

Contents

PART I: Understanding, Controlling, and Preventing Infectious Diseases

A. Epidemiology and Control of Infectious Diseases

- 1 Principles of Epidemiology and Public Health 1
Lucy A. McNamara and Stacey W. Martin
- 2 Pediatric Healthcare: Infection Epidemiology, Prevention and Control, and Antimicrobial Stewardship 9
Jane D. Siegel and Joseph B. Canney
- 3 Infections Associated With Group Childcare 24
Timothy R. Shope and Andi L. Shane
- 4 Infectious Diseases in Refugee and Internationally Adopted Children 32
Mary Allen Staat and Elizabeth D. Barnett

B. Prevention of Infectious Diseases

- 5 Passive Immunization 38
H. Cody Meissner
- 6 Active Immunization 44
Andrew T. Kroger, Candice L. Robinson, Larry K. Pickering, and Walter A. Orenstein
- 7 Antimicrobial Chemoprophylaxis 73
John S. Bradley
- 8 Protection of Travelers 81
Zoon Wangu, Kevin L. Schwartz, and Elizabeth D. Barnett

C. Host Defenses Against Infectious Diseases

- 9 Immunologic Development and Susceptibility to Infection 87
Kestutis Aukstuolis, Clinton Dunn, and M. Teresa de la Morena
- 10 Fever and the Inflammatory Response 96
Jeanette Taveras, Octavio Ramilo, and Asuncion Mejias

PART II: Clinical Syndromes and Cardinal Features of Infectious Diseases: Approach to Diagnosis and Initial Management

A. Septicemia, Toxin-, and Inflammation-Mediated Syndromes

- 11 The Systemic Inflammatory Response Syndrome, Sepsis, and Septic Shock 102
Louise Elaine Vaz and Cyndi Williams
- 12 Hemophagocytic Lymphohistiocytosis and Macrophage Activation Syndrome 106
Hayley A. Gans and David B. Lewis

B. Cardinal Symptom Complexes

- 13 Mucocutaneous Symptom Complexes 114
Ishminder Kaur and Sarah S. Long
- 14 Fever Without Localizing Signs 120
Ravi Jhaveri and Eugene D. Shapiro
- 15 Prolonged, Recurrent, and Periodic Fever Syndromes 123
Kalpana Manthiram, Kathryn M. Edwards, and Sarah S. Long
- 16 Lymphatic System and Generalized Lymphadenopathy 135
J. Christopher Day
- 17 Cervical Lymphadenitis and Neck Infections 142
Emily A. Thorell

