

CONTENTS

- Editorial Board / xi**
Contributors / xiii
Foreword: How It Began / xxiii
Preface / xxv
Author and Editor Conflicts of Interest / xxvii

section **A**

GENERAL METHODS / 1

VOLUME EDITOR: ROBERT G. HAMILTON

SECTION EDITOR: THOMAS A. FLEISHER

- 1 Introduction / 3**
THOMAS A. FLEISHER
- 2 Molecular Methods for Diagnosis of Genetic Diseases Involving the Immune System / 5**
AMY P. HSU
- 3 The Human Microbiome and Clinical Immunology / 19**
FREDERIC D. BUSHMAN
- 4 Protein Analysis in the Clinical Immunology Laboratory / 26**
ROSHINI SARAH ABRAHAM AND
DAVID R. BARNIDGE

section **B**

IMMUNOGLOBULIN METHODS / 47

VOLUME EDITOR: ROBERT G. HAMILTON

SECTION EDITOR: DAVID F. KEREN

- 5 Introduction / 49**
DAVID F. KEREN

- 6 Immunoglobulin Genes / 51**
THOMAS J. KIPPS, EMANUELA M. GHIA, AND
LAURA Z. RASSENTI
- 7 Immunoglobulin Quantification and Viscosity Measurement / 65**
JEFFREY S. WARREN
- 8 Clinical Indications and Applications of Serum and Urine Protein Electrophoresis / 74**
DAVID F. KEREN AND RICHARD L. HUMPHREY
- 9 Immunochemical Characterization of Immunoglobulins in Serum, Urine, and Cerebrospinal Fluid / 89**
ELIZABETH SYKES AND YVONNE POSEY
- 10 Cryoglobulins, Cryofibrinogenemia, and Pyroglobulins / 101**
PETER D. GOREVIC AND DENNIS GALANAKIS
- 11 Strategy for Detecting and Following Monoclonal Gammopathies / 112**
JERRY A. KATZMANN AND DAVID F. KEREN

section **C**

COMPLEMENT / 125

VOLUME EDITOR: ROBERT G. HAMILTON

SECTION EDITOR: PATRICIA C. GICLAS

- 12 Introduction / 127**
PATRICIA C. GICLAS
- 13 The Classical Pathway of Complement / 129**
PATRICIA C. GICLAS
- 14 Analysis of Activity of Mannan-Binding Lectin, an Initiator of the Lectin Pathway of the Complement System / 133**
STEFFEN THIEL
- 15 The Nature of the Diseases That Arise from Improper Regulation of the Alternative Pathway of Complement / 138**
RICHARD J. H. SMITH

section **D****FLOW CYTOMETRY / 145**

VOLUME EDITOR: JOHN L. SCHMITZ

SECTION EDITOR: MAURICE R. G. O'GORMAN

- 16 Introduction / 147**
MAURICE R. G. O'GORMAN
- 17 Polychromatic Flow Cytometry / 149**
ANGÉLIQUE BIANCOTTO AND
J. PHILIP McCOY, JR.
- 18 High-Sensitivity Detection of Red and White Blood Cells in Paroxysmal Nocturnal Hemoglobinuria by Multiparameter Flow Cytometry / 168**
ANDREA ILLINGWORTH, MICHAEL KEENEY, AND D. ROBERT SUTHERLAND
- 19 Standardized Flow Cytometry Assays for Enumerating CD34⁺ Hematopoietic Stem Cells / 182**
D. ROBERT SUTHERLAND AND
MICHAEL KEENEY
- 20 Functional Flow Cytometry-Based Assays of Myeloid and Lymphoid Functions for the Diagnostic Screening of Primary Immunodeficiency Diseases / 199**
MAURICE R. G. O'GORMAN
- 21 Acute Lymphoblastic Leukemia/Lymphoma: Diagnosis and Minimal Residual Disease Detection by Flow Cytometric Immunophenotyping / 207**
JOSEPH A. DiGIUSEPPE
- 22 Acute Myeloid Leukemia: Diagnosis and Minimal Residual Disease Detection by Flow Cytometry / 217**
BRENT WOOD AND LORI SOMA
- 23 Chronic Lymphocytic Leukemia, the Prototypic Chronic Leukemia for Flow Cytometric Analysis / 226**
HEBA DEGHEIDY, DALIA A. A. SALEM, CONSTANCE M. YUAN, AND MARYALICE STETLER-STEVENSON
- 24 Plasma Cell Disorders / 235**
JUAN FLORES-MONTERO, LUZALBA SANOJA, JOSÉ JUAN PÉREZ, FANNY POJERO, NOEMÍ PUIG, MARÍA BELÉN VIDRIALES, AND ALBERTO ORFAO
- 25 Future Cytometric Technologies and Applications / 251**
HOLDEN T. MAECKER

