CONTENTS

Section 1: The Disease History, Epidemiology and Control/Eradication Programmes

1. A Historical Review of Leprosy in India: From Antiquity to the Introduction of Multidrug Therapy **3**

KV Desikan, Shubhada S Pandya

Historic Authentication of Leprosy in India *3*; The Evolution of Modern Leprology *4*; Etiological Controversies *4*; Clinical Features as Basis of Classification *6*; Pathology *8*; Discovery and Properties of the Bacillus *8*; The Era of Chaulmoogra/Hydnocarpus Oil Therapy in India 9; Leprosy as a Public Health Problem *11*; The Bhore Committee *14*; Legislation *16*; The Era of New Drugs *17*; Developments at Independence *17*; Indian Social Initiatives and Gandhiji's Support *19*; The Indian Association of Leprologists *22*; Surgeons as Trail Blazers *27*; Dèjà Vu *27*

2. Epidemiology of Leprosy **31**

Padebettu Krishnamurthy

What is Leprosy? *31*; *Mycobacterium Leprae* *32*; Transmission *32*; Reservoir *33*; Incubation Period *33*; Infection *33*; Disease *33*; Measuring Disease Burden *34*; Distribution *35*; Determinants *38*; Prevention *40*; Leprosy Control *41*

3. Global Leprosy: Historical Perspective, Achievements, Challenges and Future Steps **46**

Erwin Cooreman

Leprosy: A Brief Overview *46*; History of the Disease *47*; History of Treatment of Leprosy *49*; Global Leprosy Situation *50*; From "Elimination as a Public Health Problem" To "Interruption of Transmission/Disease Elimination": A Paradigm Shift *51*; Impact of Coronavirus Disease 2019 *53*; Remaining Challenges *54*; List of Publications on Leprosy by WHO Global Leprosy Program *54*; World Health Assembly Resolutions Pertaining to Leprosy *56*

4. National Leprosy Eradication Programme (NLEP) and Changing National Scenario **58**

Anil Kumar, Megha Pravin Khobragade, Bisworanjan Dash, Vijay Bassapa Dhange

Progress through Different Stages *59*; Strategic Plan of Action (2004–2005) *61*; Current Scenario (as on March 31, 2021) *67*; Integration with Other National Programs of National Health Mission *68*

5. Recording, Reporting and Monitoring of Multidrug Therapy Services **71**

Pratap Rai Manglani, Varanashi Santaram

Terms Used *71*; Monitoring Tools *75*

Section 2: Basic Scientific Considerations and Pathology

6. Immunogenetics and Host Genetic Relationship **111**

Rajni Rani

Genes and Proteins of the Major Histocompatibility Complex *112*; Other Genes Involved in Susceptibility to Leprosy 116

7. Bacteriology, Growth and Evolution of Leprosy Bacillus **128**

B Sekar, Sangeetha AV, Swapna Muthusamy

Mycobacteria *129*; Clinical Spectrum of Leprosy *134*; Laboratory Diagnosis of Leprosy *134*; Drug Resistance *137*; Evolution of Leprosy Bacillus *138*; Phylogenetics and Comparative Genomics of Leprosy Bacillus *140*

8. Immunological Aspects: Innate and Adaptive Immune Responses **145**
Chaman Saini, Indira Nath
General Immune Responses *146*; Immunological Features of Leprosy *146*; Leprosy Reactions *153*; Immunopathology of Dermal Lesions *154*; Nerve Damage in Leprosy *155*; Immunogenetics of Leprosy *156*

9. Immunopathobiology of Leprosy: From the Perspective of a Dermatopathologist **162**
Uma Nahar Saikia, Ridhi Sood
Genetics *162*; Need for Histopathology *163*; Histological Stages of Leprosy *166*; Regressing Lesions (Post-treatment) *175*; Reactions in Leprosy *176*; Relapse in Leprosy *179*