18 Mediastinal and Hilar Lymphadenopathy 154

J. Christopher Day

19 Abdominal and Retroperitoneal Lymphadenopathy 161

Angela L. Myers

20 Localized Lymphadenitis, Lymphadenopathy, and Lymphangitis 163

Angela L. Myers

21 Respiratory Tract Symptom Complexes 169

Kathleen A. McGann and Sarah S. Long

22 Abdominal Symptom Complexes 178

Karen L. Kotloff

23 Neurologic Syndromes 183

Geoffrey A. Weinberg and Robert Thompson-Stone

24 Musculoskeletal Symptom Complexes 189

James B. Wood and C. Buddy Creech

C. Oral Infections and Upper and Middle Respiratory Tract Infections

25 Infections of the Oral Cavity 197

Jana Shaw

26 The Common Cold 203

Diane E. Pappas

27 Pharyngitis 206

Robert R. Tanz and Stanford T. Shulman

28 Infections Related to the Upper and Middle Airways 212

Marc Tebruegge, Petra Zimmermann, and Nigel Curtis

29 Otitis Media 221

Nader Shaikh

30 Otitis Externa and Necrotizing Otitis Externa 228

Thomas G. Boyce and Karthik Balakrishnan

31 Mastoiditis 230

Ellen R. Wald and James H. Conway

32 Sinusitis 235

Gregory P. DeMuri and Ellen R. Wald

D. Lower Respiratory Tract Infections

33 Bronchiolitis 240

H. Cody Meissner

34 Acute Pneumonia and Its Complications 243

Samir S. Shah and Paul Spearman

35 Persistent and Recurrent Pneumonia 255

Robert R. Wittler

36 Pneumonia in the Immunocompromised Host 261

Christiana Smith and Donna J. Curtis

E. Cardiac and Vascular Infections

37 Endocarditis and Other Intravascular Infections 269

Matthew P. Kronman and Stephen J. Dolgner

38 Myocarditis 279

Joseph A. Hilinski

39 Pericarditis 282

Joseph A. Hilinski

F. Central Nervous System Infections

- 40 Acute Bacterial Meningitis Beyond the Neonatal Period 286
Suresh Kumar Panuganti and Simon Nadel
41 Chronic Meningitis 297
Douglas S. Swanson and Christopher J. Harrison
42 Recurrent Meningitis 305
Robyn A. Livingston and Christopher J. Harrison
43 Aseptic and Viral Meningitis 310
Timothy R. Onarecker and José R. Romero
44 Encephalitis 315
Carol A. Glaser and Karen C. Bloch
45 Parainfectious and Postinfectious Neurologic Syndromes 331
Ronak K. Kapadia, Daniel M. Pastula, and Carol A. Glaser
46 Focal Suppurative Infections of the Nervous System 337
Christopher J. Harrison and Rachel Berkovich
47 Eosinophilic Meningitis 347
Marian G. Michaels, Debra L. Palazzi, and Klara M. Posfay-Barbe

G. Genitourinary Tract Infections

- 48 Urinary Tract Infections, Renal Abscess, and Other Complex Renal Infections 352
Hsi-Yang Wu and Linda M. Dairiki Shortliffe
49 Sexually Transmitted Infection Syndromes 358
Gail F. Shust and Adam J. Ratner
50 Genitourinary Skin and Mucous Membrane Infections and Inguinal Lymphadenopathy 363
Laura A. S. Quilter and Kimberly A. Workowski
51 Urethritis, Vulvovaginitis, and Cervicitis 366
Paula K. Braverman
52 Pelvic Inflammatory Disease 378
Eloisa Llata and Harold C. Wiesenfeld
53 Epididymitis, Orchitis, and Prostatitis 382
Michal Paret and Adam J. Ratner
54 Infectious Diseases Associated With Child Abuse 385
Beth Emerson and Kirsten Bechtel

H. Gastrointestinal and Tract Infections and Intoxications

- 55 Approach to the Diagnosis and Management of Gastrointestinal Tract Infections 388
Jumi Yi and Andi L. Shane
56 Viral Gastroenteritis 395
Eyal Leshem and Benjamin A. Lopman
57 Inflammatory Enterocolitis 401
Karen L. Kotloff
58 Enteric Diseases Transmitted Through Food, Water, and Zoonotic Exposures 408
Karen P. Neil, Jonathan Yoder, Aron J. Hall, and Megan Nichols

I. Intra-abdominal Infections

- 59 Acute Hepatitis 419
Katrina Loh and Vahe Badalyan
60 Chronic Hepatitis 423
Katrina Loh, Parvathi Mohan, and Muhammad Ali Khan
61 Granulomatous Hepatitis 427
Joshua K. Schaffzin
62 Acute Pancreatitis 429
Joshua K. Schaffzin
63 Cholecystitis and Cholangitis 431
Joshua K. Schaffzin
64 Peritonitis 433
Jonathan Albert and Rana F. Hamdy
65 Appendicitis 437
Kevin Lloyd, Mikael Petrosyan, and Rana F. Hamdy
66 Intra-abdominal, Visceral, and Retroperitoneal Abscesses 442
Gillian Taormina and Rana F. Hamdy

J. Skin and Soft-Tissue Infections

- 67 Superficial Bacterial Skin Infections and Cellulitis 446
Neha Puar and Amy Jo Nopper
68 Erythematous Macules and Papules 456
Andrea L. Zaenglein and Patrick J. Gavigan
69 Vesicles and Bullae 459
James Treat
70 Purpura 462
Dawn Z. Eichenfield and Lawrence F. Eichenfield
71 Urticaria and Erythema Multiforme 466
Leah Lalor and Kara N. Shah
72 Papules, Nodules, and Ulcers 472
Christine T. Lauren
73 Subcutaneous Tissue Infections and Abscesses 478
Charles Reece Woods
74 Myositis, Pyomyositis, and Necrotizing Fasciitis 486
Sophie E. Katz and C. Buddy Creech

K. Bone and Joint Infections

- 75 Osteomyelitis 493
Roshni Mathew and David K. Hong
76 Infectious and Inflammatory Arthritis 500
Roshni Mathew and David K. Hong
77 Diskitis 506
Roshni Mathew and David K. Hong
78 Transient Synovitis 508
Sophie E. Katz and C. Buddy Creech

