Japanese Encephalitis, West Nile Encephalitis, Usutu Encephalitis, St. Louis Encephalitis, Tick-Borne Encephalitis, Kyasanur Forest Disease, Alkhurma Hemorrhagic Fever, Zika)** 2013
Stephen J. Thomas, Timothy P. Endy, Alan L. Rothman, and Alan D. Barrett

- 154 Hepatitis C** 2040
Susanna Naggie and David L. Wyles

d. Coronaviridae

- 155 Coronaviruses, Including Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS)** 2072
Stanley Perlman and Kenneth McIntosh

e. Paramyxoviridae

- 156 Parainfluenza Viruses** 2081
Michael G. Ison

- 157 Mumps Virus** 2087
Nathan Litman and Stephen G. Baum

- 158 Respiratory Syncytial Virus** 2093
Edward E. Walsh and Janet A. Englund

- 159 Human Metapneumovirus** 2104
Angela R. Branche and Ann R. Falsey

- 160 Measles Virus (Rubeola) 2110**
Anne A. Gershon
- 161 Zoonotic Paramyxoviruses: Nipah, Hendra, and Menangle Viruses 2117**
Anna R. Thorner and Raphael Dolin
- f. Rhabdoviridae**
- 162 Vesicular Stomatitis Virus and Related Vesiculoviruses (Chandipura Virus) 2124**
Steven M. Fine
- 163 Rabies (Rhabdoviruses) 2127**
Brett Williams, Charles E. Rupprecht, and Thomas P. Bleck
- g. Filoviridae**
- 164 Marburg and Ebola Virus Hemorrhagic Fevers 2138**
Thomas W. Geisbert
- h. Orthomyxoviridae**
- 165 Influenza Viruses, Including Avian Influenza and Swine Influenza 2143**
John J. Treanor
- i. Bunyaviridae**
- 166 California Encephalitis, Hantavirus Pulmonary Syndrome, Hantavirus Hemorrhagic Fever With Renal Syndrome, and Bunyavirus Hemorrhagic Fevers 2169**
Raphael Dolin
- j. Arenaviridae**
- 167 Lymphocytic Choriomeningitis Virus, Lassa Virus, and the South American Hemorrhagic Fevers (Arenaviruses) 2177**
Alexey Seregin, Nadezhda Yun, and Slobodan Paessler
- k. Retroviridae**
- 168 Human T-Cell Leukemia Viruses (HTLV-1, HTLV-2) 2185**
Edward L. Murphy, and Roberta L. Bruhn
- 169 Human Immunodeficiency Viruses 2202**
Marvin S. Reitz, Jr., and Robert C. Gallo
- l. Picornaviridae**
- 170 Introduction to the Human Enteroviruses and Parechoviruses 2213**
José R. Romero
- 171 Poliovirus 2220**
José R. Romero
- 172 Coxsackieviruses, Echoviruses, and Numbered Enteroviruses (EV-A71, EVD-68, EVD-70) 2227**
José R. Romero
- 173 Parechoviruses 2238**
José R. Romero and Vini Vijayan
- 174 Hepatitis A Virus 2243**
Francisco Averhoff, Yury Khudyakov, and Claudia Vellozzi
- 175 Rhinovirus 2262**
Raphael Dolin
- iii. Caliciviridae and Other Gastrointestinal**
- 176 Noroviruses and Sapoviruses (Caliciviruses) 2269**
Raphael Dolin and John J. Treanor
- 177 Astroviruses and Picobirnaviruses 2277**
Raphael Dolin and John J. Treanor
- iv. Unclassified Viruses**
- 178 Hepatitis E Virus 2280**
Hirsh D. Trivedi and Sanjiv Chopra
- B PRION DISEASES**
- 179 Prions and Prion Disease of the Central Nervous System (Transmissible Neurodegenerative Diseases) 2288**
Patrick J. Bosque and Kenneth L. Tyler
- C CHLAMYDIAL DISEASES**
- 180 *Chlamydia trachomatis* (Trachoma and Urogenital Infections) 2301**
Byron E. Batteiger and Ming Tan
- 181 Psittacosis (Due to *Chlamydia psittaci*) 2320**
David Schlossberg
- 182 *Chlamydia pneumoniae* 2323**
Margaret R. Hammerschlag, Stephan A. Kohlhoff, and Charlotte A. Gaydos
- D MYCOPLASMA DISEASES**
- 183 *Mycoplasma pneumoniae* and Atypical Pneumonia 2332**
Robert S. Holzman, Michael S. Simberkoff, and Howard L. Leaf
- 184 Genital Mycoplasmas: *Mycoplasma genitalium*, *Mycoplasma hominis*, and *Ureaplasma* Species 2340**
David H. Martin
- E RICKETTSIOSES, EHRLICHIOSES, AND ANAPLASMOSES**
- 185 Introduction to Rickettsioses, Ehrlichioses, and Anaplasmoses 2344**
Didier Raoult
- 186 *Rickettsia rickettsii* and Other Spotted Fever Group Rickettsiae (Rocky Mountain Spotted Fever and Other Spotted Fevers) 2349**
Lucas S. Blanton and David H. Walker
- 187 *Rickettsia akari* (Rickettsialpox) 2358**
Pierre-Edouard Fournier and Didier Raoult

