

CONTENTS

Contributors ix

Preface xv

section I NOVEL AND EMERGING TECHNOLOGIES

- 1 **Nucleic Acid Amplification Methods Overview / 3**
FREDERICK S. NOLTE AND CARL T. WITTEW
- 2 **Application of Identification of Bacteria by DNA Target Sequencing in a Clinical Microbiology Laboratory / 19**
KARISSA D. CULBREATH, KEITH E. SIMMON, AND CATHY A. PETTI
- 3 **Microbial Whole-Genome Sequencing: Applications in Clinical Microbiology and Public Health / 32**
M. E. TÖRÖK AND S. J. PEACOCK
- 4 **Digital PCR and Its Potential Application to Microbiology / 49**
JIM F. HUGGETT, JEREMY A. GARSON, AND ALEXANDRA S. WHALE
- 5 **Massively Parallel DNA Sequencing and Microbiology / 58**
ULF GYLLENSTEN, RUSSELL HIGUCHI, AND DAVID PERSING
- 6 **Next-Generation Sequencing / 68**
CHARLES CHIU AND STEVE MILLER
- 7 **Pathogen Discovery / 80**
EFREM S. LIM AND DAVID WANG
- 8 **Matrix-Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry for Microbial Identification in Clinical Microbiology / 92**
ALEX VAN BELKUM, VICTORIA GIRARD, MAUD ARSAC, AND ROBIN PATEL
- 9 **Multiplex Technologies / 102**
KEVIN ALBY AND MELISSA B. MILLER

section II METAGENOMICS: IMPLICATIONS FOR DIAGNOSTICS

- 10 **The Skin Microbiome: Insights into Potential Impact on Diagnostic Practice / 117**
ELIZABETH A. GRICE
- 11 **The Gastrointestinal Microbiome / 126**
ABRIA MAGEE, JAMES VERSALOVIC, AND RUTH ANN LUNA
- 12 **The Vaginal Microbiome / 138**
DAVID N. FREDRICKS
- 13 **Microbial Communities of the Male Urethra / 146**
BARBARA VAN DER POL AND DAVID E. NELSON
- 14 **The Human Virome in Health and Disease / 156**
KRISTINE M. WYLIE AND GREGORY A. STORCH

section III HEALTH CARE-ASSOCIATED INFECTIONS

- 15 **Molecular Detection of *Staphylococcus aureus* Colonization and Infection / 169**
KATHY A. MANGOLD AND LANCE R. PETERSON
- 16 **Molecular Diagnostics for *Clostridium difficile* / 185**
FRÉDÉRIC BARBUT AND CURTIS J. DONSKEY
- 17 **Overview of Molecular Diagnostics in Multiple-Drug-Resistant Organism Prevention: Focus on Multiple-Drug-Resistant Gram-Negative Bacterial Organisms / 197**
KAEDE V. SULLIVAN AND DANIEL J. DIEKEMA

18 Detection of Vancomycin-Resistant Enterococci / 212
ALLISON J. McGEER AND BARBARA M. WILLEY

section **IV**
MOLECULAR DIAGNOSTICS AND PUBLIC HEALTH

19 The Impact of Molecular Diagnostics on Surveillance of Foodborne Infections / 235
JOHN BESSER, HEATHER CARLETON, RICHARD GOERING, AND PETER GERNER-SMIDT

20 Role of Molecular Methods in Improving Public Health Surveillance of Infections Caused by Antimicrobial-Resistant Bacteria in Health Care and Community Settings / 245
FRED C. TENOVER

21 Molecular Diagnostics: Huge Impact on the Improvement of Public Health in China / 256
HUI WANG, BIN CAO, Yawei ZHANG, AND SHUGUANG LI

22 Surveillance and Epidemiology of Norovirus Infections / 266
JOHN P. HARRIS

23 Molecular Diagnostic Assays for the Detection and Control of Zoonotic Diseases / 275
J. SCOTT WEESE

section **V**
SYNDROMIC DIAGNOSTICS

24 Molecular Approaches to the Diagnosis of Meningitis and Encephalitis / 287
KAREN C. BLOCH AND YI-WEI TANG

25 Using Nucleic Acid Amplification Techniques in a Syndrome-Oriented Approach: Detection of Respiratory Agents / 306
KATHERINE LOENS AND MARGARETA IEVEN

26 Molecular and Mass Spectrometry Detection and Identification of Causative Agents of Bloodstream Infections / 336
ONYA OPOTA, KATIA JATON, GUY PROD'HOM, AND GILBERT GREUB

27 Molecular Diagnosis of Gastrointestinal Infections / 362
BENJAMIN A. PINSKY AND NIAZ BANAEI

28 Diagnostic Approaches to Genitourinary Tract Infections / 386
CLAIRE C. BRISTOW AND JEFFREY D. KLAUSNER

29 Syndromic Diagnostic Approaches to Bone and Joint Infections / 401
ALEXANDER J. McADAM

section **VI**
VIROLOGY

30 Molecular Detection and Characterization of Human Immunodeficiency Virus Type 1 / 417
ANGELA M. CALIENDO AND COLLEEN S. KRAFT