L. Eye Infections

- 79 Conjunctivitis in the Neonatal Period (Ophthalmia neonatorum) 511
Douglas R. Fredrick
80 Conjunctivitis Beyond the Neonatal Period 514
Douglas R. Fredrick
81 Infective Keratitis 518
Douglas R. Fredrick
82 Infective Uveitis, Retinitis, and Chorioretinitis 522
Douglas R. Fredrick
83 Endophthalmitis 526
Douglas R. Fredrick
84 Preseptal and Orbital Infections 529
Gregory P. DeMuri and Ellen R. Wald

M. Infections Related to Trauma, Animals, and Ticks

- 85 Infection Related To Trauma 535
James Gaensbauer
86 Infections Related to Burns 538
Ishminder Kaur
87 Infection Related To Bites 543
Marvin B. Harper
88 Infections Related to Pets and Exotic Animals 550
Joseph A. Bocchini, Jr.
89 Tickborne Infections 554
Victoria A. Statler and Kristina P. Bryant

N. Infections of the Fetus and Newborn

- 90 Clinical Approach to the Neonate With Suspected Infection 561
William E. Benitz
91 Chorioamnionitis and Neonatal Consequences 564
William E. Benitz
92 Bacterial Infections in the Neonate 566
Morven S. Edwards and Carol J. Baker
93 Viral Infections in the Fetus and Neonate 572
Swetha Pinninti
94 Healthcare-Associated Infections in the Neonate 576
Joseph B. Cantey and Matthew J. Bizzarro

Contents

O. Infections and Transplantation

- 95 Infections in Solid Organ Transplant Recipients 584
Michael Green, Benjamin Hanisch, and Marian G. Michaels
96 Infections in Hematopoietic Cell Transplant Recipients 591
Jorge Luján-Zilberman and David M. Berman

P. Infections and Cancer

- 97 Risk Factors and Infectious Agents in Children With Cancer: Fever and Granulocytopenia 596
Monica I. Ardura and Andrew Y. Koh
98 Clinical Syndromes of Infection in Children With Cancer 604
Monica I. Ardura and Andrew Y. Koh

Q. Infections Associated With Hospitalization and Medical Devices

- 99 Healthcare-Associated Infections 611
Lori K. Handy, Susan E. Coffin, and Jane M. Gould
100 Clinical Syndromes of Device-Associated Infections 619
Felicia Scaggs Huang and Joshua K. Schaffzin

R. Infections in Patients With Deficient Defenses

- 101 Evaluation of the Child With Suspected Immunodeficiency 632
Randall G. Fisher and Lauren L. Smith
102 Infectious Complications of Antibody Deficiency 636
Amanda M. Green and Elisabeth E. Adderson
103 Infectious Complications of Complement Deficiency and Diseases of Its Dysregulation 644
Kathleen E. Sullivan and ¹Michael M. Frank
104 Infectious Complications of Dysfunction or Deficiency of Polymorphonuclear and Mononuclear Phagocytes 649
Lauren L. Smith and Randall G. Fisher
105 Infectious Complications of Cell-Mediated Immunity Other Than AIDS: Primary Immunodeficiencies 656
Yael Gernez and David B. Lewis
106 Infectious Complications in Special Hosts 665
Hilary Miller-Handley, David A. Rosen, David A. Hunstad, and Lara A. Danziger-Isakov
107 Infections Related to Biologic Response Modifying Drug Therapy 674
H. Dele Davies
108 Infectious Complications of Corticosteroid Therapy 679
Kari A. Simonsen and H. Dele Davies

S. Human Immunodeficiency Virus and the Acquired Immunodeficiency Syndrome

- 109 Epidemiology and Prevention of HIV Infection in Infants, Children, and Adolescents 681
Jennifer S. Read
110 Immunopathogenesis of HIV-1 Infection 684
Grace M. Aldrovandi and Nicole H. Tobin
111 Diagnosis and Clinical Manifestations of HIV Infection 686
Christiana Smith and Elizabeth J. McFarland
112 Infectious Complications of HIV Infection 694
Allison L. Agwu and Russell B. Van Dyke
113 Management of HIV Infection 700
David C. Griffith and George Kelly Siberry