- 188 ***Coxiella burnetii* (Q Fever)** 2360
Joshua D. Hartzell, Thomas J. Marrie, and Didier Raoult
- 189 ***Rickettsia prowazekii* (Epidemic or Louse-Borne Typhus)** 2368
Lucas S. Blanton and David H. Walker
- 190 ***Rickettsia typhi* (Murine Typhus)** 2372
Lucas S. Blanton, J. Stephen Dumler, and David H. Walker
- 191 ***Orientia tsutsugamushi* (Scrub Typhus)** 2377
Daniel H. Paris
- 192 ***Ehrlichia chaffeensis* (Human Monocytotropic Ehrlichiosis), *Anaplasma phagocytophilum* (Human Granulocytotropic Anaplasmosis), and Other Anaplasmataceae** 2382
J. Stephen Dumler and David H. Walker
- F. BACTERIAL DISEASES**
- 193 **Introduction to Bacteria and Bacterial Diseases** 2390
Jennifer A. Philips and Martin J. Blaser
- i. Gram-Positive Cocci**
- 194 ***Staphylococcus aureus* (Including Staphylococcal Toxic Shock Syndrome)** 2393
Yok-Ai Que and Philippe Moreillon
- 195 ***Staphylococcus epidermidis* and Other Coagulase-Negative Staphylococci** 2432
Mark E. Rupp and Paul D. Fey
- 196 **Classification of Streptococci** 2444
John P. Dekker and Kathryn L. Ruoff
- 197 ***Streptococcus pyogenes*** 2446
Amy E. Bryant and Dennis L. Stevens
- 198 **Nonsuppurative Poststreptococcal Sequelae: Rheumatic Fever and Glomerulonephritis** 2462
Stanford T. Shulman and Preeti Jaggi
- 199 ***Streptococcus pneumoniae*** 2473
Edward N. Janoff and Daniel M. Musher
- 200 ***Enterococcus Species, Streptococcus galloyticus* Group, and *Leuconostoc* Species** 2492
William R. Miller, Cesar A. Arias, and Barbara E. Murray
- 201 ***Streptococcus agalactiae* (Group B Streptococci)** 2505
Morven S. Edwards and Carol J. Baker
- 202 **Viridans Streptococci, Nutritionally Variant Streptococci, and Groups C and G Streptococci** 2513
Cheston B. Cunha
- 203 ***Streptococcus anginosus* Group** 2521
Cathy A. Petti and Charles W. Stratton IV
- ii. Gram-Positive Bacilli**
- 204 ***Corynebacterium diphtheriae* (Diphtheria)** 2526
Paul G. Saleeb
- 205 **Other Coryneform Bacteria, *Arcanobacterium haemolyticum*, and Rhodococci** 2532
Rose Kim and Annette C. Reboli
- 206 ***Listeria monocytogenes*** 2543
Jennie E. Johnson and Eleftherios Mylonakis
- 207 ***Bacillus anthracis* (Anthrax)** 2550
Gregory J. Martin and Arthur M. Friedlander
- 208 ***Bacillus* Species and Related Genera Other Than *Bacillus anthracis*** 2570
Thomas Fekete
- 209 ***Erysipelothrix rhusiopathiae*** 2575
Annette C. Reboli
- 210 **Whipple Disease** 2578
Thomas Marth and Thomas Schneider
- iii. Gram-Negative Cocci**
- 211 ***Neisseria meningitidis*** 2585
David S. Stephens
- 212 ***Neisseria gonorrhoeae* (Gonorrhea)** 2608
Jeanne M. Marrazzo and Michael A. Apicella
- 213 ***Moraxella catarrhalis*, *Kingella*, and Other Gram-Negative Cocci** 2628
Timothy F. Murphy
- iv. Gram-Negative Bacilli**
- 214 ***Vibrio cholerae*** 2636
Matthew K. Waldor and Edward T. Ryan
- 215 **Other Pathogenic Vibrios** 2645
Marguerite A. Neill
- 216 ***Campylobacter jejuni* and Related Species** 2650
Ban Mishu Allos, Martin J. Blaser, Nicole M. Iovine, and Beth D. Kirkpatrick
- 217 ***Helicobacter pylori* and Other Gastric *Helicobacter* Species** 2660
Timothy L. Cover and Martin J. Blaser
- 218 ***Enterobacteriaceae*** 2669
George E. Nelson and Matthew H. Greene
- 219 ***Pseudomonas aeruginosa* and Other *Pseudomonas* Species** 2686
Rafael Araos and Erika D'Agata
- 220 ***Stenotrophomonas maltophilia* and *Burkholderia cepacia* Complex** 2700
David Greenberg
- 221 ***Burkholderia pseudomallei* and *Burkholderia mallei*: Melioidosis and Glanders** 2706
Bart J. Currie
- 222 ***Acinetobacter* Species** 2718
Sarah Hochman and Michael Phillips
- 223 ***Salmonella* Species** 2725
David A. Pegues and Samuel I. Miller
- 224 **Bacillary Dysentery: *Shigella* and Enteroinvasive *Escherichia coli*** 2737
Herbert L. DuPont and Pablo C. Okhuysen