31 Molecular Detection and Characterization of Hepatitis C Virus / 430
MICHAEL S. FORMAN AND ALEXANDRA VALSAMAKIS

32 Molecular Detection and Characterization of Hepatitis B Virus / 449
JEFFREY J. GERMER AND JOSEPH D. C. YAO

33 Molecular Detection of Human Papillomaviruses / 465
DENISE I. QUIGLEY AND ELIZABETH R. UNGER

34 Molecular Diagnostics for Viral Infections in Transplant Recipients / 476
MATTHEW J. BINNICKER AND RAYMUND R. RAZONABLE

section **VII**
FUNGI AND PROTOZOA

35 Molecular Detection and Identification of Fungal Pathogens / 489
KATRIEN LAGROU, JOHAN MAERTENS, AND MARIE PIERRE HAYETTE

36 Molecular Approaches for Diagnosis of Chagas' Disease and Genotyping of *Trypanosoma cruzi* / 501
PATRICIO DIOSQUE, NICOLAS TOMASINI, AND MICHEL TIBAYRENC

37 Molecular Approaches for Diagnosis of Malaria and the Characterization of Genetic Markers for Drug Resistance / 516
LISA C. RANFORD-CARTWRIGHT AND LAURA CIUFFREDA

38 Molecular Detection of Gastrointestinal Parasites / 530
JACO J. VERWEIJ, ALEX VAN BELKUM, AND C. RUNE STENSVOLD

section VIII

POINT-OF-CARE/NEAR-CARE DIAGNOSTICS

- 39 Molecular Diagnostics and the Changing Face of Point-of-Care / 545**
DAVID L. DOLINGER AND ANNE M. WHALEN
- 40 Point-of-Care Technologies for the Diagnosis of Active Tuberculosis / 556**
GRANT THERON
- 41 Molecular Diagnostics for Use in HIV/AIDS Care and Treatment in Resource-Limited Settings / 580**
MAURINE M. MURTAGH
- 42 Rapid Point-of-Care Diagnosis of Malaria and Dengue Infection / 589**
LIESELOTTE CNOPS, MARJAN VAN ESBROECK, AND JAN JACOBS

section IX

THE HOST AND HOST RESPONSE

- 43 Implications of Pharmacogenetics for Antimicrobial Prescribing / 613**
AR KAR AUNG, ELIZABETH J. PHILLIPS, TODD HULGAN, AND DAVID W. HAAS
- 44 Exploiting MicroRNA (miRNA) Profiles for Diagnostics / 634**
ABHIJEET BAKRE AND RALPH A. TRIPP
- 45 Host Response in Human Immunodeficiency Virus Infection / 655**
PAUL J. McLAREN AND AMALIO TELENTI
- 46 Biomarkers of Gastrointestinal Host Responses to Microbial Infections / 663**
RANA E. EL FEGHALY, HANSRAJ BANGAR, AND DAVID B. HASLAM

section X

INFORMATION TECHNOLOGY

- 47 Point-of-Care Medical Device Connectivity: Developing World Landscape / 685**
JEFF BAKER

- 48 WHONET: Software for Surveillance of Infecting Microbes and Their Resistance to Antimicrobial Agents / 692**

JOHN STELLING AND THOMAS F. O'BRIEN

- 49 Cloud-Based Surveillance, Connectivity, and Distribution of the GeneXpert Analyzers for Diagnosis of Tuberculosis (TB) and Multiple-Drug-Resistant TB in South Africa / 707**
WENDY S. STEVENS, BRAD CUNNINGHAM, NASEEM CASSIM, NATASHA GOUS, AND LESLEY E. SCOTT

section XI

QUALITY ASSURANCE

- 50 Molecular Method Verification / 721**
DONNA M. WOLK AND ELIZABETH M. MARLOWE
- 51 Molecular Microbiology Test Quality Assurance and Monitoring / 745**
MATTHEW J. BANKOWSKI
- 52 Proficiency Testing and External Quality Assessment for Molecular Microbiology / 754**
ROBERTA M. MADEJ
- 53 Practices of Sequencing Quality Assurance / 766**
KARA L. NORMAN AND DAVID M. DINAUER
- 54 Verification and Validation of Matrix-Assisted Laser Desorption Ionization Time of Flight Mass Spectrometry-Based Protocols / 784**
MATTHEW L. FARON, BLAKE W. BUCHAN, AND NATHAN A. LEDEBOER

section XII

THE BUSINESS OF DIAGNOSTICS

- 55 Improved Diagnostics in Microbiology: Developing a Business Case for Hospital Administration / 799**
ELIZABETH M. MARLOWE, SUSAN M. NOVAK-WEEKLEY, AND MARK LAROCCO
- 56 Molecular Diagnostics and the Changing Legal Landscape / 803**
MARK L. HAYMAN, JING WANG, AND JEFFREY M. LIBBY

Index 811