PART III: Etiologic Agents of Infectious Diseases

A. Bacteria

- 114 Classification of Bacteria 708
Alexandra Sacharok and Joseph W. St Geme III

Gram-Positive Cocci

- 115 *Staphylococcus aureus* 710
Isaac Thomsen and C. Buddy Creech
116 Coagulase-Negative Staphylococci and Micrococcaceae 724
Philip Toltzis
117 Classification of Streptococci 730
David B. Haslam and Joseph W. St. Geme III
118 *Streptococcus pyogenes* (Group A Streptococcus) 732
Stanford T. Shulman, Taylor Heald-Sargent, and Robert R. Tanz
119 *Streptococcus agalactiae* (Group B Streptococcus) 740
Morven S. Edwards and Carol J. Baker
120 *Enterococcus* Species 745
David B. Haslam and Joseph W. St. Geme III
121 Viridans Streptococci, *Abiotrophia* and *Granulicatella* Species, and *Streptococcus bovis* Group 748
David B. Haslam and Joseph W. St. Geme III
122 Groups C and G Streptococci 752
David B. Haslam and Joseph W. St. Geme III
123 *Streptococcus pneumoniae* 753
Liset Olarte and Krow Ampofo
124 Other Gram-Positive, Catalase-Negative Cocci: *Leuconostoc* and *Pediococcus* Species and Other Genera 762
David B. Haslam and Joseph W. St. Geme III

Gram-Negative Cocci

- 125 *Neisseria meningitidis* 763
Andrew J. Pollard, Adam Finn, Else M. Bijker, and Amanda Cohn
126 *Neisseria gonorrhoeae* 776
Zoon Wangu and Katherine K. Hsu
127 Other *Neisseria* Species 782
Zoon Wangu and Katherine K. Hsu

Gram-Positive Bacilli

- 128 *Arcanobacterium haemolyticum* 784
Laura E. Norton and Denise F. Bratcher
129 *Bacillus* Species (Including Anthrax) 786
Liset Olarte and Denise F. Bratcher
130 *Corynebacterium diphtheriae* 789
Irini Daskalaki and Piyush Gupta
131 Other *Corynebacteria* 794
Laura E. Norton and Denise F. Bratcher
132 *Listeria monocytogenes* 797
Monica M. Farley
133 Other Gram-Positive Bacilli 802
Christelle M. Ilboudo and Denise F. Bratcher
134 *Mycobacterium tuberculosis* 806
Silvia S. Chiang and Jeffrey R. Starke
135 *Mycobacterium Nontuberculosis* Species 823
Marc Tebruegge, Laure F. Pittet, and Nigel Curtis
136 *Nocardia* Species 830
Ellen Gould Chadwick and Richard B. Thomson, Jr.

Enterobacteriaceae: Gram-Negative Bacilli

- 137 *Escherichia coli* 834
Daniel S. Dodson and Edwin J. Asturias
138 *Klebsiella* and *Raoultella* Species 837
Matthew Washam and Amy Leber

[†]Deceased.