section **E****FUNCTIONAL CELLULAR ASSAYS / 259**

VOLUME EDITOR: BARBARA DETRICK

SECTION EDITOR: STEVEN D. DOUGLAS

- 26 Introduction / 261**
STEVEN D. DOUGLAS
- 27 Cryopreservation of Peripheral Blood Mononuclear Cells / 263**
ADRIANA WEINBERG
- 28 Lymphocyte Activation / 269**
ROSHINI SARAH ABRAHAM
- 29 Functional Assays for B Cells and Antibodies / 280**
MOON H. NAHM AND ROBERT L. BURTON
- 30 Methods for Detection of Antigen-Specific T Cells by Enzyme-Linked Immunospot Assay (ELISPOT) / 290**
BARBARA L. SHACKLETT AND
DOUGLAS E. NIXON
- 31 Regulatory T Cell (Treg) Assays: Repertoire, Functions, and Clinical Importance of Human Treg / 296**
THERESA L. WHITESIDE
- 32 Measurement of NK Cell Phenotype and Activity in Humans / 300**
SAMUEL C. C. CHIANG AND
YENAN T. BRYCESON
- 33 Functional Assays for the Diagnosis of Chronic Granulomatous Disease / 310**
DEBRA LONG PRIEL AND DOUGLAS B. KUHN

section **F****CYTOKINES AND CHEMOKINES / 321**

VOLUME EDITOR: BARBARA DETRICK

SECTION EDITOR: JOHN J. HOOKS

- 34 Introduction / 323**
JOHN J. HOOKS
- 35 Multiplex Cytokine Assays / 324**
ELIZABETH R. DUFFY AND DANIEL G. REMICK
- 36 Cytokine Measurement by Flow Cytometry / 338**
HOLDEN T. MAECKER
- 37 Chemokine and Chemokine Receptor Analysis / 343**
SABINA A. ISLAM, BENJAMIN D. MEDOFF, AND
ANDREW D. LUSTER

- 38 **Cytokines: Diagnostic and Clinical Applications / 357**
PRIYANKA VASHISHT AND TIMOTHY B. NIEWOLD
- 39 **Detection of Anticytokine Autoantibodies and Clinical Applications / 365**
SARAH K. BROWNE

section **G**

IMMUNOHISTOLOGY AND IMMUNOPATHOLOGY / 373

VOLUME EDITOR: ROBERT G. HAMILTON
SECTION EDITOR: R. NEAL SMITH

- 40 **Introduction / 375**
ROBERT G. HAMILTON
- 41 **Immunofluorescence Methods in the Diagnosis of Renal and Cardiac Diseases / 376**
A. BERNARD COLLINS, JAMES R. STONE, AND R. NEAL SMITH
- 42 **Western Blot Analysis for the Detection of Anti-Glomerular Basement Membrane Antibodies and Anti-Phospholipase A2 Receptor Antibodies / 385**
A. BERNARD COLLINS AND R. NEAL SMITH

section **H**

INFECTIOUS DISEASES CAUSED BY BACTERIA, MYCOPLASMAS, CHLAMYDIAE, AND RICKETTSIAE / 391

VOLUME EDITOR: JOHN L. SCHMITZ
SECTION EDITOR: CHRISTINE M. LITWIN

- 43 **Introduction / 393**
CHRISTINE M. LITWIN
- 44 **Diagnostic Methods for Group A Streptococcal Infections / 394**
CHRISTINE M. LITWIN, SHELDON E. LITWIN, AND HARRY R. HILL
- 45 **Diagnosis of *Helicobacter pylori* Infection and Assessment of Eradication / 404**
BRUCE E. DUNN AND SUHAS H. PHADNIS
- 46 **Laboratory Diagnosis of Syphilis / 412**
JOHN L. SCHMITZ
- 47 **Lyme Disease, Relapsing Fever, and Leptospirosis / 419**
GUIQING WANG AND MARIA E. AGUERO-ROSENFELD
- 48 **Immunological Tests in Tuberculosis / 433**
CHRISTINE M. LITWIN

- 49 ***Mycoplasma*: Immunologic and Molecular Diagnostic Methods / 444**
KEN B. WAITES, MARY B. BROWN, AND JERRY W. SIMECKA