10. Biochemical Aspects of Leprosy **185**
Deepa Bisht, Nirmala Deo, Devesh Sharma, Sakshi Gautam, Shripad A Patil
Framework of *Mycobacterium Leprae* *185*; Pregenomic Study of Enzymes of *Mycobacterium Leprae* *186*; Hematological, Serological and Biochemical Changes *187*

11. Naturally Occurring Leprosy, *Mycobacterium leprae* and Other Environmental Mycobacteria **197**
Umesh Dutt Gupta, Mallika Lavania

12. Experimental Leprosy: Cultivation of *Mycobacterium leprae* and Contributions of Animal Models to Leprosy Research **203**
Linda B Adams, Maria T Pena, Rahul Sharma, Ramanuj Lahiri, Richard W Truman
Mouse Model *204*; Armadillo Model *210*

Section 3: Clinical, Laboratory Diagnosis and Differential Diagnosis

13. History-taking and Clinical Examination **225**
Aparna Palit, Ragunatha Shivanna, Arun C Inamadar
History-taking *225*; Clinical Examination *230*

14. Case Definition and Clinical Types of Leprosy **259**
Bhushan Kumar, Sunil Dogra
Case Definition *259*; Clinical Problems with Cardinal Signs *259*; Classification of the Disease *261*; Clinical Features *262*; Rare Variants of Leprosy *270*; Other Rare Variants of Leprosy *273*; Nerve Involvement and its Sequelae *273*; Systemic Involvement *274*

15. Classification of Leprosy **277**
Radhey Shyam Misra, Joginder Kumar
Need for Classification *278*; Classification Criteria *278*; Madrid Classification *279*; Indian Classification *279*; Ridley–Jopling Classification *280*; World Health Organization Classification (1982,1988,1998) *281*; Classification for Treatment in India *282*; Miscellaneous Criteria in use for Classification into PB and MB *282*; Classification: Present Global Perspective *283*; Correlation Among Various Classifications *283*

16. Histoid Leprosy **285**
Vibhu Mendiratta, Tarun Narang
History *285*; Definition *285*; Epidemiology *286*; Clinical Features *286*; Bacteriology *287*; Histopathology *287*

17. Laboratory Diagnosis **293**
Lakshmi Rajan, Joyce Ponnaiya
Slit-skin Smear Examination *293*; Skin Biopsy *297*; Nerve Biopsy *300*; Histamine Test *301*; The Sweat Test *301*; Cytological Diagnosis of Leprosy *302*; Molecular Diagnostic Tools in Leprosy *303*

18. Serological and Molecular Diagnosis of Leprosy **305**
U Sengupta, VM Katoch
Serodiagnosis *306*; Immunohistochemistry-based Approaches *308*; Future Scope for Immunoassays *308*; Genome of *Mycobacterium Leprae* *308;* Genomic Probes and Gene Amplification Assays for *Mycobacterium Leprae* *308*; Gene Amplification (PCR) Techniques *309*; Detection of Drug Resistance *309*; Future Perspective *310*

19. Differential Diagnosis of Dermatological Disorders in Relation to Leprosy **314**
NL Sharma, Vikram K Mahajan
Pityriasis Alba *317*; Polymorphic Light Eruption *318*; Vitiligo *318*; Nevus Achromicus/Nevus Anemicus *318*; Acquired Hypomelanosis *319*; Contact Leukoderma *320*; Pityriasis Versicolor *320*; Psoriasis *320*; Cutaneous Sarcoidosis *321*; Granuloma Annulare *323*; Cutaneous Leishmaniasis *324*; Cutaneous Tuberculosis *325*; Lupus Miliaris Disseminatus Faciei *325*; Discoid Lupus Erythematosus *326*; Malignancies *326*; Miscellaneous and Uncommon Disorders *326*; General Points to Remember *333*

