# Table of Contents

## PART 1 Principles

**Chapter 1  History of Insect Repellents** ............................... 3  
*Sarah J. Moore and Mustapha Debboun*

**Chapter 2  Terminology of Insect Repellents** ......................... 31  
*Graham B. White*

**Chapter 3  Vertebrate Chemical Defense: Secreted and Topically Acquired Deterrents of Arthropods** ...................... 47  
*Paul J. Weldon and John F. Carroll*

**Chapter 4  Human Emanations and Related Natural Compounds That Inhibit Mosquito Host-Finding Abilities** .............. 77  
*Ulrich R. Bernier, Daniel L. Kline, and Kenneth H. Posey*

## PART 2 Methods

**Chapter 5  Standard Methods for Testing Mosquito Repellents** ........................................... 103  
*Donald R. Barnard, Ulrich R. Bernier, Rui-de Xue, and Mustapha Debboun*

**Chapter 6  Biometrics and Behavior in Mosquito Repellent Assays** ........................................... 111  
*Donald R. Barnard and Rui-de Xue*

**Chapter 7  Animal Models for Research and Development of Insect Repellents for Human Use** .............................. 125  
*Louis C. Rutledge and Raj K. Gupta*

**Chapter 8  Techniques for Evaluating Repellents** ..................... 147  
*John M. Govere and David N. Durrheim*
Chapter 9  Use of Olfactometers for Determining Attractants and Repellents...........................................161
Jerry F. Butler

Chapter 10  Discovery and Design of New Arthropod/Insect Repellents by Computer-Aided Molecular Modeling..................................................195
Raj K. Gupta and Apurba K. Bhattacharjee

Chapter 11  Molecular-Based Chemical Prospecting of Mosquito Attractants and Repellents.................................229
Walter S. Leal

PART 3 Products and Active Ingredients

Chapter 12  Evaluation of Topical Insect Repellents and Factors That Affect Their Performance .........................245
Scott P. Carroll

Chapter 13  Repellents Used in Fabric: The Experience of the U.S. Military.......................................................261
Wilfred C. McCain and Glenn J. Leach

Chapter 14  Plant-Based Insect Repellents ...........................................275
Sarah J. Moore, Annick Lenglet, and Nigel Hill

Chapter 15  Considerations on the Use of Botanically-Derived Repellent Products.................................................305
Eugene J. Gerberg and Robert J. Novak

Chapter 16  Efficacy and Safety of Repellents Containing Deet ....311
Stephen P. Frances

Chapter 17  Lipodeet: An Improved Formulation for a Safe, Long-Lasting Repellent.............................................327
Buz Salafsky, Takeshi Shibuya, Yi-Xun He, James Ha, and Kalyanasundaram Ramaswamy
Chapter 18  Picaridin......................................................... 337
Stephen P. Frances

Chapter 19  DEPA: Efficacy, Safety, and Use of N,N-Diethyl
Phenylacetamide, a Multi-Insect Repellent.............. 341
Shri Prakash, R. Vijayaraghavan, and K. Sekhar

Chapter 20  PMD (p-Menthane-3,8-Diol) and Quwenling............ 347
Daniel Strickman

Chapter 21  IR3535 (Ethyl Butylacetylaminopropionate)......... 353
Germain Puccetti

Chapter 22  Older Synthetic Active Ingredients and
Current Additives...................................................... 361
Daniel Strickman

Chapter 23  Area Repellent Products.................................. 385
Daniel Strickman

PART 4 Uses

Chapter 24  User Acceptability: Public Perceptions of
Insect Repellents....................................................... 397
Stephen P. Frances and Mustapha Debboun

Chapter 25  Commercially Available Insect Repellents and Criteria
for Their Use .......................................................... 405
Rui-de Xue, Arshad Ali, and Jonathan F. Day

Chapter 26  Global Regulatory Perspective on Insect Repellent
Development and Registration ............................... 417
Kevin J. Sweeney

Epilogue: Prospects for the Future............................ 425
Daniel Strickman, Stephen P. Frances, and Mustapha Debboun

Appendices.............................................................. 429

Index.................................................................... 465