- 50 ***Chlamydia* and *Chlamydophila* Infections / 453**
ROSEMARY SHE

- 51 **The *Rickettsiaceae*, *Anaplasmataceae*, and *Coxiellaceae* / 461**
LUCAS S. BLANTON AND DAVID H. WALKER

- 52 **The *Bartonellaceae*, *Brucellaceae*, and *Francisellaceae* / 473**
CHRISTINE M. LITWIN, BURT ANDERSON, RENEE TSOLIS, AND AMY RASLEY

section **I**

MYCOTIC AND PARASITIC DISEASES / 483

VOLUME EDITOR: ROBERT G. HAMILTON
SECTION EDITOR: THOMAS B. NUTMAN

- 53 **Introduction / 485**
THOMAS B. NUTMAN
- 54 **Immunological and Molecular Approaches for the Diagnosis of Parasitic Infections / 486**
PATRICIA P. WILKINS AND THOMAS B. NUTMAN
- 55 **Serological and Molecular Diagnosis of Fungal Infections / 503**
MARK D. LINDSLEY

section **J**

VIRAL DISEASES / 535

VOLUME EDITOR: JOHN L. SCHMITZ
SECTION EDITORS: RICHARD L. HODINKA AND JOHN L. SCHMITZ

- 56 **Introduction / 537**
JOHN L. SCHMITZ
- 57 **Immunologic and Molecular Methods for Viral Diagnosis / 538**
MARIE LOUISE LANDRY AND YI-WEI TANG
- 58 **Herpes Simplex Virus / 550**
D. SCOTT SCHMID
- 59 **Varicella-Zoster Virus / 556**
D. SCOTT SCHMID
- 60 **Epstein-Barr Virus and Cytomegalovirus / 563**
HENRY H. BALFOUR, JR., KRISTIN A. HOGQUIST, AND PRIYA S. VERGHESE
- 61 **Human Herpesviruses 6, 7, and 8 / 578**
RICHARD L. HODINKA

- 62 Parvovirus B19 / 591**
STANLEY J. NAIDES
- 63 Respiratory Viruses / 598**
DAVID J. SPEICHER, MOHSIN ALI, AND
MAREK SMIEJA
- 64 Measles, Mumps, and Rubella Viruses / 610**
DIANE S. LELAND AND RYAN F. RELICH
- 65 Viral Hepatitis / 620**
HUBERT G. M. NIESTERS,
ANNELIES RIEZEBOS-BRILMAN, AND
CORETTA C. VAN LEER-BUTER
- 66 Viral Agents of Gastroenteritis / 639**
GABRIEL I. PARRA AND KIM Y. GREEN
- 67 Arboviruses / 648**
ROBERT S. LANCIOTTI AND JOHN T. ROEHRIG
- 68 Diagnosis of Hantavirus Infections / 658**
WILLIAM MARCIEL DE SOUZA AND
LUIZ TADEU MORAES FIGUEREIDO
- 69 Rabies Virus / 665**
D. CRAIG HOOPER
- 70 Human T-Cell Lymphotropic Virus
Types 1 and 2 / 674**
BREANNA CARUSO, RAYA MASSOUD, AND
STEVEN JACOBSON
- 71 Diagnosis of Prion Diseases / 682**
RICHARD RUBENSTEIN, ROBERT B. PETERSEN,
AND THOMAS WISNIEWSKI
- 72 Principles and Procedures of Human
Immunodeficiency Virus Diagnosis / 696**
KELLY A. CURTIS, JEFFREY A. JOHNSON, AND
S. MICHELE OWEN

section *K*

IMMUNODEFICIENCY DISEASES / 711

VOLUME EDITOR: BARBARA DETRICK

SECTION EDITORS: KATHLEEN E. SULLIVAN AND
HOWARD M. LEDERMAN

- 73 The Primary Immunodeficiency Diseases / 713**
HOWARD M. LEDERMAN
- 74 Severe Combined Immune Deficiency: Newborn
Screening / 715**
JAMES W. VERBSKY AND JOHN M. ROUTES
- 75 Combined Immunodeficiencies / 721**
CHRISTINE SEROOGY AND MELISSA ELDER
- 76 Antibody Deficiencies / 737**
KIMBERLY C. GILMOUR, ANITA CHANDRA, AND
D. S. KUMARARATNE
- 77 Hereditary and Acquired Complement
Deficiencies / 749**
PATRICIA C. GICLAS
- 78 Neutropenia and Neutrophil Defects / 765**
STEVEN M. HOLLAND