- 139 *Klebsiella granulomatis*: Granuloma Inguinale (Donovanosis) 841**
Bradley P. Stoner
- 140 *Enterobacter*, *Cronobacter*, and *Pantoea* Species 843**
W. Garrett Hunt and Sophonie Jean
- 141 *Citrobacter* Species 845**
Sophonie Jean and Monica I. Ardura
- 142 Less Commonly Encountered Enterobacterales 848**
Joshua R. Watson, Rebecca Wallihan, and Sophonie Jean
- 143 *Plesiomonas shigelloides* 850**
Liat Ashkenazi-Hoffnung and Shai Ashkenazi
- 144 *Proteus*, *Providencia*, and *Morganella* Species 852**
Christopher P. Ouellette and Huanyu Wang
- 145 *Serratia* Species 854**
Eunkyung Song and Huanyu Wang
- 146 *Salmonella* Species 855**
Megan E. Reller
- 147 *Shigella* Species 860**
Shai Ashkenazi
- 148 *Yersinia* Species 864**
Theresa J. Ochoa and Miguel O’Ryan
- Nonenterobacteriaceae: Gram-Negative Bacilli**
- 149 *Acinetobacter* Species 869**
Guliz Erdem and Huanyu Wang
- 150 *Aeromonas* Species 872**
Yalda C. Lucero and Miguel O’Ryan
- 151 Less Commonly Encountered Nonenteric Gram-Negative Bacilli 874**
Guliz Erdem and Amy Leber
- 152 *Eikenella*, *Pasteurella*, and *Chromobacterium* Species 878**
Guliz Erdem and Amy Leber
- 153 *Moraxella* Species 882**
Jessica R. Cataldi
- 154 *Pseudomonas* Species and Related Organisms 883**
Valerie J. Waters
- 155 *Pseudomonas aeruginosa* 884**
Paul J. Planet
- 156 *Burkholderia cepacia* Complex and Other *Burkholderia* Species 889**
Valerie J. Waters
- 157 *Stenotrophomonas maltophilia* 892**
Valerie J. Waters
- 158 *Vibrio cholerae* (Cholera) 893**
Talia Pinsky, Grace D. Appiah, and Eric Mintz
- 159 Other *Vibrio* Species 899**
Erin K. Stokes, Patricia M. Griffin, and Bruce J. Gutelius
- Gram-Negative Coccobacilli**
- 160 *Bartonella* Species (Cat-Scratch Disease) 901**
Jin-Young Han and Vini Vijayan
- 161 *Brucella* Species (Brucellosis) 905**
†Edward J. Young
- 162 *Bordetella pertussis* (Pertussis) and Other *Bordetella* Species 909**
Sarah S. Long, Kathryn M. Edwards, and Jussi Mertsola
- 163 *Campylobacter jejuni* and *Campylobacter coli* 919**
Jumi Yi and Evan J. Anderson
- 164 Other *Campylobacter* Species 922**
Bethany K. Sederdahl and Evan J. Anderson
- 165 *Capnocytophaga* Species 924**
Lorry G. Rubin
- 166 *Chlamydophila* (*Chlamydia*) *pneumoniae* 925**
Samir S. Shah
- 167 *Chlamydia trachomatis* 928**
Toni Darville and G. Ingrid J.G. Rours
- 168 *Chlamydia* (*Chlamydophila*) *psittaci* (Psittacosis) 933**
Miwako Kobayashi
- 169 *Coxiella burnetii* (Q Fever) 935**
Cara C. Cherry and Gilbert J. Kersh
- 170 Family Anaplasmataceae (Anaplasmosis, Ehrlichiosis, Neorickettsiosis, and Neoehrlichiosis) 937**
William L. Nicholson and Bobbi S. Pritt
- 171 *Francisella tularensis* (Tularemia) 942**
Christina A. Nelson and Lorry G. Rubin
- 172 *Haemophilus influenzae* 945**
Nadia A. Kadry and Joseph W. St. Geme III
- 173 Other *Haemophilus* Species and *Aggregatibacter* Species 951**
Emily Souder and Jennifer Vodzak
- 174 *Helicobacter pylori* 954**
Luis A. Castagnini and Mark A. Gilger
- 175 Other Gastric and Enterohepatic *Helicobacter* Species 959**
Jonathan D. Crews and Mark A. Gilger
- 176 *Kingella* Species 962**
Pablo Yagupsky
- 177 *Legionella* Species 967**
Lorry G. Rubin
- 178 *Rickettsia rickettsii* (Rocky Mountain Spotted Fever) 971**
Christopher D. Paddock and Gerardo Alvarez-Hernández
- 179 Other *Rickettsia* Species 976**
Gregory A. Dasch and Marina E. Eremeeva
- 180 *Streptococcus moniliformis* (Rat-Bite Fever) 984**
Lorry G. Rubin
- 181 Other Gram-Negative Coccobacilli 985**
Lorry G. Rubin
- Treponemataceae (Spiral Organisms)**
- 182 *Treponema pallidum* (Syphilis) 986**
Sarah A. Rawstron and Sarah J. Hawkes
- 183 Other *Treponema* Species 993**
Sarah A. Rawstron
- 184 *Leptospira* Species (Leptospirosis) 994**
Irini Daskalaki
- 185 *Borrelia burgdorferi* (Lyme Disease) 997**
Eugene D. Shapiro
- 186 Other *Borrelia* Species and *Spirillum minus* 1002**
Irini Daskalaki
- Anaerobic Bacteria**
- 187 Anaerobic Bacteria: Clinical Concepts and the Microbiome in Health and Disease 1004**
Itzhak Brook, Lindsey Albenberg, Wenjing Zong, and Sarah S. Long
- 188 *Clostridium tetani* (Tetanus) 1013**
Itzhak Brook
- 189 *Clostridium botulinum* (Botulism) 1017**
Stephen S. Arnon and Sarah S. Long
- 190 *Clostridioides difficile* 1024**
Thomas J. Sandora and Larry K. Kocolek
- 191 Other *Clostridium* Species 1027**
Itzhak Brook
- 192 *Bacteroides* and *Prevotella* Species and Other Anaerobic Gram-Negative Bacilli 1030**
Itzhak Brook
- 193 *Fusobacterium* Species 1033**
Jennifer Vodzak
- 194 Anaerobic Cocci 1036**
Debrah Meislich and Anat R. Feingold
- 195 Anaerobic Gram-Positive Nonsporulating Bacilli (Including Actinomycosis) 1037**
Anat R. Feingold and Debrah Meislich