- 225 *Haemophilus* Species, Including *H. influenzae* and *H. ducreyi* (Chancroid) 2743**
Timothy F. Murphy
- 226 *Brucellosis* (*Brucella* Species) 2753**
Hanefi C. Gul and Hakan Erdem
- 227 *Francisella tularensis* (Tularemia) 2759**
Paul G. Auwaerter and Robert L. Penn
- 228 *Pasteurella* Species 2774**
Augusto Dulanto Chiang and John J. Zurlo
- 229A *Plague* (*Yersinia pestis*) 2779**
Paul S. Mead
- 229B *Yersinia enterocolitica* and *Yersinia pseudotuberculosis* 2788**
Richard R. Watkins
- 230 *Bordetella pertussis* 2793**
Valerie Waters and Scott A. Halperin
- 231 Rat-Bite Fever: *Streptobacillus moniliformis* and *Spirillum minus* 2803**
Vijayashree Mekala and Ronald G. Washburn
- 232 Legionnaires' Disease and Pontiac Fever 2807**
Paul H. Edelstein and Craig R. Roy
- 233 *Capnocytophaga* 2818**
J. Michael Janda and Richard B. Clark
- 234 *Bartonella*, Including Cat-Scratch Disease 2824**
Stacey R. Rose and Jane E. Koehler
- 235 *Klebsiella granulomatis* (Donovanosis, Granuloma Inguinale) 2844**
Bradley P. Stoner and Hilary E.L. Reno
- 236 Other Gram-Negative and Gram-Variable Bacilli 2847**
James P. Steinberg, Joseph D. Lutgring, and Eileen M. Burd
- v. Spirochetes**
- 237 *Syphilis* (*Treponema pallidum*) 2865**
Justin D. Radolf, Edmund C. Tramont, and Juan C. Salazar
- 238 Endemic Treponematoses 2893**
Sana S. Ahmed and Dean L. Winslow
- 239 *Leptospira* Species (Leptospirosis) 2898**
David A. Haake and Paul N. Levett
- 240 Relapsing Fever Caused by *Borrelia* Species 2906**
James M. Horton
- 241 Lyme Disease (Lyme Borreliosis) Due to *Borrelia burgdorferi* 2911**
Allen C. Steere
- vi. Anaerobic Bacteria**
- 242 Anaerobic Infections: General Concepts 2923**
Ronit Cohen-Poradosu and Dennis L. Kasper
- 243 *Clostridioides difficile* (Formerly *Clostridium difficile*) Infection 2933**
Dale N. Gerding, Vincent Bensen Young, and Curtis J. Donskey
- 244 *Tetanus* (*Clostridium tetani*) 2948**
Torrey Boland Birch and Thomas P. Bleck
- 245 *Botulism* (*Clostridium botulinum*) 2954**
Torrey Boland Birch and Thomas P. Bleck
- 246 Diseases Caused by *Clostridium* 2960**
Andrew B. Onderdonk and Wendy S. Garrett
- 247 *Bacteroides*, *Prevotella*, *Porphyromonas*, and *Fusobacterium* Species (and Other Medically Important Anaerobic Gram-Negative Bacilli) 2969**
Wendy S. Garrett and Andrew B. Onderdonk
- 248 Anaerobic Cocci and Anaerobic Gram-Positive Nonsporulating Bacilli 2977**
Eija Könönen
- vii. Mycobacterial Diseases**
- 249 *Mycobacterium tuberculosis* 2985**
Daniel W. Fitzgerald, Timothy R. Sterling, and David W. Haas
- 250 *Leprosy* (*Mycobacterium leprae*) 3022**
Kathryn Dupnik
- 251 *Mycobacterium avium* Complex 3035**
Luke C. Strnad and Kevin L. Winthrop
- 252 Infections Caused by Nontuberculous Mycobacteria Other Than *Mycobacterium avium* Complex 3049**
Barbara A. Brown-Elliott and Richard J. Wallace, Jr.
- viii. Higher Bacterial Diseases**
- 253 *Nocardia* Species 3059**
Sharon C-A. Chen, Matthew R. Watts, Susan Maddocks, and Tania C. Sorrell
- 254 Agents of Actinomycosis 3071**
Thomas A. Russo
- G MYCOSES**
- 255 Introduction to Mycoses 3082**
John E. Bennett
- 256 *Candida* Species 3087**
Michail S. Lionakis and John E. Edwards, Jr.
- 257 *Aspergillus* Species 3103**
George R. Thompson III and Thomas F. Patterson
- 258 Agents of Mucormycosis and Entomophthoramycosis 3117**
Dimitrios P. Kontoyiannis and Russell E. Lewis
- 259 *Sporothrix schenckii* 3131**
John H. Rex and Pablo C. Okhuysen
- 260 Agents of Chromoblastomycosis 3137**
Duane R. Hospenthal
- 261 Agents of Mycetoma 3141**
Duane R. Hospenthal

