The Essence of Analgesia and Analgesics
The Essence of Analgesia and Analgesics

Edited by

Raymond S. Sinatra
Jonathan S. Jahr
J. Michael Watkins-Pitchford
Contents

Contributors xi

1. Introduction 1
   Ian W. Rodger

Section 1. Pain Definitions

2. Pain definitions and assessment 3
   Raymond S. Sinatra

3. Pain pathways and pain processing 7
   Amit Mirchandani and Shamsuddin Akhtar

4. Pain characteristics 13
   Alireza Sadoughi

5. Primary and secondary hyperalgesia 17
   Brenda C. McClain

6. Pain pathophysiology 23
   Alireza Sadoughi

7. Neuropathic pain 30
   Ho Dzung and Oscar A. de Leon-Casasola

8. Genetics and pain 37
   Keith A. Candiotti and Claudia R. Fernandez Robles

9. Persistent post-operative pain 41
   Peter G. Lacouture

10. Analgesic gaps 51
    Sunil J. Panchal

11. Multimodal analgesia (sites of analgesic activity) 57
    Bryan S. Williams and Asokumar Buvanendran

12. A stepwise approach to pain management 66
    Raymond S. Sinatra

Section 2. Oral and Parenteral Opioid Analgesics

13. Opioids and opioid receptors 73
    Raymond S. Sinatra

14. Morphine – oral and parenteral 82
    Joseph Rosa and Swati Patel

15. Morphine sulfate controlled-release 86
    Parisa Partownavid

16. Combination agonist–antagonist opioid analgesics 90
    Jeff Gudin

17. Meperidine 94
    Ellen Flanagan and Brian Ginsberg

18. Codeine and codeine compounds 98
    Anjali Vira

19. Oxycodone and oxycodone compounds 101
    Mary Keyes

20. Opioid plus ibuprofen compounds 105
    Kellie Park

21. Oxycodone controlled-release 108
    Amanda Barker, Justin Hata and Eric Hsu

22. Hydrocodone bitartrate 112
    Edward J. Park

23. Hydromorphone (oral and parenteral) 115
    Carsten Nadjat-Haïem and Joseph Rosa

24. Oxymorphone injectable 119
    Balazs Horvath

25. Oxymorphone extended-release 123
    Steven Levin and Imanuel Lerman
Contents

26. Methadone 127
   Keun Sam Chung
27. Fentanyl oral and buccal delivery systems 131
   Philip Levin
28. Fentanyl transdermal system 134
   Hamid Nourmand
29. Tramadol and tramadol plus acetaminophen 137
   Julie Sramcik and Raymond S. Sinatra
30. Tramadol extended-release 140
   Haruo Arita
31. Tapentadol 143
    Dan Froicu and Raymond S. Sinatra
32. Remifentanil 147
    Marjorie Podraza Stiegler
33. Nalbuphine 150
    Ana M. Lobo
34. Butorphanol 154
    J. Michael Watkins-Pitchford
35. Buprenorphine: intravenous neuraxial and transdermal applications 157
    Nalini Vadivelu
36. Opioid dosing in pediatric patients 161
    Debra E. Morrison, Abraham Rosenbaum, Co T. Truong and Zeev N. Kain
37. Opioid tolerance and dependence 165
    Sukanya Mitra
38. Opioid-induced hyperalgesia 171
    Sukanya Mitra
39. Opioid rotation 174
    Raymond S. Sinatra

Section 3. Neuraxial Opioid Analgesics
40. Epidural morphine 181
    Siamak Rahman
41. Epidural fentanyl 184
    Bita H. Zadeh
42. Epidural hydromorphone 187
    Susan Dabu-Bondoc and Greg Albert
43. Epidural sufentanil 191
    Jill Zafar, Anthony T. Yarussi and Laura Mechtler
44. Extended-release epidural morphine 194
    Akta Patel, Eugene R. Viscusi and Leslie Schechter
45. Intrathecal morphine 197
    James M. Moore
46. Evaluating epidural catheters 200
    Anna Clebone and Raymond S. Sinatra
47. Anticoagulants and regional anesthesia 204
    Gregory Cain, Michael Seneca and Ashley Vaughn