20. Differential Diagnosis of Neurological Disorders in Relation to Leprosy **334**
Bela J Shah
Types of Neuropathy *334*; Patterns of Neuropathy *335*; Epidemiology *335*; Basic Anatomy *336*; Pathophysiology *336*; Types of Nerve Damage *336*; Pathogenesis of Nerve Damage in Leprosy *337*; Basic Terminology *337*; Diagnostic Approach *337*; Various Neuropathic Disorders *340*

Section 4: Systemic Involvement and Special Situations in Leprosy

21. Systemic Involvement in Leprosy **351**
V Ramesh, Joginder Kumar
Bacillemia in Leprosy *351*; Bones, Joints and Muscles *352*; Nail Involvement *354*; Eyes *355*; Upper Respiratory Tract, Oropharynx, Paranasal Sinuses and Larynx *356*; Lower Respiratory Tract *356*; Gastrointestinal Tract *356*; Reproductive System *357*; Female Reproductive System *357*; Kidneys *357*; Endocrine Glands *357*; Lymph Nodes, Bone Marrow and Spleen *358*; Central Nervous System *358*; Cardiovascular System *358*; Hematology And Serology *359*

22. Leprosy: HIV, Immunosuppression and COVID-19 Infection **363**
Archana Singal, Kavita Bisherwal
Leprosy and HIV *363*; Leprosy and Immunosuppression *368*; COVID-19 and Leprosy *369*

23. Leprosy and Pregnancy **376**
Neena Khanna, Neha Taneja
Prevalence of Leprosy in Females *376*; Effect of Leprosy on Female Reproductive System *377*; Effect of Pregnancy on Leprosy *377*; Presentation of Leprosy in Pregnant Women *378*; Pregnancy and Reactions *379*; Effect of Leprosy on Pregnancy *380*; Effect of Leprosy on Infants, Children, and Adolescents *381*; Effect of Leprosy on Lactation *382*; Lacunae in the Studies *382*

24. Leprosy in Children and Elderly **385**
Archana Singal, Kavita Bisherwal
Leprosy in Children
Epidemiology *385*; Transmission *387*; Classification *387*; Clinical Presentation *387*; Diagnosis *392*; Treatment *393*; Prevention *393*; Contact Survey/Tracing *394*
Leprosy in Elderly
Epidemiology *394*; Clinical Features *394*; Management *395*; Quality of Life *395*

25. Ocular Leprosy **398**
Ebenezer Daniel, Chintan Malhotra
Structures of the Eye Affected by Leprosy *399*; Clinical Examination of the Eye *399*; Lagophthalmos *405*; Ectropion *409*; Entropion *409*; Trichiasis *409*; Dry Eye *409*; Corneal Sensation *409*; Corneal Ulcer (Syn: Infectious Keratitis) *410*; Corneal Opacity *411*; Episcleritis *411*; Scleritis *411*; Iridocyclitis (Syn: Iritis, Uveitis and Anterior Uveitis) *412*; Iris Atrophy *413*; Cataract *414*; Deformity, Ocular Comorbidity and Cataract Surgery *414*; Imaging Techniques for Ocular Leprosy *417*

Section 5: Nerve Physiology, Neuritis and Reactions: Pathogenesis and Management

26. Structure, Electrophysiological and Ultrasonographic Studies of Peripheral Nerve **423**
Sujai K Suneetha, P Narasimha Rao, Suman Jain
Structure and Function of Peripheral Nerve *423*; Types of Nerves *425*; Nerve Supply to the Skin *426*; Nerve Endings *426*; *Mycobacterium Leprae* and Neural Predilection *427*; Electrophysiological Study of Peripheral Nerves in Leprosy *428*; Principle of Nerve Conduction Studies *429*; Application of Electrophysiological Studies in Leprosy *430*; High-resolution Ultrasonography as an Imaging Tool in Leprosy *431*