†Deceased.

Contents

Mycoplasma

- 196 *Mycoplasma pneumoniae* 1041
Samir S. Shah
197 Other *Mycoplasma* Species 1046
Samir S. Shah
198 *Ureaplasma urealyticum* 1048
Felicia Scaggs Huang and Samir S. Shah

Diseases of Possible Infectious or Unknown Etiology

- 199 Kawasaki Disease 1050
Preeti Jaggi and Anne H. Rowley
200 Myalgic Encephalomyelitis/Chronic Fatigue Syndrome (ME/CFS) 1056
Peter C. Rowe

B. Viruses

- 201 Classification of Human Viruses 1063
Robert David Siegel

DNA Viruses: Poxviridae

- 202 Poxviridae 1068
Brett W. Petersen

DNA Viruses: Herpesviridae

- 203 Introduction to Herpesviridae 1074
David W. Kimberlin and Charles G. Prober
204 Herpes Simplex Virus 1075
David W. Kimberlin and Charles G. Prober
205 Varicella-Zoster Virus 1084
Ann M. Arvin
206 Cytomegalovirus 1092
Shannon A. Ross
207 Human Herpesviruses 6 and 7 (Roseola, Exanthem Subitum) 1099
Jennifer Lynn Nayak and Mary T. Caserta
208 Epstein-Barr Virus (Mononucleosis and Lymphoproliferative Disorders) 1107
Ben Z. Katz and William J. Muller
209 Human Herpesvirus 8 (Kaposi Sarcoma-Associated Herpesvirus) 1113
Jennifer Lynn Nayak and Mary T. Caserta

DNA Viruses: Adenoviridae

- 210 Adenoviruses 1115
Upton D. Allen, Jr.

DNA Viruses: Papovaviridae

- 211 Human Papillomavirus 1119
Loris Y. Hwang and Anna-Barbara Moscicki
212 BK, JC, and Other Human Polyomaviruses 1123
Suchitra Rao

DNA Viruses: Hepadnaviridae

- 213 Hepatitis B and Hepatitis D Viruses 1125
Aaron M. Harris and Sarah Schillie

DNA Viruses: Parvoviridae

- 214 Human Parvoviruses (Parvovirus B19 and Bocavirus) 1133
Kevin Edward Brown

RNA Viruses: Reoviridae

- 215 Coltivirus (Colorado Tick Fever) 1138
J. Erin Staples and Marc Fischer
216 Rotaviruses 1141
Margaret M. Cortese

RNA Viruses: Togaviridae, Flaviviridae, and Bunyaviridae

- 217 Togaviridae: Alphaviruses 1145
J. Erin Staples and Ann M. Powers
218 Flaviviruses 1147
Susan L. Hills and Marc Fischer
219 Bunyaviruses 1152
Mary Choi, J. Erin Staples, and Marc Fischer
220 Hepatitis C Virus 1156
Monique A. Foster, Anne C. Moorman, and Eysu H. Teshale
221 Rubella Virus 1161
Yvonne A. Maldonado and Avinash K. Shetty

RNA Viruses: Coronaviridae

- 222 Human Coronaviruses 1167
Susan M. Poutanen

RNA Viruses: Paramyxoviridae

- 223 Parainfluenza Viruses 1175
Asuncion Mejias and Octavio Ramilo
224 Mumps Virus 1180
Yvonne A. Maldonado and Avinash K. Shetty
225 Respiratory Syncytial Virus 1185
H. Cody Meissner
226 Human Metapneumovirus 1189
Jennifer E. Schuster and John V. Williams
227 Rubeola Virus: Measles and Subacute Sclerosing Panencephalitis 1192
Yvonne A. Maldonado and Avinash K. Shetty

RNA Viruses: Rhabdoviridae

- 228 Rabies Virus 1201
Rodney E. Willoughby, Jr.