- 79 Evaluation of Natural Killer (NK) Cell
Defects / 774**
KIMBERLY RISMA AND REBECCA MARSH

section *L*

ALLERGIC DISEASES / 781

VOLUME EDITOR: ROBERT G. HAMILTON

SECTION EDITOR: PAMELA A. GUERRERIO

- 80 Introduction / 783**
PAMELA A. GUERRERIO
- 81 Quantitation and Standardization of
Allergens / 784**
RONALD L. RABIN, LYNNSEY RENN, AND
JAY E. SLATER
- 82 Immunological Methods in the Diagnostic
Allergy Clinical and Research Laboratory / 795**
ROBERT G. HAMILTON
- 83 Assay Methods for Measurement of Mediators
and Markers of Allergic Inflammation / 801**
JOHN T. SCHROEDER, R. STOKES PEEBLES, JR.,
AND PAMELA A. GUERRERIO
- 84 Tests for Immunological Reactions to
Foods / 815**
CARAH B. SANTOS, DAVID M. FLEISCHER, AND
ROBERT A. WOOD
- 85 Diagnosis of Rare Eosinophilic and Mast Cell
Disorders / 825**
CEM AKIN, CALMAN PRUSSIN, AND
AMY D. KLION

section *M*

SYSTEMIC AUTOIMMUNE DISEASES / 839

VOLUME EDITOR: BARBARA DETRICK

SECTION EDITOR: WESTLEY H. REEVES

- 86 Introduction / 841**
WESTLEY H. REEVES
- 87 Antinuclear Antibody Tests / 843**
ALESSANDRA DELLAVANCE,
WILSON DE MELO CRUVINEL,
PAULO LUIZ CARVALHO FRANCESCANTONIO,
AND LUIS EDUARDO COELHO ANDRADE
- 88 Detection of Autoantibodies by Enzyme-Linked
Immunosorbent Assay and Bead Assays / 859**
EDWARD K. L. CHAN, RUFUS W. BURLINGAME,
AND MARVIN J. FRITZLER
- 89 Immunodiagnosis and Laboratory Assessment of
Systemic Lupus Erythematosus / 868**
WESTLEY REEVES, SHUHONG HAN,
JOHN MASSINI, AND YI LI

- 90 Immunodiagnosis of Autoimmune Myopathies / 878**
MINORU SATOH, ANGELA CERIBELLI,
MICHITO HIRAKATA, AND EDWARD K. L. CHAN
- 91 Immunodiagnosis of Scleroderma / 888**
MASATAKA KUWANA
- 92 Antibody and Biomarker Testing in Rheumatoid Arthritis / 897**
ANN DUSKIN CHAUFFE AND
MICHAEL RAYMOND BUBB
- 93 Antiphospholipid Antibody Syndrome: Clinical Manifestations and Laboratory Diagnosis / 905**
MARTINA MURPHY AND NEIL HARRIS
- 94 Antineutrophil Cytoplasmic Antibodies (ANCA) and Strategies for Diagnosing ANCA-Associated Vasculitides / 909**
R. W. BURLINGAME, C. E. BUCHNER, J. G. HANLY,
AND N. M. WALSH
- 95 IgG4-Related Disease: Diagnostic Testing by Serology, Flow Cytometry, and Immunohistopathology / 917**
JOHN H. STONE
- 96 Future Perspectives for Rheumatoid Arthritis and Other Autoimmune Diseases / 922**
JEREMY SOKOLOVE

section *N*

ORGAN-LOCALIZED AUTOIMMUNE DISEASES / 927

VOLUME EDITOR: JOHN L. SCHIMITZ
SECTION EDITORS: C. LYNNE BUREK AND
PATRIZIO CATUREGLI

- 97 Introduction / 929**
C. LYNNE BUREK
- 98 Endocrinopathies: Chronic Thyroiditis, Addison Disease, Pernicious Anemia, Graves' Disease, Diabetes, and Hypophysitis / 930**
C. LYNNE BUREK, N. R. ROSE,
GIUSEPPE BARBESINO, JIAN WANG,
ANDREA K. STECK, GEORGE S. EISENBARTH,
LIPING YU, LUDOVICA DE VICENTIIS,
ADRIANA RICCIUTI, ALESSANDRA DE
REMIGIS, AND PATRIZIO CATUREGLI
- 99 Myasthenia Gravis / 954**
ARNOLD I. LEVINSON AND ROBERT P. LISAK
- 100 Autoantibodies to Glycolipids in Peripheral Neuropathy / 961**
HUGH J. WILLISON
- 101 Detection of Antimitochondrial Autoantibodies in Primary Biliary Cholangitis and Liver Kidney Microsomal Antibodies in Autoimmune Hepatitis / 966**
PATRICK S. C. LEUNG, MICHAEL P. MANNS,
ROSS L. COPPEL, AND M. ERIC GERSHWIN

