THERAPEUTICS of PARKINSON’S DISEASE and OTHER MOVEMENT DISORDERS

Edited by

MARK HALLETT
National Institute of Neurological Disorders and Stroke, Bethesda, MD, USA

and

WERNER POEWE
Department of Neurology, Medical University of Innsbruck, Austria
THERAPEUTICS of PARKINSON’S DISEASE and OTHER MOVEMENT DISORDERS
THERAPEUTICS of PARKINSON’S DISEASE and OTHER MOVEMENT DISORDERS

Edited by

MARK HALLETT
National Institute of Neurological Disorders and Stroke, Bethesda, MD, USA

and

WERNER POEWE
Department of Neurology, Medical University of Innsbruck, Austria

WILEY-BLACKWELL
A John Wiley & Sons, Ltd., Publication
# Contents

Preface ............................................................................................................. ix
Contributors ..................................................................................................... xi

## PART I  PARKINSON’S DISEASE AND PARKINSONISM

1. The Etiopathogenesis of Parkinson’s Disease: Basic Mechanisms of Neurodegeneration ............................................. 3
   C. Warren Olanow and Kevin McNaught

2. Physiology of Parkinson’s Disease .......................................................... 25
   Shlomo Elias, Zvi Israel and Hagai Bergman

3. Pharmacology of Parkinson’s Disease .................................................... 37
   Jonathan M. Brotchie

4. The Treatment of Early Parkinson’s Disease ....................................... 49
   Olivier Rascol and Regina Katzenschlager

5. Treatment of Motor Complications in Advanced Parkinson’s Disease ................................. 71
   Susan H. Fox and Anthony E. Lang

6. Managing the Non-Motor Symptoms of Parkinson’s Disease ............ 91
   Werner Poewe and Klaus Seppi

7. Surgery for Parkinson’s Disease............................................................... 121
   Jens Volkmann

8. Future Cell- and Gene-Based Therapies for Parkinson’s Disease .......... 145
   Tomas Björklund, Asuka Morizane, Deniz Kirik and Patrik Brundin

9. Parkinson-Plus Disorders ...................................................................... 157
   Martin Köllensperger and Gregor K. Wenning
PART II TREMOR DISORDERS

10 Essential Tremor ................................................................. 179  Rodger J. Elble

11 Other Tremor Disorders ..................................................... 193  Günther Deuschl

PART III DYSTONIA, CRAMPS, AND SPASMS

12 Pathophysiology of Dystonia ................................................ 205  Mark Hallett

13 General Management Approach to Dystonia .......................... 217  Cynthia L. Comella

14 Botulinum Toxin for Treatment of Dystonia .......................... 227  Dirk Dressler

15 Surgical Treatments of Dystonia .......................................... 241  Christopher Kenney and Joseph Jankovic

16 Wilson’s Disease ................................................................. 251  George J. Brewer

17 Cramps and Spasms .............................................................. 263  Christine D. Esper, Pratibha G. Aia, Leslie J. Cloud and Stewart A. Factor

18 Stiff Person Syndrome ........................................................ 283  Philip D. Thompson and Hans-Michael Meinck

PART IV CHOREA, TICS AND OTHER MOVEMENT DISORDERS

19 Huntington’s Disease .......................................................... 295  Kevin M. Biglan and Ira Shoulson

20 Chorea .................................................................................. 317  Francisco Cardoso

21 Treatment of Tics and Tourette Syndrome .............................. 331  Harvey S. Singer and Erika L.F. Hedderick

22 Therapeutics of Paroxysmal Dyskinesias ............................... 345  Shyamal H. Mehta and Kapil D. Sethi

23 Treatment of Miscellaneous Disorders ................................. 353  Marie Vidailhet, Emmanuel Roze and David Grabli

24 Myoclonus ........................................................................... 363  Shu-Ching Hu, Steven J. Frucht and Hiroshi Shibasaki
PART V DRUG-INDUCED MOVEMENT DISORDERS

25 Neuroleptic-Induced Movement Disorders ................................................. 373
   S. Elizabeth Zauber and Christopher G. Goetz

26 Other Drug-Induced Dyskinesias ............................................................... 389
   Oscar S. Gershanik

PART VI ATAXIA AND DISORDERS OF GAIT AND BALANCE

27 Ataxia ........................................................................................................... 407
   Thomas Klockgether

28 Treatment of Gait and Balance Disorders ................................................... 417
   Bastiaan R. Bloem, Alexander C. Geurts, S. Hassin-Baer and Nir Giladi

PART VII RESTLESS LEGS SYNDROME

29 The Restless Legs Syndrome .................................................................. 447
   Richard P. Allen and Birgit Högl

PART VIII PEDIATRIC MOVEMENT DISORDERS

30 Pediatric Movement Disorders .................................................................. 471
   Jonathan W. Mink

PART IX PSYCHOGENIC MOVEMENT DISORDERS

31 Psychogenic Movement Disorders ............................................................. 479
   Elizabeth Peckham and Mark Hallett

Index .................................................................................................................. 489
Over the past few decades the field of neurology has seen spectacular developments in diagnostic techniques, most vividly exemplified by modern neuroimaging and molecular genetics. Although not always at the same speed this evolution has gone hand in hand with an enlarging armentarium of effective therapies to treat neurological disease. This is particularly true for the field of movement disorders, where one of the most exciting success stories of modern translational research in neuroscience unfolded more than 40 years ago: the discovery of dopamine deficiency in the striatum of patients with Parkinson’s disease and the subsequent introduction of levodopa as a dramatically effective therapy of this hitherto devastating illness. Since then the therapeutic options for Parkinson’s disease have grown exponentially, often making treatment decisions difficult. Moreover, there are now numerous therapies for other movement disorders with substantial impact on patients. While many therapies remain symptomatic, a number normalize the condition such as de-coppering in Wilson’s disease and levodopa in dopa-responsive dystonia.