- 262 Cryptococcosis (*Cryptococcus neoformans* and *Cryptococcus gattii*) 3146**
John R. Perfect
- 263 *Histoplasma capsulatum* (Histoplasmosis) 3162**
George S. Deepe, Jr.
- 264 Blastomycosis 3177**
Gregory M. Gauthier and Bruce S. Klein
- 265 Coccidioidomycosis (*Coccidioides* Species) 3190**
John N. Galgiani
- 266 Dermatophytosis (Ringworm) and Other Superficial Mycoses 3201**
Roderick J. Hay
- 267 Paracoccidioidomycosis 3211**
Ángela Restrepo-Moreno, Ángela Ma. Tobón-Orozco, and Ángel González-Marín
- 268 Uncommon Fungi and Related Species 3222**
Duane R. Hospenthal
- 269 *Pneumocystis* Species 3238**
Robert F. Miller, Peter D. Walzer, and A. George Smulian
- 270 Microsporidiosis 3255**
Louis M. Weiss
- H PROTOZOAL DISEASES**
- 271 Introduction to Protozoal Diseases 3270**
Poomum S. Korpe, Jonathan I. Ravdin, and William A. Petri, Jr.
- 272 *Entamoeba* Species, Including Amebic Colitis and Liver Abscess 3273**
William A. Petri, Jr., Rashidul Haque, and Shannon N. Moonah
- 273 Free-Living Amebae 3287**
Anita A. Koshy, Brian G. Blackburn, and Upinder Singh
- 274 Malaria (*Plasmodium* Species) 3299**
Rick M. Fairhurst and Thomas E. Wellems
- 275 *Leishmania* Species: Visceral (Kala-Azar), Cutaneous, and Mucosal Leishmaniasis 3321**
Naomi E. Aronson, Nathaniel K. Copeland, and Alan J. Magill
- 276 *Trypanosoma* Species (American Trypanosomiasis, Chagas Disease): Biology of Trypanosomes 3340**
Louis V. Kirchhoff
- 277 Agents of African Trypanosomiasis (Sleeping Sickness) 3349**
Louis V. Kirchhoff
- 278 *Toxoplasma gondii* 3355**
José G. Montoya, John C. Boothroyd, and Joseph A. Kovacs
- 279 *Giardia lamblia* 3388**
Theodore E. Nash and Luther A. Bartelt
- 280 *Trichomonas vaginalis* 3396**
Jane R. Schwebke and Laura Hinkle Bachmann
- 281 *Babesia* Species 3400**
Edouard Vannier and Jeffrey A. Gelfand
- 282 Cryptosporidiosis (*Cryptosporidium* Species) 3410**
A. Clinton White, Jr.
- 283 *Cyclospora cayetanensis*, *Cystoisospora belli*, *Sarcocystis* Species, *Balantidium coli*, and *Blastocystis* Species 3421**
Kathryn N. Suh, Isaac I. Bogoch, and Jay S. Keystone
- I DISEASES DUE TO TOXIC ALGAE**
- 284 Human Illness Associated With Harmful Algal Blooms 3429**
J. Glenn Morris, Jr.
- J DISEASES DUE TO HELMINTHS**
- 285 Introduction to Helminth Infections 3433**
James H. Maguire
- 286 Intestinal Nematodes (Roundworms) 3436**
Rojelio Mejia, Jill Weatherhead, and Peter J. Hotez
- 287 Tissue Nematodes, Including Trichinellosis, Dracunculiasis, Filariasis, Loiasis, and Onchocerciasis 3443**
James W. Kazura
- 288 Trematodes (Schistosomes and Liver, Intestinal and Lung Flukes) 3451**
James H. Maguire
- 289 Tapeworms (Cestodes) 3463**
Jessica K. Fairley and Charles H. King
- 290 Visceral Larva Migrans and Other Uncommon Helminth Infections 3473**
Theodore E. Nash
- K ECTOPARASITIC DISEASES**
- 291 Introduction to Ectoparasitic Diseases 3479**
James H. Diaz
- 292 Lice (Pediculosis) 3482**
James H. Diaz
- 293 Scabies 3487**
James H. Diaz
- 294 Myiasis and Tungiasis 3492**
James H. Diaz
- 295 Mites, Including Chiggers 3497**
James H. Diaz
- 296 Ticks, Including Tick Paralysis 3505**
James H. Diaz
- L DISEASES OF UNKNOWN ETIOLOGY**
- 297 Kawasaki Disease 3527**
Jane C. Burns