Section 4. NSAIDs
48. Nonselective nonsteroidal anti-inflammatory drugs, COX-2 inhibitors, and acetaminophen 211
    Jonathan S. Jahr and Vivian K. Lee
49. Ibuprofen 215
    Eric C. Lin and Shu-ming Wang
50. Injectable ibuprofen 218
    James H. Shull
51. Naproxen 221
    Dorothea Hall, Tyson Bolinske and Elizabeth Sinatra
52. Diclofenac gel and diclofenac patch 225
    Neil Singla
53. Diclofenac oral and diclofenac plus PPI 229
    Nehal Gatha
54. Diclofenac injectable 232
    Daniel B. Carr and Ryan Lanier
55. Ketorolac 235
    Christopher Wray
56. Celecoxib 238
    Joseph Marino
57. Etoricoxib 243
    Bryan S. Williams and Asokumar Buvanendran
58. Parecoxib 245
    Jeff Gudin and Despina Psillides
Contents

59. Meloxicam 249
   Gabriel Jacobs

60. Buffered aspirin and oral salicylate 252
   Jeanna Blitz

61. Acetaminophen oral and rectal 256
   Komal D. Patel

62. Acetaminophen injectable 258
   Vivian K. Lee and Jonathan S. Jahr

63. Fiorinal and Fioricet 262
   Alexander Timchenko

Section 5. Local Anesthetics

64. Overview of local anesthetics 267
   Lars E. Helgeson and Raymond S. Sinatra

65. Bupivacaine 274
   Thomas Halaszynski

66. Ropivacaine 276
   Neesa Patel

67. Lidocaine for neural blockade 279
   Mary Hanna Bekhit

68. Topical local anesthetics 283
   Steven J. Weisman

69. Lidocaine transdermal 288
   Maggy G. Riad

Section 6. Anticonvulsant-Type Analgesics

70. Overview of anticonvulsant analgesics 292
    J. Michael Watkins-Pitchford and Veena Salgar

71. Gabapentin 294
    Boris Gelman and Eric S. Hsu

72. Pregabalin 298
    Neil Sinha

73. Carbamazepine 301
    Keren Ziv

74. Lamotrigine 306
    Laurie Yonemoto

Section 7. NMDA Antagonists

75. Overview of NMDA receptors and antagonists 310
    R. Todd Rinnier, Michael E. Goldberg and Marc C. Torjman

76. Ketamine 316
    Carsten Nadjat-Haiem

77. Memantine 319
    Bryan S. Williams and Asokumar Buvanendran

78. Dextromethorphan 321
    Muhammad Anwar

79. NMDA antagonists: magnesium and amantadine 325
    Clinton Kakazu, John Charney and Yaw Wu

Section 8. Alpha-Adrenergic Analgesics

80. Overview of adrenergic and serotoninergic pain suppression 328
    Frederick Conlin and Shamsuddin Akhtar

81. Clonidine (transdermal and parenteral) 330
    Anahat Kaur Dhillon

82. Neuraxial clonidine hydrochloride 332
    Richard W. Hong

83. Dextromethorphan 335
    David Burbulys and Kianusch Kiai

Section 9. Antidepressants

84. Overview and use of antidepressant analgesics in pain management 338
    Paul M. Peloso

85. Tricyclic antidepressants 347
    Carly Miller and Alan Miller

86. Trazodone 351
    JinLei Li

87. Duloxetine 353
    Eric S. Hsu

88. Milnacipran 357
    Kristin L. Richards
### Contents

**Section 10. Muscle Relaxants**

89. **Overview of muscle relaxants in pain** 360  
   David A. Lindley

90. **Diazepam and lorazepam** 365  
   Mirjana Lovrinčević and Mark J. Lema

91. **Methocarbamol** 368  
   Martha Zegarra

92. **Cyclobenzaprine** 370  
   Martha Zegarra

93. **Metaxalone** 372  
   Eric S. Hsu

94. **Tizanidine** 375  
   Tariq Malik

95. **Baclofen** 379  
   Marisa Lomanto

**Section 11. Adjuvant Analgesics and Antiemetics**

96. **Corticosteroids: intravenous, neuraxial, and articular** 383  
   Johan Raeder