27. Pathomechanisms of Peripheral Nerve Damage in Leprosy **441**
Vanaja Prabhakar Shetty
General Features of Nerve Damage in Leprosy *441*; Entry of *Mycobacterium Leprae* and its Spread in the Nerves *443*; Infection of Schwann Cells by *Mycobacterium Leprae* *444*; Type of Degeneration and Regeneration Seen in Leprous Nerves *444*; Immunological Aspects of Nerve Damage *446*; Autoimmune Type of Damage *446*; Role of Mycobacterial Antigens in Nerve Damage *446*; Role of Inflammatory Cytokines in Nerve Damage *447*; Insidious Nerve Damage *447*; Lepra Reactions and Nerve Damage *447*; Neuropathic Pain in Leprosy *448*

28. Neuritis: Definition, Clinicopathological Manifestations and Proforma to Record Nerve Impairment **452**
P Narasimha Rao, Sujai K Suneetha, Gigi J Ebenezer
Neuritis/Neuropathy *452*; Pathological Basis of Neuritis *453*; Neuritis During Reactions *455*; Presentations of Neuritis in Leprosy *455*; Peripheral Nerve Involvement in Leprosy *458*; Cranial Nerve and Central Nervous System Involvement in Leprosy *459*; Examination of Peripheral Nerves *460*; Grading of Nerve Thickening, Tenderness and Neuropathic Pain *460*; Tools to Assess Nerve Function Impairment *461*; Laboratory Tools to Test for Nerve Function Impairment *465*; Imaging of the Nerves *466*; Eye Involvement *466*; Disability in Leprosy and its Grading *467*; Proformas to Record Nerve Function Impairment *468*; Proforma to Record Disability and Eye, Hand, and Foot Score *469*

29. Management of Neuritis and Neuropathic Pain **473**
Bhushan Kumar, Sunil Dogra, M Sendhil Kumaran
Diagnosis and Monitoring *474*; Management *475*; Chronic Neuropathic Pain *479*; HIV and Leprous Neuritis *482*

30. Reactions in Leprosy: Pathogenesis and Clinical Features **486**
Hemanta Kumar Kar, Mitanjali Sethy
Types of Reactions *486*; Epidemiology *486*; Type 1 Reaction *488*; Type 2 Reaction *493*; Lepromatous Exacerbation *501*; Lucio Phenomenon *502*

31. Reactions in Leprosy: Management **508**
Hemanta Kumar Kar, Mitanjali Sethy
Diagnosis *508*; Management of Type 1 Reaction (Reversal Reaction) *509*; Treatment of Late Type 1 Reactions *513*; Management of Type 2 Reactions *513*; Management of Lucio Phenomenon *519*; Management of Leprosy Reactions in Special Scenarios *520*

Section 6: Therapeutics and Prophylaxis

32. Chemotherapy of Leprosy **527**
Paul Saunderson
Dapsone *528*; Rifampicin *529*; Clofazimine *530*; Ethionamide/Prothionamide *530*; Fluoroquinolones *531*; Minocycline *531*; Clarithromycin *532*; Bedaquiline *532*; Persisters *532*; Relapse *532*; Future Regimens *533*

33. Chemotherapy: Development and Evolution of World Health Organization Multidrug Therapy (MDT) and Newer Treatment Regimens **535**
VV Pai, RR Rao, Anju Vilas Wakade
Some Significant Landmarks in the Treatment of Leprosy and the Evolution of Multidrug Therapy *536*; History of MDT in India *537*; WHO Study Group on Chemotherapy of Leprosy *537*; Post-treatment Surveillance *541*; Chemotherapy of Leprosy: Related Clinical Issues and Further Challenges *545*; Various Research Trials using Newer Antileprosy Drugs *546*

34. Chemoprophylaxis in Leprosy **555**
Peter Steinmann
Target Groups for Chemoprophylaxis *555*; Chemoprophylaxis with Dapsone *556*; Chemoprophylaxis with Acedapsone (Diacetyl Diamino Diphenyl Sulfone) *557*; Chemoprophylaxis with Rifampicin *558*; Application of Chemoprophylaxis *559*

35. Immunoprophylaxis and Immunotherapy in Leprosy **562**
Kiran Katoch
Prophylaxis *562*; Immunotherapy *565*; Other Miscellaneous Agents *567*