- 102 Cardiovascular Diseases / 975**
CHERYL L. MAIER, C. LYNNE BUREK,
NOEL R. ROSE, AND AFTAB A. ANSARI
- 103 Celiac Disease and Inflammatory Bowel Disease / 983**
MELISSA R. SNYDER
- 104 Autoantibodies Directed against Erythrocytes in Autoimmune Hemolytic Anemia / 990**
R. SUE SHIREY AND KAREN E. KING
- 105 Immune Thrombocytopenia / 995**
THOMAS S. KICKLER
- 106 Monitoring Autoimmune Reactivity within the Retina / 998**
JOHN J. HOOKS, CHI-CHAO CHAN,
H. NIDA SEN, ROBERT NUSSENBLATT, AND
BARBARA DETRICK

section *O*

CANCER / 1005

VOLUME EDITOR: ROBERT G. HAMILTON
SECTION EDITORS: DANIEL CHAN AND
LORI J. SOKOLL

- 107 Introduction / 1007**
ROBERT G. HAMILTON
- 108 Immunoassay-Based Tumor Marker Measurement: Assays, Applications, and Algorithms / 1008**
ELIZABETH A. GODBEY, LORI J. SOKOLL, AND
ALEX J. RAI
- 109 Malignancies of the Immune System: Use of Immunologic and Molecular Tumor Markers in Classification and Diagnostics / 1015**
ELAINE S. JAFFE AND MARK RAFFELD
- 110 Monitoring of Immunologic Therapies / 1036**
THERESA L. WHITESIDE
- 111 Circulating Tumor Cells as an Analytical Tool in the Management of Patients with Cancer / 1051**
DANIEL C. DANILA, HOWARD I. SCHER, AND
MARTIN FLEISHER

section *P*

TRANSPLANTATION IMMUNOLOGY / 1063

VOLUME EDITOR: BARBARA DETRICK
SECTION EDITORS: ELAINE F. REED AND
QIUHENG JENNIFER ZHANG

- 112 Histocompatibility and Immunogenetics Testing in the 21st Century / 1065**
QIUHENG JENNIFER ZHANG AND
ELAINE F. REED

- 113 Molecular Methods for Human Leukocyte Antigen Typing: Current Practices and Future Directions / 1069**
MARK KUNKEL, JAMIE DUKE,
DEBORAH FERRIOLA, CURT LIND, AND
DIMITRI MONOS
- 114 Evaluation of the Humoral Response in Transplantation / 1091**
PAUL SIKORSKI, RENATO VEGA,
DONNA P. LUCAS, AND ANDREA A. ZACHARY
- 115 Non-Human Leukocyte Antigen Antibodies in Organ Transplantation / 1103**
ANNETTE M. JACKSON AND BETHANY L. DALE
- 116 Evaluation of the Cellular Immune Response in Transplantation / 1108**
DIANA METES, NANCY L. REINSMOEN, AND
ADRIANA ZEEVI
- 117 Complement in Transplant Rejection / 1123**
CARMELA D. TAN, E. RENE RODRIGUEZ, AND
WILLIAM M. BALDWIN III
- 118 Molecular Characterization of Rejection in Solid Organ Transplantation / 1132**
DARSHANA DADHANIA, TARA K. SIGDEL,
THANGAMANI MUTHUKUMAR,
CHOLI HARTONO, MINNIE M. SARWAL, AND
MANIKKAM SUTHANTHIRAN
- 119 Killer Cell Immunoglobulin-Like Receptors in Clinical Transplantation / 1150**
RAJA RAJALINGAM, SARAH COOLEY, AND
JEROEN VAN BERGEN

- 120 Chimerism Testing / 1161**
LEE ANN BAXTER-LOWE

section **Q**

**LABORATORY
MANAGEMENT / 1169**

VOLUME EDITOR: ROBERT G. HAMILTON
SECTION EDITOR: RONALD J. HARBECK

- 121 Clinical Immunology Laboratory Accreditation, Licensure, and Credentials / 1171**
LINDA COOK AND RONALD J. HARBECK
- 122 Validation and Quality Control: General Principles and Application to the Clinical Immunology Laboratory / 1180**
VIJAYA KNIGHT AND TERRI LEBO

Author Index / 1193

Subject Index / 1195