97. **Oral corticosteroids** 388  
   Kiansush Kiani and David Burbulys

98. **Antihistamines** 391  
   Sharon Lin

99. **Parenteral antiemetics** 396  
   Zhuang T. Fang

100. **Oral antiemetics – apremitapen** 401  
    Philip F. Morway

101. **Transdermal scopolamine** 405  
    Joe C. Hong

102. **Topical capsaicin** 407  
    Jure Marijic

103. **Topical salicylates** 410  
    Jeremy M. Wong

104. **Pamidronate** 413  
    Rex Cheng and Zoren Steffens

105. **Ziconotide** 415  
    Sunil J. Panchal

106. **Methylaltrexone** 418  
    Kathleen Ji Park, Anthony DePlato and Jill Zafar

107. **Alvimopan** 420  
    Victor A. Filadora II and Sidney Allison

**Section 12. New and Emerging Analgesics**

108. **Overview: novel targets for new analgesics** 424  
    Ian W. Rodger and Peter G. Lacouture

109. **Intranasal morphine** 437  
    Denis V. Snegovskikh

110. **Intranasal ketamine** 440  
    Daniel B. Carr and Ryan Lanier

111. **Inhaled fentanyl** 444  
    Dana Oprea

112. **Hydromorphone extended-release** 448  
    Ira Whitten

113. **Hydrocodone extended-release** 452  
    Thomas Wong

114. **Iontophoretic transdermal fentanyl** 455  
    Craig T. Hartrick

115. **Tapentadol ER** 458  
    Raymond S. Sinatra

116. **Tamper-resistant opioids** 463  
    Christopher Gharibo and Fleurise Montecillo

117. **Novel sustained-release analgesics** 467  
    Danielle Perret and Michael M. Kim

118. **Extended-duration bupivacaine** 471  
    Tiffany Denepitiya-Balicki and Mamatha Punjala

119. **Morphine-6-glucuronide** 475  
    Stephen M. Eskaros

120. **Neostigmine** 479  
    Rongjie Jaing and Balazs Horvath

121. **Buprenorphine transdermal** 481  
    Martin Hale
Contents

122. Nicotine (transdermal) 484
    Dmitri Souzdalnitski, Imanuel Lerman and Keun Sam Chung

123. Local anesthetic bone paste 488
    Vadim Tokhner and Inderjeet Singh Julka

124. Peripheral kappa agonists 490
    Derek Chalmers

125. Cannabinoid agonists 492
    Yasser F. Shaheen and Aziz M. Razzuk

126. Peripheral cannabinoid receptor agonists 497
    Ho Dzung and Mark J. Lema

127. Injectable capsaicin 500
    Muhammad K. Ghori

128. TRPV-1 ion channel blockers 504
    Jeanette Derdemezi

129. Neramexane 507
    Dajie Wang

130. Nociceptin 508
    Juan Jose Egas and Bijal Patel

131. Anti-nerve growth factor 512
    Allison Gandey and Roger Chou

Index 515
Contributors

Shamsuddin Akhtar MD
Assistant Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Greg Albert MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Sidney Allison
University at Buffalo, School of Medicine and Biomedical Sciences, Roswell Park Cancer Institute, Buffalo, NY, USA

Muhammad Anwar MD
Clinical Assistant Professor, Department of Anesthesiology, Yale University, School of Medicine, New Haven, CT, USA

Haruo Arita MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Amanda Barker
Pain Fellow, Department of Anesthesiology and Perioperative Care, UC Irvine School of Medicine, Irvine, CA, USA

Mary Hanna Bekhit MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Jeanna Blitz
NYU School of Medicine, New York City, NY, USA

Tyson Bolinske MD
Medical Student, University of North Dakota, and Research Associate in Anesthesiology, Department of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

David Burbulys MD
Assistant Clinical Professor of Anesthesiology, David Geffen School of Medicine at UCLA, Department of Anesthesiology, Harbor-UCLA Medical Center, Torrance, CA, USA

Asokumar Buvanendran MD
Associate Professor of Anesthesiology, Rush Presbyterian Medical Center, Chicago, IL, USA