36. Drug Resistance and Bacillary Viability in Leprosy **572**
Masanori Matsuoka
Chemotherapy *573*; Methods for Susceptibility Assay *576*; Sentinel Surveillance by World Health Organization *579*; Global Situation of Drug Resistance *580*; Relapse and Persisters *581*; Viability in Various Conditions *581*

37. Relapse in Leprosy **586**
Devinder Mohan Thappa, Sowmya Kaimal, Anu Kiruba Devi G
Definition *587*; Relapse Rate *587*; Microbiological Aspects *589*; Immunological Tests for Relapse *590*; Histopathology *590*; Classification of Relapse *591*; Predisposing Factors for Relapse *591*; Clinical Features *592*; Differential Diagnosis *593*; Diagnosis *595*; Treatment *595*; Failure to Respond to Therapy *597*

Section 7: Morbidity, Deformity/Disability: Prevention and Management

38. Morbidity, Associated Diseases and Mortality in Leprosy **603**
Ben Naafs, S Noto, PAM Schreuder
Morbidity *603*; Comorbidities *605*; Mortality *607*; Poverty *607*; History *607*; Present *607*; COVID-19 and Leprosy *608*

39. Deformity/Disability Prevention **611**
GN Malaviya
Types of Deformities *611*; Grading of Disabilities and Deformities *612*; Factors Affecting the Onset and Progression of Disabilities *613*; Causation of Deformities *614*; Effects of Infiltration of Tissues By *Mycobacterium Leprae* *614*; Effects of Motor Paralysis *616*; Effects of Anesthesia and Analgesia *617*; Prevention of Disabilities *617*; Prevention of Progression of Disabilities *624*; Impact of Impairments due to Leprosy on Daily Activities and Social Participation *626*; Disability Management: Emerging Technologies *628*

40. Deformities of Face, Hands, Feet and Trophic Ulcers: Surgical and Nonsurgical Management **632**
Atul Shah, Neela Shah
Clinical Manifestations *633*; Disabilities and Deformities in Leprosy *633*; Testing for Nerve Damage *636*; Deformities of Hands *638*; Deformities of Feet *642*; Deformities of Face *646*; Reconstructive Surgery: A Government of India Initiative *647*; Economic Rehabilitation *648*; Health Education for a Person Affected with Leprosy *648*

41. Nursing Care in Leprosy Patients **652**
Vineet Kaur, Gurmohan Singh
Nursing Assessment of a leprosy Patient through Interview *652*; Assessment of "Risk" Status *655*; Assessment of Activities of Daily Living *655*; Role in the care of Anesthetic Limbs *655*; Intervention in Deformity Due to Leprosy *657*; Intervention for Care of the Eyes *660*; Care of Women with Leprosy *660*; Care of Indoor Patients *661*; Care in Leprosy Asylum (Leprosaria) *661*

Section 8: Stigma, Human Rights, Social Issues and Rehabilitation

42. Human Rights and Stigma in Leprosy **665**
VV Dongre, Abhay M Kudale
In the Footsteps of Time: Leprosy Discrimination and Discriminatory Laws *665*; United Nations Human Rights Council Resolutions Concerning Elimination of Discrimination Against Persons Affected by Leprosy and their Family Members *666*; Highlights of Reports of the Special Rapporteur Appointed by the United Nations Human Rights Council During the First Term (2017–2020) Regarding Elimination of Discrimination Against Persons Affected by Leprosy and their Family Members *667*; Overview of Discriminatory Laws Related to Leprosy in India *667*; Social Stigma of Leprosy and Its Effects In The Community *668*; Winds of Change: Efforts Made by the Government and Nongovernmental Organizations to Abolish Discriminatory Laws *669*