RNA Viruses: Orthomyxoviridae

- 229 Influenza Viruses 1205
Fatimah S. Dawood and Suchitra Rao

RNA Viruses: Arenaviridae and Filoviridae

- 230 Filoviruses and Arenaviruses 1213
Mary Choi, Jonathan Dyal, and James Graziano

RNA Viruses: Retroviridae

- 231 Introduction to Retroviridae 1220
Thor A. Wagner
232 Human T-Cell Lymphotropic Viruses 1220
Thor A. Wagner
233 Human Immunodeficiency Virus 1222
Thor A. Wagner

RNA Viruses: Picornaviridae

- 234 Introduction to Picornaviridae 1224
Kevin Messacar and Mark J. Abzug
235 Polioviruses 1225
Stephanie B. Troy and Yvonne A. Maldonado
236 Enteroviruses and Parechoviruses 1228
Kevin Messacar and Mark J. Abzug
237 Hepatitis A Virus 1237
Mark K. Weng, Noele P. Nelson, and Monique A. Foster
238 Rhinoviruses 1243
Diane E. Pappas and [†]J. Owen Hendley

[†]Deceased.

RNA Viruses: Caliciviridae

- 239 Caliciviruses 1245**
Cristina V. Cardemil and Aron J. Hall
- 240 Astroviruses 1248**
Jacqueline E. Tate and Cristina V. Cardemil
- 241 Hepatitis E Virus 1250**
Eyasu H. Teshale

C. Fungi

- 242 Classification of Fungi 1253**
Connie F. Cañete-Gibas, Nathan P. Wiederhold, and Thomas F. Patterson
- 243 Candida Species 1255**
William R. Otto, William J. Steinbach, and Brian T. Fisher
- 244 Aspergillus Species 1262**
William J. Steinbach
- 245 Agents of Hyalohyphomycosis and Phaeohyphomycosis 1269**
Thomas F. Patterson, Nathan P. Wiederhold, and Connie F. Cañete-Gibas
- 246 Agents of Mucormycosis 1272**
Thomas F. Patterson, Nathan P. Wiederhold, and Connie F. Cañete-Gibas
- 247 Malassezia Species 1274**
Thomas F. Patterson, Connie F. Cañete-Gibas, and Nathan P. Wiederhold
- 248 Sporothrix schenckii Complex (Sporotrichosis) 1277**
Thomas F. Patterson, Nathan P. Wiederhold, and Connie F. Cañete-Gibas
- 249 Cryptococcus Species 1279**
George R. Thompson III and Thomas F. Patterson
- 250 Histoplasma capsulatum (Histoplasmosis) 1283**
James B. Wood and John C. Christenson
- 251 Pneumocystis jirovecii 1290**
Francis Gigliotti and Terry W. Wright
- 252 Blastomyces Species (Blastomycosis) 1294**
Gregory M. Gauthier and Bruce S. Klein
- 253 Coccidioides immitis and Coccidioides posadasii (Coccidioidomycosis) 1301**
George R. Thompson III
- 254 Superficial Fungal Infections 1307**
Ananta Khurana, Kabir Sardana, and Aastha Agarwal
- 255 Agents of Eumycotic Mycetoma: *Pseudallescheria boydii* and *Scedosporium apiospermum* 1317**
Leslie A. Enane and John J. Manaloor

D. Human Parasites and Vectors

- 256 Classification of Parasites 1322**
Jill E. Weatherhead and Peter J. Hotez
- 257 Ectoparasites (Lice and Scabies) 1324**
Dirk M. Elston

Protozoa

- 258 Babesia Species (Babesiosis) 1329**
Kristina N. Feja
- 259 BalantioIDES coli (Formerly *Balantidium coli*) 1334**
Kateřina Jirků-Pomajbíková and Christen Rune Stensvold
- 260 Blastocystis Species 1335**
Christen Rune Stensvold
- 261 Cryptosporidium Species 1337**
Mohammad Nael Mhaisken and Patricia Michele Flynn
- 262 Endolimax nana 1339**
Casper S. Poulsen and Christen Rune Stensvold
- 263 Entamoeba histolytica (Amebiasis) 1341**
Vivian Tien and Upinder Singh
- 264 Other Entamoeba, Amebae, and Intestinal Flagellates 1347**
Vivian Tien and Upinder Singh

265 Giardia intestinalis (Giardiasis) 1348

Nina Salinger Prasanphanich and Robert W. French, Jr.