Gregory Cain MSN, CRNA
Department of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Keith A. Candiotti MD
Professor of Pain Medicine, and Vice-Chair University of Miami School of Medicine, Miami, FL, USA

Daniel B. Carr MD
Saltonstall Professor of Pain Research, Tufts Medical Center, Boston, MA, and Chief Medical Officer, Javelin Pharmaceuticals, Inc., Cambridge, MA, USA

Derek Chalmers PhD, DSc
President & CEO, Cara Therapeutics, Inc., Shelton, CT, USA

John Charney MD
Assistant Clinical Professor of Anesthesiology, David Geffen School of Medicine at UCLA, Department of Anesthesiology Harbor-UCLA Medical Center, Torrance, CA, USA

Rex Cheng MD
Assistant Clinical Professor of Anesthesiology, David Geffen School of Medicine at UCLA, Department of Anesthesiology, Harbor-UCLA Medical Center, Torrance, CA, USA
Contributors

Roger Chou MD
Associate Professor of Medicine, Department of Medicine and Department of Medical Informatics and Clinical Epidemiology, Oregon Health & Science University, Portland, OR, USA

Keun Sam Chung MD
Assistant Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Anna Clebone MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Frederick Conlin MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Susan Dabu-Bondoc MD
Assistant Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Tiffany Denepitiya-Balicki MD
Resident in Anesthesiology, Yale University School of Medicine, Cedar Street, New Haven, CT, USA

Jeanette Derdemezi MD
Assistant Clinical Professor of Anesthesiology, David Geffen School of Medicine at UCLA, Department of Anesthesiology, Harbor-UCLA Medical Center, Torrance, CA, USA

Anahat Kaur Dhillon MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Ho Dzung MD
Pain Fellow, Department of Anesthesiology, University at Buffalo, Buffalo, NY, USA

Juan Jose Egas MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Stephen M. Eskaros MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Zhuang T. Fang MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Claudia R. Fernandez Robles MD
Assistant Professor of Pain Medicine, University of Miami School of Medicine, Miami, FL, USA

Victor A. Filadora II
University at Buffalo, School of Medicine and Biomedical Sciences, Roswell Park Cancer Institute, Buffalo, NY, USA

Ellen Flanagan
Assistant Professor of Anesthesiology, Duke University Medical Center, Durham, NC, USA

Dan Froicu MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Allison Gandy BJ, MJ
Senior Journalist, Medscape Neurology, WebMD Professional News, New York, NY, USA

Nehal Gatha MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Boris Gelman MD
Assistant Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Christopher Gharibo MD
Pain Management Clinic, NYU Department of Anesthesiology, New York, NY, USA

Muhammad K. Ghor MD
Assistant Professor of Anesthesiology, Yale University School of Medicine, and Attending Anesthesiologist, West Haven VA Medical Center, New Haven, CT, USA

Brian Ginsberg MB BCh, FFA
Associate Professor, Medical Director, Acute Pain Service, Duke University Medical Center, Durham, NC, USA
<table>
<thead>
<tr>
<th>Contributors</th>
</tr>
</thead>
</table>
| Michael E. Goldberg MD  
Professor and Chief, Department of Anesthesiology, Cooper University Hospital, The Robert Wood Johnson Medical School – UMDNJ, Camden, NJ, USA |
| Jeff Gudin MD  
Director, Pain Management, Englewood Hospital, Englewood, NJ, USA |
| Thomas Halaszynski DMD, MD, MBA  
Associate Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA |
| Martin Hale MD  
Medical Director, Gold Coast Research LLC, Weston, FL, USA |
| Dorothea Hall MD  
Clinical Assistant Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA |
| Craig T. Hartrick MD  
Director, Academic Affairs, Beaumont Hospital, Royal Oak, MI, USA |
| Justin Hata MD  
Assistant Clinical Professor, Departments of Anesthesiology & Perioperative Care, PM&R Acting Director, Division of Pain Medicine, and Co-director, UC Irvine Comprehensive Spine Program, UCI Medical Center, USA |
| Lars E. Helgeson MD  
Assistant Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA |
| Joe C. Hong MD  
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA |
| Richard W. Hong MD  
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA |
| Balazs Horvath MD  
Assistant Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA |
| Eric S. Hsu MD  
Clinical Professor of Anesthesiology and Director Pain Fellowship Program, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA |
| Gabriel Jacobs  
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA |
| Jonathan S. Jahr MD  
Professor of Clinical Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA |
| Rongjie Jaing MD  
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA |
| Inderjeet Singh Julka MD  
Assistant Clinical Professor of Anesthesiology, David Geffen School of Medicine at UCLA, Department of Anesthesiology, Harbor-UCLA Medical Center, Torrance, CA, USA |
| Zeev N. Kain MD, MBA  
Professor of Anesthesiology and Pediatrics and Psychiatry, Chair Department of Anesthesiology and Perioperative Care, Associate Dean of Clinical Research, School of Medicine, University of California, Irvine, Orange, CA, USA |
| Clinton Kakazu MD  
Assistant Clinical Professor of Anesthesiology, David Geffen School of Medicine at UCLA, Department of Anesthesiology, Harbor-UCLA Medical Center, Torrance, CA, USA |
| Kianusch Kiali MD  
Associate Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA |
| Mary Keyes MD  
Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA |
| Michael M. Kim MD  
Director, Resident Education in Pain Medicine, Department of Anesthesiology & Perioperative Care, |
Contributors