43. Psychosocial Aspects in Leprosy **673**
Abhay M Kudale
Stigma *673*; Stigma of Leprosy *674*; Newer Tools to Eliminate Stigma and Discriminations in Leprosy *674*; What's in Name? Leprosy or Hansen's Disease or Mycobacterial Neurodermatosis? *675*; Social and Economic Rehabilitation *675*; Social and Economic Integration *676*; Self-settled Leprosy Colonies *676*; What is Rehabilitation? *676*; Institution-based Rehabilitation *677*; Community-based Rehabilitation *677*;

Social and Economic Reintegration through Rehabilitation *677*; Identifying the Target Groups for Socioeconomic Rehabilitation *678*; Categorization of Leprosy-affected People (All Leprosy Sufferers in the Area must be Examined) *678*; Empowerment *678*

44. Rehabilitation of Persons Affected by Leprosy **681**

Kamaraj Devapitchai

Leprosy Rehabilitation *681*; Community-based Rehabilitation (Now Known as Community-Based Inclusive Development) *682*; Rehabilitation Services for Disabled Persons Under the Ministry of Social Justice and Empowerment *690*; Vocational and Employment Services/Opportunities for People with Disabilities under the Ministry of Labor *690*; Services for Disabled Persons Under the Ministry of Rural Development *691*; Evolving Concept of Disability and Rehabilitation *691*; Global Developments and Leveraging *691*

45. Community-based Initiatives in Comprehensive Leprosy Work **696**

PV Ranganadha Rao, Abhay M Kudale

Leprosy *697*; Leprosy Program *697*; Community *698*; WHO Initiative to Strengthen the Participation of Persons Affected in Leprosy Services *700*; Scope of Community-based Initiatives in Leprosy *702*; Experiences of Community-based Initiatives in Comprehensive Leprosy Work *702*

46. Health Promotion, Education and Counseling **710**

Manimozhi Natarajan

Perspectives *710*; Health Promotion *711*; Health Education *712*; Crucial Decisions *716*; Disclosing Diagnosis to the Patient *718*; Motivation *719*; Storyline (Case Study) *719*; Communication Skills *720*; Program Challenges: Keeping Leprosy in Focus *721*; Key Issues in Communication for Leprosy Programs *721*; Activity Planning versus Strategic Planning *722*

47. Contribution of NGOs in India's March to Zero Leprosy **725**

Atul Shah, Bhushan Kumar

International Federation of Antileprosy Associations *726*; Sasakawa-India Leprosy Foundation *728*; Missionaries of Charity *731*; Bombay Leprosy Project *737*; Local Voluntary Organizations *740*

48. Migration and Leprosy **742**

Cassandra White

Historical Migration: How Colonialism Set the Scene *742*; Leprosy and Migration in the Contemporary Context *743*

Section 9: Future Prospects

49. Leprosy: Future Challenges **751**

Diana NJ Lockwood

Immunoprophylaxis *752*; The Organism and Susceptibility to Leprosy *752*

50. Leprosy and Its Future beyond Elimination **759**

Marcos Virmond

The Elimination Strategy *759*; Leprosy Beyond Elimination *763*; Leprosy Beyond Zero Leprosy *767*; Research *771*; Final Remarks *772*

51. Leprosy Recognition and Treatment in a Low-endemic Setting **775**

David M Scollard

What is "Low Endemic" *775*; Vertical versus Horizontal Models of Healthcare *776*; Goals and Requirements of Leprosy Services in Low-endemic Situations *776*; Surveillance *777*; The United States' Experience in the Management of Leprosy in a Low-endemic Setting *777*

52. Case Studies **780**

Pankaj Sharma, Hemanta Kumar Kar, Ruchi Gupta, Tarun Narang, M Sendhil Kumaran

Case Study Number 1 *780*; Case Study Number 2 *781*; Case Study Number 3 *783*; Case Study Number 4 *787*; Case Study Number 5 *789*; Case Study Number 6 *791*; Case Study Number 7 *793*; Case Study Number 8 *794*; Case Study Number 9 *795*

Photo Gallery **797**

Index **807**