266 Cystoisospora (Isospora) and Cyclospora Species 1353

Mohammad Nael Mhaisken and Patricia Michele Flynn

267 Leishmania Species (Leishmaniasis) 1354

Moshe Ephros and Naomi E. Aronson

268 Microsporidia 1365

Mohammad Nael Mhaisken and Patricia Michele Flynn

269 Naegleria fowleri 1366

Vivian Tien and Upinder Singh

270 Acanthamoeba Species 1369

Vivian Tien and Upinder Singh

271 Plasmodium Species (Malaria) 1372

Julie R. Gutman

272 Sarcocystis Species 1382

Douglas H. Esposito

273 Toxoplasma gondii (Toxoplasmosis) 1384

Despina G. Contopoulos-Ioannidis and Jose G. Montoya

274 Trichomonas vaginalis 1400

Laura A.S. Quilter and Kimberly A. Workowski

275 Trypanosoma Species (Trypanosomiasis) 1402

Julia C. Haston and Andres F. Camacho-Gonzalez

Nematodes**276 Intestinal Nematodes 1409**

Jill E. Weatherhead and Peter J. Hotez

277 Tissue Nematodes 1418

Daniel Griffin and Dickson D. Despommier

278 Blood and Tissue Nematodes: Filarial Worms 1424

Mary L. Kamb and Paul Cantey

Cestodes**279 Diphyllobothriidae, *Dipylidium* and *Hymenolepis* Species 1431**

Susan P. Montgomery and Sarah G.H. Sapp

280 Taenia solium, *Taenia asiatica*, and *Taenia saginata*: Taeniasis and Cysticercosis 1435

Huan Xu and Jose Serpa-Alvarez

281 Echinococcus Species: Agents of Echinococcosis 1442

Paul Cantey and Pedro L. Moro

282 Taenia (*Multiceps*) *multiceps* and *Taenia serialis*: Coenurosis 1448

Huan Xu and Jose Serpa-Alvarez

Trematodes**283 Intestinal Trematodes 1449**

Stephanie R. Bialek and LeAnne M. Fox

284 Clonorchis, *Opisthorchis*, *Fasciola*, and *Paragonimus* Species 1451

Rebecca J. Chancey

285 Blood Trematodes: Schistosomiasis 1456

Susan P. Montgomery and Anne Straily

PART IV: Laboratory Diagnosis and Therapy for Infectious Diseases**A. The Clinician and the Laboratory****286 Laboratory Diagnosis of Infection Due to Bacteria, Fungi, Parasites, and Rickettsiae 1459**

Ryan F. Relich, John J. Manaloor, and John C. Christenson

287 Laboratory Diagnosis of Infection Due to Viruses, Chlamydia, and Mycoplasma 1472

Tony Mazzulli

288 Use of Common Clinical Laboratory Tests to Assess Infectious and Inflammatory Diseases 1484

Sarah S. Long, Jennifer Vodzak, and Gregory A. Storch

Contents

- B. Anti-Infective Therapy**
- 289 Principles of Anti-Infective Therapy 1499**
John S. Bradley, Jeffrey S. Gerber, Adam L. Hersh, and Sarah S. Long
- 290 Mechanisms and Detection of Antimicrobial Resistance 1506**
Kevin Alby and Melissa B. Miller
- 291 Pharmacokinetic and Pharmacodynamic Basis of Optimal Antimicrobial Therapy 1516**
Michael Noel Neely, Jason B. Sauberan, and John S. Bradley
- 292 Antibacterial Agents 1537**
Jason B. Sauberan, Michael Noel Neely, and John S. Bradley
- 293 Antifungal Agents 1564**
Debra J. Lugo and William J. Steinbach
- 294 Topical Antimicrobial Agents 1573**
Ishminder Kaur
- 295 Antiviral Agents 1583**
David W. Kimberlin
- 296 Antiparasitic Agents 1598**
Edward T. Ryan, Julie R. Gutman, and Rebecca J. Chancey