University of California, Irvine Medical Center, Orange, CA, USA

Peter G. Lacouture MS, PhD
Executive Director, Scientific & Medical Affairs, Magidom Discovery, Lithia, FL, USA, and Adjunct Assistant Professor of Medicine, Brown University School of Medicine, Providence, RI, USA

Ryan Lanier
Senior scientist, Rock Creek Pharmaceuticals, Gloucester, MA, USA

Vivian K. Lee MD
Resident Physician, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Mark J. Lema MD
Professor and Chair, Department of Anesthesiology, University at Buffalo – SUNY, Roswell Park Cancer Institute, Buffalo, NY, USA

Oscar A. de Leon-Casasola MD
Director, Pain Management, Department of Anesthesiology, Roswell-Park Cancer Center, Buffalo, NY, USA

Imanuel Lerman MD
Internal Medicine Doctor, Department of Neurology, Yale University School of Medicine New Haven, CT, USA

Philip Levin MD
Associate Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Santa Monica/UCLA and Orthopaedics Hospital and Medical Center, Los Angeles, CA, USA

Steven Levin MD
Advanced Diagnostic Pain Treatment Centers, Yale New Haven Medical at Long Wharf, New Haven, CT, USA

JinLei Li MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Eric C. Lin
Yale University School of Medicine, New Haven, CT, USA

Sharon Lin MD
Assistant Clinical Professor, University of California, Irvine, Department of Anesthesiology and Perioperative Care, Orange, CA, USA

David A. Lindley DO
Anesthesiology and Pain Management, University of Miami, Miami, FL, USA

Ana M. Lobo MD
Assistant Professor of Anesthesiology, Yale University School of Medicine, Department of Anesthesiology, New Haven CT, USA

Marisa Lomanto MD
Pain Fellow, Yale-New Haven Hospital, Yale University School of Medicine, Department of Anesthesiology, New Haven, CT, USA

Mirjana Lovrincevic MD
Associate Professor of Anesthesiology and Oncology, University at Buffalo-SUNY, School of Medicine and Biomedical Sciences, Buffalo, NY, USA

Brenda C. McClain MD
Associate Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Tariq Malik MD
Assistant Professor of Anesthesiology, University of Chicago School of Medicine, Department of Anesthesia and Critical Care, Chicago, IL, USA

Jure Marijic MD
Associate Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Joseph Marino MD
Attending Anesthesiologist and Director, Acute Pain Management Service, Huntington Hospital, Huntington, NY, USA

Laura Mechtler
Medical Student, Hungary

Alan Miller MD
Section of Interventional Pain Management, Jefferson Medical College, Philadelphia, PA, USA
Contributors

Carly Miller MD
Section of Interventional Pain Management, Jefferson Medical College, Philadelphia, PA, USA

Amit Mirchandani MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Sukanya Mitra MD
Associate Professor, Department of Anaesthesia and Intensive Care, Government Medical College and Hospital, Chandigarh, India