IV Special Problems**A NOSOCOMIAL INFECTIONS**

- 298 Infection Prevention and Control in the Health Care Setting** 3533
Tara N. Palmore

- 299 Disinfection, Sterilization, and Control of Hospital Waste** 3543
William A. Rutala and David J. Weber

- 300 Infections Caused by Percutaneous Intravascular Devices** 3560
Susan E. Beekmann and David K. Henderson

- 301 Nosocomial Pneumonia** 3576
Michael Klompas

- 302 Health Care–Associated Urinary Tract Infections** 3585
Barbara W. Trautner and Thomas M. Hooton

- 303 Health Care–Acquired Hepatitis** 3599
Mini Kamboj and Kent A. Sepkowitz

- 304 Transfusion- and Transplantation-Transmitted Infections** 3606
Sridhar V. Basavaraju and Matthew J. Kuehnert

B INFECTIONS IN SPECIAL HOSTS

- 305 Infections in the Immunocompromised Host: General Principles** 3617
Nicole M.A. Blijlevens and Walter J.F.M. van der Velden

- 306 Prophylaxis and Empirical Therapy of Infection in Cancer Patients** 3628
Elio Castagnola, Claudio Viscoli, and Małgorzata Mikulska

- 307 Infections in Recipients of Hematopoietic Stem Cell Transplants** 3654
Jo-Anne H. Young and Celalettin Ustun

- 308 Infections in Solid-Organ Transplant Recipients** 3672
Nina Singh, Ghady Haidar, and Ajit P. Limaye

- 309 Infections in Patients With Spinal Cord Injury** 3698
Rabih O. Darouiche

- 310 Infections in Older Adults** 3704
Kevin P. High

- 311 Infections in Asplenic Patients** 3713
Janet R. Gilsdorf and Suzanne Dawid

- 312 Infections in Injection Drug Users** 3723
Donald P. Levine and Patricia Brown

- 313 Surgical Site Infections and Antimicrobial Prophylaxis** 3743
Thomas R. Talbot

C SURGICAL- AND TRAUMA-RELATED INFECTIONS

- 314 Burns** 3757
Dana M. Blyth and Clinton K. Murray

- 315 Bites** 3765
Ellie J.C. Goldstein and Fredrick M. Abrahamian

D IMMUNIZATION

- 316 Immunization** 3771
Andrew T. Kroger, Larry K. Pickering, Alison Mawle, Alan R. Hinman, and Walter A. Orenstein

E ZOONOSES

- 317 Zoonoses** 3813
W. Ian Lipkin

F PROTECTION OF TRAVELERS

- 318 Protection of Travelers** 3818
David O. Freedman

- 319 Infections in Returning Travelers** 3828
Andrea K. Boggild and David O. Freedman