While there are a number of textbooks on movement disorders, none so far has emphasized treatment, and this current work attempts to fill this gap. Practitioners want and need practical detailed advice on how to treat patients. We have recruited a team of experts who have attempted to deal with most situations. Wherever available, chapter authors have used evidence from randomized controlled clinical trials to develop practical recommendations for everyday clinical practice. As is the case for all of medicine there are many situations in the treatment of movement disorders where evidence from controlled trials is either insufficient or open to interpretation. We have therefore deliberately encouraged the expert authors to share with the reader their personal clinical acumen and therapeutic wisdom. Summary tables and algorithms are part of many chapters and will hopefully serve as a quick reference guide for practical treatment decisions in many different circumstances. Of course, each patient presents unique circumstances, so physicians will need to use their judgement every step of the way, but having expert guidance should at least set the general direction.

We are grateful to the movement disorder experts whom we have recruited from all over the world to bring their knowledge to this textbook. We appreciate their expertise and patience with our compulsive editing, as we have tried to give a uniform style to the recommendations, and occasionally added our own opinions.

We have tried to be up to date, but medications and other treatment options may change. New agents appear and some may even be withdrawn because new adverse effects surface. So, we hope that this book and its advice will be a helpful guide, but physicians must continue to be alert to any changes in practice that might arise.

MARK HALLETT
WERNER POEWE
Contributors

**PRATIBHA G. AIA**

*Department of Neurology, Emory University School of Medicine, Atlanta, GA, USA*

**RICHARD P. ALLEN**

*Neurology and Sleep Medicine, Johns Hopkins University, Baltimore, MD, USA*

**HAGAI BERGMAN**

*The Interdisciplinary Center for Neural Computation, and the Eric Roland Center for Neurodegenerative Diseases, Department of Physiology, The Hebrew University, Hadassah Medical School, Jerusalem, Israel*

**KEVIN M. BIGLAN**

*University of Rochester Medical Center, Movement and Inherited Neurological Disorders (MIND) Unit, Rochester, NY, USA*

**TOMAS BJÖRLUND**

*CNS Disease Modelling Unit, Department of Experimental Medical Science, Wallenberg Neuroscience Center, Lund University, Lund, Sweden*

**BASTIAAN R. BLOEM**

*Parkinson Center Nijmegen (ParC), Radboud University Nijmegen Medical Center, Department of Neurology (HP 935), Nijmegen, The Netherlands*

**GEORGE J. BREWER**

*Departments of Human Genetics and Internal Medicine, University of Michigan Medical School, Ann Arbor, MI, USA*

**JONATHAN M. BROTCHIE**

*Toronto Western Research Institute, Toronto Western Hospital, 399 Bathurst Street, Toronto, ON, Canada*

**PATRIK BRUNDIN**

*Neuronal Survival Unit, Department of Experimental Medical Science, Wallenberg Neuroscience Center, Lund University, Lund, Sweden*
NIR GILADI
Movement Disorders Unit, Parkinson Center, Department of Neurology, Tel-Aviv Sourasky Medical Centre, Sackler School of Medicine, Tel-Aviv University, Tel-Aviv, Israel

CHRISTOPHER G. GOETZ
Department of Neurological Sciences, Rush University Medical Center, Chicago, IL, USA

DAVID GRABLI
Fédération du Système Nerveux, Salpêtrière Hospital, Assistance Publique Hôpitaux de Paris, Université Paris 6 – Pierre et Marie Curie and INSERM U679, Paris, France

MARK HALLETT
Human Motor Control Section, National Institute of Neurological Disorders and Stroke, National Institutes of Health, Bethesda, MD, USA

SHARON HASSIN-BAER
Movement Disorders Clinic, Department of Neurology, Sheba Medical Center, Sackler School of Medicine, Tel-Aviv, Israel

ERIKA L.F. HEDDERICK
Pediatric Neurology, Harriet Lane Children’s Health Building, Baltimore, MD, USA

BIRGIT HOGL
Department of Neurology, Innsbruck Medical University, Innsbruck, Austria

SHU-CHING HU
Department of Neurology, University of Washington, Seattle, WA, USA

ZVI ISRAEL
Department of Neurosurgery, The Hebrew University, Hadassah Medical School, Jerusalem, Israel

JOSEPH JANKOVIC
Parkinson’s Disease Center and Movement Disorders Clinic, Baylor College of Medicine, Department of Neurology, Houston, TX, USA

REGINA KATZENSCHLAGER
Department of Neurology, Danube Hospital / SMZ-Ost, Vienna, Austria

CHRISTOPHER KENNEY
Parkinson’s Disease Center and Movement Disorders Clinic, Baylor College of Medicine, Department of Neurology, Houston, TX, USA

DENIZ KIRIK
CNS Disease Modelling Unit, Department of Experimental Medical Science, Wallenberg Neuroscience Center, Lund University, BMC A11, Lund, Sweden