Fleurise Montecillo
Resident in Anesthesiology, NYU Department of Anesthesiology, New York, NY, USA

James M. Moore MD
Associate Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Debra E. Morrison MD
Director, Pediatric & Neonatal Anesthesia Services, School of Medicine, University of California, Irvine, Orange, CA, USA

Philip F. Morway MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Santa Monica/UCLA and Orthopaedics Hospital and Medical Center, Los Angeles, CA, USA

Carsten Nadjat-Haiem MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Hamid Nourmand MD
Associate Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Dana Oprea MD
Fellow in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Sunil J. Panchal MD
Director, National Institute of Pain, Lutz, FL, USA

Edward J. Park MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Kathleen Ji Park
University at Buffalo, School of Medicine and Biomedical Sciences, Roswell Park Cancer Institute, Buffalo, NY, USA

Kellie Park MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Parisa Partownavid MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Akta Patel
Thomas Jefferson University, Philadelphia, PA, USA

Bijal Patel
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Komal D. Patel MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Neesa Patel MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Swati Patel MD
Associate Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Paul M. Peloso MD, MSc
Merck & Co., Inc., NJ, USA
Contributors

Danielle Perret MD
Director, Fellowship Training Program in Pain Medicine, Department of Anesthesiology & Perioperative Care, and Department of Physical Medicine and Rehabilitation, University of California, Irvine Medical Center, Orange, CA, USA

Anthony DePlato
University at Buffalo, School of Medicine and Biomedical Sciences, Roswell Park Cancer Institute, Buffalo, NY, USA

Marjorie Podraza Stiegler MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Despina Psillides MD
Department of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Mamatha Punjala MD
Assistant Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Johan Raeder MD, PhD
Professor in Anaesthesiology and Chairman of Clinical Ambulatory Anaesthesia, Oslo University Hospital, Ullevaal, Oslo, Norway

Siamak Rahman MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Aziz M. Razzuk MD
Research Associate, Occupational Health Services, Kaiser Permanente, Honolulu, Hawaii

Maggy G. Riad MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Kristin L. Richards MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

R. Todd Rinnier DO
Chief Resident, Department of Anesthesiology, Cooper University Hospital, The Robert Wood Johnson Medical School – UMDNJ, Camden, NJ, USA

Ian W. Rodger BSc, PhD, MRPharmS, FRCP
Vice President, Research & Academic, St Joseph’s Healthcare Hamilton, and Professor, Department of Medicine, McMaster University, Hamilton, Ontario, Canada

Joseph Rosa MD
Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Abraham Rosenbaum MD
Assistant Professor of Clinical Anesthesia, Section of Pediatric Anesthesia, University of California Irvine Medical Center, Orange, CA, USA

Alireza Sadoughi MD
Associate Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Veena Salgar MD
Assistant Professor of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Leslie Schechter
Department of Pharmacy, Thomas Jefferson University Hospital, Philadelphia, PA, USA

Michael Seneca MSN, CRNA
Department of Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Yasser F. Shaheen MD
Assistant Clinical Professor, Division Director, NORA, Department of Anesthesia, Yale University School of Medicine, New Haven, CT, USA

James H. Shull MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Elizabeth Sinatra BS
Research Associate in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA
Contributors

Christopher Wray MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Yaw Wu MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Harbor-UCLA Medical Center, Torrance, CA, USA

Anthony T. Yarussi MD
Assistant Professor of Anesthesiology, University at Buffalo, School of Medicine and Biomedical Sciences, Roswell Park Cancer Institute, Buffalo, NY, USA

Laurie Yonemoto MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Bita H. Zadeh MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA

Jill Zafar MD
Assistant Professor of Anesthesiology, University at Buffalo, School of Medicine and Biomedical Sciences, Roswell Park Cancer Institute, Buffalo, NY, USA

Martha Zegarra MD
Resident in Anesthesiology, Yale University School of Medicine, New Haven, CT, USA

Keren Ziv MD
Assistant Clinical Professor of Anesthesiology, Department of Anesthesiology, David Geffen School of Medicine at UCLA, Ronald Reagan UCLA Medical Center, Los Angeles, CA, USA